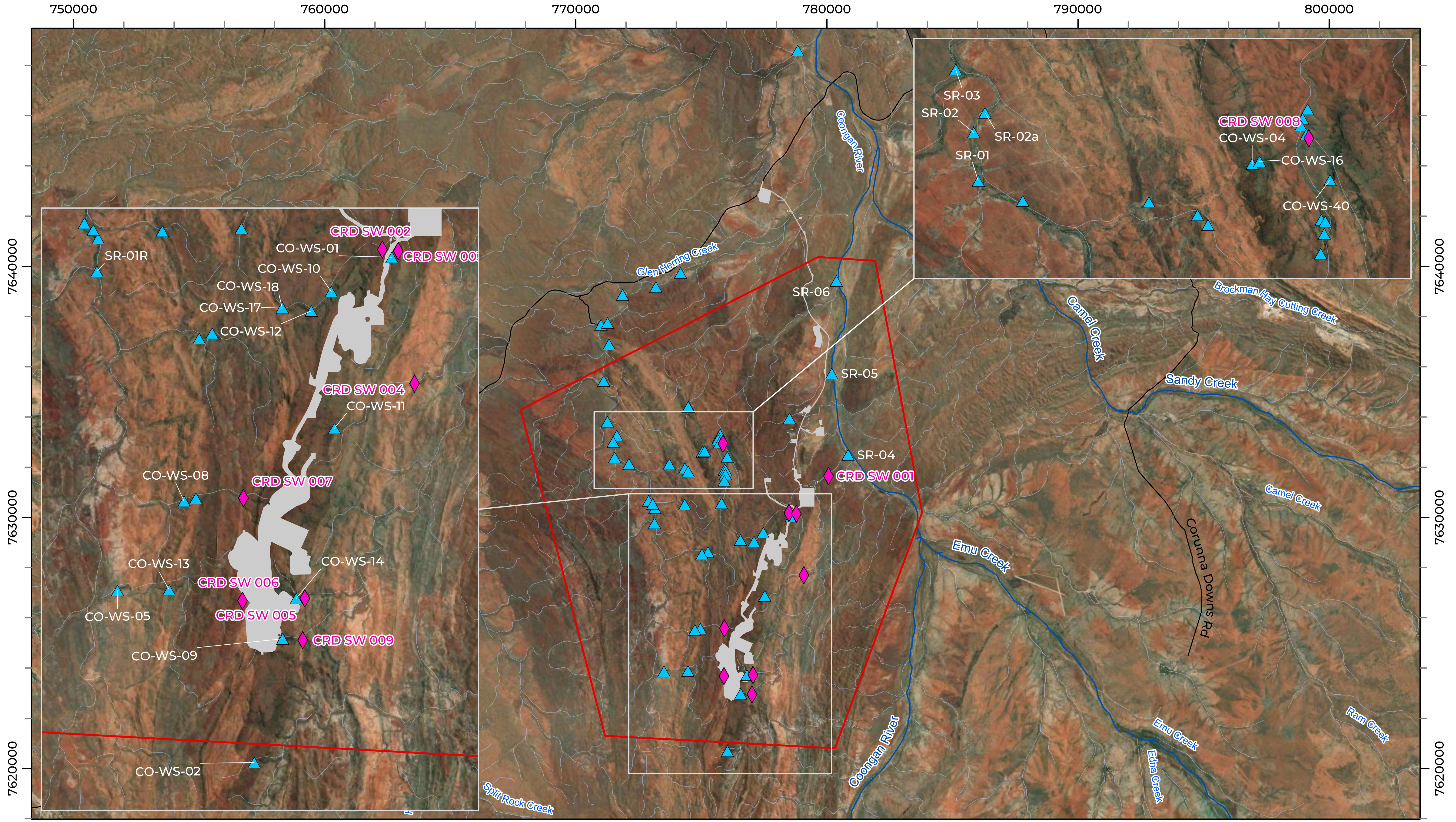


LEGEND

- Study Area
- Combined Disturbance Footprint
- Streamflow Logger
- Surface Water Pool
- Local Road

Surface Hydrology

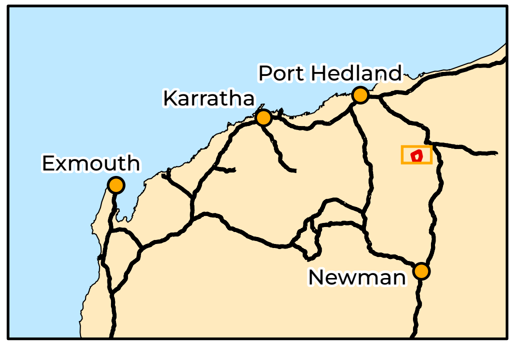
- Minor
- Major

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 3.3: Streamflow loggers used to model catchment reduction, with respect to surface water pools

Table 3.2: Catchment area and streamflow max peak and volume reduction for streamflow loggers and pools across the Project Area for hydrological model 'Scenario 3' (Smith Hydro, 2025)

Site ID	Site Type	Catchment Area Reduction	Max Peak Streamflow Reduction	Streamflow Volume Reduction
SW001	Stream logger	5.83%	8%	6%
SW002	Stream logger	7.17%	7.5%	8%
SW003	Stream logger	12.62%	14%	17%
SW004	Stream logger	0.46%	1%	0.5%
SW005	Stream logger	2.44%	3%	3%
SW006	Stream logger	36.73%	13%	12%
SW007	Stream logger	19.34%	20%	21%
SW008	Stream logger	3.62%	3.5%	5.5%
SW009	Stream logger	66.76%	68%	75%
CO-WS-01	Pool	12.72%	N/A	N/A
CO-WS-05	Pool	2.10%	N/A	N/A
CO-WS-08	Pool	7.05%	N/A	N/A
CO-WS-13	Pool	2.77%	N/A	N/A
CO-WS-14	Pool	2.40%	N/A	N/A

*Note: percentages provided here are within 5% accuracy, as the raw data weren't provided to Biologic, so values have been estimated from figures in Smith Hydro, 2025. This table can be updated for the next version of this report if the accurate percentage reduction data can be provided.

