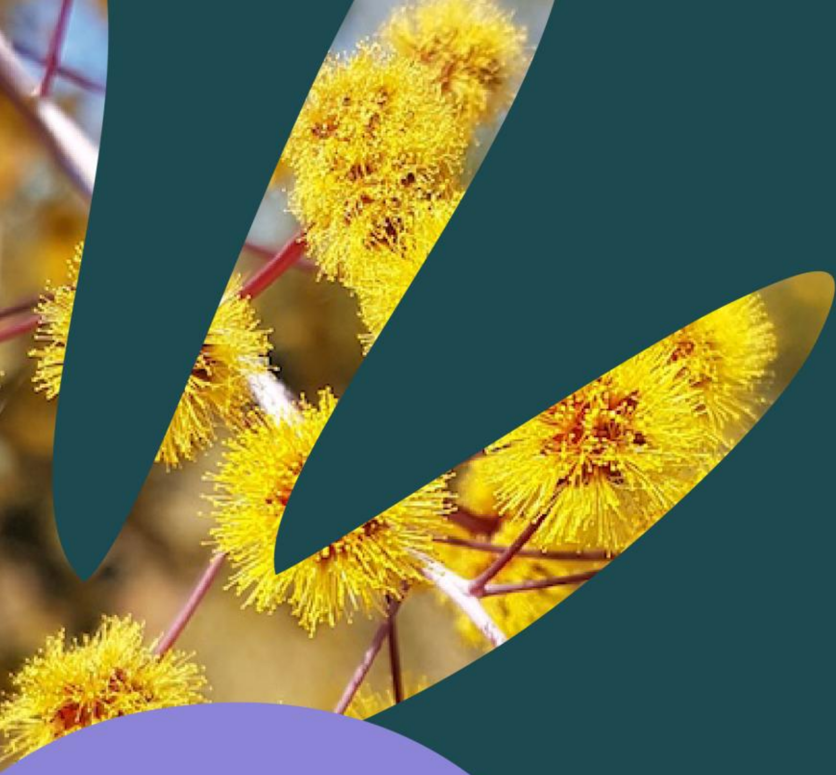


Sanjiv Ridge BWT
Aquatic Ecology Risk Assessment

Report to Atlas Iron

27 October 2025

Document Status				
Revision No.	Author	Review / Approved for Issue	Approved for Issue to Name	Date
1	Shae Surman, Jess Delaney	Chris Hofmeester, Jess Delaney	Larissa Byrne (Atlas Iron)	04/09/2025
2	Jess Delaney	Jess Delaney	Larissa Byrne and Michael Pezzaniti (Atlas Iron)	23/10/2025
3	Jess Delaney	Jess Delaney	Larissa Byrne and Michael Pezzaniti (Atlas Iron)	27/10/2025

Table of Contents

Tables

Figures

Appendices

1 Introduction

1.1 Background

Atlas Iron Pty. Ltd. (Atlas Iron) is developing the Sanjiv Ridge Project (the Project; formerly the Corunna Downs Project), an iron ore mine located approximately 33 km south of Marble Bar, in the Pilbara region of Western Australia (WA) (Figure 1.1). Stage 1 of the Project commenced in 2020 and includes conventional open cut mining, crushing and screening methods, above the groundwater table. Stage 2 comprises above water table mining of the Glen Herring deposit, on a range 3 km west of Stage 1, and includes three new pits, four waste rock dumps and haul road connecting to Stage 1 (Figure 1.1). Future Project development plans involve extending mining operations at the Stage 1 development below the water table (BWT), which will require dewatering of underlying aquifers and expansion of mine infrastructure.

Several aquatic habitats occur within and adjacent to the Project (hereafter referred to as the Study Area; Figure 1.1), including riverine pools on the Coongan River and Glen Herring Creek, and semi-permanent and permanent rock pools located on minor tributaries and drainages throughout the area. Several of these surface water pools are known to support obligate groundwater dependent vegetation (GDV) and their persistence is likely to be influenced by groundwater inflows (Woodman Environmental, 2019). Extension of mining operations BWT and associated infrastructure has the potential to impact the hydrological regime and water quality of pools, and the aquatic ecology values they support. Atlas Iron have undertaken preliminary works to model projected groundwater drawdown and assess hydrological change to surface waters in the adjacent river systems. With this information, Atlas Iron engaged Biologic Environmental (Biologic) to undertake a preliminary risk assessment of the proposed BWT development to aquatic ecosystems, hereafter referred to as "the Assessment".

1.2 Compliance

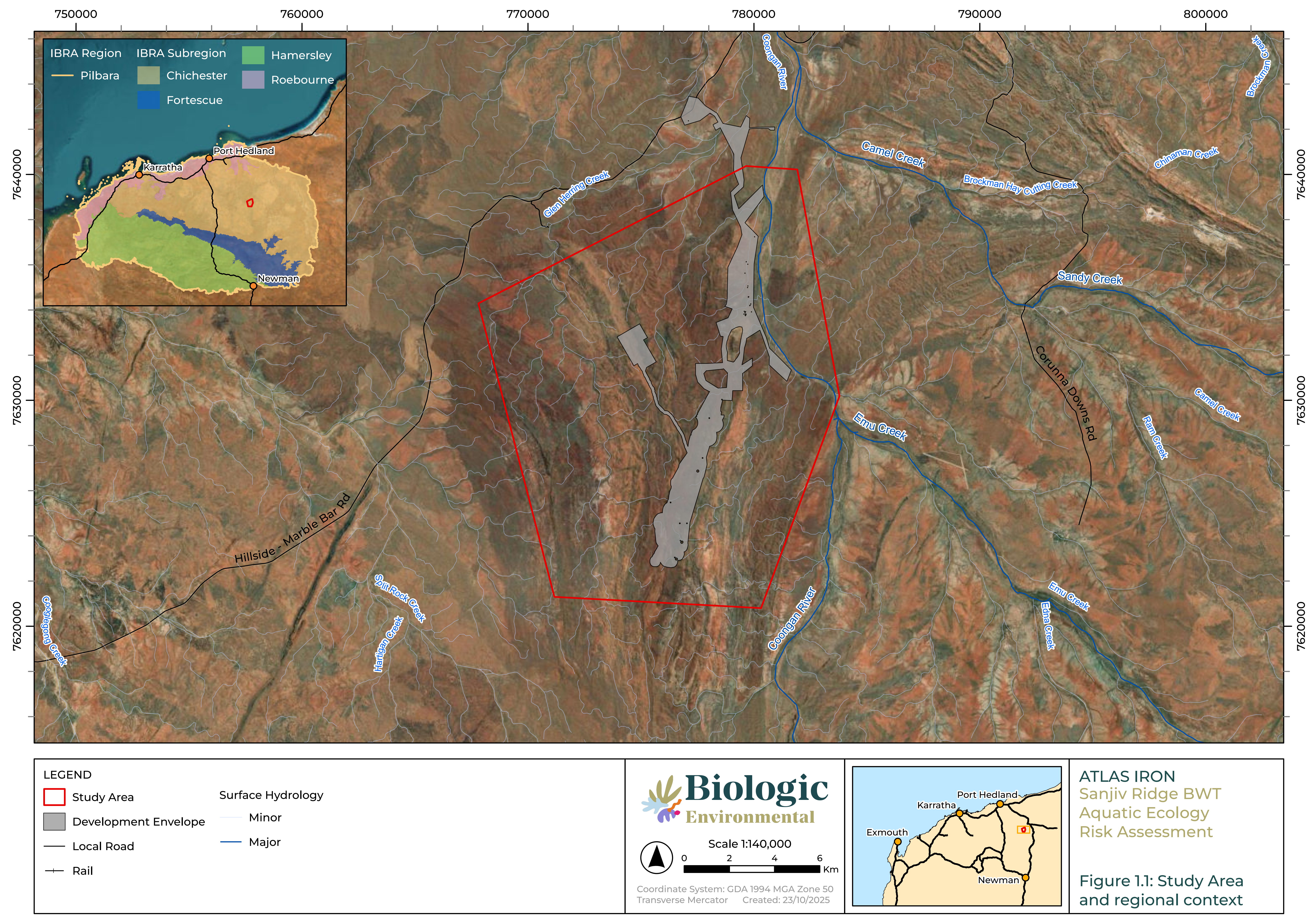
The key environmental factor relevant to the Assessment is Inland Waters. The objective of the Inland Waters Environmental Factor is "*to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected*" (EPA, 2018). For the purposes of EIA, environmental values are defined as a beneficial use or ecosystem health condition, and include the ability of an aquatic system to sustain vegetation, aquatic fauna, birdlife and the ecological processes that support them (see Appendix A). The EPA is primarily focused on impacts to significant ecosystems and in relation to the Pilbara, these include:

- Wetlands listed in the Directory of Important Wetlands in Australia (DIWA)

- Wetlands protected by Environmental Protection Policies under Part III of the EP Act
- Wild rivers, as identified by the Australian Heritage Commission and Department of Water and Environmental Regulation (DWER)
- Wetland types which may be poorly represented in the conservation reserves system
- Springs and pools, particularly in arid areas
- Ecosystems which support significant flora, vegetation and fauna species or communities, including migratory waterbirds, bats, and subterranean fauna
- Ecosystems which support significant amenity, recreation, and cultural values
- Saline lakes, estuaries and near shore ecosystems reliant on groundwater or surface water inputs.

