Queensland Hydro

Prepared for the Department of Climate Change, Energy, the Environment and Water

Borumba Pumped Hydro Energy Storage Project – Exploratory Works Preliminary Documentation

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Executive Summary

Background

Queensland Hydro is the proponent of the Borumba Pumped Hydro Energy Storage (PHES) Project (the Borumba PHES Project). The Borumba PHES Project is a 2,000 megawatt (MW), 48,000-megawatt hour (MWh), hydroelectric scheme to store, generate, and supply energy through a pumped hydroelectric structure linked to the existing Borumba Dam (Lake Borumba).

The Borumba PHES Project is located approximately 13 kilometres (km) southwest of the township of Imbil, 48 km southwest of Gympie, and 180 km northwest of Brisbane. The Borumba PHES Project and Lake Borumba are within the Yabba Creek sub catchment of the Mary River Basin.

The Borumba PHES Project includes two phases, as follows:

- Exploratory Works – the geological investigations and the associated supporting infrastructure and activities required to support the geological investigations, which will ultimately inform the development of the Borumba PHES Project.
- Main Works – the PHES Project, including the power infrastructure (powerhouse, water and access tunnels), an upper reservoir, and a lower reservoir (Lake Borumba).

The purpose of the Exploratory Works is to undertake and facilitate critical geological technical investigations to confirm the suitability of the Borumba PHES Project location and design. Investigations are particularly required in areas where key subsurface Borumba PHES Project infrastructure will be constructed due to the limited technical geological information currently available, posing considerable project risk. Much of the Exploratory Works is proposed, unavoidably, in vegetated areas that provide habitat for listed threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

EPBC referral and assessment

The Borumba Pumped Hydro Project Exploratory Works Project (herein referred to as 'the Project') was referred under the EPBC Act on 1 February 2023. Following consideration of the referral and supporting documentation, on 30 March 2023, a delegate for the Commonwealth Minister for the Environment and Water determined the Project to be a controlled action (EPBC 2023/09461) to be assessed by Preliminary Documentation. Listed threatened species and communities (sections 18 and 18A of the EPBC Act) are the relevant controlling provisions for the action.

The purpose of this Preliminary Documentation is to provide sufficient information for the Minister to make a decision on the Project, including addressing information requested by Department of Climate Change, Energy, the Environment and Water (DCCEEW).

Project description

The Project comprises the following activities:

- Geotechnical investigations – comprising test pits, boreholes (deep and shallow, including some conversion to groundwater monitoring bores), and geophysics (including surface survey lines and within boreholes).
- Spoil disposal – two dedicated areas (tunnel spoil disposal area and Kingaham spoil disposal area) for the storage and management of excess material from exploratory tunnelling, geotechnical drilling and construction activities, as well as stockpiling of stripped topsoil.
- Site access – activities associated with:
  - construction of new access tracks and upgrades to existing tracks, including waterway crossings, to enable access to geotechnical investigation sites, spoil disposal areas, and supporting infrastructure
  - the realignment of a section of Bella Creek Road, referred to as the Kingaham Creek bypass.
- Other supporting infrastructure – establishment of temporary water infrastructure and a civil construction compound (laydown area).
- Exploratory tunnel infrastructure – comprising a portal pad, staging pad, explosive store (also referred to as a magazine), and associated access tracks, and exploratory tunnels.

Activities associated with routine management of Queensland Hydro land (such as fire breaks, property fencing, access track maintenance, and any other similar activities) do not form part of the referred action.

Some preliminary activities proposed to occur in advance of the Exploratory Works, and required in order to plan for exploratory works, are outside the scope of the referred action and they are therefore excluded from the action and the Preliminary Documentation. These activities are located within previously disturbed, cleared areas.

With the exception of the Kingaham Creek bypass, the Exploratory Works infrastructure is largely temporary in nature and is not intended to remain in use for an extended duration unless required for property access and maintenance (e.g. some access tracks). Should the Borumba PHES Project Main Works not proceed, the areas impacted by the Project will be remediated where appropriate (e.g. revegetation of cleared areas, plugging of boreholes).

Project design process

The Project design process considered several factors including operational efficiencies, costs, risks (e.g. flooding), the environmental management hierarchy (e.g. targeting cleared areas and setback distances from watercourses), cultural heritage values and future land uses based on the proposed Main Works design.

Where possible, the selection of areas with existing disturbance (e.g. cleared paddocks used for cattle grazing, existing roads and tracks), was prioritised for the Exploratory Works to avoid sensitive environmental values. However, due to the nature of the Borumba PHES Project design and the objectives of the Project (i.e. to assess the suitability of the proposed locations for Borumba PHES Project key infrastructure), it was not possible to locate all works in disturbed areas. All Project infrastructure (e.g. civil construction compound, spoil disposal area, explosive store, staging pad and portal pad) (other than waterway crossings) is located outside areas at risk of inundation by flooding as identified in the Queensland Floodplain Assessment Overlay.

The Project infrastructure is mostly co-located with the proposed Main Works footprint.

Matters of national environmental significance

Desktop and field surveys undertaken for the Project identified that the following matters of national environmental significance (MNES) are either known or likely to occur in the Exploratory Works Survey area:

- Two threatened ecological communities (TEC):
  - Lowland Rainforest of Subtropical Australia TEC, Critically endangered
  - Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions, Endangered
- Nine threatened flora:
  - ball nut (*Floydia praealta*), vulnerable
  - brush sophora (*Sophora fraseri*), vulnerable
  - *Coleus omissus* (syn. *Plectranthus omissus*), endangered
  - *Coleus torrenticola* (syn. *Plectranthus torrenticola*), endangered
  - macadamia nut (*Macadamia integrifolia*), vulnerable
  - native guava (*Rhodomyrtus psidioides*), critically endangered
  - scrub turpentine (*Rhodamnia rubescens*), critically endangered
  - small-fruited Queensland nut (*Macadamia ternifolia*), vulnerable
  - three-leaved bosistoa (*Bosistoa transversa*), vulnerable
- Twelve threatened fauna:
  - Australian lungfish (*Neoceratodus forsteri*), vulnerable
  - black-breasted button-quail (*Turnix melanogaster*), vulnerable
  - giant barred frog (*Mixophyes iteratus*), vulnerable
  - glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*), vulnerable
  - greater glider (*Petauroides volans*), endangered
  - grey-headed flying-fox (*Pteropus poliocephalus*), vulnerable
  - koala (combined populations of Qld, NSW and the ACT) (*Phascolarctos cinereus*), endangered

- long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*), vulnerable
- Mary River cod (*Maccullochella mariensis*), endangered
- Mary River turtle (*Elusor macrurus*), endangered
- white-throated snapping turtle (*Elseya albagula*), critically endangered
- yellow-bellied glider (southern subsp.) (*Petaurus australis australis*), vulnerable.

Impact assessment

The Project has a total footprint of 90.3 ha. The unmitigated potential impacts associated with the Project include:

- Direct impacts such as vegetation clearing and topsoil removal causing habitat loss, and injury and mortality from vegetation clearing and collisions with vehicles.
- Indirect impacts such as:
  - habitat fragmentation
  - edge effects
  - habitat degradation from air, noise, vibration and light emissions
  - invasive pests, weeds and pathogens
  - contamination from hazardous materials
  - erosion and sedimentation
  - impacts to surface water quality
  - impacts to groundwater.
- Facilitated impacts to housing and roads.
- Cumulative impacts with other works being undertaken in the region to facilitate the Project (e.g. local road upgrades) and with other Projects proposed in the region.

Avoidance, mitigation and management

The Project has been designed to avoid and minimise, as far as possible, impacts on MNES. Key design considerations include:

- Co-locating Exploratory Works infrastructure and activities with each other and/or the proposed Main Works footprint to reduce the potential for additional disturbance.
- Reviewing environmental values for the works area and relocating Exploratory Works Project components to avoid sensitive values including habitat for critically endangered, endangered and vulnerable flora and fauna species and TECs.
- Restricting the Project footprint to what is anticipated to be required to undertake the works in a safe and efficient manner.
- Restricting the Project footprint to minimise the extent of disturbance to vegetation and habitat while also targeting cleared areas and utilising existing tracks, including minimising disturbance in sensitive areas such as steep slopes.
- Incorporating erosion and sediment controls including the installation of scour protection measures around culvert entrances and exits, on disturbed stream banks, and around waterfront land to minimise erosion.

Additional mitigation measures that further minimise and mitigate potential impacts on MNES are included in the Construction Environment Management Plan and Flora and Fauna Management Plan. These measures include:

- exclusion and buffer zones around TECs and threatened flora records
- fauna exclusion fencing including fencing to protect turtle nesting sites
- myrtle rust management
- tree hollow replacement strategy
- management of spoil and contamination
- water quality management.

A Decommissioning and Rehabilitation Strategy has also been developed for the Project. Where appropriate, temporarily disturbed areas will be rehabilitated if the Main Works do not proceed. However, some areas disturbed for the Project will not be rehabilitated and instead retained for use (e.g. upgrades to existing access tracks for property management).

Offsets

MNES found to be significantly impacted as a result of Exploratory Works Project are proposed to be offset under the EPBC Act Environmental Offsets Policy (DSEWPC 2012) (EPBC Act Offsets Policy). The significant impacts on MNES requiring offsets are:

- Lowland Rainforest of Subtropical Australia TEC
- brush sophora
- scrub turpentine
- black-breasted button-quail
- glossy black-cockatoo (south-eastern)
- greater glider (southern and central)
- koala (combined population of QLD, NSW and ACT)
- long-nosed potoroo (northern)
- yellow-bellied glider (southern subsp.).