3.4.2 Potential Impacts

3.4.2.1 Habitat

Reduction in catchment area will reduce water levels in pools within impacted areas. Ephemeral pools with limited connection to groundwater, such as CO-WS-09 and CO-WS-13, will likely experience shorter periods of inundation or may cease to hold water entirely. Surface water habitat may not persist long enough to support the entirety of the species assemblage, or to allow life cycles to be completed, leading to an ecosystem shift and loss of biodiversity (Bond *et al.*, 2008). In the Pilbara, more ephemeral aquatic habitats tend to be correlated with lower invertebrate species richness than permanent pools, although they can still support unique and endemic assemblages, especially when inundation is regular and predictable (Pinder *et al.*, 2010). Changes to inundation and hydroperiod within pools will also affect macrophytes and riparian vegetation, which provide important habitat, protection and food sources for aquatic fauna (Bella *et al.*, 2008; Greet *et al.*, 2013).

Reduced runoff volume into pools that are buffered by groundwater inflow may also lead to reductions in water levels and habitat availability, as runoff remains an important factor in surface water expression at these sites, and is also a major contributor to aquifer replenishment. The catchment area of CO-WS-14 was modelled to decrease, and paired with projected drawdown impacts discussed in Section 3.3, this site may be at risk of notable reductions in pool extent. This would limit the availability of aquatic habitat and potentially risk the diverse species assemblages present (Biologic, 2025a). Permanent pools such as CO-WS-14 provide an important refuge in arid zones and support the local persistence of aquatic biota during dry periods. Changes to hydrology that result in the loss of some permanent pools, or a change to ephemeral systems that no longer persist over the dry season, has implications for broader biodiversity loss from the area. In the absence of permanent water features, local biodiversity of aquatic biota has been reported to decline (Davis *et al.*, 2013; Pinder *et al.*, 2010).

3.4.2.2 Water Quality

Water quality of surface water pools is influenced by flow and hydroperiod. Water level recession associated with catchment reduction and reduced inflows can lead to reduced dissolved oxygen saturation, and increased conductivity, dissolved metals, nutrients and temperature, all of which can have a detrimental effect on aquatic biota (Bond *et al.*, 2008). Additionally, alteration to surface hydrology could result in a lack of flows of sufficient volume and magnitude required to flush pools. This can lead to a build of organic matter, sediment, pollutants and nutrients (Patil *et al.*, 2021). These conditions can promote algal growth and lead to a reduction in dissolved oxygen as the abundant organic matter and algae decompose over time (Patil *et al.*, 2021). Excess organic matter can also lead to other water quality impacts such as changes in pH, dissolved metal concentrations and reductions in water clarity (increases in turbidity) (Bond *et al.*, 2008; Evans *et al.*, 2005).

3.4.2.3 Aquatic Invertebrates

Current surface water levels at the Resource Area Pools provide habitat that supports a wide diversity of aquatic invertebrates. The pools remain relatively deep across seasons and some support flowing water, features that are relatively unique amongst pools within and surrounding the Study Area (Biologic, 2025a) and are known to be important on a regional-scale, given the aridity of the Pilbara (Pinder *et al.*, 2010). Water depth and presence of flowing water influences aquatic invertebrate assemblages, and have been observed to support high species richness (Dewson *et al.*, 2007; Pinder *et al.*, 2010). Reductions in surface and groundwater reserves due to a decrease in runoff has the potential to limit the expression of these features and thus may impact the ecological values of the Resource Area Pools.

Odonates

CO-WS-14 recorded a high diversity of aquatic invertebrates, and a high richness of odonates (nine taxa) which included species listed on the IUCN Red List (*Hemicordulia koomina*) (IUCN, 2025). Odonate assemblages are correlated with a high diversity and abundance of wetland flora, and are sensitive to disturbances to the riparian zone (Butler & deMaynadier, 2007; Theischinger *et al.*, 2021). Therefore, the risk to macrophytes and riparian vegetation at CO-WS-14, associated with a change in hydrology, has the potential to impact current odonate assemblages. It could reduce habitat suitability for odonates, and may result in habitat loss for *H. koomina*, a species that already has a highly fragmented distribution.

3.4.2.4 Vertebrate Taxa

The frog species recorded in the vicinity of the Resource Area Pools possess adaptations that increase their survivability in arid environments (Roberts & Edwards, 2018). While catchment area reduction may reduce in-stream habitat available for tadpoles, adult frogs of the recorded species can persist and continue to breed even with minimal surface water presence. It is unlikely that catchment modification will significantly alter the local range of these frog species.

3.5 Mine Infrastructure Development

3.5.1 Description

Disturbances associated with BWT development have the potential to indirectly impact nearby aquatic ecosystems though runoff of contaminants and sediments. This can lead to increases in turbidity and exceedances of water quality DGVs in nearby pools, with flow on effects to aquatic habitat and ecosystems (Affandi & Ishak, 2019; ANZG, 2018; Henley *et al.*, 2000; Ryan, 1991). In the Pilbara, high turbidity can be an important factor in supporting unique species assemblages (Pinder *et al.*, 2010). However, for water features that are otherwise relatively clear, increased turbidity has a cascading impact on their associated ecosystems, reducing primary production, habitat heterogeneity and faunal assemblages (Henley *et al.*, 2000).

The proximity of the Resource Area pools to the mining development area increases their potential for exposure to impacts associated with infrastructure development. Each of the aquatic sampling sites occur within 500 metres of some form of mine development, including active mine areas, future pit footprints and mine access roads (refer to Figure 3.1). Several additional surface water features that were not included in the aquatic ecology survey also occur in close proximity to mining development areas. The ecological values of these sites are unknown and should be assessed in future to fill gaps in knowledge and enable an assessment of potential risks from BWT mining. By comparison, sites along the Coongan River and Glen Herring Creek are more isolated from mining development areas. The minimum distance between the Glen Herring Creek sites and any mining areas exceeds 2 km, and it is unlikely that mining activity will indirectly impact them.

