Aquatic Fauna Desktop Assessment and Field Survey

Tabba Tabba Lithium Project

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Basis of Report

Executive Summary

An aquatic field reconnaissance survey of the Tabba Tabba Lithium Project area conducted in wet season (April) 2025 provides a snapshot of the current ecological condition of creeks in the Project area, and the receiving environments. The rivers and creeklines sampled in the Project area were found to support a diverse and abundant array of aquatic biota (Table E1).

Water quality parameters were outside ANZG (2018) default guideline values (DGVs) for conductivity, pH and dissolved oxygen. The electrical conductivity DGV is known to be highly conservative for Pilbara waters and no sites exceeded the point of ecological stress. There were elevated concentrations of soluble nitrogen (N_NOx) at SRR1, indicating that nitrogen-nutrient enrichment occurs within the Strelley River. Total phosphorus exceeded the ANZG DGV at TTR2 and TTPE2, likely due to agricultural impacts (from cattle accessing pools for drinking, disturbing sediment and soiling water) and evapoconcentration in these receding pools.

Dissolved metals concentrations were generally below DGVs at all sites across the study area except for aluminium at TTPE3. Elevated concentrations of Al are also a characteristic of inland waters in the region due to colloidal clays in silicates. There were no exceedances of ANZG DGVs for sediment quality among the metals analysed.

The majority of taxa recorded were common, ubiquitous species with Australasian or cosmopolitan distributions, and none appear on conservation lists. One taxa endemic to the Pilbara region was recorded, the aquatic hydrophilid beetle *Laccobius billi.*

A total of six species of fish were recorded in the Project area including western rainbowfish, spangled perch, milkfish, green mullet, tarpon and banded scat. Of the six species recorded, only two were true freshwater species (western rainbowfish and spangled perch), the remaining four species were of estuarine/marine origin.

Potential key threatening processes associated with Tabba Tabba mine include discharge of excess mine pit dewatering to creeklines or rivers causing alterations to hydrology and/or water quality to receiving environments, including sedimentation and alterations to river channel flow paths and groundwater drawdown from pit dewatering, resulting in changes to groundwater quantity and subsequent impact to groundwater supported surface waters.

Additional sampling of the lower creekline sites, when flowing, is required to determine if mine signature will be evident at these sites (i.e. Tabba Tabba Creek) during flow events. Wet season runoff can flush a variety of contaminants into aquatic systems, and this is known to adversely impact these environments. Impacts include changes to water chemistry and macroinvertebrate assemblage structure (shift to more pollution tolerant taxa), the introduction of pollutants to substrates making them readily available to aquatic organisms, and bioaccumulation of pollutants in some fish and invertebrate species (Masterman & Bannerman 1994). Potential impact on water quality to community uses such as livestock drinking water, cultural and heritage values should also be considered.

Table E1. Abbreviated summary of aquatic ecological values identified in the April 2025 survey.

AQUATIC ECOSYSTEM COMPONENT	ECOLOGICAL VALUES IDENTIFIED
Aquatic habitat types	• Ephemeral reaches of Tabba Tabba Creek and Strelley River within the project boundary • Permanent pool on Turner River
Water & sediment quality	• No ecologically-relevant exceedances of ANZG (2018) DGVs for surface water metals concentrations • Exceedances of conductivity and dissolved oxygen DGVs within all reaches • Total phosphorus concentrations within Tabba Tabba Creek, and N_NOx and N_NO_3 concentrations within the Strelley River, exceeded protection against eutrophication DGVs • No sediment metals concentrations were above ANZG (2018) DGVs
Riparian habitat condition	• Riparian condition surveys conducted at all nominal sites • *Melaleuca* spp. dominated overstorey, terrestrial vegetation to watermark at smaller ephemeral sites
Phytoplankton	• 53 phytoplankton taxa were identified • A significant phytoplankton bloom was present at TTR2, including concentrations of toxin producer *Limnothrix* sp.
Microinvertebrates	• 36 microinvertebrate taxa identified • No conservation significant taxa identified
Macroinvertebrates	• 121 macroinvertebrate taxa identified from aquatic habitats in the study area • No conservation listed taxa identified • Pilbara endemic beetle *Laccobius billi* recorded at three sites on Tabba Tabba Creek
Fish	• Six species of fish were recorded, including two true freshwater species • No fish were conservation listed.
Waterbirds	• One species of waterbird was identified in proximity to aquatic habitat on the Strelley River • No species were conservation listed, nor appear on migratory bird agreement lists (CAMBA, JAMBA, ROKAMBA)

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Acronyms and Abbreviations

ANZECC	Australia and New Zealand Environmental Conservation Council
ANZG	Australian and New Zealand Guidelines
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASFB	Australian Society for Fish Biology
BC Act	Biodiversity Conservation Act
CAMBA	China-Australia Migratory Bird Agreement
CD	Coondiner Creek downstream of Eagle Rock Falls
CR	Critically endangered
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DELWP	Department of Environment, Land, Water and Planning
DGO	De Grey-Oakover
DGV	Default guideline value
DO	Dissolved Oxygen
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIFAC	European Inland Fisheries Advisory Commission
EN	Endangered
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act
EW	Extinct in the wild
EX	Extinct
FBA	Freshwater Biological Association
GIS	Geographic Information System
GV	Guideline Value
IBSA	Index of Biodiversity Surveys for Assessments
ICUN	International Union for Conservation of Nature
ISQG	Interim Sediment Quality Guidelines
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
LC	Least concern
LoE	Lines of Evidence
LOR	Limit of Reporting

LWD	Large Woody Debris
N_NOx	soluble nitrogen
NATA	National Association of Testing Authorities
NHMRC	National Health and Medical Research Council
nMDS	Non-metric Multi-Dimensional Scaling
NT	Near threatened
NWQMS	National Water Quality Management Strategy
PBS	Pilbara Biological Survey
PC	Physical and Chemical Stressors
PCO	Principal Coordinates Analysis
PHC	Port Hedland Coast
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SIMPROF	Similarity Profiles
SL	Standard Length
TDS	Total Dissolved Solids
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
VU	Vulnerable
WHO	World Health Organisation
WoE	Weight of Evidence
WQMF	Water Quality Management Framework
WRM	Wetland Research & Management
WTW	Wissenschaftlich-Technische-Werkstätten

1.0 Introduction

The Tabba Tabba Lithium Project (the Project) is located in the central Pilbara, approximately 50km south-east of Port Hedland and is in the advanced stage of exploration, with pre-feasibility studies in progress. The Project concept comprises a single open cut pit to be mined over 11 years for 4.5 Mtpa of ore, waste rock dump, processing plant, tailings dam, water supply bore field, power plant, camp, airstrip, workshops, and other supporting structures.

To support the Environmental Impact Assessment (EIA) process for the proposed development, SLR Consulting was engaged to undertake an aquatic fauna desktop assessment and field reconnaissance survey.

1.1 Scope of Work

The overall scope of work comprised a reconnaissance aquatic ecology assessment to increase the knowledge of the area and included:

- Desktop assessment to identify likely presence of aquatic fauna, habitat and conservation significant species within and near the Project Area including but not limited to:
  - Conservation significant fauna listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
  - Threatened fauna listed under the Western Australian *Biodiversity Conservation Act 2016* (BC Act).
  - Priority fauna listed by the Department of Biodiversity Conservation and Attractions (DBCA).
  - Literature review of survey reports in the vicinity and relevant results.
  - Database searches including DBCA Threatened and Priority Fauna Database, Threatened Ecological Communities Database and Protected Matters Search Tool (EPBC Act).
- Reconnaissance field survey to analyse water and sediment chemistry, algae (phytoplankton), macrophytes (aquatic flora) and aquatic invertebrates, waterbirds and riparian vegetation and to determine requirements for follow-up or targeted surveys (if required).
- Preparation of a report suitable for use to support environmental approval applications to government.
- Provision of Index of Biodiversity Surveys for Assessments (IBSA) standards and GIS data.
- Survey and reports conforming to the Environmental Protection Authority (EPA) Environmental Factor Guideline – Inland Waters and any other relevant guidance materials or standards that may be applicable.
- Conservation significance of all taxa identified assessed against relevant listings and databases.

1.2 Legislation and Guidance

Aquatic ecosystem monitoring in the Project area is conducted in accordance with the EPA Environmental factor guideline *Inland Water,* broadly defined as encompassing "the occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality)" (EPA 2018).

Inland waters are considered to include groundwater systems, wetlands, estuaries, and any river, creek, stream or brook (and its floodplain), including systems that "flow permanently, for part of the year or occasionally, and parts of waterways that have been artificially modified" (EPA 2018). Thus, the EPA factor is considered to include all inland waterways irrespective of duration, frequency or volume of flow or inundation. The objective of this factor is "to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected" (EPA 2018). Environmental value is defined under the *Environmental Protection Act 1986* (EP Act) as a beneficial use or an ecosystem health condition. Aquatic fauna and the ecological processes that support them are specifically listed in the revised Environmental Factor Guideline as one of the ecosystem health values that must be considered as part of the EIA process (EPA 2018).

There are currently no prescriptive guidance statements at the state level outlining surface water quality and aquatic fauna sampling design, methods and general approaches / bioindicators. In alignment with current research however, the field surveys conducted in 2025 was consistent with the following:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (ANZG 2018);
- Australian Government 2018, Charter: National Water Quality Management Strategy (NWQMS), Department of Agriculture and Water Resources, Canberra, March. CC BY 3.0 (AG 2018);
- Batley, GE, van Dam, RA, Warne, MStJ, Chapman, JC, Fox, DR, Hickey, CW and Stauber, JL 2018. Technical rationale for changes to the Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants. Prepared for the revision of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, 49 pp (Batley et al. 2018);
- Environment Protection Authority (EPA) Guidance No. 20, Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia (EPA 2009);
- EPA Position Statement No. 3, Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002);
- EPA Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020);
- EPA Guidance No. 56, Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004).
- Warne MStJ, Batley GE, van Dam RA, Chapman JC, Fox DR, Hickey CW and Stauber JL 2018. Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants – update of 2015 version. Prepared for the revision of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, 48 pp (Warne et al. 2018).

In addition, Australia's National Water Quality Management System (NWQMS) provides authoritative guidance on the management of water quality in Australia and New Zealand (ANZG, 2018). To protect the community values of waterways (aquatic ecosystems and cultural and spiritual values), the Water Quality Management Framework (WQMF) applies a weight of evidence (WoE) process to collect, analyse and evaluate a combination of different qualitative, semi-quantitative or quantitative lines of evidence (LoE) to make an overall assessment of water quality and its associated management. Therefore, in accordance with the WQMF (ANZG 2018), water quality (physical and chemical stressors and toxicants) and aquatic fauna receptors (macroinvertebrates, and fish) can be used to characterise and monitor ecosystem health condition.

Aquatic fauna sampling methods were also similar to the following:

- Parks and Wildlife surveys of benthic macroinvertebrates for the regional Pilbara Biological Survey (PBS) (see Pinder et al. 2010); and
- National Monitoring River Health Initiative (Department of Environment Sport and Territories 1994).

Relatively few aquatic fauna species in Western Australia are listed as threatened or endangered under the BC Act or EPBC Act. Aquatic invertebrates have been historically under-studied. Lack of knowledge of their distributions often precludes aquatic invertebrates for listing as threatened or endangered, however, they often constitute diverse assemblages, and are a valuable, sensitive tool for monitoring of environmental impacts. In addition to the values listed above, the desktop review and baseline survey assessed the following:

- The International Union for Conservation of Nature (IUCN) Red List rankings, which assesses a species conservation status in terms of extinction risk, from least concern (LC), near threatened (NT), vulnerable (VU), endangered (EN), critically endangered (CR), extinct in the wild (EW) and extinct (EX). The IUCN Red List relies on expert assessments for individual species; thus it should be noted that most invertebrates are not yet listed.
- Taxa also noted as being regionally endemic / likely endemic to the west Pilbara, and those that represent species new to science based on current knowledge.

2.0 Methodology

2.1 Literature Review

2.1.1 Literature searches

Publicly available, relevant aquatic biology survey reports were sourced and reviewed for the desktop assessment. This included, but was not limited to, relevant scientific reports and studies that have been undertaken on a local and regional scale, together with published and grey literature. The aquatic biology reports reviewed for this assessment are summarised in Table 1.

Table 1. Aquatic biology reports relevant to the study area, arranged by year of publication (for full citation see references section).

YEAR OF PUBLICATION	AUTHOR	REPORT TITLE
2001	Kendrick & McKenzie	A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions: Pilbara 1 (PIL1 – Chichester subregion)
2001	Kendrick & Stanley	A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions: Pilbara 4 (PIL4 – Roebourne synopsis)

2002	Halse *et al.*	Do springs provide a window to the groundwater fauna of the Australian arid zone? Balancing the groundwater budget: proceedings on CD of an International Groundwater Conference
2004	Morgan & Gill	Fish fauna in inland waters of the Pilbara (Indian Ocean) Drainage Division of Western Australia – evidence for three sub-provinces
2005	Eberhard *et al.*	Stygofauna in the Pilbara region, north-west Western Australia: a review
2009	Morgan *et al.*	Fishes in groundwater dependent pools of the Fortescue and Yule Rivers; Pilbara, Western Australia
2009	Pinder & Leung	Conservation status and habitat associations of aquatic invertebrates in Pilbara coastal river pools.
2010	Department of Water	Yule River – ecological values and issues
2010	Pinder *et al.*	A biodiversity survey of the Pilbara Region of Western Australia, 2002 - 2007
2014	Halse *et al.*	Pilbara stygofauna: deep groundwater of an arid landscape contains globally significant radiation of biodiversity
2019	Morgan *et al.*	Technical Memo in relation to the presence of sawfish species and the construction of a marina in Port Hedland.
2022	Stantec	Mallina Gold Project - Baseline Aquatic Ecology Study of the Turner and Yule Rivers
2023	Stantec	Mallina Gold Project – Baseline Aquatic Ecology Survey of the Turner and Yule Rivers, Flood Study Memorandum

2.1.2 Database searches

Public databases were searched to obtain information on the distribution and significance of aquatic fauna species that may be relevant to the desktop assessment. Database searches are summarised in Table 2.

Table 2. Database searches.

Database	Description	Authority	Area of Search/ Species
Protected Matters Search Tool	Search conducted by SLR on 4th June 2025	DCCEEW	50 km radius of project area
Australian Wetlands Database	Search conducted by SLR on 4th June 2025	DCCEEW	50 km radius of project area
Wild Rivers (DWER-087)	Search conducted by SLR on 4th June 2025	DWER	Pilbara region

Database	Description	Authority	Area of Search/ Species
Freshwater Fish Distribution in Western Australia	Search conducted by SLR on 4th June 2025	DPIRD	All fish species
Australian Society for Fish Biology Conservation List	Search conducted by SLR on 4th June 2025	ASFB	All freshwater and estuarine fish species
Atlas of Living Australia (ALA)	Search conducted by SLR on 4th June 2025 Utilised in assessing taxonomic status and distribution of aquatic fauna	Collaborative project between academic, private and community groups.	50 km radius of study area
DBCA Threatened and Priority Fauna List April 2025	Search conducted by SLR on 4th June 2025 Utilised in assessing the conservation status of aquatic fauna	DBCA	All aquatic species

2.1.3 Aquatic ecological values – regional context

The Pilbara region is an arid environment that experiences variable climatic conditions including irregular rainfall, which results in periodic, variable flows (Pinder & Leung, 2009). Consequently, permanent, semi-permanent and ephemeral aquatic systems have high ecological value, with permanent ecosystems (i.e. spring-fed and river pools) providing important refugia for aquatic fauna during dry periods. Groundwater inflows are important to sustain these permanent pools in periods of low flow, and reduced inflow can negatively impact water quality and habitat for aquatic fauna communities (Pinder & Leung, 2009).

The project area falls within the Port Hedland Coast (PHC) and De Grey-Oakover (DGO) drainage basins and spreads the Chichester subregion within the Pilbara IBRA bioregion (Pinder *et al.* 2010). This area is surrounded by the lower reaches of multiple rivers, which include spring-fed, turbid, and tidally influenced pools (PHC), as well as claypans and river pools (DGO) (Pinder *et al.* 2010). The major rivers that surround the project area are the Yule, De Grey and Turner rivers (Figure 1), which support a range of aquatic invertebrates, stygofauna, and fish species. Unlike in some other arid regions, aquatic communities in the Pilbara are highly biodiverse and include numerous endemic species.

2.2 Field methodology

2.2.1 Sampling sites and survey timing

SLR conducted a reconnaissance aquatic ecology survey for the Tabba Tabba Lithium Project on the 14th to 16th of April 2025. A total of ten pool sites were sampled (Figure 2). These included six sites on Tabba Tabba Creek (two upstream of the proposed Project Area and four downstream), three on the Strelley River (one upstream of the proposed Project area and two downstream) and one on the Turner River East (downstream of the proposed Project area). Site photographs are provided in Appendix A.