Queensland Hydro propose that environmental offsets for the Project will primarily be delivered through land-based offsets that meet 100% of MNES offset requirements applying the Offsets Assessment Guide (DSEWPC, 2012). For one threatened flora species, the scrub turpentine, it is proposed 100% of the offset requirement will be delivered through compensatory measures due to significant threats posed by myrtle rust on the species' population. Further details and justification for the compensatory measures are provided in the Exploratory Works Offset Area Management Plan.

The proposed land-based offset areas will support the impacted MNES and associated habitat functions impacted by Exploratory Works. The proposed offsets will deliver habitat quality gains for each MNES, reduce threatening processes and improve connectivity and dispersal. This approach is consistent with the EPBC Offsets Policy.

Further details and justification for the proposed offsets are outlined in the Offset Area Management Plan, which is included in this Preliminary Documentation.

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Acknowledgement of Country

In the spirit of reconciliation, Queensland Hydro acknowledges the Traditional Custodians of Country throughout Queensland and, in particular the lands, skies and waters on which we operate. We celebrate the diversity of Aboriginal peoples and their ongoing cultures and connections to the lands, skies and waters of Queensland.

Queensland Hydro pays respect to Elders past and present honouring their continuing spiritual and cultural connections to Country.



Acronyms and abbreviations

Abbreviation	Description
°C	Degrees Celsius
µm	Micrometre
µS/cm	Microsiemens per centimetre
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ADR	Accepted development requirements for operational work that is constructing or raising waterway barrier works (Queensland Government)
AEP	Annual exceedance probability
AHD	Australian height datum
ALA	Atlas of Living Australia
ANZG	Australian and New Zealand Guidelines for fresh & marine water quality
ASS	Acid sulphate soils
ATV	All-terrain vehicles
AVH	Australian Virtual Herbarium
BAR	Bioacoustics recording
BIDZ	Blast-induced damaged zone
CEMP	Construction Environment Management Plan
cm	Centimetre
Cth	Commonwealth
db	Decibel
DBH	Diameter at breast height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCP	Dynamic Cone Penetrometer
DETSI	Queensland Department of Environment, Tourism, Science and Innovation
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts
DLGWV	Queensland Department of Local Government, Water, and Volunteers
DPI	Queensland Department of Primary Industries
DSDIP	Queensland Department of State Development, Infrastructure and Planning
EA	Environmental authority
EIS	Environmental Impact Statement
EPBC / EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ERA	Environmentally relevant activity
ERP	Estimated resident population
ESCP	Erosion and sediment control plan
EWA	Early works agreement
FFMP	Flora and fauna management plan
FSC	Fauna spotter catcher
FSL	Full supply level

Abbreviation	Description
FY	Financial year
GDE	Groundwater-dependent ecosystem
GIS	Geographic information system
GL	Gigalitre
GTRE	Ground-truthed regional ecosystem
ha	Hectares
HCSEC	Habitat critical to the survival of the ecological community
HCSS	Habitat critical to the survival of the species
HDD	Horizontal directional drilling
HQS	Habitat quality scores
HSU	Hydrostratigraphic unit
HVE	High value regrowth
Hz	Hertz
IECA	International Erosion Control Association
ILUA	Indigenous land use agreement
IRSAD	Index of relative socio-economic advantage and disadvantage
ISGC	Interim sediment guideline criteria
kg	Kilograms
kHz	Kilohertz
kL	Kilolitres
kL/day	Kilolitres per day
km	Kilometres
km^2	Square kilometres
KoRV	Koala retrovirus
kV	Kilovolt
L	Litre
L/s	Litres per second
LGA	Local government area
LOO	Likelihood of occurrence
m^2	Square metres
m^3	Cubic metres
m^3/s	Cubic metres per second
mAHD	Metres Australian height datum
mBGL	Metres below ground level
MCU	Material change of use
mg	Milligrams
mg/L	Milligrams per litre
MHQA	Modified habitat quality assessment
ML	Megalitres

Abbreviation	Description
mm	Millimetre
mm/sec	Millimetres per second
MNES	Matters of national environmental significance
MSES	Matters of state environmental significance
MW	Megawatt
MWh	Megawatt hour
NAG	Net acid generation
NAPP	Net acid production potential
NC Act	*Nature Conservation Act 1992* (Qld)
NHMRC	National Health and Medical Research Council
NPV	Net present value
NSW	New South Wales
NTU	Nephelometric turbidity unit
OAMP	Offset Area Management Plan
PASS	Potential acid sulphate soils
PECSP	Preliminary erosion sediment control plan
PHES	Pumped hydro energy storage
PMST	Protected matters search tool
Ppv	Peak particle velocity
QEOP	Queensland Environmental Offsets Policy
QGSO	Queensland Government Statisticians Office
Qld	Queensland
RE	Regional ecosystem
RFI	Request for information
RO plant	Reverse osmosis
SA	Statistical area
SAL	Suburbs and localities
SAMP	Social Assessment and Management Plan
SAT	Koala spot assessment technique points
SEIFA	Socio-economic indexes for areas
SEQ	South East Queensland
SMP	Species management program (under the NC Act)
sp.	Species
spp.	Species (plural meaning more than one species)
SPRAT	Species Profile and Threats Database
Subtropical Eucalypt Floodplain TEC	Subtropical Eucalypt Floodplain Forest of the New South Wales North Coast and South East Queensland
Syn	Synonym
TDS	Total dissolved solids

Abbreviation	Description
TEC	Threatened ecological community
TPZ	Tree protection zone
TSSC	Threatened Species Scientific Committee
VM Act	*Vegetation Management Act 1999* (Qld)
WoNS	Weeds of national significance
WQO	Water quality objective

Glossary

Term	Definition
24/7	24 hours a day, seven days a week
1% Annual Exceedance Probability (AEP)	1% AEP flood means you have a 1-in-100 chance that a flood of that size (or larger) could occur in any one year
Access road	Existing local road that provides access to the Exploratory Works Project (e.g. Bella Creek Road, Yielo Road).
Access track	Tracks required to facilitate access to geotechnical investigations, including standard tracks (up to 6 m wide) and sled/rail access tracks or similar (up to 5 m wide).
Biosecurity Act 2014 (Qld) (Biosecurity Act)	The Biosecurity Act lists declared plants and animals that have, or could have, serious economic, environmental or social impacts and are targeted for control. There are legal obligations associated with the control supply, sale, keeping and transport of declared species. Where these exotic pests and weeds are encountered, landholders have an obligation under the *Biosecurity Act* to control the declared weeds and pest animals, in accordance with relevant guidelines and local government area pest management plans. There are seven categories for restricted matter defined in the Biosecurity Act: • Categories 1 and 2 are restricted matters that have specific urgent reporting requirements. • Categories 3, 4, 5, 6 and 7 relate to restricted matter that is in a person's possession, under their control and is also about not feeding restricted matter. Several restriction categories apply to some restricted matter. In such cases, you would need to follow the requirements of all restriction categories for these restricted matter listings.
Borumba PHES Project	2,000 MW, 48,000 MWh hydroelectric scheme linked to the existing Borumba Dam (Lake Borumba). Includes the geotechnical investigations (Exploratory Works) and construction and operation of the PHES (Main Works).
Borumba PHES Survey area	This is the area surveyed by ecologists to gather ecological data for the Main Works and Exploratory Works Projects. It includes the Exploratory Works Survey area.
Buffer zone	Areas where clearing is preferably avoided or, if unavoidable, to be minimised.
Civil construction compound	Laydown area.
EPBC referral	The original documentation lodged with DCCEEW in February 2023 for controlled action determination under the EPBC Act

Term	Definition
EPBC Act conservation status	Under the EPBC Act, listed species and threatened ecological communities are assigned a conservation status of Extinct in the wild, Critically Endangered, Endangered or Vulnerable. Definitions of these terms under the Act are as follows: **Extinct in the wild** It is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range or, It has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a timeframe appropriate to its lifecycle and form. **Critically Endangered** It is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria. **Endangered** It is not Critically Endangered, and It is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria. **Vulnerable** It is not Critically Endangered or Endangered, and It is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria. **Migratory** Migratory species are those animals that migrate to Australia and its external territories or pass through or over Australian waters during their annual migrations. Examples of migratory species are species of birds (e.g. albatrosses and petrels), mammals (e.g. whales) or reptiles. Listed migratory species are those listed in the: • Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) • China-Australia Migratory Bird Agreement (CAMBA) • Japan-Australia Migratory Bird Agreement (JAMBA) • Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).
Exclusion zone	Area where Project works are not permitted to occur.
Existing Borumba dam wall	Borumba dam wall constructed in 1963 and upgraded in 1997 and 2009.
Exploratory tunnels	Underground tunnels required to assess the suitability of the geology for the proposed PHES powerhouse cavern for the Main Works.
Exploratory Works Project / the Project	Geological investigations, and supporting infrastructure and activities, needed to inform the development of the Borumba PHES Project.
Exploratory Works Survey area	See Survey area.
Explosive store	Licensed secure area for explosive material to be used in exploratory tunnelling. Also known as a magazine.
Geotechnical investigations	Geotechnical boreholes, test pits and seismic lines.
High Value Regrowth	Regulated regrowth vegetation includes vegetation that falls into one of the following categories (DNRME 2018): • Vegetation identified on a regulated vegetation map as High Value Regrowth vegetation (Category C; light blue) • Vegetation located within 50 m of watercourses in priority reef catchment areas (Category R; yellow) • Vegetation that is a least concern, of concern or endangered RE • High Value Regrowth vegetation is mature native vegetation that has not been cleared in the last 15 years.

