



# Aquatic Ecology Assessment – Wallaby Creek Wind Farm

September 2025



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8 September 2025

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## EXECUTIVE SUMMARY

Acciona Energy Australia Global Pty Ltd is preparing an Environmental Impact Statement (EIS) for the proposed Wallaby Creek Wind Farm (the Project). The Project is located south of Narromine and north of Tomingley in the Orana region of New South Wales (NSW). The Project involves the installation of 38 wind turbine generators, a Battery Energy Storage System (BESS), and associated infrastructure.

The purpose of this Aquatic Ecology Assessment is to describe the aquatic values of the Project Area relevant to current Commonwealth and State legislation, assess the impacts of the proposed development on these values, and present strategies to avoid, minimise or mitigate impacts to aquatic values.

Key findings of this Aquatic Ecology Assessment include:

- No threatened aquatic flora or fauna species are likely to occur within the Project Area.
- The Project is not expected to result in adverse surface water impacts or sedimentation of aquatic habitat downstream of the Project Area.
- The Project is not expected to have an adverse effect on downstream aquatic habitats such that threatened aquatic fish species would be adversely impacted.
- There are no wetlands of National or International Importance within the Project Area; the nearest in the catchment being wetlands of the Macquarie Marshes, which is well removed from the Project Area.
- The Project is unlikely to have a significant impact on fish passage given any cable crossing on a mapped waterway will be undertaken either via under-boring, or open trench and backfill during times of no/low flow where practicable; and any vehicle crossings would be constructed in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW Department of Primary Industries [DPI] 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003).
- The proposed positioning of underground cables and construction of access tracks for the Project would result in direct impacts to Key Fish Habitat (KFH) at the location of proposed waterway crossings. Offset obligations for these unavoidable impacts would be calculated following the detailed design of waterway crossings.

The waterways of the Project Area range from small first order (Strahler [1952] Stream Order System) tributaries to the fifth order Wallaby Creek. Other named waterways of the Project Area include Backwater Cowal and Bundara, Jacks, Rays and Ugumjil creeks. These waterways range from ephemeral drainage lines to creeks with largely intermittent flows following rainfall and runoff events. The smaller first and second order waterways of the Project Area are expected to be predominantly ephemeral, experiencing flow for relatively short duration (in the order of hours to days) following rainfall and runoff in the catchment. Some waterways have semi-permanent to permanent spring or seep-fed trickle flow and associated pools likely persisting throughout most years. Spring and seep flow from the Sappa Bulga range, to the east of the Project Area, appears to contribute semi-permanent to permanent trickle flow within Bundara, Jacks, Rays, Ugumjil and Wallaby creeks. A portion of this trickle flow may be sub-surface in bed sediments. Semi-permanent pools located along these spring/seep-fed waterways likely provide refuge for aquatic fauna between rainfall and runoff events.

Aquatic habitat assessment was undertaken at 17 sites in July 2025. Substrate complexity was generally poor across the Project Area, with very few boulders, cobbles and pebbles encountered. Bed substrates were dominated by sand at most sites, with some sites dominated by silt/clay. Gravel and bedrock comprised a minor portion of the substrates at a few sites. Most sites exhibited little (1-10%) detritus (leaves, grasses and other organic matter etc.), sticks and branches, with few sites exhibiting logs or other larger refuge.

Fish survey effort, including backpack electrofishing, was undertaken at wetted sites, including 11 of 17 aquatic habitat assessment sites. Only three fin-fish species were detected during the field survey, comprising the native cryptic carp gudgeon (*Hypseleotris acropinna*), the pest fish species goldfish (*Carassius auratus*)\* and mosquitofish (*Gambusia holbrooki*)\*. Although other species of fish may reside within or utilise the Project Area on occasion, the Project Area is unlikely to support aquatic species of conservation-significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), NSW *Biodiversity Conservation Act 2016* (BC Act) or NSW *Fisheries Management Act 1994* (FM Act), given the lack of suitable habitat features or nearby records.

The Macquarie-Bogan River, downstream of the Project Area, supports aquatic species of conservation significance including the:

- Vulnerable (EPBC Act) Murray cod (*Maccullochella peelii*);
- Endangered (MDB population; FM Act) eel-tailed catfish (*Tandanus tandanus*);
- Endangered (western population; FM Act) olive perchlet (*Ambassis agassizii*);
- Endangered (EPBC Act and FM Act) silver perch (*Bidyanus bidyanus*);
- Critically Endangered (EPBC Act and FM Act) flathead gudgeon (*Galaxia rostratus*);
- Endangered (EPBC Act and FM Act) trout cod (*M. macquariensis*);
- Endangered (EPBC Act and FM Act) Macquarie perch (*Macquaria australasica*); and
- Endangered (FM Act) southern purple spotted gudgeon (*Mogurnda adspersa*).

The Project is not expected to result in adverse surface water impacts or sedimentation of aquatic habitat downstream of the Project Area. Consequently, the Project is not expected to have an effect on downstream aquatic habitats such that threatened aquatic fish species would be adversely impacted.

No threatened aquatic flora species listed under the EPBC Act, BC Act or FM Act were recorded from the desktop searches, nor during the field survey. No threatened aquatic flora species are likely to occur within the Project Area.

There are no wetlands of National or International Importance within the Project Area. The nearest wetlands of International Importance are those of the Macquarie Marshes Nature Reserve, approximately 150 km northwest of the Project Area. The nearest wetlands of National importance are those of the broader Macquarie Marshes wetlands, approximately 80 km northwest of the Project Area. These wetlands are well removed from the Project Area and are unlikely to be relevant to the Project.

The Project Area contains waterways mapped as KFH by the Department of Primary Industries and Regional Development. KFH is typically third order (Strahler [1952] Stream Order System) streams and above that represent aquatic habitats considered crucial for the sustainability of recreational and commercial fish industries, fish populations, and the survival of threatened aquatic species. It includes most permanent and semi-permanent freshwater habitats, such as rivers, creeks, lakes, and billabongs up to the top of the bank. The State mapping of KFH has utilised broad-scale waterway mapping that can vary from the on-ground location of the waterway. DPM Envirosciences used available aerial imagery, combined with georeferenced drone imagery and habitat data recorded from aquatic survey sites, to approximate the top of bank and the extent of KFH for all waterways of the Project Area. The resulting field-verified KFH mapping for the Project Area provides an improved representation of KFH for the Project Area and can be used during the detailed design of waterway crossings to avoid, minimise and mitigate impacts to KFH.

The proposed positioning of underground cables and construction of access roads/tracks for the Project would directly impact KFH at the location of proposed waterway crossings. These habitats comprise waterways with ephemeral to intermittent flow, little to extensive cover of aquatic plants, and are either known or likely to support common native fish species and aquatic invertebrates.

The Project requires approximately 39 waterway crossings, which each create the potential for barriers to fish passage. However, the Project is unlikely to have a significant impact on fish



passage given any cable crossing on a mapped waterway would be undertaken either via under-boring, or open trench and backfill during times of no/low flow where practicable, and that vehicle crossings would be constructed in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003).

Field verification of 17 sites positioned at infrastructure crossing points within the Project Area suggests that Bundara, Jacks, Rays, Ugumjil and Wallaby creeks likely incur some contribution from seeps or springs and are therefore surface expression Groundwater Dependent Ecosystems (GDEs). However, the proposed waterway crossings are unlikely to result in significant impacts on surface expression GDEs as they are unlikely to result in groundwater or interflow drawdown or substantial modification to catchment permeability.

Mound springs are known to occur in the locality of Tantitha Road (Australian Native Plants Society [Australia] 2025). However, no mound springs were identified in the vicinity of proposed waterway crossings visited by DPM Envirosciences in July 2025. Further, vegetation mapping of the broader Project Area as part of the terrestrial ecology assessment did not identify the presence of either the 'Artesian Springs Ecological Community in the Great Artesian Basin (GAB)' (Critically Endangered Ecological Community under the BC Act) nor 'the community of native species dependent on natural discharge of groundwater from the GAB' Threatened Ecological Community (Endangered under the EPBC Act).

Indirect impacts considered in this assessment include potential impacts associated with changes in water quality, sediment deposition and potential cumulative impacts. Indirect impacts are temporary and largely confined to the construction phase of the Project. The Project is unlikely to have a significant impact on aquatic ecology as a result of these potential indirect impacts.

To avoid or mitigate adverse impacts on aquatic ecology values associated with the Project, the following mitigation and management measures are proposed, including:

- implementing buffers between Project infrastructure (other than necessary waterway crossings) and waterways consistent with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013), being:
  - 50 m for TYPE 2 or CLASS 2-3 waterways; and
  - 10-50 m for TYPE 3 or CLASS 3-4 waterways.
- designing and constructing waterway crossings consistent with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003);
- implementing hygiene measures to avoid the spread of aquatic and riparian weeds and pest fish species;
- implementing a best practice site-specific Erosion and Sediment Control Plan, to avoid water quality impacts and sedimentation of waterways within and downstream of the Project Area;
- Offsetting unavoidable impacts on field-verified KFH (such as for waterway crossings), which would most likely comprise a financial contribution to the DPI Fish Conservation Trust Fund; and
- implementing a Water Quality Monitoring Program throughout construction (and for one year following) to detect and respond to any adverse impacts on waterways within and downstream of the Project Area.

With effective implementation of the above mitigation and management measures, the Project is unlikely to result in significant impacts on aquatic ecology, including threatened fish species known from the broader Macquarie-Bogan River catchment.

Offset obligations for impacts to field-verified KFH can be calculated by the Proponent following the detailed design of waterway crossings.

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## Acronyms

| Acronym    | Description                                                                       |
|------------|-----------------------------------------------------------------------------------|
| ALA        | Atlas of Living Australia                                                         |
| ANPSA      | Australian Native Plants Society (Australia)                                      |
| AusRivAS   | Australian River Assessment System                                                |
| BESS       | Battery Energy Storage System                                                     |
| BC Act     | NSW <i>Biodiversity Conservation Act 2016</i>                                     |
| CE         | Critically Endangered (threatened fauna species conservation status)              |
| DCCEEW     | The Commonwealth Department of Climate Change, Environment, Energy and Water      |
| DO         | Dissolved Oxygen                                                                  |
| DPI        | The former NSW Department of Primary Industries                                   |
| DPIRD      | NSW Department of Primary Industries and Regional Development                     |
| E          | Endangered (threatened species conservation status)                               |
| EC         | Electrical Conductivity                                                           |
| EEC        | Endangered Ecological Community                                                   |
| EIS        | Environmental Impact Statement                                                    |
| EP&A Act   | NSW <i>Environmental Planning and Assessment Act 1979</i>                         |
| EPBC Act   | Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| FM Act     | NSW <i>Fisheries Management Act 1994</i>                                          |
| GAB        | Great Artesian Basin                                                              |
| GDE        | Groundwater-Dependent Ecosystem                                                   |
| IECA       | International Erosion Control Association (Australasian Chapter)                  |
| IESC       | Independent Expert Scientific Committee                                           |
| KFH        | Key Fish Habitat                                                                  |
| L/s        | Litres per second (flow rate)                                                     |
| MDB        | Murray-Darling Basin                                                              |
| MNES       | Matter of National Environmental Significance                                     |
| NSW        | New South Wales                                                                   |
| NSW DCCEEW | The NSW Department of Climate Change, Energy, the Environment and Water           |
| OEH        | The former NSW Office of Environment and Heritage                                 |
| TEC        | Threatened Ecological Community                                                   |
| The Bureau | Bureau of Meteorology                                                             |
| V          | Vulnerable (threatened species conservation status)                               |
| WoNS       | Weeds of National Significance                                                    |
| WQO        | Water Quality Objective                                                           |

## Definitions

| Term                            | Description                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aquatic fauna                   | An aquatic animal is either a vertebrate or invertebrate that lives in water for most or all of its life. It does not include amphibians or waterbirds (which are considered terrestrial fauna).                                                                                                                                                                                                                                 |
| Aquatic flora                   | Plants that have adapted to living in aquatic environments (saltwater or freshwater). These plants require special adaptations for living submerged in water, or at the water's surface.                                                                                                                                                                                                                                         |
| Clearing Corridor               | The development footprint for the Wallaby Creek Wind Farm Project.                                                                                                                                                                                                                                                                                                                                                               |
| Ephemeral waterways             | Waterways that flow for short periods of time following rain events.                                                                                                                                                                                                                                                                                                                                                             |
| Exotic species                  | Species introduced from other countries or states, which is not native to NSW. Identified throughout this report by placing an asterisk (*) after the common and/or scientific name.                                                                                                                                                                                                                                             |
| Fish                            | In respect to the NSW <i>Fisheries Management Act 1994</i> , fish includes fin-fish and other aquatic animal life at any stage of their life history (whether alive or dead) including oysters and other aquatic molluscs, crustaceans, echinoderms, beachworms and other invertebrates that spend all or part of their life cycle in aquatic habitats. This definition does not include amphibians, reptiles, birds or mammals. |
| Groundwater-dependent Ecosystem | Groundwater-dependent Ecosystems (or GDEs) are ecosystems that rely upon groundwater for their continued existence. They may be 100% dependent on groundwater, such as aquifer GDEs, or may access groundwater intermittently to supplement their water requirements, such as riparian tree species in arid and semi-arid areas.                                                                                                 |
| Intermittent waterways          | Waterways with seasonal flow during certain times of the year when smaller upstream waters are flowing and/or when groundwater provides enough water for stream flow.                                                                                                                                                                                                                                                            |
| Key Fish Habitat                | Aquatic habitats crucial for the sustainability of recreational and commercial fish industries, fish populations, and the survival of threatened aquatic species. It encompasses marine and estuarine habitats up to the highest astronomical tide level, and also includes most permanent and semipermanent freshwater habitats, such as rivers, creeks, lakes, and billabongs up to the top of the bank.                       |
| Project Area                    | The area containing the proposed Wallaby Creek Wind Farm Project.                                                                                                                                                                                                                                                                                                                                                                |
| Search Area                     | The broader desktop search area encompassing the Project Area, extending up to 50 kilometres from the Project Area.                                                                                                                                                                                                                                                                                                              |
| Seep                            | A moist or wet place where groundwater or interflow reaches the surface.                                                                                                                                                                                                                                                                                                                                                         |
| Spring                          | A place where water issues from the ground; often formed when the progress of water percolating through permeable rock is impeded by the presence of an impermeable rock layer.                                                                                                                                                                                                                                                  |
| Threatened species              | Generic term that encompasses Critically Endangered, Endangered and Vulnerable species listed under relevant Acts.                                                                                                                                                                                                                                                                                                               |
| Trickle flow                    | For the purposes of this assessment, < 5 litres per second.                                                                                                                                                                                                                                                                                                                                                                      |
| Waterway                        | Waterways include riverine systems, watercourses, waterways or drainage lines identified on the highest resolution topographic maps.                                                                                                                                                                                                                                                                                             |
| Wetlands                        | Wetlands include marshes, mangroves, swamps, or other areas that form a shallow body of water when inundated intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities.                                                                                                                                  |



# 1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) has been commissioned by Acciona Energy Australia Global Pty Ltd (the Proponent) to assist with the preparation of an Environmental Impact Statement (EIS) for the proposed Wallaby Creek Wind Farm (the Project). The Project is located south of Narromine and north of Tomingley in the Orana region of New South Wales (NSW) (Figure 1).

The Project Area encompasses approximately 8,800 hectares (ha), within which the Proponent proposes to install 38 Wind Turbine generators (WTGs), a Battery Energy Storage System (BESS) and associated infrastructure; the footprint of which is referred to as the Clearing Corridor. The Clearing Corridor falls within a broader Micrositing Corridor (provided by ERM in July 2025), encompassing proposed turbines, BESS, supporting infrastructure, proposed access roads and buffers, including an approximate 100-metre (m) buffer either side of proposed access roads.

DPM Envirosciences Pty Ltd (DPM Envirosciences) has been commissioned by ERM to undertake a site visit and prepare an Aquatic Ecology Assessment for the Project.

## 1.1 Purpose

The purpose of the Aquatic Ecology Assessment is to describe the aquatic values of the Project Area as relevant to current Commonwealth and State legislation, assess the impacts of the proposed development on these values, and present strategies to avoid, minimise or mitigate impacts to significant aquatic values. This report is a supporting document to the EIS.

## 1.2 Scope of work

The scope of work for this Aquatic Ecology Assessment includes the following tasks:

- identify and describe the waterways of the Project Area;
- field verify Key Fish Habitat (KFH), sensitivity (TYPE) and waterway classification (CLASS) to inform subsequent waterway crossing design;
- conduct aquatic habitat assessment (including capturing photos, aerial drone photos, and habitat feature data) where proposed permanent access roads, temporary access tracks, underground cables or above-ground transmission lines intersect State-mapped KFH;
- identify and discuss any potential and/or confirmed surface expression Groundwater-Dependent Ecosystems (GDEs) within the Project Area;
- describe aquatic flora and fauna of the Project Area;
- identify and describe any conservation-significant aquatic species, and introduced aquatic species, recorded from the Project Area;
- identify habitat resources for known and potentially occurring conservation-significant aquatic species recorded from the Project Area;
- identify and describe any aquatic Matters of National Environmental Significance (MNES) recorded from the Project Area; and
- prepare an Aquatic Ecology Assessment report.

### 1.2.1 Secretary's Environmental Assessment Requirements

The Planning Secretary's Environmental Assessment Requirements (SEARs), dated 11 February 2025, include components relevant to aquatic ecology. The SEARs require the Proponent to assess the likely impacts on KFH along Wallaby, Bundara, Ugumjil, Jacks and Fiddlers creeks, listed aquatic threatened species, populations or ecological communities scheduled under the

*Fisheries Management Act 1994* (FM Act), and a description of the measures to minimise and rehabilitate impacts.

Impacts on aquatic ecology are addressed in Section 5 of this report. Avoidance, minimisation and mitigation measures are addressed in Section 6.

## 1.2.2 Agency Advice – DPI Fisheries

The NSW Department of Primary Industries (DPI; now Department of Primary Industries and Regional Development [DPIRD]) Fisheries input into the SEARs (DPI Fisheries 19 July 2023) requests that the Proponent address impacts on aquatic ecology and controls to be established for permanent access tracks, temporary access tracks or powerlines in or adjacent to KFH (third order streams or larger, such as Wallaby, Bundara, Ugumgil, Jacks and Fiddlers creeks) and potential impacts on fish passage, riparian vegetation, threatened species and potential aquatic biodiversity offsets.

Sections of the DPI Fisheries SEARs addressed by this report are shown in Table 1.

**Table 1 Location of information addressing NSW DPI (now DPIRD) Fisheries SEARs**

| SEARs request                                                                                                                                                                                                                                                                                                                                | Section in this report                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Aquatic Ecological Assessment</b>                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                     |
| An Aquatic Ecological Assessment is required that addresses all direct and indirect impacts of the Wallaby Creek Wind Farm Project on Key Fish Habitat and associated flora and fauna including threatened species, populations, and communities during construction and operation for the life of the asset.                                | Impacts on aquatic ecology are addressed in Section 5. Avoidance, minimisation and mitigation measures are addressed in Section 6.                                                                                                                                                                                                                                                                  |
| The Aquatic Ecological Assessment should cover the assessment requirements outlined in Chapter 3 of the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (2013) including:                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                     |
| Recent aerial photograph (preferably colour), map or GIS of the locality which details the Key Fish Habitat of the development site, all habitats impacted by the development, and waterway classification (CLASS) as defined in Tables 1 and 2 of the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI 2013). | State-mapped KFH mapping is presented in Figure 5. Field-verified KFH mapping is presented in Figure 6 and Appendix C. CLASS is shown in Figure 6. These figures show the approximate location of proposed waterway crossings (Clearing Corridor dated 11 June 2025), which are still subject to detailed design.                                                                                   |
| Location details of all temporary and permanent infrastructure and construction activities, such as waterway crossings, powerlines, access tracks, etc.                                                                                                                                                                                      | The approximate location of waterway crossings, access tracks, and an electricity transmission line are shown in Figures 5 and 6 (Clearing Corridor dated 11 June 2025). The proposed infrastructure is still subject to detailed design.                                                                                                                                                           |
| Mapping of the full aerial extent of Key Fish Habitat types that will be impacted either directly or indirectly by the development and subsequent operation of the Wallaby Creek Wind Farm Project, with impacted habitats clearly identified on recent aerial photographs, maps or GIS.                                                     | KFH for the entire Project Area is presented in Figure 6 and Appendix C and is available as a shapefile to inform the detailed design. Appendix C presents drone imagery paired with field-verified KFH mapping to aid the detailed design of waterway crossings. The Clearing Corridor is depicted in the Appendix C maps, showing the worst-case scenario.                                        |
| Description, quantification, and mapping of all aquatic and riparian vegetation communities potentially impacted by the development. This should include an assessment of the extent and condition of aquatic and riparian vegetation and the presence of significant habitat features (e.g. gravel beds, snags, reed beds, rock bars, etc). | Detailed aquatic habitat assessment data for likely waterway crossing locations is provided as Appendix B. Appendix C presents drone imagery paired with field-verified KFH mapping to aid the detailed design of waterway crossings, to facilitate avoidance of significant habitat features, and to enable quantification of impacts (such as the extent of aquatic and riparian vegetation to be |

| SEARs request                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Section in this report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | impacted). The detailed design of waterways crossings was not available at the time of preparing this report. The quantification of impacts will need to be undertaken by the Proponent following the detailed design phase.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Quantification of the extent of aquatic and riparian habitat removal, modification or inundation (whether temporary or permanent) that will result from the proposed development.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The proposed infrastructure is still subject to detailed design. Appendix C presents drone imagery paired with field-verified KFH mapping to aid the detailed design of waterway crossings, to enable quantification of impacts (such as the extent of aquatic and riparian habitat impacted at each proposed waterway crossing). The detailed design of proposed crossings was not available at the time of preparing this report. Instead, the Clearing Corridor (dated 11 June 2025) is depicted as this shows the worst-case scenario. The quantification of impacts will need to be undertaken by the Proponent following the detailed design phase. |
| Development of mitigation measures during construction (e.g. Environmental Management Plans) and operation (e.g. Operational Management Plan) including monitoring of proposed mitigation measures and plans to confirm their effectiveness.                                                                                                                                                                                                                                                                                                                                                                                                                  | Proposed mitigation measures are identified in Section 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Waterway Crossings</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| The construction of permanent or temporary access tracks or underground cables through Key Fish Habitat should be in accordance with DPI Fisheries Guideline document: <i>Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)</i> , and the <i>Policy and Guidelines for Fish Friendly Waterway Crossings</i> (DPI 2003). This is to ensure that the works are designed and constructed in accordance with best management practice and with minimal impact on the aquatic environment and fish passage requirements.                                                                                                            | Mitigation measures provided in Section 6 include that all waterway crossings be designed and constructed in accordance with the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (NSW DPI 2013) (which replaced the <i>Policy and Guidelines for Fish Friendly Waterway Crossings</i> [NSW DPI 2003]).                                                                                                                                                                                                                                                                                                                          |
| <b>Loss of Riparian Vegetation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| There is also the likelihood of a loss of riparian vegetation associated with the proposed windfarm footprint, alongside Wallaby Creek and associated tributaries. The “degradation of native riparian vegetation” has been listed as a Key Threatening Process under the provisions of the <i>Fisheries Management Act 1994</i> . DPI Fisheries policy advocates the use of terrestrial buffer zones as per the <i>Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)</i> available on the Department’s website in order to maintain the riparian buffer zone and limit disturbance and susceptibility to bed or bank erosion. | The proposed infrastructure is still subject to detailed design. However, the design engineers would consider terrestrial buffer zones (Section 6.1) as per the document: <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (NSW DPI 2013) in the final placement of all infrastructure, including wind turbine generators and associated infrastructure including substations, BESS, underground supply cables, batching plant, site compounds, laydown areas, operations and maintenance facilities, hardstand areas and access tracks.                                                                                         |
| <b>Threatened Species, Populations and Ecological Communities</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| An assessment under Part 7A of the <i>Fisheries Management Act 1994</i> is required to address whether there are likely to be any significant impacts on listed threatened species, populations or ecological communities. Assessment of the impacts may require initial ‘Seven-Part Tests’.                                                                                                                                                                                                                                                                                                                                                                  | Threatened species, populations and ecological communities are considered in Sections 4.6 and 5.3 of this report. Desktop assessment, habitat assessment and fish survey effort confirmed that it is unlikely that threatened aquatic species, populations or ecological communities occur within the Project Area. Impacts on downstream habitats and species would be mitigated by the design and implementation of best practice erosion and sediment                                                                                                                                                                                                  |

| SEARs request                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Section in this report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | controls within the Project Area (Section 5.4.1). The requirement for Seven-Part Tests of significance has not been triggered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>NSW Biodiversity Offsets Policy: Aquatic Biodiversity</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| An Aquatic Biodiversity Offsets Strategy may be required that is adequately funded to mitigate and manage impacts of the Wallaby Creek Wind Farm Project during construction and subsequent operation. The EIS Aquatic Ecological Assessment will determine all direct and indirect impacts of the Wallaby Creek Wind Farm Project on Key Fish Habitat. The <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (2013) requires a minimum 2:1 offset for Type 1-3 Key Fish Habitats to help redress identified impacts. The <i>NSW Biodiversity Offsets Policy for Major Projects</i> outlines requirements for site-based offsets to compensate for the loss of each aquatic habitat type, and/or payment (currently \$114.40 m <sup>2</sup> adjusted yearly with CPI) to the NSW DPI Fish Conservation Trust Fund to compensate for the value of the aquatic habitat being lost. The EIS should address whether an Aquatic Biodiversity Offsets Strategy that is adequately funded that ensures a minimum 2:1 offset for impacted Type 1-3 Key Fish Habitats is required. | Approximate widths of direct and indirect impacts on KFH associated with vehicle and cable crossings of waterways are identified in Section 5.1.1. The proposed infrastructure is still subject to detailed design. Appendix C presents drone imagery of proposed waterway crossings paired with field-verified KFH mapping to enable quantification of KFH impacts and offset calculations during subsequent stages of the design. Compensatory habitats and offsets are discussed in Section 6.4. A financial offset to the Fish Conservation Trust Fund is likely to be the most effective way to achieve a conservation benefit for the broader Macquarie-Bogan River catchment. |

## 1.3 Legislative context

### 1.3.1 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) and regulates any action that will, or is likely to, have an impact on any MNES. MNES relevant to aquatic biodiversity include:

- wetlands of international importance (listed under the Ramsar Convention);
- listed threatened species and ecological communities;
- migratory species protected under international agreements; and
- Commonwealth marine areas.

Pursuant to the EPBC Act, a person must not undertake any action that will have, or is likely to have, a significant impact on any MNES, unless approved by DCCEEW. According to the MNES Significant Impact Guidelines 1.1 (DoE 2013), a significant impact is an impact which is important, notable or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment that is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. A significant impact is considered likely if it is real or does not have a remote chance or possibility.

MNES have been considered in Section 4.10. A referral to the DCCEEW is not triggered by matters relating to aquatic ecology for the Project Area.



### 1.3.2 NSW Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the NSW *Environmental Planning and Assessment Regulation 2021* provide the framework for environmental planning in NSW and include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed environmental assessment.

The Project is a State Significant Development being assessed under Part 4 of the EP&A Act. This aquatic ecology assessment forms part of an EIS for the development and examines the significance of likely aquatic ecological impacts of the Project and the measures required to mitigate any adverse impacts to aquatic ecosystems.

### 1.3.3 NSW Fisheries Management Act 1994

The FM Act and its regulations are relevant to aquatic habitat and fauna that may be affected by the Project. The FM Act lists threatened aquatic species, populations and ecological communities under Schedules 4, 4A and 5, respectively. Schedule 6 lists key threatening processes.

Section 4.6 of this report identifies threatened species, populations and communities with potential to occur within or downstream of the Project Area and Section 5.3 of this report assesses likely impacts of the Project on aquatic fauna.

The classification of waterways in the Project Area was carried out in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013). The assessment of ecological impacts assumes that any waterway crossing for the Project will be designed and built to comply with this policy as well as *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003).

Part 7A of the FM Act identifies the requirements for stakeholders to consider whether a development or activity is likely to significantly affect threatened species, populations or ecological communities listed on Schedules 4, 4A and 5 of the FM Act. Proponents are required to develop a list of threatened species, populations and ecological communities which may be affected directly or indirectly by the proposed action, development or activity.

If a development or activity is likely to have any impact on a threatened species, population or ecological community listed under the FM Act, an assessment of significance must be made. If the impacts are likely to be significant, or if critical habitat is affected, a species impact statement must be prepared.

A species does not have to be considered as part of an assessment of significance if adequate surveys or studies have been carried out to show that the species (DPI 2008):

- does not occur in the Project Area, or
- will not use on-site habitats on occasion, or
- will not be influenced by off-site impacts of the proposal.

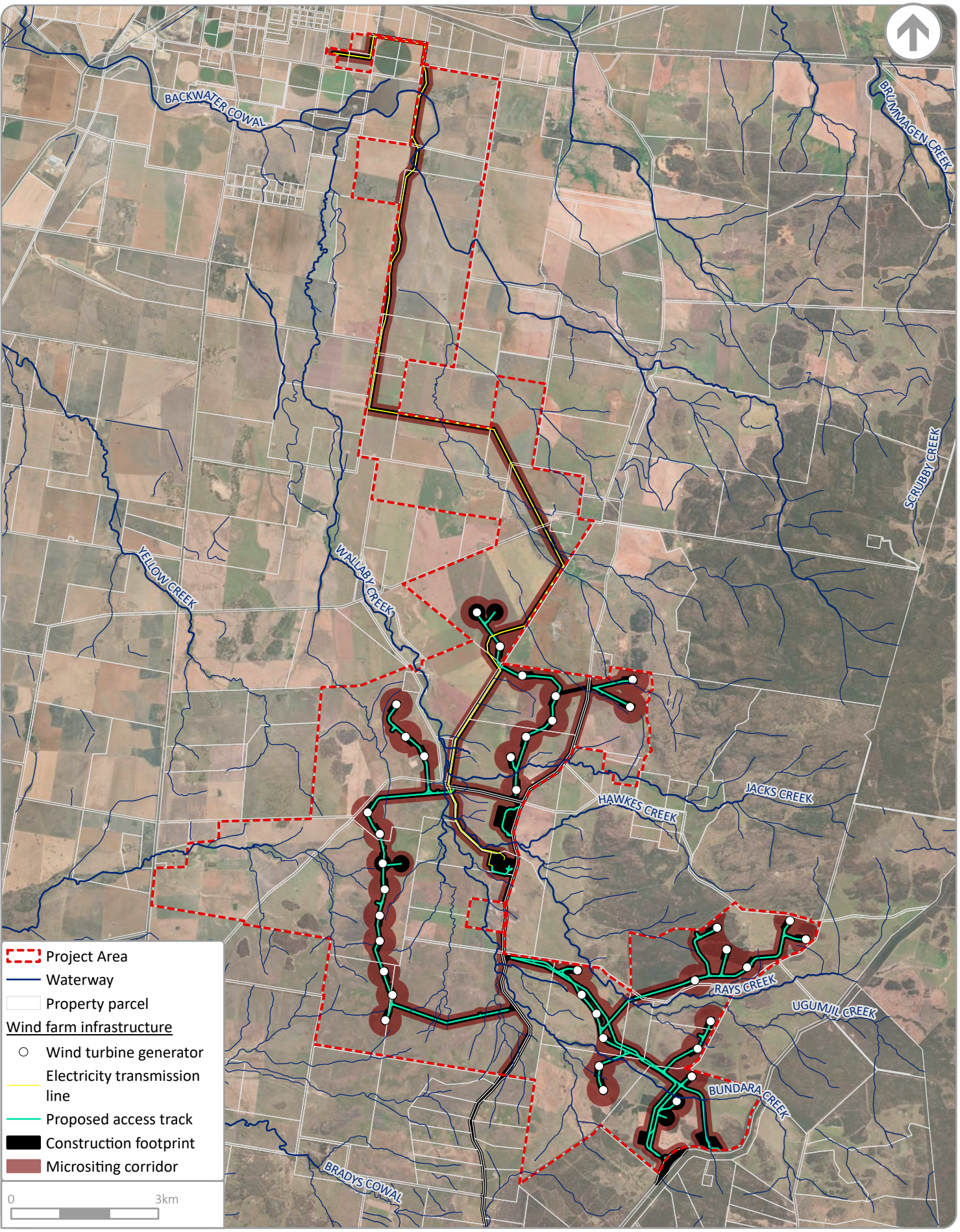




REGIONAL CONTEXT  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment  
**FIGURE 1**



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**PROJECT AREA**

Wallaby Creek Wind Farm- Aquatic Ecology Assessment

**FIGURE 2**



## 2 EXISTING ENVIRONMENT

### 2.1 Regional setting

The Project Area is located south of Narromine and north of Tomingley, bordering and falling within both the Dubbo Regional Council Local Government Area (LGA) and the Narromine Shire Council LGA (Figure 1).

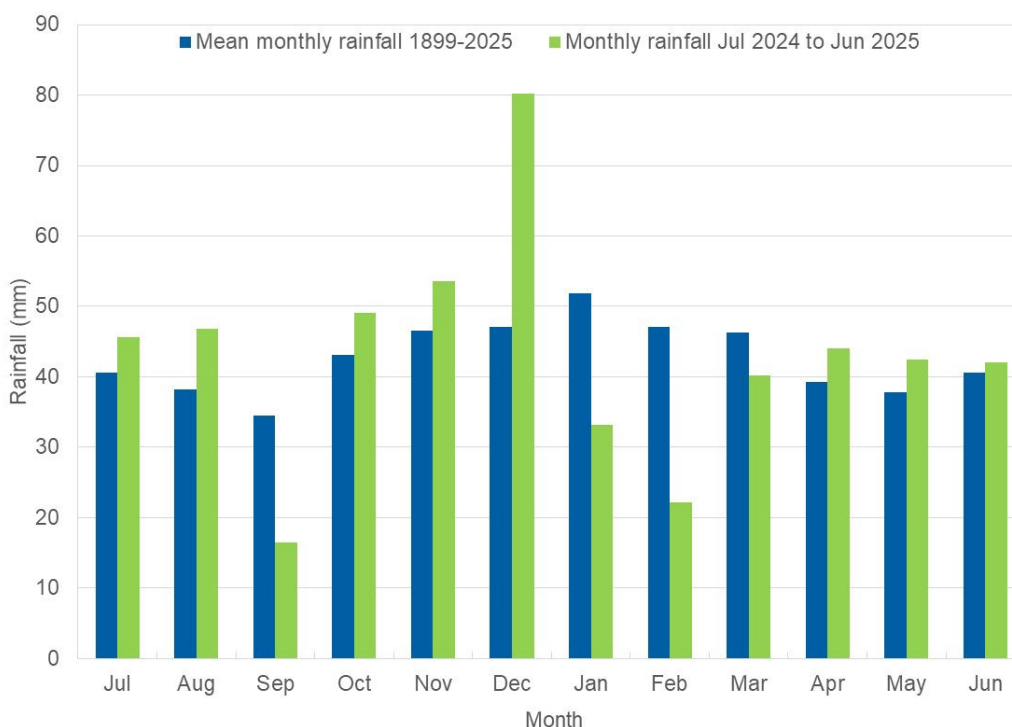
The primary land uses of the Project Area are agricultural grazing (primarily sheep, but also cattle) and cereal cropping.

### 2.2 Climate and weather

The climate of the region encompassing the Project Area is temperate, with mean maximum daily temperatures of around 33°C in summer and mean minimum daily temperatures of around 3°C in winter recorded at the nearby Dubbo Airport Automatic Weather Station 65070, approximately 25 km east-north-east of the Project Area, over the period 1946-2025 (The Bureau 2025a).

Average annual rainfall of 513 mm has been recorded at Wyanga station 51008, approximately 10 km south-west of the Project Area, over the period 1899-2025 (The Bureau 2025b). Rainfall is relatively consistent throughout an average year, with no distinct wet and dry seasons (Figure 3).

Rainfall for the Project Area in the approximate 12-month period preceding the July 2025 field survey is inferred from data recorded at Wyanga station 51008 (The Bureau 2025b). Above-average rainfall was recorded in most months, including the three months preceding sampling in July 2025 (Figure 3). The data suggests that the waterways of the Project Area may have been wetter than usual at the time of assessment.



**Figure 3 Rainfall statistics for nearby Wyanga, 10 km southwest of the Project Area (The Bureau station 51008)**



## 2.3 Hydrology

The Project Area is located within the Macquarie-Bogan River catchment of the greater Murray-Darling Basin (MDB) (Figure 1). The northern portion of the Project Area drains to Backwater Cowal, which flows into Boggy Cowal then eventually the Bogan River near Nyngan (Figure 1). Most of the southern portion of the Project Area drains to Wallaby Creek, which also flows into Backwater Creek. A small portion of the Project Area in the south-west flows to Brady's Cowal then the Bogan River (Figure 1).

Wallaby Creek is the largest waterway within the Project Area, being a fifth order (Strahler [1953] Stream Order System) waterway. Other named waterways of the Project Area include Bundara, Jacks, Rays and Ugumjil creeks and Backwater Cowal. Flow within these larger third, fourth and fifth order waterways is likely to be largely intermittent, with higher flows expected for relatively short duration (in the order of days to weeks) following rainfall and runoff in the catchment. However, site observations indicated that Jacks, Rays, Ugumjil and Wallaby creeks are spring or seep fed, and are likely to contain semi-permanent to permanent trickle flows.

The Sappa Bulga range occurs to the east of the Project Area and comprises a large part of the catchment for Jacks, Rays, Ugumjil and Wallaby creeks. The Sappa Bulga range represents the south-eastern extent of the Great Artesian Basin (GAB) watershed. A dispersed cluster of approximately 30 mound springs are found on the western side (the Project side) of the Sappa Bulga range, including along Tantitha Road (Australian Native Plants Society Australia [ANPSA] 2025). These mound springs have never ceased to flow within recorded history (ANPSA 2025). In addition to the mound springs, the Sappa Bulga range contains tens of thousands of ephemeral groundwater seeps and springs (ANPSA 2025). After wet periods, these shallow springs yield surface water for several months to sometimes over a year (ANPSA 2025).

The more substantial flows in the third, fourth and fifth order waterways of the Project Area are likely to be intermittent, with higher flows expected for relatively short duration (in the order of days to weeks) following rainfall and runoff in the catchment. However, spring and seep flow from the Sappa Bulga range appears to provide semi-permanent to permanent trickle flow within Jacks, Rays, Ugumjil and Wallaby creeks, and in Bundara Creek from just upstream of Tantitha Road. A portion of this trickle flow may be sub-surface in bed sediments; however, semi-permanent pools located along these spring-fed waterways likely provide refuge for aquatic fauna between rainfall and runoff events.

Most of the smaller first and second order waterways of the Project Area are expected to be ephemeral, experiencing flow for relatively short duration (in the order of hours to days) following rainfall and runoff in the catchment.

The NSW Water Quality and River Flow Objectives for the Macquarie-Bogan (DEC 2006) identifies environmental values for the uncontrolled waterways of this catchment (encompassing the Project Area) as:

- aquatic ecosystems;
- visual amenity;
- primary and secondary contact recreation;
- livestock water supply;
- irrigation water supply;
- homestead and drinking water supply; and
- aquatic foods.

Water Quality Objectives (WQOs) relevant to aquatic ecosystems have been used in the interpretation of physico-chemical water quality in Section 4.3.4.

## 2.4 Land use

Land within the Project Area is used predominantly for agricultural grazing (primarily sheep, then cattle) and cereal cropping. Most of the Project Area has been cleared of remnant vegetation through past agricultural practices and ongoing disturbance, although remnant vegetation has been retained, or has reestablished, along many of the larger waterways.

## 3 METHODS

### 3.1 Taxonomic nomenclature

Scientific names of flora and fauna used in this report follow those in the BioNet database (NSW Department of Climate Change, Energy, the Environment and Water [NSW DCCEEW] 2025a).

### 3.2 Determination of significance level

Threatened aquatic flora and fauna species in NSW are those aquatic taxa listed in the EPBC Act, BC Act (e.g. turtles) or the FM Act as Critically Endangered (CE), Endangered (E) or Vulnerable (V).

Aquatic flora includes plants that have adapted to living in aquatic environments. These plants require special adaptations for living submerged in water, or at the water's surface. The definition of aquatic plants in this assessment is extended to include both aquatic and semi-aquatic plants that appear in key reference texts including *Waterplants in Australia* (Sainty and Jacobs 2003) and *Aquatic and Wetland Plants* (Romanowski 1998).

Aquatic fauna includes vertebrate and invertebrate species that live in water for most of or all of their lives. This does not include amphibians or waterbirds, which are considered terrestrial.

The significance of aquatic Threatened Ecological Communities (TECs) and Endangered Ecological Communities (EECs) would be described as per their listings in the EPBC Act or FM Act, respectively as CE, E or V. However, it is noted that no such aquatic TECs or EECs are likely to occur in the Project Area (Section 4.6).

### 3.3 Threatened species likelihood of occurrence

Threatened aquatic species identified from the desktop assessment were assigned a likelihood of occurrence based on the criteria identified in Table 2. Targeted searches were undertaken in the field for species identified as either being likely to occur or having potential to occur within the Project Area based on the desktop assessment. The assessment was applied again after the survey to determine the likelihood of occurrence once site-based information could be considered.

**Table 2 Criteria adopted for the likelihood of threatened species, identified from the desktop assessment, occurring within the Project Area**

| Likelihood of occurrence | Description                                                                                                                                                                                                                                              |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Known                    | The species was positively identified and recorded in the Project Area during the field survey; or there are previous records of occurrence within the Project Area.                                                                                     |
| Likely                   | The species was not recorded during the field survey or previously; however, there are known records within 10 km of the Project Area and suitable habitat exists within the Project Area.                                                               |
| Potential                | The species was not recorded during the field survey or previously; however, there are known records within 50 km of the Project Area and suitable habitat exists within the Project Area; or State mapping indicates potential habitat for the species. |
| Unlikely                 | Habitat in the Project Area might be suitable; however, the species was not recorded during the field survey, and no known records of the species exist within the surrounding area.                                                                     |



## 3.4 Desktop assessment

Desktop searches were undertaken in July 2025 ahead of the field survey. This included a review of the following:

- DCCEEW EPBC Act Protected Matters Search Tool, to identify potential aquatic MNES within approximately 10 km of the Project Area (Appendix A) (DCCEEW 2025a).
- DCCEEW EPBC Act Species Profiles and Threats Database (SPRAT; DCCEEW 2025b).
- DPIRD indicative distribution mapping for freshwater threatened fish species and populations in NSW (DPIRD 2025a), available for viewing in the Fisheries NSW Spatial Data Portal (DPIRD 2025b).
- DPIRD Key Fish Habitat mapping (DPIRD 2025c), available for viewing in the Fisheries NSW Spatial Data Portal (DPIRD 2025b).
- Atlas of Living Australia (ALA) (2025), to interrogate existing species records.
- NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) BioNet Atlas, to identify records of aquatic species within approximately 50 km of the Project Area (NSW DCCEEW 2025a).
- DPIRD Fish Community Status mapping (DPIRD 2025d), available for viewing in the Fisheries NSW Spatial Data Portal (DPIRD 2025b).
- Directory of Important Wetlands, to identify Nationally Important Wetlands nearest to the Project Area (DCCEEW 2025c).
- Relevant survey guidelines, including:
  - Australian River Assessment System (AusRivAS) protocols for NSW streams (the former NSW Department of Environment and Conservation [DEC] 2004);
  - Macquarie-Bogan River Water Quality Objectives (WQOs) for aquatic ecosystems (the former NSW Department of Environment and Conservation [DEC] 2006).

## 3.5 Field survey

### 3.5.1 Site selection, effort and timing

Desktop assessment findings were used to plan aquatic habitat assessment and targeted fish survey effort. The field survey effort focussed on waterways intersected by or in proximity to proposed Project infrastructure. The field survey was undertaken at 17 sites by DPM Envirosciences from 22-24 July 2025.

Aquatic habitat assessment sites comprised (Figure 4):

- Backwater Cowal – site 1;
- unnamed tributaries of Backwater Cowal – sites 2, 3 and 4;
- Bundara Creek – sites 9A, 12, 14 and 15;
- unnamed tributary of Bundara Creek – site 9B;
- Jacks Creek – sites 5B and 8;
- Rays Creek – site 13;
- Ugumjil Creek – sites 6, 7, 10 and 11; and
- Wallaby Creek – site 5A.

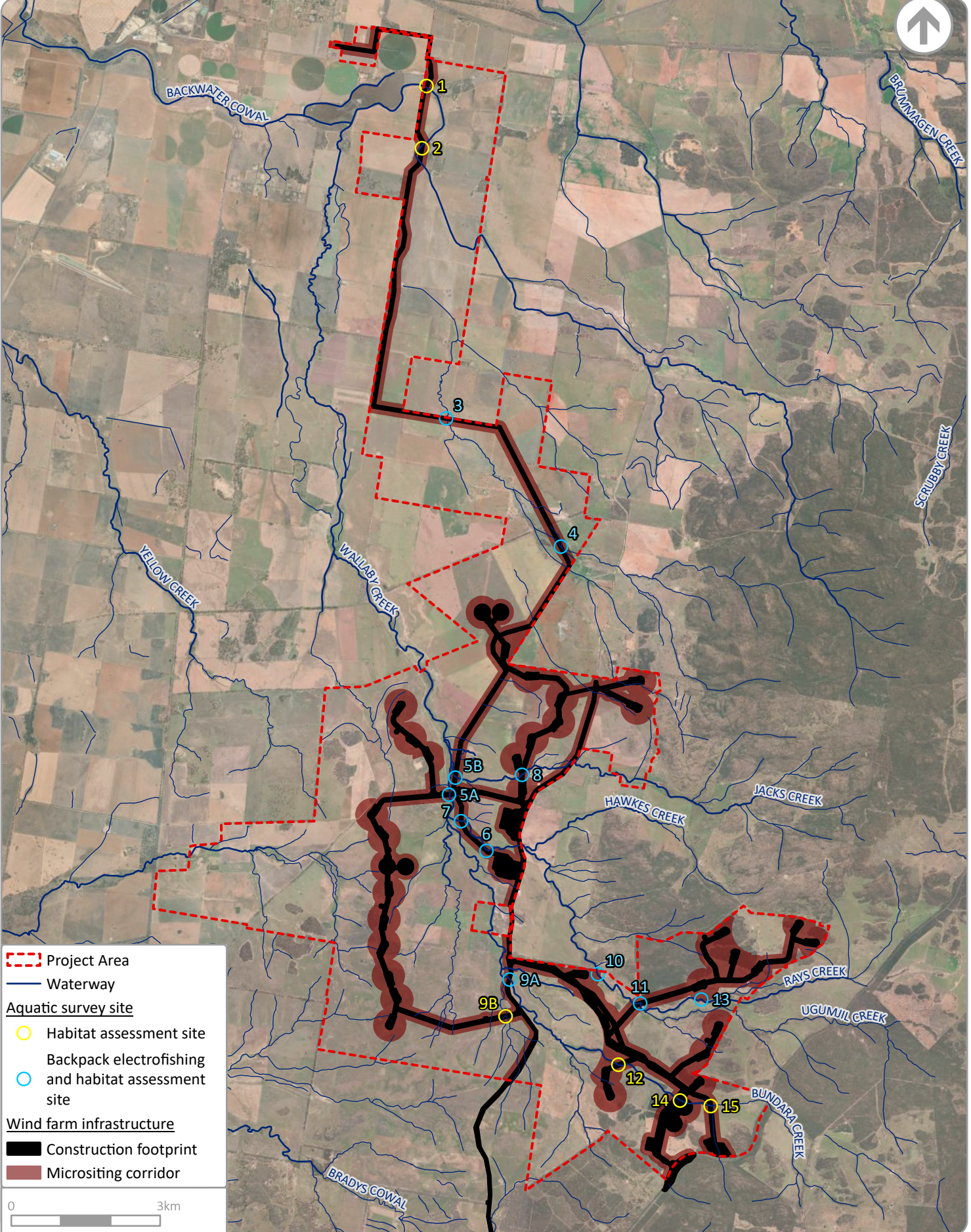
Fish survey effort, utilising backpack electrofishing techniques (Section 3.5.4), was conducted at 11 of the 17 sites. The sampling sites and survey effort are identified in Table 3.