3.5.2 Potential Impacts

3.5.2.1 Habitat

In-stream habitat alteration can occur through sedimentation of pools due to the transport of increased sediment loads from construction activities and runoff. This has the potential to adversely affect aquatic fauna. Smothering of microhabitats reduces habitat heterogeneity, which is known to play a crucial role in the structure and trophic organisation of aquatic invertebrate assemblages (Bis *et al.*, 2000; Miserendino, 2001). During the PBS, unique species assemblages were found to be associated with gradients in sediments, macrophytes, flow and hydrological regime (Pinder *et al.*, 2010). The high diversity of aquatic invertebrates recorded across the Pilbara was primarily due to the persistence of aquatic habitats along these gradients (Pinder *et al.*, 2010).

While in-stream habitat of Resource Area Pools generally comprised open substrate, some pools were found to support submerged macrophytes (CO-WS-10, CO-WS-14) (Biologic, 2025a). Submerged macrophytes increase habitat heterogeneity, providing cover and substrate for a range of aquatic fauna (Lesiv *et al.*, 2020; Thomaz & Cunha, 2010). As primary producers, they are important food sources, and along with phytoplankton increase oxygen saturation supporting respiratory processes and decomposition of detritus. Macrophytes can also reduce the concentration of several pollutants, including excess nitrates, phosphates and metals (Lesiv *et al.*, 2020; Thomaz & Cunha, 2010). As such, the smothering of aquatic plants and reduction in light penetration associated with increased turbidity, reduce primary productivity affecting food webs and altering in-stream habitat to the detriment of aquatic fauna (Wood & Armitage, 1997). During the Pilbara biologic survey, Pinder *et al.* (2010) found higher invertebrate richness was associated with higher submerged macrophyte cover.

The indirect impact of high suspended sediments and increased turbidity is likely to be short lived and can be mitigated through the use of appropriate controls (see section 4.2.1 and Table 4.1). Sediment control measures, including installations such as sediment traps and fences can be highly effective at reducing sediment load transport into aquatic features (Baker *et al.*, 2009; Chapman *et al.*, 2014).

3.5.2.2 Water Quality

The potential for increased sediment loads from construction and development can also impact water quality in nearby pools. Surface waters in the Resource Area Pools are naturally clear, with low turbidity and total suspended solids (TSS). Although aquatic fauna of the Pilbara are adapted to seasonal increases in turbidity and TSS associated with flooding in the catchment during the wet season, increases outside their natural range are likely to have adverse impacts. As mentioned previously, groundwater connection at these pools buffers them against the effects of evapoconcentration over dry periods, and water quality remains relatively consistent over time, providing persistent and predictable habitat for aquatic fauna. This provides a relatively unique situation in the arid Pilbara.

There is also the potential for sediments to introduce contaminants into nearby pools, which may become mobilised in the water column resulting in toxic effects to aquatic biota. This impact can largely be mitigated through the use of appropriate controls and bunding to capture sediments and contaminants before they enter the receiving environment (see section 4.2.1 and Table 4.1).

3.5.2.3 Aquatic Invertebrates

The relatively consistent water quality and clarity characteristic of the Resource Area Pools provide conditions which support a high richness of invertebrate taxa supported by continuous expression of groundwater (Biologic, 2025a; Pinder *et al.*, 2010). Increased turbidity and TSS can have cascading impacts on these ecosystems, from the smothering of microhabitats, changes to water quality, reduced light penetration and impacts to submerged macrophyte and algal growth, through to reduced visibility for aquatic fauna and impacts to predator-prey interactions (Henley *et al.*, 2000). Sedimentation reduces the photosynthetic capability of primary producers, reducing habitat and food availability for macroinvertebrates. This limits macroinvertebrate abundance and impacts higher order consumers within the system, such as fish and predatory macroinvertebrates (Chapman *et al.*, 2014; Rabeni *et al.*, 2005). Elevated turbidity and TSS also affects invertebrate physiology, suppresses zooplankton growth and productivity, and can compromise respiratory structures, feeding strategies (particularly filter feeders), and body condition via abrasion (Hauer *et al.*, 2018; Lemly, 1982; Rabeni *et al.*, 2005). Ultimately, long-term increases in turbidity, TSS and sedimentation have led to reductions in the loss of biodiversity in aquatic systems (Rabeni *et al.*, 2005).

Elevated turbidity and TSS can interfere with feeding apparatus of filter feeding invertebrates, including potentially significant clam shrimp and ostracods recorded within the Study Area (Biologic, 2025a; Lemly, 1982). These included *Ozestheria* `sp. Biologic-BRAN002` and *Candonopsis kimberleyi*, both of which have fragmented distributions and are known from only a few locations across northwestern Australia.

Odonates

Listed odonates including *Ictinogomphus dobsoni* and *Hemicordulia koomina* will likely be indirectly impacted by increases in turbidity and TSS associated with construction and BWT development. Odonate nymphs are predators that utilise visual cues to capture prey (Sentis *et al.*, 2023). They are sensitive to changes in trophic conditions brought about by changes in water quality, including increased turbidity. The Resource Area Pools are important refuges for *I. dobsoni* and *H. koomina,* due to the persistence, water quality (clear and low EC), and habitat (cover by submerged macrophytes) they provide. These factors ensure the success of the listed dragonflies in these pools. If the turbidity of the water exceeds their tolerance over extended periods of time, they may cease to utilise these habitats, resulting in a local range loss of two fragmented species. However, given these species are highly mobile, and these impacts are likely to be short-lived, it is unlikely to cause a major risk to these species on a regional-scale.