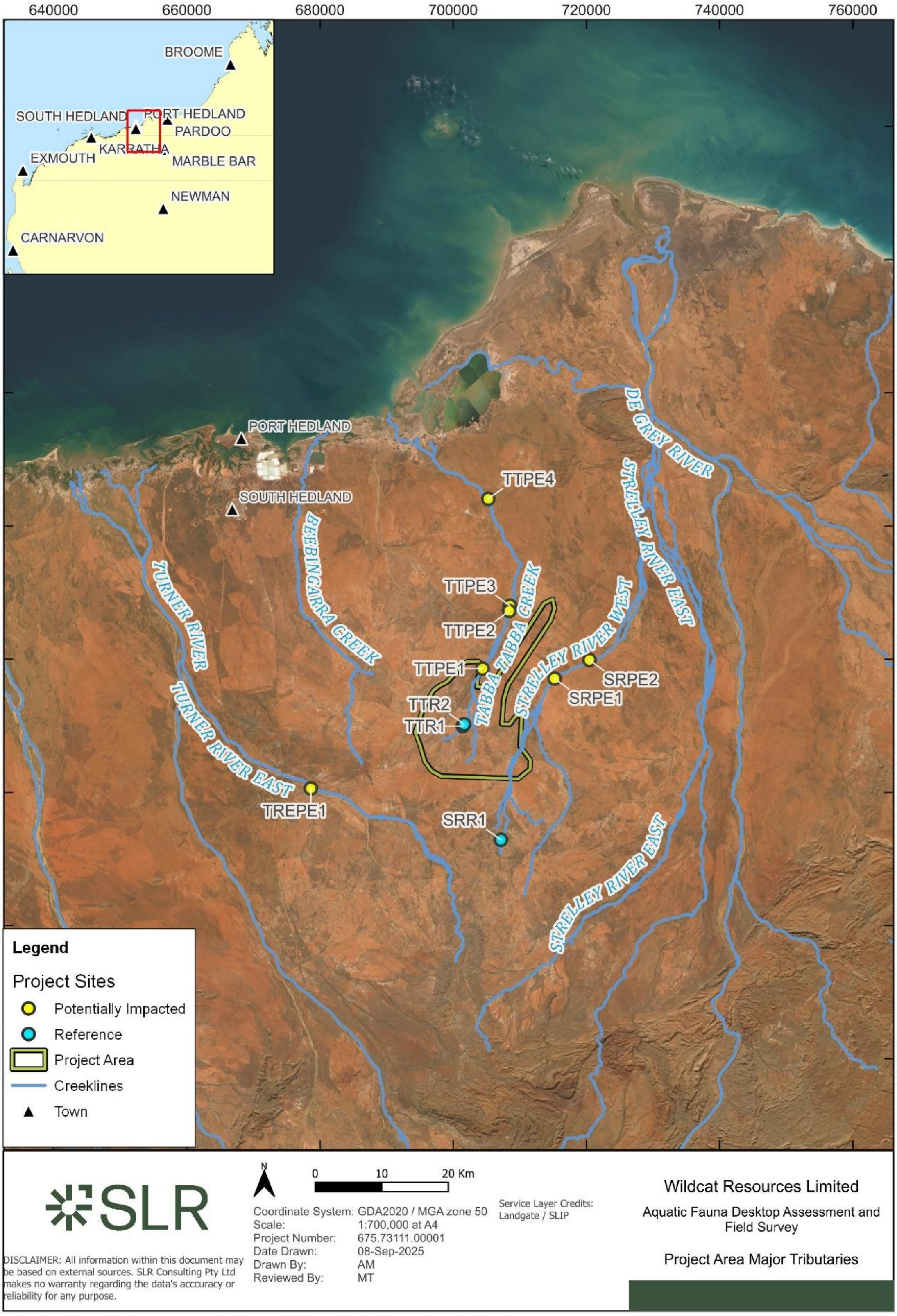

Figure 1. Major river tributaries in and surrounding the Project area.

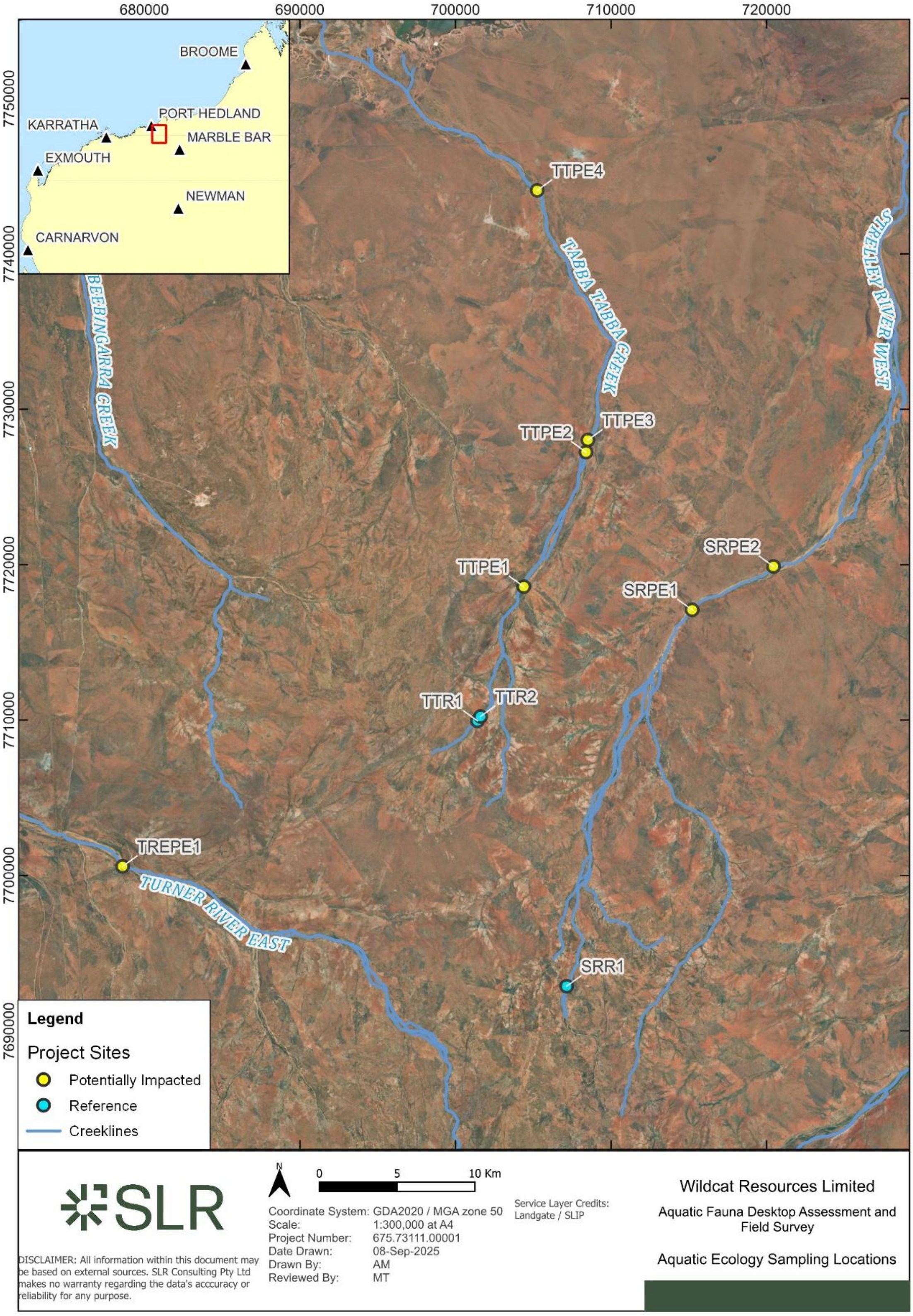

Figure 2. Sampling locations

2.2.2 Licences

This study was conducted under Fisheries Licence EXEM 251344225 (Instruments of Exemption to the *Fish Resources Management Act 1994* for Scientific Research Purposes), and DBCA Licence BA27000012-5 (Reg 27; Fauna Taking (Biological Assessment) Licence). As a condition of these licences, taxa lists and reports are required to be submitted to the respective authorities.

2.2.3 Survey limitations

Table 3 summarises the potential limitations and constraints that affected the field reconnaissance survey.

Table 3: Potential limitations and constraints

Aspect	Constraint?	Comment
Competency	No	The survey was conducted by two aquatic ecologists with prior experience in aquatic fauna surveys in Pilbara Western Australia aquatic ecosystems. The combined number of years' experience in aquatic ecology held by the personnel was 20+ years at the time of sampling. Both personnel hold university-level degrees in biological sciences. The survey was conducted under relevant licenses and scientific exemptions.
Scope	No	The scope was prepared by SLR, informed by the consultant's knowledge of previous, similar assessments and the review of the Project plans. The scope was considered sufficient to characterise the current ecological condition of aquatic environments in and around the Project area.
Fauna detected if present in the survey area	Minor	It was not feasible to sample the entire area and specific survey areas were identified within each drainage system reach that intersects the Project area to maximise species detection. Rare species with low abundance may not have been detected. Survey results and fauna detection will be cross-checked with results of desktop assessments to identify all fauna likely to be present in the survey area.
Sources of information	No	The desktop assessment collated the previous findings in the region and presented in publicly available reports and databases.
The proportion of the task achieved and further work	No	The survey was completed adequately, carried out to a sufficient level with respect to the scope.
Timing/weather/season/cycle	No	Surveys were carried out in favourable conditions. The survey was undertaken in April 2025, which is within the recommended timing for Pilbara region post-wet season sampling. At the time of sampling, ephemeral pools were receded, which was considered a minor limitation to the current study as environmental conditions may have been past-peak in terms of fauna diversity.
Disturbances	No	There were no disturbances that affected the survey.

Aspect	Constraint?	Comment
Intensity (in retrospect was the intensity adequate)	No	Based on the results the survey and the ephemeral presence of pools within and downstream of the Project area, the intensity is considered adequate to have met the reconnaissance survey scope.
Completeness (e.g., was relevant area fully surveyed)	Minor	It was not feasible for the entire area of possible habitat within the survey area to be sampled for aquatic fauna. Areas of representative habitat were selected and targeted to maximise species detection.
Resources	No	The resources made available to the survey were sufficient.
Remoteness and/or access problems	Minor	Certain sites and areas could not be visited, and alternative sites were identified if and where possible.

2.2.4 Water quality

At each site, *in situ* measurements of dissolved oxygen (DO), water temperature (ºC) and pH were taken using hand-held Wissenschaftlich-Technische-Werkstätten (WTW) and TPS field meters. Meters were calibrated immediately prior to field surveys.

Water samples were collected from all sites holding water for laboratory analyses of major ions, alkalinity, dissolved metals, nutrients, and total suspended solids (TSS). Samples for nutrients and dissolved metals were filtered in the field through 0.45 µm Millipore nitrocellulose filters. All water samples were kept cool in an esky while in the field, and either refrigerated (ions & metals), or frozen (nutrients) as soon as possible for subsequent transport to the laboratory. All laboratory analyses were conducted by the Chem Centre, Bentley, WA (a NATA accredited laboratory).

Water quality data were compared against the ANZG (2018) default guideline values (DGVs) for physical and chemical stressors (PC stressors) and toxicants applicable to tropical northern Australia (see Appendix B1 for DGVs). Water quality analytes were compared against DGVs for 95% aquatic species protection, given that the drainage systems in the vicinity of the project area is already subject to historical disturbance as a result of pastoral operations and is thus in a slightly to moderately disturbed state. In accordance with ANZG (2018), 99% DGVs were applied to bioaccumulating metals such as selenium (Se). For metals and nutrients, dissolved concentrations (0.45 µm filtered samples) were compared to the DGVs. Filtered concentrations were considered a better reflection of the fraction that may be bioavailable. By contrast, comparison of the DGVs to the total metal or total nutrient concentration may overestimate the risk to the environment (ANZG 2018).

2.2.5 Sediment quality

Sediment samples were collected at each site using a plastic trowel and nitrile gloved hand, and wet samples kept on ice in the field. Sediment samples were delivered to Chem Centre Western Australia (a NATA-accredited laboratory), and analysed for bioavailable metals: Ag, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Li, Mn, Mo, Ni, Pb, Se, Sn, and Zn. Analysis was via weak acid digest to allow comparison of bioavailable metals, rather than total sediment metal concentrations[1].

[1] Weak acid = bioavailable = comparable to ANZG (2018) sediment GVs

Limit of reporting (LOR) was sufficiently low for comparison against most recent Australian and New Zealand default guideline values for toxicants in sediments (ANZG default guideline values (DGVs); 2018 revision). Each analyte was compared against its respective ANZG (2018) GV-high and DGV (note: not all analytes currently have a GV-high or DGV set). These guidelines are an update to the previous ANZECC/ARMCANZ (2000) interim sediment quality guidelines (ISQGs). The revision, based partly on Simpson *et al.* (2013), includes guidance for use of a weight of evidence (WOE) approach to improve assessment of the potential impacts of contaminated sediments. The DGVs provide two values, the DGV, which is the threshold for effects, but metals are not necessarily bioavailable at this level, and guideline value-high (GV-High) which is the median value at which toxic effects are already likely to be observed, i.e. high probability of effects.

2.2.6 Habitat assessment

Qualitative visual observations of habitat characteristics were made at each site to assist in explaining any patterns in faunal assemblages in relation to possible mine development-related effects. SLR have standard worksheets for this task so that recordings between sites and seasons remain as comparable as possible. Habitat characteristics recorded included percent cover by inorganic sediment, submerged macrophyte, floating macrophyte, emergent macrophyte, algae, large woody debris, detritus, roots and trailing vegetation. Details of substrate composition were also recorded and included percent cover by bedrock, boulders, cobbles, pebbles, gravel, sand, silt and clay.

The dominant tree and riparian plant species were recorded for each site, as well as a qualitative description of community structure and health.

2.2.7 Phytoplankton

Phytoplankton (algae) were collected from the water column in 1-litre sample bottles (gulp samples) at each site. Six one litre samples were collected from different areas at each site, combined in a bucket, and then a 1 L sample of the composite taken. Samples were preserved immediately with Lugol’s solution (1%) for later laboratory examination and identification. In the laboratory, preserved samples were stored in cool conditions and allowed to settle for two weeks with no disturbance. Approximately ¾ of the sample volume was then carefully decanted and discarded, and the settled algal cells in the concentrated fraction were forwarded to Ecoscope Environmental Laboratory for taxonomic identification and enumeration of dominant species.

Results for phytoplankton abundances are given as cells/mL, however for any taxa identified as toxin producers / potential toxin producers, cells/mL were converted to mm^3/mL for comparisons to World Health Organisation guideline values (WHO 2025). For reference, conversions factors for most common taxa are provided by the Victorian state government Department of Environment, Land, Water and Planning (DELWP), and can be found here: BIOVOLUME-CALCULATOR.XLSX

2.2.8 Microinvertebrates

Microinvertebrates include aquatic invertebrates that are, mostly, too small to be seen with the naked eye; (< 250 μm in size; e.g. micro-crustaceans including ostracods, copepods, cladocerans) and single-celled protists and rotifers. Microinvertebrates were collected from the water column using a 53 μm mesh plankton net to sweep over a standard 15 m distance at each site. Samples were preserved in 70% ethanol for laboratory enumeration and identification. Samples were processed by identifying the first 200-300 individuals encountered in an agitated sample decanted into a 125 mm^2 gridded plastic tray, with the tray then scanned for additional missed taxa also identified to species level and recorded as ‘present’. Specimens were identified to the lowest taxon possible, i.e. species or morphotypes.

2.2.9 Macroinvertebrates

Macroinvertebrates include aquatic invertebrates visible to the naked eye, (≥ 250 µm in size; e.g. aquatic beetles and bugs, snails, and larvae of midges, caddisflies, mayflies and dragonflies). Macroinvertebrates were collected using a 250 µm mesh Freshwater Biological Association (FBA) design D-frame dip net. All meso-habitats at a site were sampled, including trailing riparian vegetation, woody debris, open water column and benthic sediments, with the aim of maximising the number of species recorded. Each sample was washed through a 250 µm sieve to remove fine sediment, while leaf litter and other coarse debris were carefully washed into the sieve to remove attached animals and then discarded. Samples were preserved in 70% ethanol for laboratory enumeration and identification. Collected specimens were then identified to the lowest possible level (genus or species level) and enumerated to $\log_{10}$ abundance scale (i.e. 1 = 1 individual, 2 = 2 - 10 individuals, 3 = 11 – 100 individuals, 4 = 101-1,000 individuals, *etc.*).

2.2.10 Fish

Fish were sampled using a variety of methods including seine netting, gill nets, dip nets and by visual observation depending on site characteristics. Four 10 m long gill nets with a 2 m drop, made of lightweight fine stretched mesh sizes of 10 mm, 13 mm, 19 mm and 25 mm, were set to target a wide variety of fish species and sizes. Nets were checked frequently to avoid fish deaths. Catches from the nets were combined to form one replicate sample from each sampling location. Smaller species and juveniles were sampled by beach seine (12 m net, with a 2 m drop and 6 mm mesh) deployed in shallow areas where there were little vegetation or large woody debris. Where possible, two hauls of the seine were conducted at each site to maximise the number of individuals caught. Fish were identified in the field, with standard length[2] (SL) measurements taken, and then released alive.

2.2.11 Waterbirds

Waterbird species were surveyed by walking the banks of pools at each site and using visual observation and calls to identify all waterbirds present, with abundance counts recorded. Any additional waterbirds not initially observed were identified and recorded over the duration of sampling at each site (~2-3 hrs). The conservation status of each species was reported against relevant databases (i.e. IUCN Redlist, DBCA Threatened and Priority Fauna list, EPBC Act List of Threatened Fauna, Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), BirdLife Australia database).

2.3 Data analysis

All data collected were entered into Excel spreadsheets.

[2] Standard length (SL) - measured from the tip of the snout to the posterior end of the last vertebra or to the posterior end of the midlateral portion of the hypural plate (i.e. this measurement excludes the length of the caudal fin).

2.3.1 Assessment of conservation significance of fauna

The conservation significance of all aquatic fauna recorded was assessed using established lists of conservation fauna. For invertebrates, reference was made to the IUCN Red List of Threatened Species (IUCN 2025) and DBCA Threatened and Priority Fauna Rankings (DBCA 2025). Fish species were compared against the IUCN Red List of Threatened Species (IUCN 2051), DBCA Threatened and Priority Fauna Rankings (DBCA 2025), and Australian Society for Fish Biology Conservation List (ASFB 2025). Reference was also made to other Pilbara studies, as well as databases such as The Australian Faunal Directory, The Australian National Insect Collection Database and in-house SLR database for distribution and occurrence information for all aquatic species.

2.3.2 Statistical analysis

Multivariate analyses were performed using the PRIMER package v 7 (Plymouth Routines in Multivariate Ecological Research; Clarke *et al.* 2014) to investigate differences in water quality and aquatic fauna assemblages (micro- and macro-invertebrates) between systems. Relationships between faunal assemblages and physio-chemical characteristics were also examined. Analyses applied to the data included some or all of the following:

1. Describing pattern amongst the water quality and fauna assemblage data (i.e. microinvertebrates and macroinvertebrates) using cluster and ordination techniques. Similarity matrices for environmental data were based on the Euclidean Distance Measure, and environmental data were log transformed, where necessary, and standardised prior to analyses. Similarity matrices for fauna data were based on the Bray-Curtis Similarity Measure (Bray and Curtis 1957). Due to the high degree of variability within the microinvertebrate data, the data were first dispersion-weighted in PRIMER. Microinvertebrate data were square root transformed prior to analysis.
2. Ordination for water and sediment quality data was by metric Multi-Dimensional Scaling (mMDS) (Clarke and Gorley 2014), to visualise relationships between sites based on analytes. Ordinations were depicted as two-dimensional plots based on Euclidean similarity matrices.
3. Ordination for micro- and macro-invertebrates was by non-metric MDS (nMDS) (Clarke and Gorley 2014). Ordinations were depicted as two-dimensional plots based on Bray-Curtis similarity matrices.
4. A cluster analysis was used to identify groupings of sites based on faunal assemblages (SIMPROF 5%). Where strong groupings were detected, Similarity Percentages analysis was used to identify key species contributing to difference observed (using SIMPROF groups).
5. To examine the potential links between water quality analytes and assemblage composition, correlation tests (BioENV) were used, correlating resemblance matrices of fauna and water quality per site and identifying key water quality analytes correlated to faunal receptors.
6. Where there was apparent structuring of faunal assemblages based on water quality detected using BioENV and ordination, the vector overlay tool was used to visualize correlation between key water quality analytes and assemblage composition (using Pearson's correlation co-efficient).