Term	Definition
Kingaham Creek bypass	Realignment of a section of Bella Creek Road to avoid two crossings of Kingaham Creek.
Lake Borumba	Existing reservoir with an approximate storage capacity of 46 GL and an inundation area of approximately 482 ha at FSL (135.01 mAHD).
Main Works Project	The PHES Project, including the power infrastructure (powerhouse, water and access tunnels), an upper reservoir, and a lower reservoir (Lake Borumba)
Matters of national environmental significance (MNES)	The nine matters of national environmental significance protected under the EPBC Act are: • World Heritage properties • National heritage places • Wetlands of international importance (listed under the Ramsar Convention) • Listed threatened species and ecological communities • Migratory species protected under international agreements • Commonwealth marine areas • The Great Barrier Reef Marine Park • Nuclear actions (including uranium mines) • A water resource, in relation to coal seam gas development and large coal mining development.
Matters of state environmental significance (MSES)	Matters of state environmental significance includes environmental values protected under various State legislative Acts. These are identified as prescribed environmental matters and are defined under the State Planning Policy (SPP) and Schedule 2 of the QLD Environmental Offsets Regulation 2014.
Non-remnant vegetation	Vegetation that is not mapped as remnant vegetation by the Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development or DETSI and/or which fails to meet DETSI's criteria for remnant vegetation (see definition of remnant vegetation, below). This includes regrowth, heavily thinned or logged vegetation and significantly disturbed vegetation that fails to meet the structural and/or floristic characteristics of remnant vegetation. It also includes urban and cropping land. Non-remnant vegetation may retain significant biodiversity values.
Portal pad	Work pad at the entrance of the exploratory tunnel portal.
Project area	The boundary within which Project components can be micro-sited.
Project footprint	The area associated with construction of Project components (disturbance footprint). Underground Project components do not have a Project footprint.
Regional ecosystem (RE)	A vegetation community, within a bioregion, that is consistently associated with a particular combination of geology, landform and soil (Young et al. 1999).
Regrowth vegetation	As defined under the VM Act, regrowth is any vegetation that is not 70% of height of an equivalent community of undisturbed vegetation or 50% of what would be undisturbed foliage cover and a mix of species represented in undisturbed communities
Remnant vegetation	Remnant woody vegetation is defined as vegetation where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy (Neldner et al. 2019)
Restricted area	Areas, including but not limited to exclusion and buffer zones, established during the Exploratory Works where Project activities are prohibited or limited.
Spoil disposal areas	Dedicated areas for disposal of spoil material from construction activities.

Term	Definition
Staging pad	Work pad located near the portal pad containing infrastructure, equipment and material to support exploratory tunnelling.
Study area	This broad term is intended to capture the area of influence within which the Project is located. The Study area does not have a defined boundary, or distance from the Project area, as the area of influence is different for the various environmental factors, such as waterway catchments or fauna dispersal.
Survey area (also Exploratory Works Survey area)	This is the area surveyed by ecologists to gather ecological data. The Survey area typically extends 100 m either side of the Project area to capture environmental values both within, adjacent to or surrounding the Project area. The environmental values identified within the Survey area are reported in this report to provide context of the environment surrounding the Project area.
Temporary water infrastructure	Water pumps, pipelines and storage tanks collecting water from Lake Borumba for distribution to geotechnical boreholes and exploratory tunnels.
Weeds of National Environmental Significance (WoNS)	Thirty-two (32) species of weeds are declared to be weeds of national significance, based on their invasiveness, potential for spread and environmental, social and economic impacts. The State Government is responsible for the legislation and administration of WoNS in Queensland and landholders are responsible for managing WoNS. The Australian Weeds Strategy provides a framework for establishing consistency between all stakeholders and identifies priorities for national weed management with the aim of minimizing the environmental, social and economic impacts of weeds. A National Management Group has been established for each of the WoNS to manage the implementation of the respective National Strategic Plans.

1. Overview

1.1 Background

Queensland Hydro is the proponent of the Borumba Pumped Hydro Energy Storage (PHES) Project (the Borumba PHES Project). The Borumba PHES Project is a 2,000 megawatt (MW), 48,000-megawatt hour (MWh), hydroelectric scheme to store, generate and supply energy through a pumped hydroelectric structure linked to the existing Borumba Dam (Lake Borumba). It is located approximately 13 kilometres (km) southwest of the township of Imbil, 48 km southwest of Gympie, and 180 km northwest of Brisbane, within the Yabba Creek sub catchment of the Mary River Basin.

The Borumba PHES Project proposes to use the increased capacity of Lake Borumba and a new upper reservoir as a way of storing energy. In a decarbonised energy market, excess wind and solar renewable energy drawn from the grid will be used during low demand periods to pump water from Lake Borumba to the upper reservoir, essentially converting the upper reservoir into a giant battery.

The stored energy will then be released by returning the water to Lake Borumba through a turbine, producing electricity (Figure 1). Electricity can be generated almost immediately and at any time, making it possible for the power to be fed into the grid when it is needed, to balance the variability of renewable energy generation with the patterns of energy demand of Queensland homes and businesses. The Borumba PHES Project can also produce large amounts of electricity over a long duration providing reliable, dispatchable energy at times when wind and solar energy is not available (Figure 2).

In September 2022, the Borumba PHES Project was announced as a priority project to support Queensland achieving the state's renewable energy target. In June 2023, the then state government provided $6 billion in equity investment towards the Borumba PHES Project as a long-term investment in Queensland's electricity infrastructure. The Borumba PHES Project ultimately supports the decarbonisation of Queensland's, and Australia's, energy system to ensure the health, diversity and productivity of the environment are maintained or enhanced for future generations.

The Borumba PHES Project includes two Project phases:

- Exploratory Works – the geological investigations at key locations, the supporting infrastructure and activities required to inform the development of the Borumba PHES Project.
- Main Works – the PHES Project, including the power infrastructure (powerhouse, water and access tunnels), an upper reservoir, and a lower reservoir (Lake Borumba).

Figure 3 illustrates the relationship between these Project phases and identifies the components of the Exploratory Works.

The purpose of the Exploratory Works is to undertake and facilitate critical technical investigations to confirm the suitability of the Borumba PHES Project location and design. Investigation is particularly required in areas where key subsurface infrastructure will be constructed due to limited technical geological information currently available posing considerable project risk. Much of the Exploratory Works would be located, unavoidably, in vegetated areas that provide habitat for listed threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

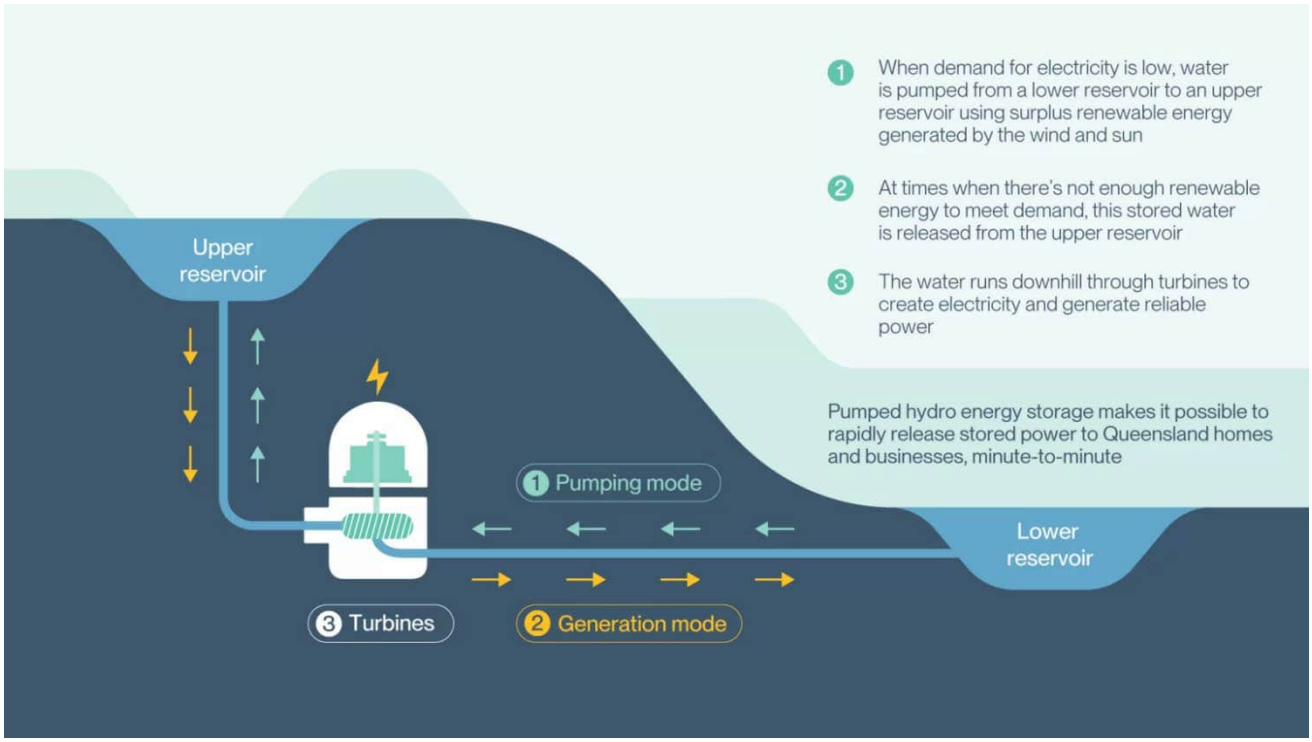
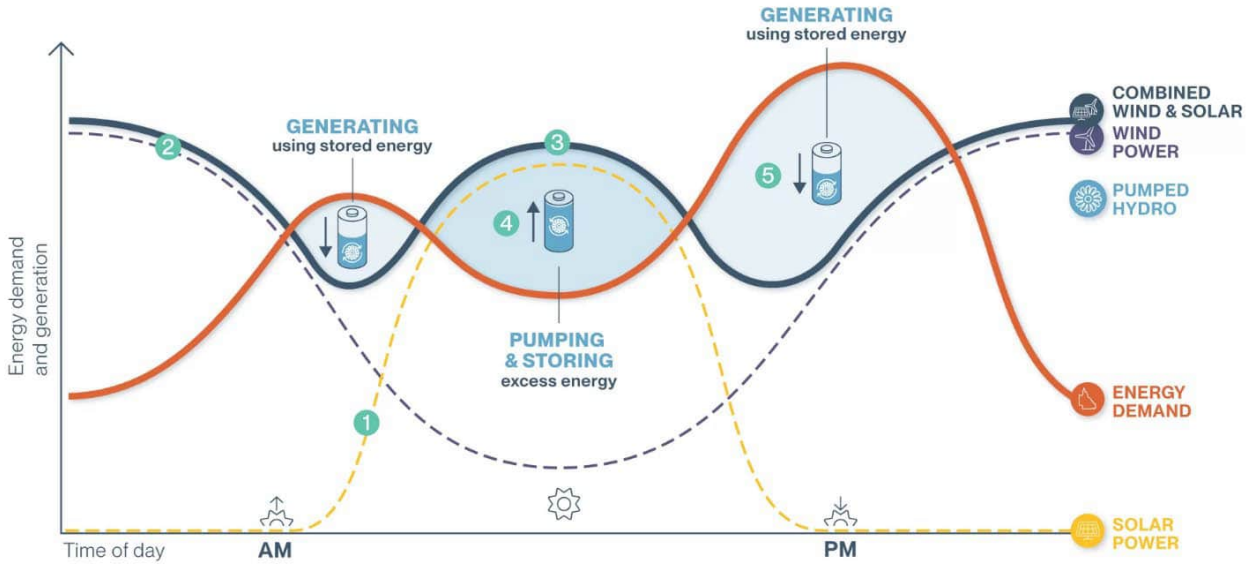