3.5.2.4 Vertebrate Taxa

No fish were recorded from the Resource Area Pools, however pools on Glen Herring Creek and Coongan River supported several freshwater fish species, in some cases in large abundance (Biologic, 2025a). Freshwater fish are sensitive to changes in water turbidity, as it can cause a reduction in food availability, impede gill function via clogging and abrasion, and disrupt hunting and/or territorial behaviours requiring visual cues (Younger & Wolkersdorfer, 2004). As it unlikely that mine development within the Resource Area will cause an increase in sediment transport as far downstream as Glen Herring Creek and the Coongan River, pools which support fish populations are unlikely to be impacted by any increases turbidity associated with BWT development.

Several species of waterbird including black-fronted dotterels (*Charadrius melanops*), Pacific black ducks (*Anas superciliosa*), and little pied cormorants (*Microcarbo melanoleucos*) were recorded at pools along the Coongan River and Glen Herring Creek (Biologic, 2025a). Several mine access roads run close to the Coongan River and waterbirds are known to respond negatively to traffic, with regular disturbance impacting bird fitness and reproductive success (Borgmann, 2011). Waterbirds were recorded exhibiting a variety of behaviours (including nesting) during the baseline aquatic survey (Biologic, 2025a). However, due to the establishment of mine access roads, prior to the BWT development, it is unlikely that traffic levels will have more than a minor and intermittent impact on waterbirds.

4 Summary and Conclusions

4.1 EIA Summary

Several activities associated with development of the Sanjiv Ridge mine may potentially impact aquatic ecosystems occurring within the Study Area. These include groundwater drawdown, alterations to surface hydrology and impacts from mining infrastructure development. Proximity of development activities to the Resource Area Pools exposes them to increased risk of cumulative impacts, as several sites occur within areas predicted to be affected by drawdown, catchment reduction and mine infrastructure. This includes ephemeral pools (CO-WS-08, CO-WS-09, CO-WS-13), and permanent groundwater fed pools (CO-WS-01, CO-WS-14). Cumulative loss of water flows and adverse impacts to water quality from mining activities may compromise several unique and significant aquatic ecosystems occurring at these sites.

Groundwater modelling suggested that most drawdown will be limited to areas close to mining pits, with minimal drawdown extending beyond the Resource Area. Modelled drawdown occurs primarily within the FBA system, and is not anticipated to reach alluvial aquifers associated with the Coongan River or Glen Herring Creek. Given that springs and pools of the arid Pilbara region are considered significant ecosystems in the context of EIA, it will be important to ensure other permanent pools remain unaffected by drawdown and catchment alterations to provide an ongoing refuge for aquatic biota, along with the maintenance of biodiversity across the area. Several permanent, groundwater-fed pools occur in areas that are unlikely to be impacted (i.e. CO-WS-05 and CO-WS-16).

Catchment area reduction modelling suggests that reductions in runoff will be minimal beyond the Resource Area Pools. Sites with the largest modelled reductions generally occur immediately downstream of development activities, with catchment reduction diminishing with increased distance downstream. Catchment reductions are unlikely to significantly impact runoff volume into pools along Glen Herring Creek and the Coongan River.

Several pools within the Resource Area are predicted to be impacted by both catchment reduction and drawdown, which would result in cumulative impacts to water supply and flushing. Reduction in surface water levels and persistence can have considerable consequences for water quality and habitat availability, and may limit the suitability of pools for aquatic fauna. This may also limit their ability to function as dry season refuge sites. Reduced flushing associated with catchment reduction also increases the risk of eutrophication and can allow buildup of detritus, both of which will negatively affect water quality and can result in anoxic conditions.

Pools along the Glen Herring Creek and Coongan River are unlikely to be greatly affected by mine infrastructure development, as they do not occur in close proximity to any significant mine developments. However, the Resource Area Pools may be impacted by increased sedimentation, reducing water clarity, increased TSS and potential contaminant issues in the water column. The Resource Area Pools are naturally clear and extended periods of high turbidity may negatively impact macroinvertebrate assemblages, especially filter feeders and visual foragers. Long periods of turbidity can smother macrophytes, which provide habitat for aquatic fauna, increase dissolved oxygen concentrations and absorb pollutants suspended in the water column.

4.2 Considerations and Mitigation Options

4.2.1 Mitigation

The risks described above will likely be mitigated, at least to some extent, by appropriate management and control measures (Table 4.1). This is especially true for potential impacts associated with the mine infrastructure development, such as the movement of sediments and contaminants into pools via runoff from the mine. Sediment traps, fences and bunding may provide appropriate mitigation to reduce excess sediment transport into water features from mining areas, however their efficacy will depend on appropriate placement and maintenance over successive flooding events (Chapman *et al.*, 2014).

Ongoing monitoring should continue throughout the BWT development to assess whether drawdown and catchment reduction are affecting aquatic habitats. This should include monitoring of surface water levels, water quality and aquatic ecology to inform continuing BWT operations and catchment recovery post mine closure.