3.0 Desktop Study

3.1 Protected areas and Wild Rivers

Database searches identified no Priority 1 or Priority 2 Wild Rivers (DWER-087) within the study area, although the downgraded Upper Yule River does occur within a 50 km radius of the project area. The De Grey River and the Leslie (Port Hedland) Salt Fields system are Nationally Important Wetlands that occur within a 50 km radius of the project area. Sub-regionally significant wetlands within the study area include permanent pools of the Yule and Turner Rivers, as well as mangroves at the mouths of the Turner and De Grey Rivers (Kendrick & Stanley 2001). There are no Ramsar[3] sites within the study area.

3.2 Review of previous aquatic fauna surveys within and surrounding the study area

The Pilbara Biological Survey (Pinder *et al.* 2010) is the most extensive aquatic fauna survey in the Pilbara, with data collected between 2003 and 2006 from a range of wetland types (ie. springs, river pools, rock pools and claypans) and across 100 sites throughout the region. Over 1000 aquatic invertebrate species were collected during this survey. Three sites from this study are in proximity to the project area: Cooliarin Pool (turbid pool), Paradise Pool (claypan), and Red Rock on Indee Station (rock pools). Numerous other sites from the survey were positioned within the De Grey and Port Hedland Coast basins. Although some studies have indicated that arid zones in Australia lack fauna diversity, Pinder *et al.* (2010) suggests that aquatic invertebrates in the Pilbara are highly diverse. Permanent wetlands in the Pilbara are likely to have higher habitat diversity and species richness compared to temporary waters (Pinder *et al.* 2010).

Pinder & Leung (2009) explored macroinvertebrate habitat associations and species diversity within the De Grey and Yule River catchments that surround the project area, while Morgan & Gill (2004) outline the native freshwater and estuarine/marine fish species present within the Pilbara region. Stygofauna surveys in the Pilbara region are summarised in Eberhard *et al.* (2005), including a review of 332 published reports, 13% of which reported on stygofauna in the De Grey and Port Headland Basins.

Stantec (2022, 2023) provides a baseline survey of aquatic fauna in permanent and semi-permanent pools of the Yule and Turner Rivers in July 2022. Six sites were sampled during this survey, including two Yule River sites and four Turner River sites, all of which are located within 50 km of the project area.

The following sections provide a review of relevant aquatic fauna surveys in the region (summarised in Table 1). This includes surveys and studies that were conducted within 50 km of the project area, or with data collected from sites on or between the Yule and De Grey Rivers. This review includes a summary of the aquatic taxa present, mention of conservation-significant species, as well as any relevant ecological processes and threats.

3.2.1 Microinvertebrates

There is a lack of information on aquatic microinvertebrates in the rivers surrounding the project area. The microinvertebrate groups found by Pinder *et al.* (2010) in the Pilbara include Rotifera, Ostracoda (seed shrimp), Copepoda and Cladocera (water fleas). Pinder *et al.* (2010)

[3] Ramsar refers to the Ramsar Convention, a 1971 international treaty for the conservation and wise use of wetlands, named after the city in Iran where it was signed. A Ramsar site is a wetland designated as being of international importance for biodiversity, unique ecosystems, or other values, and listed under the Convention.

outlined numerous taxa, primarily undescribed microcrustaceans and rotifers, that had not been documented outside of the region, including ostracods belonging to the genera *Cypretta, Bennelongia, Limnocythere* and *Paralimnocythere.* These were referred to as the Pilbara endemics, although further surveying may result in the discovery of these species outside of the region.

The copepod *Eodiaptomus lumholtzi* has been recorded at sites on the Yule and Turner Rivers (Stantec 2023). *E. lumholtzi* is currently listed as Vulnerable under the IUCN Red List of Threatened Species, however this status needs to be updated following multiple new records of the species in Western Australia and the Northern Territory since its original IUCN listing. Multiple other conservation-significant microinvertebrate species are known from the Pilbara region, including the copepods *Speleophria bunderae* and *Stygocyclopia australis,* as well as the ostracod *Welesina kornickeri*. However, these species are confined to Bundera Sinkhole on the Cape Range peninsula, over 500 km from the Project area.

3.2.2 Macroinvertebrates

The major macroinvertebrate groups found in two of the main rivers catchments surrounding the Project area (De Grey and Yule Rivers) are Trichoptera (caddisflies), Odonata (dragonflies and damselflies), Lepidoptera (aquatic caterpillars), Hemiptera (true bugs), Ephemeroptera (mayflies), Diptera (aquatic fly larvae), Coleoptera (aquatic beetles), Crustacea, Acarina (aquatic mites), Oligochaeta (segmented worms) and Mollusca (snails) (Pinder & Leung 2009). Both the De Grey and Yule River catchments were characterised by high richness in Diptera and Coleoptera taxa, and lower richness in the groups Mollusca, Oligochaeta, Crustacea, Lepidoptera and Odonata (Pinder & Leung 2009), which aligns with the broader findings of Pinder *et al.* 2010 in the region (17.9% of taxa were Diptera, 10.8% Coleoptera). The Yule River catchment had notably higher richness in Hemiptera and Acarina compared to the De Grey, as well as higher richness overall (Pinder & Leung 2009).

Pinder & Leung (2009) collected 16 species that had not yet been recorded in the Pilbara and were not found by Pinder *et al*. (2010). Of the 16 species, 12 of these were collected in either the De Grey or Yule Rivers, including seven Acarina species (*Arrenurus* sp. 22, *Austraturus* sp. P3, *Koenikea distans*, *Koenikea setosa*, *Unionicola* nr *alpa*, *Unionicola* nr *vidrinei*, *Unionicola* sp P1), two Coleoptera species (*Hydrochus* sp. P5, *Paranacaena* sp. P1) and three Diptera species (Muscidae sp. N, *Polypedilum griseoguttatum*, *Skusella* nr "V12 ex-WA"). Knowledge of these species' distributions is limited due to a lack of taxonomic information; however, it is possible that some of these species are endemic to the Pilbara, and are potentially more common in, or confined to, coastal pools (Pinder & Leung 2009).

Known Pilbara endemics that are likely to occur within 50 km of the project area include (Stantec 2022; Stantec 2023):

- *Sternopriscus pilbaraensis* (Coleoptera)
- *Laccobius billi* (Coleoptera)
- *Tiporus tambreyi* (Coleoptera)
- *Anisops nabillus* (Hemiptera)
- *Ictinogomphus dobsini* (Odonata)
- *Eurysticta coolawanyah* (Odonata)

The aquatic beetles listed here (*S. pilbaraensis, L. billi* and *T. tambreyi*) have a widespread distribution throughout the region and are not listed as conservation significant species (Stantec 2022).

The Pilbara Dragonfly (*Antipodogomphus hodgkini*) is endemic to the Pilbara and is listed as DBCA Priority 3 and Endangered under the IUCN Red List of Threatened Species (Dow

2019a). This species is known from only a few locations within the Fortescue and Chichester subregions, occurring mostly within or at proximity to Millstream Creek (Dow 2019a). *A. hodgkini* was not recorded from the Yule or Turner Rivers during surveys in 2022 (Stantec 2023).

The endemic Pilbara Pin Damselfly (*Eurysticta coolawanyah*) has been recorded from the De Grey, Yule, Turner and Fortescue Rivers (Pinder & Leung 2009; Stantec 2022; Stantec 2023), within 50 km of the Project area. This species is listed as Vulnerable under the IUCN Red List of Threatened Species due to an extent of occurrence of less than 20,000 km² and one known instance of habitat degradation (Dow 2019b). Groundwater extraction and climate change can exacerbate lowering of the water table, which is a major threat to *E. coolawanyah* (Dow 2019b).

The endemic Pilbara Tiger Dragonfly (*Ictinogomphus dobsoni*) is listed as Near Threatened under the IUCN Red List of Threatened Species (Dow 2017). This species has been recorded at sites in the Millstream-Chichester National Park, as well as in pools on the Yule and Fortescue Rivers (Pinder & Leung 2009), and may occur within 50 km of the Project area. The Pilbara Emerald Dragonfly (*Hemicordulia koomina*) is listed as Vulnerable under the IUCN Red List of Threatened Species due to having a small extent of occurrence (approx. 6,504 km²) and experiencing habitat degradation (Dow 2019c). *H. koomina* has been recorded at a site on the Yule River (Stantec 2022) within 50 km of the Project area.

3.2.3 Fish

Native freshwater fish species that are common to the Pilbara and are likely to occur within the major catchments surrounding the Project area include (FFDWA; Morgan & Gill 2004):

- Barred Grunter (*Amniataba percoides*)
- Bony Bream (*Nematalosa erebi*)
- Pilbara Tandan (*Neosilurus* sp.[4])
- Spangled Perch (*Leiopotherapon unicolor*)
- Flathead Goby (*Glossogobius giuris*)
- Western Rainbowfish (*Melanotaenia australis*)
- Indonesian Short-finned Eel (*Anguilla bicolor*)
- Lesser Salmon Catfish (*Arius graeffei*)
- Hyrtl's Tandan (*Neosilurus hyrtlii*)
- Murchison River Hardyhead (*Craterocephalus cuneiceps*)
- Empire Gudgeon (*Hypseleotris compressa*).

Stantec (2023) describes seven of these species to occur in the Yule River *(M. Australis, L. unicolor, A. percoides, N. hyrtlii, N. erebi, H. compressa, A. bicolor*) and four to occur in the Turner River (*M. Australis, L. unicolor, N. erebi, H. compressa*), using information collated from both the 2022 survey and previous surveys. Two of these species, the Murchison River Hardyhead (*C. cuneiceps*) and the Pilbara Tandan (*Neosilurus sp.*) are considered endemic to the region (Morgan & Gill, 2004).

The Indonesian short-finned eel, *A. bicolor*, is listed as Near Threatened on the IUCN Red List of Threatened Species under criteria A2bcde (Pike *et al*. 2020) and has been found in both the Yule and De Grey Rivers, within 50 km of the Project area (Morgan & Gill, 2004). Although

[4] The *Neosilurus* catfish known from the Pilbara is genetically distinct to the described species *Neosilurus hyrtlii* (Unmack, 2013). The Pilbara species is currently known as *Neosilurus* sp. ("Pilbara Tandan") until further taxonomic work has been undertaken and descriptions have been made.

A. bicolor has a widespread distribution throughout the Indo-Pacific, the species has been experiencing population decline, potentially due to unsustainable exploitation, habitat loss and degradation, pollution, invasive species, and mining (Pike *et al*. 2020). Although exploitation of this species is concentrated in East Asia, other threats to this species are poorly understood (Pike *et al*. 2020) and could be affecting populations in the Pilbara.

Two species of vulnerable (BC Act) cave gudgeon (the Blind Gudgeon, *Milyeringa veritas*, and the Barrow Cave Gudgeon, *Milyeringa justitia*) are endemic to the Pilbara, however these species are restricted to areas that don't coincide with the project area (Cape Range Peninsula and Barrow Island, respectively) (Morgan *et al*. 2014). The Blind Cave Eel (*Ophisternon candidum*) and Pilbara endemic Fortescue Grunter (*Leiopotherapon aheneus*) are listed as BC Act and EPBC Act Vulnerable and DBCA Priority 4 respectively, however these species have not been recorded in rivers close to the Project area.

Native species that are likely to exist in the estuarine systems surrounding the Project area, usually during juvenile life stages, include the Milkfish (*Chanos chanos*), Oxeye Herring (*Megalops cyprinoides*), and Striped Butterfish (*Selenotoca multifasciata*) (FFDWA), with the lower reaches of the Yule and De Grey rivers likely acting as a nursery for these species. Four conservation-significant sawfish species are also likely to occur within estuarine systems downstream from the Project area. These include:

- Freshwater Sawfish, *Pristis pristis* (EPBC Vulnerable, IUCN Critically Endangered, BC Act Migratory & DBCA Priority 3)
- Dwarf Sawfish, *Pristis clavata* (EPBC Vulnerable, IUCN Critically Endangered, BC Act Migratory & DBCA Priority 1)
- Green Sawfish, *Pristis zijsron* (EPBC & BC Act Vulnerable, IUCN Critically Endangered)
- Narrow Sawfish, *Anoxypristis cuspidata* (EPBC & BC Act Migratory, IUCN Critically Endangered).

The coastal reaches of the Ashburton River have been recognised as an important pupping site for Green Sawfish (*P. zijsron*) (Morgan *et al*. 2019), and hence, other estuarine systems in the Pilbara, such as the lower reaches of the De Grey, Turner and Yule Rivers, may also be essential breeding sites for sawfish.

3.2.4 Waterbirds

The Black-necked Stork (*Ephippiorhynchus asiaticus australis*) is listed as Near Threatened under the IUCN Red List of Threatened Species. *E. asiaticus has* been recorded in the coastal reaches of the Turner River (Stantec 2022), within 50 km of the Project area. Stantec (2022) found 12 other species that are likely to occur within 50 km of the Project area, including the Straw-necked Ibis (*Threskiornis spinicollis*), Australasian Grebe (*Tachybaptus novaehollandiae*) and White-necked Heron (*Ardea pacifica*). These species are all listed as Least Concern under the IUCN Red List of Threatened Species and have widespread distributions across Australia. Hence, populations are unlikely to be strongly affected by activities within the project area.

4.0 Field Survey Results

4.1 Water Quality

Water quality data were compared against ANZG (2018) water quality guidelines, using default DGVs for physical and chemical stressors applicable to slightly to moderately disturbed lowland rivers from tropical northern Australia (see Appendix B for DGVs). All water quality data recorded during the current study are provided in Appendix B.

4.1.1 *In situ* results

Surface water quality in the wet season 2025 was generally characterised by slightly circum-neutral to slightly alkaline pH (Table 4). Alkaline pH has been widely recorded in surface waters across the east and west Pilbara (Johnson & Wright 2001, WRM unpub. data).

Low dissolved oxygen (DO), below the lower ANZG default GV (85% saturation) was observed at six sites (Table 4). Oxygen is consumed by chemical reactions and the metabolism of organisms including fish and invertebrates. Dissolved oxygen levels also vary throughout the day-night period, with oxygen depletion occurring during the night and supersaturation in the day in areas with high productivity and algal growth (excessive algal growth was observed at sites SRR1, SRPE1, TTPE3 and TTPE4 see photographs in Appendix A). Additionally, as organic matter accumulates, the process of decomposition requires dissolved oxygen. Although oxygen needs of aquatic biota differ between species and life history stage, studies have reported DO less than 50% saturation can cause harm to fish and macroinvertebrate populations through reduced fecundity, decreased feeding activity, slowed larval and juvenile growth, suppressed emergence, impaired swimming ability, and death (Butler *et al*. 1970, EIFAC 1973, Connolly *et al.* 2004, Flint *et al.* 2014). DO was below 50% at three sites (TTPE2, TTR1 and SRPE1). For six tropical, northern Australian fish species, Butler and Burrows (2007) reported acute toxicity levels of around 25 to 30% saturation at water temperatures of 23 to 33° C, while some studies have reported chronic responses in macroinvertebrates and fish to saturation levels below 50% (Butler et al*.* 1970, Davis 1975, Alabaster & Lloyd 1982). Low DO concentrations are also known to increase the toxicity of some contaminants (EIFAC 1973, Davis 1975). ANZG (2018) acknowledges that DO concentrations will vary diurnally and with depth and that monitoring programs should be used to assess local variability.

Concentrations in exceedance of the upper DGV for DO were recorded at two sites (Table 4). Super-saturation occurs when net photosynthesis exceeds total oxygen consumption in waterbodies and is common in areas of high algal and macrophyte growth, particularly if spot measurements are taken later in the day after a period of active photosynthesis (Caraco and Cole 2002). Waterbodies with super-saturated daytime DO are likely to experience oxygen stress overnight, as respiration by plants, algae, bacteria and other aquatic fauna deplete DO (Caraco and Cole 2002, Connolly *et al.* 2004, Flint *et al.* 2014).

Electrical conductivity (EC) exceeded the DGV of 250 µS/cm at four sites (Table 4), however, the DGV is known to be highly conservative for Pilbara waters and there is a general acceptance that when conductivity is less than 1500 µS/cm, freshwater ecosystems experience little ecological stress (Hart *et al.* 1991, Horrigan *et al.* 2005). No sites exceeded the point of ecological stress.

Table 4. *In situ* water quality recorded at Tabba Tabba Lithium Project sites in the wet-25. Values outside of ANZG (2018) guideline values are highlighted in orange.

System	Site	Time	Temp ^{0}C	Cond (us/cm)	pH	Redox	DO%	DO mg/L
	DGV			250	6-8		85-120	
Tabba Tabba Creek	TTR1	15:00	29.6	99.5	7.18	-13.2	35.4	2.86
	TTR2	15:30	29.8	123.4	6.83	23.7	52.7	3.97
	TTPE1	15:21	30.0	206.6	6.64	24.2	22.2	1.35
	TTPE2	11:30	31.2	315.1	7.53	-30.0	70.1	5.25
	TTPE3	17:00	30.0	246.0	8.63	-92.3	130.6	7.04
	TTPE4	11:30	32.2	521.0	8.26	-71.4	102.2	7.65
Turner River	TRPE1	8:30	27.5	194.0	7.39	-22.0	78.7	6.21
Strelley River	SRR1	12:30	31.2	1314.0	7.87	-41.2	172.1	13.48
	SRPE1	8:00	27.0	158.3	7.14	-3.9	41.6	3.20
	SRPE2	9:30	30.1	297.7	7.45	-23.2	92.1	7.03

4.1.2 Ionic composition

Ionic composition was dominated by calcium (Ca^{2+}) at TTR1, TTR2, TRPE1 and SRPE2 and sodium (Na^{2+}) at TTPE1 – 4, SRR1 and SRPE1. All sites were dominated by HCO_3 anions. Alkalinity at all sites was high, and above the threshold for which waters would be considered poorly buffered (≤ 20 mg/L). Due to these waters being well buffered, the removal of carbon dioxide during photosynthesis would not result in rapidly rising pH (Sawyer and McCarty 1978, Romaire 1985, Lawson 2002).

With the prevalence of temporary waterbodies across the Project area, concentrations of anions and cations can change over space and time. Therefore, spot measurements reported here should only be considered indicative of ionic composition of waterbodies at one point in time, however differences often indicate different sources of water influencing sites, such as springs or groundwater, as opposed to direct rainfall/runoff.