In this context, springs and pools within and surrounding the Project would be considered significant ecosystems for the purposes of EIA. Overall, the Assessment was undertaken with consideration of the following policy and guidance:

- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Environmental Protection Act 1986* (EP Act)
- *Rights in Water and Irrigation Act 1914* (WA) (RIWI Act)
- Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA, 2021)
- Environmental Factor Guideline, Inland Waters (EPA, 2018)
- Environmental Factor Guideline, Flora and Vegetation (EPA, 2016a)
- Environmental Factor Guideline, Terrestrial Fauna (EPA, 2016b)
- Technical Guidance, Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000; ANZG, 2018).



Biologic Environmental

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/10/2025

ATLAS IRON
Sanjiv Ridge BWT
Aquatic Ecology
Risk Assessment

Figure 1.1: Study Area and regional context

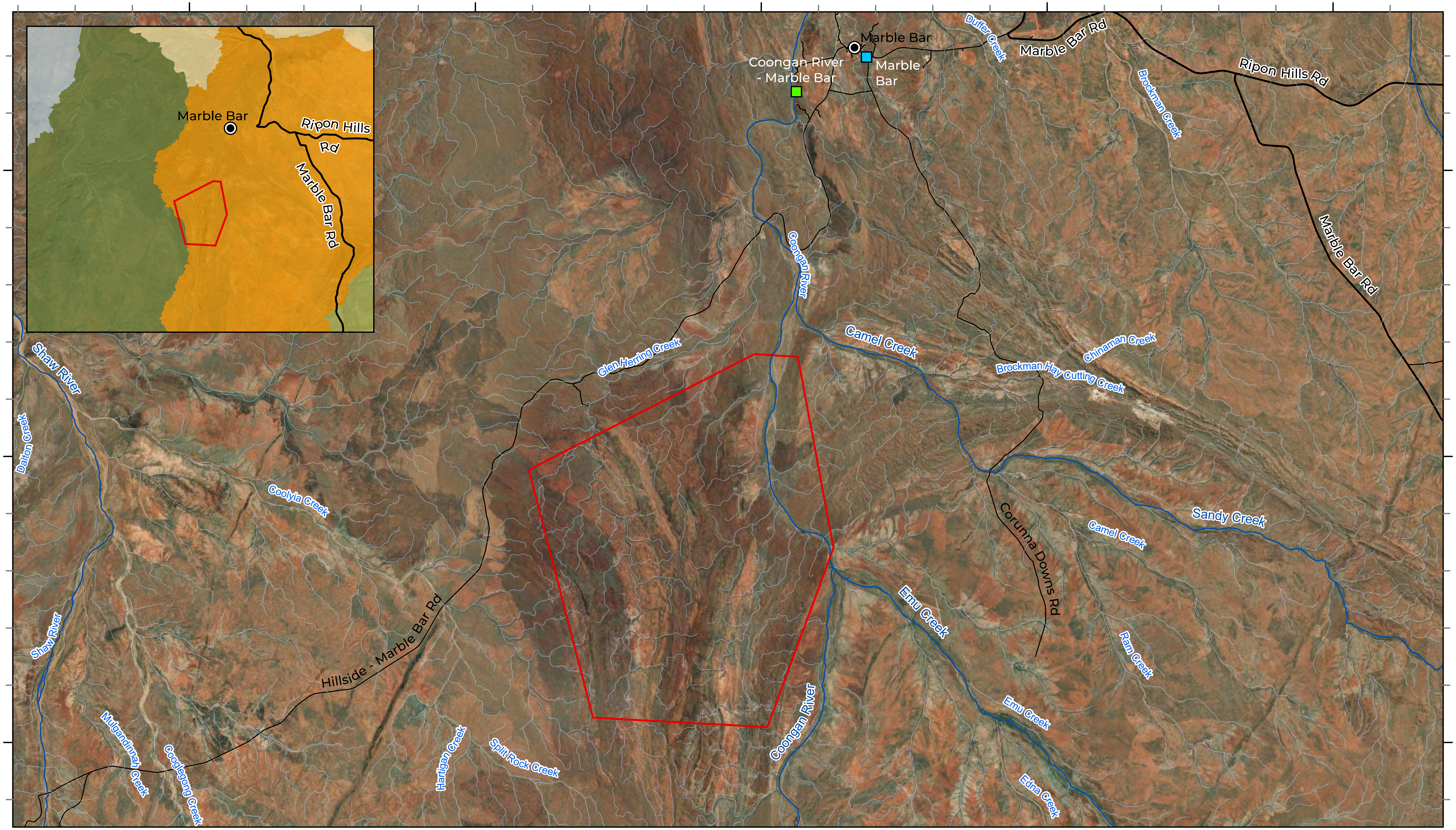
2 Existing Environment and Ecological Receptors

2.1 Hydrology and Hydrogeology

The Study Area is located in the De Grey River Basin, which covers 56,890 km^2 and extends over 350 km inland (Ruprecht & Ivanescu, 2000). Within this, the Project occurs in the Coongan River catchment. The catchment covers 7,090 km^2 containing the Coongan River and its tributaries, which include Glen Herring Creek, Emu Creek, and Camel Creek in the vicinity of the Study Area (Figure 2.1). The Coongan River is approximately 278 km in length, and flows north, where it joins the De Grey River around 90 km downstream of the Project Area, before draining into the Indian Ocean (Ruprecht & Ivanescu, 2000).

Both alluvial groundwater and fractured rock aquifer systems feed water features in the Study Area, however groundwater occurrence is often compartmentalised as the system is associated with varying degrees of permeability, controlled by structural features such as fractures, weathered zones, bedding planes, partings and joints (SRK, 2025; Woodman Environmental, 2019). The hydrogeological system is highly anisotropic and heterogeneous (SRK, 2025). Numerous pools have been identified in the vicinity of the Study Area, occurring along the Coongan River, Glen Herring Creek and along the ridge within the Project proper (hereafter referred to the Resource Area Pools). The Resource Area Pools primarily recharge via rainfall, however several are considered to be dependent on groundwater (Atlas Iron, 2019; Biologic, 2025a; SRK, 2019).

Several water features in the vicinity of the Project have been identified as potential aquatic groundwater dependent ecosystems (GDEs) in the Bureau of Meteorology (BoM) GDE Atlas (BoM, 2025). This includes sections of the Coongan River (High potential GDE) and Emu Creek (Moderate Potential GDE), as well as several individual pools (Unclassified Potential GDE) located on the Coongan River, Glen Herring Creek and within the Resource Area (BoM, 2025) (Figure 2.2). One baseline aquatic survey sampling site aligned with one of these BoM (2025) GDE pools (SR-05), while one other aquatic GDE aligns with a known pool (CO-WS-40) in the Resource Area that has not yet been sampled (Figure 2.2 and Figure 3.1).



LEGEND

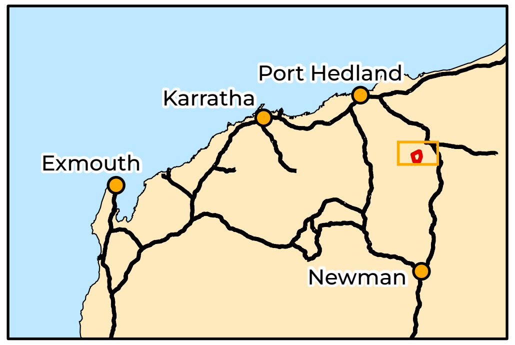
Study Area	Surface Hydrology	Gauging Station	Catchment	Strelley River
Local Road	Minor	Rainfall	Coongan River	
State Road	Major	Streamflow	DeGrey River	
			Nullagine River	
			Shaw River	