Table 4.1: Inland Waters values, potential risks and considerations

Area	Inland Waters Values Present	Potential Risks/Impacts	Considerations for maintenance of biological values and ecological integrity
Resource Area Pools	• Aquatic GDEs present - permanent groundwater fed pools, providing persistent and consistent aquatic habitat, with little seasonal variation in water level or quality • Complex in-stream habitat, including submerged macrophytes • Notable land features including small waterfalls and bat caves • High richness of invertebrates within the hyporheic zone, indicating the hydrological connection between surface waters and groundwater provides an important refuge for epigean taxa at certain times of year • Permanent hyporheos stygophiles present within the hyporheic zone • High richness of invertebrates (193 taxa from one year's sampling of four sites, across surface and hyporheic habitats) • One pool, CO-WS-14 recorded notably high macroinvertebrate richness, comparable to nearby PBS sites that were sampled during a much wetter period (early 2000s) • Supports listed invertebrates - *Hemicordulia koomina* (IUCN Vulnerable) - *Ictinogomphus dobsoni* (IUCN Near Threatened) • Significant flora - *Themeda* sp. Panorama (DBCA Priority 1) • Supports *Uperoleia glandulosa* (glandular toadlet), *Litoria larisonans* (desert tree frog) and *Cyclorana maini* (Main's frog), including tadpoles • At least two pools (CO-WS-10 & CO-WS-14) are relatively pristine and currently show very limited impacts from disturbance (no weeds) • Suitable habitat for the MNES Pilbara olive python *Liasis olivaceus barroni* (Vulnerable EPBC Act and BC Act)	**Drawdown** Groundwater modelling indicated drawdown impacts to CO-WS-01, CO-WS-08 (seasonal), CO-WS-09 (seasonal), CO-WS-10, CO-WS-12, CO-WS-13 and CO-WS-14, which would likely lead to: • Reduction in surface water levels, extent and aquatic habitat present • Disconnection of surface waters from hyporheic zones and groundwater, affecting hyporheos and surface water resilience to perturbations • Loss of perennial surface water flows, due to reduction in groundwater inflow resulting in reductions in biodiversity • Changes to water quality associated with lowering water levels, including decreased oxygen and increased ion concentrations • Potential for AMD and NMD if drawdown exposes any PAF material	• There are several groundwater-fed, permanent pools remaining outside areas of drawdown impact which will continue to provide a refuge during dry conditions and may serve to maintain biodiversity on a local-scale (noting that surveys are required to confirm this and understand baseline environmental values present at sites which have not been sampled to-date, i.e. CO-WS-05, CO-WS-16) • Additional baseline survey is required to fill gaps in ecological knowledge • Consider supplementing the high value, groundwater fed pools within zones of drawdown impact (i.e. CO-WS-10, CO-WS-14) • Monitor surface water levels and water quality in pools across the Resource Area, as well as Reference pools for context • Monitor aquatic fauna to confirm maintenance of environmental values • Develop SSGVs once an adequate baseline water quality dataset has been obtained
		Alterations to Surface Hydrology Streamflow and catchment area reductions are projected to primarily impact CO-WS-01, CO-WS-05, CO-WS-08, CO-WS-13 and CO-WS-14, which would likely lead to: • Changes to the hydrologic regime including reduction in surface water levels, extent, persistence and aquatic habitat present • Changes to water quality due to reduced water levels, including reduced oxygen saturation and evapoconcentration of analytes as waters recede • Reduction in flushing flows, resulting in adverse water quality due to the build up of organic matter	• Additional baseline survey to fill gaps in ecological knowledge • Monitor surface water levels and water quality in pools across the Resource Area, as well as Reference pools for context • Monitor aquatic fauna to confirm maintenance of environmental values • Consider supplementing pools which will receive cumulative impacts from both drawdown and alterations to surface hydrology (i.e. CO-WS-01, CO-WS-08, CO-WS-09, CO-WS-13, CO-WS-13). Pools selected for supplementation would likely be based on values. However, some pools have not yet been sampled.
		Mine infrastructure development Primarily impacting pools in closest proximity to the BWT development, such as CO-WS-01, CO-WS-04, CO-WS-09, CO-WS-10, CO-WS-14 and CO-WS-16, and would likely lead to: • Sedimentation of pools – diffuse source. Increased sediment loads due to mine infrastructure development, fluvial processes or dust resulting in the smothering of aquatic habitat and fauna and increased turbidity • Mining activities which expose and mobilise contaminants (metals, decreased pH, nutrients etc) which enter pools via runoff • Dust deposition may contribute contaminants to pools, i.e. high ammonia and nitrate from blasting	• Install sediment traps and dust monitors and ensure they are working as intended • Ensure suitable bunding and treatment of all contaminants on-site • Monitor surface water quality in pools across the Resource Area, as well as Reference pools for context

Area	Inland Waters Values Present	Potential Risks/Impacts	Considerations for maintenance of biological values and ecological integrity
Coongan River	• High potential aquatic GDEs present • High richness of invertebrates (178 taxa from one year's sampling of three sites, across surface and hyporheic habitats) • Groundwater dependent invertebrate taxa are present within the hyporheic zone, including stygobites • Supports invertebrates which are potentially restricted/ significant/known from few records/represent new records or OTUs - *Wandesia* `sp. Biologic-ACAR028` - *Guineaxonopsis* sp. - *Ozestheria* `sp. Biologic-BRAN002` - *Australocamptus* `sp. Biologic-HARP099` • Supports listed invertebrates - *Hemicordulia koomina* (IUCN Vulnerable) - *Nososticta* sp. (likely to represent *Nososticta pilbara*, DBCA Priority 2 and IUCN Endangered) • Supports at least four freshwater fish species • Provides breeding habitat for western rainbowfish • Several species of waterbirds use these pools, including nesting sites for the black-fronted dotterel (*Charadrius melanops*)	**Drawdown** Modelling indicated no impact to pools on the Coongan River from drawdown associated with BWT mining **Alterations to Surface Hydrology** Modelling indicated that alterations to surface hydrology in the Coongan River from catchment reduction within the Resource Area would be negligible **Mine infrastructure development** The Coongan River pools are a sufficient distance from the BWT development that the risk of downstream impacts from increased sediment loads and contaminants in runoff would be low	• Monitor surface water levels and water quality in Coongan River pools, as well as Reference pools, to confirm no impacts
Glen Herring Creek	• Aquatic GDEs present • High richness of invertebrates (164 taxa from one year's sampling of three sites, across surface and hyporheic habitats) • Supports invertebrates which are potentially significant/known from few records - *Ozestheria* `sp. Biologic-BRAN002` - *Candonopsis kimberleyi* (known from few records, and only one other record in the Pilbara, from the lower De Grey River catchment) • Supports listed invertebrates - *Eurysticta coolawanyah* (IUCN Vulnerable) • Supports at least four freshwater fish species • Important breeding and nursery grounds for western rainbowfish and spangled perch • Supports *Uperoleia glandulosa*, including tadpoles • Waterbirds present	**Drawdown** Modelling indicated no impact to pools on Glen Herring Creek from drawdown **Alterations to Surface Hydrology** Modelling indicated that alterations to surface hydrology in Glen Herring Creek from catchment reduction within the Resource Area would be negligible **Mine infrastructure development** The Glen Herring Creek pools are a sufficient distance from the BWT development that the risk of downstream impacts from increased sediment loads and contaminants in runoff would be low	• Monitor surface water levels and water quality in Glen Herring Creek pools, as well as Reference pools, to confirm no impacts