4.1.3 Nutrients

Availability of nitrogen in its various forms (TN, NO_3, NO_2, NH_3, NH_4^+) is a limiting factor which often governs the distribution and activity of many aquatic organisms as well as controlling the rate of vital ecosystem processes such as primary production. Dependent on the environmental capacity for nitrogen loading, nitrogen-enrichment can lead to eutrophication, and consequent ecological issues such as excessive algal and cyanobacterial growth, particularly during the dry season as water levels recede and water temperatures increase.

An elevated concentration of soluble nitrogen (N_NOx), compared to the ANZG DGV of 0.03 mg/L, was recorded at SRR1 (5.6 mg/L), and total phosphorus exceeded the DGV of 0.01 mg/L at TTR2 and TTPE2. Nitrate concentrations at SRR1 (5.5 mg/L) were above the toxicity DGV for 95% of species protection (2.6 mg/L; moderately hard waters). Nitrate can occur naturally in the environment or through groundwater contamination, runoff from agriculture or animal waste or discharge from industrial activities (ANZG 2025). Nitrogen and phosphorus availability often controls primary productivity and can lead to eutrophication and algal-bloom formations. Large algal blooms can result in adverse impacts to aquatic systems, through toxicity and reduced DO as blooms decay, with consequent losses in biodiversity (ANZG

2018). Percentage of algae at each site was recorded at the time of the survey and is discussed further in Section 4.3.2 below. Highly eutrophic waters tend to support high abundances of pollution-tolerant species, but few rare taxa, and overall, less complexity in community structure (ANZG 2018).

4.1.4 Dissolved metals

Dissolved metals were generally below DGVs (95% of species protection) at all sites across the study area except for aluminium at TTPE3 (Appendix B). Elevated concentrations of Al are also a characteristic of inland waters in the region due to colloidal clays in silicates (WRM 2009;2015;2017).

4.1.5 Spatial patterns based on water quality variables

Multivariate analyses were used to examine spatial patterns in overall water quality within the Project area. Surface water quality within Tabba Tabba Creek sites were similar to the larger river pools of the Strelley and Turner River (Figure 3).

A PCO plot was used to visualise the overall differences in water chemistry within the Project area. A total of 52.3% of the variation between sites was explained by the two PCO axes (Figure 4). The differences in site water chemistry were obvious in the PCO ordination, and supported the pattern observed in the mMDS ordination, with SRR1 skewed to the right of the ordination. Parameters best correlated (Pearson R > 0.9) with PCO axes were major ions including electrical conductivity and total nitrogen, as well as lithium and barium. Levels of these analytes were higher at SRR1 compared to the other reconnaissance survey sites.

Overall, Tabba Tabba Creek sites were similar to sites on the Strelley and Turner rivers, showing regional similarity within water quality parameters.

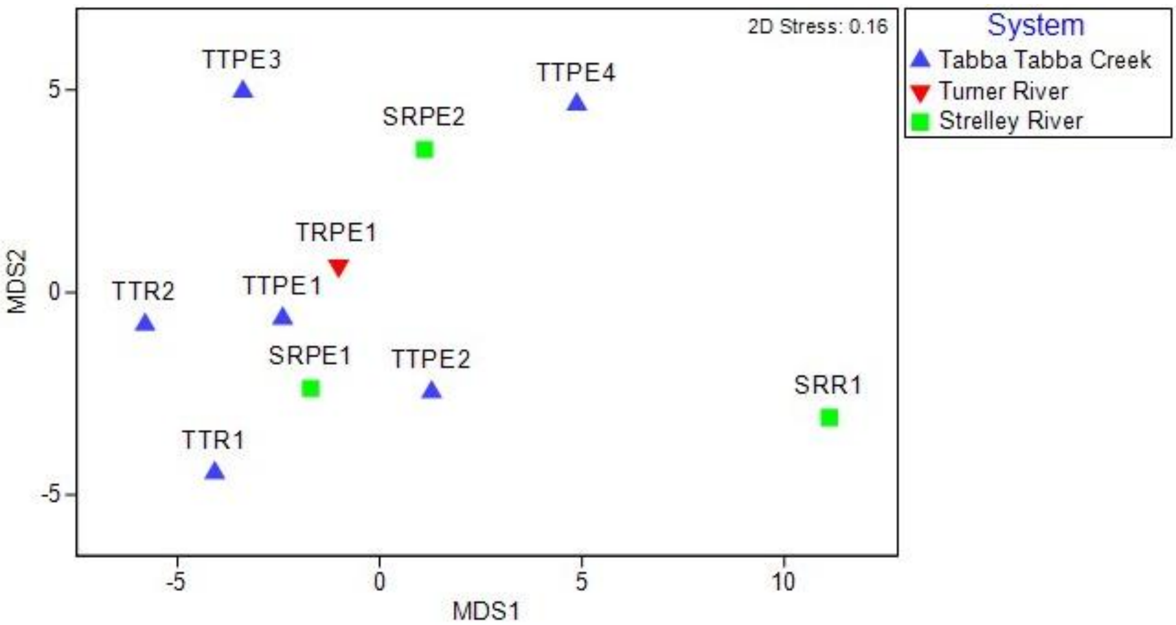

Figure 3. Metric MDS ordination of surface water analytes across the Project area.

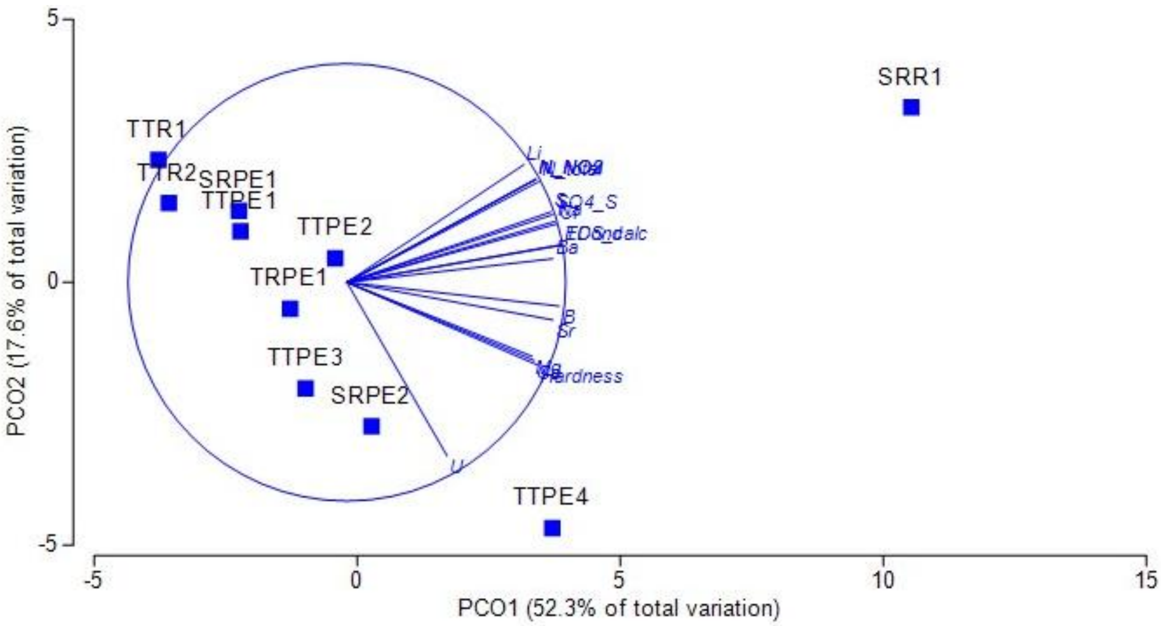

Figure 4. PCO of surface water analytes across the Project area. Pearson correlation vector = 0.9.

4.2 Sediment Quality

4.2.1 Sediment metal concentrations

Sediments form an important component of aquatic ecosystems and support a wide range of benthic organisms (Pulford and Flowers 2006). However, they can also serve as a sink for any contaminants (Simpson *et al.* 2005), which may influence aquatic biota. Sediments collected targeted a mix of shallow deposits of sand silt/clay with majority of representative substrate being larger sizes of gravel and pebbles. Different types of metals and nutrients vary in propensity to bind with sediments, depending on the organic matter, sand and clay content of the sediment (Gregory 2008). There were no exceedances of ANZG DGVs for sediment quality among the metals analysed (Appendix C), however, few metals currently have defined guideline values for sediments (ANZG 2018). Periodic drying and seasonal flooding in the region generally result in flushing of accumulated nutrients and sediment with a generally low likelihood of long-term build-up of concentrations of any toxicant.

4.2.2 Spatial patterns based on sediment quality variables

Like surface water quality variables, there was little spatial variation between sites, with most sites grouped together (Figure 5). SSR1 and TTR1 were different from all other sites, and each other, due to elevations of several analytes (Ba, Li, Mn and Pb) in sediments at these sites. Metal analytes within most sites were in low concentrations, often below the limit of detection, so the detection of analytes within SRR1 and TTR1 caused this spatial variation.

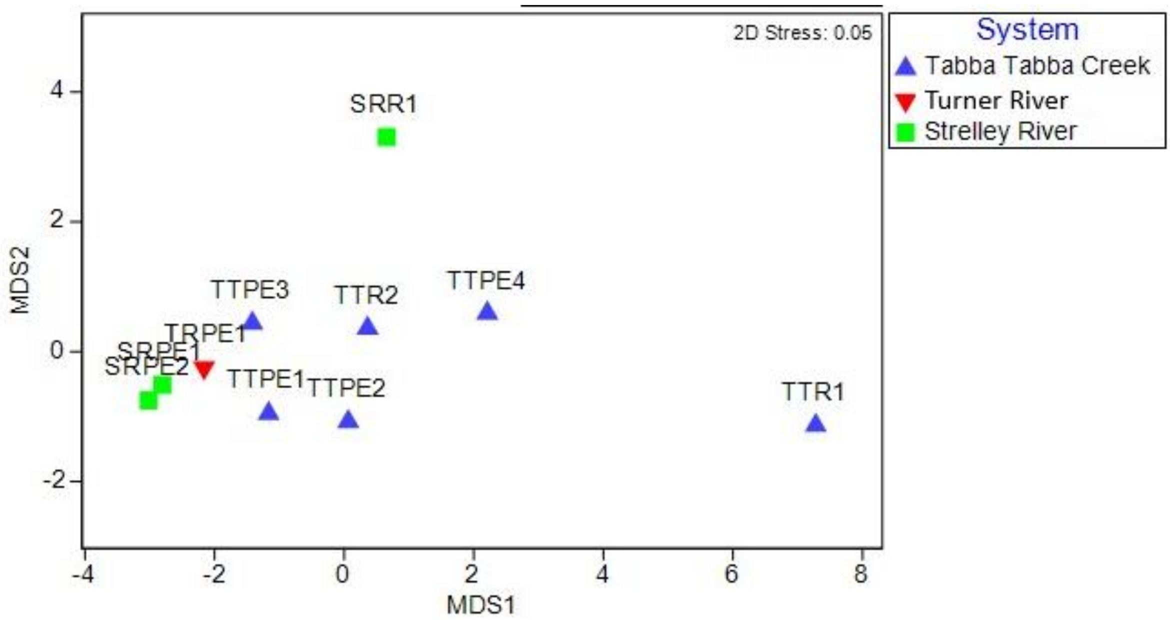

Figure 5. Metric MDS ordination of sediment analytes across the Project area.

4.3 Habitat

In-stream habitats and benthic sediments, along with water quality, streamflow and persistence of surface water, are known to influence aquatic invertebrate communities in freshwater systems, with greater habitat complexity (more habitat types) generally leading to increased species diversity and abundance (Watkins *et al.* 1983, Erman and Erman 1984, Heino 2000). The makeup of benthic substrates is also an important driver of species composition (Erman and Erman 1984, O'Connor 1991, Jähnig and Lorenz 2008). In the Pilbara region, freshwater ecosystems can vary from shallow, ephemeral pools to kilometre-long, deep, permanent pools. Dominant substrates can vary from solid bedrock, boulders and cobbles to fine silt or clay, though the substrate of most ephemeral creeks comprises mainly gravel and pebbles (Pinder and Leung 2009, Pinder *et al.* 2010). Diversity of in-stream habitat is also variable between ecosystems, depending on underlying geology, hydrology and water quality (Pinder and Leung 2009, Pinder *et al.* 2010). Each habitat component is important for aquatic invertebrates; be it for predator avoidance, breeding and oviposition (egg-laying), food sources, creation of micro-flow environments, materials for case construction, and/or sites for larval and pupal stages to develop and emerge (Rouquette and Thomson 2004, Leipelt and Suhling 2005, Yilmaz and Gül Aslan 2014).

4.3.1 Substrate

Substrates were dominated by sand at all sites sampled, with small amounts of gravel, pebbles, cobbles, boulders, bedrock and silt (Figure 6). Due to dominance by sand, there was little substrate diversity. The structure and diversity of substrates are known to influence macroinvertebrate assemblages, with greater substrate complexity generally equating to higher species richness and abundance (Erman & Erman 1984, O'Connor 1991, Jähnig & Lorenz 2008).

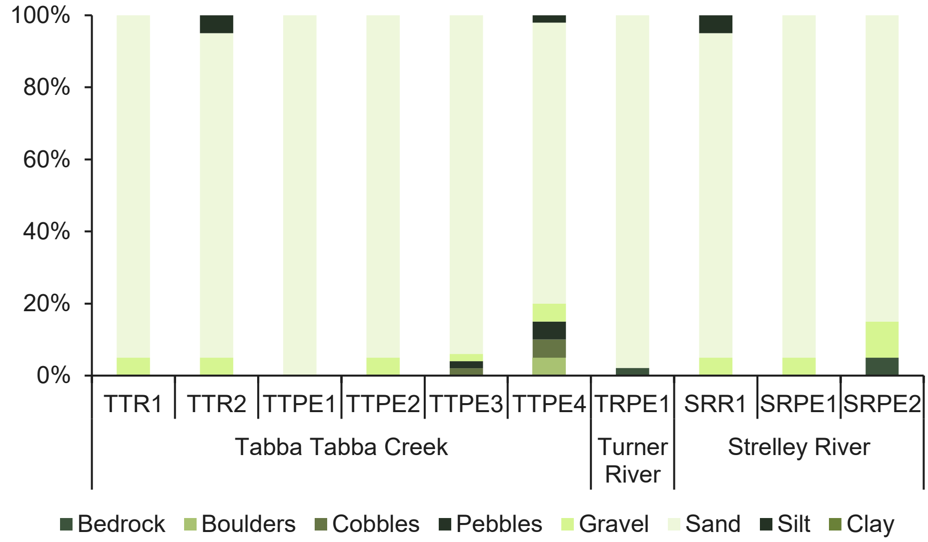

Figure 6. Plots of substrate composition, showing percentage cover.

4.3.2 In-stream habitat diversity

Habitat types at all sites were dominated by open mineral substrates, except for SRR1 which was dominated by algal cover (Figure 7). All sites had smaller proportions of detritus, large woody debris and/or trailing vegetation. TRPE1 on the Turner River was the only site with emergent and submerged vegetation, like due to the impermanence of water at the other sites. Vegetation here consisted of water milfoil *Myriophyllum* sp., and bullrushes *Schoenoplectus* sp. and *Typha domingensis*.

Diversity of in-stream habitat can also play a crucial role in influencing the richness, abundance and assemblage structure of aquatic fauna, with greater habitat complexity (such as aquatic macrophyte, detritus and large woody debris) generally leading to increased species diversity and abundance (Erman & Erman 1984, Heino 2000). However, the relative proportions of each in-stream substrate and habitat type will change annually and seasonally as wetted width and longitudinal extent of surface water changes in response to rainfall.

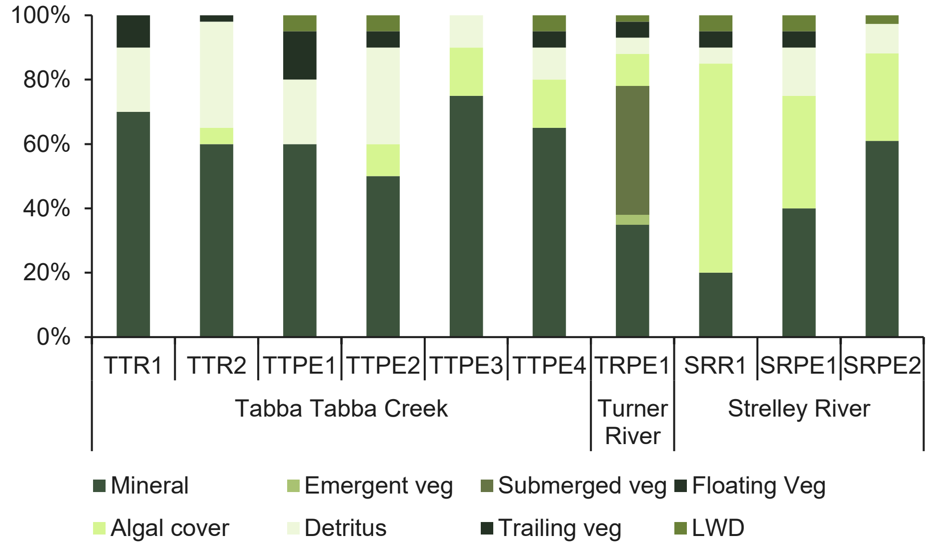

Figure 7. In-stream habitat diversity, showing percentage cover.

4.4 Phytoplankton

4.4.1 Phytoplankton taxonomic composition and species richness

Algae can occur as either free-floating planktonic or benthic organisms (Bellinger and Sigee 2010). Planktonic algae are referred to as phytoplankton and have several important roles within aquatic ecosystems. This includes primary production through photosynthesis and nutrient cycling, and in the provision of food resources, supporting higher order consumers such as aquatic invertebrates and small fish (Porter *et al.* 2008; Sainty and Jacobs 2003). Phytoplankton in temporary waters also demonstrate seasonal succession of species, depending on trophic status and nutrient availability (Bellinger and Sigee 2010).

A total of 53 phytoplankton taxa were recorded in the Project area. Phytoplankton composition included Cyanophyta (blue-green algae), Chlorophyta (green algae), and Bacillariophyceae (diatoms) (Appendix D). The list includes groups which could not be identified to species level due to unresolved taxonomy and/or immature specimens. Cyanophyta and Chlorophyta generally dominated phytoplankton taxa and/or abundance at each site. Species richness varied from 11 at TTR1 to 29 at SRPE1 (Figure 8). Total cell count (cells/mL) was lowest at TTPE1 and highest at TTR2, which was dominated by cyanobacteria (Figure 9).