**Table 3 Aquatic survey effort across the Project Area, July 2025**

| Waterway                  | Site ID | Date     | Latitude (GDA'20) | Longitude (GDA'20) | Backpack e-fishing (seconds power-on time) | Physico-chem. water quality | Water sample retained for ion analysis | Habitat assess. / aquatic plant survey / photos |
|---------------------------|---------|----------|-------------------|--------------------|--------------------------------------------|-----------------------------|----------------------------------------|-------------------------------------------------|
| Backwater Cowal           | 1       | 22/07/25 | -32.2639          | 148.2833           | -                                          | Dry                         | Dry                                    | ✓                                               |
| Backwater Cowal tributary | 2       | 22/07/25 | -32.2752          | 148.2825           | -                                          | Dry                         | Dry                                    | ✓                                               |
|                           | 3       | 22/07/25 | -32.3242          | 148.2884           | ✓ (542)                                    | ✓                           | ✓                                      | ✓                                               |
|                           | 4       | 22/07/25 | -32.3473          | 148.3133           | ✓ (207)                                    | ✓                           | ✓                                      | ✓                                               |
| Wallaby Creek             | 5A      | 22/07/25 | -32.3926          | 148.2899           | ✓ (623)                                    | ✓                           | ✓                                      | ✓                                               |
| Jacks Creek               | 5B      | 23/07/25 | -32.3895          | 148.2913           | ✓ (416)                                    | ✓                           | ✓                                      | ✓                                               |
|                           | 8       | 23/07/25 | -32.3888          | 148.3055           | ✓ (277)                                    | ✓                           | ✓                                      | ✓                                               |
| Ugumjil Creek             | 6       | 23/07/25 | -32.4027          | 148.2981           | ✓ (161)                                    | ✓                           | ✓                                      | ✓                                               |
|                           | 7       | 23/07/25 | -32.3974          | 148.2926           | ✓ (194)                                    | ✓                           | ✓                                      | ✓                                               |
|                           | 10      | 24/07/25 | -32.4249          | 148.3223           | ✓ (613)                                    | ✓                           | ✓                                      | ✓                                               |
|                           | 11      | 24/07/25 | -32.4301          | 148.3314           | ✓ (398)                                    | ✓                           | ✓                                      | ✓                                               |
| Bundara Creek             | 9A      | 23/07/25 | -32.4261          | 148.3034           | ✓ (397)                                    | ✓                           | ✓                                      | ✓                                               |
|                           | 12      | 24/07/25 | -32.4413          | 148.3269           | -                                          | Dry                         | Dry                                    | ✓                                               |
|                           | 14      | 24/07/25 | -32.4477          | 148.3402           | -                                          | Dry                         | Dry                                    | ✓                                               |
|                           | 15      | 24/07/25 | -32.4486          | 148.3468           | -                                          | Dry                         | Dry                                    | ✓                                               |
| Bundara Creek tributary   | 9B      | 23/07/25 | -32.4327          | 148.3026           | -                                          | Dry                         | Dry                                    | ✓                                               |
| Rays Creek                | 13      | 24/07/25 | -32.4293          | 148.3445           | ✓ (310)                                    | ✓                           | ✓                                      | ✓                                               |



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# WATERWAYS AND AQUATIC HABITAT ASSESSMENT SITES

Wallaby Creek Wind Farm- Aquatic Ecology Assessment

FIGURE 4



### 3.5.2 Aquatic habitats

Aquatic fauna habitat assessment was undertaken at each site to establish a general description of the waterway, riparian vegetation, and aquatic habitat features available. The data collected included water level, depth, velocity, physico-chemical water quality, width, canopy cover, substrate types, habitat attributes, local catchment erosion, sediment deposits, water colour, presence of algae, water odour, substrate odour, presence of large woody debris, dominant riparian flora species composition and relative abundance, and a visual assessment of disturbance related to human activities as per the NSW Australian River Assessment System (AusRivAS; DEC 2004). The visual assessment as per DEC (2004) ranks each of the following categories as 0 (No evidence of disturbance), 1 (Little disturbance), 2 (Moderate disturbance), 3 (High disturbance) or 4 (Extreme disturbance):

- water quality – including odour, water clarity, disruption of the natural hydrology, presence of foam from detergents, and oils;
- instream conditions – including change in substrate (e.g. rock piles or sedimentation from road construction or other development), pipes, rubbish, filamentous algae, alien fish species, and invasion by exotic aquatic plants;
- riparian zone – including revegetation, exotic plant invasion, bank degradation, and point sources; and
- catchment activities – including mines, sewage treatment plants, tips, dams, industry, logging, grazing, other agriculture, clearing, salinity, and urban development.

Photos were obtained and site profiles were compiled for each site (Appendix B).

### 3.5.3 Surface water quality

In-situ physico-chemical water quality was assessed as a component of the aquatic habitat assessments to inform initial equipment settings for backpack electrofishing and to assist in characterising aquatic habitats. The ionic composition of surface water was sampled and assessed to assist in characterising surface waters, including their likely interaction with groundwater.

#### **In-situ measurements**

In-situ physico-chemical water quality parameters were measured at each wetted survey site using a Hach Turbidimeter 2100Q and a YSI Professional Plus multi-parameter water quality meter, calibrated prior to and following sampling. Water quality parameters measured included:

- temperature (°C);
- pH;
- specific conductivity ( $\mu\text{S}/\text{cm}$ ); and
- turbidity (NTU).

Dissolved oxygen (mg/L and % saturation) was not measured due to failure of the sensor (inaccurate readings), despite successful calibration at the start of survey.

Salinity is described based on the following specific conductivity ranges (Queensland Department of Agriculture, Fisheries and Forestry [DAFF] 2012):

- fresh –  $<800 \mu\text{S}/\text{cm}$ ;
- marginal –  $800$  to  $1,600 \mu\text{S}/\text{cm}$ ;
- brackish –  $1,600$  to  $4,800 \mu\text{S}/\text{cm}$ ;
- slightly saline –  $4,800$  to  $10,000 \mu\text{S}/\text{cm}$ ;
- moderately saline –  $10,000$  to  $20,000 \mu\text{S}/\text{cm}$ ; and
- saline –  $>20,000 \mu\text{S}/\text{cm}$ .

## Ions

Water samples were obtained from each wetted site. Samples were chilled and delivered to ALS Environmental (a NATA accredited laboratory) and were analysed for the following major ions to assist in characterising surface waters of the Project Area:

- major anions (chloride [Cl], sulphate [SO<sub>4</sub>] and alkalinity [bicarbonate HCO<sub>3</sub>]); and
- major cations (calcium [Ca], magnesium [Mg], sodium [Na] and potassium [K]).

## Data analysis

Physico-chemical water quality measurements were compared (for context) against the Macquarie-Bogan River Water Quality Objectives for aquatic ecosystems (DEC 2006).

### 3.5.4 Fish

Fish were surveyed at 11 sites (Table 3) using backpack electrofishing techniques. This included the use of a Smith-Root LR-24 electrofisher by a Senior Operator to thoroughly sample a 100 m reach with settings of 100Hz frequency, 20% duty cycle, and 150-350v depending on specific conductivity). Immobilised fish and crustaceans were identified and released in-situ. A specimen of each fish species was netted and photographed. Netted pest fish species were euthanised and disposed of. Netted native species were released unharmed.

### 3.5.5 Key Fish Habitat TYPE and CLASS

One of the primary objectives of the FM Act is to conserve fish stocks and KFH. KFH includes those habitats that are crucial to the survival of native fish stocks (DPI 2013). The term excludes man-made habitats, such as agricultural drains and off-stream dams and ponds, and those natural waterways which are dry most of the time or have limited habitat value (DPI 2013).

KFH has been mapped by DPIRD (2025c) for a broad area encompassing the Project Area by identifying the mapped centreline of waterways as well as polygons of adjoining waterbodies. These waterways have been mapped at a broad scale and can vary from the on-ground location of the waterway. DPM Envirosciences used available aerial mapping in ESRI, combined with georeferenced drone imagery and habitat data obtained during the field survey, to approximate the bankfull (top of bank) extent of KFH for all waterways of the Project Area. The resulting field-verified KFH map for the Project Area (Section 4.2, Figure 6) provides a more accurate and current representation of KFH than the broad-scale State mapping.

The classification and sensitivity of sampled waterways in the Project Area was assessed in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI 2013).

#### *Aquatic habitat sensitivity*

The sensitivity of affected fish habitat was assessed using both desktop and field data. In this context, 'sensitivity' is defined by DPI (2013) by the importance of the habitat to the survival and resilience of fish (noting that 'fish' under the FM Act includes aquatic invertebrates).

Table 4 defines those habitats which are considered KFH in accordance with the FM Act, relevant policies and guidelines. Fish habitat sensitivity rankings were also applied, to provide context to the importance of the 'TYPE' of KFH encountered in the Project Area.

'Freshwater habitats that contain native aquatic plants' are allocated 'TYPE 1 – Highly sensitive KFH' in accordance with DPI (2013). However, it is assumed that the intent of this classification is to protect freshwater habitats where the natural emergent or submerged components of the vegetation constitute a significant structural or habitat feature. DPM Envirosciences therefore

considers that stream reaches with only little (1-10% cover) to some (10-50% cover) semi-aquatic plants, such as *Juncus* spp. or *Cyperus* spp., are unlikely to meet the intent of the 'TYPE 1 – Highly sensitive KFH' classification and have instead been allocated 'TYPE 2 – Moderately sensitive KFH'.

**Table 4 Key Fish Habitat and associated sensitivity classification scheme (DPI 2013)**

|                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TYPE 1 – Highly sensitive KFH:</b>                                                                                                                                                             |
| ▪ strapweed ( <i>Posidonia australis</i> )                                                                                                                                                        |
| ▪ <i>Zostera</i> , <i>Heterozostera</i> , <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds >5m <sup>2</sup> in area                                                                    |
| ▪ coastal saltmarsh >5m <sup>2</sup> in area                                                                                                                                                      |
| ▪ coral communities                                                                                                                                                                               |
| ▪ coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings)                 |
| ▪ Marine Park, an aquatic reserve or intertidal protected area                                                                                                                                    |
| ▪ SEPP 14 coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia |
| ▪ freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 m in length, or native aquatic plants           |
| ▪ any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act                                                                           |
| ▪ mound springs                                                                                                                                                                                   |
| <b>TYPE 2 – Moderately sensitive KFH:</b>                                                                                                                                                         |
| ▪ <i>Zostera</i> , <i>Heterozostera</i> , <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds >5m <sup>2</sup> in area                                                                    |
| ▪ mangroves                                                                                                                                                                                       |
| ▪ coastal saltmarsh <5m <sup>2</sup> in area                                                                                                                                                      |
| ▪ marine macroalgae such as <i>Ecklonia</i> and <i>Sargassum</i> species                                                                                                                          |
| ▪ estuarine and marine rocky reefs                                                                                                                                                                |
| ▪ coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management plan)                 |
| ▪ aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area                                                                                                  |
| ▪ stable intertidal sand / mud flats, coastal and estuarine sandy beaches with large populations of in-fauna                                                                                      |
| ▪ freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in Type 1                                                                                                 |
| ▪ weir pools and dams up to full supply level where the weir or dam is across a natural waterway                                                                                                  |
| <b>TYPE 3 – Minimally sensitive KFH, which may include:</b>                                                                                                                                       |
| ▪ unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna                                                                                  |
| ▪ coastal and freshwater habitats not included in Types 1 or 2                                                                                                                                    |
| ▪ ephemeral aquatic habitat not supporting native aquatic or wetland vegetation                                                                                                                   |
| <b>Not KFH:</b>                                                                                                                                                                                   |
| ▪ First and second order streams on gaining streams (based on the Strahler method of stream ordering)                                                                                             |
| ▪ Farm dams on first and second order streams or unmapped gullies                                                                                                                                 |
| ▪ Agricultural and urban drains                                                                                                                                                                   |
| ▪ Urban or other artificial ponds (e.g. evaporation basins, aquaculture ponds)                                                                                                                    |
| ▪ Sections of stream that have been concrete-lined or piped (not including a waterway crossing)                                                                                                   |
| ▪ Canal estates                                                                                                                                                                                   |



### Waterway classification

The waterways of the Project Area were further classified in accordance with DPI (2013). This classification (CLASS) scheme factors in the functionality of the waterway as fish habitat, using indicators such as:

- hydraulic geometry (stream shape and size);
- frequency of stream flows (perennial, intermittent or ephemeral);
- presence of aquatic habitat units (pools, riffles, vegetation, snags);
- presence of threatened or protected fish species and other native fish; and
- connection to adjacent habitats (e.g. floodplain wetlands).

The waterways were classified using a combination of desktop (aerial imagery and drainage mapping), supplemented by field data (Appendix B).

**Table 5 Classification of waterways for fish passage (NSW DPI 2013)**

| Classification                              | Characteristics of waterway class                                                                                                                                                                                                                                                                                               |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CLASS 1</b><br>Major key fish habitat    | Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'.                                                                                                                                        |
| <b>CLASS 2</b><br>Moderate key fish habitat | Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Freshwater aquatic vegetation is present. Type 1 and 2 habitats present.                                                  |
| <b>CLASS 3</b><br>Minimal key fish habitat  | Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other Class 1-3 fish habitats. |
| <b>CLASS 4</b><br>Unlikely key fish habitat | Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools post rain events (e.g. dry gullies or shallow floodplain depressions with no aquatic flora present).                                                   |

### 3.5.6 Turtles

Turtle survey was limited to opportunistic observations.

### 3.5.7 Mammals

Habitat suitability for platypus (*Ornithorhynchus anatinus*) was assessed at each site. This included targeted searches for burrows along banks.

### 3.5.8 Aquatic flora

Aquatic plants were surveyed at each site. Plants were identified to species (where possible) using available literature and taxonomic keys where needed. The abundance of each species was estimated using the categories: extensive (>75% cover), moderate (50-75%), some (10-50%) or little (1-10%).

### 3.6 Assumptions and limitations

The information presented in this report is subject to the following assumptions and limitations:

- Some of the databases used to obtain information for this report have caveats regarding the completeness of data they contain. For example, the BioNet database is based only on recorded sightings of species, and therefore the absence of a species record in a search area does not necessarily imply that the species does not occur.
- Data from the DCCEEW EPBC Protected Matters Search Tool (DCCEEW 2025a) is based on actual records, primarily from State Government databases, combined with modelled distributions of species according to their ecological characteristics. Species identified by this search 'may' occur in the Project Area but require thorough on-ground investigation to confirm their presence.
- As the presence or otherwise of a particular fauna species within the site can only be confirmed by detailed targeted field survey, the precautionary principle has been adopted throughout this assessment. A species would be considered to have potential to occur in the Project Area if it was recorded in database searches for the region and field surveys indicated that potential habitat for the species is present, based on existing knowledge of the species' ecological requirements.

## 4 RESULTS – AQUATIC ECOLOGY

### CHARACTERISTICS OF THE PROJECT AREA

#### 4.1 Waterways

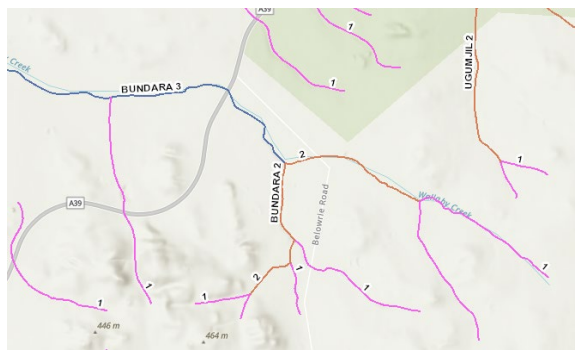
The *Water Management (General) Regulation 2018 hydroline spatial data 1.0* (Department of Planning, Housing and Infrastructure [DPHI] 2025) mapping identifies creeks, streams and tributaries (referred to collectively as waterways) for the Project Area. These waterways range from small first order (Strahler [1952] Stream Order System) tributaries to the fifth order Wallaby Creek (Figure 4). The waterways of the Project Area are ephemeral to largely intermittent. Flow within the larger third, fourth and fifth order waterways is likely to be predominantly intermittent, with moderate to high flows expected for relatively short duration (in the order of days to weeks) following rainfall and runoff in the catchment. However, spring or seep contributions from the Sappa Bulga range contribute semi-permanent to permanent trickle flows in Bundara Creek (downstream of Tantitha Road), Jacks Creek, Rays Creek, Ugumgil Creek (downstream of Rays Creek) and Wallaby Creek (Section 4.9, Figure 12). Semi-permanent natural pools and artificial dams along these spring/seep-fed waterways provide potential refuge for aquatic fauna between rainfall and runoff events.

Most of the smaller first and second order waterways of the Project Area are expected to be ephemeral, experiencing flow for relatively short duration (in the order of hours to days) following rainfall and runoff in the catchment.

#### 4.2 Key Fish Habitat

Waterways within the Project Area of stream order (Strahler [1952] Stream Order System) three and above are mapped by DPIRD (2025c) as KFH (Figure 5). Aquatic habitat sensitivities have been determined and KFH classifications refined in accordance with the *Policy and guidelines for fish habitat conservation and management* (DPI 2013) (Table 6).

On upper Bundara Creek in the south-west of the Project Area, the DPIRD (2025c) KFH mapping appears to have utilised waterway mapping that connects an isolated or upper tributary of Ugumgil Creek to Bundara Creek, thereby elevating the stream order to three for a section of Bundara Creek where sites 12, 14 and 15 are positioned (Plate 1; Figure 5).



WaterNSW Strahler Stream Order mapping



DPIE hydroline spatial data 1.0 mapping

#### Plate 1 Variation in waterway mapping layers used

Field observations were consistent with the *Water Management (General) Regulation 2018 hydroline spatial data 1.0* (DPIE 2025), which presents this reach of Bundara Creek as stream order two. The field-verified KFH mapping (Figure 6) has revised the upstream extent of KFH on

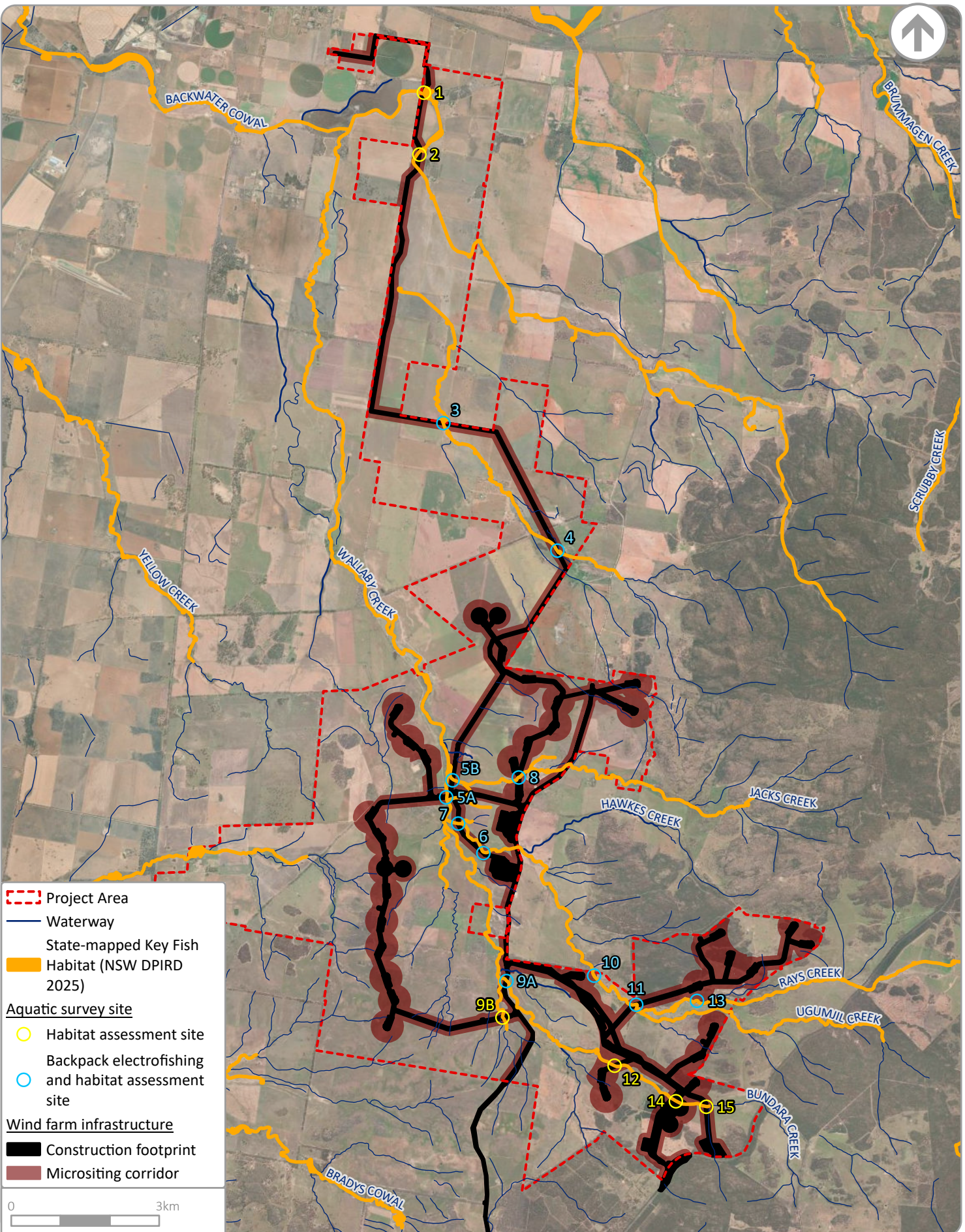


Bundara Creek to align with the revised stream order. The stream order of Ugumgil Creek within the Project Area remains unchanged by the remapping.

The field-verified KFH map for the Project Area (Figure 6) provides an improved representation of KFH for the Project Area than the broad-scale State mapping. The field-verified KFH mapping also extends the State-mapped KFH vector lines to KFH polygons, indicating the spatial extent of KFH at the location of proposed crossings.

Appendix C presents field-verified KFH mapping overlaid on drone imagery obtained during the aquatic habitat assessment at the proposed crossings. No significant habitat features (gravel beds, snags, reed beds or rock bars) are presented on these maps, as no such significant habitat features were detected at these locations (Section 4.3.1).

\*C:\Users\DeannaBay\iss\OneDrive - EcoGIS\Documents\EcoGIS\02 Projects\DPM Envirosiences\255 Wallaby Wind Farm\Wallaby Wind Farm.aprx 8/08/2025



## STATE-MAPPED KEY FISH HABITAT

Wallaby Creek Wind Farm- Aquatic Ecology Assessment

FIGURE 5



**Table 6 Waterways, aquatic habitat sensitivity and Key Fish Habitat assessed at each site**

| Waterway                  | Site code | Key Fish Habitat (KFH)    |                | Aquatic habitat sensitivity <sup>#</sup> |                                                                                                   | Waterway classification <sup>#</sup> |                                                                                                                                                        |
|---------------------------|-----------|---------------------------|----------------|------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           |           | State-mapped <sup>^</sup> | Field verified | TYPE                                     | Reason                                                                                            | CLASS                                | Reason                                                                                                                                                 |
| Backwater Cowal           | 1         | ✓                         | ✓              | 2 – Moderately sensitive KFH             | Freshwater habitat; ephemeral aquatic habitat supporting aquatic vegetation.                      | 2 – Moderate KFH                     | Aquatic vegetation is present; forms part of a wetland.                                                                                                |
| Backwater Cowal tributary | 2         | ✓                         | ✓              | 2 – Moderately sensitive KFH             | Freshwater habitat; ephemeral aquatic habitat supporting aquatic vegetation.                      | 2 – Moderate KFH                     | Aquatic vegetation is present; forms part of a wetland.                                                                                                |
| Backwater Cowal tributary | 3         | ✓                         | ✓              | 2 – Moderately sensitive KFH             | Freshwater habitat; ephemeral aquatic habitat supporting aquatic vegetation.                      | 3 – Minimal KFH                      | Intermittent flow and sporadic refuge for aquatic fauna (yabbies); pools form within the waterways after a rain event.                                 |
|                           | 4         | ✓                         | ✓              |                                          |                                                                                                   |                                      |                                                                                                                                                        |
| Wallaby Creek             | 5A        | ✓                         | ✓              | 2 – Moderately sensitive KFH             | Freshwater habitat; intermittent to semi-permanent aquatic habitat supporting aquatic vegetation. | 2 – Moderate KFH                     | Clearly defined bed and banks; predominantly intermittent flow, with spring/seep trickle or sub-surface interflow contributing to semi-permanent pools |
| Jacks Creek               | 5B        | ✓                         | ✓              | 2 – Moderately sensitive KFH             | Freshwater habitat; intermittent to semi-permanent aquatic habitat supporting aquatic vegetation. | 2 – Moderate KFH                     | Predominantly intermittent flow, with spring/seep trickle or sub-surface interflow contributing to semi-permanent pools.                               |
|                           | 8         | ✓                         | ✓              |                                          |                                                                                                   |                                      |                                                                                                                                                        |
| Ugumjil Creek             | 6         | ✓                         | ✓              | 2 – Moderately sensitive KFH             | Freshwater habitat; intermittent to semi-ephemeral aquatic habitat supporting aquatic vegetation. | 2 – Moderate KFH                     | Predominantly intermittent flow, with spring/seep trickle or sub-surface interflow contributing to semi-permanent pools.                               |
|                           | 7         | ✓                         | ✓              |                                          |                                                                                                   |                                      |                                                                                                                                                        |
|                           | 10        | ✓                         | ✓              |                                          |                                                                                                   |                                      |                                                                                                                                                        |
|                           | 11        | ✓                         | ✓              |                                          |                                                                                                   |                                      |                                                                                                                                                        |

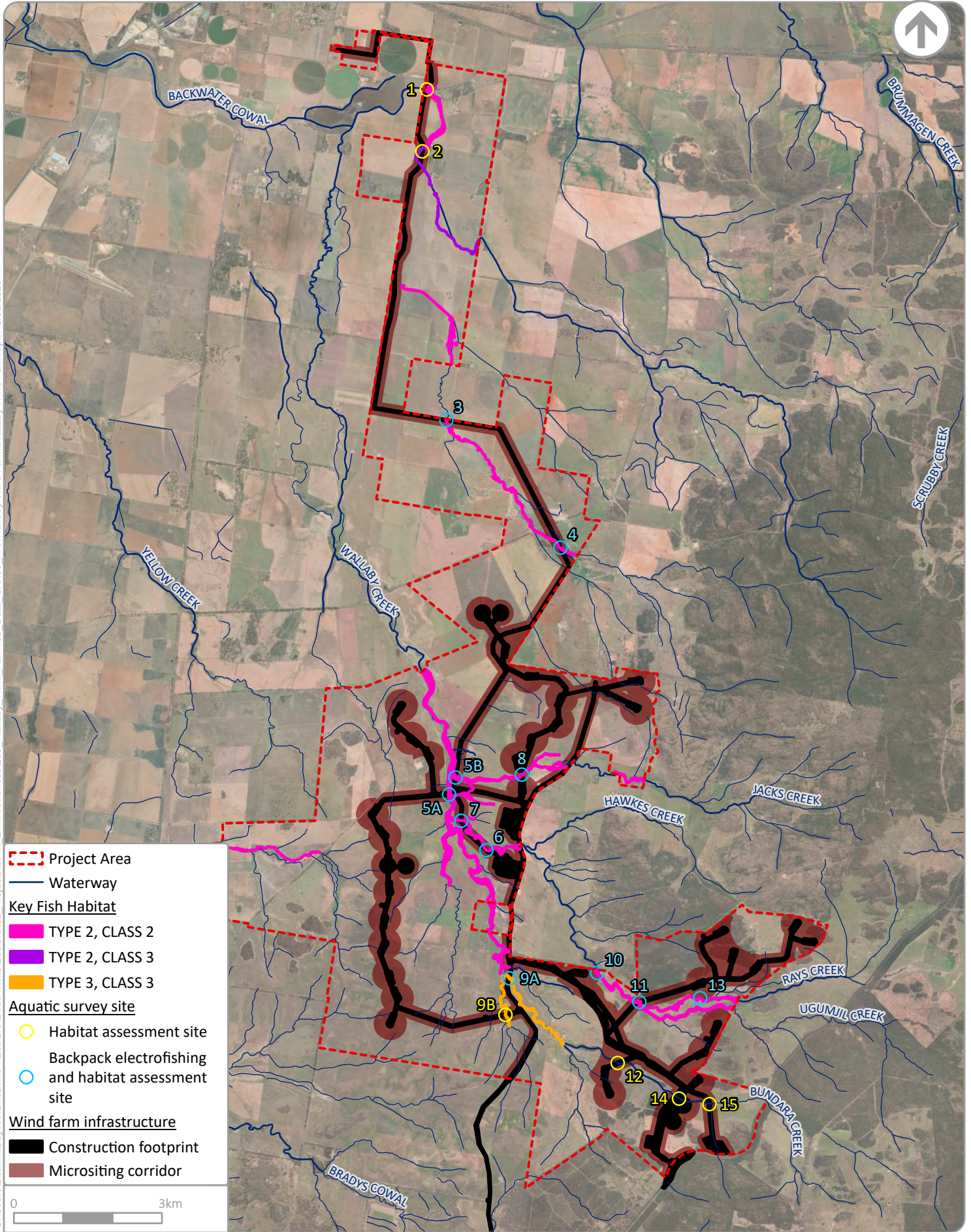
| Waterway                | Site code | Key Fish Habitat (KFH)    |                | Aquatic habitat sensitivity <sup>#</sup> |                                                                                                          | Waterway classification <sup>#</sup> |                                                                                                                                             |
|-------------------------|-----------|---------------------------|----------------|------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
|                         |           | State-mapped <sup>^</sup> | Field verified | TYPE                                     | Reason                                                                                                   | CLASS                                | Reason                                                                                                                                      |
| Bundara Creek           | 9A        | ✓                         | ✓              | 3 – Minimally sensitive KFH              | Ephemeral aquatic habitat not supporting native aquatic plants, apart from some <i>Juncus usitatus</i> . | 3 – Minimal KFH                      | Intermittent flow and sporadic refuge for aquatic fauna (yabbies); pools form within the waterway after a rain event.                       |
|                         | 12        | ✓                         | Not KFH        | Not KFH                                  | Second order stream.                                                                                     | 4 – Unlikely KFH                     | Waterway with ephemeral flow following rain events only. Predominantly dry gully lacking aquatic flora, apart from <i>Juncus usitatus</i> . |
|                         | 14        | ✓                         | Not KFH        |                                          |                                                                                                          |                                      |                                                                                                                                             |
|                         | 15        | ✓                         | Not KFH        |                                          |                                                                                                          |                                      |                                                                                                                                             |
| Bundara Creek tributary | 9B        | ✓                         | ✓              | 3 – Minimally sensitive KFH              | Ephemeral aquatic habitat not supporting native aquatic plants, apart from some <i>Juncus usitatus</i> . | 3 – Minimal KFH                      | Ephemeral to intermittent flow and likely sporadic refuge for aquatic fauna; pools likely form within the waterway after a rain event.      |
| Rays Creek              | 13        | ✓                         | ✓              | 2 – Moderately sensitive KFH             | Freshwater habitat; intermittent to semi-permanent aquatic habitat supporting aquatic vegetation.        | 2 – Moderate KFH                     | Predominantly intermittent flow, with spring/seep trickle or sub-surface interflow contributing to semi-permanent pools.                    |

Notes:

<sup>^</sup> Based on DPIRD Key Fish Habitat mapping (DPIRD 2025c).

<sup>#</sup> Consistent with criteria identified in the *Policy and guidelines for fish habitat conservation and management* (DPI 2013).





## FIELD-VERIFIED KEY FISH HABITAT

Wallaby Creek Wind Farm- Aquatic Ecology Assessment

**FIGURE 6**



## 4.3 Aquatic habitat

The waterways of the Project Area range from ephemeral first and second order (Strahler [1952] Stream Order System) waterways to larger third, fourth and fifth order waterways with largely intermittent flows following rainfall and runoff events, but with semi-permanent to permanent spring or seep-fed trickle flow and associated pools (Plate 2) likely persisting throughout most years. Spring and seep flow from the Sappa Bulga range, to the east of the Project Area, appears to contribute semi-permanent to permanent trickle flow within Jacks, Rays, Ugumgil and Wallaby creeks, and in Bundara Creek from just upstream of Tantitha Road (Section 4.9, Figure 12). A portion of this trickle flow may be sub-surface in bed sediments. Semi-permanent pools located along these spring/seep-fed waterways likely provide refuge for aquatic fauna between rainfall and runoff events.

Trickle flow of approximately 3 litres per second [L/s] was encountered at site 5A on Wallaby Creek in July 2025. Trickle flow of approximately 2 L/s was encountered at sites 6, 7, 10 and 11 on Ugumgil Creek, and at site 13 on Rays Creek. Trickle flow of approximately 1 L/s was encountered at site 5B on Jacks Creek, and approximately <0.1 L/s further upstream at site 8. Isolated pools with no discernible surface flow were encountered at sites 3 and 4 on a tributary of Backwater Cowal and at site 9A on Bundara Creek. The remaining six sites were dry at the time of assessment.



Site 5A – Intermittent to semi-permanent fifth order Wallaby Creek (State-mapped and field verified KFH)



Site 10 – Intermittent to semi-permanent fourth order Ugumgil Creek (State and field-verified KFH)



Site 5B – Intermittent to semi-permanent Jack's Creek (State-mapped and field-verified KFH)



Site 15 – Ephemeral second order Bundara Creek (State-mapped KFH; field-verified as not KFH)

### Plate 2 Representative waterways of the Project Area, July 2025

#### 4.3.1 Instream habitat

The instream habitat attributes for each of the 17 aquatic habitat assessment sites are summarised in site profiles provided as Appendix B.

Substrate complexity was generally poor across the Project Area, with very few boulders, cobbles and pebbles encountered. Bed substrates were dominated by sand at most sites, with some sites dominated by silt/clay. Gravel and bedrock comprised a minor portion of the substrates at most sites (Appendix B). Most sites exhibited little (1-10%) detritus (leaves, grasses and other organic matter etc.), sticks and branches; and few sites exhibited logs or other larger refuge.

A long history of cropping and sheep and cattle grazing throughout the Project Area has resulted in a high level of disturbance and signs of eutrophication in several waterways. These signs included animal excrement, filamentous algae, branched algae (*Nitella* sp.) and extensive periphyton cover.

Local catchment erosion (being erosion that can be seen from standing at each site) was uncommon, and generally restricted to minor occurrences of sheet erosion and bank slumping. No gully erosion (>0.3 m deep) or tunnel erosion was detected.

Stream banks were stable to moderately stable at each site. Bank vegetative stability was excellent (over 80% of the streambank surfaces were covered by vegetation) at most sites, and streamside cover varied between Fair (sections dominated by grasses and rushes) and Excellent (sections dominated by trees).

#### 4.3.2 Adjacent land use

Land use across the Project Area is dominated by cereal cropping and both sheep and cattle grazing of varying intensities. Most of the Project Area has been cleared through past agricultural practices and ongoing disturbance, although riparian woodland vegetation has been retained along most of the larger waterways.

The width of riparian zones (single bank measurements) in representative stream reaches assessed ranged from approximately 1 m (almost complete lack of riparian vegetation except for grasses) to 50 m in woodland (Appendix B). Canopy cover in the riparian zones ranged from non-existent (0%) to 65% (mid-dense). Canopy species encountered in the riparian zones of aquatic sites included river red gum (*Eucalyptus camaldulensis*), Blakely's red gum (*E. blakelyi*), bimbil box (*E. populnea* subsp. *bimbil*), yellow box (*E. melliodora*), inland grey box (*E. microcarpa*), white box (*E. albens*), mugga ironbark (*E. sideroxylon*), river oak (*Casuarina cunninghamiana*), white cypress pine (*Callitris glaucophylla*) and kurrajong (*Brachychiton populneus*) (Appendix B).

#### 4.3.3 Visual assessment of human disturbance

A visual assessment of disturbance related to human activities was undertaken at each site as per NSW AusRivAS protocols (DEC 2004). Overall disturbance ratings ranged from Little to Moderate disturbance (Appendix B). Water quality disturbances were noted at two of the 17 sites and included disruption of the natural hydrology where the waterway had been dammed. Instream disturbances included prevalence of filamentous algae, invasion by both terrestrial and aquatic exotic flora species, exotic fish species, livestock grazing within waterways, constructed drains, fuel reduction burning and silt deposition. Riparian zone disturbances included revegetation from historic clearing, exotic plant invasion by blackberry (*Rubus fruticosus* sp. aggregate)\*, sweet briar (*Rosa rubiginosa*)\*, African boxthorn (*Lycium ferocissimum*)\* and a diversity of weeds in the ground layer, and bank degradation including sheet erosion, bank slumping and pugging by livestock. Notable catchment disturbances included historic vegetation clearing, cereal cropping, and sheep and cattle grazing (Appendix B).

#### 4.3.4 Physico-chemical water quality

In-situ measurements and water quality sampling was undertaken at 11 of the 17 aquatic habitat assessment sites. The other six sites were dry at the time of assessment.

Surface water temperatures at the time of assessment ranged from 7.0°C to 12.4°C (Table 7). Water temperatures are influenced by season, time of day, shading and waterbody depth.

pH levels ranged from 6.4 (slightly acid) to 7.8 (mildly alkaline), falling within the WQO range of 6.5-8.5 (Table 7).

Specific conductivity levels ranged from 192  $\mu\text{S}/\text{cm}$  (fresh) at site 3 on a tributary of Backwater Cowal to 606  $\mu\text{S}/\text{cm}$  (also fresh) at site 5B on Jacks Creek. The variable specific conductivity levels likely reflect varying geology, groundwater contributions, areas of salinity associated with a long history of tree clearing, and varying contact time with substrates. The WQO guideline range of 30-350  $\mu\text{S}/\text{cm}$  was exceeded at four of the 11 wetted sites sampled (Table 7).

Turbidity levels ranged from 10.5 NTU (high clarity) at site 8 on Rays Creek to 447 NTU (poor clarity) at site 4 on a tributary of Backwater Cowal (Table 7). The higher turbidity at some sites was likely associated with washload (silts and clays held in suspension) downstream of worked soils in cereal cropping land.



**Table 7 Surface water quality measurements from the Project Area, 22-24 July 2025**

| Parameter                                    | Units         | WQO     | Site  |       |            |            |            |            |            |           |            |            |       |           |           |       |           |       |       |
|----------------------------------------------|---------------|---------|-------|-------|------------|------------|------------|------------|------------|-----------|------------|------------|-------|-----------|-----------|-------|-----------|-------|-------|
|                                              |               |         | 1     | 2     | 3          | 4          | 5A         | 5B         | 6          | 7         | 8          | 9A         | 9B    | 10        | 11        | 12    | 13        | 14    | 15    |
| Date                                         | DD/MM/25      | -       | 22/07 | 22/07 | 22/07      | 22/07      | 22/07      | 23/07      | 23/07      | 23/07     | 23/07      | 23/07      | 23/07 | 24/07     | 24/07     | 24/07 | 24/07     | 24/07 | 24/07 |
| Time (EST)                                   | 00:00         | -       | NA    | NA    | 08:13      | 10:25      | 12:35      | 08:45      | 12:04      | 10:50     | 13:40      | 15:33      | NA    | 08:57     | 10:34     | NA    | 11:55     | NA    | NA    |
| Flow estimate                                | L/s           | -       | Dry   | Dry   | Nil        | Nil        | 3          | 1          | 2          | 2         | <0.1       | Nil        | Dry   | 2         | 2         | Dry   | 2         | Dry   | Dry   |
| <b>Physico-chemical water quality</b>        |               |         |       |       |            |            |            |            |            |           |            |            |       |           |           |       |           |       |       |
| Water temperature                            | °C            | -       | -     | -     | 9.3        | 9.5        | 10.5       | 8.9        | 10.5       | 9.8       | 12.4       | 10.5       | -     | 7.0       | 7.2       | -     | 7.9       | -     | -     |
| pH                                           | pH units      | 6.5-8.0 | -     | -     | 6.4        | 6.4        | 6.7        | 7.6        | 7.0        | 7.4       | 7.8        | 6.9        | -     | 7.3       | 7.0       | -     | 7.2       | -     | -     |
| Specific conductivity                        | µS/cm (@25°C) | 30-350  | -     | -     | 192        | <b>447</b> | <b>420</b> | <b>606</b> | 327        | 332       | <b>512</b> | 303        | -     | 315       | 286       | -     | 276       | -     | -     |
| Turbidity                                    | NTU           | 2-25    | -     | -     | <b>378</b> | <b>447</b> | <b>99</b>  | <b>79</b>  | <b>100</b> | <b>74</b> | 10.5       | <b>376</b> | -     | <b>84</b> | <b>80</b> | -     | <b>76</b> | -     | -     |
| Alkalinity (as CaCO <sub>3</sub> )           | mg/L          | -       | -     | -     | 51         | 56         | 80         | 88         | 61         | 63        | 584        | 34         | -     | 56        | 52        | -     | 50        | -     | -     |
| <b>Major cations</b>                         |               |         |       |       |            |            |            |            |            |           |            |            |       |           |           |       |           |       |       |
| Calcium (Ca <sup>2+</sup> )                  | mg/L          | -       | -     | -     | 3          | 6          | 1          | 3          | 1          | 1         | 92         | 3          | -     | <1        | <1        | -     | <1        | -     | -     |
| Magnesium (Mg <sup>2+</sup> )                | mg/L          | -       | -     | -     | 3          | 4          | 2          | 3          | 2          | 2         | 168        | 8          | -     | 2         | 2         | -     | 2         | -     | -     |
| Sodium (Na <sup>+</sup> )                    | mg/L          | -       | -     | -     | 30         | 77         | 83         | 119        | 64         | 64        | 608        | 48         | -     | 61        | 57        | -     | 55        | -     | -     |
| Potassium (K <sup>+</sup> )                  | mg/L          | -       | -     | -     | 8          | 9          | 4          | 3          | 3          | 3         | 4          | 10         | -     | 3         | 2         | -     | 2         | -     | -     |
| <b>Major anions</b>                          |               |         |       |       |            |            |            |            |            |           |            |            |       |           |           |       |           |       |       |
| Chloride (Cl <sup>-</sup> )                  | mg/L          | -       | -     | -     | 28         | 101        | 73         | 117        | 58         | 59        | 1130       | 49         | -     | 56        | 49        | -     | 46        | -     | -     |
| Sulphate (SO <sub>4</sub> <sup>2-</sup> )    | mg/L          | -       | -     | -     | 11         | 31         | 19         | 33         | 12         | 12        | 201        | 42         | -     | 12        | 10        | -     | 10        | -     | -     |
| Bicarbonate (HCO <sub>3</sub> <sup>-</sup> ) | mg/L          | -       | -     | -     | 51         | 56         | 80         | 88         | 61         | 63        | 584        | 34         | -     | 56        | 52        | -     | 50        | -     | -     |

Notes:

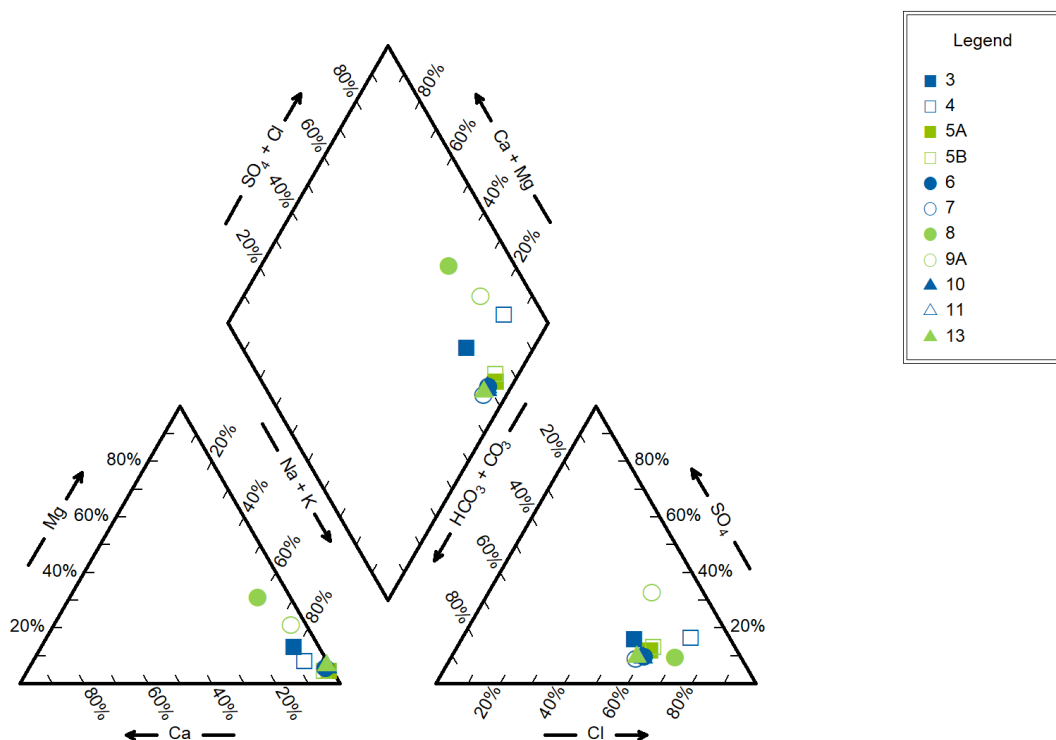
EST = Eastern Standard Time; Electrical Conductivity measurements provided are Specific Conductivity (i.e. standardised to 25°C); WQO = Water Quality Objective for aquatic ecosystems in uncontrolled streams of the Macquarie-Bogan catchment (DECCW 2006) – these guidelines are the same for 'controlled streams' and 'controlled rivers with reduced flow'; Alkalinity is total alkalinity; **Bolded** text indicates an exceedance of the WQO.

### 4.3.5 Ionic composition of surface waters

The concentration and proportion of ions in surface waters depends on the geology, land-use, topography, climate and the proportionate contributions of groundwater flow, interflow and overland flow (Boulton and Brock 2001). These proportionate contributions will vary depending on seasonal and climatic patterns and so the source of ions will also vary. During periods of low to no rainfall or runoff, groundwater contributions can become more evident. During periods of high rainfall and runoff, catchment and atmospheric sources typically dominate.

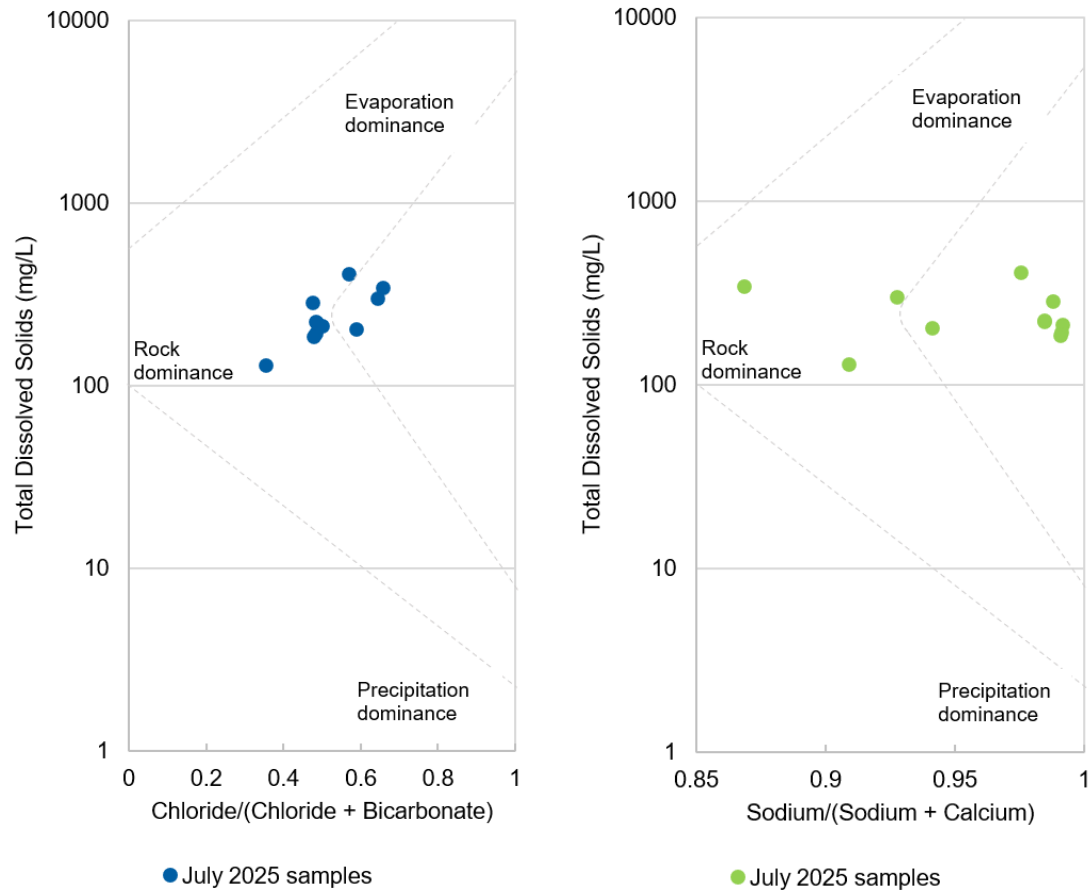
The concentrations of major anions and cations in surface water samples collected from the Project Area are provided in Appendix D. The relative proportions of these major cations and anions are presented for surface waters in a Piper plot as Figure 7. The Piper plot indicates that most surface water samples of the Project Area were of sodium chloride type waters.