Biologic Environmental

Scale 1:190,000

0 2 4 6 8 Km

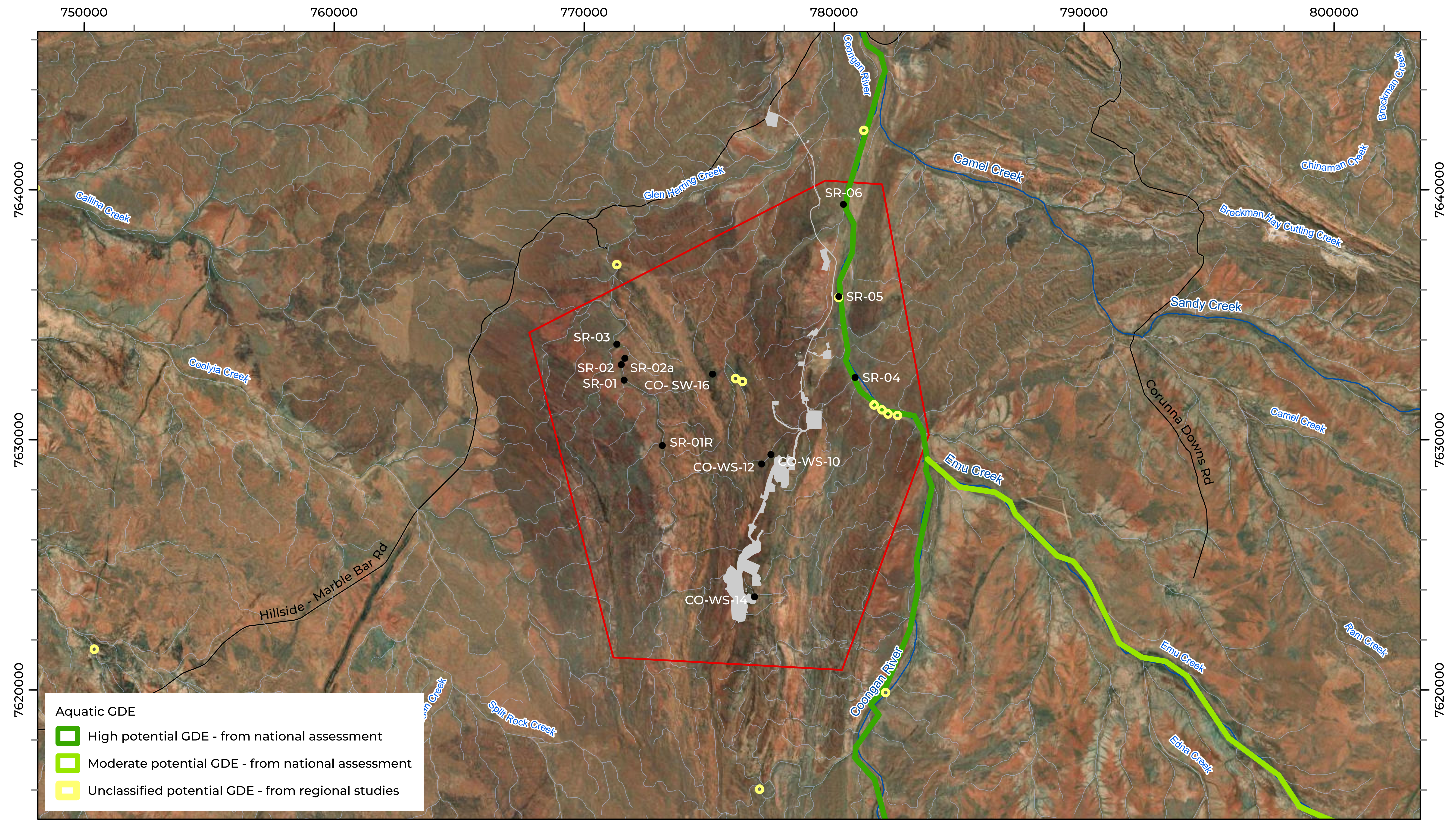
Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/10/2025



ATLAS IRON

Sanjiv Ridge BWT Aquatic Ecology Risk Assessment

Figure 2.1: Hydrology of the Study Area



LEGEND

Study Area

Combined Disturbance Footprint

Local Road

Surface Hydrology

Minor

Major

Aquatic Ecology Sample Site

Biologic Environmental

Scale 1:140,000

0 2 4 6 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/10/2025

Port Hedland
Karratha
Exmouth
Newman

ATLAS IRON

Sanjiv Ridge BWT Aquatic Ecology Risk Assessment

Figure 2.2: Biologic Aquatic Sampling sites and GDEs identified from the BoM GDE Atlas

2.2 Ecological Receptors

2.2.1 Previous Surveys

Biologic completed a two-season, baseline aquatic ecology survey and a targeted riparian vegetation survey in the Study Area in 2024 (Biologic, 2025a, 2025b). Along with a desktop assessment, field survey effort involved sampling 12 sites across Glen Herring Creek, Coongan River and Resource Area Pools (Table 2.1 and Figure 2.2), in the post-wet (April 2024) and dry season (September 2024). Multiple ecological indicators (lines of evidence) were sampled where surface water was present, including water quality, riparian vegetation (dominant riparian vegetation, submerged and emergent macrophytes), hyporheos fauna, macroinvertebrates and fish. Observations of other vertebrate fauna, including frogs and waterbirds were recorded. Sediments were collected when sampling sites were dry and were used in laboratory rehydration emergence trials.

A separate study to identify the presence of GDV was undertaken in 2024. This involved the assessment of 131 sites, including several pools across the Project (Biologic, 2025b). Both permanent and ephemeral pools were included in the assessment, allowing ground-truthing of surface water persistence levels (Table 2.1). Riparian vegetation was categorised based on Biologic's GDV assessment framework which rates the dependence on groundwater on a five point scale; High, Moderate, Low, Negligible and None.

2.2.2 Glen Herring Creek

Surface waters of Glen Herring Creek pools were generally characterised by fresh, clear waters, with basic pH and high total nitrogen (total N) and total phosphorous (total P) concentrations, but generally low levels of dissolved metals except dissolved copper (dCu), uranium (dU) and vanadium (dV; Table 2.2). There were some pre-existing disturbances noted, including impacts from cattle and the presence of invasive weeds. In-stream habitat diversity was high, and comprised high proportions of complex, heterogenous substrates such as submerged macrophytes, algae and detritus, which provide habitat for a wide range of aquatic biota. In the three pools sampled, this biodiversity included a total of 164 aquatic invertebrate taxa (across both surface and hyporheic habitats), including nine significant or restricted species, one stygobitic species present in the hyporheic zone, 24 macrophytes and groundwater dependent ecosystem (GDE) flora indicator species, four freshwater fish species, tadpoles and the black-fronted dotterel (Table 2.2). Fish populations included high proportions of new recruits of western rainbowfish and spangled perch, indicating conditions conducive to breeding. In particular, SR-01 and SR-03 were found to represent important breeding and nursery habitat for these species in the local area (Table 2.2).

Table 2.1: Pools sampled in the Study Area

Creek/System	Site	Persistence	Latitude	Longitude	Aquatic Ecology Sampling*	GDV Flora Assessment^	Biologic GDV Rating
Glen Herring Creek	SR-01	Likely permanent	-21.3903	119.6196	✓	✓ Site SRGR-062	Moderate
	SR-01R	Ephemeral	-21.4137	119.6346	✓		
	SR-02	Ephemeral	-21.3847	119.6183	✓	✓ Site SRGR-061	
	SR-02a	Ephemeral	-21.3824	119.6197	✓		
	SR-03	Permanent	-21.3773	119.6165	✓	✓ Site SRGR-071	Moderate
Coongan River	SR-04	Semi-permanent	-21.3878	119.7085	✓	✓ Site SRGR-097	
	SR-05	Ephemeral	-21.3587	119.7017	✓		
	SR-06	Semi-permanent	-21.3255	119.7030	✓		
Resource Area Pools	CO-WS-05	Permanent	-21.4669	119.6393	×	✓	Moderate-High
	CO-WS-10	Permanent – spring fed	-21.4162	119.6766	✓		
	CO-WS-12	Permanent – spring fed	-21.4197	119.6731	✓	✓	Moderate-High
	CO-WS-14	Permanent – spring fed	-21.4677	119.6713	✓	✓	High
	CO-WS-16	Permanent – spring fed	-21.3875	119.6535	✓	✓	High
	CO-WS-25	Likely ephemeral	-21.3420	119.6154	×	✓	Moderate-High
	CO-WS-26	Likely ephemeral	-21.3427	119.6129	×	✓	High
	CO-WS-27	Potentially permanent	-21.3497	119.6161	×	✓	Moderate-High
	CO-WS-28	Potentially permanent	-21.3629	119.6143	×	✓	Moderate-High

* Biologic (2025a)

^Biologic (2025b)

SR-03 on Glen Herring Creek was considered likely to represent an aquatic GDE (Figure 2.2), or at least be partly maintained by groundwater inputs, due to:

- High numbers of GDE indicator flora taxa, including several High indicator species
- Minimal variation in EC between seasons, suggesting some groundwater inflow reducing evapoconcentration effects.

2.2.3 Coongan River

Water quality in the Coongan River pools was characterised by fresh waters, with variable dissolved oxygen (DO) saturation, basic pH and low turbidity. Nutrient concentrations were generally low in comparison to ANZG (2018) toxicity default guideline values (DGVs), but total N and total P exceeded DGVs for eutrophication at some sites. While dissolved metal concentrations were generally low in the Coongan River, there were some exceedances of toxicity DGVs, including dissolved aluminium (dAl), chromium (dCr) and copper (dCu). In-stream habitat varied between seasons, but was dominated by submerged macrophyte cover in the wet season (Table 2.2). Widespread impacts from cattle grazing and trampling were observed throughout the area, as well as vehicle tracks and invasive weeds.

The Coongan River pools sampled supported a rich assemblage of aquatic invertebrates with 178 taxa recorded across both surface and hyporheic habitats, including 13 significant or restricted species, and groundwater dependent taxa within the hyporheos which included one stygobitic taxon (Table 2.2). The riparian zone recorded a high richness of GDE flora indicator species, with a total of 29 macrophytes and GDE indicator taxa recorded. Vertebrates using Coongan River pools included four freshwater fish and three waterbird species, with SR-05 identified as a nesting site for black-fronted dotterel (Table 2.2). Chicks were present at this site in the wet season of 2024.