Figure 1: How pumped hydro energy storage works



1 As the sun rises, solar energy generation steadily increases, typically reaching its peak in the middle of the day before tapering off at sunset.

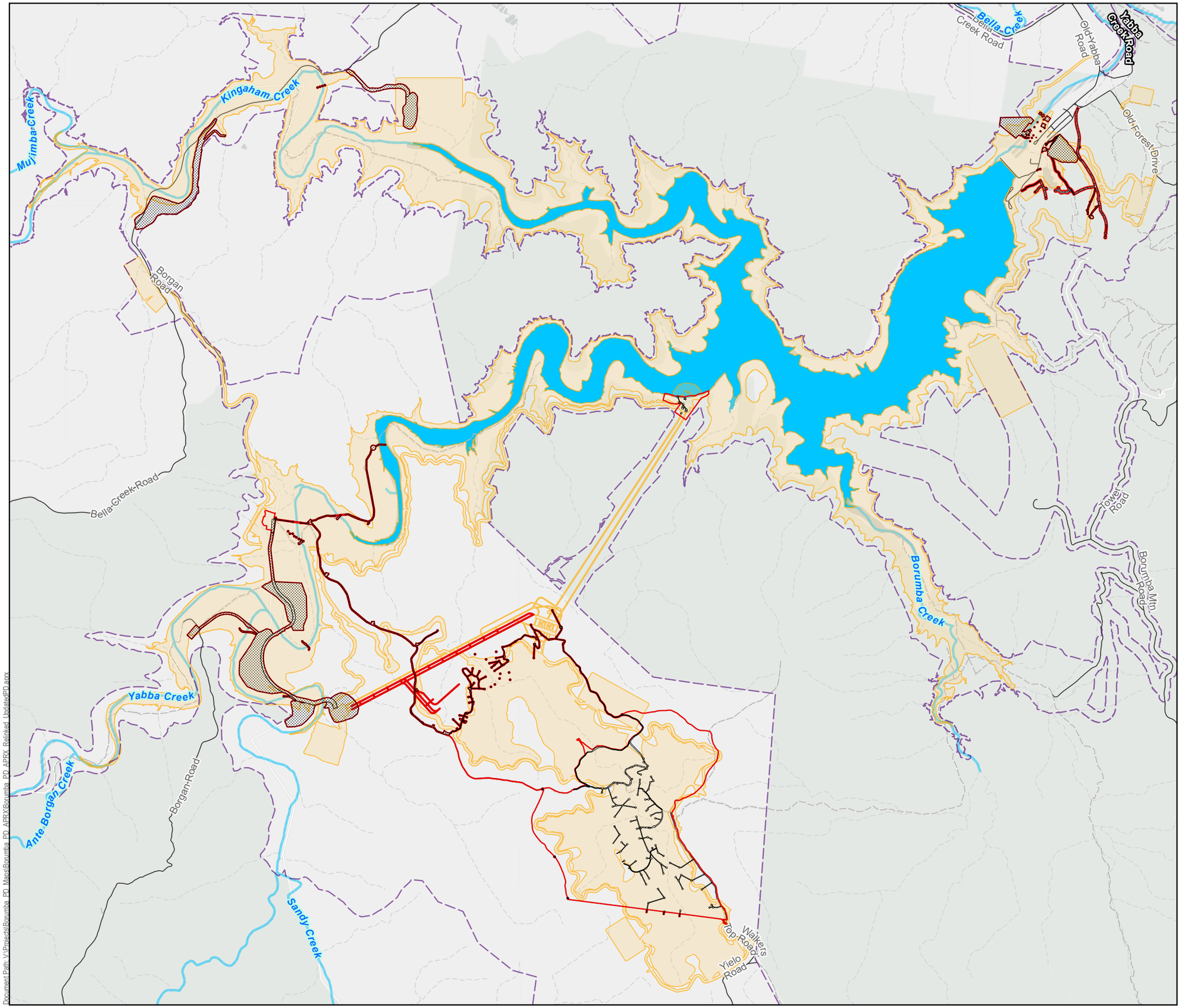
2 On average, it's windier in the mornings and afternoons with a lull in wind activity during the middle of the day. Wind energy is used during these early morning and later afternoon periods.

3 When the sun is shining and the wind is blowing, wind and solar energy combine to deliver a relatively stable source of energy throughout the day.

4 Surplus energy stemming from wind and solar sources during the day is harnessed to pump water from a lower reservoir to store in a higher reservoir.

5 When demand for energy is high, the stored water is released from the upper reservoir back to the lower reservoir to power generators that ensure a rapidly available energy supply for Queenslanders, on-demand.

Figure 2: Energy demand and generation



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Queensland Hydro

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

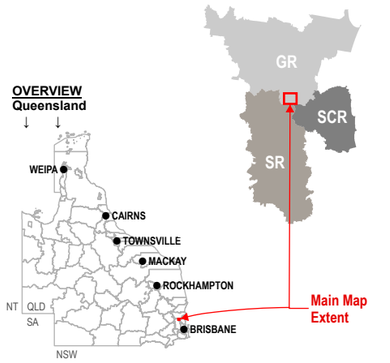
Exploratory Works Project

- Project Area
- Project Footprint

Main Works Project

- Main Works Project Area
- Main Works Project Footprint

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
5. Basemap World Light Gray Canvas Base @ Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

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Exploratory Works Project
Preliminary Documentation

BORUMBA PHES PROJECT
EXPLORATORY WORKS AND MAIN WORKS

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 3

1.2 Related actions – RFI item 2.4

The Borumba PHES Project phases are being assessed separately under the EPBC Act:

- EPBC 2023/09461 – the Exploratory Works that are the subject of this Preliminary Documentation (referred to in this Preliminary Documentation as 'Exploratory Works' or 'the Project').
- EPBC 2023/09646 – the Borumba PHES Project Main Works (also referred to as 'Main Works' or the 'Main Works Project').

Some preliminary activities have been excluded from the controlled action and they will not affect matters of national environmental significance (MNES). This includes activities required to plan Exploratory Works, such as geotechnical activities in already developed or cleared lands. Self-assessments under the EPBC Act have been undertaken for these preliminary activities.

The Main Works Project was referred to the Commonwealth Minister for the Environment and Water in September 2023 and determined to be a controlled action on the 19 December 2023. The Main Works Project is being assessed by accredited assessment under the *State Development and Public Works Organisation Act 1971* (Qld).

Figure 4 illustrates the relationship between the Borumba PHES Project phases in the context of the EPBC assessment.

1.3 EPBC referral and assessment

The Project was referred under the EPBC Act on 2 February 2023. Following consideration of the referral and supporting documentation, a delegate for the Commonwealth Minister for the Environment and Water determined the Project to be a controlled action (EPBC 2023/09461) to be assessed by Preliminary Documentation on 30 March 2023.

The proposed activities for the Project have been identified to impact MNES, with listed threatened species and communities (sections 18 and 18A of the EPBC Act) the relevant controlling provisions for the action.

To facilitate the assessment by Preliminary Documentation, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) issued a Request for Additional Information Required for Assessment by Preliminary Documentation on 21 April 2023.

Formal variations to the controlled action were approved by the Minister's delegate on:

- 16 October 2023 for the inclusion of the Bella Creek Road realignment (Kingaham Creek bypass)
- 26 September 2025 for amendments to the EPBC Referral area, locations of some Exploratory Works components, Kingaham Creek bypass design, and temporary waterway crossing design.

The purpose of this Preliminary Documentation (which includes this report, its appendices, the original referral, and an Offset Area Management Plan) is to provide sufficient information for the Minister to make a decision on the Project, including addressing information requested by DCCEEW.

The Preliminary Documentation has been revised to incorporate changes associated with the 26 September 2025 variation and comments received during the public notification period, where relevant. New and amended footprint components were surveyed to confirm there were no additional MNES listed species present.