4.2.2 Water Quality – Development of SSGVs

The primary objective of the ANZG (2018) water quality guidelines is, "to provide an authoritative guide for setting water quality objectives required to sustain current, or likely future, environmental values… for natural and semi-natural water resources in Australia and New Zealand". ANZG (2018) provides default guideline values (DGVs) for a range of chemical and physical stressors. Rather than acting as pass or fail compliance criteria, DGVs are designed to protect aquatic ecosystems at a low level of risk, with exceedances intended to act as prompts to alert managers and regulators of changes in water quality that may need to be investigated. In this context, a low level of risk can be inferred when water quality conditions are below (or within) relevant DGVs (ANZG, 2018).

The 2024 aquatic survey indicated that baseline water quality does not always meet ANZG (2018) DGVs naturally for several analytes across the Study Area. At Resource Area Pools, for example, N_NOx exceeded the eutrophication DGV and dFe exceeded the interim working level at some sites. In the Coongan River, dAl and dCu were recorded in concentrations exceeding ANZG (2018) 95% toxicity DGVs, while in Glen Herring Creek, total N and total P were elevated in comparison to eutrophication DGVs (Biologic, 2025a). The DGVs are intended to be applied to systems with no baseline data or where baseline data are insufficient to adequately describe the natural or existing seasonal fluctuations in water quality. In cases where water quality naturally and consistently exceeds DGVs, and to reduce the risk of compliance issues associated with changes to water quality due to development, ANZG (2018) recommends the development of site-specific guideline values (SSGVs) that are tailored to the local conditions. To develop an appropriate dataset to calculate SSGVs, ANZG (2018) indicate that two years of monthly water quality monitoring data are required to ensure seasonal and temporal variation is accounted for, including the wetting-drying cycle in more ephemeral systems (Smith *et al.*, 2020). SSGVs should be developed for both stressors (pH, electrical conductivity, dissolved oxygen, total nitrogen and total phosphorus) and toxicants (dissolved metals, ammonia, nitrate). Generally, major ions (calcium, potassium, sodium, chloride, sulfate) do not require SSGVs, as changes in these analytes are captured by monitoring EC. However, an SSGV should be developed for magnesium, as this can be a dominant solute in mine drainage, often as $MgSO_4$ (Jones *et al.*, 2008). Magnesium has also been shown to be markedly more toxic to aquatic species in Northern Australia than previously thought (van Dam *et al.*, 2008). Including sulfate in SSGVs may also be important as changes in concentration of this ion can provide an early warning of AMD. The development of SSGVs would allow meaningful, ongoing water quality monitoring after the BWT development.

4.3 Gaps and Limitations

4.3.1 Risk Assessment

This risk assessment is preliminary only, and is based on hydrological modelling undertaken by external consultants (Smith Hydro, 2025; SRK, 2025). These studies acknowledged that the hydrogeological features present in the Study Area present challenges when modelling groundwater drawdown, particularly when assessing the connectivity between groundwater features. In some cases, modelling was based on limited data and a sparse time series for water levels.

Risks associated with drawdown, catchment reduction and the construction of site infrastructure for the BWT have been addressed here, at least from a preliminary standpoint using data available to-date. However, any potential discharge operations have not been assessed. Although this is mentioned in Smith Hydro (2025), no detail is provided regarding how much excess dewatered groundwater there may be, and therefore what the potential volumes of discharge are, the location of the discharge outlet, and/or timing and frequency of discharge (continuous or seasonal).

4.3.2 Baseline Survey

It is also acknowledged here that the Assessment uses data collected from a two-season aquatic ecology survey undertaken in the Study Area (Biologic, 2025a). Results from that survey provide a snapshot of the ecological health and values present in 2024. However, ANZG (2018) indicates that sampling over a period of at least three years is required to develop an appropriate dataset to cover the range in natural variability present within the aquatic ecosystem. In arid and more tropical areas, ANZG (2018) recommends bi-annual sampling over this period to account for seasonal and temporal variation in these dynamic systems. A robust baseline dataset also allows statistical analysis to be undertaken in the future as part of monitoring programs, to assess whether there have been changes in water quality and/or ecological values, and whether these changes are likely due to the development, or rather are region wide and potentially due to climate-change.

The Assessment was also constrained by gaps in ecological knowledge for some of the pools within the Resource Area, in areas at risk of potential impacts from drawdown and catchment reduction. Pools which require baseline survey to adequately document values and condition to allow an assessment of risk to be made include, but are not limited to, CO-WS-01, CO-WS-05, CO-WS-08, CO-WS-09 and CO-WS-13 (Table 4.2). In addition, one potentially permanent pool that corresponds with a BoM (2025) aquatic GDE, sits outside potential impact areas (CO-WS-40). It would be prudent to understand the baseline ecological values of this pool, and definitively determine that it is outside areas of impact from the expanded development. This pool may represent a long-term refuge and provide an offset for loss of habitat for other pools that are likely to be impacted.