Sodium is readily dispersed and is prevalent in soil, rock and other deposits. Chlorides are typically dissolved from rocks and soils derived from evaporites, minerals or igneous rock, although are also concentrated in animal excretions. The catchments of these waterways include the Sappa Bulga range, with a surface geology dominated by Obley Granite (Figure 9). Granite intrusions in the range cause partial resurfacing of subterranean flows (ANPSA 2025). Both the granite geology, and the likely expression of groundwater from the GAB, are likely sources of sodium chloride in the surface waters of the Project Area.



**Figure 7 Piper plot showing relative abundance of major cations and anions from surface water samples collected from the Project Area, 22-24 July 2025**

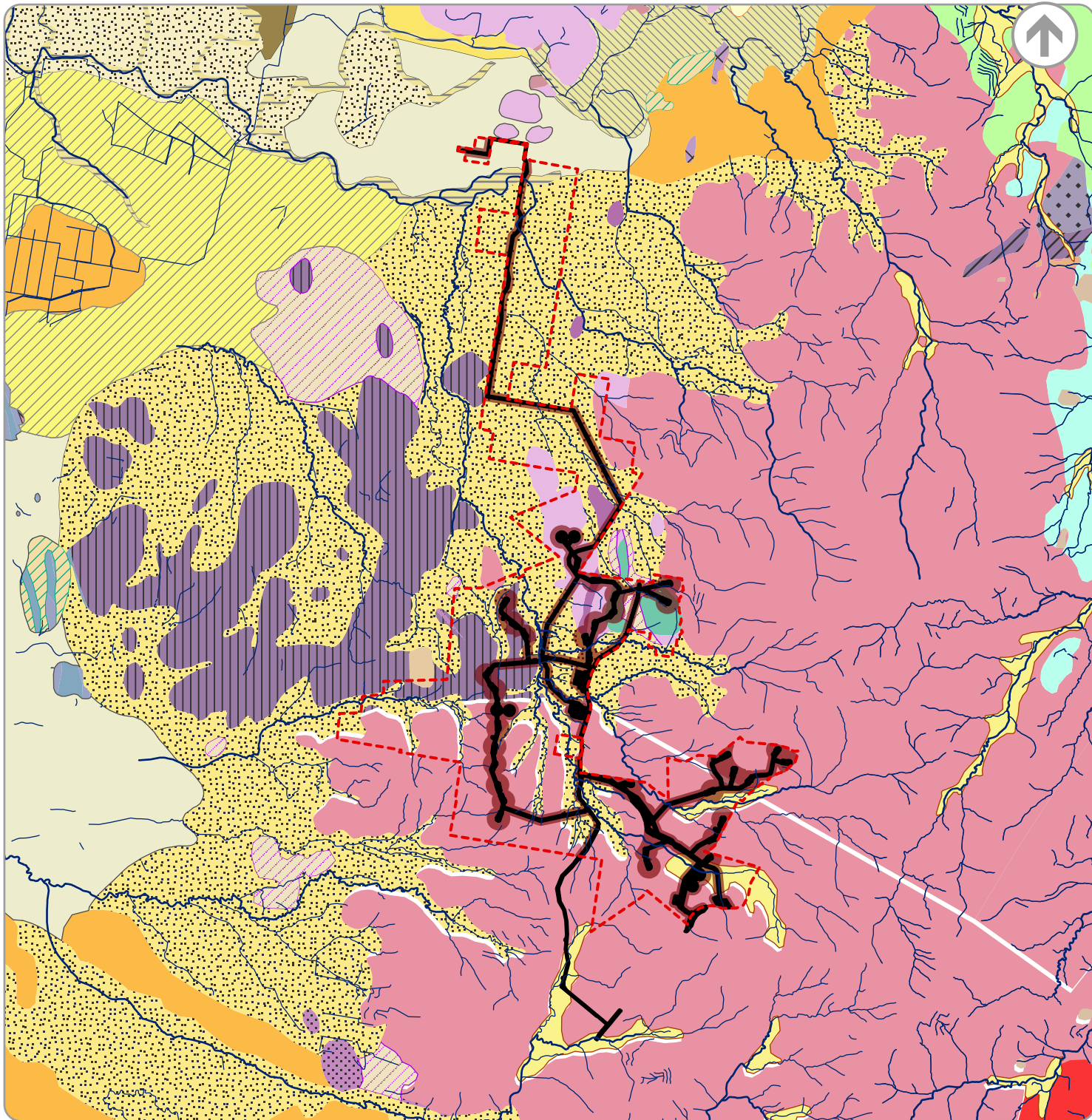
The sodium chloride dominated samples collected from the Project Area exhibited a moderate concentration (based on the logarithmic scale of Gibbs [1970]) of total dissolved salts (approximately 129 to 406 mg/L, inferred from specific conductivity levels of 192 to 606  $\mu\text{S}/\text{cm}$ ) (Figure 8). Catchment geology, groundwater expressions and interflow likely influence the ionic composition and salt concentration in surface waters of the Project Area.



**Figure 8 Gibbs (1970) diagrams and ionic balance of surface water samples collected from the Project Area, 22-24 July 2025**



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- |                                                                                                                                       |                                                                                                                                              |                                                                                                                                         |                                                                                                                       |                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <span style="border: 1px dashed red; padding: 2px;"> </span> Project Area                                                             | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Marra Creek Formation - channelised backplain facies | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Alluvial floodplain deposits                    | <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Dubbo Volcanics - trachyte    | <span style="background-color: pink; border: 1px solid black; padding: 2px;"> </span> Obley Granite                                    |
| <span style="background-color: black; border: 1px solid black; padding: 2px;"> </span> Construction footprint                         | <span style="background-color: lightyellow; border: 1px solid black; padding: 2px;"> </span> Marra Creek Formation - back plain facies       | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Alluvial floodplain deposits - backplain facies | <span style="background-color: lightgreen; border: 1px solid black; padding: 2px;"> </span> Pilliga Sandstone         | <span style="background-color: teal; border: 1px solid black; padding: 2px;"> </span> Tantitha Ultramafic Complex                      |
| <span style="background-color: brown; border: 1px solid black; padding: 2px;"> </span> Micrositing corridor                           | <span style="background-color: lightyellow; border: 1px solid black; padding: 2px;"> </span> Marra Creek Formation - channel facies          | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Alluvial fan deposits                           | <span style="background-color: red; border: 1px solid black; padding: 2px;"> </span> Turtle Rock Volcanics - trachyte | <span style="background-color: lightpink; border: 1px solid black; padding: 2px;"> </span> Ungrouped Ordovician sedimentary units      |
| <span style="color: blue;">—</span> Waterway                                                                                          | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Marra Creek Formation - meander plain facies         | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Alluvial valley deposits - terraced             | <span style="background-color: lightblue; border: 1px solid black; padding: 2px;"> </span> Napperby Formation         | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Ungrouped Ordovician sedimentary units - chert |
| <u>Surface Geology</u>                                                                                                                | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Trangie Formation - meander plain facies             | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Colluvium                                       | <span style="background-color: brown; border: 1px solid black; padding: 2px;"> </span> Timbregongie Granite           | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Mugincoble Chert                               |
| <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Alluvial terrace deposits - high-stand facies |                                                                                                                                              | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Colluvial and residual deposits                 | <span style="background-color: blue; border: 1px solid black; padding: 2px;"> </span> Hervey Group                    | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Toongi Group                                   |
| <span style="background-color: brown; border: 1px solid black; padding: 2px;"> </span> Residual deposits - ferruginous                |                                                                                                                                              | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Residual deposits                               | <span style="background-color: blue; border: 1px solid black; padding: 2px;"> </span> Hyandra Creek Group             | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Saint Andrews beds                             |
| <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Bugwah Formation - meander plain facies       |                                                                                                                                              | <span style="background-color: brown; border: 1px solid black; padding: 2px;"> </span> Dubbo Volcanics                                  | <span style="background-color: blue; border: 1px solid black; padding: 2px;"> </span> Dulladerry Volcanics            | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Cotton Formation                               |
|                                                                                                                                       |                                                                                                                                              |                                                                                                                                         | <span style="background-color: brown; border: 1px solid black; padding: 2px;"> </span> Canonbar Igneous Complex       |                                                                                                                                        |

0 5km

## SURFACE GEOLOGY OF THE STUDY AREA

Wallaby Creek Wind Farm- Aquatic Ecology Assessment

**FIGURE 9**

## 4.4 Aquatic flora

A total of 16 aquatic (or semi-aquatic) plant species were recorded from the Project Area (Table 8). All native aquatic flora species detected are common species. Two species are introduced. No threatened aquatic flora species were detected, nor are threatened aquatic flora species likely to occur in the Project Area (Section 4.6.1).

Most aquatic flora species encountered within the Project Area were semi-aquatic species including fringing and emergent grasses, forbs, sedges and rushes. Submerged macrophytes were limited to branched algae (*Nitella* sp.). The greatest species richness was recorded from site 5B, being on a spring/seep-fed reach of Jacks Creek.

Table 8 Aquatic flora recorded from the Project Area, 22-24 July 2025

| Scientific name                      | Common name            | Site |   |   |   |    |    |   |   |   |    |    |    |    |    |    |    |    |  |
|--------------------------------------|------------------------|------|---|---|---|----|----|---|---|---|----|----|----|----|----|----|----|----|--|
|                                      |                        | 1    | 2 | 3 | 4 | 5A | 5B | 6 | 7 | 8 | 9A | 9B | 10 | 11 | 12 | 13 | 14 | 15 |  |
| <i>Callitriche</i> sp.               | -                      |      |   |   |   |    |    |   |   |   |    |    | L  | L  |    | L  |    |    |  |
| <i>Cycnogeton procerum</i>           | Water ribbons          |      |   |   |   |    | L  |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Cyperus difformis</i>             | Dirty dora             |      |   |   |   |    |    |   |   |   |    |    | L  | L  |    |    |    |    |  |
| <i>Cyperus eragrostis</i> *          | Umbrella sedge*        |      |   |   | L |    |    |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Diplachne fusca</i>               | Brown beetle grass     |      |   |   |   |    | L  |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Duma florulenta</i>               | Lignum                 | L    |   |   |   |    |    |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Eleocharis plana</i>              | Flat spike-sedge       |      | S |   | S |    | L  |   |   | L |    |    |    |    |    |    |    |    |  |
| <i>Juncus usitatus</i>               | Common rush            |      | E | L | M | L  | E  | S | S |   | S  | S  | S  | S  | L  | S  | L  | L  |  |
| <i>Ludwigia peploides</i>            | Water primrose         |      |   | L |   |    |    |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Nitella</i> sp.                   | Branched algae         |      |   |   |   |    | L  |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Persicaria decipiens</i>          | Slender knotweed       |      |   |   |   |    | L  | L | L |   |    |    | L  | L  |    | L  |    |    |  |
| <i>Phragmites australis</i>          | Common reed            |      |   |   |   |    |    |   |   |   |    |    |    |    |    | L  |    |    |  |
| <i>Polygonum plebeium</i>            | Small knotweed         |      |   |   |   |    | L  |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Ranununculus</i> sp.              | River buttercup        |      |   |   |   |    | L  |   |   |   |    |    |    |    |    |    |    |    |  |
| <i>Typha domingensis</i>             | Narrow-leaved cumbungi |      |   |   |   |    |    |   |   | L |    |    | L  | L  |    |    |    |    |  |
| <i>Veronica anagallis-aquatica</i> * | Blue water speedwell*  |      |   | L |   |    | L  |   |   |   |    |    | L  | L  |    |    |    |    |  |
| Species richness                     |                        | 1    | 2 | 3 | 3 | 1  | 9  | 2 | 2 | 2 | 1  | 1  | 6  | 6  | 1  | 4  | 1  | 1  |  |

Notes: \* denotes introduced species; L = 1-10% (little); S = 10-50% (some); M = 50-75% (moderate); E = >75% (extensive).



## 4.5 Aquatic fauna

### 4.5.1 Fin-fish

Three species were recorded from 272 fin-fishes captured from the Project Area (Table 9). This comprised the native cryptic carp gudgeon (*Hypseleotris acropinna*) and the pest fish species goldfish (*Carassius auratus*)\* and mosquitofish (*Gambusia holbrooki*)\*. A specimen of each was photographed on site (Plate 3).

**Table 9 Fin-fishes recorded from the Project Area, 22-24 July 2025**

| Scientific name               | Common name          | Site |   |    |    |     |   |   |    |    |    |    |
|-------------------------------|----------------------|------|---|----|----|-----|---|---|----|----|----|----|
|                               |                      | 3    | 4 | 5A | 5B | 6   | 7 | 8 | 9A | 10 | 11 | 13 |
| <i>Carassius auratus</i> *    | Goldfish*            | -    | - | -  | -  | -   | - | - | -  | 2  | -  | -  |
| <i>Gambusia holbrooki</i> *   | Mosquitofish*        | -    | - | 4  | 21 | 158 | - | - | -  | 38 | 25 | -  |
| <i>Hypseleotris acropinna</i> | Cryptic carp gudgeon | -    | - | -  | -  | 3   | - | - | -  | 5  | -  | 16 |
| Number of individuals         |                      | -    | - | 4  | 21 | 161 | - | - | -  | 45 | 25 | 16 |
| Species richness              |                      | -    | - | 1  | 1  | 2   | - | - | -  | 3  | 1  | 1  |

Notes:

\* denotes introduced species.



Goldfish (*Carassius auratus*)\*



Mosquitofish (*Gambusia holbrooki*)\*



Cryptic carp gudgeon (*Hypseleotris acropinna*)

### Plate 3 Fish captured from the Project Area, July 2025

Carp gudgeons (*Hypseleotris* spp.) are found in slow-moving or still waters, normally associated with macrophytes or other aquatic vegetation (Lintermans 2023). They are widespread and abundant in the MDB where there are four sexual species present (western, bald, boofhead and cryptic carp gudgeons) as well as multiple hybrids of the latter three species (Lintermans 2023).

Carp gudgeons are relatively mobile and have been recorded moving up to 2 km in four days, and up to 13.7 km upstream over 12 months (Lintermans 2023).

Pest fish species are discussed in Section 4.7.2.

Fish community health across NSW waterways has been mapped by DPIRD (2025d) using metrics for Expectedness, Nativeness and Recruitment to spatially represent the status of fish communities across NSW. The resulting NSW Freshwater Fish Community Status mapping (DPIRD 2025d) identifies Wallaby Creek within the Project Area as Poor (Figure 10). The Poor status of the fish communities in the Project Area is supported by the low species richness and prevalence of pest fish species observed by DPM Envirosciences in July 2025.

#### 4.5.2 Platypus

Suitable habitat for platypus was not encountered within the Project Area. No platypus burrows were encountered at any of the 17 aquatic habitat assessment sites, despite targeted searches at each site. It is considered unlikely that platypus occupies the Project Area.

#### 4.5.3 Turtles

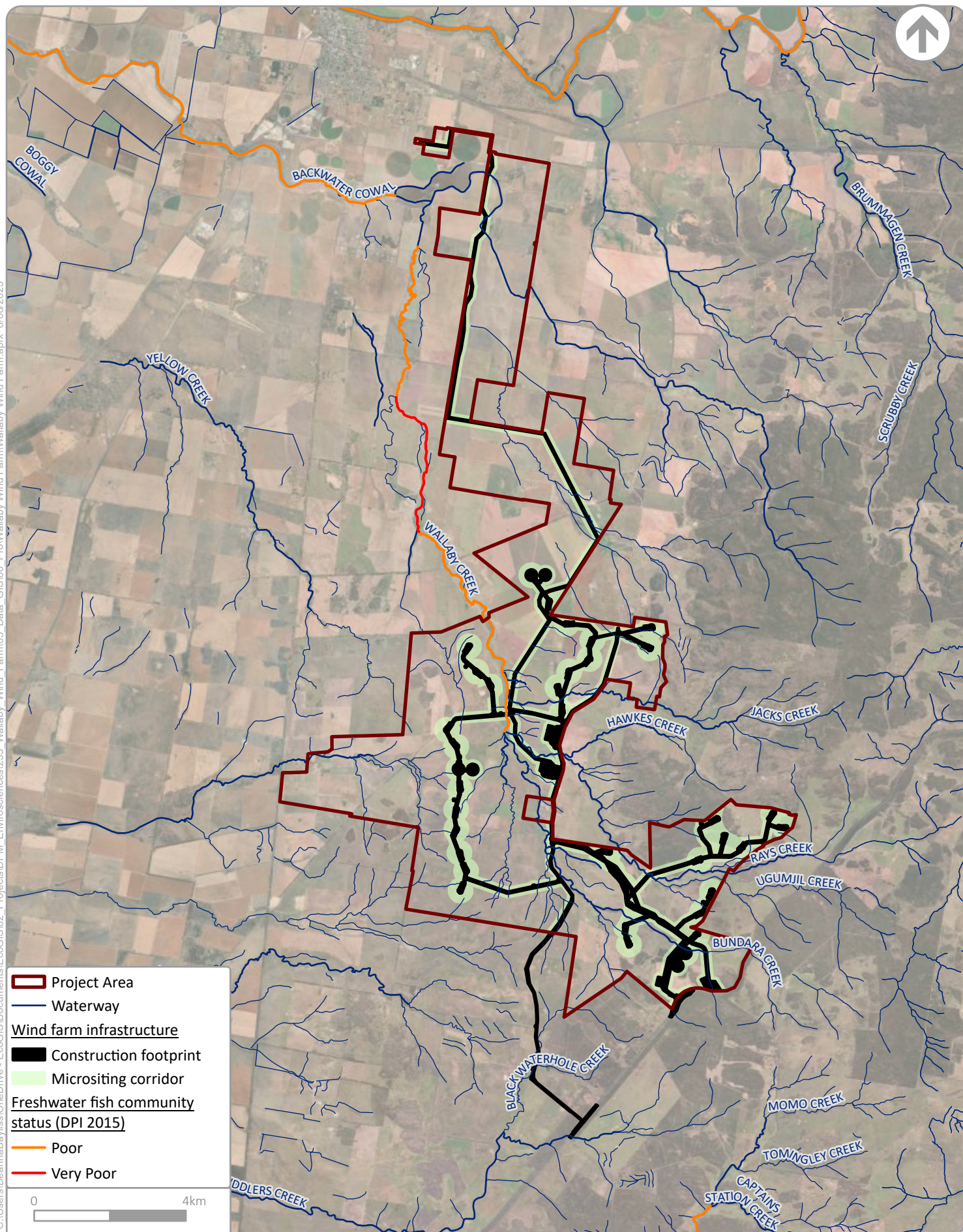
No turtles were detected within the Project Area during the field surveys 22-24 July 2025. However, no dedicated turtle survey effort was undertaken. Remnants of an old shell belonging to an eastern long-neck turtle (*Chelodina longicollis*) was opportunistically detected at site 15 on Bundara Creek (Appendix B). The eastern long-neck turtle is a common, widespread and highly mobile species throughout the MDB and all eastern flowing rivers in NSW (and other states). Another two common species, the Macquarie turtle (*Emydura macquarii*) and broad-shelled river turtle (*Chelodina expansa*), may occupy the waterways and dams of the Project Area on occasion.

#### 4.5.4 Macrocrustaceans

Two macro-crustacean species: inland yabby (*Cherax destructor*) and glass shrimp (*Paratya australiense*), were opportunistically encountered within the Project Area during backpack electrofishing. Inland yabby was detected at all 11 wetted sites. Glass shrimp was detected only at sites 6 and 10 on Ugumjil Creek (Appendix B).



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## NSW FRESHWATER FISH COMMUNITY STATUS

Wallaby Creek Wind Farm - Aquatic Ecology Assessment

**FIGURE 10**

## 4.6 Threatened species and ecological communities

### 4.6.1 Turtles

No threatened turtle species are likely to occur in the Project Area, nor in the broader Macquarie-Bogan River catchment.

### 4.6.2 Aquatic flora

No threatened aquatic flora species listed under the EPBC Act, BC Act or FM Act were recorded from the desktop searches, nor during the surveys. No threatened aquatic flora species are likely to occur within the Project Area.

### 4.6.3 Aquatic fauna

No threatened fauna species listed under the EPBC Act, BC Act or FM Act were recorded during the surveys. Desktop searches (Section 3.4) identified eight threatened fish species, or their potential habitats, as having been recorded from within 50 km of the Project Area, comprising (Table 10):

- western population of olive perchlet (*Ambassis agassizii*) – Endangered (FM Act);
- silver perch (*Bidyanus bidyanus*) – Endangered (EPBC Act), Vulnerable (FM Act);
- flathead galaxias (*Galaxia rostratus*) – Critically Endangered (EPBC Act and FM Act);
- trout cod (*Maccullochella macquariensis*) – Endangered (EPBC Act and FM Act);
- Murray cod (*Maccullochella peelii*) – Vulnerable (EPBC Act);
- Macquarie perch (*Macquaria australasica*) – Endangered (EPBC Act and FM Act);
- southern purple spotted gudgeon (*Mogurnda adspersa*) – Endangered (FM Act); and
- Murray-Darling Basin population of eel-tailed catfish (*Tandanus tandanus*) – Endangered (FM Act).

Whilst waterways mapped as part of the indicative distribution of threatened fish species occur within 50 km of the Project Area, no such waterways are mapped within the Project Area itself (DPIRD 2025a).

It is unlikely that these threatened species occur within waterways of the Project Area as either resident or transient occurrences (Table 10). The waterways of the Project Area lack habitat features suitable for silver perch, trout cod, Murray cod, Macquarie perch and eel-tailed catfish (Table 10 and Appendix B). Whilst the waterways of the Project Area may represent suitable habitat for the olive perchlet, flathead galaxias and southern purple spotted gudgeon, there are no records from within 50 km of the Project Area, and these species were not detected during targeted fish surveys within the Project Area.

It is concluded that threatened fish species are unlikely to occur within the Project Area. Therefore, the requirement for an assessment of significance has not been triggered.



Table 10 Threatened aquatic fauna species recorded from the desktop Search Area

| Scientific name                                | Common name                         | Status                |                     | Preferred habitat                                                                                                                                                     | Likelihood of occurrence within the Project Area based on desktop assessment                                                                                                                                                                                                           | Likelihood of occurrence within the Project Area post field survey                                                                                                | Data Source         |                           |                       |          |
|------------------------------------------------|-------------------------------------|-----------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------|-----------------------|----------|
|                                                |                                     | EPBC Act <sup>1</sup> | FM Act <sup>2</sup> |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                   | DCCEEW 2025a (PMST) | NSW DCCEEW 2025a (BioNet) | DPIRD 2025a (mapping) | ALA 2025 |
| <i>Ambassis agassizii</i> (western population) | Olive perchlet (western population) | -                     | E                   | Slow-flowing or still waters of rivers, creeks, ponds, reservoirs, drainage ditches and swamps (Allen, Midgley and Allen 2002).                                       | <b>Potential.</b> The nearby Macquarie River is mapped as part of this species' indicative distribution (DPIRD 2025a). Recorded from the Bogan River at Nyngan, but no records from within 50 km of the Project Area (ALA 2025).                                                       | <b>Unlikely.</b> Potential habitat occurs within the Project Area. However, species not detected within the Project Area despite targeted survey effort.          |                     |                           | ✓                     |          |
| <i>Bidyanus bidyanus</i>                       | Silver perch                        | E                     | V                   | Free-flowing waters including a wide variety of riverine environments, from meandering alluvial, lowland reaches to clear, rocky upland reaches (DCCEEW 2024).        | <b>Unlikely.</b> Species or species habitat 'known' to occur within the broader Search Area (DCCEEW 2025a). The nearby Macquarie River is mapped as part of this species' indicative distribution (DPIRD 2025a). However, no records from within 50 km of the Project Area (ALA 2025). | <b>Unlikely.</b> Species and species habitat not detected within the Project Area.                                                                                | ✓                   |                           | ✓                     |          |
| <i>Galaxia rostratus</i>                       | Flathead galaxias                   | CE                    | CE                  | Inhabits a variety of habitats including billabongs, lakes, swamps and rivers, with a preference for still or slow flowing waters; schooling in midwater (DotE 2016). | <b>Potential.</b> Backwater Cowal, approximately 3 km downstream of the Project Area, is mapped as part of the species' indicative distribution (DPIRD 2025a). However, no records from within 50 km of the Project Area (ALA 2025).                                                   | <b>Unlikely.</b> Marginal potential habitat occurs within the Project Area. However, species not detected within the Project Area despite targeted survey effort. |                     |                           | ✓                     |          |

| Scientific name                     | Common name | Status                |                     | Preferred habitat                                                                                                                                                                                                                                                                      | Likelihood of occurrence within the Project Area based on desktop assessment                                                                                                                                                                                                                                                                              | Likelihood of occurrence within the Project Area post field survey                 | Data Source         |                           |                       |          |
|-------------------------------------|-------------|-----------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------|---------------------------|-----------------------|----------|
|                                     |             | EPBC Act <sup>1</sup> | FM Act <sup>2</sup> |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |                                                                                    | DCCEEW 2025a (PMST) | NSW DCCEEW 2025a (BioNet) | DPIRD 2025a (mapping) | ALA 2025 |
| <i>Maccullochella macquariensis</i> | Trout cod   | E                     | E                   | Lowland, turbid and slow-flowing rivers (Lintermans 2007), occupying stream positions with a high abundance of large woody debris in deep water close to riverbanks (DCCEEW 2025b).                                                                                                    | <b>Unlikely.</b> Species or species habitat 'likely' to occur within the broader Search Area (DCCEEW 2025a). The nearby Macquarie River is mapped as part of this species' indicative distribution (DPIRD 2025a). Recorded from within 50 km of the Project Area, near Dubbo (ALA 2025). However, suitable habitat unlikely to occur within Project Area. | <b>Unlikely.</b> Species and species habitat not detected within the Project Area. | ✓                   |                           | ✓                     | ✓        |
| <i>Maccullochella peelii</i>        | Murray cod  | V                     | -                   | Deep water with in-stream habitat such as boulders, logs, and overhanging vegetation (Allen et al. 2002). From fast-moving clear upland streams to slow-flowing turbid lowland waters. Most individuals stay within a 10 km reach of the river (Pusey et al. 2004; Allen et al. 2002). | <b>Unlikely.</b> Species or species habitat 'known' to occur within the Search Area (DCCEEW 2025a). Recorded from the Macquarie River at Narromine (ALA 2025). However, suitable habitat unlikely to occur within Project Area.                                                                                                                           | <b>Unlikely.</b> Species and species habitat not detected within the Project Area. | ✓                   |                           |                       | ✓        |

| Scientific name               | Common name                     | Status                |                     | Preferred habitat                                                                                                                                                                                                                                                                                                                                                                                                             | Likelihood of occurrence within the Project Area based on desktop assessment                                                                                                                                                                                                        | Likelihood of occurrence within the Project Area post field survey                                                                                      | Data Source         |                           |                       |          |
|-------------------------------|---------------------------------|-----------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------|-----------------------|----------|
|                               |                                 | EPBC Act <sup>1</sup> | FM Act <sup>2</sup> |                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                     |                                                                                                                                                         | DCCEEW 2025a (PMST) | NSW DCCEEW 2025a (BioNet) | DPIRD 2025a (mapping) | ALA 2025 |
| <i>Macquaria australasica</i> | Macquarie perch                 | E                     | E                   | Clear water and deep, rocky holes with lots of cover such as aquatic vegetation, large boulders, debris and overhanging banks (DCCEEW 2025b). Once widespread throughout the cooler upper reaches of the southern tributaries of the MDB in Victoria and NSW (DCCEEW 2025b). Now considered isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW (Ingram et al. 1990, cited in DCCEEW 2025b). | <b>Unlikely.</b> Species or species habitat 'may' occur within the Search area (DCCEEW 2025a). Current known distribution unlikely to extend to the Project Area. No species' indicative distribution (DPIRD 2025a) nor records mapped within 50 km of the Project Area (ALA 2025). | <b>Unlikely.</b> Species and species habitat not detected within the Project Area.                                                                      | ✓                   |                           |                       |          |
| <i>Mogurnda adspersa</i>      | Southern purple spotted gudgeon | -                     | E                   | Slow moving or still waters of creeks, rivers, wetlands and billabongs, preferring slower flowing, deeper habitats (Lintermans 2023). Usually associated with good cover of aquatic vegetation in its southern range (Lintermans 2023). Occurs in the MDB as well as parts of coastal northern NSW and Queensland, but now rare in inland NSW.                                                                                | <b>Potential.</b> Nearby waterways are mapped as part of the species' indicative distribution, although no such mapped waterways within the Project Area (DPIRD 2025a). Recorded from within 50 km of the Project Area, near Dubbo (ALA 2025).                                      | <b>Unlikely.</b> Marginal habitat occurs within the Project Area. However, species not detected within the Project Area despite targeted survey effort. |                     |                           | ✓                     | ✓        |



| Scientific name                           | Common name                         | Status                |                     | Preferred habitat                                         | Likelihood of occurrence within the Project Area based on desktop assessment                                                                                                                                                                      | Likelihood of occurrence within the Project Area post field survey                 | Data Source         |                           |                       |          |
|-------------------------------------------|-------------------------------------|-----------------------|---------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------|---------------------------|-----------------------|----------|
|                                           |                                     | EPBC Act <sup>1</sup> | FM Act <sup>2</sup> |                                                           |                                                                                                                                                                                                                                                   |                                                                                    | DCCEEW 2025a (PMST) | NSW DCCEEW 2025a (BioNet) | DPIRD 2025a (mapping) | ALA 2025 |
| <i>Tandanus tandanus</i> (MDB population) | Eel-tailed catfish (MDB population) | -                     | E                   | Slow-flowing streams and lake habitats (Lintermans 2023). | <b>Unlikely.</b> The nearby Macquarie River is mapped as part of this species' indicative distribution (DPIRD 2025a). Recorded from the Macquarie River at Narromine (ALA 2025). However, suitable habitat unlikely to occur within Project Area. | <b>Unlikely.</b> Species and species habitat not detected within the Project Area. |                     |                           | ✓                     | ✓        |

#### Notes:

CE = Critically Endangered, E = Endangered, V = Vulnerable.

<sup>1</sup> EPBC Act = status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

<sup>2</sup> FM Act = status under the NSW *Fisheries Management Act 1994*.

#### Data sources:

- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2025a, EPBC Act Protected Matters Report – Project Area plus 50 km buffer – created 17 July 2025.
- NSW Department of Climate Change, Energy, the Environment and Planning (NSW DCCEEW) 2025a, BioNet Atlas – Project Area plus 50 km buffer – created 17 July 2025.
- NSW Department of Primary Industries and Regional Development (DPIRD) 2025a, indicative distribution mapping for freshwater threatened fish species and populations in NSW, available for viewing in the Fisheries NSW Spatial Data Portal (DPIRD 2025b) – Project Area plus 50 km – searches 17 July 2025.
- Atlas of Living Australia (ALA) 2025 – Project Area plus 50 km – searches 17 July 2025.

#### 4.6.4 Aquatic Endangered Ecological Communities

Four aquatic Endangered Ecological Communities (EECs) are listed under the FM Act in NSW, comprising aquatic ecological communities in the:

- lower Murray River catchment;
- lowland catchment of the Darling River;
- lowland catchment of the Lachlan River; and
- catchment of the Snowy River.

The Project Area does not fall within an area containing aquatic EECs.

The Sappa Bulga range represents the south-eastern extent of the GAB watershed and GAB mound springs are known to occur in the catchment of the Project Area (ANPSA 2025). Mound springs occur where consistent surface expressions of groundwater sustain vegetative growth through extreme droughts over time, where the sustained plants and algae filter and retain windblown particles and water-soluble minerals, building up a mound over time. No mound springs were recorded in the vicinity of proposed waterway crossings visited by DPM Envirosciences in July 2025. Vegetation mapping of the broader Project Area was undertaken by ERM and did not identify any communities consistent with the 'Artesian Springs Ecological Community in the GAB' (Critically Endangered under the BC Act) nor 'the community of native species dependent on natural discharge of groundwater from the GAB' TEC (Endangered under the EPBC Act).

### 4.7 Introduced species

#### 4.7.1 Introduced aquatic flora

Two widespread, introduced aquatic plant species were detected within representative aquatic habitats of the Project Area, comprising umbrella sedge (*Cyperus eragrostis*)\* and blue water speedwell (*Veronica anagallis-aquatica*)\*. Although introduced, umbrella sedge and blue water speedwell are not known to be particularly problematic to aquatic ecosystems, nor to agricultural grazing enterprises.

#### 4.7.2 Pest fish species

Pest fishes can cause a variety of issues within the aquatic environment, such as competing with native fish for food and habitat, preying on native species, habitat disturbance and introduction of disease. Established introduced species typically have a wide range of environmental tolerances, habitat requirements and food requirements. In addition, they tend to have high reproductive rates and be early maturing, allowing populations to become readily established. These attributes often allow introduced fishes to be more adaptable to changes in the environment, whether natural or manmade, than some native fish species.

The pest fish species goldfish (*Carassius auratus*)\* was detected only at site 10 on Ugumjil Creek (Appendix B). The goldfish is an ornamental fish introduced to Australia as aquarium fish, but once released, colonised many Australian freshwater systems. The goldfish is now well established in the MDB (Allen et al. 2002). However, unlike common carp (*Cyprinus carpio*), the goldfish is not known to have formed large, problematic populations.

The pest fish species mosquitofish (*Gambusia holbrooki*)\* was detected at five of the 11 wetted sites sampled (Section 4.5.1). Mosquitofish are likely to push up into other waterways of the

broader Project Area during times of flow and connectivity. Mosquitofish are a small but aggressive species that chase and fin-nip fish much larger than themselves. They also prey on the eggs of native fish and frogs and larval native fish, and significantly reduce growth rates of small native fish (Lintermans 2023). Mosquitofish are implicated in the decline of many native fish species, including the purple spotted gudgeon. Suggested mitigation measures to reduce the risk of spreading mosquitofish are provided in Section 6.2.

## 4.8 Wetlands

### 4.8.1 Wetlands of International Importance

There are no wetlands of International Importance (i.e. Ramsar wetlands) identified within the Project Area or broader desktop Search Area in the EPBC Act Protected Matters Search Tool (DCCEEW 2025a). Wetlands of International Importance nearest to the Project Area are those of the Macquarie Marshes Nature Reserve, approximately 150 km (direct line) to the northwest.

### 4.8.2 Wetlands of National importance

Nationally important wetlands are listed in the Directory of Important Wetlands in Australia (DCCEEW 2025c). Wetlands of National importance nearest to the Project Area are those of the broader Macquarie Marshes, approximately 80 km (direct line) to the northwest.

## 4.9 Groundwater-dependent ecosystems

GDEs are ecosystems that rely upon groundwater for their continued existence. They may be 100% dependent on groundwater, such as aquifer GDEs, or may access groundwater intermittently to supplement their water requirements, such as riparian tree species in arid and semi-arid areas (IESC 2018). GDEs include subterranean, surface expression and terrestrial GDEs. Surface expression (aquatic) GDEs are those ecosystems dependent on the surface expression of groundwater and include river baseflow systems, springs and swamps. Surface expression GDEs of the Project Area are considered further below.

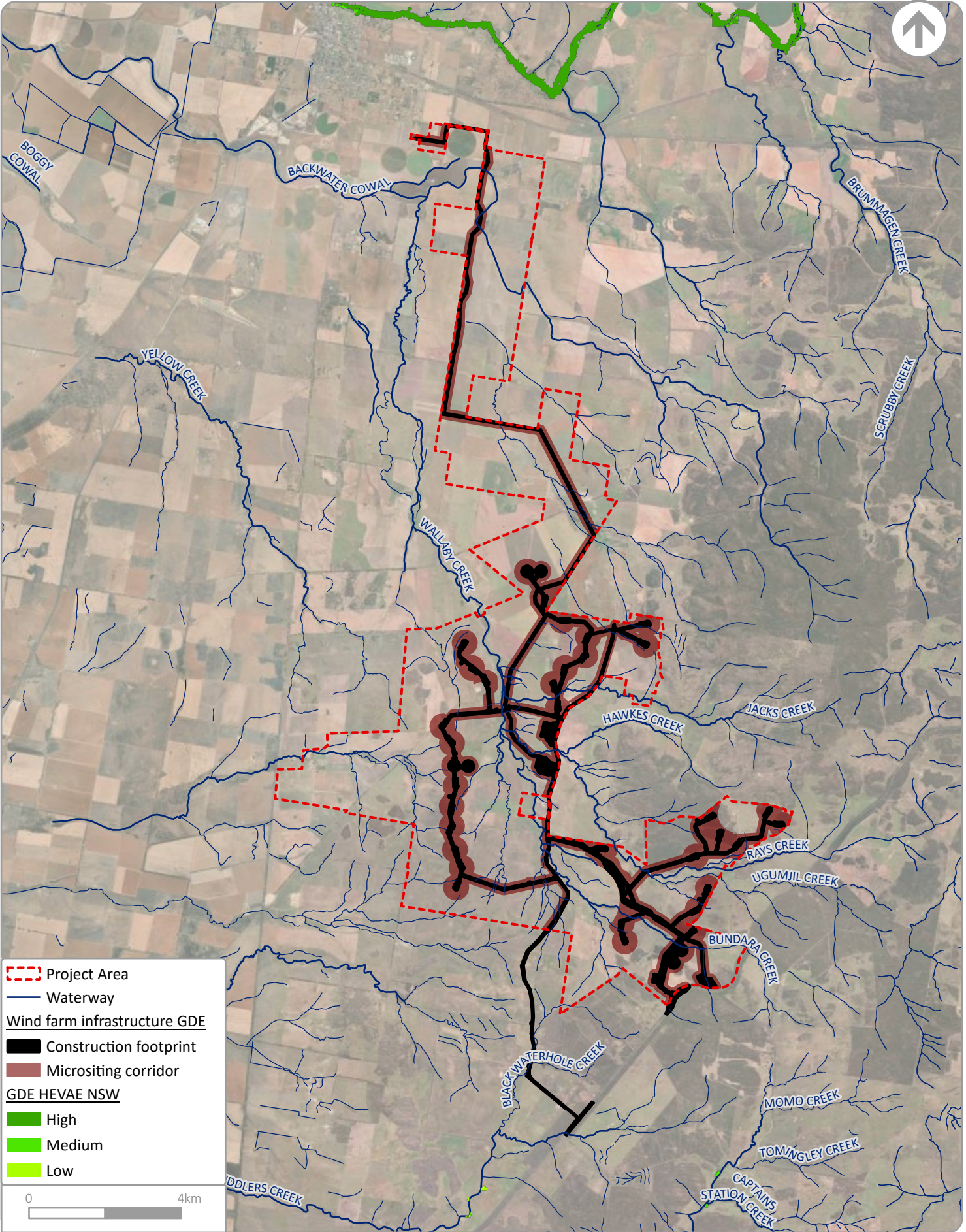
Desktop mapping of potential High Ecological Value Aquatic GDEs throughout NSW (NSW Department of Climate Change, Energy, the Environment and Water [NSW DCCEEW] 2025b) shows High Value aquatic GDEs on the Macquarie River at Narromine, but no known or derived aquatic GDEs within the Project Area (Figure 11).

Aquatic assessment at 17 sites suggests that Jacks Creek (sites 5B and 8), Rays Creek (site 13), Ugumjil Creek (sites 6, 7, 10 and 11) and Wallaby Creek (site 5A), likely incur some contribution from springs or seeps and are therefore aquatic GDEs. Waterways that are likely surface expression GDEs of the Project Area are presented as Figure 12.

GAB mound springs are known to occur in the catchment of the Project Area (ANPSA 2025). Mound springs occur where consistent surface expressions of groundwater sustain vegetative growth through extreme droughts over time, where the sustained plants and algae filter and retain windblown particles and water-soluble minerals, building up a mound over time. No mound springs were identified in the vicinity of proposed waterway crossings visited by DPM Envirosciences in July 2025. Vegetation mapping of the broader Project Area was undertaken by ERM and did not identify any areas consistent with the 'Artesian Springs Ecological Community in the GAB' (Critically Endangered under the BC Act) nor 'the community of native species dependent on natural discharge of groundwater from the GAB' TEC (Endangered under the EPBC Act).



\*C:\Users\DeannaBayliss\OneDrive - EcoGIS\Documents\EcoGIS02 - Projects\DPM - Envirosiences\255 Wallaby Wind Farm\Wallaby Wind Farm.aprx 8/08/2025

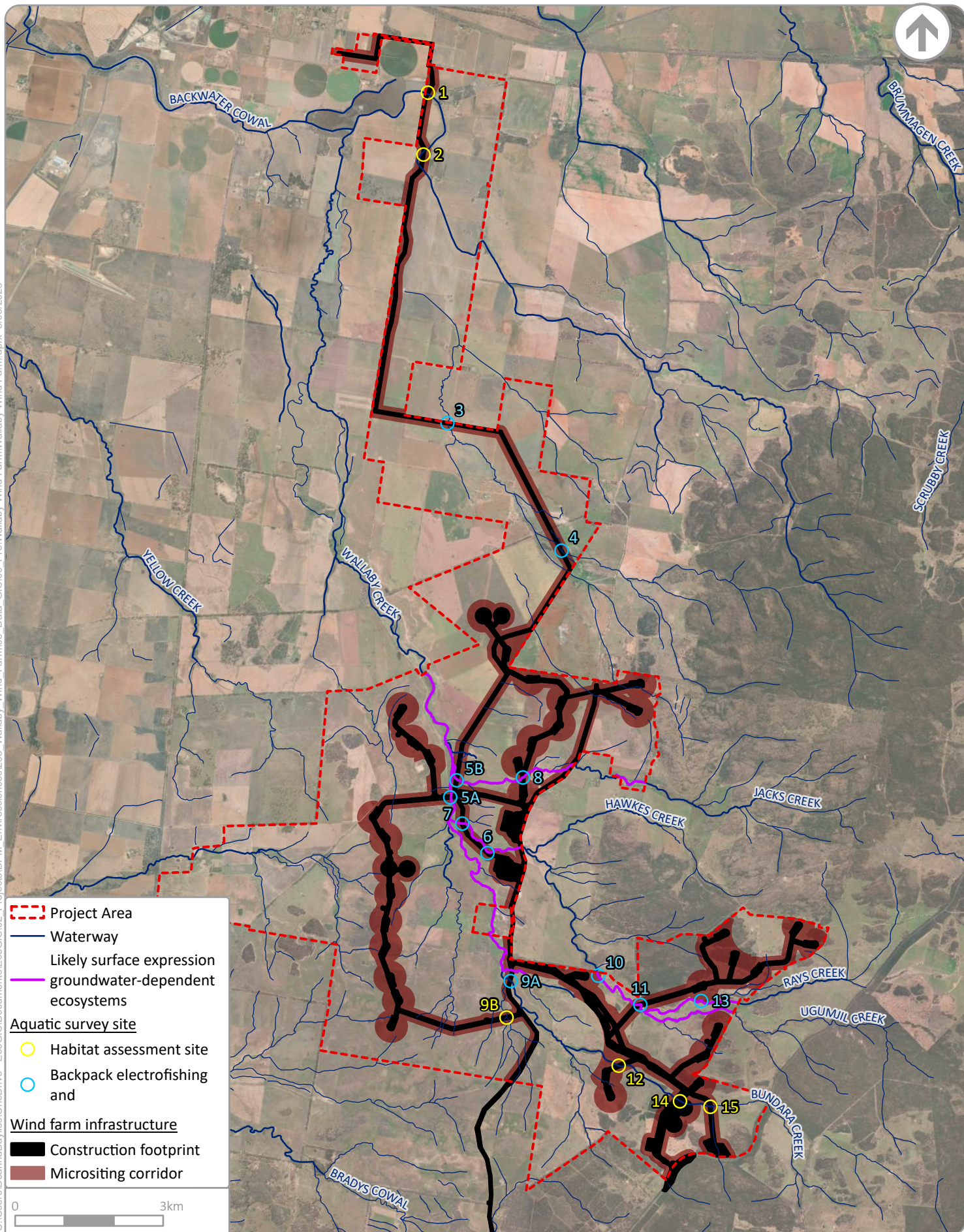


## STATE-MAPPED HIGH ECOLOGICAL VALUE AQUATIC GDES

Wallaby Creek Wind Farm - Aquatic Ecology Assessment

FIGURE 11





## FIELD-VERIFIED LIKELY SURFACE EXPRESSION GDES

Wallaby Creek Wind Farm- Aquatic Ecology Assessment

**FIGURE 12**



## 4.10 Matters of National Environmental Significance

### World and National Heritage properties

No World Heritage Properties or National Heritage Places are identified for the Search Area in the EPBC Act Protected Matters Report (DCCEEW 2025a, Appendix A).

### Wetlands of International Importance

There are no wetlands of International Importance (i.e. Ramsar wetlands) identified within the Project Area or broader desktop Search Area in the EPBC Act Protected Matters Search Tool (DCCEEW 2025a). Wetlands of International Importance nearest to the Project Area are those of the Macquarie Marshes Nature Reserve, approximately 150 km (direct line) to the northwest. Wetlands of International Importance are well removed from the Project Area.

### Threatened Ecological Communities

No EPBC Act listed TECs, relevant to aquatic ecology, are identified from the Search Area (DCCEEW 2025a). No aquatic TECs were identified at the waterway crossings assessed by DPM Envirosciences in July 2025.

GAB mound springs are known to occur in the catchment of the Project Area (ANPSA 2025). No mound springs were identified in the vicinity of proposed waterway crossings visited by DPM Envirosciences in July 2025. Vegetation mapping of the broader Project Area was undertaken by ERM and did not identify 'the community of native species dependent on natural discharge of groundwater from the GAB' TEC (Endangered under the EPBC Act).

### Threatened Species

No MNES aquatic flora or fauna species were detected during the field survey.

Based on the EPBC Act Protected Matters Report (DCCEEW 2025a, Appendix A) MNES aquatic fauna species, or their habitats, that are 'known' to occur in the broader desktop Search Area (DCCEEW 2025a) include the Endangered silver perch (*Bidyanus bidyanus*) and the Vulnerable Murray cod (*Maccullochella peelii*). This report also identified the Endangered trout cod (*Maccullochella macquariensis*), or its habitat, as 'likely' to occur in the broader desktop Search Area and the Endangered Macquarie Perch (*Macquaria australasica*) 'may' occur in the broader desktop Search Area (DCCEEW 2025a). However, these species were not encountered within the Project Area and are considered unlikely to occur (Section 4.6.3).

No MNES aquatic flora species are likely to occur within the Project Area (Section 4.6.2).

### Migratory Species

No aquatic migratory species (i.e. migratory species that live in water for most or all their lives) are identified from the Search Area.

### Commonwealth Marine Areas

The Project Area is located over 300 km west (direct line) of any Commonwealth Marine Area.

### Nuclear actions (including uranium mines)

The Project does not involve any nuclear actions.

### Water resource

Water resources are an MNES when in relation to coal seam gas and large coal mining developments. The Project is not a coal seam gas or coal mining development.