Planktolyngyba minor was the most widespread and dominant cyanobacteria, present at seven sites, *Nitzchia* sp. was the most widespread diatom, present at all sites and *Monoraphidium* sp. was the most widespread green algae, present at all sites.

A significant phytoplankton bloom was detected at TTR2, with dominance of cyanobacteria recorded (Figure 9). Total cyanobacteria concentration was 0.69 mm^3/L, of which 0.15 mm^3/L comprised of toxin producer *Limnothirx* sp. This concentration places it in the Amber level alert mode category, based on NHMRC Guidelines (2008). The NHMRC Guidelines recommend that investigations into the causes of the elevated levels at monitoring sites, as well as increased sampling to enable risks to recreational users to be more accurately assessed. It is highly unlikely that TTR2 would hold any water in the dry season, as it was only a remnant pool at the time of sampling and unlikely to pose an ongoing threat to any recreational users. The high density of cells and TTR2 cannot be easily paired with water column nutrient concentrations (Section 4.1.3), however this is not always expected as the process of primary production in the cells relies on assimilation and thus removes some nitrate from the water column (Salk *et al.* 2018). Where these spikes in cell count occur, it is likely that there was previously a higher water column nitrate concentration fuelling the increase in production. In theory, the assimilated nitrogen will be incorporated into the algal biomass in the water column. (Bellinger and Sigee 2010).

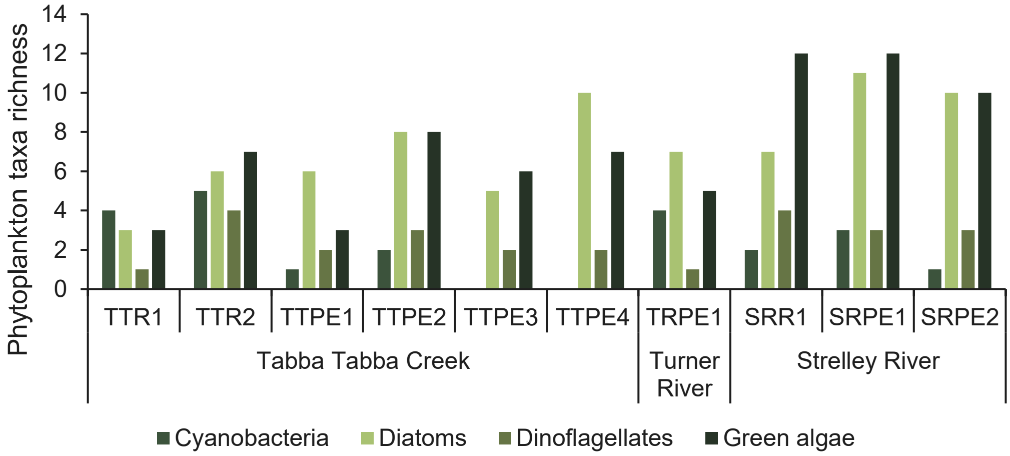

Figure 8. Phytoplankton taxa richness and composition per site.

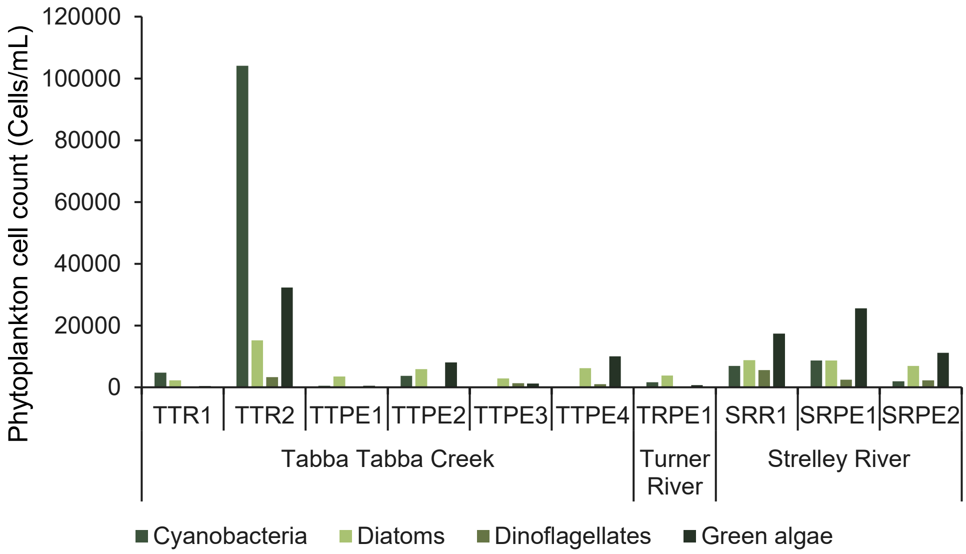

Figure 9. Phytoplankton cell count (cells/mL) and composition per site.

4.5 Microinvertebrates

4.5.1 Microinvertebrate taxonomic composition and species richness

A total of 36 microinvertebrate taxa were recorded from the survey area (Appendix E). Microinvertebrate taxa richness ranged from three at SRPE2 to 17 at TRPE1 (Figure 10). The list includes groups which could not be identified to species level due to unresolved taxonomy and / or immature specimens. Therefore, the total microinvertebrate species richness is likely greater than that reported here. Microinvertebrate composition included protists, rotifers (wheel animals), copepods (microcrustaceans), cladocerans (water fleas) and ostracods (seed shrimp) (Figure 11). Generally, Rotifera and Copepoda comprised the greatest number of microinvertebrate taxa at each site, with Ostracoda and Cladocera comprising the least (Figure 11). The microinvertebrate fauna was somewhat typical of that commonly recorded from tropical / sub-tropical freshwater systems (*e.g.* Koste and Shiel 1983, Tait *et al.* 1984, Smirnov and De Meester 1996, Segers *et al*. 2004).

The majority of microinvertebrate taxa recorded from the survey area were common, ubiquitous species with Australasian or cosmopolitan distributions, with no listed species recorded.

Large spatial and temporal variability is commonly reported for microinvertebrates of freshwater systems world-wide. Variation typically depends on factors such as flow regime, pool size, primary production rates and water quality parameters (Miquelis *et al.* 1998, Schiemer *et al*. 2001, Schöll *et al.* 2012). In Pilbara surface waters, microinvertebrate taxa richness is known to fluctuate markedly between sites and seasons (Pinder *et al.* 2010, WRM unpub. data). Long term, seasonal monitoring would be required to accurately characterise the drivers and dynamics of microinvertebrate taxa richness and composition within the survey area.

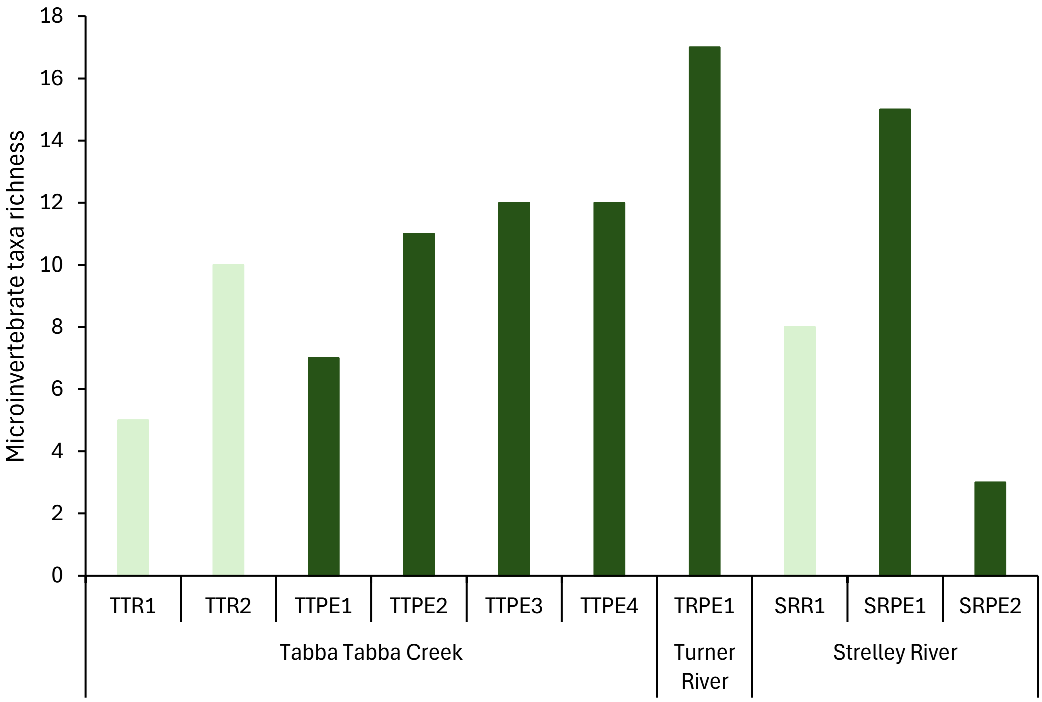

Figure 10. Microinvertebrate species richness per site.

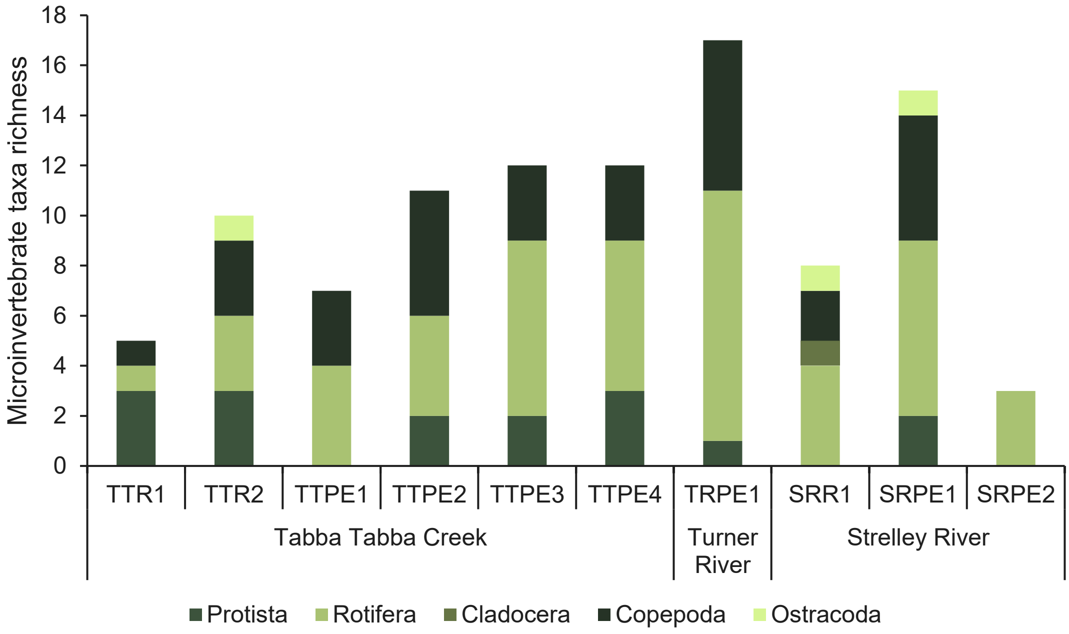

Figure 11. Microinvertebrate taxa richness by species composition

4.5.2 Spatial patterns in microinvertebrate assemblages

Some spatial variation of microinvertebrate assemblages was evident in the ordination plots. SRPE2 was skewed to the right of the ordination, likely because it was depauperate in taxa, consisting only of Rotifera. Tabba Tabba Creek sites were dispersed in the middle of the nMDS plot, with the remaining sites skewed to the left (Figure 12).

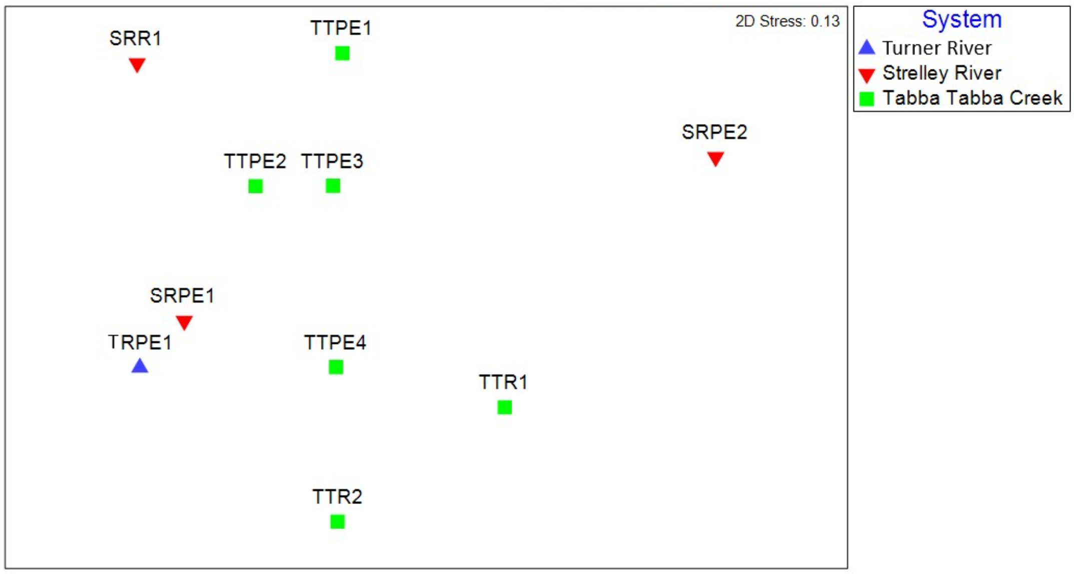

Figure 12. nMDS ordination of microinvertebrate assemblage data collected from the Project area.

4.6 Macroinvertebrates

4.6.1 Macroinvertebrate taxonomic composition and species richness

A total of 121 macroinvertebrate taxa were recorded from all sites in the Project area. Macroinvertebrate taxa richness at each site ranged from 32 at TRPE1 and SRR1 to 52 at TTPE2 and TTPE4 (Figure 13). The totals include groups that could not be identified to species level due to a lack of suitable taxonomic keys (i.e. Diptera families, some families of Coleoptera, etc.), unresolved taxonomy, damage, or life history stage (i.e. immature specimens). Therefore, the total macroinvertebrate species richness at these sites is likely greater than that reported here.

The aquatic invertebrate community recorded during the reconnaissance survey of the Project area was generally consistent with previous studies of river systems in the Pilbara, where insects are prevalent (Pinder and Leung 2009; Pinder *et al.* 2010; WRM 2009; 2015; 2017). The fauna consisted of Cnidaria (freshwater hydra), Mollusca (aquatic snails), Oligochaeta (aquatic segmented worms), Collembola (springtails), Branchiopoda (clam shrimp), Arachnida (water mites), Odonata (dragonfly and damselfly larvae), Ephemeroptera (may fly larvae), Hemiptera (aquatic true bugs), Coleoptera (aquatic beetles), Diptera (two-winged fly larvae), Trichoptera (caddis-fly larvae) and Lepidoptera (freshwater caterpillar larvae) (Appendix F). Insecta were the dominant group, with 100 of the 121 (83%) recorded taxa belonging to this class (Appendix F). Typically, insects constitute around 80% of all aquatic fauna in freshwater systems of the Pilbara (Pinder *et al*. 2010). Of the insects, the best represented taxa were Diptera (35 taxa, 35% of Insecta), followed by Coleoptera (31 taxa, 31%) and Hemiptera (17 taxa, 17%). Diptera are typically the most diverse order of insects in freshwater systems (Hutchinson 1993). Chironomids (non-biting midge larvae) constituted 57% of the Diptera taxa. Chironomids often constitute the most common and abundant invertebrate taxa in freshwaters worldwide, due to their tolerance to a range of environmental conditions, including low oxygen, high temperatures, high salinity and nutrients and desiccation (Cornette *et al.* 2015). All insect groups recorded were considered transient or opportunistic taxa, comprising mobile winged adult stages, which allow them to readily disperse and rapidly colonise newly created habitats (Gooderham and Tsyrlin 2002).

The majority of macroinvertebrate fauna were common, ubiquitous species found widely across Australia, and none appear on conservation lists. One taxa endemic to the Pilbara region was recorded at TTR2, TTPE2 and TTPE3, the aquatic hydrophilid beetle *Laccobius billi. L. billi* was only recorded from one site during the Pilbara Biological Survey; Cangan Pool on the Yule River (Pinder *et al.* 2010) and is almost exclusively recorded from standing, shallow pools, particularly those occurring at the lower reaches of ephemeral systems (Table 5). This species has since recorded at other sites of similar habitat within the Pilbara (WRM unpub. data).

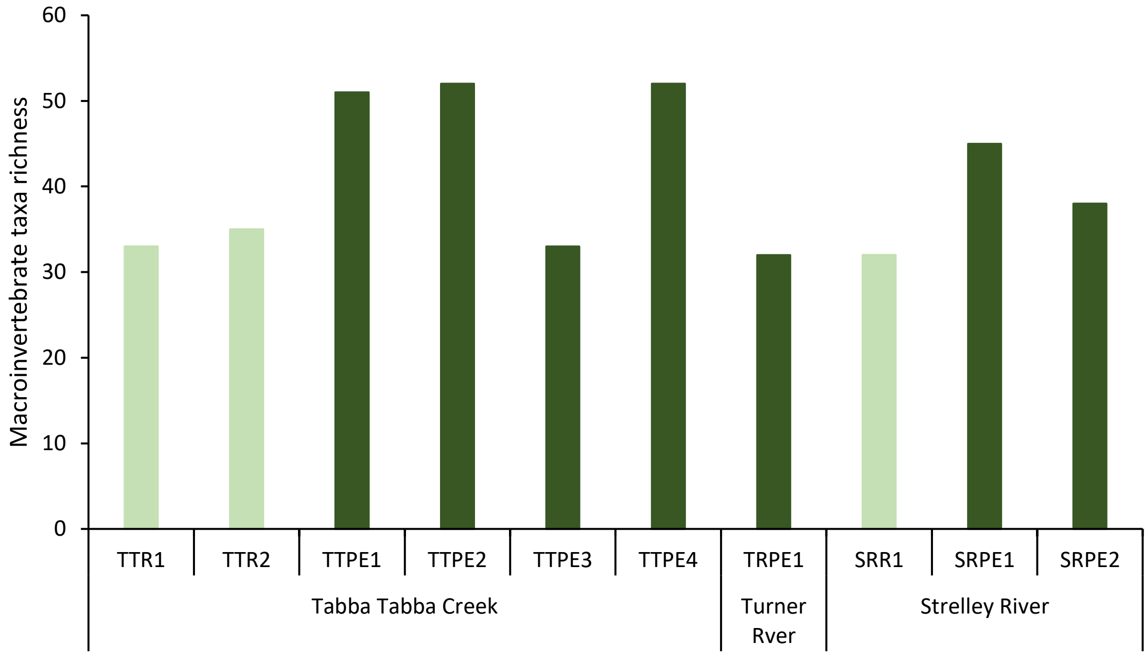

Figure 13. Macroinvertebrate taxa richness.