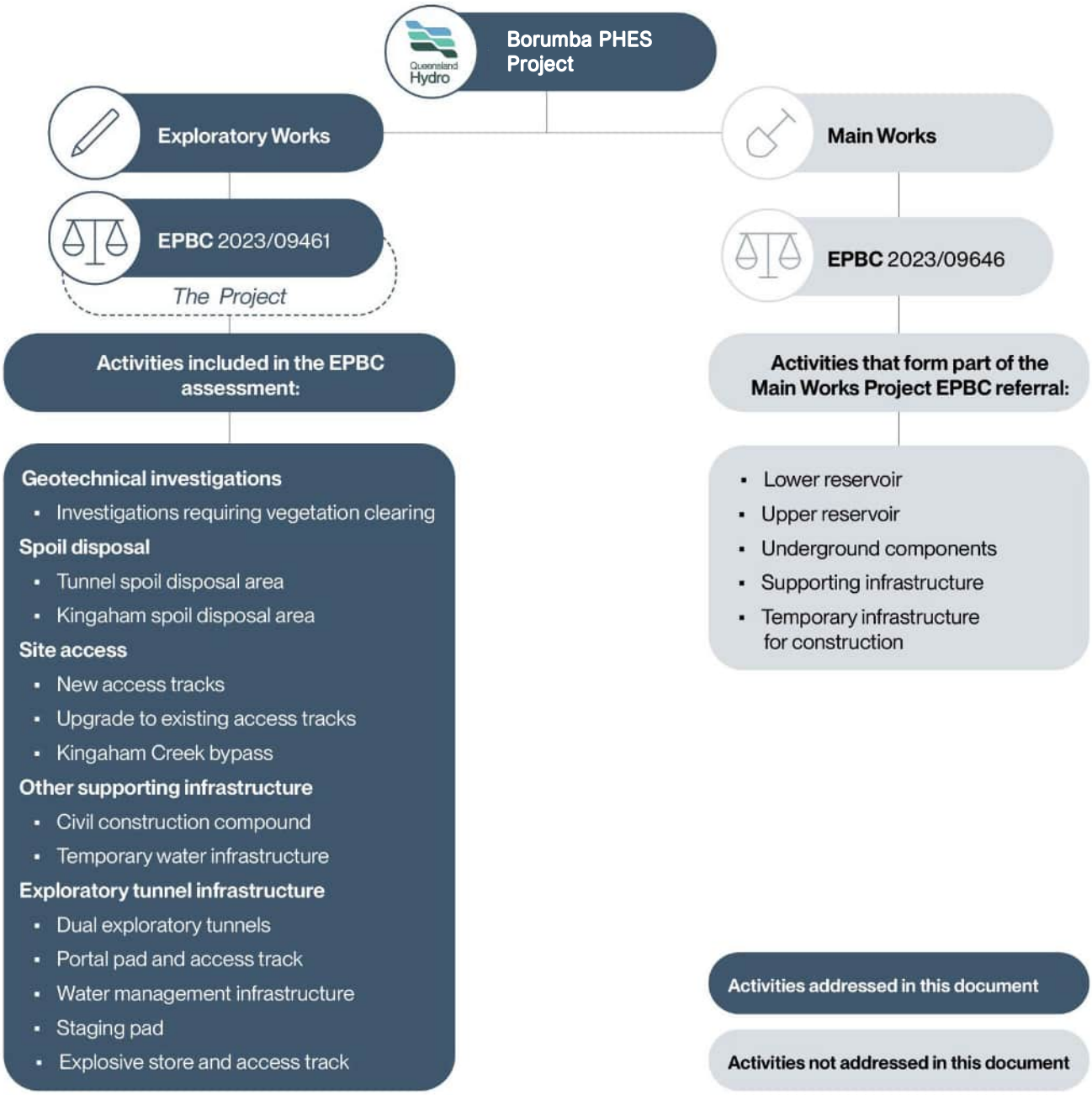


Figure 4: Borumba PHES Project definition

1.4 Changes since referral

1.4.1 Material changes and Project refinements since EPBC referral – RFI Item 2.1(d)

1.4.1.1 Works included in the action

The EPBC referral provided two design options, with respective total disturbance areas for the Project of 81.96 ha for the Orange option and 83.89 ha for the Green option. Since the referral the Project has been reviewed and optimised in response to engineering inputs, along with inputs from cultural and environmental investigations. This has resulted in an increase of approximately 6.6 ha, with the current Project footprint having a total area of 90.3 ha.

All optimisations and refinements of the Project have been undertaken with regard to the environmental management hierarchy, with an objective to avoid additional impacts where possible.

Figure 5 shows the indicative design from EPBC referral and the current Project design compared to the EPBC referral (Green) design option. Refinements of the Project design were driven by:

- The selection of a preferred tunnel alignment option (the Green option) after the referral and a preference for locating infrastructure in previously cleared areas to minimise disturbance to MNES and improve operational efficiencies, logistics and safety.
- The refinement of the Main Works design, including consideration of alternate cavern locations in more accessible areas due to limited geological information for the site.
- A focused effort to avoid and reduce potential impacts to MNES wherever possible that led to changes to proposed geotechnical investigation methods and supporting infrastructure requirements and design.

Changes and refinements to the Project design in response to the above included the following:

- **Relocation and revision of the supporting infrastructure** (e.g. portal pad, staging pad, explosive store) for the exploratory tunnelling to historically cleared areas, which avoided clearing of MNES habitat at the locations identified in the EPBC referral (refer to Section 6.1.2 for more information). The location of the explosive store was also revised to comply with legislative requirements for the safe storage of explosives. Design revisions for these supporting infrastructure components included an increase to their proposed footprint to accommodate Project activities, but these increases were primarily in previously disturbed areas. These areas are also designed in a manner that avoids or minimise redesign for the Main Works (if approved) and thus additional clearing or disturbance.
- **Inclusion of an option for an alternate exploratory tunnel alignment** associated with an alternate cavern location proposed for the Main Works. The Green option alignment has been retained as the preferred option, and the alternate tunnel option diverges from the preferred option at approximately 600 m along the alignment. Potential impacts associated with the alternate option would be less than those for the preferred option, as it is approximately 1.2 km in length instead of 2 km (refer to Section 2.7 for more information). This may include less potential for groundwater drawdown and a reduction in spoil volumes for the Exploratory Works.
- **Revision of geotechnical investigations** to include locations relevant to the Main Works design optimisation (e.g. alternate cavern and potential quarry locations), maximise the information obtained from each location (e.g. drilling of multiple boreholes from one staging area), co-locate investigation sites and staging areas with access tracks, and utilise investigation methods that reduce disturbance (e.g. sled tracks or similar). These changes result in an overall reduction in the footprint associated with geotechnical investigations and the access tracks required to support them (Table 1). Sections 6.1.3 and 6.1.4 provide further information on avoiding of impacts to MNES through refinement of geotechnical investigations and access tracks, while Section 2.3.1 provides a description of the revised geotechnical methods and supporting infrastructure requirements.
- **Realignment of a section of Bella Creek Road** (referred to as Kingaham Creek bypass) to avoid construction of two Kingaham Creek crossings and improve flood immunity of this section of road. The bypass avoids instream works that could impact water quality and habitat in a creek known to support MNES and reduces riparian vegetation clearing which has the potential to impact connectivity. The change however results in additional clearing of vegetation in a previously cleared (in the last 30 years) and disturbed area used for cattle grazing. The inclusion of the bypass was the subject of a formal variation to the action that was accepted by the Minister's delegate on 16 October 2023. The bypass was also included in the formal variation to the action that was accepted on 26 September 2025, due to changes made to the design to improve management of surface water runoff.

- **Refinement of the tunnel spoil disposal area design and the addition of a new disposal area to support the Kingaham Creek bypass construction.** The tunnel spoil disposal area was relocated with other exploratory tunnel supporting infrastructure when the preferred tunnel alignment was selected, and the design amended to ensure sufficient space for water management. However, the refined design maintains a 50 m set back from Yabba and Sandy creeks, is in previously disturbed area for cattle grazing, and has similar clearing requirements as the referral design. The spoil area is also co-located within the inundation area for the Main Works to reduce the risk of unnecessary clearing. The design includes an additional spoil disposal area to ensure sufficient space to stockpile excess materials and to minimise potential social and environmental impacts associated with transporting materials from the Kingaham Creek bypass construction. It is located in a previously disturbed area used for cattle grazing, more than 100 m from Kingaham Creek, that was selected to avoid additional impacts to MNES. The site was also preferred as it is co-located with a proposed camp location for the Main Works reducing the risk of unnecessary clearing and potentially reducing the Main Works footprint and impacts. Further information on the spoil areas is provided in Section 2.4 and Section 6.1.2.2.
- **Addition of a civil construction compound** in the former tunnel spoil location. The need for an area to support civil construction works (e.g. access track works, establishment of the portal and staging pads) was identified, so a construction compound was designed in the original tunnel spoil location. This area has been used for cattle grazing and subject to historical clearing and so its inclusion results in only a small addition to clearing requirements despite increasing the Project footprint. The site was also preferred as it is co-located with a proposed inundation area for the Main Works reducing the risk of unnecessary clearing and potentially reducing the Main Works footprint and impacts.
- **Refinement of the temporary water infrastructure design** in response to the relocation of the supporting infrastructure and increased understanding of site conditions. The design of the temporary water infrastructure was updated to reflect the changes in the supporting infrastructure, with a water tank farm moved to the western side of Yabba Creek near Borgan Road, and the pipeline extended within the footprint of previously existing infrastructure (e.g. Walker's Top Road) or other proposed infrastructure (e.g. the portal access track). In addition, further assessment of the proposed water take site found that the water reliability at this location was likely to be insufficient for the Exploratory Works, so the site was moved downstream to a deeper section of the lake to improve reliability.
- **Removal of emergency helipads** from the Project design. The helipads' benefits were reviewed and it was determined these did not outweigh the potential environmental impacts to MNES habitat. Therefore, the helipads were removed from the Project.
- **Inclusion of two additional crossing upgrades and revision of water crossing designs** to include temporary culverts and concrete bed level crossings (in addition to the originally proposed gravel crossings) to reduce potential impacts to water quality.