## 5 POTENTIAL IMPACTS

The Project involves the installation of 38 wind turbine generators, BESS and associated infrastructure, including transmission lines, substations, underground supply cables, batching plant, site compounds, accommodation camp, laydown areas, operations and maintenance facilities, hardstand areas and access roads/tracks.

No infrastructure, other than linear infrastructure, would be positioned within waterways. Waterways may be intersected by linear infrastructure, including access roads/tracks and underground electrical cables. Existing access tracks across waterways would be utilised where possible for construction and operation of the Project.

The placement of underground electrical cables through/beneath waterways would utilise either under-boring techniques, or open trench and backfill during times of no/low flow. The Proponent would consider cost, geotechnical and other environmental (including forecast weather) considerations in deciding which technique to employ at each crossing.

Potential impacts on aquatic ecology are largely confined to the construction phase. Construction activities have the potential to impact:

- channel morphology, hydraulic characteristics, and aquatic habitat within, upstream of, and downstream of, the construction area;
- water quality, due to erosion and sedimentation leading to locally increased dissolved and suspended solids, turbidity, nutrients and contaminants, and reduced dissolved oxygen levels;
- water quality, due to accidental release of drilling fluids from under-boring;
- aquatic and riparian ecological health and community assemblages, associated with the modification of habitat and changes in water quality;
- fish passage, albeit temporary and with impacts likely limited to resilient species well adapted to ephemeral and intermittent systems; and
- the behaviour of aquatic biota (including avoidance response, and reduced foraging) and physiology (including gill damage to fish) associated with increased suspended sediment concentrations and deposition.

### 5.1 Aquatic habitat

The placement of underground electrical cables and construction of permanent and temporary access tracks for the Project would result in minor modification of aquatic habitat at the location of proposed waterway crossings. These habitats comprise waterways with ephemeral to largely intermittent flow. However, Bundara, Jacks, Rays, Ugumjil and Wallaby creeks likely incur semi-permanent to permanent trickle flow contribution from springs and seeps.

Aquatic habitats of the Project Area are not expected to support aquatic species of conservation-significance listed under the EPBC Act, FM Act or BC Act (Section 4.6).

#### 5.1.1 Waterway crossings

There are approximately 39 waterway crossings proposed within the Project Area, where proposed access roads/tracks intersect a State-mapped waterway (Figure 2).

The construction of waterway crossings would result in the removal of aquatic habitat and riparian vegetation from the bed and banks of waterways. The waterway crossings for vehicles would comprise culvert or bed level crossings. The extent of impact for vehicle crossings is unknown at this point in time. However, a typical vehicle crossing is likely to directly impact a 10 m width of waterway plus indirectly impact an additional 5 m either side of the crossing, resulting in an



approximate 20 m-wide impact across the waterway. The construction of each waterway crossing is expected to take approximately one week.

The placement of underground electrical cables through waterways would utilise either under-boring techniques, or open trench and backfill during times of no/low flow. Underground electrical cables would be bored or trenched and placed beneath the stream bed. The extent of impact for electrical cable crossings is unknown at this point in time. However, a typical trench across a waterway is likely to directly impact a 5 m width of waterway plus indirectly impact an additional 5 m either side of the trench, resulting in an approximate 15 m-wide impact across the waterway. The construction of each waterway crossing is expected to take approximately one week.

Under-boring utilises trench-less techniques, such as horizontal directional drilling, which involves the use of a self-propelled drilling machine, excavator, drilling mud plant, and extraction of a small amount of water from the stream or a water tank. Catch pits are excavated on either side of the waterway at the beginning and end of the borehole to capture drilling mud returns.

Open trench crossings require clearing of vegetation, soil, rock and any large woody debris (if present), the installation of temporary coffer dams if required, the use of a flume pipe or pump and hoses to convey water through the construction area where necessary, as well as excavation and reinstatement of the bed and bank. The soil or sediment removed from the trench would be stockpiled and either used for backfilling or disposed of (away from the waterway, in accordance with an Erosion and Sediment Control Plan [Section 6]).

Direct impacts on aquatic habitat for vehicle crossings would be permanent. Direct impacts on aquatic habitat for cable crossings, and indirect impacts, would be localised, temporary and short in duration. Mitigation and management measures are discussed in Section 6.

### 5.1.2 Removal of Key Fish Habitat

The Project requires approximately 39 waterway crossings that would result in the direct loss of field-verified TYPE 2 and 3 KFH. The extent of KFH to be removed for these vehicle crossings or open trench infrastructure is unknown at this stage of the Project planning phase but would be calculated by the Proponent during the detailed design phase. Based on a worst-case scenario of impacting the full extent clearing corridors identified in the spatial data provided by ERM in July 2025, the Project has the potential to impact up to 27,877 m<sup>2</sup> of field-verified KFH. The field-verified KFH mapping prepared by DPM Envirosciences (Appendix C and provided separately as digital spatial data) should be used to inform the location and design of waterway crossings to avoid KFH, where possible, or minimise impacts to KFH. The field-verified KFH data can be used to position proposed waterway crossings to minimise impacts to KFH and to calculate associated offset obligations for KFH impacted by the Project.

## 5.2 Aquatic flora

Relatively minor occurrences of commonly occurring aquatic flora species (Section 4.4) would be removed for the construction of underground electrical cables and access tracks. No conservation-significant (EPBC Act, BC Act or FM Act) aquatic flora species are likely to be impacted. Similarly, no substantial macrophyte beds are likely to be impacted (Appendix C).

In the absence of suitable mitigation measures (Section 6.2), aquatic weeds, such as umbrella sedge (*Cyperus eragrostis*)\* and blue water speedwell (*Veronica anagallis-aquatica*)\*, could be spread by machinery during the construction phase. Although these species are of little ecological significance, weed hygiene measures would still be implemented (Section 6.2).

## 5.3 Aquatic fauna

Aquatic fauna within the Project Area could be impacted by habitat removal associated with the placement of underground electrical cables and construction of permanent and temporary access tracks (as discussed in Section 5.1). Without mitigation, impacts could extend to fish, turtles, platypus and aquatic invertebrates of downstream habitats. The Project has potential to impact on water quality and sedimentation of the Project Area and of downstream environments including those of the broader Macquarie-Bogan River. Potential impacts of sediment-laden water include increased turbidity (decreased light penetration resulting in decreased photosynthesis, oxygen levels, and food availability), smothering of foraging habitat such as aquatic vegetation and of interstitial spaces between large sediments, and gill damage to fish. However, with implementation of suitable water, sediment and erosion controls (Sections 6.2 and 6.4) during construction, operation and decommissioning of the Project, impacts on habitats of the Project Area and downstream environments are unlikely to occur. Consequently, significant impacts on aquatic fauna species are also unlikely.

### 5.3.1 Threatened fish

Habitat assessment and fish survey effort has determined that threatened fish species are unlikely to occur within the waterways of the Project Area as either resident or transient occurrences (Section 4.6.3). The Macquarie-Bogan river and tributaries, downstream of the Project Area, support fish species of conservation significance.

In the absence of suitable mitigation measures, the Project has potential to impact on water quality and sedimentation of downstream environments including the Macquarie-Bogan River, which in turn may impact the quality of habitat for threatened aquatic species. However, with implementation of suitable water, sediment and erosion controls (Sections 6.2 and 6.4) within the Project Area, impacts on downstream environments are unlikely. Consequently, the Project is not expected to have an adverse effect on downstream aquatic habitats such that threatened fish would be adversely impacted.

### 5.3.2 Fish passage

Poorly designed waterway crossings can create a barrier to fish passage, restricting and/or isolating fish communities and preventing access to fish habitats otherwise available to them. Poorly designed structures can kill or injure fish attempting to move over or around them. They may also cause fish to become stranded and subjected to poor water quality, lack of food, increased predation, crowding or other conditions that can negatively affect their health, wellbeing, and productivity.

The Project requires approximately 39 crossings of waterways, which each create the potential for barriers to native fish passage if not constructed correctly. However, the Project is unlikely to have a significant impact on fish passage given the cable crossings will be undertaken either via under-boring, or open trench and backfill during times of no/low flow, and that vehicle waterway crossings would be constructed in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003). Crossings constructed in accordance with these documents ensures that barriers are temporary, limited to the construction phase, and that flow and bed/bank stability is reinstated to a condition equivalent or better than pre-construction.

## 5.4 Surface water

### 5.4.1 Erosion and sedimentation

Construction of waterway crossings for access tracks and placement of underground electrical cables temporarily elevates the risk of mobilising soils and sediments, which impacts water quality and aquatic habitat. Trench excavation for the placement of cables requires soils/sediments to be temporarily excavated, with the generally more productive topsoils and less productive and more erodible subsoils segregated and stockpiled separately. Following cable placement, a portion of the subsoil is reinstated, excess subsoil is disposed of, and all topsoil is reinstated. Areas of exposed soils, including open trenches and temporary soil stockpiles/windrows, are at higher risk of being mobilised by air or water which could result in impacts to water quality and aquatic habitats.

A 'best practice' Erosion and Sediment Control Plan would be developed and implemented throughout Project construction, consistent with the International Erosion Control Association (IECA) recommendations (Section 6) or equivalent. If implemented effectively, environmental risks to water quality from disturbed area runoff are expected to be low.

### 5.4.2 Leaks and spills

Leaks or spills of hydrocarbon-based fluids from construction equipment represent a potential risk to aquatic habitat downstream of the Project. However, there is a low risk of leaks and spills occurring given the implementation of suitable management measures, including implementation of a spill response (Section 6). As such, the Project is unlikely to result in leaks/spills that would eventuate in serious environmental harm to aquatic species or their habitats.

## 5.5 Cumulative impacts

The Project is located within the Macquarie-Bogan River catchment of the greater MDB. Both the Macquarie and Bogan river sub-catchments are subject to broad-ranging disturbances, including dams, sewage treatment plant effluent discharges, vegetation clearing, agriculture, and erosion and sediment deposition associated with broad-scale vegetation clearing, historical outbreaks of European rabbits (*Oryctolagus cuniculus*), logging, urban development, earthworks and road construction.

An Erosion and Sediment Control Plan should be designed such that the risk of off-site uncontrolled release of Project affected water during construction and operation of the Project is very low and sediment inputs can be controlled through drainage, and erosion and sediment control measures. On this basis, the Project has a very low risk of contributing to water quality degradation or cumulative sediment loads to waterways downstream of the Project Area, including the Macquarie-Bogan River and tributaries.

Any overland flows affected by construction would be managed in accordance with best practice erosion and sediment control measures. The Project is unlikely to contribute to cumulative impacts on the aquatic ecosystems of the Macquarie-Bogan River catchment of the MDB, given the limited potential impacts associated with the Project and the implementation of mitigation and management measures described in Section 6.



## 6 MITIGATION AND MANAGEMENT MEASURES

The mitigation strategy for the Project has focused on a hierarchy of:

1. avoidance;
2. minimisation;
3. mitigation; then
4. offset residual impacts.

The avoidance or minimisation of adverse impacts is most relevant to the design phase of the Project, where information collected through desktop analysis and field surveys can be incorporated into the planning and preliminary engineering work (Section 6.1).

Mitigation of impacts and the implementation of monitoring and management plans are most relevant to the construction and operational phases of the Project. Table 11 (Section 6.2) provides a summary of the mitigation measures for the Project, with a brief description of potential impacts and measures that can be implemented for the Project.

Residual impacts (impacts that remain after the implementation of mitigation measures) may be required to be offset. This includes offsetting impacts on field-verified KFH (Section 6.3).

### 6.1 Measures to avoid and minimise impacts

The following measures would be implemented to avoid and/or minimise impacts on aquatic ecology:

- Project infrastructure, other than access tracks, underground electrical cables, and overhead transmission lines, should be positioned away from waterways by implementing suitable riparian zone buffers consistent with the *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI 2013), being the larger of:
  - 50 m for TYPE 2 or CLASS 2-3 waterways; and
  - 10-50 m for TYPE 3 or CLASS 3-4 waterways.
- Consider long range weather forecasts and schedule the construction of waterway crossings to coincide with periods of expected no to low flow.
- Where possible, access tracks would be co-located with underground cables, to reduce the disturbance footprint.
- Underground electrical cables typically require an approximate 10-20 m wide right-of-way (for direct impacts), allowing sufficient room for trenching, topsoil and subsoil segregation, and movement of construction vehicles, cable-laying equipment and other plant. This could be reduced to an approximate 5 m wide right-of-way (for direct impacts) at waterway crossings of cables (unless where co-located with access tracks also being constructed), minimising the removal of aquatic habitat and riparian vegetation to the smallest practicable width.
- Vehicle access tracks from the public road network to Project infrastructure would utilise existing property access tracks where available.

## 6.2 Impact mitigation

Mitigation measures proposed to be implemented for the Project are provided in Table 11.

**Table 11 Mitigation measures**

| Potential impact                                       | Mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Aquatic habitat clearing                            | <ul style="list-style-type: none"> <li>Maintain riparian buffer zones (10-50 m, depending on KFH TYPE or CLASS) between field-verified KFH and ground disturbance for Project infrastructure other than waterway crossings for vehicle access tracks and underground electrical cables.</li> <li>Design and construct waterway crossings consistent with: <ul style="list-style-type: none"> <li><i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI 2013); and</li> <li><i>Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge 2003).</li> </ul> </li> <li>Implement an Erosion and Sediment Control Plan (Section 6.4) prepared in accordance with best practice guidelines.</li> <li>Rehabilitate impacted riparian zones with plantings of suitable trees and shrubs of local provenance, as a long-term measure to stabilise stream banks, improve water quality (by shading and filtering), and increase aquatic habitat complexity.</li> <li>Clean down machinery in-between waterway crossing work areas, to reduce the risk of spreading propagules from aquatic and riparian weeds and to reduce the risk of spreading potential pest fish species during times of flow.</li> <li>When removing weeds, contain all vegetative material such that it is unable to be carried by wind or water back into any waterway or elsewhere.</li> </ul>                                                                                     |
| 2. Creating a barrier to fish passage                  | <ul style="list-style-type: none"> <li>Where possible, construct waterway crossings following dry weather and when dry weather is forecast throughout construction, so that surface water flows (and aquatic fauna) are less likely to be encountered.</li> <li>Design and construct waterway crossings consistent with: <ul style="list-style-type: none"> <li><i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (NSW DPI 2013); and</li> <li><i>Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge 2003).</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 3. Alteration to surface water quality and/or quantity | <ul style="list-style-type: none"> <li>Where possible, construct waterway crossings following dry weather and when dry weather is forecast, so that surface water flows (and associated risks of impacting water quality) are less likely to be encountered.</li> <li>If using open cut trenching for placement of cables at waterway crossings, utilise an excavator or backhoe to enable trench spoil to be stockpiled away from the streambed. Position the cable, backfill the trench and apply erosion control rip rap (rock size to withstand predicted flow rates) immediately, minimising the risk of encountering flow events whilst sediments/soils are exposed.</li> <li>Implement a site-specific Erosion and Sediment Control Plan (Section 6.4) prepared in accordance with best practice.</li> <li>Rehabilitate impacted riparian zones with plantings of suitable trees and shrubs of local provenance, as a long-term measure to stabilise stream banks, improve water quality (by shading and filtering), and increase aquatic habitat complexity.</li> <li>Refuel and maintain machinery in designated locations away from sensitive areas (i.e. outside of KFH and its buffers, and away from all waterways generally). Formalise an appropriate spill response procedure as part of the Construction Environmental Management Plan.</li> <li>Implement the Water Quality Monitoring Program (Section 6.4) throughout the construction phase, and for one year following completion of construction.</li> </ul> |

## 6.3 Compensatory habitats and offsets

The Project requires approximately 39 waterway crossings, including approximately 17 crossings of waterways where KFH occurs. This would result in the direct loss of field-verified KFH (Section 5.1.2). The *Policy and Guidelines for Fish Habitat Conservation and Management* (2013) requires a minimum 2:1 offset for TYPE 1-3 KFH to help redress identified impacts. The *NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014) outlines requirements for site-based offsets to compensate for the loss of each aquatic habitat type, and/or payment (in 2023-24 that rate was

\$114.40 per m<sup>2</sup>, adjusted yearly with Consumer Price Index) to the DPI Fish Conservation Trust Fund to compensate for the value of the aquatic habitat being lost.

Habitat rehabilitation and/or environmental compensation could be undertaken to ensure 'no net loss' of KFH. Opportunities to enhance and/or protect existing KFH in the Project Area include re-snagging and increasing aquatic habitat complexity. Aquatic habitat rehabilitation can be undertaken to satisfy offset obligations (offsets to occur outside of the Disturbance Footprint so they are additional to stabilising the Disturbance Footprint) to satisfy offset obligations for necessary interference with KFH such as that required for the construction of waterway crossings. However, payment into the DPI Fish Conservation Trust Fund may result in more tangible conservation outcomes for native fish communities of the broader Macquarie-Bogan River catchment, as funds can be directed from multiple sources towards key projects that benefit fish communities.

Offset calculations would need to be undertaken following the detailed design phase when the Disturbance Footprint is finalised.

## 6.4 Management and monitoring plans

The following management and monitoring plans should be implemented during the construction phase of the Project:

1. Construction Environmental Management Plan, including (specific to aquatic ecology):
  - weed hygiene protocols, including clean downs between waterway crossings;
  - instruction to refuel and maintain machinery in designated locations away from sensitive areas such as waterways (including outside of KFH and its buffers);
  - a spill response procedure; and
  - a Water Quality Monitoring Program, including:
    - details of the potential sources of contaminants that could impact on water quality;
    - a description of the water management system for the Project;
    - corrective actions and contingency procedures for emergencies; and
    - a program for monitoring and review of the effectiveness of the Water Quality Monitoring Program.
2. Erosion and Sediment Control Plan, including:
  - design and installation in accordance with *Best Practice Erosion and Sediment Control* (IECA 2008) or equivalent;
  - minimise the area of disturbance;
  - where possible, apply local temporary erosion control measures;
  - intercept runoff from undisturbed areas and divert around disturbed areas; and
  - where temporary measures are likely to be ineffective, divert runoff from disturbed areas to sedimentation basins prior to release from the site.

## 7 CONCLUSION

Key findings of this Aquatic Ecology Assessment include:

- No threatened aquatic flora or fauna species are likely to occur within the Project Area.
- The Project is not expected to result in adverse surface water impacts or sedimentation of aquatic habitat downstream of the Project Area.
- The Project is not expected to have an adverse effect on downstream aquatic habitats such that threatened aquatic fish species would be adversely impacted.
- There are no wetlands of National or International Importance within the Project Area; the nearest being those associated with the Macquarie Marshes wetlands, which are well removed from the Project Area.
- The Project is unlikely to have a significant impact on fish passage given any cable crossing on a mapped waterway will be undertaken either via under-boring, or open trench and backfill during times of no/low flow where practicable; and any vehicle crossings would be constructed in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003).
- The proposed positioning of underground supply cables and construction of access tracks for the Project would result in direct impacts to KFH at the location of proposed waterway crossings. Offset obligations for these unavoidable impacts would be calculated following the detailed design of waterway crossings.

The waterways of the Project Area range from small first order (Strahler [1952] Stream Order System) tributaries to the fifth order Wallaby Creek. Other named waterways of the Project Area include Backwater Cowal and Bundara, Jacks, Rays and Ugumjil creeks.

The waterways of the Project Area range from ephemeral first and second order waterways to larger third, fourth and fifth order waterways with largely intermittent flows following rainfall and runoff events, but with semi-permanent to permanent spring or seep-fed trickle flow and associated pools likely persisting throughout most years. Spring and seep flow from the Sappa Bulga range, to the east of the Project Area, appears to contribute semi-permanent to permanent trickle flow within Jacks, Rays, Ugumjil and Wallaby creeks, and in Bundara Creek from just upstream of Tantiitha Road (Section 4.9, Figure 12). A portion of this trickle flow may be sub-surface in bed sediments. Semi-permanent pools located along these spring/seep-fed waterways likely provide refuge for aquatic fauna between rainfall and runoff events.

The Project Area is unlikely to support aquatic species of conservation-significance listed under the EPBC Act, BC Act or FM Act, given the lack of suitable habitat features or nearby records. The Macquarie-Bogan River and tributaries downstream of the Project Area support aquatic species of conservation significance. However, the Project is not expected to result in adverse surface water impacts or sedimentation of aquatic habitat downstream of the Project Area. Consequently, the Project is not expected to have an adverse effect on downstream aquatic habitats such that threatened aquatic fish species would be adversely impacted.

No threatened aquatic flora species listed under the EPBC Act, BC Act or FM Act were recorded from the desktop searches, nor during the surveys. No threatened aquatic flora species are likely to occur within the Project Area.

The Project Area contains waterways mapped as KFH by DPIRD (2025c). DPM Envirosciences used available aerial imagery, combined with georeferenced drone imagery and habitat data recorded during the survey, to approximate the top of bank extent of KFH for all waterways of the Project Area. The resulting field-verified KFH mapping for the Project Area provides an accurate



and current representation of KFH and can be used during the detailed design of waterway crossings to avoid, minimise and mitigate impacts to KFH.

The proposed positioning of underground cables and construction of access roads/tracks for the Project would result in direct loss of KFH at the location of proposed waterway crossings. These habitats comprise waterways with ephemeral to largely intermittent flow, little to extensive cover of aquatic plants, and are either known or likely to support common native fish species and aquatic invertebrates.

The Project requires approximately 39 waterway crossings, which each create the potential for barriers to fish passage. However, the Project is unlikely to significantly impact fish passage given any cable crossing on a mapped waterway will be undertaken either via under-boring or open trench and backfilling, and scheduled during times of no/low flow where practicable. Vehicle crossings would be constructed in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003).

Field verification of 17 sites in July 2025 suggests that Bundara, Jacks, Rays, Ugumjil and Wallaby creeks likely incur some contribution from seeps or springs and are therefore surface expression GDEs. However, the proposed waterway crossings are unlikely to result in significant impacts on surface expression GDEs as they are unlikely to result in groundwater or interflow drawdown or substantial modification to catchment permeability.

Mound springs are known to occur in the locality of Tantitha Road (ANPSA 2025; locations not specified). However, no mound springs were identified in the vicinity of proposed waterway crossings visited by DPM Envirosciences in July 2025. Further, vegetation mapping of the broader Project Area was undertaken by ERM and did not identify any 'Artesian Springs Ecological Community in the GAB' (Critically Endangered under the BC Act) nor 'the community of native species dependent on natural discharge of groundwater from the GAB' TEC (Endangered under the EPBC Act).

Indirect impacts considered in this assessment include potential impacts associated with changes in water quality, sediment deposition and potential cumulative impacts. Indirect impacts are temporary and largely confined to the construction phase of the Project. The Project is unlikely to have a significant impact on aquatic ecology as a result of these potential indirect impacts.

To avoid or mitigate adverse impacts on aquatic ecology values associated with the Project, the following mitigation and management measures are proposed, including:

- implementing buffers between Project infrastructure (other than necessary waterway crossings) and waterways consistent with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013), being:
  - 50 m for TYPE 2 or CLASS 2-3 waterways; and
  - 10-50 m for TYPE 3 or CLASS 3-4 waterways.
- designing and constructing waterway crossings consistent with the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003);
- implementing hygiene measures to avoid the spread of aquatic and riparian weeds and pest fish species;
- implementing a best practice site-specific Erosion and Sediment Control Plan, to avoid water quality impacts and sedimentation of waterways within and downstream of the Project Area;
- offsetting unavoidable impacts on field-verified KFH, which would most likely comprise a financial contribution to the DPI Fish Conservation Trust Fund; and

- implementing a Water Quality Monitoring Program throughout construction (and for one year following) to detect and respond to any adverse impacts on waterways within and downstream of the Project Area.

With effective implementation of the above mitigation and management measures, the Project is unlikely to result in significant impacts on aquatic ecology, including threatened fish species known from the broader Macquarie-Bogan River catchment.

Offset obligations for impacts to field-verified KFH can be calculated by the Proponent following the detailed design of waterway crossings.

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## **Appendix A: EPBC Act Protected Matters Report**



Australian Government

Department of Climate Change, Energy,  
the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 17-Jul-2025

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

|                                                              |      |
|--------------------------------------------------------------|------|
| <a href="#">World Heritage Properties:</a>                   | None |
| <a href="#">National Heritage Places:</a>                    | None |
| <a href="#">Wetlands of International Importance (Ramsar</a> | 4    |
| <a href="#">Great Barrier Reef Marine Park:</a>              | None |
| <a href="#">Commonwealth Marine Area:</a>                    | None |
| <a href="#">Listed Threatened Ecological Communities:</a>    | 6    |
| <a href="#">Listed Threatened Species:</a>                   | 45   |
| <a href="#">Listed Migratory Species:</a>                    | 9    |

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

|                                                                     |      |
|---------------------------------------------------------------------|------|
| <a href="#">Commonwealth Lands:</a>                                 | 4    |
| <a href="#">Commonwealth Heritage Places:</a>                       | None |
| <a href="#">Listed Marine Species:</a>                              | 17   |
| <a href="#">Whales and Other Cetaceans:</a>                         | None |
| <a href="#">Critical Habitats:</a>                                  | None |
| <a href="#">Commonwealth Reserves Terrestrial:</a>                  | None |
| <a href="#">Australian Marine Parks:</a>                            | None |
| <a href="#">Habitat Critical to the Survival of Marine Turtles:</a> | None |

## Extra Information

This part of the report provides information that may also be relevant to the area you have

|                                                         |      |
|---------------------------------------------------------|------|
| <a href="#">State and Territory Reserves:</a>           | None |
| <a href="#">Regional Forest Agreements:</a>             | None |
| <a href="#">Nationally Important Wetlands:</a>          | None |
| <a href="#">EPBC Act Referrals:</a>                     | 4    |
| <a href="#">Key Ecological Features (Marine):</a>       | None |
| <a href="#">Biologically Important Areas:</a>           | None |
| <a href="#">Bioregional Assessments:</a>                | 1    |
| <a href="#">Geological and Bioregional Assessments:</a> | None |



# Details

## Matters of National Environmental Significance

| Wetlands of International Importance (Ramsar Wetlands)                |                                       | [ Resource Information ] |
|-----------------------------------------------------------------------|---------------------------------------|--------------------------|
| Ramsar Site Name                                                      | Proximity                             | Buffer Status            |
| <a href="#">Banrock station wetland complex</a>                       | 700 - 800km upstream from Ramsar site | In feature area          |
| <a href="#">Riverland</a>                                             | 600 - 700km upstream from Ramsar site | In feature area          |
| <a href="#">The coorong, and lakes alexandrina and albert wetland</a> | 800 - 900km upstream from Ramsar site | In feature area          |
| <a href="#">The macquarie marshes</a>                                 | 100 - 150km upstream from Ramsar site | In feature area          |

Listed Threatened Ecological Communities

[ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Community Name                                                                                                                     | Threatened Category   | Presence Text                         | Buffer Status       |
|------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------------------------|---------------------|
| <a href="#">Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions</a>               | Endangered            | Community may occur within area       | In feature area     |
| <a href="#">Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia</a>         | Endangered            | Community likely to occur within area | In feature area     |
| <a href="#">Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland</a> | Critically Endangered | Community may occur within area       | In buffer area only |
| <a href="#">Poplar Box Grassy Woodland on Alluvial Plains</a>                                                                      | Endangered            | Community likely to occur within area | In feature area     |
| <a href="#">Weeping Myall Woodlands</a>                                                                                            | Endangered            | Community likely to occur within area | In feature area     |
| <a href="#">White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</a>                                | Critically Endangered | Community likely to occur within area | In feature area     |

| Community Name | Threatened Category | Presence Text | Buffer Status |
|----------------|---------------------|---------------|---------------|
|----------------|---------------------|---------------|---------------|

Listed Threatened Species

[ [Resource Information](#) ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.  
 Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|-----------------|---------------------|---------------|---------------|
|-----------------|---------------------|---------------|---------------|

BIRD

[Anthochaera phrygia](#)

|                           |                       |                                                                    |                 |
|---------------------------|-----------------------|--------------------------------------------------------------------|-----------------|
| Regent Honeyeater [82338] | Critically Endangered | Foraging, feeding or related behaviour likely to occur within area | In feature area |
|---------------------------|-----------------------|--------------------------------------------------------------------|-----------------|

[Aphelocephala leucopsis](#)

|                          |            |                                                       |                 |
|--------------------------|------------|-------------------------------------------------------|-----------------|
| Southern Whiteface [529] | Vulnerable | Species or species habitat known to occur within area | In feature area |
|--------------------------|------------|-------------------------------------------------------|-----------------|

[Botaurus poiciloptilus](#)

|                             |            |                                                  |                 |
|-----------------------------|------------|--------------------------------------------------|-----------------|
| Australasian Bittern [1001] | Endangered | Species or species habitat may occur within area | In feature area |
|-----------------------------|------------|--------------------------------------------------|-----------------|

[Calidris acuminata](#)

|                              |            |                                                  |                 |
|------------------------------|------------|--------------------------------------------------|-----------------|
| Sharp-tailed Sandpiper [874] | Vulnerable | Species or species habitat may occur within area | In feature area |
|------------------------------|------------|--------------------------------------------------|-----------------|

[Calidris ferruginea](#)

|                        |                       |                                                  |                 |
|------------------------|-----------------------|--------------------------------------------------|-----------------|
| Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area | In feature area |
|------------------------|-----------------------|--------------------------------------------------|-----------------|

[Callocephalon fimbriatum](#)

|                          |            |                                                  |                     |
|--------------------------|------------|--------------------------------------------------|---------------------|
| Gang-gang Cockatoo [768] | Endangered | Species or species habitat may occur within area | In buffer area only |
|--------------------------|------------|--------------------------------------------------|---------------------|

[Calyptorhynchus lathami lathami](#)

|                                             |            |                                                       |                 |
|---------------------------------------------|------------|-------------------------------------------------------|-----------------|
| South-eastern Glossy Black-Cockatoo [67036] | Vulnerable | Species or species habitat known to occur within area | In feature area |
|---------------------------------------------|------------|-------------------------------------------------------|-----------------|

[Climacteris picumnus victoriae](#)

|                                           |            |                                                        |                 |
|-------------------------------------------|------------|--------------------------------------------------------|-----------------|
| Brown Treecreeper (south-eastern) [67062] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
|-------------------------------------------|------------|--------------------------------------------------------|-----------------|

[Falco hypoleucos](#)

|                   |            |                                                        |                 |
|-------------------|------------|--------------------------------------------------------|-----------------|
| Grey Falcon [929] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
|-------------------|------------|--------------------------------------------------------|-----------------|

[Gallinago hardwickii](#)

|                                      |            |                                                  |                 |
|--------------------------------------|------------|--------------------------------------------------|-----------------|
| Latham's Snipe, Japanese Snipe [863] | Vulnerable | Species or species habitat may occur within area | In feature area |
|--------------------------------------|------------|--------------------------------------------------|-----------------|

| Scientific Name                                                                                                                                               | Threatened Category   | Presence Text                                          | Buffer Status   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------|-----------------|
| <a href="#">Grantiella picta</a><br>Painted Honeyeater [470]                                                                                                  | Vulnerable            | Species or species habitat known to occur within area  | In feature area |
| <a href="#">Hirundapus caudacutus</a><br>White-throated Needletail [682]                                                                                      | Vulnerable            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Lathamus discolor</a><br>Swift Parrot [744]                                                                                                       | Critically Endangered | Species or species habitat known to occur within area  | In feature area |
| <a href="#">Leipoa ocellata</a><br>Malleefowl [934]                                                                                                           | Vulnerable            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Lophochroa leadbeateri leadbeateri</a><br>Major Mitchell's Cockatoo (eastern), Eastern Major Mitchell's Cockatoo, Pink Cockatoo (eastern) [82926] | Endangered            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Melanodryas cucullata cucullata</a><br>South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]                                           | Endangered            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Neophema chrysostoma</a><br>Blue-winged Parrot [726]                                                                                              | Vulnerable            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Pedionomus torquatus</a><br>Plains-wanderer [906]                                                                                                 | Critically Endangered | Species or species habitat may occur within area       | In feature area |
| <a href="#">Polytelis swainsonii</a><br>Superb Parrot [738]                                                                                                   | Vulnerable            | Species or species habitat known to occur within area  | In feature area |
| <a href="#">Rostratula australis</a><br>Australian Painted Snipe [77037]                                                                                      | Endangered            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Stagonopleura guttata</a><br>Diamond Firetail [59398]                                                                                             | Vulnerable            | Species or species habitat known to occur within area  | In feature area |

FISH

| Scientific Name                                                                                                                                                                                   | Threatened Category | Presence Text                                                      | Buffer Status       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------|---------------------|
| <a href="#">Bidyanus bidyanus</a><br>Silver Perch, Bidyan [76155]                                                                                                                                 | Endangered          | Species or species habitat known to occur within area              | In feature area     |
| <a href="#">Maccullochella macquariensis</a><br>Trout Cod [26171]                                                                                                                                 | Endangered          | Species or species habitat likely to occur within area             | In feature area     |
| <a href="#">Maccullochella peelii</a><br>Murray Cod [66633]                                                                                                                                       | Vulnerable          | Species or species habitat known to occur within area              | In buffer area only |
| <a href="#">Macquaria australasica</a><br>Macquarie Perch [66632]                                                                                                                                 | Endangered          | Species or species habitat may occur within area                   | In feature area     |
| FROG                                                                                                                                                                                              |                     |                                                                    |                     |
| <a href="#">Crinia sloanei</a><br>Sloane's Froglet [59151]                                                                                                                                        | Endangered          | Species or species habitat may occur within area                   | In feature area     |
| MAMMAL                                                                                                                                                                                            |                     |                                                                    |                     |
| <a href="#">Chalinolobus dwyeri</a><br>Large-eared Pied Bat, Large Pied Bat [183]                                                                                                                 | Endangered          | Species or species habitat known to occur within area              | In feature area     |
| <a href="#">Dasyurus maculatus maculatus (SE mainland population)</a><br>Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]                            | Endangered          | Species or species habitat may occur within area                   | In feature area     |
| <a href="#">Nyctophilus corbeni</a><br>Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]                                                                                              | Vulnerable          | Species or species habitat likely to occur within area             | In feature area     |
| <a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a><br>Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104] | Endangered          | Species or species habitat likely to occur within area             | In feature area     |
| <a href="#">Pteropus poliocephalus</a><br>Grey-headed Flying-fox [186]                                                                                                                            | Vulnerable          | Foraging, feeding or related behaviour likely to occur within area | In feature area     |
| PLANT                                                                                                                                                                                             |                     |                                                                    |                     |



| Scientific Name                                                                                          | Threatened Category   | Presence Text                                          | Buffer Status   |
|----------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------|-----------------|
| <a href="#">Androcalva procumbens</a><br>[87153]                                                         | Vulnerable            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Austrostipa wakoolica</a><br>[66623]                                                         | Endangered            | Species or species habitat may occur within area       | In feature area |
| <a href="#">Homoranthus darwinioides</a><br>[12974]                                                      | Vulnerable            | Species or species habitat may occur within area       | In feature area |
| <a href="#">Lepidium aschersonii</a><br>Spiny Peppercress [10976]                                        | Vulnerable            | Species or species habitat may occur within area       | In feature area |
| <a href="#">Lepidium monolocoides</a><br>Winged Pepper-cress [9190]                                      | Endangered            | Species or species habitat may occur within area       | In feature area |
| <a href="#">Prasophyllum petilum</a><br>Tarengo Leek Orchid [55144]                                      | Endangered            | Species or species habitat may occur within area       | In feature area |
| <a href="#">Prasophyllum sp. Wybong (C.Phelps ORG 5269)</a><br>a leek-orchid [81964]                     | Critically Endangered | Species or species habitat may occur within area       | In feature area |
| <a href="#">Swainsona murrayana</a><br>Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765] | Vulnerable            | Species or species habitat likely to occur within area | In feature area |
| <a href="#">Swainsona recta</a><br>Small Purple-pea, Mountain Swainson-pea, Small Purple Pea [7580]      | Endangered            | Species or species habitat may occur within area       | In feature area |
| <a href="#">Thesium australe</a><br>Austral Toadflax, Toadflax [15202]                                   | Vulnerable            | Species or species habitat may occur within area       | In feature area |
| <a href="#">Vincetoxicum forsteri listed as Tylophora linearis</a><br>[92384]                            | Endangered            | Species or species habitat likely to occur within area | In feature area |

REPTILE

| Scientific Name                                                                                        | Threatened Category | Presence Text                                                | Buffer Status   |
|--------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------|-----------------|
| <a href="#">Anomalopus mackayi</a><br>Five-clawed Worm-skink, Long-legged<br>Worm-skink [25934]        | Vulnerable          | Species or species<br>habitat may occur<br>within area       | In feature area |
| <a href="#">Aprasia parapulchella</a><br>Pink-tailed Worm-lizard, Pink-tailed<br>Legless Lizard [1665] | Vulnerable          | Species or species<br>habitat likely to occur<br>within area | In feature area |
| <a href="#">Hemiaspis damelii</a><br>Grey Snake [1179]                                                 | Endangered          | Species or species<br>habitat may occur<br>within area       | In feature area |

Listed Migratory Species

[ Resource Information ]

| Scientific Name                                           | Threatened Category | Presence Text                                                | Buffer Status   |
|-----------------------------------------------------------|---------------------|--------------------------------------------------------------|-----------------|
| Migratory Marine Birds                                    |                     |                                                              |                 |
| <a href="#">Apus pacificus</a><br>Fork-tailed Swift [678] |                     | Species or species<br>habitat likely to occur<br>within area | In feature area |

|                                                                          |            |                                                              |                 |
|--------------------------------------------------------------------------|------------|--------------------------------------------------------------|-----------------|
| Migratory Terrestrial Species                                            |            |                                                              |                 |
| <a href="#">Hirundapus caudacutus</a><br>White-throated Needletail [682] | Vulnerable | Species or species<br>habitat likely to occur<br>within area | In feature area |
| <a href="#">Motacilla flava</a><br>Yellow Wagtail [644]                  |            | Species or species<br>habitat may occur<br>within area       | In feature area |

|                                                                    |                       |                                                        |                 |
|--------------------------------------------------------------------|-----------------------|--------------------------------------------------------|-----------------|
| Migratory Wetlands Species                                         |                       |                                                        |                 |
| <a href="#">Actitis hypoleucos</a><br>Common Sandpiper [59309]     |                       | Species or species<br>habitat may occur<br>within area | In feature area |
| <a href="#">Calidris acuminata</a><br>Sharp-tailed Sandpiper [874] | Vulnerable            | Species or species<br>habitat may occur<br>within area | In feature area |
| <a href="#">Calidris ferruginea</a><br>Curlew Sandpiper [856]      | Critically Endangered | Species or species<br>habitat may occur<br>within area | In feature area |
| <a href="#">Calidris melanotos</a><br>Pectoral Sandpiper [858]     |                       | Species or species<br>habitat may occur<br>within area | In feature area |

| Scientific Name                                                              | Threatened Category | Presence Text                                    | Buffer Status       |
|------------------------------------------------------------------------------|---------------------|--------------------------------------------------|---------------------|
| <a href="#">Gallinago hardwickii</a><br>Latham's Snipe, Japanese Snipe [863] | Vulnerable          | Species or species habitat may occur within area | In feature area     |
| <a href="#">Pandion haliaetus</a><br>Osprey [952]                            |                     | Species or species habitat may occur within area | In buffer area only |

## Other Matters Protected by the EPBC Act

Commonwealth Lands

[ [Resource Information](#) ]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

| Commonwealth Land Name                                                              | State | Buffer Status       |
|-------------------------------------------------------------------------------------|-------|---------------------|
| Communications, Information Technology and the Arts - Australian Postal Corporation |       |                     |
| Commonwealth Land - Australian Postal Commission [14064]                            | NSW   | In buffer area only |
| Communications, Information Technology and the Arts - Telstra Corporation Limited   |       |                     |
| Commonwealth Land - Australian & Overseas Telecommunications Corporation [14074]    | NSW   | In buffer area only |
| Commonwealth Land - Australian Telecommunications Commission [14066]                | NSW   | In buffer area only |

|                             |     |                     |
|-----------------------------|-----|---------------------|
| Unknown                     |     |                     |
| Commonwealth Land - [14065] | NSW | In buffer area only |

Listed Marine Species

[ [Resource Information](#) ]

| Scientific Name                                                     | Threatened Category | Presence Text                                                              | Buffer Status   |
|---------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------|-----------------|
| Bird                                                                |                     |                                                                            |                 |
| <a href="#">Actitis hypoleucos</a><br>Common Sandpiper [59309]      |                     | Species or species habitat may occur within area                           | In feature area |
| <a href="#">Apus pacificus</a><br>Fork-tailed Swift [678]           |                     | Species or species habitat likely to occur within area overfly marine area | In feature area |
| <a href="#">Bubulcus ibis as Ardea ibis</a><br>Cattle Egret [66521] |                     | Species or species habitat may occur within area overfly marine area       | In feature area |

| Scientific Name                                                                           | Threatened Category   | Presence Text                                                              | Buffer Status   |
|-------------------------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------------------|-----------------|
| <a href="#">Calidris acuminata</a><br>Sharp-tailed Sandpiper [874]                        | Vulnerable            | Species or species habitat may occur within area                           | In feature area |
| <a href="#">Calidris ferruginea</a><br>Curlew Sandpiper [856]                             | Critically Endangered | Species or species habitat may occur within area overfly marine area       | In feature area |
| <a href="#">Calidris melanotos</a><br>Pectoral Sandpiper [858]                            |                       | Species or species habitat may occur within area overfly marine area       | In feature area |
| <a href="#">Chalcites osculans as Chrysococcyx osculans</a><br>Black-eared Cuckoo [83425] |                       | Species or species habitat likely to occur within area overfly marine area | In feature area |
| <a href="#">Gallinago hardwickii</a><br>Latham's Snipe, Japanese Snipe [863]              | Vulnerable            | Species or species habitat may occur within area overfly marine area       | In feature area |
| <a href="#">Haliaeetus leucogaster</a><br>White-bellied Sea-Eagle [943]                   |                       | Species or species habitat likely to occur within area                     | In feature area |
| <a href="#">Hirundapus caudacutus</a><br>White-throated Needletail [682]                  | Vulnerable            | Species or species habitat likely to occur within area overfly marine area | In feature area |
| <a href="#">Lathamus discolor</a><br>Swift Parrot [744]                                   | Critically Endangered | Species or species habitat known to occur within area overfly marine area  | In feature area |
| <a href="#">Merops ornatus</a><br>Rainbow Bee-eater [670]                                 |                       | Species or species habitat may occur within area overfly marine area       | In feature area |
| <a href="#">Motacilla flava</a><br>Yellow Wagtail [644]                                   |                       | Species or species habitat may occur within area overfly marine area       | In feature area |



| Scientific Name                                                                                                  | Threatened Category | Presence Text                                                              | Buffer Status       |
|------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------|---------------------|
| <a href="#">Myiagra cyanoleuca</a><br>Satin Flycatcher [612]                                                     |                     | Species or species habitat known to occur within area overfly marine area  | In feature area     |
| <a href="#">Neophema chrysostoma</a><br>Blue-winged Parrot [726]                                                 | Vulnerable          | Species or species habitat likely to occur within area overfly marine area | In feature area     |
| <a href="#">Pandion haliaetus</a><br>Osprey [952]                                                                |                     | Species or species habitat may occur within area                           | In buffer area only |
| <a href="#">Rostratula australis as Rostratula benghalensis (sensu lato)</a><br>Australian Painted Snipe [77037] | Endangered          | Species or species habitat likely to occur within area overfly marine area | In feature area     |

### Extra Information

| EPBC Act Referrals <a href="#">[ Resource Information ]</a> |            |                  |                   |                     |
|-------------------------------------------------------------|------------|------------------|-------------------|---------------------|
| Title of referral                                           | Reference  | Referral Outcome | Assessment Status | Buffer Status       |
| <a href="#">Narwonah Materials Distribution Centre</a>      | 2022/09226 |                  | Completed         | In buffer area only |
| <a href="#">Wallaby Creek Wind Farm Project</a>             | 2023/09676 |                  | Assessment        | In feature area     |

| Controlled action                                            |           |                   |               |                     |
|--------------------------------------------------------------|-----------|-------------------|---------------|---------------------|
| <a href="#">Parkes to Narromine Section Inland Rail, NSW</a> | 2016/7731 | Controlled Action | Post-Approval | In buffer area only |

| Not controlled action                                                                                        |           |                       |           |                 |
|--------------------------------------------------------------------------------------------------------------|-----------|-----------------------|-----------|-----------------|
| <a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a> | 2015/7522 | Not Controlled Action | Completed | In feature area |

| Bioregional Assessments <a href="#">[ Resource Information ]</a> |                            |                            |                     |
|------------------------------------------------------------------|----------------------------|----------------------------|---------------------|
| SubRegion                                                        | BioRegion                  | Website                    | Buffer Status       |
| Central West                                                     | Northern Inland Catchments | <a href="#">BA website</a> | In buffer area only |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

## 3 DATA SOURCES

### Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

### Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

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## **Appendix B: Aquatic Survey Site Profiles**

|                                                                                                                                                                                                                                           |                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>Site code:</b> 1                                                                                                                                                                                                                       | <b>Location:</b> Tributary of Backwater Cowal     |
| <b>Date:</b> 22/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                             |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.2639; 148.2833 (GDA 2020) |
| <b>Water level:</b> no flow - dry                                                                                                                                                                                                         | <b>Likely flow nature:</b> ephemeral              |
| <b>Topography:</b> floodplain                                                                                                                                                                                                             |                                                   |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                   |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                   |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                   |
| <b>Field-verified waterway classification:</b> CLASS 2 – Moderate KFH                                                                                                                                                                     |                                                   |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                   |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                   |
| <b>Mode wetted width:</b> 0 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 130 m                      |
| <b>Maximum depth:</b> 0 m                                                                                                                                                                                                                 | <b>Bankfull height:</b> 1.5 m                     |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 0 m                  |
| <b>Habitat types:</b> 0% riffle, 0% run, 0% sandy pool, 0% rocky pool, 100% dry                                                                                                                                                           |                                                   |
| <b>Variety of habitat:</b> large woody debris, macrophytes                                                                                                                                                                                |                                                   |
| <b>Habitat attributes:</b> detritus (S), sticks (S), branches (S), logs (L), periphyton (N), moss (N), filamentous algae (N), macrophytes (L), bank overhang (N), trailing bank vegetation (N), blanketing silt (N), substrate anoxia (N) |                                                   |
| <b>Upstream landuse:</b> past vegetation clearing, cropping, grazing                                                                                                                                                                      |                                                   |
| <b>Adjacent landuse (right bank):</b> past clearing, cropping, grazing some natural                                                                                                                                                       |                                                   |
| <b>Adjacent landuse (left bank):</b> past clearing, cropping, grazing, grazing                                                                                                                                                            |                                                   |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                   |
| <b>Bed substrates:</b> 95% silt/clay (<0.05 mm), 5% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                    |                                                   |
| <b>Edge substrates:</b> 95% silt/clay (<0.05 mm), 5% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                   |
| <b>Bank soils:</b> clay                                                                                                                                                                                                                   | <b>Bank stability:</b> stable                     |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                        |
| <b>Channel shape:</b> flat U shaped                                                                                                                                                                                                       | <b>Recent deposits:</b> silt (N), sand (N)        |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (N), bank slumping (N), cattle pugging (N)                                                                                                                         |                                                   |