The desktop assessment identified the Coongan River, in an area encompassing all three Study Area sites (SR-04 to SR-06), as having a high potential to support aquatic GDEs (Figure 2.2). Results from the Survey support the concept that these pools are influenced by groundwater flows, especially SR-04 and SR-06, including:

- A high number of GDV/GDE flora indicator taxa recorded from both sites, including four High indicator species
- Both sites supporting the obligate phreatophyte *Melaleuca argentea*
- Both sites supporting groundwater dependent invertebrate taxa within the hyporheic zone, including stygobites at SR-06.

2.2.4 Resource Area Pools

Four permanent gorge pools with groundwater inflows were sampled in the Study Area, with CO-WS-12, CO-WS-14 and CO-WS-16 all considered likely to represent aquatic GDEs (Atlas

Iron, 2019; Biologic, 2025a; Woodman Environmental, 2019). Surface expression of groundwater was observed at all three of these pools, and the riparian zones supported a high richness of GDE indicator flora species (25 macrophyte and GDE indicator species), including the obligate phreatophyte *Melaleuca argentea* at CO-SW-14 and CO-SW-16 (Biologic, 2025a). The Biologic (2025b) GDV assessment also indicated groundwater dependence, with CO-WS-14 and CO-WS-16 being assessed as having a High GDV rating. The vegetation type recorded at CO-WS-16 was also reported to have affinities with the Priority 2 Pilbara Pools Priority Ecological Community (PEC) (Biologic, 2025b).

Resource Area pools were particularly fresh, and their connection to groundwaters and persistence meant that they were buffered from evapoconcentration effects and recorded minimal change in salinity (as electrical conductivity; EC) between seasons (Table 2.2).

The Resource Area pools supported a notably high richness of aquatic invertebrates. In total, across both hyporheic and surface water habitats, 193 invertebrate taxa were recorded, including eight potentially significant or restricted species and a high richness of odonates (dragonflies and damselflies). Permanent hyporheos stygophiles were present in the hyporheic zone of CO-WS-12 and CO-WS-14, highlighting the connection to groundwater at these sites. These gorge pools did not support fish due to their isolated and disconnected nature, coupled with the presence of waterfalls within gorge systems, limiting the movement of fish. However, the Resource Area pools supported three species of frog (Table 2.2).

Table 2.2: Summary of aquatic habitat, condition and values at Glen Herring Creek, Coongan River and Resource Area Pools

System	Habitat and Hydrology	Water Quality	Flora	Invertebrate Fauna	Vertebrate Fauna	Overall Condition
Glen Herring Creek	• Large permanent to semi-permanent creek pools • SR-03 may constitute a permanent pool that is supported by groundwater • Groundwater connection appears highest in the northern area (downstream) and potentially reduces moving upstream • High in-stream habitat richness, including complex, heterogenous substrates with which to support aquatic fauna	• Generally fresh (EC higher in the dry at SR-01, likely due to evapoconcentration), basic and clear waters • Ionic composition dominated by sodium (Na) and bicarbonate (HCO_3) • Relatively high concentrations of total nitrogen (total N) and total phosphorus (total P), exceeding eutrophication DGVs (except SR-03) • Generally low concentrations of dissolved metals, but with exceedance of the ANZG (2018) 95% toxicity DGV for dissolved copper (dCu)	• Flora indicating groundwater connection at SR-03 (relatively high GDE indicator taxa richness, including High indicator species) • Emergent macrophytes present at all sites • Relatively abundant submerged macrophytes	• Generally richness of groundwater dependent taxa in the hyporheic zone, but one stygobitic taxon recorded from SR-02 • Macroinvertebrate taxa richness was moderate, but lower than the Resource Area pools • 9 significant invertebrate taxa recorded from hyporheic zones and surface waters	• A total of 4 fish species recorded, with all present at SR-01 • Important breeding and nursery habitat for western rainbowfish and spangled perch • Black-fronted dotterel recorded at SR-02	• Impacts from cattle grazing and trampling along the banks and in-stream, some elevated nutrient inputs • Several species of invasive weeds, with buffel grass the most abundant
Coongan River	• Sites sampled were typically large riverine pools • Some water persistence but water levels generally reduced by the Dry 24 • All sites located in area identified as having a high potential to support aquatic GDEs (BoM, 2025) • SR-05 identified as a potential aquatic GDE pool (BoM, 2025) • Creek beds generally comprised transmissive substrates such as sand and gravel, with some clay • In-stream habitat richness was variable, but generally dominated by open substrate and submerged macrophyte cover, with some algae	• Generally fresh (though SR-06 was brackish), with variable DO, basic pH and low turbidity • EC increase at SR-04 and SR-06 in the dry season, likely due to evapoconcentration • Ionic composition dominated by Na and HCO_3 • Low nitrogen oxides (N_NOx), but some exceedances of eutrophication DGVs for total N (SR-04 and SR-05) and total P (all sites) • Generally low concentrations of dissolved metals, but with some exceedances of 95% toxicity DGVs (i.e., dAl and dCu)	• Relatively high GDE indicator taxa richness, with several High indicator species at each site. This likely indicate high levels of groundwater connection at these sites. • Emergent and submerged macrophytes present at all sites	• Permanent stygophiles present at every site in the wet season, albeit absent from all sites except for SR-06 in the dry season. SR-06 recorded the highest richness of groundwater dependent species in the Study Area in the dry season • High macroinvertebrate taxa richness, particularly at SR-04 in the wet season (68 taxa) • Notably high richness of odonates at SR-04 • 13 significant invertebrate taxa recorded from hyporheic zones and surface waters	• A total of 4 fish species recorded, with all present at SR-04 • Pilbara bony bream highly abundant at SR-04 • Pacific black ducks and Little pied cormorants recorded at SR-04 • Black-fronted dotterels recorded at SR-05. Nesting site observed in the wet season, with chicks present	• Widespread impacts from cattle grazing and trampling, vehicle tracks and invasive weeds • High richness of invasive weed species, with Mexican poppy particularly abundant