4.6.2 Spatial patterns in macroinvertebrate assemblages

nMDS ordination was conducted on macroinvertebrate data collected during the survey. There were no clear spatial trends in macroinvertebrate assemblage composition (Figure 14). TRPE1 was skewed to the far right of the nMDS plot, with the difference of this assemblage likely due to unique habitat characteristics (only site that was deep, permanent with emergent and submerged vegetation present).

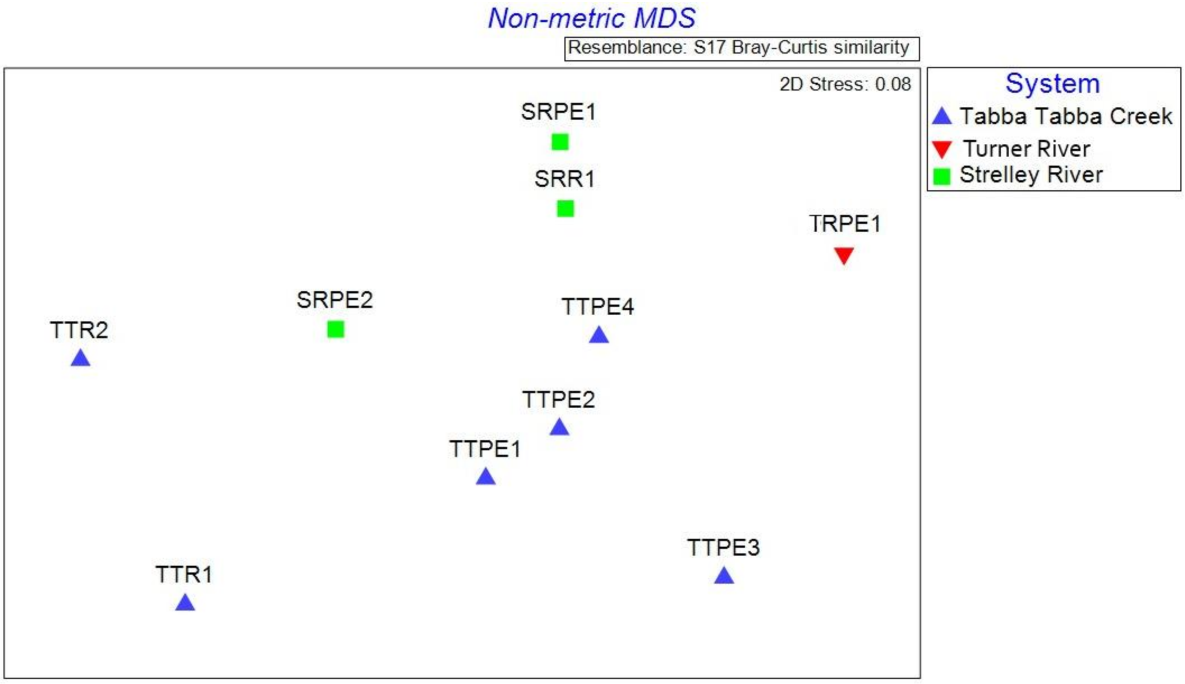

Figure 14. nMDS ordination of macroinvertebrate assemblage data (log abundance) collected from the Project area.

4.7 Fish

As some sites were too shallow and small to undertake traditional fish sampling methods, comparison of species abundance was not comparable between sites. As such, only presence/absence of fish species is reported on here.

A total of six species of fish were recorded in the Project area including western rainbowfish, spangled perch, milkfish, green mullet, tarpon and banded scat. Of the six species recorded, only two were true freshwater species (western rainbowfish and spangled perch), the remaining four species were of estuarine/marine origin. Freshwater systems of the Pilbara also host a number of species that are considered to be of marine or estuarine origin, most of which have a non-obligatory freshwater juvenile phase. The presence of marine/estuarine species in freshwater systems of the Pilbara is likely to be influenced by the frequency, timing and duration of flood events; the species listed above would only enter rivers if flooding coincided with their recruitment phase, while distance moved upstream is governed by the duration of the flood event (Morgan and Gill 2004). As floods recede, it is common for these species to become isolated in permanent upstream pools, forming small remnant populations that are cut-off from marine habitats (Morgan and Gill 2004). Spangled perch and milkfish were the most recorded species, at five sites each. No conservation listed species were recorded during the current survey, however future surveys may recover more species.

No fish were recorded at TTR1, TTR2 and SRPE2, and TRPE1 had the highest species richness with five out of the six species recorded (Table 5). This is not unexpected, given TRPE1 was the largest, and only permanent site that was sampled.

Table 5. Summary of fish species recorded in the Project area (presence/absence).

		Tabba Tabba Creek						Turner River	Strelley River		
Scientific name	**Common name**	**TTR1**	**TTR2**	**TTPE1**	**TTPE2**	**TTPE3**	**TTPE4**	**TRPE1**	**SRR1**	**SRPE1**	**SRPE2**
Leiopotherapon unicolor	Spangled perch					X	X	X	X	X	
Melanotaenia australis	Western rainbowfish							X	X	X	
Chanos chanos	Milkfish			X	X	X	X	X			
Megalops cyprinoides	Tarpon							X			
Liza subviridis	Greenback mullet						X	X			
Selenotoca multifasciata	Banded scat						X				

4.8 Waterbirds

One waterbird species was recorded at one of the ten sites: a white-faced heron (*Egretta novaehollandiae*) at SRPE1. Three other bird species were recorded; 12 budgerigars (*Melopsittacus undulatus)*, four rainbow bee-eaters (*Merops ornatus)* and two white-plumed honeyeaters (*Lichenostomus pencillatus)* at TRPE1. No species recorded were conservation listed, nor did any species appear on JAMBA, CAMBA or ROKAMBA lists.

All species have widespread distributions, across the Australian continent or the Australasian region. TRPE1 would likely act as an important refuge for local waterbirds during the drier seasons.

5.0 Summary and Conclusions

An aquatic field reconnaissance survey of the Tabba Tabba Lithium Project area conducted in wet season (April) 2025 provides a snapshot of the current ecological condition of creeks in the Project area, and the receiving environments. The rivers and creeklines sampled in the Project area were found to support a diverse and abundant array of aquatic biota.

5.1 Water and sediment quality

Water quality parameters were outside ANZG values for conductivity, pH and dissolved oxygen. The electrical conductivity DGV is known to be highly conservative for Pilbara waters and no sites exceeded the point of ecological stress. There were elevated concentrations of soluble nitrogen (N_NOx) at SRR1, indicating that nutrient enrichment occurs within the Strelley River. Total phosphorus exceeded the ANZG DGV at TTR2 and TTPE2, likely due to agricultural impacts (from cattle accessing pools for drinking, disturbing sediment and soiling water) and evapoconcentration in these receding pools.

Dissolved metals were generally below DGVs at all sites across the study area except for aluminium at TTPE3. Elevated concentrations of Al are also a characteristic of inland waters in the region due to colloidal clays in silicates. There were no exceedances of ANZG DGVs for sediment quality among the metals analysed.

5.2 Aquatic fauna

The majority of taxa recorded were common, ubiquitous species with Australasian or cosmopolitan distributions, and none appear on conservation lists. One taxa endemic to the Pilbara region was recorded at TTR2, TTPE2 and TTPE3, the aquatic hydrophilid beetle *Laccobius billi.*

A total of six species of fish were recorded in the Project area including western rainbowfish, spangled perch, milkfish, green mullet, tarpon and banded scat. Of the six species recorded, only two were true freshwater species (western rainbowfish and spangled perch), the remaining four species were of estuarine/marine origin.

5.3 Summary

In terms of aquatic habitat, the sites within Tabba Tabba Creek were small pools holding water around the outside meanders or around root systems of trees. These pools likely persist for weeks to months after significant wet season rainfall. The Strelley and Turner rivers were broad, low gradient mobile sand-bed channels. It is likely that pools vary in extent and duration between years depending on the magnitude of the wet season, with pools likely changing location between seasons. Depositional areas for fine sediments tended to be small areas in the lee of rock outcrops or behind debris dams. Of all the locations visited, only one site, TRPE1, was deep enough and supported vegetation that indicated it was a permanently inundated/permanent pool.

Database records suggest that semi-permanent and permanent pools downstream of the mining envelope (i.e. TRPE1) would intermittently support significant migratory waterbird species, including the common sandpiper, wood sandpiper, osprey and glossy ibis (Stantec 2023). These pools could also provide refuge and migratory routes for fauna, including fish populations linked to permanent water (Morgan *et al.* 2009). Therefore, permanent pools within the Project area are considered high in ecological value, within a local context. Tabba Tabba Creek is highly ephemeral; however, these pools support a variety of transient aquatic biota able to colonise waterbodies that form in the wet season.

Additional sampling of the lower creekline sites, when flowing, is required to determine if mine impacts will be evident at these sites (i.e. Tabba Tabba Creek) during flow events. Wet season runoff can flush a variety of contaminants into aquatic systems, and this is known to adversely impact these environments. Impacts include changes to water chemistry and macroinvertebrate assemblage structure (shift to more pollution tolerant taxa), the introduction of pollutants to substrates making them readily available to aquatic organisms, and bioaccumulation of pollutants in some fish and invertebrate species (Masterman & Bannerman 1994).

Potential key threatening processes associated with Tabba Tabba mine include discharge of excess mine pit dewatering to creeklines or rivers causing alterations to hydrology and/or water quality to receiving environments, including sedimentation and alterations to river channel flow paths and groundwater drawdown from pit dewatering, resulting in changes to groundwater quantity and subsequent impact to groundwater supported surface waters.

Acidification of waterbodies through AMD processes is generally caused by exposure of acid generating rock-types to air and water through mining/construction operations. AMD runoff into aquatic habitats is known to cause decreased pH and increased dissolved metal concentrations, and vast reductions in the abundance and diversity of aquatic biota (DeNicola & Stapleton 2002). AMD can also cause elevated bioaccumulation of metals in aquatic organisms, with varying degrees of toxicity. The precipitation of metals released through AMD can bury hard substrates and organisms, while also extending the time of recovery in streams following mine closure (DeNicola & Stapleton 2002).

Acidification via AMD is known to cause significant shifts in macroinvertebrate assemblage structure, where acid/metal tolerant taxa, and taxa which favour extremely stressed areas, such as fugitive, predatory and opportunistic groups tend to increase, and acid/metal sensitive taxa such as Crustacea, molluscs and Ephemeroptera are superseded (Gerhardt et al. 2004). The lack of predatory pressure from fish in these environments also allows predatory macroinvertebrates such as Coleoptera and Hemiptera to dominate (Gerhardt et al. 2004). Gerhardt *et al.* (2004) reported that even small decreases in pH and elevations in metal concentrations related to AMD runoff can have adverse impacts on the behaviour of fish and macroinvertebrates.

Metalliferous drainage (where there is metalliferous drainage, without the acidification effects) can occur when ores are excavated from below the water table, stockpiled and allowed to oxidise. Selenium has been identified as a constituent of concern for metalliferous drainage, both in Western Australia and overseas (Fitzgerald *et al.* 2008). This is because selenium typically occurs as selenite under reducing conditions below the water table, but when material is removed and stockpiled, selenite can oxidise to selenate; a weakly adsorbing form which is unable to remain attached to mineral surfaces at near neutral pH and can therefore be released into the receiving environment (Lipinski *et al.* 1987, Gruebel *et al.* 1995, Su & Suarez 2000). While selenium is an essential nutrient in aquatic systems, it can be toxic to fish and other aquatic biota at concentrations slightly higher than nutritional requirements (Lemly & Smith 1987, Maier & Knight 1993).

Stormwater runoff, which can introduce a variety of pollutants to aquatic systems, is known to adversely impact these environments. Impacts include changes to water chemistry and macroinvertebrate assemblage structure (shift to more pollution tolerant taxa), the introduction of pollutants to substrates making them readily available to aquatic organisms, and bioaccumulation of pollutants in some fish and invertebrate species (Masterman and Bannerman 1994).

5.4 Recommendations

There is the potential that future mining activity to impact the aquatic ecological values of Tabba Tabba Creek and downstream habitats. Thus, it is important that an adequate aquatic ecological baseline is established, and an ongoing targeted monitoring program be developed.

If excess water is to be released into Tabba Tabba Creek, impacts to the receiving section via alterations to the hydrological regime must be considered. The structure and function of a riverine ecosystem and many adaptations of its biota are determined by patterns of temporal variation in river flows. Therefore, it is suggested that discharge operations mimic, as much as possible, the natural flow regime, taking into consideration the magnitude, frequency and timing of flow events.

Unseasonal availability of surface water would likely affect species adapted to the current flow regime, and it would be expected that intermittently available surface water in the wet season would be more readily adapted to than intermittently available water in the dry season. As such, the main considerations for protecting existing aquatic fauna and ecological values, where possible, include:

- Intermittent, seasonal discharge to mimic, as much as possible, the natural flow regime;
- Alternate use of discharge points to allow infiltration, and to prevent surface flows developing;
- Reducing scouring of the receiving creekline, by reducing flow velocity where possible.

It is recommended that baseline water quality and fauna sampling be conducted annually (late-wet season) over a period of three years, in order to characterise temporal variability and to support future approvals. Faunal assemblages and water chemistry, particularly in ephemeral systems, can change markedly across years. Improved understanding of natural, stochastic (i.e. random) changes in such ecosystems over time allows for better differentiation between natural and mine-related influences. If spatially and temporally robust sampling is undertaken, temporal variance in water quality and faunal assemblages can be adequately characterised, and any mine-related impacts accurately assessed.

The survey should aim to mobilise 2 to 3 weeks after wet season rainfall to capture ephemeral sites when surface water is still present. Sampling should coincide with the period of recessional flow in the creeklines. This can be done in consultation with site representatives.

As the project develops, it would be beneficial to obtain more specific mine development plans to support monitoring and define potential impacts to Tabba Tabba Creek, Strelley River and Turner River.

6.0 References

Alabaster JS & Lloyd R (1982) Water quality criteria for freshwater fish. 2nd edition. pp. 127-142. London, England: Butterworth Scientific.

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.

ANZG (2025) Toxicant default guideline values for aquatic ecosystem protection. Nitrate in freshwater. Technical Brief.

Batley GE, van Dam RA, Warne MStJ, Chapman JC, Fox DR, Hickey CW, Stauber, JL (2018) Technical rationale for changes to the Method for Deriving Australian and New

Zealand Water Quality Guideline Values for Toxicants. Prepared for the revision of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, 49 pp

Bellinger E, Sigee (2010) Freshwater Algae: Identification and use as bioindicators. Wiley-Blackwell, Volume 25, pp. 1265-1266.

Butler B, Burrows DW (2007) Dissolved Oxygen Guidelines for Freshwater Habitats of Northern Australia. Report 07/32 Australian Centre for Tropical Freshwater Research, James Cook University, Townsville.

Butler B, Doudoroff P, Shumway DL (1970) Dissolved oxygen requirements of freshwater fishes. FAO Fisheries Technical Paper No. 86, 291 pp.

Caraco NF, Cole JJ (2002) Contrasting impacts of a native and alien macrophyte on dissolved oxygen in a large river. *Ecological Applications* **12**: 1496-1509.

Connolly NM, Crossland MR, Pearson RG (2004) Effect of low dissolved oxygen on survival, emergence, and drift of tropical stream macroinvertebrates. *Journal of the North American Benthological Society* **23:** 251-270.

Davis JC (1975) Minimal dissolved oxygen requirements of aquatic life with emphasis on Canadian species: A review. *Journal of Fisheries Research Board of Canada* **32**: 2295-2332.

DeNicola DM, Stapleton MG (2002) Impact of acid mine drainage on benthic communities in streams: the relative roles of substratum vs. aqueous effects. Environmental Pollution 119: 303-315.

Department of Environment Sport and Territories, Land and Water Resources – Research and Development Corporation, Commonwealth Environment Protection Authority (1994) National River Processes and Management Program: Monitoring River Health Initiative. River Bioassessment Manual, Version 1.0. February 1994.

Dow R (2017). *Ictinogomphus dobsoni*. *The IUCN Red List of Threatened Species* 2017: e.T14278410A59256758. https://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T14278410A59256758.en. Accessed on 03 July 2025.

Dow R (2019a). *Antipodogomphus hodgkini*. *The IUCN Red List of Threatened Species* 2019: e.T14276088A59256638. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T14276088A59256638.en. Accessed on 03 July 2025.

Dow R (2019b) *Eurysticta coolawanyah*. *The IUCN Red List of Threatened Species* 2019: e.T163568A14675082. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T163568A14675082.en. Accessed on 02 July 2025.

Dow R (2019c) *Hemicordulia koomina*. *The IUCN Red List of Threatened Species* 2019: e.T163549A87527502. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T163549A87527502.en. Accessed on 04 July 2025.

Eberhard, S. M., Halse, S. A., & Humphreys, W. F. (2005). Stygofauna in the Pilbara region, north-west Western Australia: a review. *Journal of the Royal Society of Western Australia*, *88*, 167.

EIFAC (1973) Water quality criteria for European freshwater fish: Report on zinc and freshwater fish. European Inland Fisheries Advisory Commission (EIFAC) Working Party on Water Quality Criteria and European Freshwater Fish. EIFAC Technical Paper No. 21, 322 pp.

EPA (2002) Position Statement Number 3: Terrestrial biological surveys as an element of biodiversity protection. Environmental Protection Authority.

EPA (2004) Guidance Statement Number 56: Terrestrial fauna surveys for environmental impact assessment in Western Australia. Environmental Protection Authority.

EPA (2009) EPA Guidance Statement Number 20: Sampling of short range endemic invertebrate fauna for environmental impact assessment in Western Australia. Environmental Protection Authority, May 2009.

EPA (2018) Environmental Factor Guideline: Inland Waters. Environmental Protection Authority, Western Australia. 29 June 2018.

Environmental Protection Authority (2020). Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment, EPA, Western Australia.

Erman DC, Erman NA (1984) The response of stream macroinvertebrates to substrate size and heterogeneity. *Hydrobiologia* **108**: 75-82.

Fitzgerald D, Nicholson R, Regoli L (2008) Environmental management criteria for molybdenum and selenium: a review relevant to the mining industry. British Columbia Mine Reclamation Symposium.

Flint N, Crossland MR, Pearson RG (2014) Sublethal effects of fluctuating hypoxia on juvenile tropical Australian freshwater fish. *Marine and Freshwater Research* **66**: 293-304.