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                        |                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                      |                                            |
| Width of riparian zone on left bank: 50 m                                                                                                                                                                                                                  | Width of riparian zone on right bank: 50 m |
| Bare ground: L                                                                                                                                                                                                                                             | Grasses/forbs: E                           |
| Shrubs: S                                                                                                                                                                                                                                                  | Trees <10 m: S                             |
| Trees >10m: S                                                                                                                                                                                                                                              | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                     |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                 | Dominant stratum: tree                     |
| Health: good                                                                                                                                                                                                                                               | Dieback: not detected                      |
| EDL height: 19 m                                                                                                                                                                                                                                           | EDL cover: 45%                             |
| Canopy species: <i>Eucalyptus camaldulensis</i> (D)                                                                                                                                                                                                        |                                            |
| Shrub species: <i>Eucalyptus camaldulensis</i> (F), <i>Duma florulenta</i> (O), <i>Sclerolaena muricata</i> (O)                                                                                                                                            |                                            |
| Ground species: <i>Trifolium</i> spp.* (A), <i>Atriplex semibaccata</i> (D), <i>Vittadinia</i> spp. (O), <i>Marrubium vulgare</i> * (O), <i>Silybum marianum</i> * (O), <i>Lepidium africanum</i> * (O), <i>Malva</i> sp. (O), <i>Heliotropium</i> sp. (O) |                                            |

| Macrophytes                                                  |                                                              |
|--------------------------------------------------------------|--------------------------------------------------------------|
| Submerged macrophytes: none detected                         |                                                              |
| Floating macrophytes: none detected                          |                                                              |
| Emergent macrophytes: <i>Duma florulenta</i> (L)             |                                                              |
| Aquatic biota                                                |                                                              |
| Aquatic macroinvertebrate sampling undertaken: no            |                                                              |
| Habitat for platypus: unlikely habitat                       |                                                              |
| State-mapped habitat for threatened fish species: unlikely   |                                                              |
| Field-verified habitat for threatened fish species: unlikely |                                                              |
| Fish sampling undertaken: no                                 |                                                              |
| Visual assessment of human disturbance (NSW AusRivAS)        |                                                              |
| 1. Water quality                                             | 1 – little disturbance (disruption of the natural hydrology) |
| 2. Instream                                                  | 0 – no evidence of disturbance                               |
| 3. Riparian zone                                             | 1 – little disturbance (exotic plant invasion)               |
| 4. Catchment assessment                                      | 2 – moderate disturbance (clearing, agriculture, grazing)    |
| Overall score                                                | 4/16 (little disturbance)                                    |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>Site code:</b> 2                                                                                                                                                                                                                       | <b>Location:</b> Tributary of Backwater Cowal     |
| <b>Date:</b> 22/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                             |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.2752; 148.2825 (GDA 2020) |
| <b>Water level:</b> no flow - dry                                                                                                                                                                                                         | <b>Likely flow nature:</b> ephemeral              |
| <b>Topography:</b> floodplain                                                                                                                                                                                                             |                                                   |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                   |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                   |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                   |
| <b>Field-verified waterway classification:</b> CLASS 2 – Moderate KFH                                                                                                                                                                     |                                                   |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                   |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                   |
| <b>Mode wetted width:</b> 0 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 100 m                      |
| <b>Maximum depth:</b> 0 m                                                                                                                                                                                                                 | <b>Bankfull height:</b> 0.7 m                     |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 0 m                  |
| <b>Habitat types:</b> 0% riffle, 0% run, 0% sandy pool, 0% rocky pool, 100% dry                                                                                                                                                           |                                                   |
| <b>Variety of habitat:</b> macrophytes                                                                                                                                                                                                    |                                                   |
| <b>Habitat attributes:</b> detritus (N), sticks (N), branches (N), logs (N), periphyton (N), moss (N), filamentous algae (N), macrophytes (E), bank overhang (N), trailing bank vegetation (N), blanketing silt (N), substrate anoxia (N) |                                                   |
| <b>Upstream landuse:</b> past vegetation clearing, irrigated cropping, moderate grazing                                                                                                                                                   |                                                   |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, light grazing                                                                                                                                                             |                                                   |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, light grazing                                                                                                                                                              |                                                   |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                   |
| <b>Bed substrates:</b> 95% silt/clay (<0.05 mm), 5% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                    |                                                   |
| <b>Edge substrates:</b> 95% silt/clay (<0.05 mm), 5% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                   |
| <b>Bank soils:</b> clay                                                                                                                                                                                                                   | <b>Bank stability:</b> stable                     |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                        |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)        |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (N), bank slumping (N), cattle pugging (S)                                                                                                                         |                                                   |



Upstream



Left bank



Downstream



Right bank

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



| Riparian vegetation                                                                                                                                                                                                                    |                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                  |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                               | Width of riparian zone on right bank: 1 m |
| Bare ground: L                                                                                                                                                                                                                         | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                              | Trees <10 m: L                            |
| Trees >10m: N                                                                                                                                                                                                                          | Exotic riparian species: L                |
| Composition and health                                                                                                                                                                                                                 |                                           |
| Vegetation status: agricultural                                                                                                                                                                                                        | Dominant stratum: grassland/wetland       |
| Health: average                                                                                                                                                                                                                        | Dieback: not detected                     |
| EDL height: 0.5 m                                                                                                                                                                                                                      | EDL cover: 80%                            |
| Canopy species: <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> (O), <i>Eucalyptus melliodora</i> (O)                                                                                                                                  |                                           |
| Shrub species: <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> (R)                                                                                                                                                                     |                                           |
| Ground species: <i>Juncus usitatus</i> (D), <i>Eleocharis plana</i> (F), <i>Centaurea calcitrapa</i> * (O), <i>Carthamus lanatus</i> * (O), <i>Arctotheca calendula</i> * (O), <i>Trifolium</i> spp.* (O), <i>Lobelia concolor</i> (O) |                                           |

| Macrophytes                                                                   |                                                                |
|-------------------------------------------------------------------------------|----------------------------------------------------------------|
| Submerged macrophytes: none detected                                          |                                                                |
| Floating macrophytes: none detected                                           |                                                                |
| Emergent macrophytes: <i>Juncus usitatus</i> (E), <i>Eleocharis plana</i> (S) |                                                                |
| Aquatic biota                                                                 |                                                                |
| Aquatic macroinvertebrate sampling undertaken: no                             |                                                                |
| Habitat for platypus: unlikely habitat                                        |                                                                |
| State-mapped habitat for threatened fish species: unlikely                    |                                                                |
| Field-verified habitat for threatened fish species: unlikely                  |                                                                |
| Fish sampling undertaken: no                                                  |                                                                |
| Visual assessment of human disturbance (NSW AusRivAS)                         |                                                                |
| 1. Water quality                                                              | 1 – little disturbance (disruption of the natural hydrology)   |
| 2. Instream                                                                   | 1 – moderate disturbance (constructed drain)                   |
| 3. Riparian zone                                                              | 2 – moderate disturbance (devegetation, exotic plant invasion) |
| 4. Catchment assessment                                                       | 2 – moderate disturbance (past clearing, cropping, grazing)    |
| Overall score                                                                 | 6/16 (moderate disturbance)                                    |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).

|                                                                                                                                                                                                                                           |                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| <b>Site code:</b> 3                                                                                                                                                                                                                       | <b>Location:</b> Unnamed tributary of Backwater Cowel |
| <b>Date:</b> 22/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                 |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.3242; 148.2884 (GDA 2020)     |
| <b>Water level:</b> no flow - isolated                                                                                                                                                                                                    | <b>Likely flow nature:</b> ephemeral                  |
| <b>Topography:</b> floodplain                                                                                                                                                                                                             |                                                       |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                       |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                       |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                       |
| <b>Field-verified waterway classification:</b> CLASS 3 – Minimal KFH                                                                                                                                                                      |                                                       |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                       |
| <b>Water quality</b>                                                                                                                                                                                                                      |                                                       |
| <b>Time (EST):</b> 8:13                                                                                                                                                                                                                   | <b>Water temperature:</b> 9.3°C                       |
| <b>Sp. Conductivity:</b> 192 µS/cm                                                                                                                                                                                                        | <b>pH:</b> 6.4                                        |
| <b>Dissolved oxygen:</b> -                                                                                                                                                                                                                | <b>Dissolved oxygen:</b> -                            |
| <b>Turbidity:</b> 378 NTU                                                                                                                                                                                                                 | <b>Ion sample collected:</b> yes                      |
| <b>Observations within 2 m of sampling point</b>                                                                                                                                                                                          |                                                       |
| <b>Shading:</b> 100%                                                                                                                                                                                                                      | <b>Water colour:</b> opaque                           |
| <b>Water odour:</b> none detected                                                                                                                                                                                                         | <b>Water surface:</b> normal                          |
| <b>Algae on substrate:</b> N                                                                                                                                                                                                              | <b>Algae in water column:</b> N                       |
| <b>Emergent macrophytes:</b> N                                                                                                                                                                                                            | <b>Submerged macrophytes:</b> N                       |
| <b>Floating macrophytes:</b> N                                                                                                                                                                                                            |                                                       |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                       |
| <b>Mode wetted width:</b> 3 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 10 m                           |
| <b>Maximum depth:</b> 0.7 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1.5 m                         |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 6 m                      |
| <b>Habitat types:</b> 0% riffle, 0% run, 90% sandy pool, 0% rocky pool, 10% dry                                                                                                                                                           |                                                       |
| <b>Variety of habitat:</b> shallow (<0.5 m), deep (>0.5 m), pool, macrophytes                                                                                                                                                             |                                                       |
| <b>Habitat attributes:</b> detritus (L), sticks (N), branches (N), logs (N), periphyton (L), moss (N), filamentous algae (L), macrophytes (L), bank overhang (L), trailing bank vegetation (S), blanketing silt (N), substrate anoxia (N) |                                                       |
| <b>Upstream landuse:</b> past clearing, non-irrigated cropping, moderate grazing                                                                                                                                                          |                                                       |
| <b>Adjacent landuse (right bank):</b> past clearing, non-irrigated cropping, moderate grazing                                                                                                                                             |                                                       |
| <b>Adjacent landuse (left bank):</b> past clearing, non-irrigated cropping, moderate grazing                                                                                                                                              |                                                       |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                       |
| <b>Bed substrates:</b> 10% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                       |
| <b>Edge substrates:</b> 10% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                  |                                                       |
| <b>Bank soils:</b> sandy clay, loam                                                                                                                                                                                                       | <b>Bank stability:</b> moderately stable              |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                            |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)            |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (N), bank slumping (L), cattle pugging (N)                                                                                                                         |                                                       |

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream

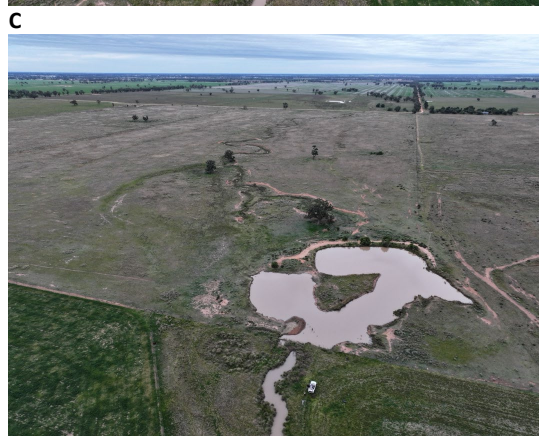


Right bank



| Riparian vegetation                                                                                                                                                                                                                                                                                     |                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                                                                                   |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                                                                                                | Width of riparian zone on right bank: 1 m |
| Bare ground: L                                                                                                                                                                                                                                                                                          | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                                                                                               | Trees <10 m: N                            |
| Trees >10m: N                                                                                                                                                                                                                                                                                           | Exotic riparian species: M                |
| Composition and health                                                                                                                                                                                                                                                                                  |                                           |
| Vegetation status: agricultural                                                                                                                                                                                                                                                                         | Dominant stratum: grassland               |
| Health: average                                                                                                                                                                                                                                                                                         | Dieback: not detected                     |
| EDL height: 0.5 m                                                                                                                                                                                                                                                                                       | EDL cover: 95%                            |
| Canopy species: none detected                                                                                                                                                                                                                                                                           |                                           |
| Shrub species: <i>Rosa rubiginosa</i> * (R)                                                                                                                                                                                                                                                             |                                           |
| Ground species: <i>Carex appressa</i> (D), <i>Anthosachne scabra</i> (A), <i>Sporobolus</i> sp. (F), <i>Heliotropium</i> sp. (O), <i>Paspalum</i> sp. (O), <i>Eragrostis</i> sp. (O), <i>Medicago sativa</i> * (F), <i>Trifolium</i> spp.* (O), <i>Cynodon dactylon</i> (F), <i>Enteropogon</i> sp. (O) |                                           |

| Macrophytes                                                                                                               |                                                                              |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                                                                                      |                                                                              |
| Floating macrophytes: none detected                                                                                       |                                                                              |
| Emergent macrophytes: <i>Juncus usitatus</i> (L), <i>Veronica anagallis-aquatica</i> * (L), <i>Ludwigia peploides</i> (L) |                                                                              |
| Aquatic biota                                                                                                             |                                                                              |
| Aquatic macroinvertebrate sampling undertaken: no                                                                         |                                                                              |
| Habitat for platypus: unlikely habitat                                                                                    |                                                                              |
| State-mapped habitat for threatened fish species: unlikely                                                                |                                                                              |
| Field-verified habitat for threatened fish species: unlikely                                                              |                                                                              |
| Fish sampling undertaken: backpack electrofishing (542 seconds)                                                           |                                                                              |
| Aquatic vertebrates encountered: none                                                                                     |                                                                              |
| Notes: only inland yabby ( <i>Cherax destructor</i> ) detected                                                            |                                                                              |
| Visual assessment of human disturbance (NSW AusRivAS)                                                                     |                                                                              |
| 1. Water quality                                                                                                          | 1 – little disturbance (disruption of the natural hydrology)                 |
| 2. Instream                                                                                                               | 1 – little disturbance (filamentous algae)                                   |
| 3. Riparian zone                                                                                                          | 3 – high disturbance (devegetation, exotic plant invasion, bank degradation) |
| 4. Catchment assessment                                                                                                   | 3 – high disturbance (past clearing, cropping grazing, dam)                  |
| Overall score                                                                                                             | 8/16 (moderate disturbance)                                                  |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).

|                                                                                                                                                                                                                                           |                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| <b>Site code:</b> 4                                                                                                                                                                                                                       | <b>Location:</b> Unnamed tributary of Backwater Cowal |
| <b>Date:</b> 22/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                 |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.3473; 148.3133 (GDA 2020)     |
| <b>Water level:</b> no flow - isolated                                                                                                                                                                                                    | <b>Likely flow nature:</b> ephemeral                  |
| <b>Topography:</b> floodplain                                                                                                                                                                                                             |                                                       |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                       |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                       |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                       |
| <b>Field-verified waterway classification:</b> CLASS 2 – Moderate KFH                                                                                                                                                                     |                                                       |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                       |
| <b>Water quality</b>                                                                                                                                                                                                                      |                                                       |
| <b>Time (EST):</b> 10:25                                                                                                                                                                                                                  | <b>Water temperature:</b> 9.5°C                       |
| <b>Sp. Conductivity:</b> 447 µS/cm                                                                                                                                                                                                        | <b>pH:</b> 6.4                                        |
| <b>Dissolved oxygen:</b> -                                                                                                                                                                                                                | <b>Dissolved oxygen:</b> -                            |
| <b>Turbidity:</b> 239 NTU                                                                                                                                                                                                                 | <b>Ion sample collected:</b> yes                      |
| <b>Observations within 2 m of sampling point</b>                                                                                                                                                                                          |                                                       |
| <b>Shading:</b> 100%                                                                                                                                                                                                                      | <b>Water colour:</b> opaque                           |
| <b>Water odour:</b> none detected                                                                                                                                                                                                         | <b>Water surface:</b> normal                          |
| <b>Algae on substrate:</b> S                                                                                                                                                                                                              | <b>Algae in water column:</b> N                       |
| <b>Emergent macrophytes:</b> L                                                                                                                                                                                                            | <b>Submerged macrophytes:</b> N                       |
| <b>Floating macrophytes:</b> N                                                                                                                                                                                                            |                                                       |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                       |
| <b>Mode wetted width:</b> 2 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 10 m                           |
| <b>Maximum depth:</b> 0.3 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1 m                           |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 4 m                      |
| <b>Habitat types:</b> 0% riffle, 0% run, 80% sandy pool, 0% rocky pool, 20% dry                                                                                                                                                           |                                                       |
| <b>Variety of habitat:</b> shallow (<0.5 m), pool, macrophytes                                                                                                                                                                            |                                                       |
| <b>Habitat attributes:</b> detritus (L), sticks (N), branches (N), logs (N), periphyton (L), moss (N), filamentous algae (S), macrophytes (S), bank overhang (N), trailing bank vegetation (S), blanketing silt (N), substrate anoxia (N) |                                                       |
| <b>Upstream landuse:</b> past vegetation clearing, moderate grazing, non-irrigated cropping                                                                                                                                               |                                                       |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, moderate grazing                                                                                                                                                          |                                                       |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, moderate grazing                                                                                                                                                           |                                                       |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                       |
| <b>Bed substrates:</b> 10% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                       |
| <b>Edge substrates:</b> 10% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                  |                                                       |
| <b>Bank soils:</b> sandy clay, loam                                                                                                                                                                                                       | <b>Bank stability:</b> moderately stable              |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                            |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)            |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (L), bank slumping (N), cattle pugging (N)                                                                                                                         |                                                       |

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                                                                                                                      |                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                                                                                                                                    |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                                                                                                                                                 | Width of riparian zone on right bank: 1 m |
| Bare ground: S                                                                                                                                                                                                                                                                                                                                           | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                                                                                                                                                | Trees <10 m: N                            |
| Trees >10m: N                                                                                                                                                                                                                                                                                                                                            | Exotic riparian species: M                |
| Composition and health                                                                                                                                                                                                                                                                                                                                   |                                           |
| Vegetation status: agricultural                                                                                                                                                                                                                                                                                                                          | Dominant stratum: grassland               |
| Health: average                                                                                                                                                                                                                                                                                                                                          | Dieback: not detected                     |
| EDL height: 0.5 m                                                                                                                                                                                                                                                                                                                                        | EDL cover: 85%                            |
| Canopy species: none detected                                                                                                                                                                                                                                                                                                                            |                                           |
| Shrub species: none detected                                                                                                                                                                                                                                                                                                                             |                                           |
| Ground species: <i>Juncus usitatus</i> (D), <i>Cynodon dactylon</i> (A), <i>Eleocharis plana</i> (A), <i>Trifolium</i> spp.* (F), <i>Echium plantagineum</i> * (O), <i>Arctotheca calendula</i> * (O), <i>Rumex</i> sp. (O), <i>Scolochloa festuacea</i> (O), <i>Sclerolaena muricata</i> (O), <i>Carthamus lanatus</i> * (O), <i>Carex appressa</i> (O) |                                           |

| Macrophytes                                                                                                    |                                                                                 |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                                                                           |                                                                                 |
| Floating macrophytes: none detected                                                                            |                                                                                 |
| Emergent macrophytes: <i>Juncus usitatus</i> (M), <i>Eleocharis plana</i> (S), <i>Cyperus eragrostis</i> * (L) |                                                                                 |
| Aquatic biota                                                                                                  |                                                                                 |
| Aquatic macroinvertebrate sampling undertaken: no                                                              |                                                                                 |
| Habitat for platypus: unlikely habitat                                                                         |                                                                                 |
| State-mapped habitat for threatened fish species: unlikely                                                     |                                                                                 |
| Field-verified habitat for threatened fish species: unlikely                                                   |                                                                                 |
| Fish sampling undertaken: backpack electrofishing (207 seconds)                                                |                                                                                 |
| Aquatic vertebrates encountered: none                                                                          |                                                                                 |
| Notes: only inland yabby ( <i>Cherax destructor</i> ) detected                                                 |                                                                                 |
| Visual assessment of human disturbance (NSW AusRivAS)                                                          |                                                                                 |
| 1. Water quality                                                                                               | 0 (no evidence of disturbance)                                                  |
| 2. Instream                                                                                                    | 0 (no evidence of disturbance)                                                  |
| 3. Riparian zone                                                                                               | 2 (moderate disturbance, devegetation, exotic plant invasion)                   |
| 4. Catchment assessment                                                                                        | 2 (moderate disturbance, clearing, agriculture, grazing, drainage modification) |
| Overall score                                                                                                  | 4/16 (little disturbance)                                                       |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)

B: Aerial photograph from 100 m above ground, looking upstream

C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNR (2001).  
Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>Site code:</b> 5A                                                                                                                                                                                                                      | <b>Location:</b> Wallaby Creek                                                           |
| <b>Date:</b> 22/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                                                    |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.3926; 148.2899 (GDA 2020)                                        |
| <b>Water level:</b> moderate (= watermark)                                                                                                                                                                                                | <b>Likely flow nature:</b> semi-permanent (likely spring/seep fed; estimated 3 L/s flow) |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                                                          |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                                                          |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                                                          |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                                                          |
| <b>Field-verified waterway classification:</b> CLASS 2 – Moderate KFH                                                                                                                                                                     |                                                                                          |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                                                          |
| <b>Water quality</b>                                                                                                                                                                                                                      |                                                                                          |
| <b>Time (EST):</b> 12:35                                                                                                                                                                                                                  | <b>Water temperature:</b> 10.5°C                                                         |
| <b>Sp. Conductivity:</b> 420 µS/cm                                                                                                                                                                                                        | <b>pH:</b> 6.7                                                                           |
| <b>Dissolved oxygen:</b> -                                                                                                                                                                                                                | <b>Dissolved oxygen:</b> -                                                               |
| <b>Turbidity:</b> 99.2 NTU                                                                                                                                                                                                                | <b>Ion sample collected:</b> yes                                                         |
| <b>Observations within 2 m of sampling point</b>                                                                                                                                                                                          |                                                                                          |
| <b>Shading:</b> 80%                                                                                                                                                                                                                       | <b>Water colour:</b> clear                                                               |
| <b>Water odour:</b> none detected                                                                                                                                                                                                         | <b>Water surface:</b> normal                                                             |
| <b>Algae on substrate:</b> L                                                                                                                                                                                                              | <b>Algae in water column:</b> N                                                          |
| <b>Emergent macrophytes:</b> L                                                                                                                                                                                                            | <b>Submerged macrophytes:</b> N                                                          |
| <b>Floating macrophytes:</b> N                                                                                                                                                                                                            |                                                                                          |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                                                          |
| <b>Mode wetted width:</b> 1.5 m                                                                                                                                                                                                           | <b>Bankfull width:</b> 35 m                                                              |
| <b>Maximum depth:</b> 0.6 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1.5 m                                                            |
| <b>Minimum wetted width:</b> 0.5 m                                                                                                                                                                                                        | <b>Maximum wetted width:</b> 4 m                                                         |
| <b>Habitat types:</b> 0% riffle, 20% run, 80% sandy pool, 0% rocky pool, 0% dry                                                                                                                                                           |                                                                                          |
| <b>Variety of habitat:</b> shallow (<0.5 m), deep (>0.5 m), pool, run, large woody debris, macrophytes                                                                                                                                    |                                                                                          |
| <b>Habitat attributes:</b> detritus (M), sticks (S), branches (S), logs (L), periphyton (S), moss (N), filamentous algae (L), macrophytes (L), bank overhang (L), trailing bank vegetation (S), blanketing silt (N), substrate anoxia (N) |                                                                                          |
| <b>Upstream landuse:</b> past vegetation clearing, non-irrigated cropping, grazing                                                                                                                                                        |                                                                                          |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, moderate grazing                                                                                                                                                          |                                                                                          |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, light grazing                                                                                                                                                              |                                                                                          |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                                                          |
| <b>Bed substrates:</b> 10% silt/clay (<0.05 mm), 70% sand (0.05-2 mm), 20% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                  |                                                                                          |
| <b>Edge substrates:</b> 10% silt/clay (<0.05 mm), 70% sand (0.05-2 mm), 20% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                 |                                                                                          |
| <b>Bank soils:</b> sandy loam                                                                                                                                                                                                             | <b>Bank stability:</b> moderately stable                                                 |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                                                               |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)                                               |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (N), bank slumping (L), cattle pugging (N)                                                                                                                         |                                                                                          |

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream

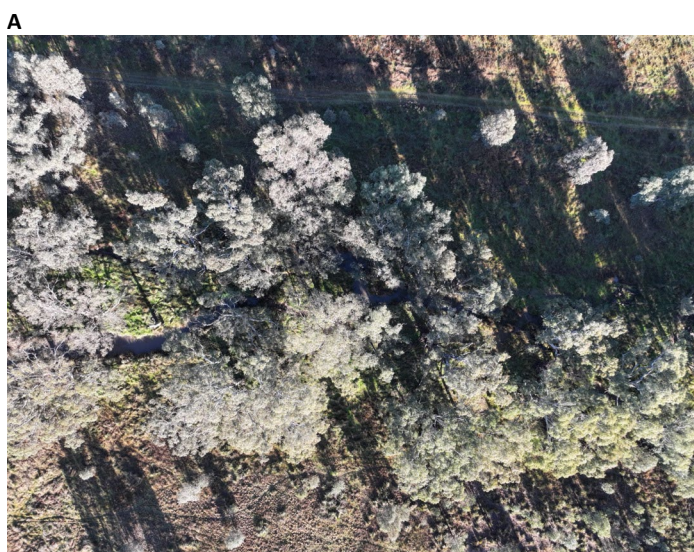


Right bank



| Riparian vegetation                                                                                                                                                                                                                                            |                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                          |                                            |
| Width of riparian zone on left bank: 15 m                                                                                                                                                                                                                      | Width of riparian zone on right bank: 25 m |
| Bare ground: N                                                                                                                                                                                                                                                 | Grasses/forbs: E                           |
| Shrubs: L                                                                                                                                                                                                                                                      | Trees <10 m: S                             |
| Trees >10m: M                                                                                                                                                                                                                                                  | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                         |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                     | Dominant stratum: tree                     |
| Health: good                                                                                                                                                                                                                                                   | Dieback: not detected                      |
| EDL height: 18 m                                                                                                                                                                                                                                               | EDL cover: 65%                             |
| Canopy species: <i>Eucalyptus camaldulensis</i> (D)                                                                                                                                                                                                            |                                            |
| Shrub species: <i>Eucalyptus camaldulensis</i> (O), <i>Rosa rubiginosa</i> * (R)                                                                                                                                                                               |                                            |
| Ground species: <i>Carex appressa</i> (D), <i>Verbena bonariensis</i> * (O), <i>Juncus usitatus</i> (O), <i>Stellaria media</i> * (O), <i>Enteropogon</i> sp. (O), <i>Cynodon dactylon</i> (O), <i>Carthamus lanatus</i> * (O), <i>Lomandra longifolia</i> (O) |                                            |

| Macrophytes                                                     |                                                             |
|-----------------------------------------------------------------|-------------------------------------------------------------|
| Submerged macrophytes: none detected                            |                                                             |
| Floating macrophytes: none detected                             |                                                             |
| Emergent macrophytes: <i>Juncus usitatus</i> (L)                |                                                             |
| Aquatic biota                                                   |                                                             |
| Aquatic macroinvertebrate sampling undertaken: no               |                                                             |
| Habitat for platypus: unlikely habitat                          |                                                             |
| State-mapped habitat for threatened fish species: unlikely      |                                                             |
| Field-verified habitat for threatened fish species: unlikely    |                                                             |
| Fish sampling undertaken: backpack electrofishing (623 seconds) |                                                             |
| Aquatic vertebrates encountered: <i>Gambusia holbrooki</i> *    |                                                             |
| Notes: inland yabby ( <i>Cherax destructor</i> ) detected       |                                                             |
| Visual assessment of human disturbance (NSW AusRivAS)           |                                                             |
| 1. Water quality                                                | 0 – no evidence of disturbance                              |
| 2. Instream                                                     | 0 – no evidence of disturbance                              |
| 3. Riparian zone                                                | 1 – little disturbance (exotic plant invasion)              |
| 4. Catchment assessment                                         | 2 – moderate disturbance (past clearing, cropping, grazing) |
| Overall score                                                   | 3/16 (little disturbance)                                   |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)

B: Aerial photograph from 100 m above ground, looking upstream

C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRm (2001).  
Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <b>Site code:</b> 5B                                                                                                                                                                                                                      | <b>Location:</b> Jacks Creek                                                                     |
| <b>Date:</b> 23/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                                                            |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.3895; 148.2913 (GDA 2020)                                                |
| <b>Water level:</b> moderate (= watermark)                                                                                                                                                                                                | <b>Likely flow nature:</b> permanent or semi-permanent (likely spring/seep fed; flow est. 1 L/s) |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                                                                  |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                                                                  |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                                                                  |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                                                                  |
| <b>Field-verified waterway classification:</b> CLASS 2 – Moderate KFH                                                                                                                                                                     |                                                                                                  |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                                                                  |
| <b>Water quality</b>                                                                                                                                                                                                                      |                                                                                                  |
| <b>Time (EST):</b> 8:45                                                                                                                                                                                                                   | <b>Water temperature:</b> 8.9°C                                                                  |
| <b>Sp. Conductivity:</b> 606 µS/cm                                                                                                                                                                                                        | <b>pH:</b> 7.6                                                                                   |
| <b>Dissolved oxygen:</b> -                                                                                                                                                                                                                | <b>Dissolved oxygen:</b> -                                                                       |
| <b>Turbidity:</b> 79 NTU                                                                                                                                                                                                                  | <b>Ion sample collected:</b> yes                                                                 |
| <b>Observations within 2 m of sampling point</b>                                                                                                                                                                                          |                                                                                                  |
| <b>Shading:</b> 90%                                                                                                                                                                                                                       | <b>Water colour:</b> clear                                                                       |
| <b>Water odour:</b> slight anoxia                                                                                                                                                                                                         | <b>Water surface:</b> normal                                                                     |
| <b>Algae on substrate:</b> N                                                                                                                                                                                                              | <b>Algae in water column:</b> N                                                                  |
| <b>Emergent macrophytes:</b> L                                                                                                                                                                                                            | <b>Submerged macrophytes:</b> N                                                                  |
| <b>Floating macrophytes:</b> N                                                                                                                                                                                                            |                                                                                                  |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                                                                  |
| <b>Mode wetted width:</b> 1 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 20 m                                                                      |
| <b>Maximum depth:</b> 0.8 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1 m                                                                      |
| <b>Minimum wetted width:</b> 0.5 m                                                                                                                                                                                                        | <b>Maximum wetted width:</b> 5 m                                                                 |
| <b>Habitat types:</b> 0% riffle, 90% run, 10% sandy pool, 0% rocky pool, 0% dry                                                                                                                                                           |                                                                                                  |
| <b>Variety of habitat:</b> shallow (<0.5 m), deep (>0.5 m), pool, run, macrophytes, large woody debris                                                                                                                                    |                                                                                                  |
| <b>Habitat attributes:</b> detritus (M), sticks (L), branches (L), logs (L), periphyton (L), moss (N), filamentous algae (L), macrophytes (E), bank overhang (L), trailing bank vegetation (E), blanketing silt (N), substrate anoxia (S) |                                                                                                  |
| <b>Upstream landuse:</b> past vegetation clearing, moderate grazing                                                                                                                                                                       |                                                                                                  |
| <b>Adjacent landuse (right bank):</b> natural, past vegetation clearing                                                                                                                                                                   |                                                                                                  |
| <b>Adjacent landuse (left bank):</b> natural, past vegetation clearing                                                                                                                                                                    |                                                                                                  |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                                                                  |
| <b>Bed substrates:</b> 30% silt/clay (<0.05 mm), 70% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                                                                  |
| <b>Edge substrates:</b> 30% silt/clay (<0.05 mm), 70% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                  |                                                                                                  |
| <b>Bank soils:</b> sandy loam                                                                                                                                                                                                             | <b>Bank stability:</b> stable                                                                    |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                                                                       |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)                                                       |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (N), bank slumping (N), cattle pugging (N)                                                                                                                         |                                                                                                  |

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRm (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                                                                                                            |                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                                                                                                          |                                            |
| Width of riparian zone on left bank: 20 m                                                                                                                                                                                                                                                                                                      | Width of riparian zone on right bank: 20 m |
| Bare ground: N                                                                                                                                                                                                                                                                                                                                 | Grasses/forbs: E                           |
| Shrubs: L                                                                                                                                                                                                                                                                                                                                      | Trees <10 m: L                             |
| Trees >10m: M                                                                                                                                                                                                                                                                                                                                  | Exotic riparian species: N                 |
| Composition and health                                                                                                                                                                                                                                                                                                                         |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                                                                                                     | Dominant stratum: tree                     |
| Health: good                                                                                                                                                                                                                                                                                                                                   | Dieback: not detected                      |
| EDL height: 19 m                                                                                                                                                                                                                                                                                                                               | EDL cover: 55%                             |
| Canopy species: <i>Eucalyptus camaldulensis</i> (D)                                                                                                                                                                                                                                                                                            |                                            |
| Shrub species: <i>Eucalyptus camaldulensis</i> (O), <i>Rosa rubiginosa</i> * (O), <i>Lycium ferocissimum</i> * (O), <i>Sida</i> sp. (O), <i>Brachychiton populneus</i> (R), <i>Acacia stenophylla</i> (O)                                                                                                                                      |                                            |
| Ground species: <i>Juncus usitatus</i> (D), <i>Cynodon dactylon</i> (F), <i>Heliotropium</i> sp. (O), <i>Verbena bonariensis</i> * (O), <i>Trifolium</i> spp.* (O), <i>Arctotheca calendula</i> * (O), <i>Carthamus lanatus</i> * (O), <i>Rumex</i> sp. (O), <i>Sporobolus</i> sp. (O), <i>Veronica persica</i> * (O), <i>Aristida</i> sp. (O) |                                            |

| Macrophytes                                                                                                                                                                                                                                                                   |                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Submerged macrophytes: <i>Nitella</i> sp. (L)                                                                                                                                                                                                                                 |                                                             |
| Floating macrophytes: none detected                                                                                                                                                                                                                                           |                                                             |
| Emergent macrophytes: <i>Juncus usitatus</i> (E), <i>Ranunculus</i> sp. (L), <i>Cynogeton procerum</i> (L), <i>Eleocharis plana</i> (L), <i>Polygonum plebeium</i> (L), <i>Diplachne fusca</i> (L), <i>Veronica anagallis-aquatica</i> * (L), <i>Persicaria decipiens</i> (L) |                                                             |
| Aquatic biota                                                                                                                                                                                                                                                                 |                                                             |
| Aquatic macroinvertebrate sampling undertaken: no                                                                                                                                                                                                                             |                                                             |
| Habitat for platypus: unlikely habitat                                                                                                                                                                                                                                        |                                                             |
| State-mapped habitat for threatened fish species: unlikely                                                                                                                                                                                                                    |                                                             |
| Field-verified habitat for threatened fish species: unlikely                                                                                                                                                                                                                  |                                                             |
| Fish sampling undertaken: backpack electrofishing (416 seconds)                                                                                                                                                                                                               |                                                             |
| Aquatic vertebrates encountered: <i>Gambusia holbrooki</i> *                                                                                                                                                                                                                  |                                                             |
| Notes: inland yabby ( <i>Cherax destructor</i> ) detected                                                                                                                                                                                                                     |                                                             |
| Visual assessment of human disturbance (NSW AusRivAS)                                                                                                                                                                                                                         |                                                             |
| 1. Water quality                                                                                                                                                                                                                                                              | 0 – no evidence of disturbance                              |
| 2. Instream                                                                                                                                                                                                                                                                   | 0 – no evidence of disturbance                              |
| 3. Riparian zone                                                                                                                                                                                                                                                              | 1 – little disturbance (exotic plant invasion)              |
| 4. Catchment assessment                                                                                                                                                                                                                                                       | 2 – moderate disturbance (past clearing, cropping, grazing) |
| Overall score                                                                                                                                                                                                                                                                 | 3/16 (little disturbance)                                   |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)

B: Aerial photograph from 100 m above ground, looking upstream

C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                            |                                                                                                                      |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Site code:</b> 6                        | <b>Location:</b> Ugumjil Creek                                                                                       |
| <b>Date:</b> 23/07/2025                    | <b>Season:</b> autumn                                                                                                |
| <b>Assessor:</b> DM                        | <b>Coordinates:</b> -32.4027; 148.2981 (GDA 2020)                                                                    |
| <b>Water level:</b> moderate (= watermark) | <b>Likely flow nature:</b> intermittent to semi-permanent, with potential spring/seep trickle flow; estimated 2 L/s) |

**Topography:** broad valley

#### Fish habitat classification

**State-mapped Key Fish Habitat (KFH):** yes

**Field-verified KFH:** yes

**Field-verified waterway classification:** CLASS 2 – Moderate KFH

**Field-verified aquatic habitat sensitivity:** TYPE 2 – Moderately sensitive KFH

#### Water quality

|                                    |                                  |
|------------------------------------|----------------------------------|
| <b>Time (EST):</b> 12:04           | <b>Water temperature:</b> 10.5°C |
| <b>Sp. Conductivity:</b> 327 µS/cm | <b>pH:</b> 7.0                   |
| <b>Dissolved oxygen:</b> -         | <b>Dissolved oxygen:</b> -       |
| <b>Turbidity:</b> 100 NTU          | <b>Ion sample collected:</b>     |

#### Observations within 2 m of sampling point

|                                   |                                 |
|-----------------------------------|---------------------------------|
| <b>Shading:</b> 100%              | <b>Water colour:</b> clear      |
| <b>Water odour:</b> none detected | <b>Water surface:</b> normal    |
| <b>Algae on substrate:</b> L      | <b>Algae in water column:</b> N |
| <b>Emergent macrophytes:</b> S    | <b>Submerged macrophytes:</b> N |
| <b>Floating macrophytes:</b> N    |                                 |

#### Reach observations (100 m reach, or 10 x modal width)

|                                                                                                                                                                                                                                           |                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Mode wetted width:</b> 0.5 m                                                                                                                                                                                                           | <b>Bankfull width:</b> 20 m      |
| <b>Maximum depth:</b> 0.2 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1.8 m    |
| <b>Minimum wetted width:</b> 0.3 m                                                                                                                                                                                                        | <b>Maximum wetted width:</b> 1 m |
| <b>Habitat types:</b> 0% riffle, 90% run, 10% sandy pool, 0% rocky pool, 0% dry                                                                                                                                                           |                                  |
| <b>Variety of habitat:</b> shallow (<0.5 m), run, pool, macrophytes                                                                                                                                                                       |                                  |
| <b>Habitat attributes:</b> detritus (S), sticks (N), branches (N), logs (N), periphyton (L), moss (N), filamentous algae (L), macrophytes (S), bank overhang (S), trailing bank vegetation (M), blanketing silt (N), substrate anoxia (N) |                                  |
| <b>Upstream landuse:</b> past vegetation clearing, non-irrigated cropping, moderate grazing                                                                                                                                               |                                  |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing                                                                                                                                                                            |                                  |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing                                                                                                                                                                             |                                  |

#### Bed, edge and bank characteristics

|                                                                                                                                                                           |                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| <b>Bed substrates:</b> 20% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 20% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock  |                                            |
| <b>Edge substrates:</b> 20% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 20% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock |                                            |
| <b>Bank soils:</b> sandy loam                                                                                                                                             | <b>Bank stability:</b> moderately stable   |
| <b>Bed stability:</b> bed stable                                                                                                                                          | <b>Bank shape:</b> concave                 |
| <b>Channel shape:</b> U shaped                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N) |

**Local catchment erosion:** gully (N), rill (N), tunnel (N), sheet (L), bank slumping (L), cattle pugging (N)

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream

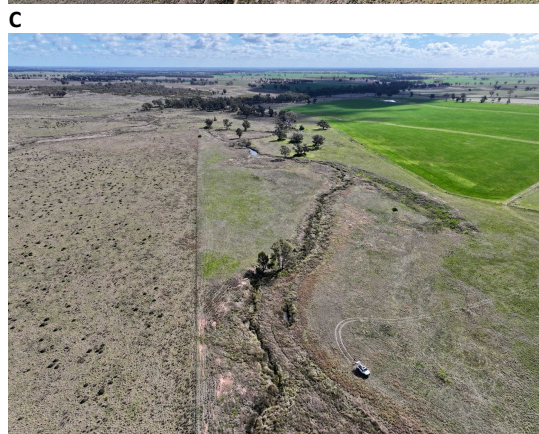


Right bank



| Riparian vegetation                                                                                                                                                                                                                                                              |                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                                                            |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                                                                         | Width of riparian zone on right bank: 1 m |
| Bare ground: L                                                                                                                                                                                                                                                                   | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                                                                        | Trees <10 m: N                            |
| Trees >10m: N                                                                                                                                                                                                                                                                    | Exotic riparian species: L                |
| Composition and health                                                                                                                                                                                                                                                           |                                           |
| Vegetation status: agricultural                                                                                                                                                                                                                                                  | Dominant stratum: grassland               |
| Health: average                                                                                                                                                                                                                                                                  | Dieback: not detected                     |
| EDL height: 1.2 m                                                                                                                                                                                                                                                                | EDL cover: 95%                            |
| Canopy species: none detected                                                                                                                                                                                                                                                    |                                           |
| Shrub species: <i>Lomandra longifolia</i> (R), <i>Melia azedarach</i> (R), <i>Rosa rubiginosa</i> * (R)                                                                                                                                                                          |                                           |
| Ground species: <i>Carex appressa</i> (D), <i>Juncus usitatus</i> (F), <i>Verbena bonariensis</i> * (O), <i>Bidens pilosa</i> * (O), <i>Paspalum</i> sp. (O), <i>Rumex</i> sp. (O), <i>Cynodon dactylon</i> (O), <i>Conyza bonariensis</i> * (O), <i>Cenchrus spinifex</i> * (O) |                                           |

| Macrophytes                                                                                                 |                                                                                          |
|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                                                                        |                                                                                          |
| Floating macrophytes: none detected                                                                         |                                                                                          |
| Emergent macrophytes: <i>Juncus usitatus</i> (S), <i>Persicaria decipiens</i> (L)                           |                                                                                          |
| Aquatic biota                                                                                               |                                                                                          |
| Aquatic macroinvertebrate sampling undertaken: no                                                           |                                                                                          |
| Habitat for platypus: unlikely habitat                                                                      |                                                                                          |
| State-mapped habitat for threatened fish species: unlikely                                                  |                                                                                          |
| Field-verified habitat for threatened fish species: unlikely                                                |                                                                                          |
| Fish sampling undertaken: backpack electrofishing (161 seconds)                                             |                                                                                          |
| Aquatic vertebrates encountered: <i>Hypseleotris acropinna</i> , <i>Gambusia holbrooki</i> *                |                                                                                          |
| Notes: inland yabby ( <i>Cherax destructor</i> ) and glass shrimp ( <i>Paratya australiensis</i> ) detected |                                                                                          |
| Visual assessment of human disturbance (NSW AusRivAS)                                                       |                                                                                          |
| 1. Water quality                                                                                            | 0 – no evidence of disturbance                                                           |
| 2. Instream                                                                                                 | 0 – no evidence of disturbance (filamentous algae)                                       |
| 3. Riparian zone                                                                                            | 3 – high disturbance (past vegetation clearing, exotic plant invasion, bank degradation) |
| 4. Catchment assessment                                                                                     | 2 – moderate disturbance (past vegetation clearing, grazing, cropping)                   |
| Overall score                                                                                               | 5/16 (little disturbance)                                                                |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                               |                                                                                                                               |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Site code:</b> 7                           | <b>Location:</b> Ugumjil Creek                                                                                                |
| <b>Date:</b> 23/07/2025                       | <b>Season:</b> autumn                                                                                                         |
| <b>Assessor:</b> DM                           | <b>Coordinates:</b> -32.3974;<br>148.2926 (GDA 2020)                                                                          |
| <b>Water level:</b> moderate<br>(= watermark) | <b>Likely flow nature:</b> intermittent<br>to semi-permanent, with potential<br>spring/seep trickle flow; estimated<br>2 L/s) |

**Topography:** broad valley

#### Fish habitat classification

**State-mapped Key Fish Habitat (KFH):** yes

**Field-verified KFH:** yes

**Field-verified waterway classification:** CLASS 2 – Moderate KFH

**Field-verified aquatic habitat sensitivity:** TYPE 2 – Moderately sensitive KFH

#### Water quality

|                                    |                                  |
|------------------------------------|----------------------------------|
| <b>Time (EST):</b> 10:50           | <b>Water temperature:</b> 9.8°C  |
| <b>Sp. Conductivity:</b> 332 µS/cm | <b>pH:</b> 7.4                   |
| <b>Dissolved oxygen:</b> -         | <b>Dissolved oxygen:</b> -       |
| <b>Turbidity:</b> 74 NTU           | <b>Ion sample collected:</b> yes |

#### Observations within 2 m of sampling point

|                                   |                                 |
|-----------------------------------|---------------------------------|
| <b>Shading:</b> 100%              | <b>Water colour:</b> clear      |
| <b>Water odour:</b> none detected | <b>Water surface:</b> normal    |
| <b>Algae on substrate:</b> L      | <b>Algae in water column:</b> N |
| <b>Emergent macrophytes:</b> L    | <b>Submerged macrophytes:</b> N |
| <b>Floating macrophytes:</b> N    |                                 |

#### Reach observations (100 m reach, or 10 x modal width)

|                                                                                                                                                                                                                                           |                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Mode wetted width:</b> 1 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 15 m        |
| <b>Maximum depth:</b> 0.3 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1.5 m      |
| <b>Minimum wetted width:</b> 0.3 m                                                                                                                                                                                                        | <b>Maximum wetted width:</b> 1.5 m |
| <b>Habitat types:</b> 0% riffle, 80% run, 20% sandy pool, 0% rocky pool, 0% dry                                                                                                                                                           |                                    |
| <b>Variety of habitat:</b> shallow (<0.5 m), pool, run, large woody debris, macrophytes                                                                                                                                                   |                                    |
| <b>Habitat attributes:</b> detritus (S), sticks (L), branches (L), logs (L), periphyton (S), moss (N), filamentous algae (L), macrophytes (M), bank overhang (L), trailing bank vegetation (M), blanketing silt (N), substrate anoxia (L) |                                    |
| <b>Upstream landuse:</b> past vegetation clearing, non-irrigated cropping, moderate grazing                                                                                                                                               |                                    |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, light grazing                                                                                                                                                             |                                    |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, light grazing                                                                                                                                                              |                                    |

#### Bed, edge and bank characteristics

|                                                                                                                                                                          |                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| <b>Bed substrates:</b> 10% silt/clay (<0.05 mm), 85% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock  |                                            |
| <b>Edge substrates:</b> 85% silt/clay (<0.05 mm), 10% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock |                                            |
| <b>Bank soils:</b> sandy loam                                                                                                                                            | <b>Bank stability:</b> stable              |
| <b>Bed stability:</b> bed stable                                                                                                                                         | <b>Bank shape:</b> concave                 |
| <b>Channel shape:</b> U shaped                                                                                                                                           | <b>Recent deposits:</b> silt (N), sand (N) |

**Local catchment erosion:** gully (N), rill (N), tunnel (N), sheet (N), bank slumping (N), cattle grazing (N)

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                                    |                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                                  |                                            |
| Width of riparian zone on left bank: 15 m                                                                                                                                                                                                                              | Width of riparian zone on right bank: 15 m |
| Bare ground: N                                                                                                                                                                                                                                                         | Grasses/forbs: E                           |
| Shrubs: L                                                                                                                                                                                                                                                              | Trees <10 m: L                             |
| Trees >10m: S                                                                                                                                                                                                                                                          | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                                 |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                             | Dominant stratum: tree                     |
| Health: good                                                                                                                                                                                                                                                           | Dieback: 1-10%                             |
| EDL height: 15 m                                                                                                                                                                                                                                                       | EDL cover: 15%                             |
| Canopy species: <i>Eucalyptus camaldulensis</i> (D), <i>Eucalyptus microcarpa</i> (R)                                                                                                                                                                                  |                                            |
| Shrub species: <i>Lycium ferocissimum</i> * (O), <i>Eucalyptus camaldulensis</i> (O), <i>Melia azedarach</i> (R), <i>Lomandra longifolia</i> (R)                                                                                                                       |                                            |
| Ground species: <i>Carex appressa</i> (D), <i>Juncus usitatus</i> (F), <i>Verbena bonariensis</i> * (O), <i>Bidens pilosa</i> * (O), <i>Daucus glochidiatus</i> (O), <i>Bromus</i> sp. (O), <i>Rumex</i> sp. (O), <i>Paspalum</i> sp. (O), <i>Cynodon dactylon</i> (O) |                                            |

| Macrophytes                                                                       |                                                                            |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Submerged macrophytes: none detected                                              |                                                                            |
| Floating macrophytes: none detected                                               |                                                                            |
| Emergent macrophytes: <i>Juncus usitatus</i> (S), <i>Persicaria decipiens</i> (L) |                                                                            |
| Aquatic biota                                                                     |                                                                            |
| Aquatic macroinvertebrate sampling undertaken: no                                 |                                                                            |
| Habitat for platypus: unlikely habitat                                            |                                                                            |
| State-mapped habitat for threatened fish species: unlikely                        |                                                                            |
| Field-verified habitat for threatened fish species: unlikely                      |                                                                            |
| Fish sampling undertaken: backpack electrofishing (194 seconds)                   |                                                                            |
| Aquatic vertebrates encountered: none                                             |                                                                            |
| Notes: only inland yabby ( <i>Cherax destructor</i> ) detected                    |                                                                            |
| Visual assessment of human disturbance (NSW AusRivAS)                             |                                                                            |
| 1. Water quality                                                                  | 0 – no evidence of disturbance                                             |
| 2. Instream                                                                       | 0 – no evidence of disturbance                                             |
| 3. Riparian zone                                                                  | 2 – moderate disturbance (past vegetation clearing, exotic plant invasion) |
| 4. Catchment assessment                                                           | 2 – moderate disturbance (past vegetation clearing, cropping, grazing)     |
| Overall score                                                                     | 4/16 (little disturbance)                                                  |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)