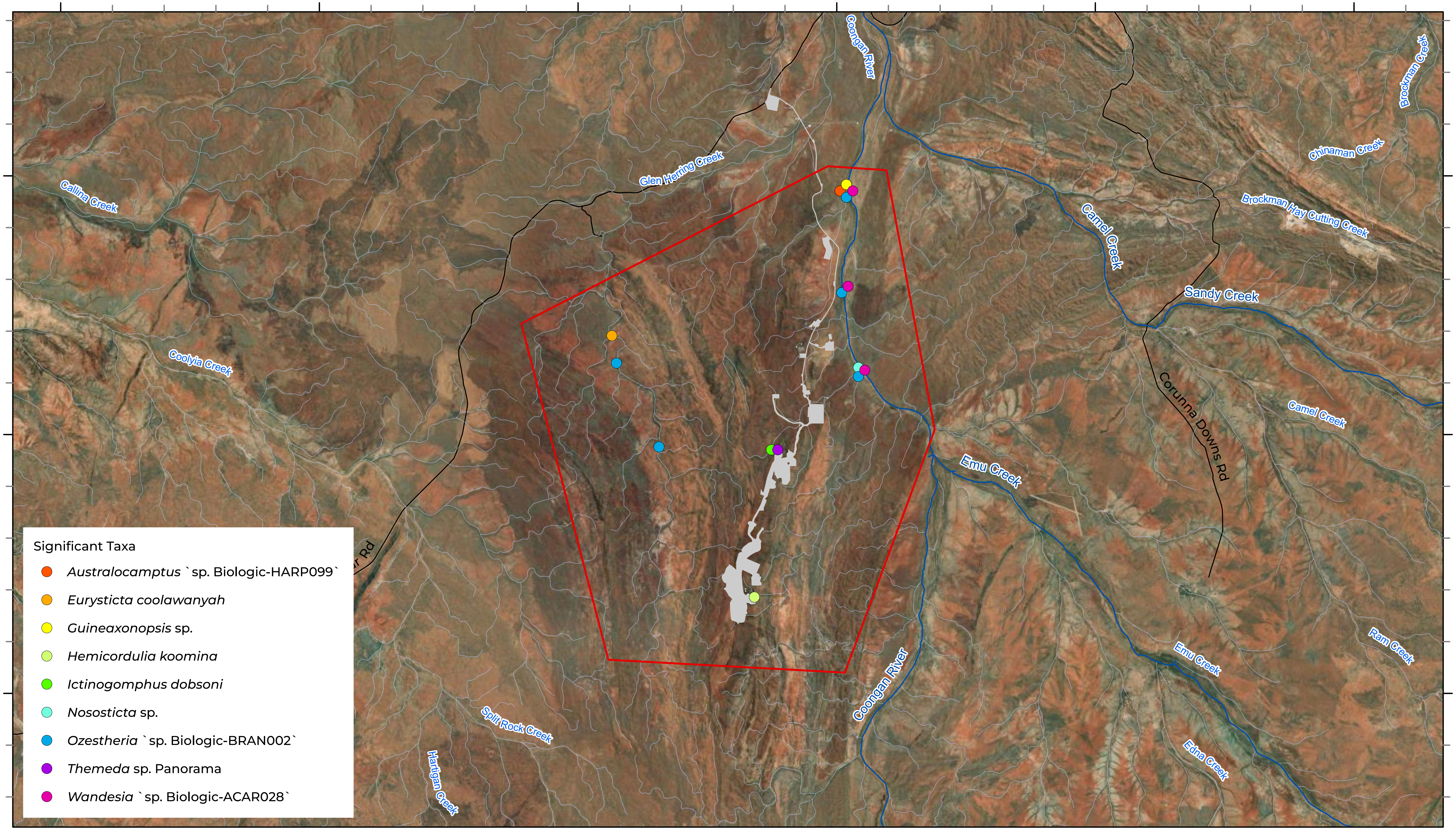
System	Habitat and Hydrology	Water Quality	Flora	Invertebrate Fauna	Vertebrate Fauna	Overall Condition
Resource Area Pools	• Permanent gorge pools • Aquatic GDEs present at CO-WS-12, CO-WS-14, CO-WS-16 based on GDV/GDE indicator flora and water quality and information provided in (Atlas Iron, 2019) • Surface expression of groundwater observed at CO-WS-14 and CO-WS-16 • CO-WS-10 likely to be influenced by groundwater inputs, but maintained by aspect and lack of evaporation • Substrates primarily bedrock • In-stream habitat dominated by open inorganic substrates, with some submerged macrophytes and algae present.	• Generally, fresh, consistent and adequate DO, basic and clear waters • Except slightly acidic at CO-WS-16 (Dry 2024) • Turbidity slightly elevated at CO-WS-16 • Pools buffered from evapoconcentration effects in the dry season due to groundwater connection and persistence of surface water • Ionic composition had relatively equal concentrations of Na, calcium (Ca), magnesium (Mg), HCO_3 and chloride (Cl) • Low N_NOx concentrations but elevated total N and total P in comparison to eutrophication DGVs • Generally low dissolved metal concentrations, with some ANZG interim working level exceedances (i.e., dCo and dFe)	• CO-WS-14 supported several High GDE indicator species • Other sites (except CO-WS-10) contained a relatively high richness of Moderate/Low species • Low macrophyte richness, with submerged macrophytes only present at CO-WS-10 and CO-WS-14 • One significant species, *Themeda* sp. Panorama recorded from CO-WS-10	• Relatively low hyporheic richness compared to Glen Herring Creek and Coongan River pools • Permanent stygophiles only recorded at CO-WS-12 and CO-WS-14 • Notably high macroinvertebrate taxa richness at CO-WS-14 and CO-WS-10, with 83 and 81 taxa recorded, respectively • High richness of odonates recorded at CO-WS-14 • 8 significant invertebrate taxa recorded from hyporheic zones and surface waters	• No fish recorded from the Resource Area pools • CO-WS-10 supports *Litoria rubella* and *Cyclorana maini* frogs • CO-WS-12 supports *Uperoleia glandulosa* • Tadpoles present at all sites	• Some invasive weeds present, but with low richness and abundance, especially compared to Glen Herring Creek and Coongan River pools • Secondary evidence of invasive predators such as cats at CO-WS-12

2.3 Significant Taxa

Several significant taxa were recorded during the baseline aquatic ecology survey, including a Priority 1 flora species and seven invertebrate taxa. Of the significant invertebrate taxa, three where undescribed taxa/new Operational Taxonomic Units (OTUs) with potentially restricted distributions, and four were listed on the IUCN Red List of Threatened Species (IUCN, 2025) (Table 2.3 and Figure 2.3). Despite no direct observations during the baseline survey, the Resource Area Pools were also identified as suitable foraging habitat for the Pilbara Olive Python (*Liasis olivaceus barroni*), which is a Matter of National Environmental Significance (MNES) species, and is also listed as Vulnerable under the WA BC Act and Federal EPBC Act (Table 2.3). One other dragonfly was highlighted as likely to occur within the Study Area from the desktop assessment. The Pilbara billabongfly, *Austroagrion pindrina*, is listed as Vulnerable on the IUCN Red List. This species has the potential to occur within the Resource Area pools and/or permanent pools across the Study Area.

Table 2.3: Significant species known, or likely to occur, in the Study Area, including baseline survey and database search records

Type	Taxon	Sites recorded	Significance/Listing/Distribution
Flora	*Themeda* sp. Panorama	CO-WS-10	DBCA Priority 1
Water mites	*Wandesia* `sp. Biologic-ACAR028`	SR-04, SR-05, SR-06	Poorly known genus Potentially restricted OTU known only from Study Area and Upper Fortescue River catchment
Clam shrimp	*Ozestheria* `sp. Biologic-BRAN002`	SR-02, SR-04, SR-05, SR-06	OTU has a fragmented distribution and is known from few records Currently known from the Study Area, Harding River, Red Hill Creek, Cane River, and Marillana Creek
Copepods	*Australocamptus* `sp. Biologic-HARP099`	SR-06	Genus endemic to WA First record of this OTU
Odonates (dragonflies and damselflies)	*Hemicordulia koomina*	CO-WS-14	Vulnerable – IUCN Red List
	Eurysticta coolawanyah	SR-03	Vulnerable – IUCN Red List
	Ictinogomphus dobsoni	CO-WS-10	Near Threatened – IUCN Red List
	Austroagrion pindrina	Desktop assessment – likely to occur in Resource Area pools and permanent pools of the Study Area	Vulnerable – IUCN Red List
	Nososticta sp.	SR-04	May be *Nososticta pilbara,* listed as Endangered by the IUCN Red List and as a Priority 2 species by DBCA, but specimen was too immature to be identified beyond genus
Snake	*Liasis olivaceus barroni* (Pilbara olive python)	Desktop assessment - Suitable foraging habitat identified – Resource Area Pools	Vulnerable – WA BC Act and Federal EPBC Act



LEGEND

- Study Area
- Combined Disturbance Footprint
- Local Road

Surface Hydrology

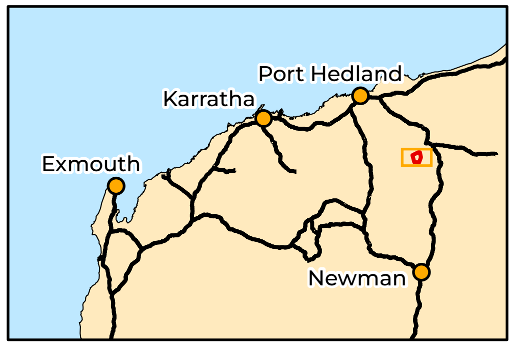
- Minor
- Major

Biologic Environmental

Scale 1:140,000

0 2 4 6 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/10/2025



ATLAS IRON

Sanjiv Ridge BWT Aquatic Ecology Risk Assessment

Figure 2.3: Significant taxa recorded from the Study Area

3 Risk Assessment

3.1 Main Threats to Receptors

Atlas Iron is proposing to expand the Sanjiv Ridge Mine, which will involve pit development BWT and extension of some mining area footprints (Smith Hydro, 2025; SRK, 2025). Activities that have the potential to impact aquatic ecology receptors include:

- Groundwater drawdown from pit dewatering
- Alterations to surface hydrology and catchment reduction
- Disturbances associated with mine infrastructure development
- Discharge of excess groundwater into surrounding creeks.

These potential impacts are discussed in sections 3.3 to 3.5, noting that although Smith Hydro (2025) mention the discharge of excess groundwater, no further detail was provided. Further studies are currently underway to determine discharge requirements . As such, potential risks associated with discharge have not been assessed here.

3.2 Assumptions and Limitations

There are several limitations and/or assumptions associated with the following risk assessment, including:

- Modelling was undertaken by external sources.
- Discharge of excess of groundwater is mentioned in Smith Hydro (2025), but no detail is provided. Therefore, risks from discharge cannot be assessed here.
- Potential for acid mine drainage (AMD) and associated contamination has not been assessed.
- Lack of a complete baseline dataset for aquatic ecology that covers the seasonal and temporal variability in aquatic ecosystems.
- Several pools within the Resource Area have not been sampled, and as such there is no understanding of the baseline aquatic ecology values they support currently.

All hydrological information and hydrogeological modelling data used to undertake the Assessment were provided by external sources, and Biologic takes no responsibility for the accuracy of information provided in those reports. This includes:

- Sanjiv Ridge: Hydrology Baseline and Impact Assessment 2025 (Smith Hydro, 2025)
- Sanjiv Ridge Stage 5 Below Water Table Numerical Model Report (SRK, 2025)
- Corunna Downs Mine Water Supply H3 Hydrogeological Assessment (SRK, 2019).