The exploratory tunnel design was also refined from a single tunnel to dual tunnels (and inclusion of an additional short tunnel extension for the alternate alignment option) to improve safety and construction outcomes by:

- Improving egress – connecting the tunnels with cross passages will establish a secondary means of egress if one of the tunnels becomes inaccessible and will provide improved passing opportunities for vehicles during works.
- Improving ventilation – establishing one of the tunnels as a dedicated return airway will minimise exposure of personnel to contaminants and improve ventilation management options during construction as well as maximising fresh air at the work front.
- Improving constructability – smaller tunnels with typical dimensions will allow use of standard equipment and proven construction practices, as well as allowing safer implementation of controls for water management and ground support.
- Improving geotechnical stability – smaller tunnels are more geotechnically stable.

The refinement of the exploratory tunnel design did not result in an increase to potential impacts due to the dual tunnels having a smaller cross-section than the single tunnel, which means a similar volume of spoil will be generated and the portal face will be slightly smaller (64 m^2 in total for the dual tunnels compared to 70 m^2 for the single tunnel). More information on the exploratory tunnels is provided in Section 2.7.

The tunnel design refinement will also potentially reduce Main Works infrastructure construction (if approved). The Main Works will use the Exploratory Works tunnel as the basis for the main access tunnel and the electrical and ventilation tunnel, which will be co-located at this portal, reducing the extent of construction works in the area.

Table 1 summarises differences in the Project size since the EPBC referral (grouped by activity type), which comprises a 6.6 ha increase to the total Project footprint. The Project footprint reflects surface disturbance and does not include underground works as part of disturbance area calculations. Importantly, the increase in the Project footprint has largely occurred in previously disturbed areas used for cattle grazing, with a reduced footprint in more vegetated areas.

Table 1: Summary of differences in size of the indicative Project footprint

Component	Footprint area (ha) – EPBC referral (Green option)	Footprint area (ha) – Current	Difference since EPBC referral (ha)
Geotechnical investigations	22.1	13.5	-8.6
Spoil disposal	8.5	15.5	+7.0
Site access	42.4	25.9	-16.5
Other supporting infrastructure	1.0	15.5	+14.5
Exploratory tunnel infrastructure	9.9	19.9	+10.0
Total surface footprint for all works	**83.9**	**90.3**	**+6.6**

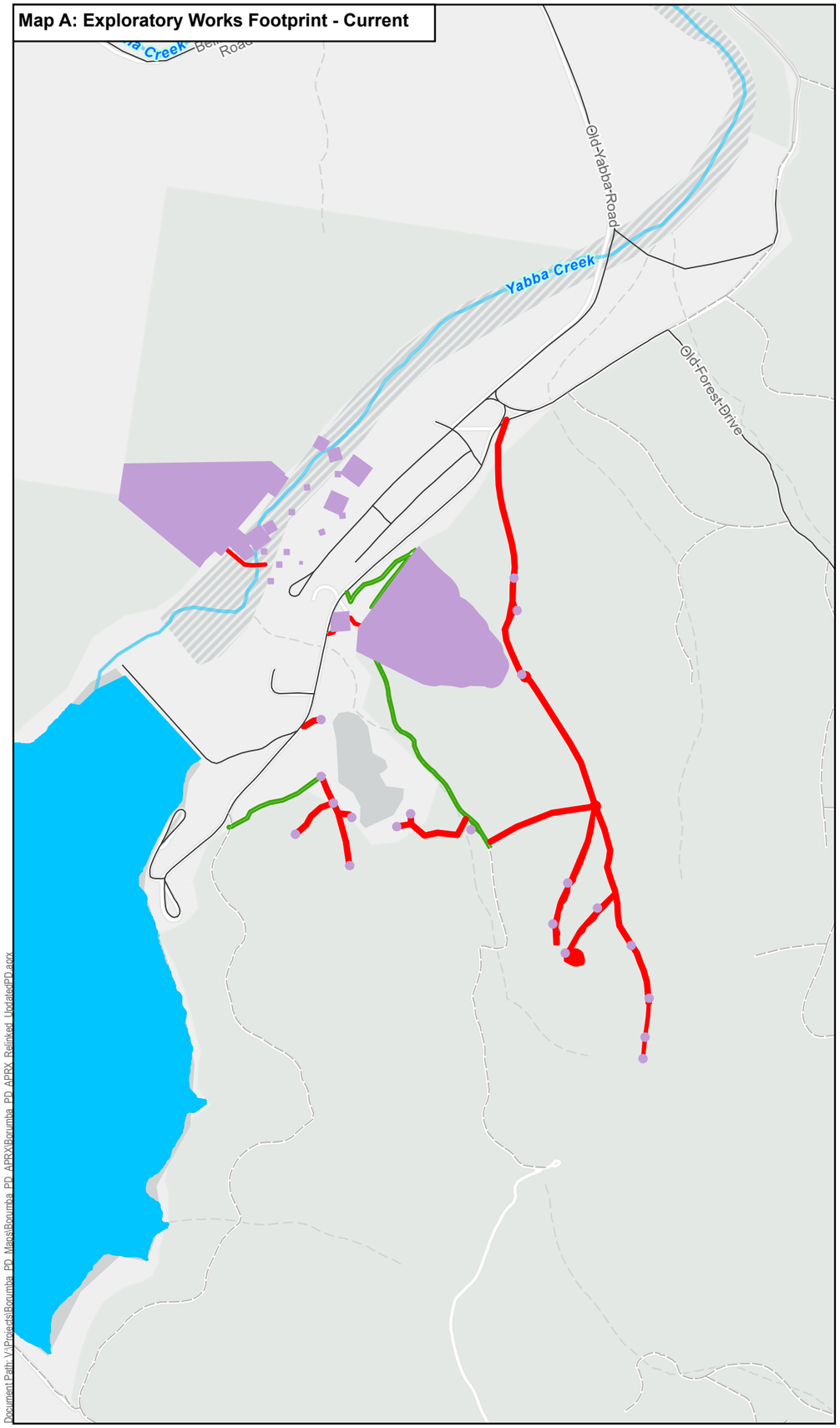
1.4.1.2 Works excluded from the action

As per the EPBC referral, several preliminary activities were excluded from the proposed action. These activities are identified in Figure 4 and Section 2.1 and were largely activities required to plan for Exploratory Works.

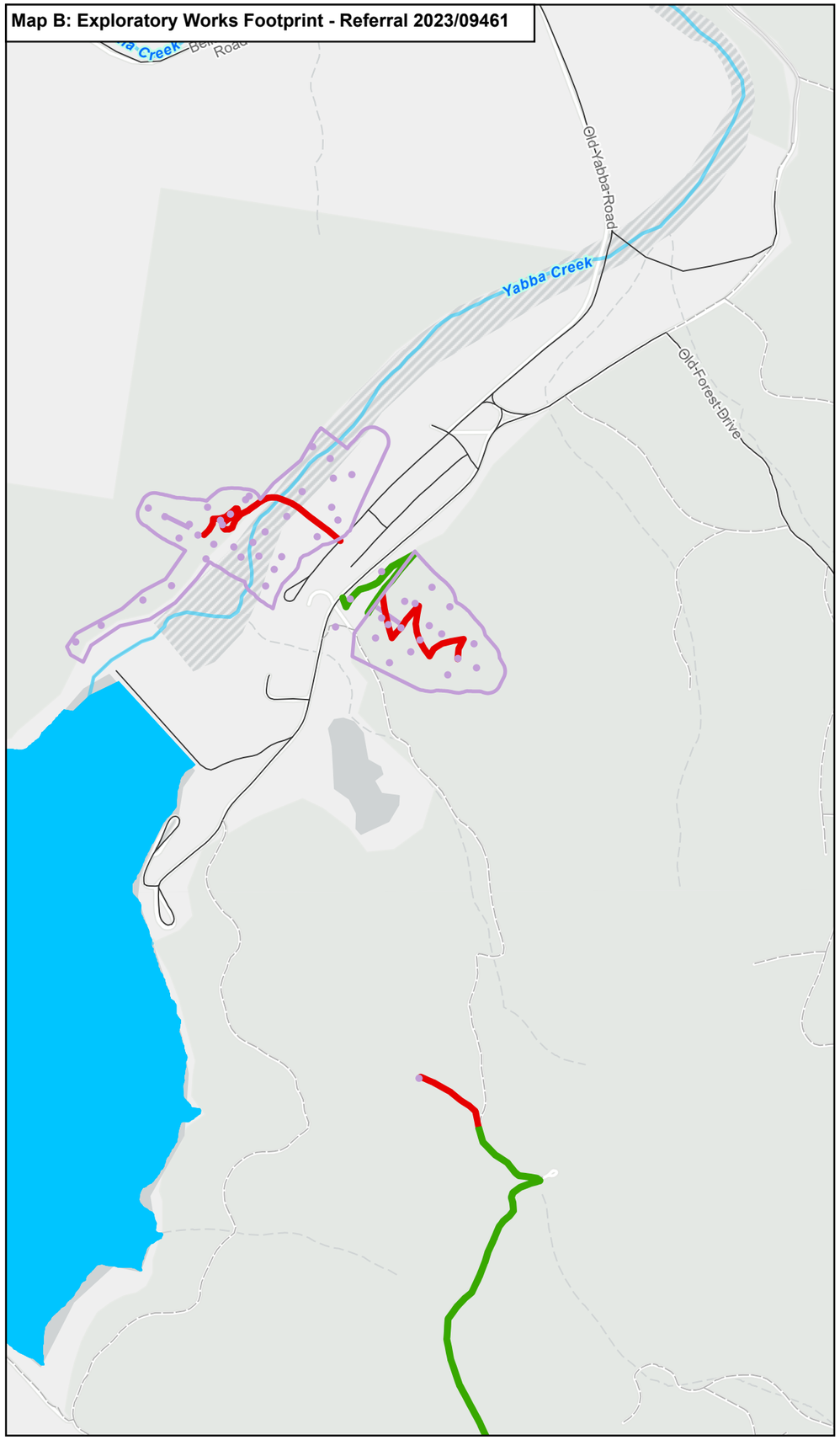
For completeness and clarity, it is noted that:

- The design and location of temporary workers accommodation camps (TWACs) and associated ancillary works (i.e. road upgrades – see point below, rapid deployment camps) have been revised to reduce potential impacts on the local community and roads, and in response to ground conditions. The revised TWACs have been self-assessed and are still located outside areas that would impact on MNES. The TWACs have not changed in substance and remain excluded from the action.
- The locations of some geotechnical investigation sites identified in the referral were adjusted and some additional sites identified to optimise the data collected and inform the Exploratory Works design. The revised geotechnical investigation sites were self-assessed and remained outside areas that would impact on MNES. These geotechnical investigation sites have not changed in substance and remain excluded from the action.
- Proposed upgrades to local government roads used to access the Project (i.e. Bella Creek Road, Borgan Road, Yielo Road and Sunday Creek Road) have been refined to enable suitable access for the construction of the TWACs. These refinements comprise additional surface improvements and widening in selected areas. The revised upgrades were self-assessed and remained outside areas that would impact on MNES. The works have not changed in substance and remain excluded from the action.
- Activities associated with undertaking environmental and cultural heritage impact assessments, securing the site, and ensuring the safety and wellbeing of personnel are excluded from the action.

Map A: Exploratory Works Footprint - Current



Map B: Exploratory Works Footprint - Referral 2023/09461



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Map A: Exploratory Works Footprint - Current

- Existing Tracks to be Upgraded
- Geotechnical Investigations
- New Tracks

Map B: Exploratory Works Footprint - Referral 2023/09461

- Geotechnical Investigations
- Existing Access Track Upgrades
- New Access Tracks
- Geotechnical Investigation Area Boundary

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
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Exploratory Works Project
Preliminary Documentation

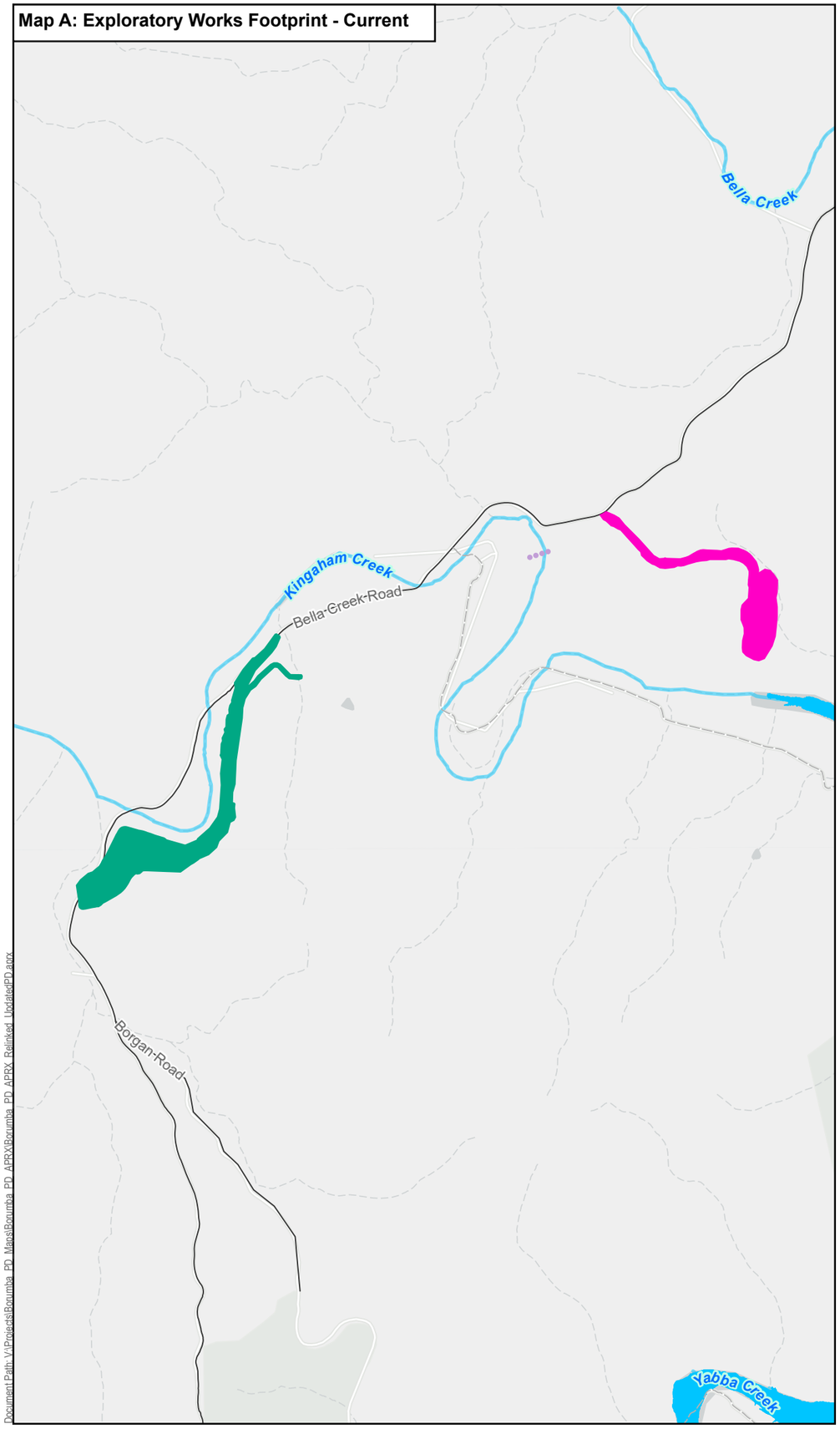
EXPLORATORY WORKS REFINEMENTS AND CHANGES SINCE THE REFERRAL AREA 1 - BORUMBA DAM

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 3/10/2025
REVISION:	A

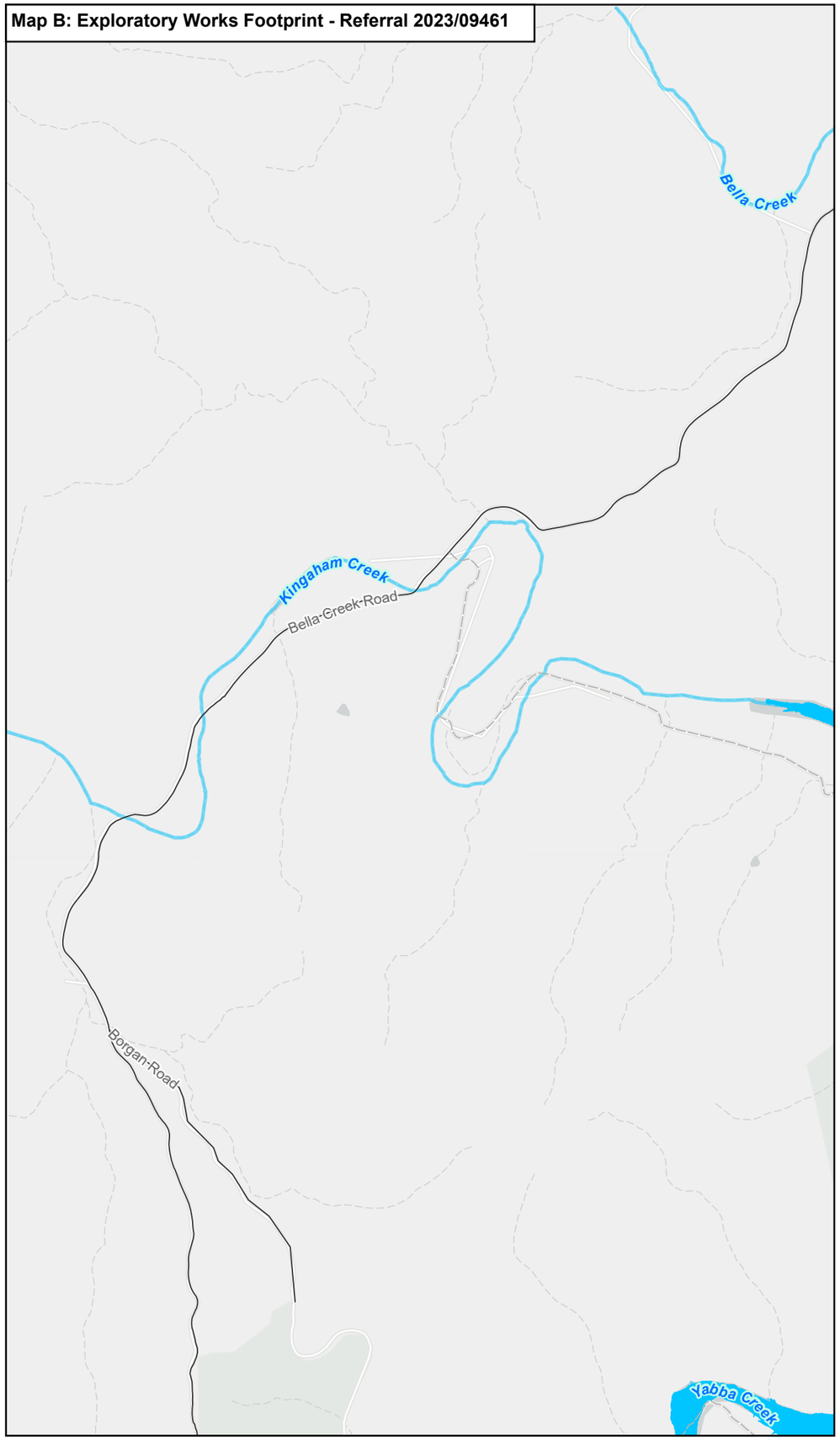
FIGURE 5a

Document Path: V:\Projects\Borumba_PD_Maps\Borumba_PD_APRX\Borumba_PD_APRX_Relinked_UpdatedPD.aprx