B: Aerial photograph from 100 m above ground, looking upstream

C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNR (2001).  
Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Site code:</b> 8                                                                                                                                                                                                                       | <b>Location:</b> Jacks Creek                                                                             |
| <b>Date:</b> 23/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                                                                    |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.3888; 148.3055 (GDA 2020)                                                        |
| <b>Water level:</b> moderate (= watermark)                                                                                                                                                                                                | <b>Likely flow nature:</b> semi-permanent (potentially spring/seep fed; trickle flow estimated <0.1 L/s) |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                                                                          |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                                                                          |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                                                                          |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                                                                          |
| <b>Field-verified waterway classification:</b> CLASS 2 – Moderate KFH                                                                                                                                                                     |                                                                                                          |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                                                                          |
| <b>Water quality</b>                                                                                                                                                                                                                      |                                                                                                          |
| <b>Time (EST):</b> 13:40                                                                                                                                                                                                                  | <b>Water temperature:</b> 12.4°C                                                                         |
| <b>Sp. Conductivity:</b> 512 µS/cm                                                                                                                                                                                                        | <b>pH:</b> 7.8                                                                                           |
| <b>Dissolved oxygen:</b> 87.5%                                                                                                                                                                                                            | <b>Dissolved oxygen:</b> 9.13 mg/L                                                                       |
| <b>Turbidity:</b> 10.5 NTU                                                                                                                                                                                                                | <b>Ion sample collected:</b> yes                                                                         |
| <b>Observations within 2 m of sampling point</b>                                                                                                                                                                                          |                                                                                                          |
| <b>Shading:</b> 20%                                                                                                                                                                                                                       | <b>Water colour:</b> clear                                                                               |
| <b>Water odour:</b> none detected                                                                                                                                                                                                         | <b>Water surface:</b> normal                                                                             |
| <b>Algae on substrate:</b> L                                                                                                                                                                                                              | <b>Algae in water column:</b> N                                                                          |
| <b>Emergent macrophytes:</b> L                                                                                                                                                                                                            | <b>Submerged macrophytes:</b> N                                                                          |
| <b>Floating macrophytes:</b> N                                                                                                                                                                                                            |                                                                                                          |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                                                                          |
| <b>Mode wetted width:</b> 2 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 20 m                                                                              |
| <b>Maximum depth:</b> 0.2 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 0.8 m                                                                            |
| <b>Minimum wetted width:</b> 0.1 m                                                                                                                                                                                                        | <b>Maximum wetted width:</b> 4 m                                                                         |
| <b>Habitat types:</b> 0% riffle, 30% run, 70% sandy pool, 0% rocky pool, 0% dry                                                                                                                                                           |                                                                                                          |
| <b>Variety of habitat:</b> shallow (<0.5 m), pool, run, macrophytes                                                                                                                                                                       |                                                                                                          |
| <b>Habitat attributes:</b> detritus (L), sticks (N), branches (N), logs (N), periphyton (E), moss (N), filamentous algae (L), macrophytes (L), bank overhang (N), trailing bank vegetation (S), blanketing silt (N), substrate anoxia (N) |                                                                                                          |
| <b>Upstream landuse:</b> past vegetation clearing, moderate grazing                                                                                                                                                                       |                                                                                                          |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, heavy grazing                                                                                                                                                             |                                                                                                          |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, heavy grazing                                                                                                                                                              |                                                                                                          |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                                                                          |
| <b>Bed substrates:</b> 39% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 1% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                                                                          |
| <b>Edge substrates:</b> 39% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 1% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                  |                                                                                                          |
| <b>Bank soils:</b> sandy clay                                                                                                                                                                                                             | <b>Bank stability:</b> moderately stable                                                                 |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                                                                               |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)                                                               |
| <b>Local catchment erosion:</b> gully (N), rill (L), tunnel (N), sheet (S), bank slumping (N), cattle pugging (N)                                                                                                                         |                                                                                                          |

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                                                                                                            |                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                                                                                                                          |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                                                                                                                                       | Width of riparian zone on right bank: 1 m |
| Bare ground: S                                                                                                                                                                                                                                                                                                                                 | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                                                                                                                                      | Trees <10 m: N                            |
| Trees >10m: L                                                                                                                                                                                                                                                                                                                                  | Exotic riparian species: L                |
| Composition and health                                                                                                                                                                                                                                                                                                                         |                                           |
| Vegetation status: agricultural                                                                                                                                                                                                                                                                                                                | Dominant stratum: grassland               |
| Health: poor                                                                                                                                                                                                                                                                                                                                   | Dieback: not detected                     |
| EDL height: 0.7 m                                                                                                                                                                                                                                                                                                                              | EDL cover: 80%                            |
| Canopy species: <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> (R)                                                                                                                                                                                                                                                                            |                                           |
| Shrub species: <i>Lycium ferocissimum</i> * (O)                                                                                                                                                                                                                                                                                                |                                           |
| Ground species: <i>Carex appressa</i> (D), <i>Cynodon dactylon</i> (A), <i>Trifolium</i> spp.* (A), <i>Rumex</i> sp. (O), <i>Onopordum acanthium</i> subsp. <i>acanthium</i> * (O), <i>Arctotheca calendula</i> * (O), <i>Silybum marianum</i> * (O), <i>Sonchus oleraceus</i> * (O), <i>Urtica incisa</i> (R), <i>Xanthium spinosum</i> * (R) |                                           |

| Macrophytes                                                                     |                                                                                                         |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                                            |                                                                                                         |
| Floating macrophytes: none detected                                             |                                                                                                         |
| Emergent macrophytes: <i>Typha domingensis</i> (L), <i>Eleocharis plana</i> (L) |                                                                                                         |
| Aquatic biota                                                                   |                                                                                                         |
| Aquatic macroinvertebrate sampling undertaken: no                               |                                                                                                         |
| Habitat for platypus: unlikely habitat                                          |                                                                                                         |
| State-mapped habitat for threatened fish species: unlikely                      |                                                                                                         |
| Field-verified habitat for threatened fish species: unlikely                    |                                                                                                         |
| Fish sampling undertaken: backpack electrofishing (277 seconds)                 |                                                                                                         |
| Aquatic vertebrates encountered: tadpoles only                                  |                                                                                                         |
| Notes: inland yabby ( <i>Cherax destructor</i> ) detected                       |                                                                                                         |
| Visual assessment of human disturbance (NSW AusRivAS)                           |                                                                                                         |
| 1. Water quality                                                                | 0 – no evidence of disturbance                                                                          |
| 2. Instream                                                                     | 1 – little disturbance (filamentous algae)                                                              |
| 3. Riparian zone                                                                | 3 – high disturbance (past vegetation clearing, exotic plant invasion, bank degradation, sheep grazing) |
| 4. Catchment assessment                                                         | 2 – moderate disturbance (past vegetation clearing, grazing, cropping)                                  |
| Overall score                                                                   | 6/16 (moderate disturbance)                                                                             |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>Site code:</b> 9A                                                                                                                                                                                                                      | <b>Location:</b> Bundara Creek                    |
| <b>Date:</b> 23/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                             |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.4261; 148.3034 (GDA 2020) |
| <b>Water level:</b> no flow - isolated                                                                                                                                                                                                    | <b>Likely flow nature:</b> ephemeral              |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                   |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                   |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                   |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                   |
| <b>Field-verified waterway classification:</b> CLASS 3 – Minimal KFH                                                                                                                                                                      |                                                   |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 3 – Minimally sensitive KFH                                                                                                                                                       |                                                   |
| <b>Water quality</b>                                                                                                                                                                                                                      |                                                   |
| <b>Time (EST):</b> 15:33                                                                                                                                                                                                                  | <b>Water temperature:</b> 10.5°C                  |
| <b>Sp. Conductivity:</b> 303 µS/cm                                                                                                                                                                                                        | <b>pH:</b> 6.9                                    |
| <b>Dissolved oxygen:</b> -                                                                                                                                                                                                                | <b>Dissolved oxygen:</b> -                        |
| <b>Turbidity:</b> 376 NTU                                                                                                                                                                                                                 | <b>Ion sample collected:</b> yes                  |
| <b>Observations within 2 m of sampling point</b>                                                                                                                                                                                          |                                                   |
| <b>Shading:</b> 90%                                                                                                                                                                                                                       | <b>Water colour:</b> opaque                       |
| <b>Water odour:</b> none detected                                                                                                                                                                                                         | <b>Water surface:</b> normal                      |
| <b>Algae on substrate:</b> N                                                                                                                                                                                                              | <b>Algae in water column:</b> N                   |
| <b>Emergent macrophytes:</b> L                                                                                                                                                                                                            | <b>Submerged macrophytes:</b> N                   |
| <b>Floating macrophytes:</b> N                                                                                                                                                                                                            |                                                   |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                   |
| <b>Mode wetted width:</b> 0.4 m                                                                                                                                                                                                           | <b>Bankfull width:</b> 20 m                       |
| <b>Maximum depth:</b> 0.2 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1.1 m                     |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 3 m                  |
| <b>Habitat types:</b> 0% riffle, 0% run, 50% sandy pool, 0% rocky pool, 50% dry                                                                                                                                                           |                                                   |
| <b>Variety of habitat:</b> shallow (<0.5 m), pool, macrophytes                                                                                                                                                                            |                                                   |
| <b>Habitat attributes:</b> detritus (L), sticks (N), branches (N), logs (N), periphyton (N), moss (N), filamentous algae (L), macrophytes (L), bank overhang (N), trailing bank vegetation (S), blanketing silt (N), substrate anoxia (N) |                                                   |
| <b>Upstream landuse:</b> past vegetation clearing, light grazing                                                                                                                                                                          |                                                   |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, light grazing                                                                                                                                                             |                                                   |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, light grazing, road corridor                                                                                                                                               |                                                   |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                   |
| <b>Bed substrates:</b> 15% silt/clay (<0.05 mm), 80% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                   |
| <b>Edge substrates:</b> 15% silt/clay (<0.05 mm), 80% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                  |                                                   |
| <b>Bank soils:</b> sandy loam                                                                                                                                                                                                             | <b>Bank stability:</b> stable                     |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                        |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)        |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (N), bank slumping (N), cattle pugging (N)                                                                                                                         |                                                   |

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                     |                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                                   |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                                                | Width of riparian zone on right bank: 1 m |
| Bare ground: N                                                                                                                                                                                                                                          | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                                               | Trees <10 m: L                            |
| Trees >10m: N                                                                                                                                                                                                                                           | Exotic riparian species: L                |
| Composition and health                                                                                                                                                                                                                                  |                                           |
| Vegetation status: agricultural                                                                                                                                                                                                                         | Dominant stratum: grassland               |
| Health: average                                                                                                                                                                                                                                         | Dieback: not detected                     |
| EDL height: 0.8 m                                                                                                                                                                                                                                       | EDL cover: 95%                            |
| Canopy species: <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (R), <i>Pittosporum angustifolium</i> (R)                                                                                                                                  |                                           |
| Shrub species: <i>Lycium ferocissimum</i> * (R), <i>Cassinia</i> sp. (R), <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (R)                                                                                                              |                                           |
| Ground species: <i>Carex appressa</i> (D), <i>Juncus usitatus</i> (F), <i>Trifolium</i> spp.* (O), <i>Cynodon dactylon</i> (O), <i>Arctotheca calendula</i> * (O), <i>Sonchus hydrophilus</i> (O), <i>Carthamus lanatus</i> * (O), <i>Rumex</i> sp. (O) |                                           |

| Macrophytes                                                     |                                                                        |
|-----------------------------------------------------------------|------------------------------------------------------------------------|
| Submerged macrophytes: none detected                            |                                                                        |
| Floating macrophytes: none detected                             |                                                                        |
| Emergent macrophytes: <i>Juncus usitatus</i> (S)                |                                                                        |
| Aquatic biota                                                   |                                                                        |
| Aquatic macroinvertebrate sampling undertaken: no               |                                                                        |
| Habitat for platypus: unlikely habitat                          |                                                                        |
| State-mapped habitat for threatened fish species: unlikely      |                                                                        |
| Field-verified habitat for threatened fish species: unlikely    |                                                                        |
| Fish sampling undertaken: backpack electrofishing (397 seconds) |                                                                        |
| Aquatic vertebrates encountered: none                           |                                                                        |
| Notes: inland yabby ( <i>Cherax destructor</i> ) detected       |                                                                        |
| Visual assessment of human disturbance (NSW AusRivAS)           |                                                                        |
| 1. Water quality                                                | 0 – no evidence of disturbance                                         |
| 2. Instream                                                     | 0 – no evidence of disturbance                                         |
| 3. Riparian zone                                                | 2 – high disturbance (past vegetation clearing, exotic plant invasion) |
| 4. Catchment assessment                                         | 2 – high disturbance (past vegetation clearing, grazing, cropping)     |
| Overall score                                                   | 4/16 (little disturbance)                                              |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>Site code:</b> 9B                                                                                                                                                                                                                      | <b>Location:</b> Tributary of Bundara Creek       |
| <b>Date:</b> 23/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                             |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.4327; 148.3026 (GDA 2020) |
| <b>Water level:</b> no flow - dry                                                                                                                                                                                                         | <b>Likely flow nature:</b> ephemeral              |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                   |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                   |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                   |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                   |
| <b>Field-verified waterway classification:</b> CLASS 3 – Minimal KFH                                                                                                                                                                      |                                                   |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 3 – Minimally sensitive KFH                                                                                                                                                       |                                                   |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                   |
| <b>Mode wetted width:</b> 0 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 10 m                       |
| <b>Maximum depth:</b> 0 m                                                                                                                                                                                                                 | <b>Bankfull height:</b> 1.2 m                     |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 0 m                  |
| <b>Habitat types:</b> 0% riffle, 0% run, 0% sandy pool, 0% rocky pool, 100% dry                                                                                                                                                           |                                                   |
| <b>Variety of habitat:</b> macrophytes                                                                                                                                                                                                    |                                                   |
| <b>Habitat attributes:</b> detritus (L), sticks (N), branches (N), logs (N), periphyton (N), moss (N), filamentous algae (N), macrophytes (S), bank overhang (N), trailing bank vegetation (N), blanketing silt (N), substrate anoxia (N) |                                                   |
| <b>Upstream landuse:</b> past vegetation clearing, non-irrigated cropping, moderate grazing                                                                                                                                               |                                                   |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, non-irrigated cropping                                                                                                                                                    |                                                   |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, moderate grazing                                                                                                                                                           |                                                   |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                   |
| <b>Bed substrates:</b> 5% silt/clay (<0.05 mm), 75% sand (0.05-2 mm), 20% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                   |
| <b>Edge substrates:</b> 5% silt/clay (<0.05 mm), 75% sand (0.05-2 mm), 20% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                  |                                                   |
| <b>Bank soils:</b> sandy clay, loam                                                                                                                                                                                                       | <b>Bank stability:</b> moderately stable          |
| <b>Bed stability:</b> moderate deposition                                                                                                                                                                                                 | <b>Bank shape:</b> concave                        |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)        |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (N), bank slumping (L), cattle pugging (N)                                                                                                                         |                                                   |



Upstream



Left bank



Downstream



Right bank

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



| Riparian vegetation                                                                                                                                                                                                                                                                                                                                                        |                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                                                                                                                                                      |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                                                                                                                                                                   | Width of riparian zone on right bank: 1 m |
| Bare ground: L                                                                                                                                                                                                                                                                                                                                                             | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                                                                                                                                                                  | Trees <10 m: L                            |
| Trees >10m: L                                                                                                                                                                                                                                                                                                                                                              | Exotic riparian species: S                |
| Composition and health                                                                                                                                                                                                                                                                                                                                                     |                                           |
| Vegetation status: exotic                                                                                                                                                                                                                                                                                                                                                  | Dominant stratum: grassland               |
| Health: average                                                                                                                                                                                                                                                                                                                                                            | Dieback: not detected                     |
| EDL height: 1.1 m                                                                                                                                                                                                                                                                                                                                                          | EDL cover: 95%                            |
| Canopy species: <i>Callitris glaucophylla</i> (R), <i>Eucalyptus sideroxylon</i> (R), <i>Eucalyptus melliodora</i> (R)                                                                                                                                                                                                                                                     |                                           |
| Shrub species: <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (R), <i>Maireana</i> sp. (R), <i>Acacia dealbata</i> (R)                                                                                                                                                                                                                                       |                                           |
| Ground species: <i>Juncus usitatus</i> (D), <i>Carex appressa</i> (F), <i>Cynodon dactylon</i> (F), <i>Sporobolus</i> sp. (F), <i>Arctotheca calendula</i> * (O), <i>Carthamus lanatus</i> * (O), <i>Enteropogon</i> sp. (O), <i>Verbena bonariensis</i> * (O), <i>Rumex</i> sp. (O), <i>Verbascum virgatum</i> * (O), <i>Trifolium</i> spp.* (O), <i>Aristida</i> sp. (O) |                                           |

| Macrophytes                                                  |                                                                                          |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                         |                                                                                          |
| Floating macrophytes: none detected                          |                                                                                          |
| Emergent macrophytes: <i>Juncus usitatus</i> (S)             |                                                                                          |
| Aquatic biota                                                |                                                                                          |
| Aquatic macroinvertebrate sampling undertaken: no            |                                                                                          |
| Habitat for platypus: unlikely habitat                       |                                                                                          |
| State-mapped habitat for threatened fish species: unlikely   |                                                                                          |
| Field-verified habitat for threatened fish species: unlikely |                                                                                          |
| Fish sampling undertaken: no                                 |                                                                                          |
| Aquatic vertebrates encountered: none                        |                                                                                          |
| Visual assessment of human disturbance (NSW AusRivAS)        |                                                                                          |
| 1. Water quality                                             | 0 – no evidence of disturbance                                                           |
| 2. Instream                                                  | 0 – no evidence of disturbance                                                           |
| 3. Riparian zone                                             | 3 – high disturbance (past vegetation clearing, exotic plant invasion, bank degradation) |
| 4. Catchment assessment                                      | 2 – moderate disturbance (past vegetation clearing, cropping, grazing)                   |
| Overall score                                                | 5/16 (little disturbance)                                                                |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                               |                                                                                                                               |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Site code:</b> 10                          | <b>Location:</b> Ugumjil Creek                                                                                                |
| <b>Date:</b> 24/07/2025                       | <b>Season:</b> autumn                                                                                                         |
| <b>Assessor:</b> DM                           | <b>Coordinates:</b> -32.4249;<br>148.3223 (GDA 2020)                                                                          |
| <b>Water level:</b> moderate<br>(= watermark) | <b>Likely flow nature:</b> intermittent<br>to semi-permanent, with potential<br>spring/seep trickle flow; estimated<br>2 L/s) |

**Topography:** broad valley

#### Fish habitat classification

**State-mapped Key Fish Habitat (KFH):** yes

**Field-verified KFH:** yes

**Field-verified waterway classification:** CLASS 2 – Moderate KFH

**Field-verified aquatic habitat sensitivity:** TYPE 2 – Moderately sensitive KFH

#### Water quality

|                                    |                                  |
|------------------------------------|----------------------------------|
| <b>Time (EST):</b> 8:57            | <b>Water temperature:</b> 7.0°C  |
| <b>Sp. Conductivity:</b> 315 µS/cm | <b>pH:</b> 7.3                   |
| <b>Dissolved oxygen:</b> -         | <b>Dissolved oxygen:</b> -       |
| <b>Turbidity:</b> 84 NTU           | <b>Ion sample collected:</b> yes |

#### Observations within 2 m of sampling point

|                                   |                                 |
|-----------------------------------|---------------------------------|
| <b>Shading:</b> 50%               | <b>Water colour:</b> clear      |
| <b>Water odour:</b> none detected | <b>Water surface:</b> normal    |
| <b>Algae on substrate:</b> N      | <b>Algae in water column:</b> N |
| <b>Emergent macrophytes:</b> N    | <b>Submerged macrophytes:</b> N |
| <b>Floating macrophytes:</b> N    |                                 |

#### Reach observations (100 m reach, or 10 x modal width)

|                                                                                                                                                                                                                                           |                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Mode wetted width:</b> 1 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 40 m      |
| <b>Maximum depth:</b> 0.8 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1.5 m    |
| <b>Minimum wetted width:</b> 0.5 m                                                                                                                                                                                                        | <b>Maximum wetted width:</b> 2 m |
| <b>Habitat types:</b> 0% riffle, 20% run, 80% sandy pool, 0% rocky pool, 0% dry                                                                                                                                                           |                                  |
| <b>Variety of habitat:</b> shallow (<0.5 m), deep (>0.5 m), pool, run, large woody debris, macrophytes                                                                                                                                    |                                  |
| <b>Habitat attributes:</b> detritus (L), sticks (L), branches (L), logs (L), periphyton (N), moss (N), filamentous algae (N), macrophytes (L), bank overhang (E), trailing bank vegetation (M), blanketing silt (N), substrate anoxia (N) |                                  |
| <b>Upstream landuse:</b> past vegetation clearing, heavy grazing, non-irrigated cropping                                                                                                                                                  |                                  |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, non-irrigated cropping, moderate grazing                                                                                                                                  |                                  |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, non-irrigated cropping, moderate grazing                                                                                                                                   |                                  |

#### Bed, edge and bank characteristics

|                                                                                                                                                                         |                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| <b>Bed substrates:</b> 5% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock  |                                            |
| <b>Edge substrates:</b> 5% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock |                                            |
| <b>Bank soils:</b> loamy sand                                                                                                                                           | <b>Bank stability:</b> stable              |
| <b>Bed stability:</b> bed stable                                                                                                                                        | <b>Bank shape:</b> stepped                 |
| <b>Channel shape:</b> U shaped                                                                                                                                          | <b>Recent deposits:</b> silt (N), sand (N) |

**Local catchment erosion:** gully (N) rill (N) tunnel (N) sheet (N)

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                                                     |                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                                                   |                                            |
| Width of riparian zone on left bank: 20 m                                                                                                                                                                                                                                               | Width of riparian zone on right bank: 20 m |
| Bare ground: N                                                                                                                                                                                                                                                                          | Grasses/forbs: E                           |
| Shrubs: L                                                                                                                                                                                                                                                                               | Trees <10 m: S                             |
| Trees >10m: M                                                                                                                                                                                                                                                                           | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                                                  |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                                              | Dominant stratum: tree                     |
| Health: good                                                                                                                                                                                                                                                                            | Dieback: not detected                      |
| EDL height: 19 m                                                                                                                                                                                                                                                                        | EDL cover: 60%                             |
| <b>Canopy species:</b> <i>Eucalyptus blakelyi</i> (D), <i>Eucalyptus melliodora</i> (O), <i>Eucalyptus microcarpa</i> (O), <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (R)                                                                                             |                                            |
| <b>Shrub species:</b> <i>Eucalyptus blakelyi</i> (O), <i>Acacia dealbata</i> (O), <i>Lycium ferocissimum</i> * (R), <i>Lomandra longifolia</i> (O)                                                                                                                                      |                                            |
| <b>Ground species:</b> <i>Carex appressa</i> (D), <i>Arundinella nepalensis</i> (D), <i>Juncus usitatus</i> (F), <i>Cynodon dactylon</i> (O), <i>Arctotheca calendula</i> * (O), <i>Pittosporum angustifolium</i> (O), <i>Sonchus oleraceus</i> * (O), <i>Verbena bonariensis</i> * (O) |                                            |

| Macrophytes                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Submerged macrophytes:</b> none detected                                                                                                                                                                                |
| <b>Floating macrophytes:</b> none detected                                                                                                                                                                                 |
| <b>Emergent macrophytes:</b> <i>Juncus usitatus</i> (S), <i>Persicaria decipiens</i> (L), <i>Callitriche</i> sp. (L), <i>Cyperus difformis</i> (L), <i>Veronica anagallis-aquatica</i> * (L), <i>Typha domingensis</i> (L) |
| Aquatic biota                                                                                                                                                                                                              |
| <b>Aquatic macroinvertebrate sampling undertaken:</b> no                                                                                                                                                                   |
| <b>Habitat for platypus:</b> unlikely habitat                                                                                                                                                                              |
| <b>State-mapped habitat for threatened fish species:</b> unlikely                                                                                                                                                          |
| <b>Field-verified habitat for threatened fish species:</b> unlikely                                                                                                                                                        |
| <b>Fish sampling undertaken:</b> backpack electrofishing (613)                                                                                                                                                             |
| <b>Aquatic vertebrates encountered:</b> <i>Hypseleotris acropinna</i> , <i>Carassius auratus</i> *, <i>Gambusia holbrooki</i> *                                                                                            |
| <b>Notes:</b> inland yabby ( <i>Cherax destructor</i> ) and glass shrimp ( <i>Paratya australiensis</i> ) detected                                                                                                         |

| Visual assessment of human disturbance (NSW AusRivAS) |                                                                        |
|-------------------------------------------------------|------------------------------------------------------------------------|
| <b>1. Water quality</b>                               | 0 – no evidence of disturbance                                         |
| <b>2. Instream</b>                                    | 0 – no evidence of disturbance                                         |
| <b>3. Riparian zone</b>                               | 1 – little disturbance (exotic plant invasion)                         |
| <b>4. Catchment assessment</b>                        | 2 – moderate disturbance (past vegetation clearing, cropping, grazing) |
| <b>Overall score</b>                                  | 3/16 (little disturbance)                                              |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Site code:</b> 11                                                                                                                                                                                                                      | <b>Location:</b> Ugumjil Creek                                                                                       |
| <b>Date:</b> 24/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                                                                                |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.4301; 148.3314 (GDA 2020)                                                                    |
| <b>Water level:</b> moderate (= watermark)                                                                                                                                                                                                | <b>Likely flow nature:</b> intermittent to semi-permanent, with potential spring/seep trickle flow; estimated 2 L/s) |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                                                                                      |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                                                                                      |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                                                                                      |
| <b>Field-verified KFH:</b> yes                                                                                                                                                                                                            |                                                                                                                      |
| <b>Field-verified waterway classification:</b> CLASS 2 – Moderate KFH                                                                                                                                                                     |                                                                                                                      |
| <b>Field-verified aquatic habitat sensitivity:</b> TYPE 2 – Moderately sensitive KFH                                                                                                                                                      |                                                                                                                      |
| <b>Water quality</b>                                                                                                                                                                                                                      |                                                                                                                      |
| <b>Time (EST):</b> 10:34                                                                                                                                                                                                                  | <b>Water temperature:</b> 7.2°C                                                                                      |
| <b>Sp. Conductivity:</b> 286 µS/cm                                                                                                                                                                                                        | <b>pH:</b> 7.0                                                                                                       |
| <b>Dissolved oxygen:</b> 139.6%                                                                                                                                                                                                           | <b>Dissolved oxygen:</b> 16.6 mg/L                                                                                   |
| <b>Turbidity:</b> 80 NTU                                                                                                                                                                                                                  | <b>Ion sample collected:</b>                                                                                         |
| <b>Observations within 2 m of sampling point</b>                                                                                                                                                                                          |                                                                                                                      |
| <b>Shading:</b> 50%                                                                                                                                                                                                                       | <b>Water colour:</b> clear                                                                                           |
| <b>Water odour:</b> none detected                                                                                                                                                                                                         | <b>Water surface:</b> normal                                                                                         |
| <b>Algae on substrate:</b> N                                                                                                                                                                                                              | <b>Algae in water column:</b> N                                                                                      |
| <b>Emergent macrophytes:</b> N                                                                                                                                                                                                            | <b>Submerged macrophytes:</b> N                                                                                      |
| <b>Floating macrophytes:</b> N                                                                                                                                                                                                            |                                                                                                                      |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                                                                                      |
| <b>Mode wetted width:</b> 1 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 40 m                                                                                          |
| <b>Maximum depth:</b> 0.4 m                                                                                                                                                                                                               | <b>Bankfull height:</b> 1.5 m                                                                                        |
| <b>Minimum wetted width:</b> 0.6 m                                                                                                                                                                                                        | <b>Maximum wetted width:</b> 3 m                                                                                     |
| <b>Habitat types:</b> 0% riffle, 10% run, 90% sandy pool, 0% rocky pool, 0% dry                                                                                                                                                           |                                                                                                                      |
| <b>Variety of habitat:</b> shallow (<0.5 m), pool, large woody debris, macrophytes                                                                                                                                                        |                                                                                                                      |
| <b>Habitat attributes:</b> detritus (S), sticks (L), branches (L), logs (L), periphyton (L), moss (N), filamentous algae (L), macrophytes (S), bank overhang (L), trailing bank vegetation (L), blanketing silt (N), substrate anoxia (N) |                                                                                                                      |
| <b>Upstream landuse:</b> past vegetation clearing, moderate to heavy grazing, non-irrigated cropping                                                                                                                                      |                                                                                                                      |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, non-irrigated cropping, moderate grazing                                                                                                                                  |                                                                                                                      |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, non-irrigated cropping, heavy grazing                                                                                                                                      |                                                                                                                      |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                                                                                      |
| <b>Bed substrates:</b> 5% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                    |                                                                                                                      |
| <b>Edge substrates:</b> 5% silt/clay (<0.05 mm), 90% sand (0.05-2 mm), 5% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock                                                                   |                                                                                                                      |
| <b>Bank soils:</b> loamy sand                                                                                                                                                                                                             | <b>Bank stability:</b> moderately stable                                                                             |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> stepped                                                                                           |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (L), sand (N)                                                                           |
| <b>Local catchment erosion:</b> gully (N) rill (N) tunnel (N) sheet (L)                                                                                                                                                                   |                                                                                                                      |

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                                                                                                         |                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                                                                                                       |                                            |
| Width of riparian zone on left bank: 20 m                                                                                                                                                                                                                                                                                                   | Width of riparian zone on right bank: 20 m |
| Bare ground: S                                                                                                                                                                                                                                                                                                                              | Grasses/forbs: M                           |
| Shrubs: L                                                                                                                                                                                                                                                                                                                                   | Trees <10 m: S                             |
| Trees >10m: S                                                                                                                                                                                                                                                                                                                               | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                                                                                                      |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                                                                                                  | Dominant stratum: tree                     |
| Health: average                                                                                                                                                                                                                                                                                                                             | Dieback: 1-10%                             |
| EDL height: 13 m                                                                                                                                                                                                                                                                                                                            | EDL cover: 35%                             |
| Canopy species: <i>Eucalyptus blakelyi</i> (D), <i>Callitris glaucophylla</i> (O)                                                                                                                                                                                                                                                           |                                            |
| Shrub species: <i>Eucalyptus blakelyi</i> (O), <i>Eucalyptus blakelyi</i> (O), <i>Acacia deanei</i> (O), <i>Lomandra longifolia</i> (O)                                                                                                                                                                                                     |                                            |
| Ground species: <i>Rubus anglocandicans</i> * (O), <i>Carex appressa</i> (D), <i>Juncus usitatus</i> (A), <i>Cynodon dactylon</i> (F), <i>Arctotheca calendula</i> * (O), <i>Sonchus oleraceus</i> * (O), <i>Carthamus lanatus</i> * (O), <i>Silybum marianum</i> * (O), <i>Verbena bonariensis</i> * (O), <i>Plantago lanceolata</i> * (O) |                                            |

| Macrophytes                                                                                                                                                                                                         |                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                                                                                                                                                                                |                                                                                          |
| Floating macrophytes: none detected                                                                                                                                                                                 |                                                                                          |
| Emergent macrophytes: <i>Juncus usitatus</i> (S), <i>Typha domingensis</i> (L), <i>Cyperus difformis</i> (L), <i>Persicaria decipiens</i> (L), <i>Veronica anagallis-aquatica</i> * (L), <i>Callitriche</i> sp. (L) |                                                                                          |
| Aquatic biota                                                                                                                                                                                                       |                                                                                          |
| Aquatic macroinvertebrate sampling undertaken: no                                                                                                                                                                   |                                                                                          |
| Habitat for platypus: unlikely habitat                                                                                                                                                                              |                                                                                          |
| State-mapped habitat for threatened fish species: unlikely                                                                                                                                                          |                                                                                          |
| Field-verified habitat for threatened fish species: unlikely                                                                                                                                                        |                                                                                          |
| Fish sampling undertaken: backpack electrofishing (398 seconds)                                                                                                                                                     |                                                                                          |
| Aquatic vertebrates encountered: <i>Gambusia holbrooki</i> *                                                                                                                                                        |                                                                                          |
| Notes: inland yabby ( <i>Cherax destructor</i> ) detected                                                                                                                                                           |                                                                                          |
| Visual assessment of human disturbance (NSW AusRivAS)                                                                                                                                                               |                                                                                          |
| 1 – little disturbance (disruption of the natural hydrology)                                                                                                                                                        | 1 – little disturbance (disruption of the natural hydrology)                             |
| 2. Instream                                                                                                                                                                                                         | 2 – moderate disturbance (fuel reduction burn, silt deposition, grazing within waterway) |
| 3. Riparian zone                                                                                                                                                                                                    | 2 – moderate disturbance (past vegetation clearing, exotic plant invasion)               |
| 4. Catchment assessment                                                                                                                                                                                             | 2 – moderate disturbance (past vegetation clearing, cropping, grazing, dam)              |
| Overall score                                                                                                                                                                                                       | 7/16 (moderate disturbance)                                                              |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Site code:</b> 12                                                                                                                                                                                                                      | <b>Location:</b> Bundara Creek                       |
| <b>Date:</b> 24/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.4413;<br>148.3269 (GDA 2020) |
| <b>Water level:</b> no flow - dry                                                                                                                                                                                                         | <b>Likely flow nature:</b> ephemeral                 |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                      |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                      |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                      |
| <b>Field-verified KFH:</b> unlikely (actually stream order 2, not 3)                                                                                                                                                                      |                                                      |
| <b>Field-verified waterway classification:</b> CLASS 4 – Unlikely KFH                                                                                                                                                                     |                                                      |
| <b>Field-verified aquatic habitat sensitivity:</b> Not KFH                                                                                                                                                                                |                                                      |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                      |
| <b>Mode wetted width:</b> 0 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 25 m                          |
| <b>Maximum depth:</b> 0 m                                                                                                                                                                                                                 | <b>Bankfull height:</b> 2.5 m                        |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 0 m                     |
| <b>Habitat types:</b> 0% riffle, 0% run, 0% sandy pool, 0% rocky pool, 100% dry                                                                                                                                                           |                                                      |
| <b>Variety of habitat:</b> large woody debris, macrophytes                                                                                                                                                                                |                                                      |
| <b>Habitat attributes:</b> detritus (L), sticks (L), branches (L), logs (L), periphyton (N), moss (N), filamentous algae (N), macrophytes (L), bank overhang (N), trailing bank vegetation (N), blanketing silt (N), substrate anoxia (N) |                                                      |
| <b>Upstream landuse:</b> past vegetation clearing, moderate grazing, non-irrigated cropping                                                                                                                                               |                                                      |
| <b>Adjacent landuse (right bank):</b> moderate grazing                                                                                                                                                                                    |                                                      |
| <b>Adjacent landuse (left bank):</b> non-irrigated cropping                                                                                                                                                                               |                                                      |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                      |
| <b>Bed substrates:</b> 31% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 5% gravel (2-4 mm), 1% pebble (4-64 mm), 1% cobble (64-256 mm), 1% boulder (>256 mm), 1% bedrock                                                                   |                                                      |
| <b>Edge substrates:</b> 31% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 5% gravel (2-4 mm), 1% pebble (4-64 mm), 1% cobble (64-256 mm), 1% boulder (>256 mm), 1% bedrock                                                                  |                                                      |
| <b>Bank soils:</b> sandy loam                                                                                                                                                                                                             | <b>Bank stability:</b> stable                        |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                           |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)           |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (L), bank slumping (N), cattle pugging (N)                                                                                                                         |                                                      |



Upstream



Left bank



Downstream



Right bank

**Notes:**

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNR (2001).



| Riparian vegetation                                                                                                                                                                                                                                           |                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                         |                                            |
| Width of riparian zone on left bank: 20 m                                                                                                                                                                                                                     | Width of riparian zone on right bank: 20 m |
| Bare ground: L                                                                                                                                                                                                                                                | Grasses/forbs: E                           |
| Shrubs: L                                                                                                                                                                                                                                                     | Trees <10 m: S                             |
| Trees >10m: L                                                                                                                                                                                                                                                 | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                        |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                    | Dominant stratum: tree                     |
| Health: good                                                                                                                                                                                                                                                  | Dieback: 1-10%                             |
| EDL height: 13 m                                                                                                                                                                                                                                              | EDL cover: 35%                             |
| <b>Canopy species:</b> <i>Eucalyptus blakelyi</i> (D), <i>Callitris glaucophylla</i> (D), <i>Eucalyptus sideroxylon</i> (O), <i>Allocasuarina</i> sp. (R)                                                                                                     |                                            |
| <b>Shrub species:</b> <i>Acacia deanei</i> (O), <i>Melichrus</i> sp. (O), <i>Dodonaea</i> sp. (O)                                                                                                                                                             |                                            |
| <b>Ground species:</b> <i>Cynodon dactylon</i> (D), <i>Aristida</i> sp. (F), <i>Carex appressa</i> (F), <i>Carthamus lanatus</i> * (O), <i>Sonchus oleraceus</i> * (O), <i>Arctotheca calendula</i> * (O), <i>Poa</i> sp. (O), <i>Cheilanthes sieberi</i> (O) |                                            |

| Macrophytes                                                         |                                                                        |
|---------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Submerged macrophytes:</b> none detected                         |                                                                        |
| <b>Floating macrophytes:</b> none detected                          |                                                                        |
| <b>Emergent macrophytes:</b> <i>Juncus usitatus</i> (L)             |                                                                        |
| Aquatic biota                                                       |                                                                        |
| <b>Aquatic macroinvertebrate sampling undertaken:</b> no            |                                                                        |
| <b>Habitat for platypus:</b> unlikely habitat                       |                                                                        |
| <b>State-mapped habitat for threatened fish species:</b> unlikely   |                                                                        |
| <b>Field-verified habitat for threatened fish species:</b> unlikely |                                                                        |
| <b>Fish sampling undertaken:</b> no                                 |                                                                        |
| <b>Aquatic vertebrates encountered:</b> none                        |                                                                        |
| Visual assessment of human disturbance (NSW AusRivAS)               |                                                                        |
| <b>1. Water quality</b>                                             | 0 – no evidence of disturbance                                         |
| <b>2. Instream</b>                                                  | 0 – no evidence of disturbance                                         |
| <b>3. Riparian zone</b>                                             | 1 – little disturbance (exotic plant invasion)                         |
| <b>4. Catchment assessment</b>                                      | 2 – moderate disturbance (past vegetation clearing, cropping, grazing) |
| <b>Overall score</b>                                                | <b>3/16 (little disturbance)</b>                                       |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                               |                                                                                                                               |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Site code:</b> 13                          | <b>Location:</b> Rays Creek                                                                                                   |
| <b>Date:</b> 24/07/2025                       | <b>Season:</b> autumn                                                                                                         |
| <b>Assessor:</b> DM                           | <b>Coordinates:</b> -32.4293;<br>148.3445 (GDA 2020)                                                                          |
| <b>Water level:</b> moderate<br>(= watermark) | <b>Likely flow nature:</b> intermittent<br>to semi-permanent, with potential<br>spring/seep trickle flow; estimated<br>2 L/s) |

**Topography:** broad valley

#### Fish habitat classification

**State-mapped Key Fish Habitat (KFH):** yes

**Field-verified KFH:** yes

**Field-verified waterway classification:** CLASS 2 – Moderate KFH

**Field-verified aquatic habitat sensitivity:** TYPE 2 – Moderately sensitive KFH

#### Water quality

**Time (EST):** 11:55 **Water temperature:** 7.9°C

**Sp. Conductivity:** 276 µS/cm **pH:** 7.4

**Dissolved oxygen:** - **Dissolved oxygen:** -

**Turbidity:** 76 NTU **Ion sample collected:** yes

#### Observations within 2 m of sampling point

**Shading:** 0% **Water colour:** clear

**Water odour:** none detected **Water surface:** normal

**Algae on substrate:** S **Algae in water column:** N

**Emergent macrophytes:** L **Submerged macrophytes:** N

**Floating macrophytes:** N

#### Reach observations (100 m reach, or 10 x modal width)

**Mode wetted width:** 0.5 m **Bankfull width:** 25 m

**Maximum depth:** 0.3 m **Bankfull height:** 1 m

**Minimum wetted width:** 0.3 m **Maximum wetted width:** 1 m

**Habitat types:** 0% riffle, 40% run, 60% sandy pool, 0% rocky pool, 0% dry

**Variety of habitat:** shallow (<0.5 m), pool, run, macrophytes, large woody debris

**Habitat attributes:** detritus (L), sticks (L), branches (L), logs (N), periphyton (S), moss (N), filamentous algae (L), macrophytes (S), bank overhang (L), trailing bank vegetation (S), blanketing silt (N), substrate anoxia (N)

**Upstream landuse:** past vegetation clearing, moderate grazing

**Adjacent landuse (right bank):** past vegetation clearing, moderate grazing

**Adjacent landuse (left bank):** past vegetation clearing, moderate grazing

#### Bed, edge and bank characteristics

**Bed substrates:** 59% silt/clay (<0.05 mm), 40% sand (0.05-2 mm), 1% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock

**Edge substrates:** 59% silt/clay (<0.05 mm), 40% sand (0.05-2 mm), 1% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock

**Bank soils:** sandy clay, loam **Bank stability:** stable

**Bed stability:** bed stable **Bank shape:** concave

**Channel shape:** U shaped **Recent deposits:** silt (L), sand (N)

**Local catchment erosion:** gully (N), rill (N), tunnel (N), sheet (L), bank slumping (N), cattle grazing (S)

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                            |                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                          |                                            |
| Width of riparian zone on left bank: 20 m                                                                                                                                                                                                                      | Width of riparian zone on right bank: 20 m |
| Bare ground: S                                                                                                                                                                                                                                                 | Grasses/forbs: E                           |
| Shrubs: L                                                                                                                                                                                                                                                      | Trees <10 m: S                             |
| Trees >10m: L                                                                                                                                                                                                                                                  | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                         |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                     | Dominant stratum: tree                     |
| Health: average                                                                                                                                                                                                                                                | Dieback: 1-10%                             |
| EDL height: 12 m                                                                                                                                                                                                                                               | EDL cover: 40%                             |
| <b>Canopy species:</b> <i>Eucalyptus blakelyi</i> (D), <i>Eucalyptus microcarpa</i> (O), <i>Brachychiton populneus</i> (R)                                                                                                                                     |                                            |
| <b>Shrub species:</b> <i>Eucalyptus blakelyi</i> (O), <i>Acacia deanei</i> (O), <i>Lycium ferocissimum</i> * (O), <i>Maireana</i> sp. (O), <i>Lomandra longifolia</i> (R)                                                                                      |                                            |
| <b>Ground species:</b> <i>Cynodon dactylon</i> (D), <i>Carex appressa</i> (A), <i>Juncus usitatus</i> (A), <i>Arctotheca calendula</i> * (O), <i>Carthamus lanatus</i> * (O), <i>Trifolium</i> spp.* (O), <i>Rumex</i> sp. (O), <i>Daucus glochidiatus</i> (O) |                                            |

| Macrophytes                                                                                                                                           |                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>Submerged macrophytes:</b> none detected                                                                                                           |                                                                                          |
| <b>Floating macrophytes:</b> none detected                                                                                                            |                                                                                          |
| <b>Emergent macrophytes:</b> <i>Juncus usitatus</i> (S), <i>Phragmites australis</i> (L), <i>Persicaria decipiens</i> (L), <i>Callitriche</i> sp. (L) |                                                                                          |
| Aquatic biota                                                                                                                                         |                                                                                          |
| <b>Aquatic macroinvertebrate sampling undertaken:</b> no                                                                                              |                                                                                          |
| <b>Habitat for platypus:</b> unlikely habitat                                                                                                         |                                                                                          |
| <b>State-mapped habitat for threatened fish species:</b> unlikely                                                                                     |                                                                                          |
| <b>Field-verified habitat for threatened fish species:</b> unlikely                                                                                   |                                                                                          |
| <b>Fish sampling undertaken:</b> backpack electrofishing (310 seconds)                                                                                |                                                                                          |
| <b>Aquatic vertebrates encountered:</b> <i>Hypseleotris acropinna</i>                                                                                 |                                                                                          |
| <b>Notes:</b> inland yabby ( <i>Cherax destructor</i> ) detected                                                                                      |                                                                                          |
| Visual assessment of human disturbance (NSW AusRivAS)                                                                                                 |                                                                                          |
| <b>1. Water quality</b>                                                                                                                               | 0 – no evidence of disturbance                                                           |
| <b>2. Instream</b>                                                                                                                                    | 2 – moderate disturbance (fuel reduction burn, silt deposition, grazing within waterway) |
| <b>3. Riparian zone</b>                                                                                                                               | 1 – little disturbance (exotic plant invasion)                                           |
| <b>4. Catchment assessment</b>                                                                                                                        | 2 – moderate disturbance (past vegetation clearing, grazing, dam)                        |
| <b>Overall score</b>                                                                                                                                  | <b>5/16 (little disturbance)</b>                                                         |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)

B: Aerial photograph from 100 m above ground, looking upstream

C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNR (2001).  
Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Site code:</b> 14                                                                                                                                                                                                                      | <b>Location:</b> Bundara Creek                       |
| <b>Date:</b> 24/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.4477;<br>148.3402 (GDA 2020) |
| <b>Water level:</b> no flow - dry                                                                                                                                                                                                         | <b>Likely flow nature:</b> ephemeral                 |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                      |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                      |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                      |
| <b>Field-verified KFH:</b> unlikely (actually stream order 2, not 3)                                                                                                                                                                      |                                                      |
| <b>Field-verified waterway classification:</b> CLASS 4 – Unlikely KFH                                                                                                                                                                     |                                                      |
| <b>Field-verified aquatic habitat sensitivity:</b> Not KFH                                                                                                                                                                                |                                                      |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                      |
| <b>Mode wetted width:</b> 0 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 12 m                          |
| <b>Maximum depth:</b> 0 m                                                                                                                                                                                                                 | <b>Bankfull height:</b> 1 m                          |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 0 m                     |
| <b>Habitat types:</b> 0% riffle, 0% run, 0% sandy pool, 0% rocky pool, 100% dry                                                                                                                                                           |                                                      |
| <b>Variety of habitat:</b> macrophytes, large woody debris                                                                                                                                                                                |                                                      |
| <b>Habitat attributes:</b> detritus (L), sticks (L), branches (L), logs (L), periphyton (N), moss (N), filamentous algae (N), macrophytes (L), bank overhang (N), trailing bank vegetation (N), blanketing silt (N), substrate anoxia (N) |                                                      |
| <b>Upstream landuse:</b> past vegetation clearing, moderate grazing, non-irrigated cropping                                                                                                                                               |                                                      |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, light grazing                                                                                                                                                             |                                                      |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, light grazing                                                                                                                                                              |                                                      |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                      |
| <b>Bed substrates:</b> 10% silt/clay (<0.05 mm), 80% sand (0.05-2 mm), 6% gravel (2-4 mm), 1% pebble (4-64 mm), 1% cobble (64-256 mm), 1% boulder (>256 mm), 1% bedrock                                                                   |                                                      |
| <b>Edge substrates:</b> 10% silt/clay (<0.05 mm), 80% sand (0.05-2 mm), 6% gravel (2-4 mm), 1% pebble (4-64 mm), 1% cobble (64-256 mm), 1% boulder (>256 mm), 1% bedrock                                                                  |                                                      |
| <b>Bank soils:</b> sandy loam                                                                                                                                                                                                             | <b>Bank stability:</b> moderately stable             |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                           |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)           |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (L), bank slumping (L), cattle pugging (N)                                                                                                                         |                                                      |