Groundwater within the Study Area occurs in a fractured bedrock aquifer (FBA), which is highly compartmentalised, with variable degrees of connectivity between groundwater features within the system and to nearby alluvial aquifers (SRK, 2019). It was noted by SRK (2025) that these hydrogeological features present challenges when modelling groundwater drawdown, particularly when assessing the connectivity between groundwater features within the FBA For example, groundwater modelling relies on the assumption that all surface groundwater monitoring locations are fully connected and cannot account for perched aquifers (i.e. disconnected from the underlying system) that may be present (SRK, 2025). SRK (2025) acknowledged that, in some cases, modelling was based on limited data and a sparse time series for water levels (i.e., the Glen Herring pit).

It is also noted that information regarding the aquatic ecology receptors is based on a single, two-season aquatic ecosystem survey (Biologic, 2025a). For aquatic ecosystems driven by highly seasonal events (such as those of the Pilbara region), multiple surveys provide the most comprehensive representation of aquatic invertebrate biodiversity. In cases where monitoring may be required in future to assess potential impacts, it is important that the baseline dataset captures the natural seasonal and temporal variation of the area. ANZG (2018) recommends bi-annual sampling over a period of at least three years to develop an appropriate ecological dataset to cover the natural variability present within an aquatic ecosystem. This also allows statistical analysis to be undertaken in the future, to assess any potential impacts from the development as part of a monitoring program.

A further gap to this assessment is the fact that several surface water features that fall within, or in the vicinity of, drawdown contours for the proposed BWT development have not been sampled to-date (i.e., CO-WS-01, CO-WS-08, CO-WS-09 and CO-WS-13). Therefore, an accurate assessment of the potential risk to these pools cannot be made. More generic comments are provided for these sites based on the known hydrology of the Study Area, and using ecological information from nearby Resource Area Pools.

Finally, the Study Area occurs in a pastoral area and cattle have direct access to the Coongan River and Glen Herring Creek. This can have marked impacts on surface water features, including trampling of edge sediments, erosion, increased turbidity, water level drawdown from drinking, increased nutrient concentrations and eutrophication, trampling and grazing of emergent macrophytes and the spread of weeds. Given the terrain, the Resource Area Pools had comparatively few pre-existing disturbances, though weeds were recorded at some sites.

3.3 Groundwater Drawdown

3.3.1 Description

Projected drawdown associated with the expanded mine development occurs primarily within the fractured bedrock aquifer (FBA) of the Study Area (Figure 3.1). Currently, groundwater is stored within the underlying FBA system, and exhibits highly variable depth to water, ranging from less than 5 metres below ground level (mbgl) in topographic lows and drainage lines, up to 85 mbgl beneath ridges and elevated areas. This large variability is due to the compartmentalised nature of the FBA, which is controlled by local geology, faulting, and the distribution of fractures and weathered zones.

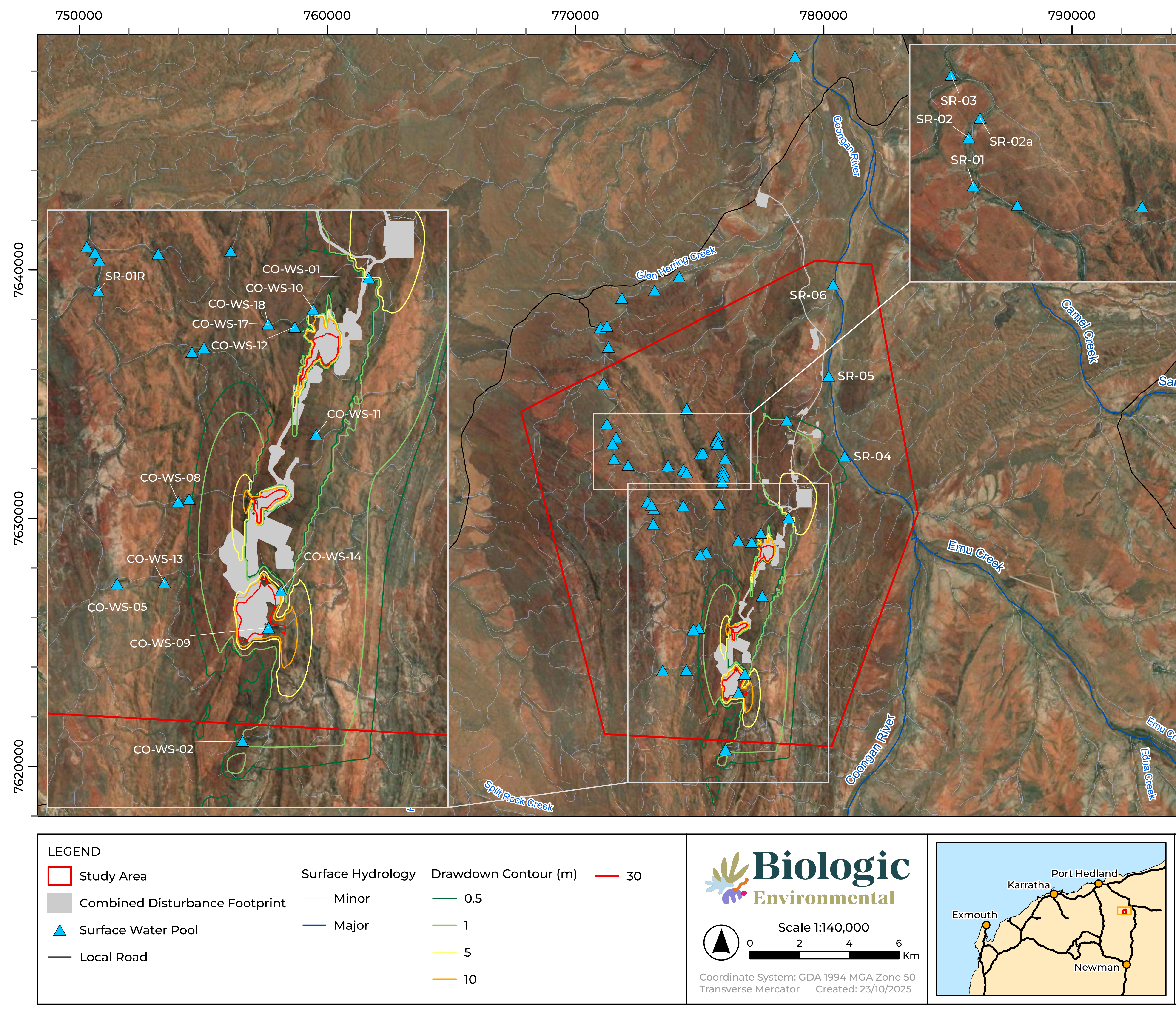
In contrast, the alluvial aquifers—which occur in valley floors and drainage lines—generally have a much shallower and more consistent depth to water, ranging between 2 to 10 mbgl. These aquifers are more directly influenced by surface water recharge and tend to be unconfined, with water levels closely following the surface topography.

During the operational mining phase (up to 2032), greatest drawdown is anticipated to occur closest to the mine pits (168 mbgl drawdown), and decrease with distance from the pits to 1 mgbl, approximately 3 km from Sparrow Lake (SRK, 2025) (Figure 3.1). Modelling suggests that following the cessation of mining activity in 2032, drawdown will extend over 2 km from mining pits, with a maximum drawdown of 47 mgbl (Figure 3.1).

Most of the drawdown during the operational phase and post-closure will occur in the vicinity of the Resource Area Pools. Of the pools sampled during the baseline aquatic ecology survey, CO-WS-14 is the only pool modelled to be affected by drawdown during the operational phase (Table 3.1, Figure 3.1). Predicted drawdown at CO-WS-14 during operations is modelled to reach 1 m, or 6 m under the more conservative scenario. Other water features in the Resource Area also occur within areas of predicted drawdown, including CO-WS-01, CO-WS-08, CO-WS-09 and CO-WS-13. Surface water expression at these pools is generally ephemeral and considered to be primarily influenced by rainwater (Woodman Environmental, 2019). However, CO-WS-01 was considered to be supported by groundwater inflows, and ephemeral pool CO-WS-09 to a lesser extent, was thought to be influenced by seasonal groundwater expression (Woodman Environmental, 2019). Projected drawdown at CO-WS-09 and CO-WS-01 during the operational phase is >10 metres and 5.5 metres, respectively (SRK, 2025) (Table 3.1, Figure 3.1).

Table 3.1: Summary of modelled drawdown at Resource Area Pools

Site	Aquatic Sampling	Groundwater Connection	Depth to Groundwater	Drawdown Operations	Drawdown Post-Closure
CO-WS-01	×	Spring-fed	Surface	5.5 metres	nil
CO-WS-08	×	Seasonal	<10 metres	nil	2-4 metres
CO-WS-09	×	Seasonal	>5 metres	> 10 metres	>20 metres
CO-WS-10	✓	Spring-fed	Surface	nil	2-5 metres
CO-WS-12	✓	Spring-fed	Surface	nil	0-3 metres
CO-WS-13	×	Seep	Surface	nil	2-3 metres
CO-WS-14	✓	Spring-fed	Surface	1-6 metres	2-14 metres



ATLAS IRON
Sanjiv Ridge BWT
Aquatic Ecology
Risk Assessment
Figure 3.1: Location of surface water features/ pools against predicted drawdown contours

Post-closure drawdown is projected to impact several pools sampled during the Biologic (2025a) baseline aquatic ecology survey (CO-WS-10, CO-WS-12, CO-WS-14), as well as three pools that have not yet been sampled (CO-WS-08, CO-WS-09, CO-WS-13). Drawdown extent at these pools is predicted to range from 0-3 m (CO-WS-12), up to >20 m (CO-WS-09) post cessation of mining in 2032 (Table 3.1, Figure 3.1).