Gerhardt A, Janssens de Bisthoven L, Soares AMVM (2004) Macroinvertebrate response to acid mine drainage: community metrics and on-line behavioural toxicity bioassay. Environmental Pollution 130: 263-274.

Gooderham J, Tsyrlin E (2002). The Waterbug Book. CSIRO Publishing.

Gregory S, Nichols E (2008) Differences in sediment organic matter composition ad PAH weathering between non-vegetated and recently vegetated fuel oiled sediments. *International Journal of Phytoremediation*, 10, 473.

Gruebel KA, Davis JA, Leckie JO (1995) Kinetics of oxidation of selenite to selenate in the presence of oxygen, titania and light. Environmental Science and Technology 29: 586-594.

Halse, S.A., Scanlon, M.D. and Cocking, J.S. (2002). Do springs provide a window to the groundwater fauna of the Australian arid zone? Balancing the groundwater budget: proceedings on CD of an International Groundwater Conference, 12–17 May 2002, Darwin, Australia

Halse SA, Scanlon M, Cocking J, Barron H, Richardson J, Eberhard S. (2014). Pilbara stygofauna: deep groundwater of an arid landscape contains globally significant radiation of biodiversity. *Records of the Western Australian Museum, Supplement*, *78*(2), 443.

Hart B, Bailey, Edwards P, Hortle K, James K, McMahon A, Meredith C, Swadling K (1991). A review of salt sensitivity of Australian freshwater biota. *Hydrobiologia* 210: 105-144.

Heino J (2000) Lentic macroinvertebrate assemblage structure along gradients in spatial heterogeneity, habitat size and water chemistry. *Hydrobiologia* **418**: 229-242.

Horrigan N, Choy S, Marshall J, Recknagel F (2005) Response of stream macroinvertebrates to changes in salinity and the development of a salinity index. *Marine and Freshwater Research* **56**: 825–833.

Hutchinson GE (1993) *A Treatise on Limnology*. Vol. IV, The Zoobenthos. Ed. Y.H. Edmondson. John Wiley & Sons, Inc., 944pp.

Jähnig SC, Lorenz AW (2008) Substrate-specific macroinvertebrate diversity patterns following stream restoration. *Aquatic Sciences* **70**: 292-303.

Kendrick P, Mckenzie N (2001). A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions: Pilbara 1 (PIL1 – Chichester subregion).

Kendrick P, Stanley F (2001). A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions: Pilbara 4 (PIL4 – Roebourne synopsis).

Koste W, Shiel RJ (1983) Morphology, systematics and ecology of new monogonont Rotifera (Rotatoria) from the Alligator Rivers region, Northern Territory. *Transactions of the Royal Society of South Australia* **107**: 109-121.

Lawson L (2002) ADEQ staff comments on the water quality of priority streams in Pima County, Draft. Unpublished report.

Leipelt KG, Suhling F (2005) Larval biology, life cycle and habitat requirements of *Macromia splendens*, revisited (Odonata: Macromiidae). *International Journal of Odonatology* **8**: 33-44.

Lemly AD, Smith GJ (1987) Aquatic Cycling of Selenium: Implications for Fish and Wildlife, Fish and Wildlife Leaflet 12. U.S. Fish and Wildlife Service, Washington, D.C.

Lipinski NG, Huang PM, Hammer UT, Liaw WK (1987) The interaction of selenate and selenite with selected freshwater sediments. International Review of Hydrobiology 72: 107-114.

Maier KJ, Knight AW (1993) Comparative acute toxicity and bioconcentration of selenium by the midge Chironomus decorus exposed to selenate, selenite, and seleno-DL-methionine. Archives of Environmental Contamination and Toxicology 25: 365-370.

Masterman JP, Bannerman RT (1994) Impacts of stormwater runoff on urban streams in Milwaukee County, Wisconsin. National Symposium on Water Quality. November 1994. American Water Resources Association.

Miquelis A, Rougier C, Pourriot R (1998) Impact of turbulence and turbidity on the grazing rate of the rotifer *Brachionus calyciflorus* (Pallas). *Hydrobiologia* **386**: 203–211.

Morgan D, Gill H (2004). Fish fauna in inland waters of the Pilbara (Indian Ocean) Drainage Division of Western Australia evidence for three subprovinces. *Zootaxa*, *636*(1), 1-43.

Morgan D, Unmack P, Beatty S, Ebner B, Allen M, Keleher J, Murphy J (2014). An overview of the'freshwater fishes' of Western Australia. *Journal of the Royal Society of Western Australia*, *97*, 263-278.

Morgan D, Wueringer B, McDavitt M (2019). Technical Memo in relation to the presence of sawfish species and the construction of a marina in Port Hedland. Murdoch University, Sharks and Rays Australia report to Department of Transport, Government of Western Australia. (Murdoch University, Murdoch).

National Health and Medical Research Centre (2008) Guidelines for Managing Risks in Recreational Water. Australian Government.

O'Connor (1991) The effects of habitat complexity on the macroinvertebrates colonising wood substrates in a lowland stream. *Oecologia* **85**: 504-512.

Pike C, Crook V, Jacoby, D Gollock M 2020. *Anguilla bicolor* (amended version of 2019 assessment). *The IUCN Red List of Threatened Species* 2020: e.T166894A176494582. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T166894A176494582.en. Accessed on 02 July 2025.

Pinder A, Leung A. (2009). Conservation status and habitat associations of aquatic invertebrates in Pilbara coastal river pools. *Report of the Department of Environment and Conservation, Government of Western Australia, Australia*.

Pinder AM, Halse SA, Shiel RJ, McRae JM (2010) An arid zone awash with diversity: patterns in the distribution of aquatic invertebrates in the Pilbara region of Western Australia. *Western Australian Museum, Supplement* **78**: 205-246.

Pinder AM, McKenzie NL, van Leeuwin S (2011). *A biodiversity survey of the Pilbara region of Western Australia, 2002-2007*. Western Australian Museum.

Porter S, Mueller D, Spahr N, Munn M, Dubrovsky N (2008) Efficiacy of algal metrics for assessing nutrient and organic enrichment in flowing waters. *Freshwater Biology*, 53, 1036.

Pulford I, Flowers H (2006) Environmental chemistry at a glance. Blackwell Publishing.

Romaire RP (1985) Water quality [In] Hunter JV, Brown EE (eds.) Crustacean and Mollusc Aquaculture in the United States. AVI Publishing Co. Inc., Westport.

Rouquette JR, Thomson DJ (2004) Habitat associations of the endangered damselfly, *Coenagrion mercuriale*, in a water meadow ditch system in southern England. *Biological Conservation* **123**: 225-235

Sainty G, Jacobs S (2003) Waterplants in Australia. Sainty and Associates.

Salk KR, Bullerjahn GS, McKay RML, Chaffin JD, Ostrom NE (2018) Nitrogen cycling in Sandusky Bay, Lake Erie: oscillations between strong and weak export and implications for harmful algal blooms. Biogeosciences 15: 2891–2907

Sawyer CN & McCarty PL (1978) Chemistry for Environmental Engineering. New York: McGraw-Hill.

Schiemer F, Keckeis H, Reckendorfer W, Winkler G (2001) The “inshore retention concept” and its significance for large rivers. Archive of Hydrobiology, Supplement **135**: 509–516.

Schöll K, Kiss A, Dinka M, Berczik Á (2012), Flood-pulse effects on zooplankton assemblages in a river- floodplain system (gemenc floodplain of the Danube, Hungary). *International Review of Hydrobiology* **97**: 41-54.

Segers H Kotethip W, Sanoamuang L (2004) Biodiversity of freshwater microfauna in the floodplain of the River Mun, Northeast Thailand: The Rotifera, Monogononta. *Hydrobiologia* **515:** 1-9.

Simpson SL, Batley GB, Chariton AA (2013) Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO Land and Water Science Report 08/07. CSIRO Land and Water.

Smirnov NN, De Meester L (1996) Contributions to the Cladocera fauna from Papua New Guinea*. Hydrobiologia* **317**: 65–68.

Stantec (2023). Mallina Gold Project – Baseline Aquatic Ecology Survey of the Turner and Yule Rivers, Flood Study Memorandum.

Stantec (2022). Mallina Gold Project – Baseline Aquatic Ecology Survey of the Turner and Yule Rivers. Final Report.

Su C, Suarez DL (2000) Selenate and selenite sorption on iron oxides: an infrared and electrophoretic study. Soil Science Society of America Journal 64: 101-111.

Tait RD, Shiel RJ, Koste W (1984) Structure and dynamics of zooplankton communities, Alligator Rivers region, NT, Australia. *Hydrobiologia* **113**: 1-13.

Warne MStJ, Batley GE, van Dam RA, Chapman JC, Fox DR, Hickey CW and Stauber JL (2018). Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants – update of 2015 version. Prepared for the revision of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, 48 pp

WHO (2025) Guidelines on recreational water quality. Volume 1: coastal and fresh waters. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.

WRM (2009) API Aquila: Baseline Aquatic Ecosystem Surveys. Unpublished report by Weland Research & Management to Australia Premium Iron.

WRM (2015b) ORIA Stage II Expansion – Knox Creek Plain Baseline Aquatic Fauna Survey, October 2014. Unpublished report to Kimberley Agricultural Investment Pty Ltd by Wetland Research & Management. 5 August 2015.

WRM (2017) Mesa H Project Baseline Aquatic Ecosystem Surveys - Wet Season Sampling 2016. Unpublished report to Astron Environmental Services Pty Ltd by Wetland Research & Management. Final Report, April 2017.

Yilmaz A, Gül Aslan E (2014) Faunistical and ecological investigations on water scavenger beetles (Coleoptera: Hydrophilidae) of Isparta Province, Turkey. *Pakistan Journal of Zoology* **46**: 1663-1671.

Appendix A Site Photographs

Aquatic Fauna Desktop Assessment and Field Survey

Tabba Tabba Lithium Project

Wildcat Resources Limited

SLR Project No.: 675.073111.00001

21 October 2025

TTR1	TTR2
	
TTPE1	**TTPE2**
	
TTPE3	**TTPE4**
	

TRPE1	SRR1
	
SRPE2	**SRPE3**
	

Appendix B Water Quality Data

Aquatic Fauna Desktop Assessment and Field Survey

Tabba Tabba Lithium Project

Wildcat Resources Limited

SLR Project No.: 675.073111.00001

21 October 2025

			Tabba Tabba Creek						Turner River	Strelley River		
	Units	DGV	TTR1	TTR2	TTPE1	TTPE2	TTPE3	TTPE4	TRPE1	SRR1	SRPE1	SRPE2
Alkalin	mg/L		48	58	76	61	91	121	75	96	51	144
ECond	uS/cm	250	113	130	212	343	286	580	208	1430	165	334
TDS_calc	mg/L		62	71	120	190	160	320	110	790	91	180
TSS	mg/L		<1	2	2	3	6	1	1	4	6	2
Hardness	mg/L		32	40	48	79	49	140	61	140	34	110
Ca	mg/L		9.3	11.8	13.8	21.6	15.6	35	16	39.7	9.1	35.3
Cl	mg/L		6	5	21	67	32	106	18	339	20	19
K	mg/L		1.8	1.9	1.4	3.3	2.2	4.3	2.1	4	2.2	2.1
Mg	mg/L		2.2	2.5	3.2	6	2.3	12.8	5.2	10.9	2.8	5.8
Na	mg/L		8.5	7.6	22.2	29.1	36.6	56.2	15.2	205	17.2	22
SO4_S	mg/L		0.3	0.2	0.5	1.8	2.5	12.7	1.7	55.4	0.8	1.5
HCO3	mg/L		58	71	92	75	91	147	92	111	62	176
CO3	mg/L		<1	<1	<1	<1	10	<1	<1	3	<1	<1
OH	mg/L		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N_NH3	mg/L	0.9	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N_NO2	mg/L	NP	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.09	<0.01	<0.01
N_NO3	mg/L	2.6*	0.02	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	5.5	<0.01	<0.01
N_NOx	mg/L	0.01	0.02	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	5.6	<0.01	<0.01
N_total	mg/L	0.3	0.19	0.11	0.22	0.4	0.19	0.33	0.26	6.1	0.29	0.21
P_SR	mg/L	NP	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
P_total	mg/L	0.01	0.01	0.014	0.01	0.012	0.006	<0.005	<0.005	<0.005	0.009	<0.005
Ag	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Al	mg/L	0.055	<0.005	<0.005	<0.005	<0.005	0.059	0.017	<0.005	0.008	<0.005	<0.005
As	mg/L	0.0024	0.00098	0.0012	0.0011	0.00082	0.0014	0.00076	0.0013	0.00041	0.00086	0.0011
B	mg/L	0.94	0.03	0.04	0.05	0.05	0.06	0.08	0.06	0.12	0.04	0.07
Ba	mg/L	NP	0.034	0.036	0.035	0.043	0.027	0.067	0.026	0.1	0.026	0.043
Cd	mg/L	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Co	mg/L	NP	0.0025	0.0021	0.0006	0.0003	0.0002	0.0001	0.0003	0.0001	0.0007	0.0005
Cr	mg/L	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cu	mg/L	0.0014	<0.0001	<0.0001	<0.0001	0.0003	0.0004	0.0009	0.0002	0.0005	<0.0001	<0.0001
Fe	mg/L	0.7	0.62	0.3	0.53	0.17	0.081	0.013	0.32	0.083	0.25	0.1
Li	mg/L	NP	0.0011	0.0014	0.0017	0.002	0.0013	0.0015	0.0019	0.006	0.0022	0.0006

			Tabba Tabba Creek						Turner River	Strelley River		
	Units	DGV	TTR1	TTR2	TTPE1	TTPE2	TTPE3	TTPE4	TRPE1	SRR1	SRPE1	SRPE2
Mn	mg/L	1.9	0.34	0.63	0.13	0.083	0.01	0.004	0.038	0.01	0.17	0.42
Mo	mg/L	NP	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ni	mg/L	0.011	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pb	mg/L	0.0034	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
S	mg/L	NP	<0.1	<0.1	0.2	0.6	0.8	4.2	0.6	18	0.3	0.5
Se	mg/L	NP	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Si	mg/L	NP	7.3	6.4	7.7	7.6	6.8	5.3	7.6	9.3	7.4	6.6
Sr	mg/L	NP	0.073	0.089	0.12	0.18	0.079	0.4	0.15	0.5	0.1	0.28
U	mg/L	NP	<0.0001	<0.0001	<0.0001	0.0001	0.0003	0.0019	0.0004	0.0005	0.0001	0.0013
V	mg/L	NP	0.0003	0.0001	0.0002	0.0003	0.0019	0.0017	0.0006	0.0004	0.0001	<0.0001
Zn	mg/L	0.008	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

* Toxicity DGV

Appendix C Sediment Quality Data

Aquatic Fauna Desktop Assessment and Field Survey

Tabba Tabba Lithium Project

Wildcat Resources Limited

SLR Project No.: 675.073111.00001

21 October 2025

			Tabba Tabba Creek						Turner River	Strelley River		
	DGV	Units	TTR1	TTR2	TTPE1	TTPE2	TTPE3	TTPE4	TRPE1	SRR1	SRPE1	SRPE2
Ag	1	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
As	20	mg/kg	0.22	0.09	0.05	0.1	0.06	0.08	0.05	0.06	0.02	0.02
Ba		mg/kg	15	7	3.6	4.3	5.6	7.9	2.5	6.8	2	1.8
Be		mg/kg	0.18	0.041	0.021	0.033	0.019	0.048	0.014	0.042	0.013	0.011
Cd	1.5	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Co		mg/kg	0.57	0.33	0.16	0.23	0.28	0.61	0.15	0.22	0.072	0.053
Cr		mg/kg	0.44	0.12	0.08	0.25	0.09	0.24	0.11	0.15	0.06	0.04
Cu	80	mg/kg	2.2	0.54	0.34	0.51	0.27	0.84	0.17	0.44	0.11	0.08
Hg	0.15	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Li		mg/kg	0.06	0.03	0.02	0.02	0.02	0.06	0.01	0.11	0.01	<0.01
Mn		mg/kg	27	22	8.6	11	13	21	8.9	45	5.4	2.7
Mo		mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ni	21	mg/kg	1.3	0.4	0.2	0.3	0.2	0.4	0.1	0.2	<0.1	<0.1
Pb	50	mg/kg	3	0.92	0.51	0.65	0.35	0.82	0.34	0.96	0.25	0.16
Sb		mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Se		mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sn		mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zn	200	mg/kg	1.4	0.6	0.7	0.6	<0.5	1.1	<0.5	0.6	<0.5	<0.5

Appendix D Phytoplankton Data

Aquatic Fauna Desktop Assessment and Field Survey

Tabba Tabba Lithium Project

Wildcat Resources Limited

SLR Project No.: 675.073111.00001

21 October 2025

		Tabba Tabba Creek						Turner River	Strelley River		
	Lowest taxon	**TTR1**	**TTR2**	**TTPE1**	**TTPE2**	**TTPE3**	**TTPE4**	**TRPE1**	**SRR1**	**SRPE1**	**SRPE2**
Cyanobacteria	*Cylindrospermum* spp	0	0	0	0	0	0	190	0	0	0
	Heteroleibleinia spp	1450	25900	0	2210	0	0	0	0	0	0
	Leptolyngbya spp	1330	0	0	0	0	0	0	1310	1430	0
	Limnothrix spp	0	12100	540	0	0	0	0	0	1790	0
	Lyngbya spp	230	0	0	0	0	0	0	0	0	0
	Phormidium spp	0	0	0	0	0	0	140	0	0	0
	Planktolyngbya contorta	0	3320	0	0	0	0	0	0	0	0
	Planktolyngbya limnetica	0	13900	0	0	0	0	0	0	0	0
	Planktolyngbya minor	1710	48900	0	1510	0	0	1270	5560	5460	1990
	Trichodesmium iwanoffianum	0	0	0	0	0	0	80	0	0	0
Diatoms	*Achnanthes oblongella*	660	0	470	0	0	880	0	1930	1640	490
	Achnanthes spp	0	1890	980	1430	970	1650	1150	2210	890	1050
	Achnanthidium exiguum	0	830	0	0	0	0	0	0	0	0
	Achnanthidium minutissimum	0	0	0	250	0	0	590	0	720	1570
	Aulacoseira spp	0	2310	0	670	0	0	150	240	610	270
	Cyclotella spp	0	0	0	0	0	0	0	930	0	0
	Eunotia spp	0	0	0	0	0	0	0	0	90	0
	Fragillaria spp	0	0	0	210	0	220	0	0	250	0
	Hantzschia amphioxys	0	0	0	0	0	50	0	0	0	150
	Luticola spp	0	0	230	0	0	0	0	0	0	0
	Navicula radiosa	0	0	390	0	0	790	890	180	1110	540
	Navicula spp	0	0	250	1150	360	450	230	0	560	690
	Nitzschia linearis	1090	5210	0	1090	1050	760	0	2180	1450	740
	Nitzschia spp	460	4890	1130	980	460	1220	760	1150	1130	1350
	Pinnularia spp	0	0	0	130	40	140	0	0	220	0
	Surirella spp	0	0	0	0	0	70	0	0	0	0
	Synedra spp	0	0	0	0	0	0	0	0	0	20
	Synedra ulna	0	40	0	0	0	0	10	0	0	0
Dinoflagellates	*Ceratium hirundinella*	0	0	0	10	0	0	0	10	0	0
	Cryptomonas spp	50	2130	0	110	1110	930	30	5410	2210	1890