The desktop assessment undertaken as part of the 2024 baseline survey also highlighted that additional restricted and/or significant species have the potential to occur within aquatic habitats of the Study Area. These include:

- Copepod *Eodiaptomus lumholtzi* – Vulnerable IUCN
- Copepod *Parastenocaris* sp. – unresolved taxonomy, but species within this genus can have restricted distributions
- Stygal amphipods Melitidae sp. and Paramelitidae sp. – unresolved taxonomy but species within these families tend to be SREs
- Stygal syncarid *Atopobathynella* `sp. Biologic-PBAT078` - recorded from nearby Reference sites on Emu Creek, this is the first record of the OTU and these syncarids tend to occur over relatively short ranges, there is the potential that it occurs within the Study Area
- *Austroagrion pindrina* – Vulnerable IUCN.

Further surveys are required to ascertain their presence within the Study Area.

Table 4.2: Cumulative impacts to Resource Area Pools and whether baseline surveys have been undertaken

Pool	Groundwater Connection	Drawdown Impact Operations	Drawdown Impact Post-Closure	Catchment Reduction	Baseline Aquatic Sampling Undertaken?
CO-WS-01	Spring-fed	✓	×	✓	×
CO-WS-05	Potential	×	×	✓	×
CO-WS-08	Seasonal	×	✓	✓	×
CO-WS-09	Seasonal	✓	✓	✓	×
CO-WS-10	Spring-fed	×	✓		✓
CO-WS-12	Spring-fed	×	✓		✓
CO-WS-13	Seep	×	✓	✓	×
CO-WS-14	Spring-fed	✓	✓	✓	✓

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Appendix A: Overview of the Protection of Inland Waters

Inland Waters

Surveys undertaken to support environmental impact assessment of inland aquatic ecosystems (Inland Waters) in Western Australia must be undertaken in consideration of the following policy and guidance issued by the relevant State or Federal department, including:

- *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)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000; ANZG, 2018).

The Environmental Protection Authority (EPA) defines Inland Waters as:

"The occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality)" (EPA, 2018).

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). The EPA is primarily focused on impacts to significant ecosystems. In relation to arid areas such as the Pilbara, significant ecosystems include (but are not limited to):

- 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.

Technical and Best Practice Guidance

There is currently no technical sampling guidance available for Inland Waters in Western Australia. However, the Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (ANZG, 2018), developed by the Australian Government, provide authoritative guidance on the management of water quality for natural and semi-natural water resources in Australia and New Zealand, via a Water Quality Management Framework (WQMF). This guidance outlines requirements for sampling multiple lines of evidence across the pressure-stressor-ecosystem receptor causal pathway, to provide confidence in aquatic ecology survey conclusions.

Further to this, Smith *et al.* (2020) provides guidance for the application of the WQMF as it relates to temporary waters (e.g. ephemeral rivers, episodic lakes), which are common in the Pilbara region. The Aquatic Ecosystems Toolkit (Aquatic Ecosystems Task Group, 2012) provides a nationally-agreed framework that offers a set of good practice tools for mapping, classifying and assessing the condition of aquatic ecosystems, and guidance to identify high ecological value aquatic ecosystems (HEVAE).

Additionally, the Assessment was undertaken in accordance with the following guidance and procedures:

- Technical Guidance, Terrestrial Vertebrate Fauna Surveys for Impact Assessment (EPA, 2020)
- Best practice aquatic fauna sampling as undertaken during the Pilbara Biological Survey (Pinder *et al.*, 2010) and National Monitoring River Health Initiative (Choy & Thompson, 1995).

Significant Aquatic Fauna, Flora and Ecological Communities

All native aquatic fauna, flora and ecological communities in Western Australia are protected at a state level under the BC Act and at a national level under the EPBC Act. Any action that has the potential to impact native fauna or flora needs to be approved by relevant state and/or federal departments in accordance with the WA EP Act and the federal EPBC Act.

While all native fauna, flora and ecological communities are protected under these Acts, some species and communities are afforded extra protection. This includes species or communities that are considered threatened under the EPBC Act and/or BC Act, or migratory bird species that are protected under international agreements and subsequently listed as Migratory under the EPBC Act and/or BC Act. Furthermore, any species or communities that may be threatened but for which there is insufficient information available to allocate a threatened status under the EBPC Act and/or BC Act, can also be listed as Priority species or communities by the WA DBCA. For the purposes of this assessment, as per EPA (2020), significant species and communities are those that are afforded protection under the EPBC Act, BC Act and/or listed as Priority by DBCA.

A summary of legislation and technical guidance applicable to this assessment is provided in Table A1. Conservation status codes are provided in Tables A2 to A5.

Table A1: Summary of key legislative, regulatory and technical guidance applicable to the Assessment