Coongan River and Glen Herring Creek occur atop alluvial aquifers, unlike the Resource Area Pools. These alluvial aquifers are associated with drainage lines lying within transmissive substrates, with variable groundwater levels reflecting seasonal rainfall patterns (SRK, 2019). Both systems are predicted to be mostly undisturbed by projected drawdown, although several smaller tributaries fall within drawdown contours (Figure 3.1). Drawdown within these tributaries was considered unlikely to impact runoff and overall water supply to the major creeklines (SRK, 2019).

3.3.2 Potential Impacts

3.3.2.1 Habitat

The pools and springs in the Study Area represent significant ecosystems under the Inland Waters environmental factor, as defined by the EPA for the purposes of EIA (EPA, 2018). Results from previous studies indicate that many of the pools occurring in the Resource Area represent aquatic GDEs, and comprise a high richness of mesic and GDE indicator flora taxa, and support groundwater dependent invertebrate taxa within the hyporheic zone (Atlas Iron, 2019; Biologic, 2025a, 2025b; Woodman Environmental, 2019). Therefore, groundwater drawdown has the potential to reduce surface water levels and inflows, especially during the dry season when recharge from rainfall is minimal. This not only reduces habitat availability, extent, and persistence, but also the suitability of aquatic habitats for biota (Baumgartner *et al.*, 2008; Carmignani & Roy, 2017). Flowing waters are known to support distinct invertebrate assemblages, with riffle zones known to represent a distinct and rich habitat type (Bunn & Arthington, 2002; Hill *et al.*, 2008; Pinder *et al.*, 2010). At Resource Area Pool CO-WS-14, groundwater inflow provides persistent flowing surface water, which influences the rich aquatic biota present. Given CO-WS-14 occurs within the drawdown zone during both the operational phase and post-closure, there is the potential for loss of habitat and flow, which would ultimately result in a reduction in aquatic biodiversity.

Drawdown also has the potential to reduce the availability and connectivity of hyporheic habitat. At CO-SW-12 and CO-WS-14, the hyporheic zone is known to support groundwater dependent invertebrate fauna, along with surface water taxa utilising the zone as a refuge (Biologic, 2025a). This suggests, that at present, there is a connection through the hydrological profile from groundwater through the hyporheic zone and into surface waters. Drawdown has the potential to impact this connection and reduce the availability and distribution of hyporheic habitat in this area. Exchange between surface and subsurface waters is essential for biological regulation of hyporheic zones, and alterations to these hydrological linkages pose a threat to shallow aquifer ecosystems (Hancock, 2002; Hancock *et al.*, 2005). The hyporheic zone is an ecotone between surface and subterranean aquatic systems, and includes elements of both epigean (surface water) and groundwater taxa (stygofauna). Surface water taxa move down the profile and exploit the hydrologic connection, potentially as a nursery to protect juveniles from predation (Bruno *et al.*, 2012; Jacobi & Cary, 1996) or as a refuge during drought and floods (Coe, 2001; Dole-Olivier & Marmonier, 1992; Hose *et al.*, 2005). Alternatively, stygobitic invertebrates can migrate up the profile for access to nutrients and food sources. In this way, the hyporheic zone enhances the resilience of the benthic surface water community to disturbance and influences river recovery following perturbations, whilst also ensuring the maintenance of biodiversity within the stygofaunal assemblage. Reductions in hydrological connectivity associated with groundwater drawdown can result in:

- The inhibition of gas and nutrient exchange between the hyporheic zone and surface waters, resulting in a reduction in redox potential, dissolved oxygen, organic matter, food resources and nutrient flow (Boulton, 2001; Dole-Olivier & Marmonier, 1992; Edwards, 1998; Hancock, 2002).
- Damage to resident fauna reducing the filtration capability of the hyporheic zone (Hancock, 2002).
- Increased pollutant transfer into and across different ecosystems within the hydrological profile due to failures in hyporheic filtration (Hancock, 2002).
- Loss of hyporheic refuge for surface water invertebrates, contributing to a loss in biodiversity within aquatic ecosystems (Wood *et al.*, 2010).

3.3.2.2 Water Quality

Drawdown of groundwater can adversely impact surface water quality, primarily through reductions in water levels. As pools recede, there are associated changes to water quality including reductions in dissolved oxygen, as well as increased concentrations of naturally-occurring ions, nutrients and metals due to evapoconcentration effects (Bond *et al.*, 2008). This can lead to increases in salinity, and the potential for eutrophication and toxic effects. The Resource Area Pools with groundwater connection are naturally buffered against the effects of evapoconcentration and seasonal fluctuations in water levels and water quality (Biologic, 2025a). Therefore, if groundwater connectivity is reduced or lost at these pools, they would no longer be buffered during dry periods, leading to fluctuations in water quality, potentially outside background levels and potentially outside the tolerance of resident fauna adapted to life in these pools.

The potential for AMD should also be considered if Potential Acid Forming (PAF) material occurs within Resource Area, which could be exposed and oxidised during drawdown (Pearce *et al.*, 2019). This can lead to reductions in pH and mobilisation of metals, which may enter waterways and significantly impact aquatic biota (ANZG, 2018; Gejl *et al.*, 2019). There is also the potential for neutral mine drainage (NMD, otherwise referred to as metalliferous drainage). This can occur when iron ores are excavated from below water table, stockpiled and allowed to oxidise. NMD can contain elevated concentrations of major ions such as calcium, magnesium and sulfate and/or dissolved metals, which can lead to direct toxic effects (i.e. sulfate, dissolved metals) or increases in EC which can be just as difficult to manage (DFAT, 2016). Selenium (Se) has been identified as a constituent of concern for similar projects in the Pilbara because selenite can oxidise to selenate, the most soluble and bioavailable form of Se (Etteieb *et al.*, 2020), which can be released at near neutral pH. While Se is essential for aquatic life, it can bioaccumulate and becomes toxic at concentrations just above nutritional requirements (ANZG, 2018; Hamilton, 2004).

3.3.2.3 Aquatic Invertebrates

Many of the Resource Area Pools supported a notably high richness of aquatic macroinvertebrates, either comparable to, or greater than, nearby pools sampled during the PBS following the notably wet period of the late 1990s/early 2000s (Biologic, 2025a). This is likely driven by the permanent and consistent habitat present, with low seasonal variability in water levels, in-stream habitat and water quality conditions (Biologic, 2025a). Such groundwater fed, permanent pools provide important refuges for aquatic invertebrate taxa in drought conditions and often support higher invertebrate richness than ephemeral waterbodies (Davis *et al.*, 2013; Halse *et al.*, 2002; Kay *et al.*, 1999). As such, these predictable sources of water have high conservation importance in arid and ephemeral landscapes such as the Pilbara, because they provide the mechanism for maintenance of biodiversity on a local-scale, through the provision of refugia and source of colonisation of ephemeral pools once flows return in the wet season (Davis *et al.*, 2013). A reduction in groundwater level resulting in reductions to surface water habitat extent and persistence of Resource Area Pools therefore has the potential to reduce macroinvertebrate richness within these pools, as well as a reduce overall biodiversity across the area. However, given that not all permanent, groundwater-fed pools will be impacted by drawdown based on the hydrological modelling (i.e. CO-WS-05, CO-WS-16), the risk of any large-scale biodiversity loss is likely to be relatively low. This does, however, depend on the values present at other Resource Area Pools that have not yet been sampled, including CO-WS-05 and CO-WS-40.