Upstream



Left bank



Downstream



Right bank

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).



| Riparian vegetation                                                                                                                                                                                                                                       |                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Cover                                                                                                                                                                                                                                                     |                                            |
| Width of riparian zone on left bank: 5 m                                                                                                                                                                                                                  | Width of riparian zone on right bank: 10 m |
| Bare ground: L                                                                                                                                                                                                                                            | Grasses/forbs: E                           |
| Shrubs: L                                                                                                                                                                                                                                                 | Trees <10 m: S                             |
| Trees >10m: L                                                                                                                                                                                                                                             | Exotic riparian species: L                 |
| Composition and health                                                                                                                                                                                                                                    |                                            |
| Vegetation status: remnant                                                                                                                                                                                                                                | Dominant stratum: tree                     |
| Health: average                                                                                                                                                                                                                                           | Dieback: 1-10%                             |
| EDL height: 15 m                                                                                                                                                                                                                                          | EDL cover: 25%                             |
| Canopy species: <i>Eucalyptus blakelyi</i> (D), <i>Callitris glaucophylla</i> (D), <i>Eucalyptus albens</i> (R), <i>Eucalyptus melliodora</i> (R)                                                                                                         |                                            |
| Shrub species: <i>Maireana</i> sp. (F), <i>Acacia</i> sp. (O)                                                                                                                                                                                             |                                            |
| Ground species: <i>Cynodon dactylon</i> (D), <i>Aristida</i> sp. (D), <i>Arctotheca calendula</i> * (F), <i>Juncus usitatus</i> (O), <i>Cheilanthes sieberi</i> (O), <i>Wahlenbergia</i> sp. (O), <i>Lepidium</i> sp. (O), <i>Carthamus lanatus</i> * (O) |                                            |

| Macrophytes                                                  |                                                                                              |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                         |                                                                                              |
| Floating macrophytes: none detected                          |                                                                                              |
| Emergent macrophytes: <i>Juncus usitatus</i> (L)             |                                                                                              |
| Aquatic biota                                                |                                                                                              |
| Aquatic macroinvertebrate sampling undertaken: no            |                                                                                              |
| Habitat for platypus: unlikely habitat                       |                                                                                              |
| State-mapped habitat for threatened fish species: unlikely   |                                                                                              |
| Field-verified habitat for threatened fish species: unlikely |                                                                                              |
| Fish sampling undertaken: no                                 |                                                                                              |
| Aquatic vertebrates encountered: none                        |                                                                                              |
| Visual assessment of human disturbance (NSW AusRivAS)        |                                                                                              |
| 1. Water quality                                             | 0 – no evidence of disturbance                                                               |
| 2. Instream                                                  | 0 – no evidence of disturbance                                                               |
| 3. Riparian zone                                             | 2 – moderate disturbance (past vegetation clearing, exotic plant invasion, bank degradation) |
| 4. Catchment assessment                                      | 2 – moderate disturbance (past vegetation clearing, grazing)                                 |
| Overall score                                                | 4/16 (little disturbance)                                                                    |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).



|                                                                                                                                                                                                                                           |                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Site code:</b> 15                                                                                                                                                                                                                      | <b>Location:</b> Bundara Creek                       |
| <b>Date:</b> 24/07/2025                                                                                                                                                                                                                   | <b>Season:</b> autumn                                |
| <b>Assessor:</b> DM                                                                                                                                                                                                                       | <b>Coordinates:</b> -32.4486;<br>148.3468 (GDA 2020) |
| <b>Water level:</b> no flow - dry                                                                                                                                                                                                         | <b>Likely flow nature:</b> ephemeral                 |
| <b>Topography:</b> broad valley                                                                                                                                                                                                           |                                                      |
| <b>Fish habitat classification</b>                                                                                                                                                                                                        |                                                      |
| <b>State-mapped Key Fish Habitat (KFH):</b> yes                                                                                                                                                                                           |                                                      |
| <b>Field-verified KFH:</b> unlikely (actually stream order 2, not 3)                                                                                                                                                                      |                                                      |
| <b>Field-verified waterway classification:</b> CLASS 4 – Unlikely KFH                                                                                                                                                                     |                                                      |
| <b>Field-verified aquatic habitat sensitivity:</b> Not KFH                                                                                                                                                                                |                                                      |
| <b>Reach observations (100 m reach, or 10 x modal width)</b>                                                                                                                                                                              |                                                      |
| <b>Mode wetted width:</b> 0 m                                                                                                                                                                                                             | <b>Bankfull width:</b> 20 m                          |
| <b>Maximum depth:</b> 0 m                                                                                                                                                                                                                 | <b>Bankfull height:</b> 2 m                          |
| <b>Minimum wetted width:</b> 0 m                                                                                                                                                                                                          | <b>Maximum wetted width:</b> 0 m                     |
| <b>Habitat types:</b> 0% riffle, 0% run, 0% sandy pool, 0% rocky pool, 100% dry                                                                                                                                                           |                                                      |
| <b>Variety of habitat:</b> macrophytes, large woody debris                                                                                                                                                                                |                                                      |
| <b>Habitat attributes:</b> detritus (L), sticks (L), branches (L), logs (L), periphyton (N), moss (N), filamentous algae (N), macrophytes (L), bank overhang (N), trailing bank vegetation (N), blanketing silt (N), substrate anoxia (N) |                                                      |
| <b>Upstream landuse:</b> past vegetation clearing, moderate grazing, non-irrigated cropping                                                                                                                                               |                                                      |
| <b>Adjacent landuse (right bank):</b> past vegetation clearing, light grazing                                                                                                                                                             |                                                      |
| <b>Adjacent landuse (left bank):</b> past vegetation clearing, light grazing                                                                                                                                                              |                                                      |
| <b>Bed, edge and bank characteristics</b>                                                                                                                                                                                                 |                                                      |
| <b>Bed substrates:</b> 27% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 5% gravel (2-4 mm), 1% pebble (4-64 mm), 1% cobble (64-256 mm), 1% boulder (>256 mm), 5% bedrock                                                                   |                                                      |
| <b>Edge substrates:</b> 27% silt/clay (<0.05 mm), 60% sand (0.05-2 mm), 5% gravel (2-4 mm), 1% pebble (4-64 mm), 1% cobble (64-256 mm), 1% boulder (>256 mm), 5% bedrock                                                                  |                                                      |
| <b>Bank soils:</b> sandy loam                                                                                                                                                                                                             | <b>Bank stability:</b> moderately stable             |
| <b>Bed stability:</b> bed stable                                                                                                                                                                                                          | <b>Bank shape:</b> concave                           |
| <b>Channel shape:</b> U shaped                                                                                                                                                                                                            | <b>Recent deposits:</b> silt (N), sand (N)           |
| <b>Local catchment erosion:</b> gully (N), rill (N), tunnel (N), sheet (L), bank slumping (N), cattle pugging (N)                                                                                                                         |                                                      |



Upstream



Left bank



Downstream



Right bank



| Riparian vegetation                                                                                                                                                                                                                                                     |                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cover                                                                                                                                                                                                                                                                   |                                           |
| Width of riparian zone on left bank: 1 m                                                                                                                                                                                                                                | Width of riparian zone on right bank: 1 m |
| Bare ground: L                                                                                                                                                                                                                                                          | Grasses/forbs: E                          |
| Shrubs: L                                                                                                                                                                                                                                                               | Trees <10 m: L                            |
| Trees >10m: L                                                                                                                                                                                                                                                           | Exotic riparian species: S                |
| Composition and health                                                                                                                                                                                                                                                  |                                           |
| Vegetation status: agricultural                                                                                                                                                                                                                                         | Dominant stratum: grassland               |
| Health: poor                                                                                                                                                                                                                                                            | Dieback: 1-10%                            |
| EDL height: 0.5 m                                                                                                                                                                                                                                                       | EDL cover: 90%                            |
| Canopy species: <i>Eucalyptus</i> sp. (O), <i>Callitris glaucophylla</i> (O)                                                                                                                                                                                            |                                           |
| Shrub species: <i>Maireana</i> sp. (F), <i>Callitris glaucophylla</i> (O)                                                                                                                                                                                               |                                           |
| Ground species: <i>Aristida</i> sp. (D), <i>Trifolium</i> spp. * (A), <i>Arctotheca calendula</i> * (A), <i>Cynodon dactylon</i> (O), <i>Lepidium</i> sp. (O), <i>Carthamus lanatus</i> * (O), <i>Sporobolus</i> sp. (O), <i>Juncus</i> sp. (O), <i>Solanum</i> sp. (O) |                                           |

| Macrophytes                                                                                       |                                                                                          |
|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Submerged macrophytes: none detected                                                              |                                                                                          |
| Floating macrophytes: none detected                                                               |                                                                                          |
| Emergent macrophytes: <i>Juncus</i> sp. (L)                                                       |                                                                                          |
| Aquatic biota                                                                                     |                                                                                          |
| Aquatic macroinvertebrate sampling undertaken: no                                                 |                                                                                          |
| Habitat for platypus: unlikely habitat                                                            |                                                                                          |
| State-mapped habitat for threatened fish species: unlikely                                        |                                                                                          |
| Field-verified habitat for threatened fish species: unlikely                                      |                                                                                          |
| Fish sampling undertaken: no                                                                      |                                                                                          |
| Aquatic vertebrates encountered: none                                                             |                                                                                          |
| Notes: remnants of a shell belonging to eastern long-neck turtle ( <i>Chelodina longicollis</i> ) |                                                                                          |
| Visual assessment of human disturbance (NSW AusRivAS)                                             |                                                                                          |
| 1. Water quality                                                                                  | 0 – no evidence of disturbance                                                           |
| 2. Instream                                                                                       | 0 – no evidence of disturbance                                                           |
| 3. Riparian zone                                                                                  | 3 – high disturbance (past vegetation clearing, exotic plant invasion, bank degradation) |
| 4. Catchment assessment                                                                           | 2 – moderate disturbance (past vegetation clearing, grazing)                             |
| Overall score                                                                                     | 5/16 (little disturbance)                                                                |



A: Aerial photograph from 100 m above ground level; upstream (left) to downstream (right)  
 B: Aerial photograph from 100 m above ground, looking upstream  
 C: Aerial photograph from 100 m above ground, looking downstream

Notes:

Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%), as per DNRM (2001).  
 Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).

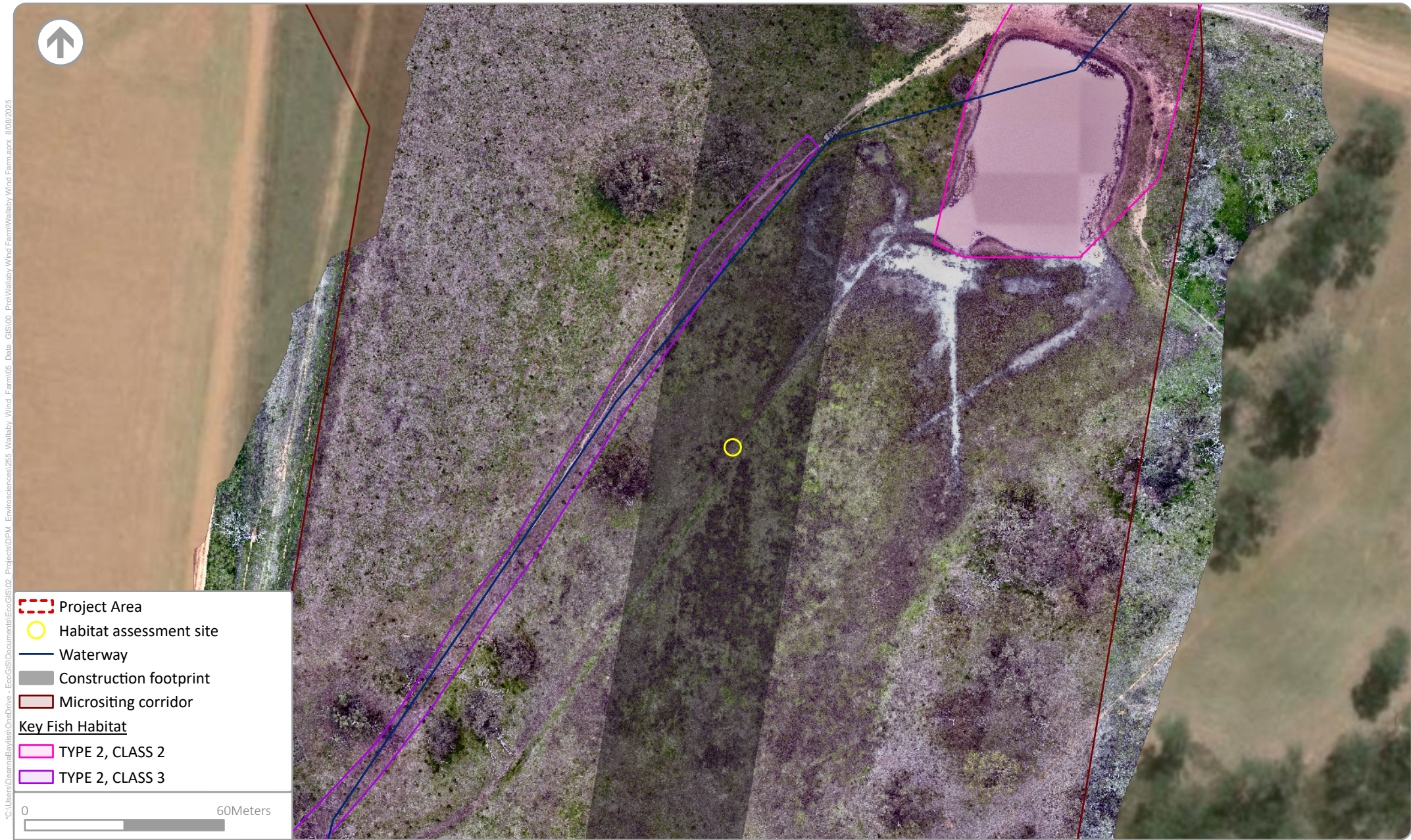
## **Appendix C: Drone imagery and field-verified KFH mapping**





**FIELD-VERIFIED KEY FISH HABITAT- SITE 1**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

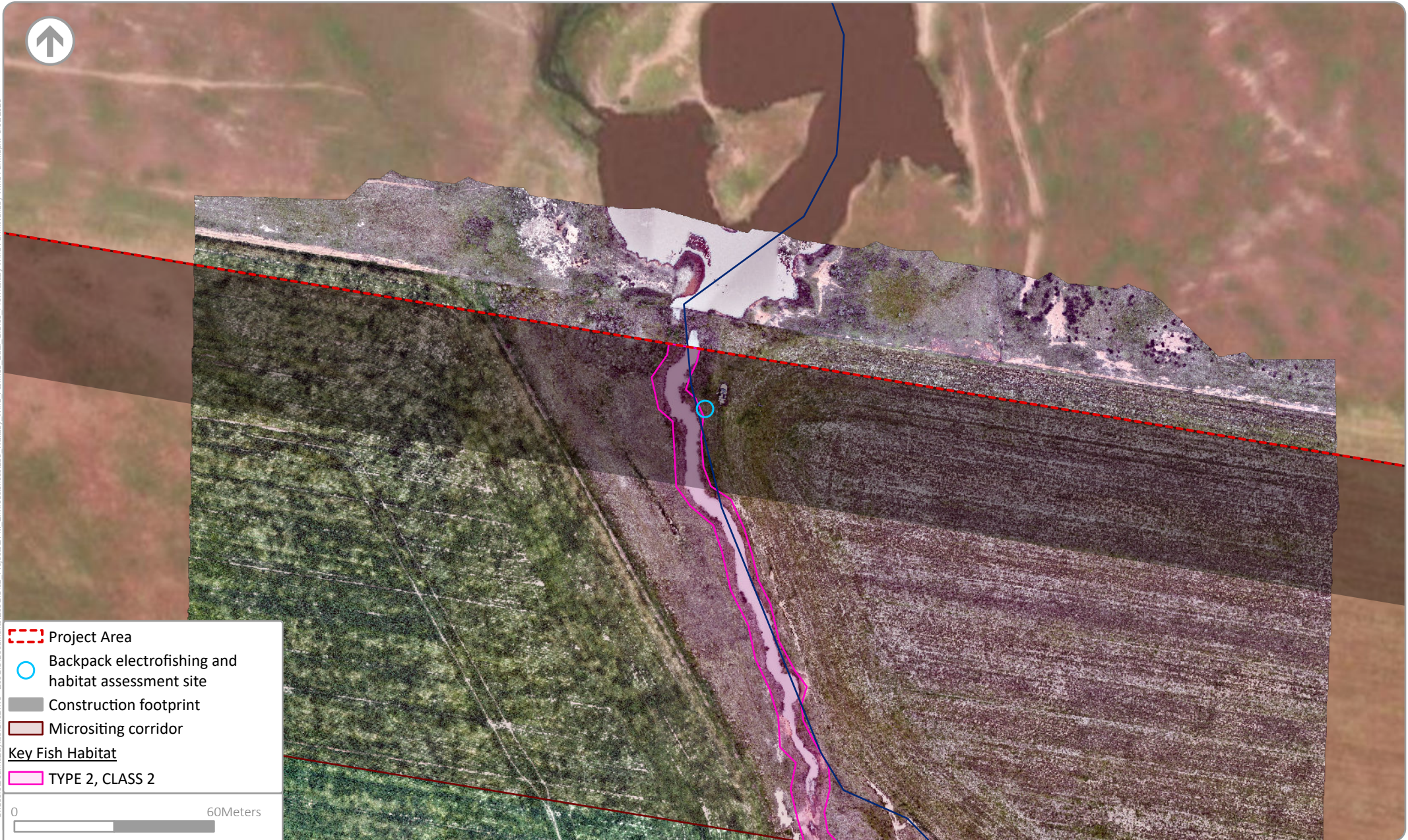




**FIELD-VERIFIED KEY FISH HABITAT- SITE 2**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment



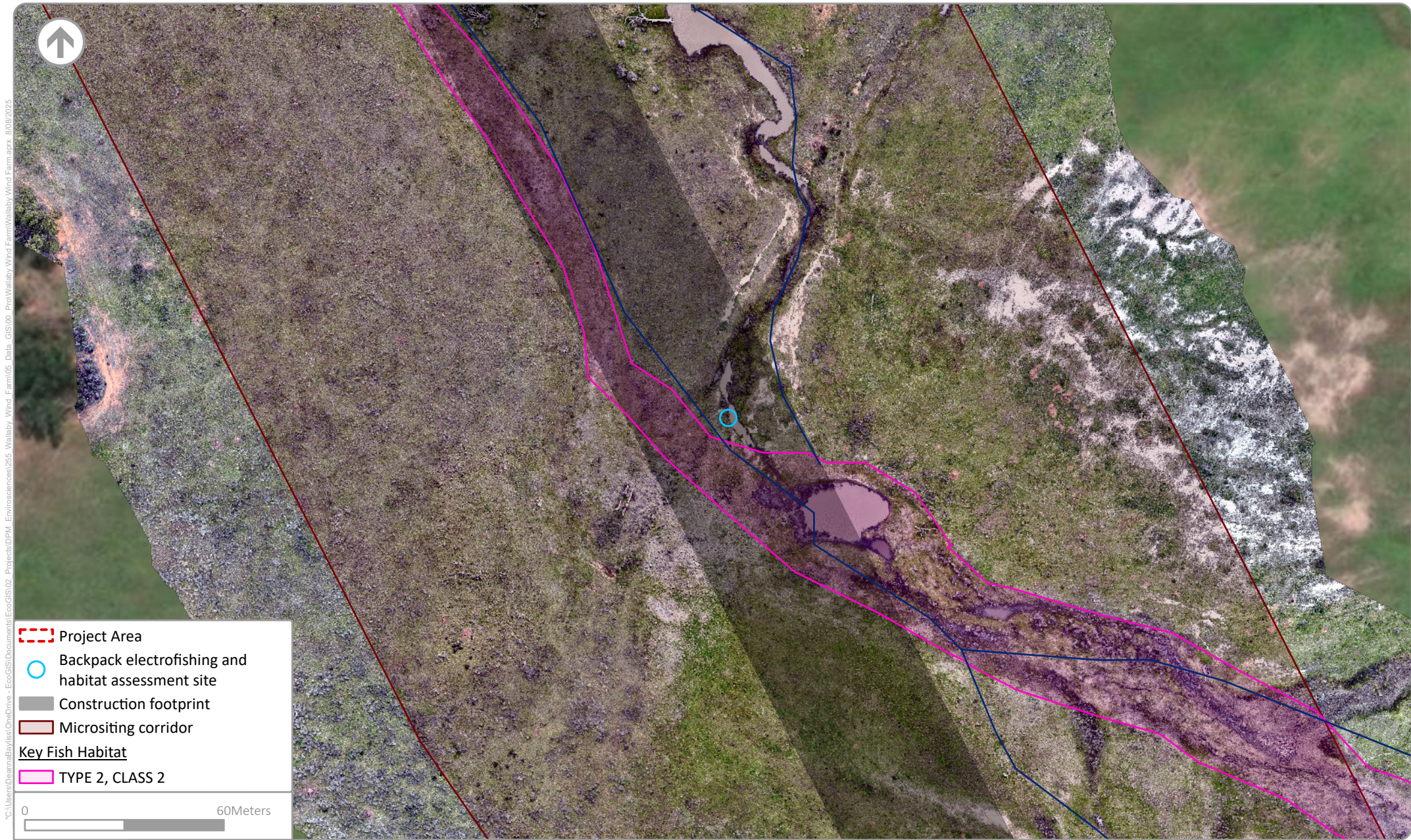
\*C:\Users\Dean\OneDrive - EcoGIS\Documents\EcoGIS02 - Projects\DPM - Envirosiences\255 Wallaby Wind Farm\05 Data GIS00 - Proj\Wallaby Wind Farm\Wallaby Wind Farm.aprx 8/09/2025



**FIELD-VERIFIED KEY FISH HABITAT- SITE 3**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

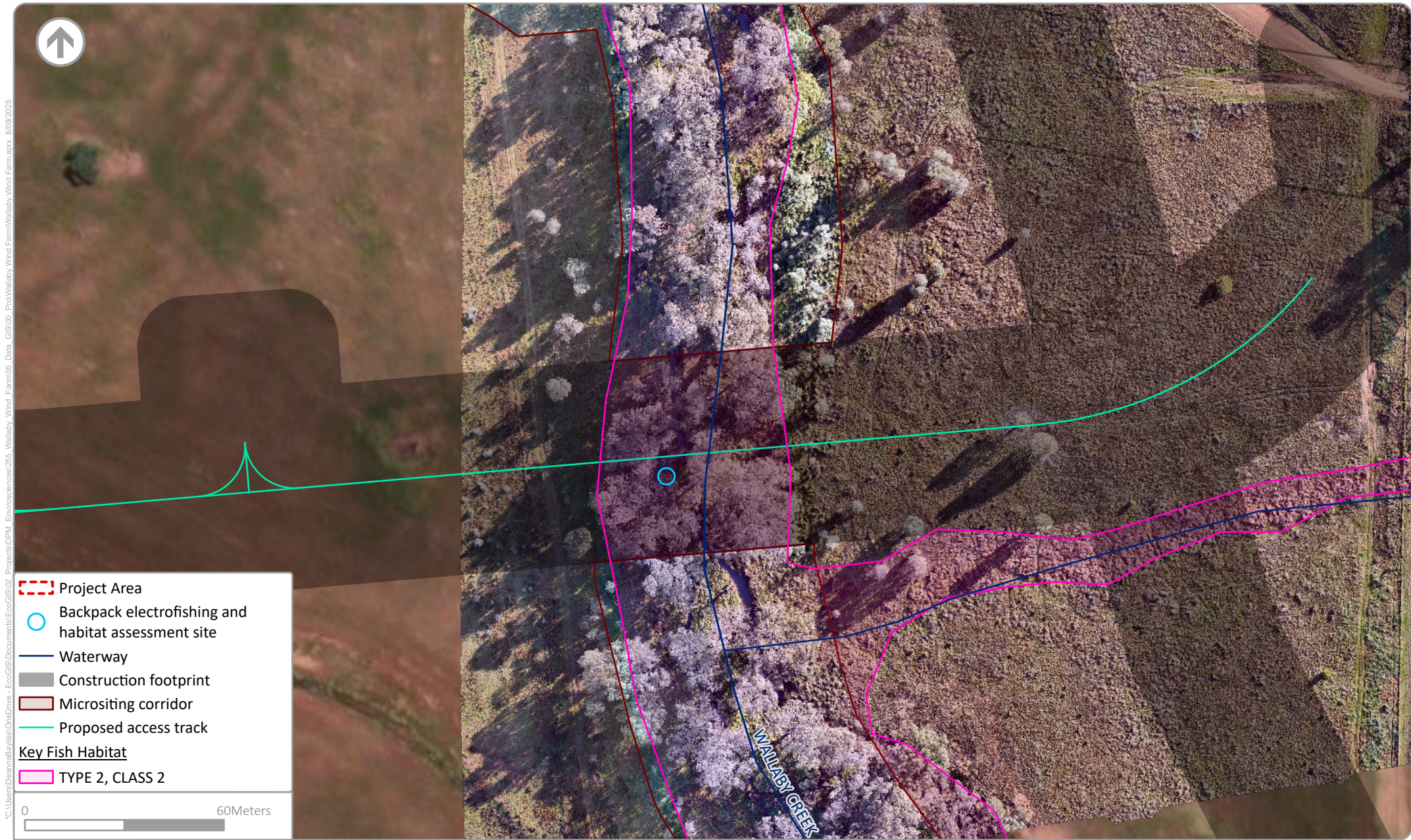
## APPENDIX C





FIELD-VERIFIED KEY FISH HABITAT - SITE 4  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment



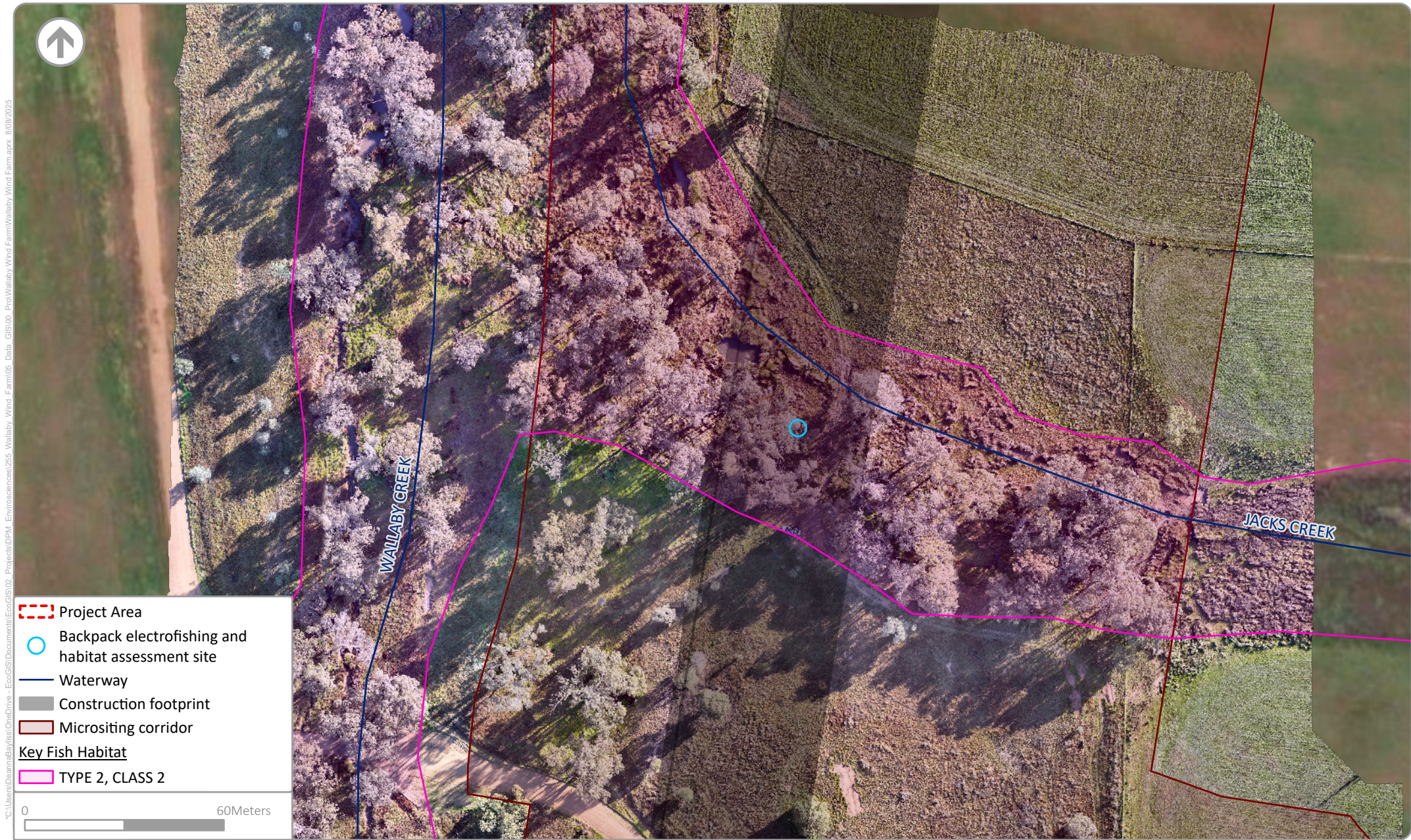


## FIELD-VERIFIED KEY FISH HABITAT- SITE 5A

Wallaby Creek Wind Farm- Aquatic Ecology Assessment

## APPENDIX C





FIELD-VERIFIED KEY FISH HABITAT- SITE 5B  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

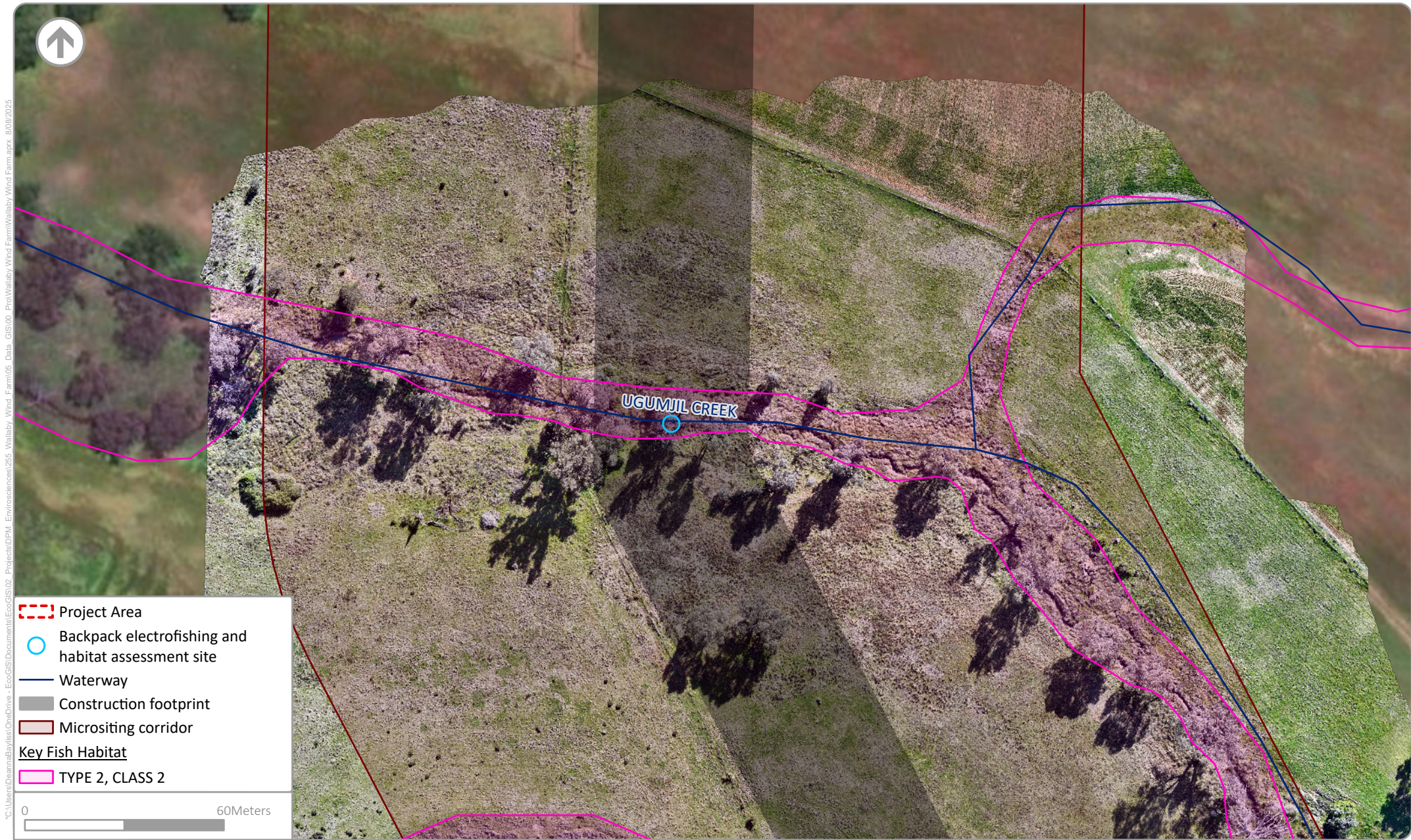
APPENDIX C





FIELD-VERIFIED KEY FISH HABITAT- SITE 6  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment





FIELD-VERIFIED KEY FISH HABITAT- SITE 7  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment





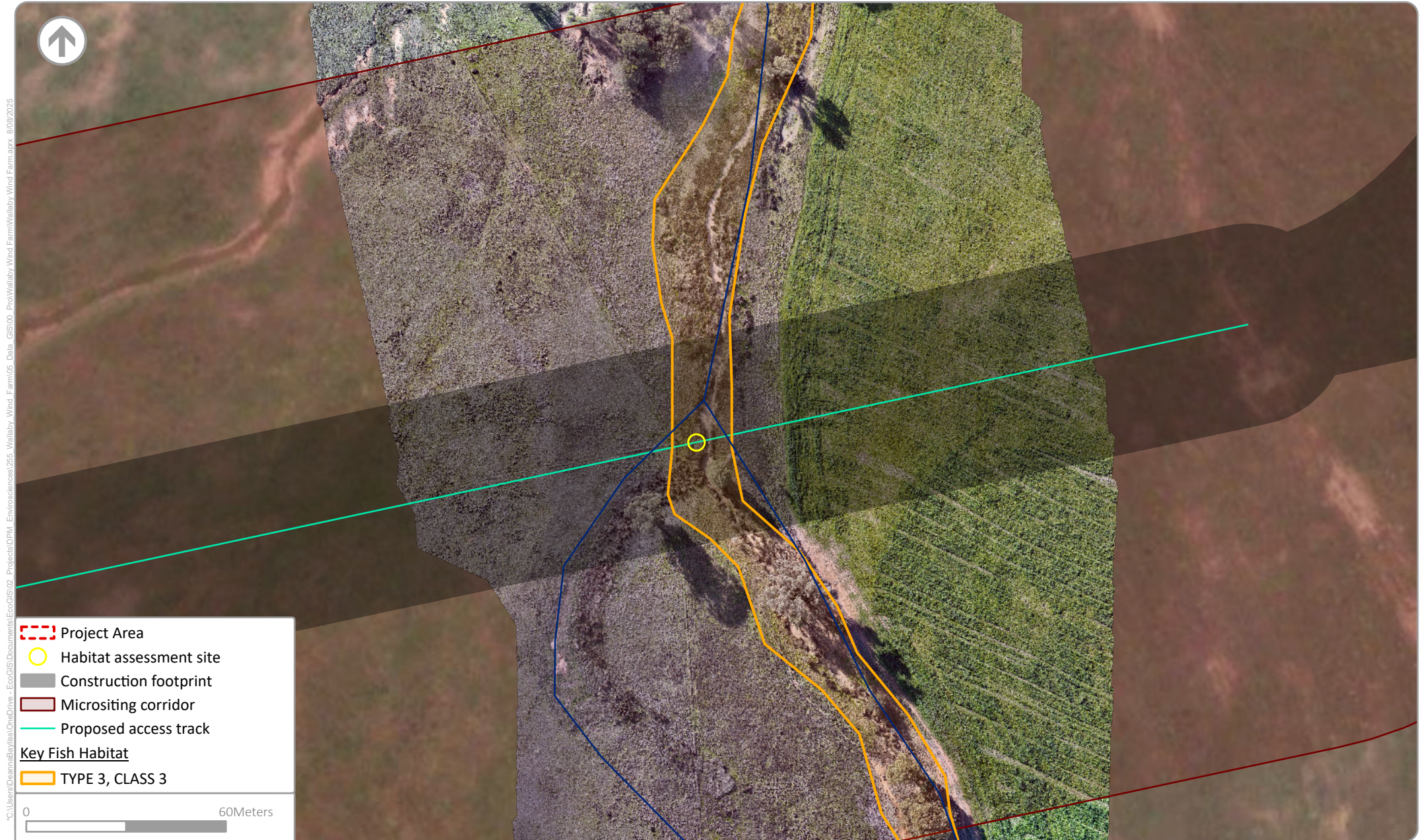
FIELD-VERIFIED KEY FISH HABITAT- SITE 8  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment





FIELD-VERIFIED KEY FISH HABITAT- SITE 9A  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

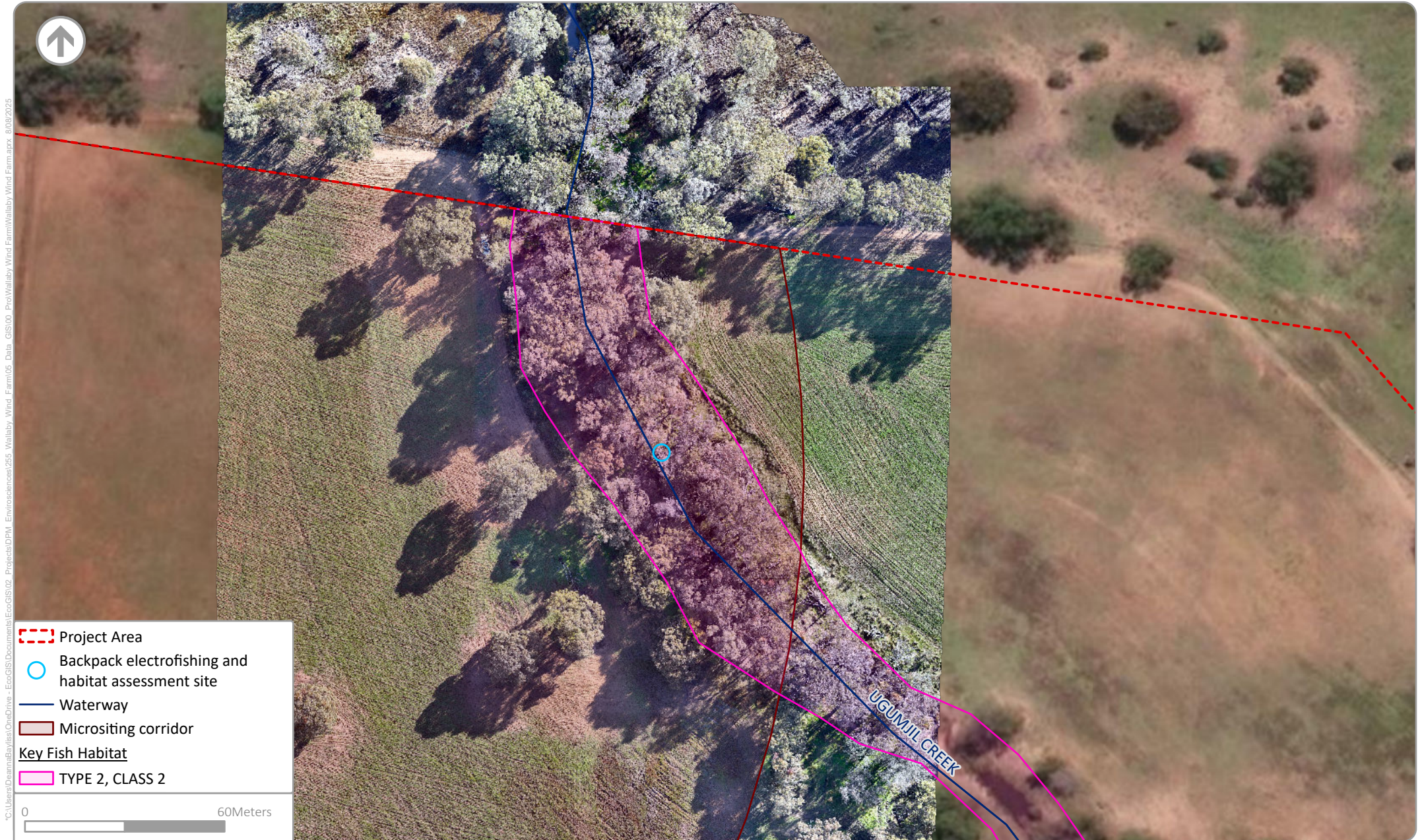




**FIELD-VERIFIED KEY FISH HABITAT- SITE 9B**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

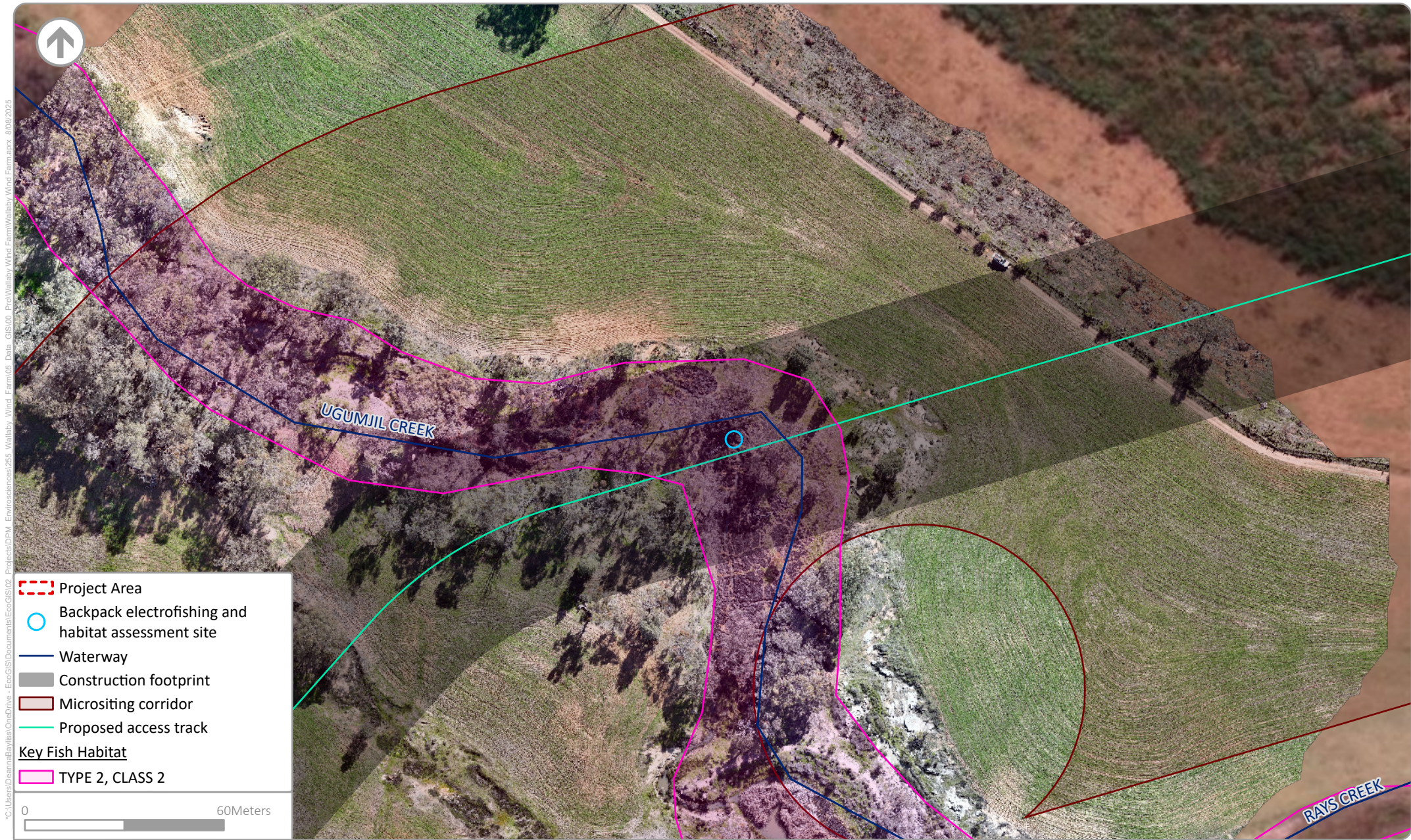
## APPENDIX C





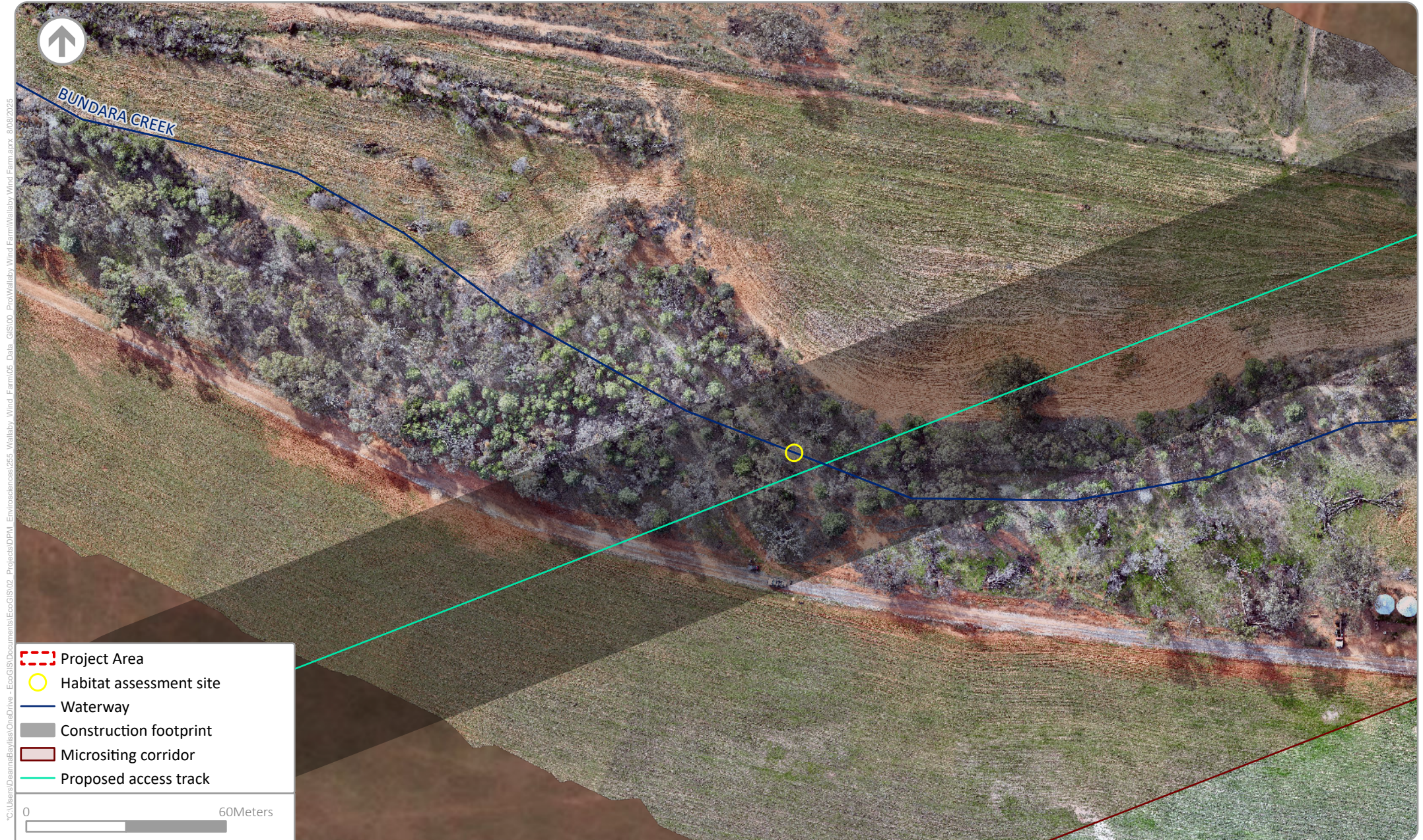
**FIELD-VERIFIED KEY FISH HABITAT- SITE 10**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment





**FIELD-VERIFIED KEY FISH HABITAT- SITE 11**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

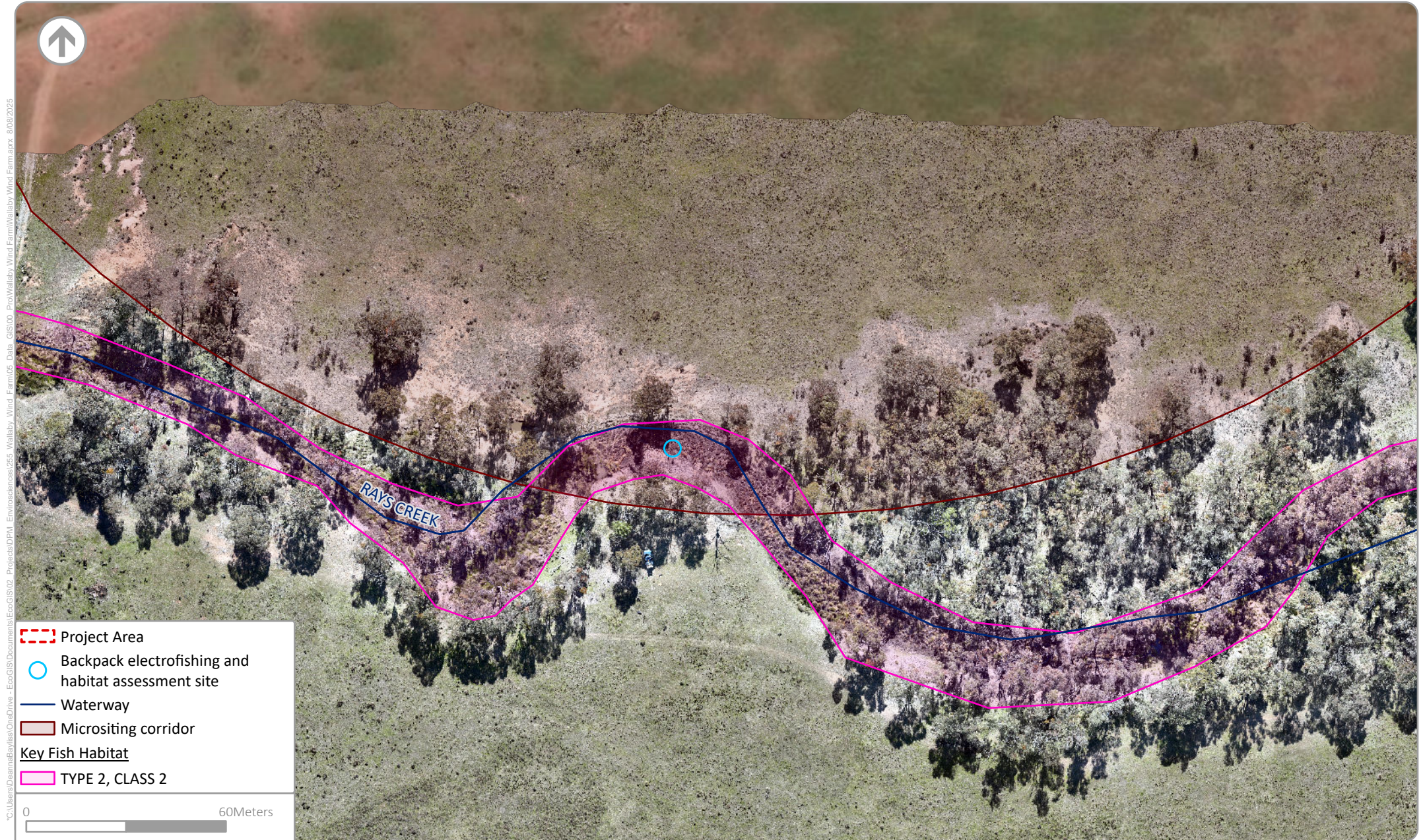




**FIELD-VERIFIED KEY FISH HABITAT- SITE 12**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

## APPENDIX C

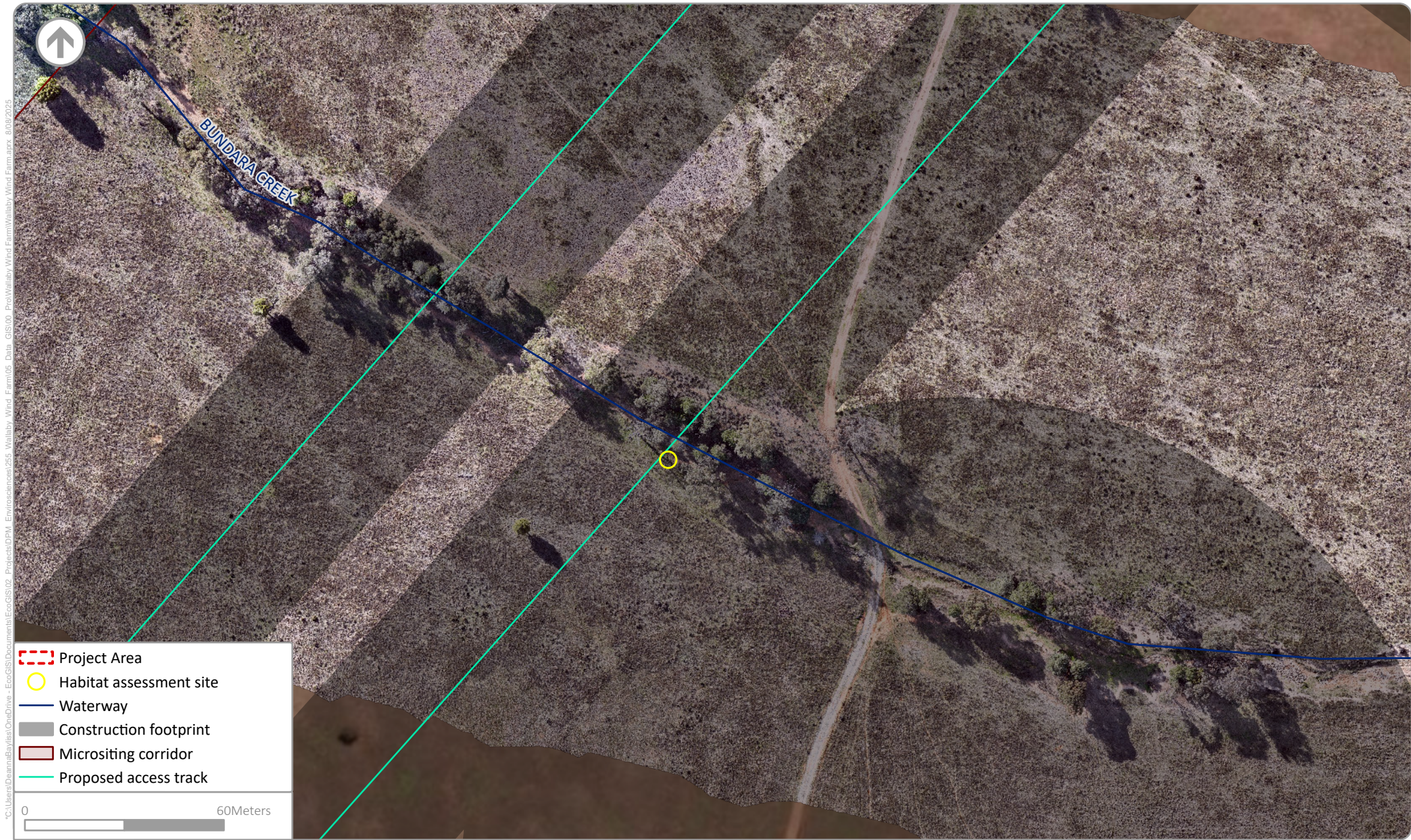




FIELD-VERIFIED KEY FISH HABITAT- SITE 13  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

## APPENDIX C

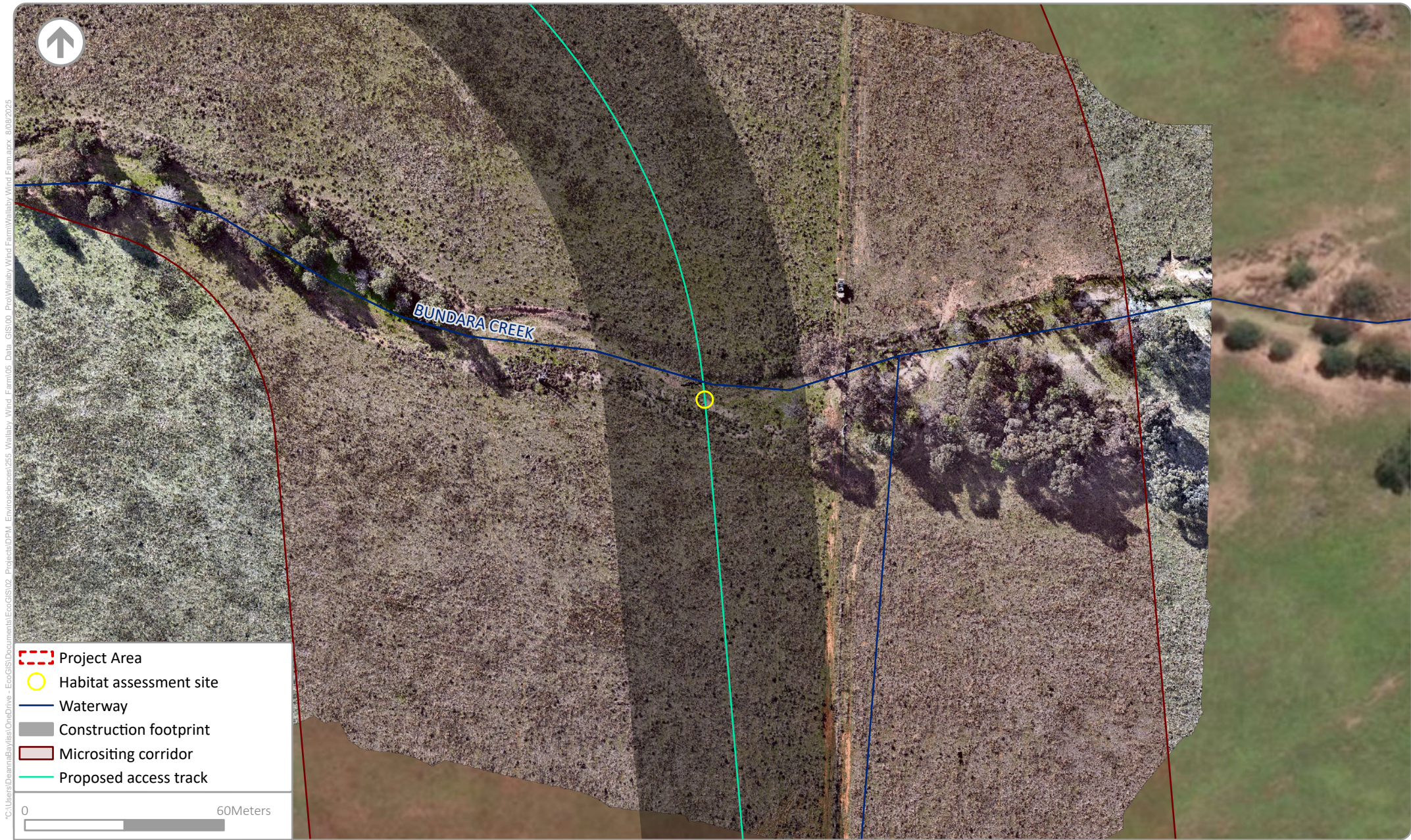




**FIELD-VERIFIED KEY FISH HABITAT- SITE 14**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment

**APPENDIX C**





**FIELD-VERIFIED KEY FISH HABITAT- SITE 15**  
Wallaby Creek Wind Farm- Aquatic Ecology Assessment



## **Appendix D: Water Sampling Analytical Results**





## CERTIFICATE OF ANALYSIS

|                         |                                           |                         |                                                    |
|-------------------------|-------------------------------------------|-------------------------|----------------------------------------------------|
| Work Order              | : <b>EB2525857</b>                        | Page                    | : 1 of 5                                           |
| Amendment               | : <b>1</b>                                |                         |                                                    |
| Client                  | : <b>DPM ENVIROSCIENCES PTY LTD</b>       | Laboratory              | : Environmental Division Brisbane                  |
| Contact                 | : <b>MR DAVID MOORE</b>                   | Contact                 | : Customer Services EB                             |
| Address                 | : <b>12 LAUREN DRIVE<br/>BUDERIM 4556</b> | Address                 | : <b>2 Byth Street Stafford QLD Australia 4053</b> |
| Telephone               | : ----                                    | Telephone               | : +61-7-3552-8685                                  |
| Project                 | : <b>DPM25009 Wallaby Creek Wind Farm</b> | Date Samples Received   | : 28-Jul-2025 10:08                                |
| Order number            | : ----                                    | Date Analysis Commenced | : 28-Jul-2025                                      |
| C-O-C number            | : ----                                    | Issue Date              | : 05-Aug-2025 11:22                                |
| Sampler                 | : <b>DAVID MOORE</b>                      |                         |                                                    |
| Site                    | : ----                                    |                         |                                                    |
| Quote number            | : <b>EN/333</b>                           |                         |                                                    |
| No. of samples received | : <b>11</b>                               |                         |                                                    |
| No. of samples analysed | : <b>11</b>                               |                         |                                                    |



Accreditation No. 825  
Accredited for compliance with  
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| <i>Signatories</i> | <i>Position</i>          | <i>Accreditation Category</i>      |
|--------------------|--------------------------|------------------------------------|
| Beatriz Llarinas   | Senior Chemist           | Brisbane Inorganics, Stafford, QLD |
| Kim McCabe         | Senior Inorganic Chemist | Brisbane Inorganics, Stafford, QLD |



## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H<sup>+</sup> to the Cations and Nitrate, SiO<sub>2</sub> and Fluoride to the Anions.
- Amendment (04/08/2025): This report has been amended following the update of the project Id to "DPM25009 Wallaby Creek Wind Farm". All analysis results are as per the previous report
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.





## Analytical Results

Sub-Matrix: WATER  
 (Matrix: WATER)

| Sample ID                                              |             |      |       | Site 3            | Site 4            | Site 5A           | Site 5B           | Site 6            |
|--------------------------------------------------------|-------------|------|-------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Sampling date / time                                   |             |      |       | 22-Jul-2025 00:00 | 22-Jul-2025 00:00 | 22-Jul-2025 00:00 | 22-Jul-2025 00:00 | 23-Jul-2025 00:00 |
| Compound                                               | CAS Number  | LOR  | Unit  | EB2525857-001     | EB2525857-002     | EB2525857-003     | EB2525857-004     | EB2525857-005     |
|                                                        |             |      |       | Result            | Result            | Result            | Result            | Result            |
| <b>ED037P: Alkalinity by PC Titrator</b>               |             |      |       |                   |                   |                   |                   |                   |
| Hydroxide Alkalinity as CaCO3                          | DMO-210-001 | 1    | mg/L  | <1                | <1                | <1                | <1                | <1                |
| Carbonate Alkalinity as CaCO3                          | 3812-32-6   | 1    | mg/L  | <1                | <1                | <1                | <1                | <1                |
| Bicarbonate Alkalinity as CaCO3                        | 71-52-3     | 1    | mg/L  | 51                | 56                | 80                | 88                | 61                |
| Total Alkalinity as CaCO3                              | ----        | 1    | mg/L  | 51                | 56                | 80                | 88                | 61                |
| <b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b> |             |      |       |                   |                   |                   |                   |                   |
| Sulfate as SO4 - Turbidimetric                         | 14808-79-8  | 1    | mg/L  | 11                | 31                | 19                | 33                | 12                |
| <b>ED045G: Chloride by Discrete Analyser</b>           |             |      |       |                   |                   |                   |                   |                   |
| Chloride                                               | 16887-00-6  | 1    | mg/L  | 28                | 101               | 73                | 117               | 58                |
| <b>ED093F: Dissolved Major Cations</b>                 |             |      |       |                   |                   |                   |                   |                   |
| Calcium                                                | 7440-70-2   | 1    | mg/L  | 3                 | 6                 | 1                 | 3                 | 1                 |
| Magnesium                                              | 7439-95-4   | 1    | mg/L  | 3                 | 4                 | 2                 | 3                 | 2                 |
| Sodium                                                 | 7440-23-5   | 1    | mg/L  | 30                | 77                | 83                | 119               | 64                |
| Potassium                                              | 7440-09-7   | 1    | mg/L  | 8                 | 9                 | 4                 | 3                 | 3                 |
| <b>EN055: Ionic Balance</b>                            |             |      |       |                   |                   |                   |                   |                   |
| ∅ Total Anions                                         | ----        | 0.01 | meq/L | 2.04              | 4.61              | 4.05              | 5.74              | 3.10              |
| ∅ Total Cations                                        | ----        | 0.01 | meq/L | 1.91              | 4.21              | 3.93              | 5.65              | 3.08              |
| ∅ Ionic Balance                                        | ----        | 0.01 | %     | ----              | 4.59              | 1.58              | 0.84              | 0.48              |



## Analytical Results

Sub-Matrix: WATER  
 (Matrix: WATER)

| Sample ID                                              |             |      |       | Site 7            | Site 8            | Site 9A           | Site 10           | Site 11           |
|--------------------------------------------------------|-------------|------|-------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Sampling date / time                                   |             |      |       | 23-Jul-2025 00:00 | 23-Jul-2025 00:00 | 23-Jul-2025 00:00 | 24-Jul-2025 00:00 | 24-Jul-2025 00:00 |
| Compound                                               | CAS Number  | LOR  | Unit  | EB2525857-006     | EB2525857-007     | EB2525857-008     | EB2525857-009     | EB2525857-010     |
|                                                        |             |      |       | Result            | Result            | Result            | Result            | Result            |
| <b>ED037P: Alkalinity by PC Titrator</b>               |             |      |       |                   |                   |                   |                   |                   |
| Hydroxide Alkalinity as CaCO3                          | DMO-210-001 | 1    | mg/L  | <1                | <1                | <1                | <1                | <1                |
| Carbonate Alkalinity as CaCO3                          | 3812-32-6   | 1    | mg/L  | <1                | <1                | <1                | <1                | <1                |
| Bicarbonate Alkalinity as CaCO3                        | 71-52-3     | 1    | mg/L  | 63                | 584               | 34                | 56                | 52                |
| Total Alkalinity as CaCO3                              | ----        | 1    | mg/L  | 63                | 584               | 34                | 56                | 52                |
| <b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b> |             |      |       |                   |                   |                   |                   |                   |
| Sulfate as SO4 - Turbidimetric                         | 14808-79-8  | 1    | mg/L  | 12                | 201               | 42                | 12                | 10                |
| <b>ED045G: Chloride by Discrete Analyser</b>           |             |      |       |                   |                   |                   |                   |                   |
| Chloride                                               | 16887-00-6  | 1    | mg/L  | 59                | 1130              | 49                | 56                | 49                |
| <b>ED093F: Dissolved Major Cations</b>                 |             |      |       |                   |                   |                   |                   |                   |
| Calcium                                                | 7440-70-2   | 1    | mg/L  | 1                 | 92                | 3                 | <1                | <1                |
| Magnesium                                              | 7439-95-4   | 1    | mg/L  | 2                 | 168               | 8                 | 2                 | 2                 |
| Sodium                                                 | 7440-23-5   | 1    | mg/L  | 64                | 608               | 48                | 61                | 57                |
| Potassium                                              | 7440-09-7   | 1    | mg/L  | 3                 | 4                 | 10                | 3                 | 2                 |
| <b>EN055: Ionic Balance</b>                            |             |      |       |                   |                   |                   |                   |                   |
| ∅ Total Anions                                         | ----        | 0.01 | meq/L | 3.17              | 47.7              | 2.94              | 2.95              | 2.63              |
| ∅ Total Cations                                        | ----        | 0.01 | meq/L | 3.08              | 45.0              | 3.15              | 2.89              | 2.70              |
| ∅ Ionic Balance                                        | ----        | 0.01 | %     | 1.57              | 2.98              | ----              | ----              | ----              |





## Analytical Results

|                                                        |             |      |       |           |                   |       |       |       |       |
|--------------------------------------------------------|-------------|------|-------|-----------|-------------------|-------|-------|-------|-------|
| Sub-Matrix: WATER<br>(Matrix: WATER)                   |             |      |       | Sample ID | Site 13           | ----  | ----  | ----  | ----  |
| Sampling date / time                                   |             |      |       |           | 24-Jul-2025 00:00 | ----  | ----  | ----  | ----  |
| Compound                                               | CAS Number  | LOR  | Unit  |           | EB2525857-011     | ----- | ----- | ----- | ----- |
|                                                        |             |      |       | Result    | ----              | ----  | ----  | ----  | ----  |
| <b>ED037P: Alkalinity by PC Titrator</b>               |             |      |       |           |                   |       |       |       |       |
| Hydroxide Alkalinity as CaCO3                          | DMO-210-001 | 1    | mg/L  |           | <1                | ----  | ----  | ----  | ----  |
| Carbonate Alkalinity as CaCO3                          | 3812-32-6   | 1    | mg/L  |           | <1                | ----  | ----  | ----  | ----  |
| Bicarbonate Alkalinity as CaCO3                        | 71-52-3     | 1    | mg/L  |           | 50                | ----  | ----  | ----  | ----  |
| Total Alkalinity as CaCO3                              | ----        | 1    | mg/L  |           | 50                | ----  | ----  | ----  | ----  |
| <b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b> |             |      |       |           |                   |       |       |       |       |
| Sulfate as SO4 - Turbidimetric                         | 14808-79-8  | 1    | mg/L  |           | 10                | ----  | ----  | ----  | ----  |
| <b>ED045G: Chloride by Discrete Analyser</b>           |             |      |       |           |                   |       |       |       |       |
| Chloride                                               | 16887-00-6  | 1    | mg/L  |           | 46                | ----  | ----  | ----  | ----  |
| <b>ED093F: Dissolved Major Cations</b>                 |             |      |       |           |                   |       |       |       |       |
| Calcium                                                | 7440-70-2   | 1    | mg/L  |           | <1                | ----  | ----  | ----  | ----  |
| Magnesium                                              | 7439-95-4   | 1    | mg/L  |           | 2                 | ----  | ----  | ----  | ----  |
| Sodium                                                 | 7440-23-5   | 1    | mg/L  |           | 55                | ----  | ----  | ----  | ----  |
| Potassium                                              | 7440-09-7   | 1    | mg/L  |           | 2                 | ----  | ----  | ----  | ----  |
| <b>EN055: Ionic Balance</b>                            |             |      |       |           |                   |       |       |       |       |
| ∅ Total Anions                                         | ----        | 0.01 | meq/L |           | 2.50              | ----  | ----  | ----  | ----  |
| ∅ Total Cations                                        | ----        | 0.01 | meq/L |           | 2.61              | ----  | ----  | ----  | ----  |



## QUALITY CONTROL REPORT

Work Order : **EB2525857**

Page : 1 of 4

Amendment : **1**

Client : **DPM ENVIROSCIENCES PTY LTD**

Contact : **MR DAVID MOORE**

Address : **12 LAUREN DRIVE  
BUDERIM 4556**

Telephone : ----

Project : **DPM25009 Wallaby Creek Wind Farm**

Order number : ----

C-O-C number : ----

Sampler : **DAVID MOORE**

Site : ----

Quote number : **EN/333**

No. of samples received : **11**

No. of samples analysed : **11**

Laboratory : **Environmental Division Brisbane**

Contact : **Customer Services EB**

Address : **2 Byth Street Stafford QLD Australia 4053**

Telephone : **+61-7-3552-8685**

Date Samples Received : **28-Jul-2025**

Date Analysis Commenced : **28-Jul-2025**

Issue Date : **05-Aug-2025**



Accreditation No. 825  
Accredited for compliance with  
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| Signatories      | Position                 | Accreditation Category             |
|------------------|--------------------------|------------------------------------|
| Beatriz Llarinas | Senior Chemist           | Brisbane Inorganics, Stafford, QLD |
| Kim McCabe       | Senior Inorganic Chemist | Brisbane Inorganics, Stafford, QLD |





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The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

# = Indicates failed QC

\* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

| Sub-Matrix: WATER                                                 |           |                                          |             | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                    |
|-------------------------------------------------------------------|-----------|------------------------------------------|-------------|-----------------------------------|------|-----------------|------------------|---------|--------------------|
| Laboratory sample ID                                              | Sample ID | Method: Compound                         | CAS Number  | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Acceptable RPD (%) |
| ED037P: Alkalinity by PC Titrator (QC Lot: 6749464)               |           |                                          |             |                                   |      |                 |                  |         |                    |
| EB2525131-001                                                     | Anonymous | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1                                 | mg/L | <1              | <1               | 0.0     | No Limit           |
|                                                                   |           | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1                                 | mg/L | <1              | <1               | 0.0     | No Limit           |
|                                                                   |           | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1                                 | mg/L | 100             | 100              | 0.0     | 0% - 20%           |
|                                                                   |           | ED037-P: Total Alkalinity as CaCO3       | ----        | 1                                 | mg/L | 100             | 100              | 0.0     | 0% - 20%           |
| EB2525857-007                                                     | Site 8    | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1                                 | mg/L | <1              | <1               | 0.0     | No Limit           |
|                                                                   |           | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1                                 | mg/L | <1              | <1               | 0.0     | No Limit           |
|                                                                   |           | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1                                 | mg/L | 584             | 587              | 0.6     | 0% - 20%           |
|                                                                   |           | ED037-P: Total Alkalinity as CaCO3       | ----        | 1                                 | mg/L | 584             | 587              | 0.6     | 0% - 20%           |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6749366) |           |                                          |             |                                   |      |                 |                  |         |                    |
| EB2525857-001                                                     | Site 3    | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1 (5)*                            | mg/L | 11              | 11               | 0.0     | No Limit           |
| EB2525857-010                                                     | Site 11   | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8  | 1                                 | mg/L | 10              | 10               | 0.0     | 0% - 50%           |
| ED045G: Chloride by Discrete Analyser (QC Lot: 6749365)           |           |                                          |             |                                   |      |                 |                  |         |                    |
| EB2525857-001                                                     | Site 3    | ED045G: Chloride                         | 16887-00-6  | 1 (5)*                            | mg/L | 28              | 30               | 5.4     | No Limit           |
| EB2525857-010                                                     | Site 11   | ED045G: Chloride                         | 16887-00-6  | 1                                 | mg/L | 49              | 49               | 0.0     | 0% - 20%           |
| ED093F: Dissolved Major Cations (QC Lot: 6749970)                 |           |                                          |             |                                   |      |                 |                  |         |                    |
| EB2525121-008                                                     | Anonymous | ED093F: Calcium                          | 7440-70-2   | 1                                 | mg/L | 36              | 36               | 0.0     | 0% - 20%           |
|                                                                   |           | ED093F: Magnesium                        | 7439-95-4   | 1                                 | mg/L | 16              | 16               | 0.0     | 0% - 50%           |
|                                                                   |           | ED093F: Sodium                           | 7440-23-5   | 1                                 | mg/L | 220             | 221              | 0.6     | 0% - 20%           |
|                                                                   |           | ED093F: Potassium                        | 7440-09-7   | 1                                 | mg/L | 65              | 65               | 0.0     | 0% - 20%           |
| EB2525857-009                                                     | Site 10   | ED093F: Calcium                          | 7440-70-2   | 1                                 | mg/L | <1              | <1               | 0.0     | No Limit           |



| Sub-Matrix: WATER                                             |           |                   |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                    |
|---------------------------------------------------------------|-----------|-------------------|------------|-----------------------------------|------|-----------------|------------------|---------|--------------------|
| Laboratory sample ID                                          | Sample ID | Method: Compound  | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Acceptable RPD (%) |
| ED093F: Dissolved Major Cations (QC Lot: 6749970) - continued |           |                   |            |                                   |      |                 |                  |         |                    |
| EB2525857-009                                                 | Site 10   | ED093F: Magnesium | 7439-95-4  | 1                                 | mg/L | 2               | 2                | 0.0     | No Limit           |
|                                                               |           | ED093F: Sodium    | 7440-23-5  | 1                                 | mg/L | 61              | 60               | 0.0     | 0% - 20%           |
|                                                               |           | ED093F: Potassium | 7440-09-7  | 1                                 | mg/L | 3               | 3                | 0.0     | No Limit           |





## Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

| Sub-Matrix: WATER                                                |            |      |      | Method Blank (MB)<br>Report | Laboratory Control Spike (LCS) Report |                    |                       |     |
|------------------------------------------------------------------|------------|------|------|-----------------------------|---------------------------------------|--------------------|-----------------------|-----|
|                                                                  |            |      |      |                             | Spike<br>Concentration                | Spike Recovery (%) | Acceptable Limits (%) |     |
| Method: Compound                                                 | CAS Number | LOR  | Unit |                             | Result                                |                    | LCS                   | Low |
| ED037P: Alkalinity by PC Titrator (QCLot: 6749464)               |            |      |      |                             |                                       |                    |                       |     |
| ED037-P: Total Alkalinity as CaCO3                               | ----       | ---- | mg/L | ----                        | 200 mg/L                              | 95.4               | 80.0                  | 120 |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6749366) |            |      |      |                             |                                       |                    |                       |     |
| ED041G: Sulfate as SO4 - Turbidimetric                           | 14808-79-8 | 1    | mg/L | <1                          | 25 mg/L                               | 97.3               | 85.0                  | 118 |
|                                                                  |            |      |      | <1                          | 100 mg/L                              | 102                | 85.0                  | 118 |
| ED045G: Chloride by Discrete Analyser (QCLot: 6749365)           |            |      |      |                             |                                       |                    |                       |     |
| ED045G: Chloride                                                 | 16887-00-6 | 1    | mg/L | <1                          | 10 mg/L                               | 112                | 90.0                  | 115 |
|                                                                  |            |      |      | <1                          | 1000 mg/L                             | 104                | 90.0                  | 115 |
| ED093F: Dissolved Major Cations (QCLot: 6749970)                 |            |      |      |                             |                                       |                    |                       |     |
| ED093F: Calcium                                                  | 7440-70-2  | 1    | mg/L | <1                          | 50 mg/L                               | 102                | 70.0                  | 130 |
| ED093F: Magnesium                                                | 7439-95-4  | 1    | mg/L | <1                          | 50 mg/L                               | 94.3               | 70.0                  | 130 |
| ED093F: Sodium                                                   | 7440-23-5  | 1    | mg/L | <1                          | 50 mg/L                               | 96.4               | 70.0                  | 130 |
| ED093F: Potassium                                                | 7440-09-7  | 1    | mg/L | <1                          | 50 mg/L                               | 95.6               | 70.0                  | 130 |

## Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

|                                                                         |           |                                        |            | Matrix Spike (MS) Report |                        |                       |      |
|-------------------------------------------------------------------------|-----------|----------------------------------------|------------|--------------------------|------------------------|-----------------------|------|
|                                                                         |           |                                        |            | Spike<br>Concentration   | SpikeRecovery(%)<br>MS | Acceptable Limits (%) |      |
| Laboratory sample ID                                                    | Sample ID | Method: Compound                       | CAS Number |                          |                        | Low                   | High |
| <b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6749366)</b> |           |                                        |            |                          |                        |                       |      |
| EB2525857-002                                                           | Site 4    | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 100 mg/L                 | 100                    | 70.0                  | 130  |
| <b>ED045G: Chloride by Discrete Analyser (QCLot: 6749365)</b>           |           |                                        |            |                          |                        |                       |      |
| EB2525857-002                                                           | Site 4    | ED045G: Chloride                       | 16887-00-6 | 2000 mg/L                | 113                    | 70.0                  | 130  |



## QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EB2525857**

Page : 1 of 5

Amendment : **1**

Client : **DPM ENVIROSCIENCES PTY LTD**  
Contact : **MR DAVID MOORE**  
Project : **DPM25009 Wallaby Creek Wind Farm**  
Site : **----**  
Sampler : **DAVID MOORE**  
Order number : **----**

Laboratory : **Environmental Division Brisbane**  
Telephone : **+61-7-3552-8685**  
Date Samples Received : **28-Jul-2025**  
Issue Date : **05-Aug-2025**  
No. of samples received : **11**  
No. of samples analysed : **11**

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

### Summary of Outliers

#### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

#### Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

#### Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**





## Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

| Method                                                                | Extraction / Preparation |                    |              | Analysis      |                  |              |
|-----------------------------------------------------------------------|--------------------------|--------------------|--------------|---------------|------------------|--------------|
| Container / Client Sample ID(s)                                       | Date extracted           | Due for extraction | Days overdue | Date analysed | Due for analysis | Days overdue |
| ED093F: Dissolved Major Cations                                       |                          |                    |              |               |                  |              |
| Clear Plastic Bottle - Natural<br>Site 3, Site 4,<br>Site 5A, Site 5B | ----                     | ----               | ----         | 31-Jul-2025   | 29-Jul-2025      | 2            |
| Clear Plastic Bottle - Natural<br>Site 6, Site 7,<br>Site 8, Site 9A  | ----                     | ----               | ----         | 31-Jul-2025   | 30-Jul-2025      | 1            |

## Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

| Method                                                          | Sample Date        | Extraction / Preparation |                    |            | Analysis      |                  |             |   |
|-----------------------------------------------------------------|--------------------|--------------------------|--------------------|------------|---------------|------------------|-------------|---|
| Container / Client Sample ID(s)                                 |                    | Date extracted           | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation  |   |
| ED037P: Alkalinity by PC Titrator                               |                    |                          |                    |            |               |                  |             |   |
| Clear Plastic Bottle - Natural (ED037-P)<br>Site 3,<br>Site 5A, | Site 4,<br>Site 5B | 22-Jul-2025              | ----               | ----       | ----          | 29-Jul-2025      | 05-Aug-2025 | ✓ |
| Clear Plastic Bottle - Natural (ED037-P)<br>Site 6,<br>Site 8,  | Site 7,<br>Site 9A | 23-Jul-2025              | ----               | ----       | ----          | 29-Jul-2025      | 06-Aug-2025 | ✓ |
| Clear Plastic Bottle - Natural (ED037-P)<br>Site 10,<br>Site 13 | Site 11,           | 24-Jul-2025              | ----               | ----       | ----          | 29-Jul-2025      | 07-Aug-2025 | ✓ |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA                 |                    |                          |                    |            |               |                  |             |   |
| Clear Plastic Bottle - Natural (ED041G)<br>Site 3,<br>Site 5A,  | Site 4,<br>Site 5B | 22-Jul-2025              | ----               | ----       | ----          | 28-Jul-2025      | 19-Aug-2025 | ✓ |
| Clear Plastic Bottle - Natural (ED041G)<br>Site 6,<br>Site 8,   | Site 7,<br>Site 9A | 23-Jul-2025              | ----               | ----       | ----          | 28-Jul-2025      | 20-Aug-2025 | ✓ |
| Clear Plastic Bottle - Natural (ED041G)<br>Site 10,<br>Site 13  | Site 11,           | 24-Jul-2025              | ----               | ----       | ----          | 28-Jul-2025      | 21-Aug-2025 | ✓ |



Matrix: WATER

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

| Method                                                         | Sample Date        | Extraction / Preparation |                    |            | Analysis      |                  |             |   |
|----------------------------------------------------------------|--------------------|--------------------------|--------------------|------------|---------------|------------------|-------------|---|
| Container / Client Sample ID(s)                                |                    | Date extracted           | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation  |   |
| ED045G: Chloride by Discrete Analyser                          |                    |                          |                    |            |               |                  |             |   |
| Clear Plastic Bottle - Natural (ED045G)<br>Site 3,<br>Site 5A, | Site 4,<br>Site 5B | 22-Jul-2025              | ----               | ----       | ----          | 28-Jul-2025      | 19-Aug-2025 | ✓ |
| Clear Plastic Bottle - Natural (ED045G)<br>Site 6,<br>Site 8,  | Site 7,<br>Site 9A | 23-Jul-2025              | ----               | ----       | ----          | 28-Jul-2025      | 20-Aug-2025 | ✓ |
| Clear Plastic Bottle - Natural (ED045G)<br>Site 10,<br>Site 13 | Site 11,           | 24-Jul-2025              | ----               | ----       | ----          | 28-Jul-2025      | 21-Aug-2025 | ✓ |
| ED093F: Dissolved Major Cations                                |                    |                          |                    |            |               |                  |             |   |
| Clear Plastic Bottle - Natural (ED093F)<br>Site 3,<br>Site 5A, | Site 4,<br>Site 5B | 22-Jul-2025              | ----               | ----       | ----          | 31-Jul-2025      | 29-Jul-2025 | ✗ |
| Clear Plastic Bottle - Natural (ED093F)<br>Site 6,<br>Site 8,  | Site 7,<br>Site 9A | 23-Jul-2025              | ----               | ----       | ----          | 31-Jul-2025      | 30-Jul-2025 | ✗ |
| Clear Plastic Bottle - Natural (ED093F)<br>Site 10,<br>Site 13 | Site 11,           | 24-Jul-2025              | ----               | ----       | ----          | 31-Jul-2025      | 31-Jul-2025 | ✓ |





## Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

| Quality Control Sample Type                            |         | Count |         | Rate (%) |          |            | Quality Control Specification  |
|--------------------------------------------------------|---------|-------|---------|----------|----------|------------|--------------------------------|
| Analytical Methods                                     | Method  | QC    | Regular | Actual   | Expected | Evaluation |                                |
|                                                        |         |       |         |          |          |            |                                |
| Laboratory Duplicates (DUP)                            |         |       |         |          |          |            |                                |
| Alkalinity by Auto Titrator                            | ED037-P | 2     | 20      | 10.00    | 10.00    | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser                          | ED045G  | 2     | 19      | 10.53    | 10.00    | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved                              | ED093F  | 2     | 17      | 11.76    | 10.00    | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G  | 2     | 19      | 10.53    | 10.00    | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Laboratory Control Samples (LCS)                       |         |       |         |          |          |            |                                |
| Alkalinity by Auto Titrator                            | ED037-P | 1     | 20      | 5.00     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser                          | ED045G  | 2     | 19      | 10.53    | 10.00    | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved                              | ED093F  | 1     | 17      | 5.88     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G  | 2     | 19      | 10.53    | 10.00    | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Method Blanks (MB)                                     |         |       |         |          |          |            |                                |
| Chloride by Discrete Analyser                          | ED045G  | 1     | 19      | 5.26     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved                              | ED093F  | 1     | 17      | 5.88     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G  | 1     | 19      | 5.26     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Matrix Spikes (MS)                                     |         |       |         |          |          |            |                                |
| Chloride by Discrete Analyser                          | ED045G  | 1     | 19      | 5.26     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G  | 1     | 19      | 5.26     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |



## Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

| Analytical Methods                                                 | Method       | Matrix | Method Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------|--------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alkalinity by Auto Titrator                                        | ED037-P      | WATER  | In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. Auto Titrator) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                     |
| Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by Discrete Analyser | ED041G       | WATER  | In house: Referenced to APHA 4500-SO <sub>4</sub> . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO <sub>4</sub> suspension is measured by a photometer and the SO <sub>4</sub> -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3) |
| Chloride by Discrete Analyser                                      | ED045G       | WATER  | In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.                                                                                                                                           |
| Major Cations - Dissolved                                          | ED093F       | WATER  | In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)   |
| Ionic Balance by PCT DA and Turbi SO <sub>4</sub> DA               | * EN055 - PG | WATER  | In house: Referenced to APHA 1030E. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                                                                                   |





## SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2525857**

Amendment : **1**

Client : **DPM ENVIROSCIENCES PTY LTD**

Contact : **MR DAVID MOORE**

Address : **12 LAUREN DRIVE  
BUDERIM 4556**

Laboratory : **Environmental Division Brisbane**

Contact : **Customer Services EB**

Address : **2 Byth Street Stafford QLD Australia  
4053**

E-mail : **dmoore@dpm-enviro.com.au**

Telephone : **----**

Facsimile : **----**

E-mail : **ALSEnviro.Brisbane@alsglobal.com**

Telephone : **+61-7-3552-8685**

Facsimile : **+61-7-3243 7218**

Project : **DPM25009 Wallaby Creek Wind Farm**

Order number : **----**

C-O-C number : **----**

Site : **----**

Sampler : **DAVID MOORE**

Page : **1 of 2**

Quote number : **EB2019DPMENV0001 (EN/333)**

QC Level : **NEPM 2013 B3 & ALS QC Standard**

### Dates

Date Samples Received : **28-Jul-2025 10:08**

Client Requested Due : **04-Aug-2025**

Date

Issue Date : **04-Aug-2025**

Scheduled Reporting Date : **04-Aug-2025**

### Delivery Details

Mode of Delivery : **Client Drop Off**

No. of coolers/boxes : **2**

Receipt Detail : **BAG**

Security Seal : **Not Available**

Temperature : **13.2, 14.1, 15.2°C**

No. of samples received / analysed : **11 / 11**

### General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **\*SRN Reissued 04/08/2025: As per the email from David Moore on 04/08/2025 this work order has been amended to update the project ID to "DPM25009 Wallaby Creek Wind Farm".**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**



## Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

## Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

| Laboratory sample ID | Sampling date / time | Sample ID | WATER - NT-01 & 02<br>Ca, Mg, Na, K, Chloride, SO4, Alkalinity |
|----------------------|----------------------|-----------|----------------------------------------------------------------|
| EB2525857-001        | 22-Jul-2025 00:00    | Site 3    | ✓                                                              |
| EB2525857-002        | 22-Jul-2025 00:00    | Site 4    | ✓                                                              |
| EB2525857-003        | 22-Jul-2025 00:00    | Site 5A   | ✓                                                              |
| EB2525857-004        | 22-Jul-2025 00:00    | Site 5B   | ✓                                                              |
| EB2525857-005        | 23-Jul-2025 00:00    | Site 6    | ✓                                                              |
| EB2525857-006        | 23-Jul-2025 00:00    | Site 7    | ✓                                                              |
| EB2525857-007        | 23-Jul-2025 00:00    | Site 8    | ✓                                                              |
| EB2525857-008        | 23-Jul-2025 00:00    | Site 9A   | ✓                                                              |
| EB2525857-009        | 24-Jul-2025 00:00    | Site 10   | ✓                                                              |
| EB2525857-010        | 24-Jul-2025 00:00    | Site 11   | ✓                                                              |
| EB2525857-011        | 24-Jul-2025 00:00    | Site 13   | ✓                                                              |

## Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

## Requested Deliverables

### DAVID MOORE

|                                                                |       |                          |
|----------------------------------------------------------------|-------|--------------------------|
| - *AU Certificate of Analysis - NATA (COA)                     | Email | dmoore@dpm-enviro.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)    | Email | dmoore@dpm-enviro.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)            | Email | dmoore@dpm-enviro.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | dmoore@dpm-enviro.com.au |
| - A4 - AU Tax Invoice (INV)                                    | Email | dmoore@dpm-enviro.com.au |
| - Chain of Custody (CoC) (COC)                                 | Email | dmoore@dpm-enviro.com.au |
| - EDI Format - ENMRG (ENMRG)                                   | Email | dmoore@dpm-enviro.com.au |
| - EDI Format - XTab (XTAB)                                     | Email | dmoore@dpm-enviro.com.au |



| <div style="display: flex; justify-content: space-between;"> <div> <b>CHAIN OF CUSTODY</b><br/> <small>ALS Laboratory: please tick</small> </div> <div> <small>13400 Alameda Drive, Bundoora Vic 3086<br/> Ph: 07 4952 5795 E: als@alsglobal.com</small> </div> <div> <small>13400 Alameda Drive, Bundoora Vic 3086<br/> Ph: 07 4952 5795 E: als@alsglobal.com</small> </div> <div> <small>13400 Alameda Drive, Bundoora Vic 3086<br/> Ph: 07 4952 5795 E: als@alsglobal.com</small> </div> </div> |           |                                                                                                                                                                                     |        |                                                                                                                                                                                                           |               |                                                                                                                                                                                                                    |  |                        |                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------|--------------------------------------------------------------------------------------------------|
| <b>CLIENT:</b> DPM Envirosiences Pty Ltd<br><b>OFFICE:</b> Buderim                                                                                                                                                                                                                                                                                                                                                                                                                                 |           | <b>TURNAROUND REQUIREMENTS:</b> <input type="checkbox"/> Standard TAT (List due date):<br><input type="checkbox"/> Non Standard or urgent TAT (List due date):                      |        | <b>FOR LABORATORY USE ONLY (Circle)</b><br>Custody Seal Intact? Yes No N/A<br>Free ice / frozen ice bricks present upon receipt? Yes No N/A<br>Random Sample Temperature on Receipt: °C<br>Other comment: |               |                                                                                                                                                                                                                    |  |                        |                                                                                                  |
| <b>PROJECT:</b> Blackwater North Project<br><b>ORDER NUMBER:</b> N/A<br><b>PROJECT MANAGER:</b> David Moore                                                                                                                                                                                                                                                                                                                                                                                        |           | <b>PROJECT NO.:</b> DPM25009<br><b>ALS QUOTE NO.:</b> EN/333/20<br><b>COUNTRY OF ORIGIN:</b> Australia                                                                              |        | <b>COG SEQUENCE NUMBER (Circle)</b><br>COG: 1 2 3 4 5 6 7<br>OF: 1 2 3 4 5 6 7                                                                                                                            |               |                                                                                                                                                                                                                    |  |                        |                                                                                                  |
| <b>PURCHASE ORDER NO.:</b> N/A<br><b>SAMPLER:</b> David Moore<br><b>COC Emailed to ALS?</b> ( YES / NO )<br><b>Email Reports to</b> (will default to PM if no other addresses are listed): dmoore@dpm-enviro.com.au<br><b>Email Invoice to</b> (will default to PM if no other addresses are listed): dmoore@dpm-enviro.com.au                                                                                                                                                                     |           | <b>CONTACT PH:</b> 0427 694 433<br><b>SAMPLER MOBILE:</b> 0427 694 433<br><b>EDD FORMAT (or default):</b><br><b>RELINQUISHED BY:</b> DAVID MOORE<br><b>DATE/TIME:</b> 28/7/25 10:06 |        | <b>RECEIVED BY:</b> David<br><b>DATE/TIME:</b> 28/7/25 10:08<br><b>RELINQUISHED BY:</b><br><b>RECEIVED BY:</b>                                                                                            |               |                                                                                                                                                                                                                    |  |                        |                                                                                                  |
| <b>COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |                                                                                                                                                                                     |        |                                                                                                                                                                                                           |               |                                                                                                                                                                                                                    |  |                        |                                                                                                  |
| ALS USE ONLY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | SAMPLE DETAILS<br>MATRIX: Solid(S) Water(W)                                                                                                                                         |        | CONTAINER INFORMATION                                                                                                                                                                                     |               | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)<br>Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). |  | Additional information |                                                                                                  |
| LAB ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SAMPLE ID | DATE / TIME                                                                                                                                                                         | MATRIX | TYPE & PRESERVATIVE<br>(refer to codes below)                                                                                                                                                             | TOTAL BOTTLES | Cations & Anions: Major (Ca, Mg, Na, K, Cl, SO <sub>4</sub> , Ammonium) + Ionic Balance (Suite NT-1 & NT-2)                                                                                                        |  |                        | Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc. |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 3    | 22/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 4    | 22/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 5A   | 22/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 5B   | 22/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 6    | 23/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 7    | 23/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 8    | 23/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 9A   | 23/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Site 10   | 24/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Site 11   | 24/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Site 13   | 24/07/2025                                                                                                                                                                          | W      | P                                                                                                                                                                                                         | 1             | ✓                                                                                                                                                                                                                  |  |                        |                                                                                                  |
| <b>TOTAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |                                                                                                                                                                                     |        |                                                                                                                                                                                                           | 11            |                                                                                                                                                                                                                    |  |                        |                                                                                                  |

Environmental Division  
 Brisbane  
 Work Order Reference  
**EB2525857**  
  
 Telephone : 61-7-3552-8685

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic;  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugol's Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.