		Tabba Tabba Creek						Turner River	Strelley River		
	Lowest taxon	**TTR1**	**TTR2**	**TTPE1**	**TTPE2**	**TTPE3**	**TTPE4**	**TRPE1**	**SRR1**	**SRPE1**	**SRPE2**
	Gymnodinium spp	0	60	0	0	0	0	0	0	0	0
	Peridinium spp	0	90	10	0	0	0	0	30	30	20
	Trachelomonas spp	0	1050	30	20	210	60	0	150	260	370
Green algae	*Ankistrodesmus* spp	0	0	0	60	0	0	0	650	0	0
	Chlamydomonas spp	0	5460	250	690	360	1310	130	1770	2390	3810
	Closterium spp	0	60	40	0	0	0	0	0	40	0
	Cosmarium spp	0	0	0	30	30	0	0	480	110	150
	Crucigenia spp	0	0	0	0	0	270	0	0	2820	0
	Desmidium spp	0	0	0	0	0	0	0	0	1010	0
	Dictyosphaerium spp	0	0	0	0	0	0	0	1010	0	0
	Golenkinia spp	0	0	0	0	0	0	0	0	0	30
	Kirchneriella spp	0	0	0	0	0	3250	0	3350	5550	1040
	Koliella spp	0	0	0	0	0	0	0	0	0	120
	Lagerheimia spp	0	0	0	0	0	0	0	0	0	20
	Mallomonas spp	0	30	0	0	0	0	0	0	0	0
	Micrasterias spp	0	0	0	50	20	0	0	0	70	40
	Monoraphidium spp	210	2740	170	370	670	790	170	1290	780	1560
	Mougeotia spp	0	0	0	0	0	3930	230	0	3350	3950
	Oedogonium spp	0	0	0	0	0	0	0	3890	0	0
	Oocystis parva	0	0	0	150	0	0	0	1610	0	0
	Pediastrum spp	0	0	0	0	60	0	0	0	0	0
	Scenedesmus spp	0	430	0	190	120	340	110	2150	650	480
	Schroederia spp	130	290	0	0	0	0	0	0	0	0
	Selenastrum spp	0	0	0	0	0	130	0	0	0	0
	Spirogyra spp	0	23300	0	6520	0	0	0	870	8790	0
	Staurastrum spp	0	0	0	0	0	0	10	50	30	0
	Tetraedron spp	80	0	0	0	0	0	0	260	0	0

Appendix E Microinvertebrate Data

Aquatic Fauna Desktop Assessment and Field Survey

Tabba Tabba Lithium Project

Wildcat Resources Limited

SLR Project No.: 675.073111.00001

21 October 2025

		TabbaTabba Creek						Turner River	Strelley River		
	Lowest taxon	TTR1	TTR2	TTPE1	TTPE2	TTPE3	TTPE4	TRPE1	SRR1	SRPE1	SRPE2
Protista	Euplotes spp	6	0	0	2	5	6	4	0	6	0
	Coleps spp	0	0	0	0	3	0	0	0	0	0
	Cyclidium spp	1	6	0	0	0	3	0	0	0	0
	Homalozoon spp	2	1	0	1	0	2	0	0	0	0
	Strobilidium spp	0	4	0	0	0	0	0	0	3	0
Rotifera	*Asplanchna brightwelli*	0	19	0	0	0	7	0	0	0	0
	Asplanchna spp	0	0	0	4	4	0	2	9	0	0
	Anuraeopsis navicula	3	65	0	0	6	11	11	0	9	1
	Brachionus angularis	0	0	0	0	0	0	6	0	2	0
	Brachionus falcatus	0	0	0	0	0	0	25	0	0	0
	Brachionus quadridentatus	0	0	0	3	0	8	0	1	3	0
	Brachionus spp	0	0	0	0	1	4	5	0	0	1
	Encentrum spp	0	4	0	0	0	0	0	0	0	0
	Filinia longiseta	0	0	0	0	0	0	18	0	0	0
	Finilia spp	0	0	0	0	0	0	0	0	1	0
	Keratella testudo	0	0	0	0	0	52	36	0	0	0
	Lecane luna	0	0	2	1	4	0	0	5	0	0
	Lepadella spp	0	0	0	0	3	0	4	0	0	0
	Polyarthra spp	0	0	0	0	0	0	3	0	0	0
	Polyarthra vulgaris	0	0	1	0	18	0	9	0	4	1
	Trichocerca spp	0	0	0	0	0	0	0	4	0	0
	Notholca spp	0	0	0	0	0	0	0	0	5	0
	Platyias patulus	0	0	4	6	5	0	0	0	89	0
	Trichotria pseudocurta	0	0	1	0	0	3	0	0	0	0
Cladocera	*Alona* spp	0	0	0	0	0	0	0	6	0	0

		TabbaTabba Creek						Turner River	Strelley River		
	Lowest taxon	TTR1	TTR2	TTPE1	TTPE2	TTPE3	TTPE4	TRPE1	SRR1	SRPE1	SRPE2
Copepoda	Unknown Nauplii	1	2	1	1	1	1	3	2	5	0
Calanoid	*Boeckella fluvialis*	0	0	0	0	0	0	7	0	9	0
	Boeckella spp	0	1	0	1	0	0	0	0	0	0
	Calamoecia spp	0	0	0	2	0	0	0	0	12	0
	Copepodite Calanoida	0	0	0	0	0	0	2	0	0	0
Cyclopoid	Copepodite Cyclopoida	0	1	3	3	8	5	14	13	21	0
	Eucyclops australiensis	0	0	0	0	0	0	8	0	0	0
	Mesocyclops australiensis	0	0	0	6	0	1	24	0	41	0
	Mesocyclops spp	0	0	1	0	1	0	0	0	0	0
Ostrcoda	*Limnocythere* spp	0	0	0	0	0	0	0	0	1	0
	Newnhamia fenestrata	0	6	0	0	0	0	0	3	0	0

Appendix F Macroinvertebrate Data

Aquatic Fauna Desktop Assessment and Field Survey

Tabba Tabba Lithium Project

Wildcat Resources Limited

SLR Project No.: 675.073111.00001

21 October 2025

			Tabba Tabba Creek						Turner River	Strelley River		
Phylum/Class/Order	**Family**	**Lowest taxon**	**TTR1**	**TTR2**	**TTPE1**	**TTPE2**	**TTPE3**	**TTPE4**	**TRPE1**	**SRR1**	**SRPE1**	**SRPE2**
ANNELIDA												
Oligochaeta		Oligochaeta spp.	2	3	3	3	1	2	2	1	0	3
MOLLUSCA												
Gastropoda												
Hygrophila	Planorbidae	*Gyraulus* spp.	0	0	0	0	0	0	2	0	2	0
		Leichhardtia sisurnius	0	0	2	3	0	2	0	1	1	0
ARTHROPODA												
Arachnida		*Acarina* spp. (imm/dam)	1	1	1	2	1	2	3	2	2	0
Sarcoptiformes		*Oribatida* spp.	0	0	0	0	0	0	0	0	2	0
Trombidiformes	Arrenuridae	*Arrenurus mantonensis*	0	0	2	2	0	1	2	1	3	0
		Arrenurus vanderpalae	0	0	0	0	0	1	0	0	0	0
	Eylaidae	*Eylais* spp.	0	1	0	0	1	0	0	0	1	2
	Hydrachnidae	*Hydrachna* spp.	0	0	0	0	0	2	0	0	0	0
	Hygrobatidae	*Australiobates* sp.	0	0	0	0	0	1	0	0	0	0
		Coaustraliobates spp.	0	0	2	0	0	0	3	0	0	0
	Limnesiidae	*Limnesia maceripalpis*	0	0	0	0	0	0	2	0	0	0
		Limnesia parasolida	0	0	0	0	2	0	2	0	0	0
		Limnesia solida	0	0	2	2	1	2	3	3	2	0
	Pionidae	*Piona cumberlandensis*	0	0	0	0	1	0	0	0	0	0
	Unionicolidae	*Encentridophorus sarasini*	2	1	2	2	1	0	0	0	1	0
		Koenikea spp.	0	0	0	0	0	0	2	0	0	0
		Neumania spp.	1	0	2	2	2	2	0	0	0	0
		Recifella spp.	0	0	0	1	2	0	2	0	0	0
		Unionicolidae sp.	0	0	0	0	0	0	0	1	0	0
	Oxidae	*Oxus (Oxus)* sp.	0	1	0	0	0	0	0	0	0	0

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Insecta												
Coleoptera	Dytiscidae	Bidessini sp. (L)	0	0	0	0	0	0	0	0	1	0
		Copelatus nigrolineatus	0	0	0	2	0	0	0	0	0	0
		Cybister tripunctatus	0	0	1	1	0	1	0	0	2	0
		Eretes australis	2	2	0	0	0	0	0	0	0	2
		Hydaticus consanguineus	1	0	0	0	0	0	0	0	0	0
		Hydroglyphus grammopterus	2	2	1	2	0	0	0	0	3	2
		Hydroglyphus leai	0	0	0	0	0	2	1	0	2	0
		Hydroglyphus orthogrammus	0	0	0	0	0	0	0	0	2	2
		Hyphydrus lyratus	0	0	1	3	0	1	0	2	2	2
		Hyphydrus spp. (L)	0	0	0	2	0	0	0	0	0	0
		Laccophilus sharpi	1	0	0	2	0	1	0	0	0	0
		Limbodessus compactus	0	0	0	0	1	0	0	0	0	0
		Megaporus sp. (L)	0	0	0	1	0	0	0	0	0	0
		Rhantaticus congestus	0	0	0	2	0	0	0	0	0	0
	Gyrinidae	*Dineutus australis*	0	0	0	0	0	1	0	0	0	3
	Hydrophilidae	*Agraphydrus coomani*	3	1	2	0	0	0	0	0	0	0
		Berosus pulchellus	0	2	0	2	0	0	0	0	2	2
		Enochrus elongatulus	0	0	2	0	0	0	0	2	2	0
		Enochrus sp. (L)	0	0	1	0	0	0	0	0	0	0
		Helochares spp. (L)	0	0	0	0	0	1	0	0	2	0
		Laccobius billi	0	1	0	2	1	0	0	0	0	0
		Laccobius spp. (L)	0	0	0	0	2	0	0	0	0	1
		Paracymus pygmaeus	0	0	0	0	1	2	1	3	2	1
		Paracymus spenceri	0	0	0	1	0	0	0	0	0	0
		Regimbartia attenuata	0	0	0	2	0	2	0	2	2	0
		Sternolophus marginicollis	1	1	0	0	0	0	0	0	0	0

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		Sternolophus spp. (L)	1	1	0	0	0	0	0	0	0	0
	Spercheidae	*Spercheus* spp.	0	0	1	1	0	0	0	0	0	0
	Hydrochidae	*Hydrochus* spp.	2	0	3	3	2	3	0	2	0	3
	Hydraenidae	*Hydraena* spp.	3	3	3	2	2	2	0	0	0	2
		Limnebius spp.	2	0	2	2	2	0	0	0	0	1
Diptera	Stratiomyidae	Stratiomyidae spp.	3	2	1	2	0	2	0	3	2	3
	Tabanidae	Tabanidae spp.	0	0	0	0	0	2	0	0	2	0
	Ceratopogonidae	Ceratopogonidae spp. (P)	2	2	0	0	0	1	1	0	1	2
		Ceratopogoninae spp.	3	2	2	0	2	3	2	3	0	3
		Dasyheleinae spp.	0	4	0	0	2	2	2	2	3	3
		Forcipomyiinae spp.	2	0	1	0	0	0	0	0	0	0
	Chironomidae	Chironomidae spp.	0	0	2	0	0	0	0	0	0	0
		Chironomidae spp. (P)	2	0	0	3	2	3	2	1	1	3
	Chironominae											
	Chironomini	*Chironomus* sp. (WWC3)	3	3	3	0	0	0	0	3	4	3
		Cryptochironomus griseidorsum (WWC4)	0	2	0	2	0	0	2	0	0	0
		Dicrotendipes sp. 1 (WWC8)	0	0	1	3	2	3	3	3	3	3
		Paraborniella tonnoiri (WWC24)	2	0	0	0	0	0	0	0	0	0
		Parachironomus sp. K2 (WWC16)	0	0	1	0	0	0	2	0	0	0
		Polypedilum (Pentapedilum) leei (WWC7)	2	0	2	2	0	1	0	0	0	0
		Polypedilum watsoni (WWC11)	0	0	2	3	2	2	0	0	0	0
		Stenochironomus watsoni (WWC5)	0	0	1	2	0	1	0	0	0	0
	Tanytarsini	*Cladotanytarsus* sp. (WWTS4)	0	0	1	2	2	2	2	0	0	0
		Paratanytarsus sp. (WWTS2)	0	0	1	0	0	0	0	0	0	0
		Tanytarsus sp. (WWTS1)	2	2	2	3	0	2	2	3	2	4
	Orthocladiinae	*Corynoneura* sp. (WWO5)	0	2	0	0	0	0	0	0	0	0
		Cricotopus albitarsis (WWO3)	0	2	0	0	0	0	0	0	0	0

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		Rheocricotopus sp. (WWO1)	0	3	0	0	1	0	0	0	0	0
		Thienemanniella sp. (WWO4)	0	0	0	0	2	0	0	0	0	0
	Tanypodinae	*Ablabesmyia hilli* (WWT6)	0	0	2	2	0	3	0	0	0	0
		Larsia albiceps (WWT4)	0	0	3	4	3	4	4	3	3	4
		Paramerina sp. 2	0	0	0	0	0	0	2	0	0	0
		Paramerina sp. (WWT1)	3	0	1	0	0	0	0	0	0	0
		Procladius sp. (WWT5)	0	0	3	2	2	3	2	3	4	0
	Culicidae	*Aedes* spp.	0	3	2	0	1	2	0	1	0	0
		Anopheles spp.	3	1	2	0	0	0	0	0	0	2
		Culex spp.	2	4	2	3	0	3	1	2	1	2
	Simuliidae	Simuliidae sp.	0	1	0	0	0	0	0	0	0	0
	Chaoboridae	Chaoboridae sp.	0	0	0	0	0	0	1	0	0	0
	Tipulidae	Tipulidae sp.	0	0	1	0	0	0	0	0	0	0
		Tipulidae spp. (P)	0	0	0	0	2	0	0	0	0	0
Ephemeroptera	Baetidae	Baetidae spp. (imm/dam)	0	0	3	3	3	3	2	3	3	2
		Cloeon fluviatile	0	0	0	0	0	2	0	0	2	0
		Cloeon sp. Red Stripe	0	0	3	3	0	3	1	3	3	2
	Caenidae	Caenidae spp. (imm/dam)	3	2	2	3	3	3	4	3	3	4
		Tasmanocoenis sp. M	3	2	2	3	3	3	2	0	2	3
		Tasmanocoenis sp. P/arcuata	0	0	0	0	0	0	0	0	1	0
Odonata												
Zygoptera		Zygoptera spp. (imm/dam)	0	0	2	2	0	3	2	2	2	0
	Coenagrionidae	*Ischnura aurora*	0	0	0	0	0	2	0	0	1	0
Anisoptera		Anisoptera spp. (imm/dam)	2	3	2	3	2	3	0	1	3	3
	Libellulidae	*Diplacodes bipunctata*	0	2	2	2	0	3	0	2	2	0
		Diplacodes haematodes	0	0	1	2	0	0	0	0	1	0
		Orthetrum caledonicum	0	0	0	2	0	2	0	0	0	0

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Phylum/Class/Order	**Family**	**Lowest taxon**	**TTR1**	**TTR2**	**TTPE1**	**TTPE2**	**TTPE3**	**TTPE4**	**TRPE1**	**SRR1**	**SRPE1**	**SRPE2**
		Tramea spp.	0	0	0	2	0	0	0	0	0	0
Trichoptera		Trichoptera sp.	0	0	0	0	0	0	1	0	0	0
	Ecnomidae	*Ecnomus* spp.	0	0	0	0	0	2	0	1	0	0
	Leptoceridae	*Oecetis* spp.	0	0	0	0	0	2	0	0	0	0
Hemiptera	Gerridae	Gerridae spp. (imm/dam)	0	0	0	0	0	2	0	0	1	0
		Limnogonus fossarum gilguy	0	0	2	0	0	0	0	1	0	1
	Veliidae	Veliidae spp. (imm/dam)	0	0	1	2	0	0	0	0	0	0
		Veliidae sp. (F)	0	0	0	1	0	0	0	0	0	0
	Hebridae	Hebridae sp. (imm/dam)	0	1	0	0	0	0	0	0	0	0
	Hydrometridae	Hydrometridae sp. (imm/dam)	0	0	1	0	0	0	0	0	0	0
	Mesoveliidae	Mesoveliidae sp. (imm/dam)	0	0	0	0	0	0	0	0	1	0
	Corixoidea	Corixoidea spp. (imm/dam)	0	1	2	3	2	2	0	1	0	2
	Micronectidae	*Micronecta annae*	0	0	0	2	0	0	0	0	0	2
		Micronecta sp. (F)	0	0	0	2	0	1	0	0	2	2
	Notonectidae	*Anisops canaliculatus*	1	0	0	0	0	0	0	0	0	1
		Anisops hackeri	0	0	0	0	0	0	0	0	1	0
		Anisops nasutus	1	0	0	0	0	0	0	0	0	2
		Anisops sp. (F)	1	0	0	0	0	0	0	0	0	3
		Anisops stali	0	0	0	0	0	0	0	0	0	2
		Notonectidae spp. (imm/dam)	2	1	0	0	0	0	0	0	0	1
	Pleidae	*Paraplea* spp.	0	0	0	0	0	2	0	1	0	0
Lepidoptera	Crambidae	*Acentropinae* sp.	0	1	0	0	0	0	0	0	0	0
		Taxa richness	**33**	**35**	**51**	**52**	**33**	**52**	**32**	**32**	**45**	**38**

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