<u>Hyporheic invertebrates</u>

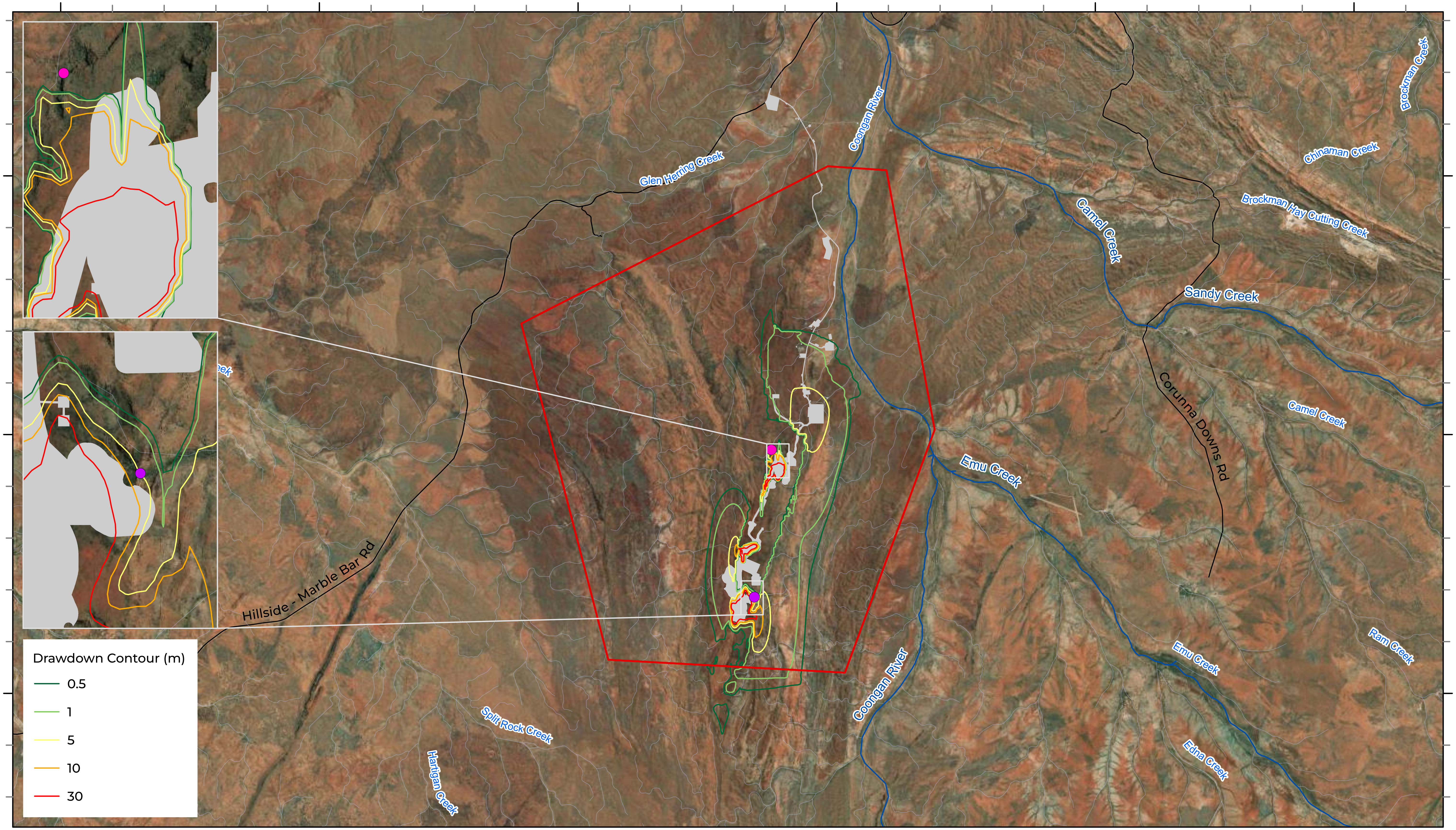
The Resource Area Pools supported a high richness of invertebrate taxa within the hyporheic zone, and although no stygobitic taxa were recorded, CO-WS-12 and CO-WS-14 supported a permanent stygophile ostracod, *Vestalenula marmonieri* (Biologic, 2025a). Several occasional stygophiles occurred at all Resource Area Pools, including *Pristina longiseta*, *P. aequiseta*, *Candonopsis* cf. *tenuis*, *Riocypris* cf. *fitzroyi*, *Mesocyclops brooksi*, *M. notius*, *Microcyclops* *varicans*, *Hydraena* sp., and Scirtidae sp. These species are all relatively common but may be impacted by changes to the hyporheic zone, potentially resulting in a loss of diversity within the Resource Area Pools.

<u>Odonates</u>

Odonate assemblages are known to be positively correlated with high abundance and richness of littoral zone macrophytes, utilising them as refuges and as habitat for egg laying which ensure protection from predators (Butler & deMaynadier, 2007; Paulson, 2019). Drawdown can potentially reduce the availability of habitat (especially macrophyte cover) and prey availability, rendering impacted pools less suitable for odonates.

The Pilbara tiger dragonfly, *Ictinogomphus dobsoni*, is listed as Near Threatened on the IUCN Red List of Threatened Species, and is known to occur at the Resource Area Pools. The listing was based on the species only being recorded from a small number of locations (seven across the Pilbara) (IUCN, 2025). The data used for the IUCN classification did not include grey literature records or the regional Pilbara Biological Survey (PBS) by Pinder *et al.* (2010), where it was recorded at 16 locations. During the baseline aquatic survey, *Ictinogomphus dobsoni* was recorded from CO-WS-10, which was modelled to be subject to 2 – 5 m drawdown post-closure (Figure 3.2). However, given *I. dobsoni* has a relatively widespread distribution across the Pilbara, including at reference sites relatively close to the Study Area (SRRef-03), it is unlikely that drawdown of the Resource Area Pools would have a marked impact on populations at regional scale (Dow, 2017). The IUCN (2025) did note, however, that habitat shifts and alteration due to climate change will become a serious issue for *I. dobsoni* in the future, so cumulative impacts from drawdown in a drying climate may need to be considered.

The Pilbara emerald, *Hemicordulia koomina,* is listed as Vulnerable by the IUCN (2025), based on a severely fragmented population and records from few sites within the Pilbara region. While this listing also excludes records from the PBS and grey literature; the species is still known to be relatively rarely recorded (Biologic, 2025a; Pinder *et al.*, 2010). Aside from its fragmented distribution, other major threats identified by the IUCN (2025) are drawdown from groundwater abstraction and climate change. During the baseline aquatic ecology survey, *H. koomina* was recorded from Resource Area Pool CO-WS-14, which was modelled to be subject to drawdown of up to 3 m post-closure (Figure 3.2). Considering *H. koomina* also has a relatively widespread distribution across the Pilbara, it is unlikely that drawdown of the Resource Area Pools would have a marked impact on regional populations.



LEGEND

Study Area
Combined Disturbance Footprint
Local Road

Surface Hydrology
Minor
Major

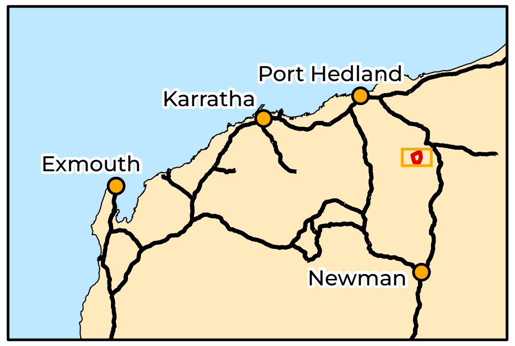
Significant Taxa
Hemicordulia koomina
Ictinogomphus dobsoni

Biologic Environmental

Scale 1:140,000

0 2 4 6 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/10/2025



ATLAS IRON
Sanjiv Ridge BWT
Aquatic Ecology
Risk Assessment

Figure 3.2: Distribution of significant taxa against predicted drawdown contours

3.3.2.4 Vertebrate Fauna

The Resource Area Pools did not support fish, likely due to the rugged topography and isolated nature of the pools limiting fish movement. Other vertebrates recorded included high abundances of tadpoles, with adult *Uperoleia glandulosa*, *Litoria larisonans* and *Cyclorana maini* also recorded. These species are common throughout the Pilbara and are well adapted to dry conditions (Roberts & Edwards, 2018). However, local distributions of frogs may become disrupted if drawdown reduces the persistence of surface waters and nursery habitats.

3.4 Alterations to Surface Hydrology

3.4.1 Description

All streamflow loggers used to assess changes in catchment area by Smith Hydro (2025) occurred within or just outside the Resource Area, with seven sites located in tributaries draining directly eastward from the Resource Area into the Coongan River, and two logger sites located in creeklines draining westward before eventually discharging into the Coongan River (Figure 3.3). Of the Resource Area Pools assessed by Biologic (2025a), hydrological modelling indicated that only one (CO-WS-14), has the potential to be impacted by a reduction in catchment area (Smith Hydro, 2025). Four other pools that were not sampled as part of the baseline aquatic survey also had modelled catchment area reductions, including CO-WS-01, CO-WS-05, CO-WS-08, CO-WS-13 (Figure 3.3 and Table 3.2). These pools vary in hydrology and persistence, but all exhibit some degree of groundwater connection (SRK, 2019). A reduction in catchment area may result in reductions to recharge surrounding these sites, and overall reductions in the timing, magnitude and frequency of flows to these pools. Table 3.1.

The greatest reduction in catchment area was modelled to occur at streamflow logger site SW009, with an estimated reduction of 67% (Figure 3.3 and Table 3.2). Interestingly, CO-WS-09, an ephemeral pool with seasonal groundwater influence, was not modelled to have any catchment reduction, despite being situated just 300 m upstream of SW009 and occurring within the same catchment. The ecological values of CO-WS-09 have not been assessed but the pool is likely to be impacted by a large reduction in catchment area, especially given it is primarily fed by rainwater and flows from the catchment.

Catchment area reduction is likely to have negligible impact on runoff volume and aquifer recharge in water features beyond the Resource Area, with modelled streamflow rate and volume reductions less pronounced with increasing distance from mining development areas (Smith Hydro, 2025). This includes aquatic sampling sites along the Glen Herring Creek and Coongan River, where numerous unimpacted tributaries contribute to surface runoff.