Legislation / Guidance	Summary in relation to the Assessment
Key Legislation and Regulatory Guidance	
Environmental Protection Act 1986 (EP Act)	• Provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment, via the process of EIA
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	• Ensures nationally significant animals, plants, habitats or places (Matters of National Environmental Significance; MNES) are identified and protected. These include species and ecological communities listed as critically endangered, endangered or vulnerable at the Commonwealth level, as well as migratory and marine species, wetlands of international importance (Ramsar wetlands), national heritage places and world heritage areas
Biodiversity Conservation Act 2016 (BC Act)	• Provides protection for species or ecological communities at the State level. Species or ecological communities may be listed as threatened (e.g. critically endangered, endangered, vulnerable, near threatened) or Priority (e.g. Prioroity 1, 2, 3, 4).
Environmental Factor Guideline, Inland Waters (EPA, 2018)	• 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*" • Inland waters are defined as *"The occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality)"* • Primary focus is impacts to 'signifcant ecosystems', which in arid areas include: o wetlands listed in the Directory of Important Wetlands in Australia (DIWA) o wetlands protected by Environmental Protection Policies under Part III of the EP Act o wild rivers, as identified by the Australian Heritage Commission and Department of Water and Environmental Regulation (DWER) o wetland types which may be poorly represented in the conservation reserves system o springs and pools o ecosystems which support significant flora, vegetation and fauna species or communities, including migratory waterbirds, bats, and subterranean fauna o ecosystems which support significant amenity, recreation, and cultural values.
Environmental Factor Guideline, Terrestrial Fauna (EPA, 2016b)	• The objective of Terrestrial Fauna is to "*protect terrestrial fauna so that biological diversity and ecological integrity are maintained*" • Terrestrial fauna are defined as as animals living on the land or using land (including aquatic systems) for part of their lives, which for aquatic ecosystems include vertebrates (freshwater fish, amphibians, reptiles, waterbirds, and semi-aquatic mammals) and aquatic invertebrates
Environmental Factor Guideline, Flora and Vegetation (EPA, 2016a)	• The objective of Flora and Vegetation is to "*to protect flora and vegetation so that biological diversity and ecological integrity are maintained*" • In relation to aquatic ecosystems this includes aquatic flora (submerged and emergent aquatic macrophytes) and riparian vegetation
Technical Guidance and Proceedures	
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018)	• The Australian and New Zealand Guidelines (ANZG) provide authoritative guidance on the management of water quality for natural and semi-natural water resources in Australia and New Zealand, via a Water Quality Management Framework (WQMF) • Outlines requirements for sampling multiple lines of evidence across the pressure-stressor-ecosystem receptor causal pathway under the WQMF, to provide confidence in aquatic ecological survey conclusions • Priovide toxicant default water and sediment quality guideline values (DGVs) for the protection of aquatic ecosystems
Assessing and Managing Water Quality in Temporary Waters (Smith *et al.*, 2020)	• Provides guidance for the application of the WQMF as it relates to temporary waters (e.g. ephemeral rivers, episodic lakes), which are common in the Pilbara region
Aquatic Ecosystems Toolkit (Aquatic Ecosystems Task Group, 2012)	• A nationally-agreed framework that provides a set of good practice tools for mapping, classifying and assessing the condition of aquatic ecosystems, and provides guidance to identify high ecological value aquatic ecosystems (HEVAE).
Survey Guidelines for Australia's Threatened Fish: Guidelines for Detecting Fish Listed as Threatened Under the EPBC Act (DSEWPaC, 2011)	• Provides guidance on the effort and methods considered appropriate when conducting surveys for freshwater fish listed as threatened under the EPBC Act
Technical Guidance, Terrestrial Fauna Surveys (EPA, 2016c)	• Provides relevant information on sampling aquatic/semi-aquatic vertebrate fauna (e.g. waterbirds, pythons, turtles, frogs) with respect to timing, effort and the level of survey
Pilbara Biological Survey (Pinder *et al.*, 2010) and National Monitoring River Health Initiative (Choy & Thompson, 1995)	• Sampling methods for the Assessment followed methods applied in these surveys, as they are considered 'best practice' in the absence of prescriptive technical guidance for sampling Inland Waters in Western Australia

Table A2 – Conservation categories under the *EPBC Act 1999*

Category	Definition
Threatened Fauna Species	
Extinct (EX)	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild (EW)	Taxa known to survive only in captivity
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered (EN)	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable (VU)	Taxa facing a high risk of extinction in the wild in the medium-term future
Migratory (MIG)	Consists of species listed under the following International Conventions: Japan-Australia Migratory Bird Agreement (JAMBA) China-Australia Migratory Bird Agreement (CAMBA) Convention on the Conservation of Migratory Species of Wild animals (Bonn Convention)
Threatened Ecological Communities (TEC)	
Critically Endangered	An ecological community is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	An ecological community is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered nor endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Table A3 – Conservation categories under the *BC Act 2016*

Category	Definition
Threatened Fauna Species	
Critically Endangered (CR)	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Published under schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered fauna.
Endangered (EN)	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Published under schedule 2 of the Wildlife Conservation Notice 2018 for endangered fauna..
Vulnerable (VU)	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Published under schedule 3 of the Wildlife Conservation Notice 2018 for vulnerable fauna.
Extinct (EX)	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation Notice 2018 for extinct fauna.
MI	Birds that are subject to international agreements relating to the protection of migratory birds.
CD	Special conservation need being species dependent on ongoing conservation intervention. (Conservation Dependant)
OS	In need of special protection, otherwise than for the reasons pertaining to Schedule 1 through to Schedule 6 Fauna. (Other specially protected species.
Threatened Ecological Communities (TEC)	
Critically Endangered (CR)	An ecological community is eligible for listing in the category of critically endangered ecological community at a particular time if, at that time — (a) it is facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines; and (b) listing in that category is otherwise in accordance with the ministerial guidelines.
Endangered (EN)	An ecological community is eligible for listing in the category of endangered ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community; and (b) it is facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.

Category	Definition
Vulnerable (VU)	An ecological community is eligible for listing in the category of vulnerable ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community or an endangered ecological community; and (b) it is facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.
Collapsed	An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time — (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover — (i) its species composition or structure; or (ii) its species composition and structure.

Table A4 – DBCA Priority Definitions

Category	Definition
Priority Fauna Species	
Priority 1 (P1)	**Poorly-known Species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 (P2)	**Poorly-known Species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3 (P3)	**Poorly-known Species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 (P4)	**Rare, Near Threatened and other species in need of monitoring** a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Priority Ecological Communities (PEC)	
Priority 1 (P1)	**Poorly-known ecological communities** Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g., within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but

Category	Definition
	do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2 (P2)	**Poorly-known Ecological Communities** Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3 (P3)	**Poorly-known Ecological Communities** (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4 (P4)	**Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.** (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5 (P5)	**Conservation Dependent Ecological Communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table A5 – IUCN Categories

Category	Definition
Extinct (Ex)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (Ex)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (Cr)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (En)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (Vu)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

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Endangered (En)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (Vu)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
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Vulnerable (Vu)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
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