Map A: Exploratory Works Footprint - Current



Map B: Exploratory Works Footprint - Referral 2023/09461



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Map A: Exploratory Works Footprint - Current

- Geotechnical Investigations
- Kingaham Creek Bypass
- Kingaham Spoil Area and Access Track

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
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Exploratory Works Project
Preliminary Documentation

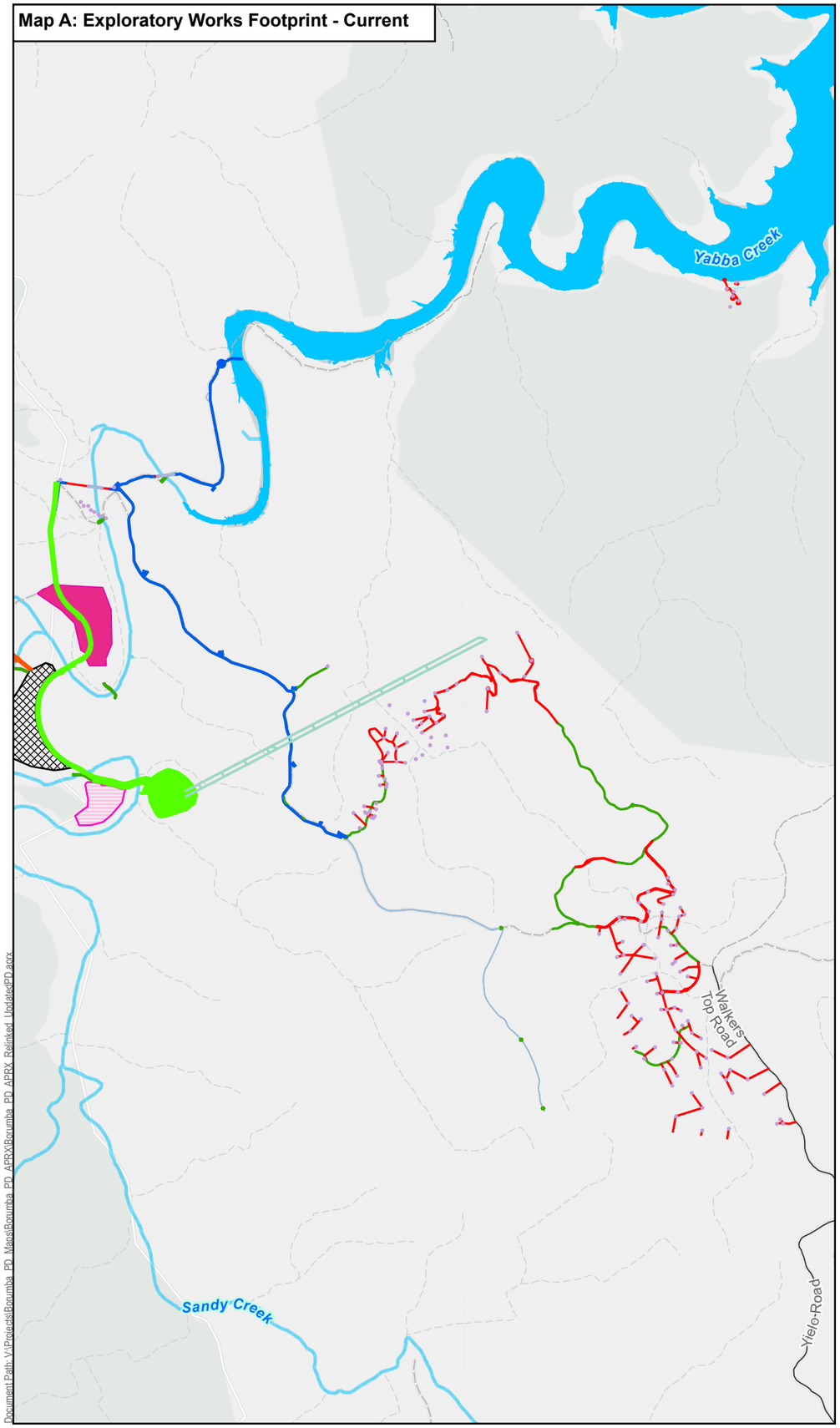
EXPLORATORY WORKS REFINEMENTS AND CHANGES SINCE THE REFERRAL AREA 2 - KINGAHAM CREEK

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 3/10/2025
REVISION:	A

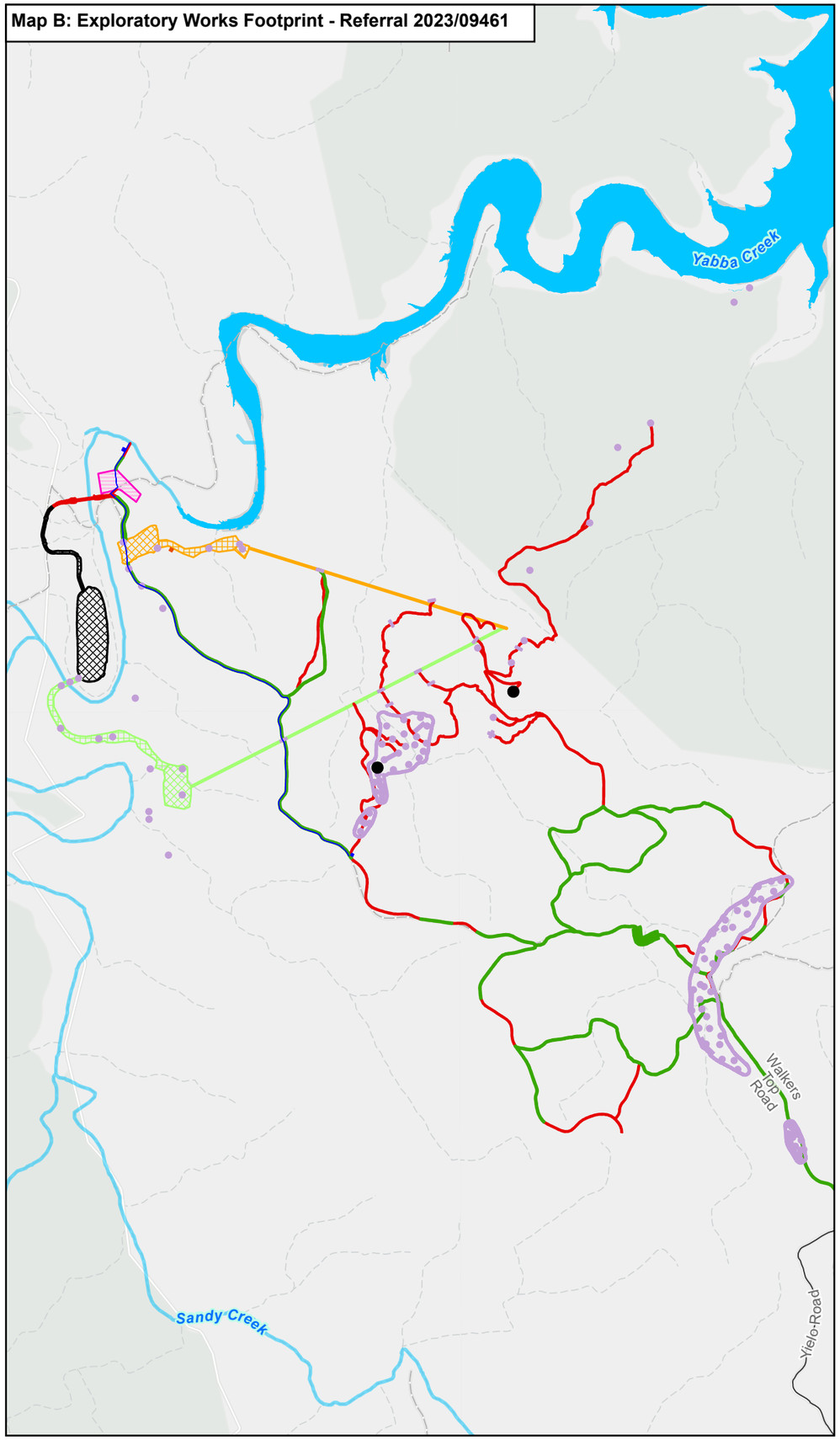
FIGURE 5b

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Map A: Exploratory Works Footprint - Current



Map B: Exploratory Works Footprint - Referral 2023/09461



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Map A: Exploratory Works Footprint - Current

- Construction Compound
- Existing Tracks to be Upgraded
- Explosive Store and Access Road
- Geotechnical Investigations
- New Tracks
- Portal Pad and Access Track
- Staging Pad
- Temporary Water Infrastructure
- Tunnel Spoil Disposal
- Exploratory Tunnel
- Underground Temporary Water Infrastructure

Map B: Exploratory Works Footprint - Referral 2023/09461

- Geotechnical Investigations
- Exploratory tunnel, portal pad and access road - Orange option
- Exploratory tunnel, portal pad and access road - Green option
- Existing Access Track Upgrades
- New Access Tracks
- Emergency helipads
- Temporary Water Infrastructure
- Geotechnical Investigation Area Boundary
- Explosive store
- Staging pad
- Spoil disposal area

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
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Exploratory Works Project
Preliminary Documentation

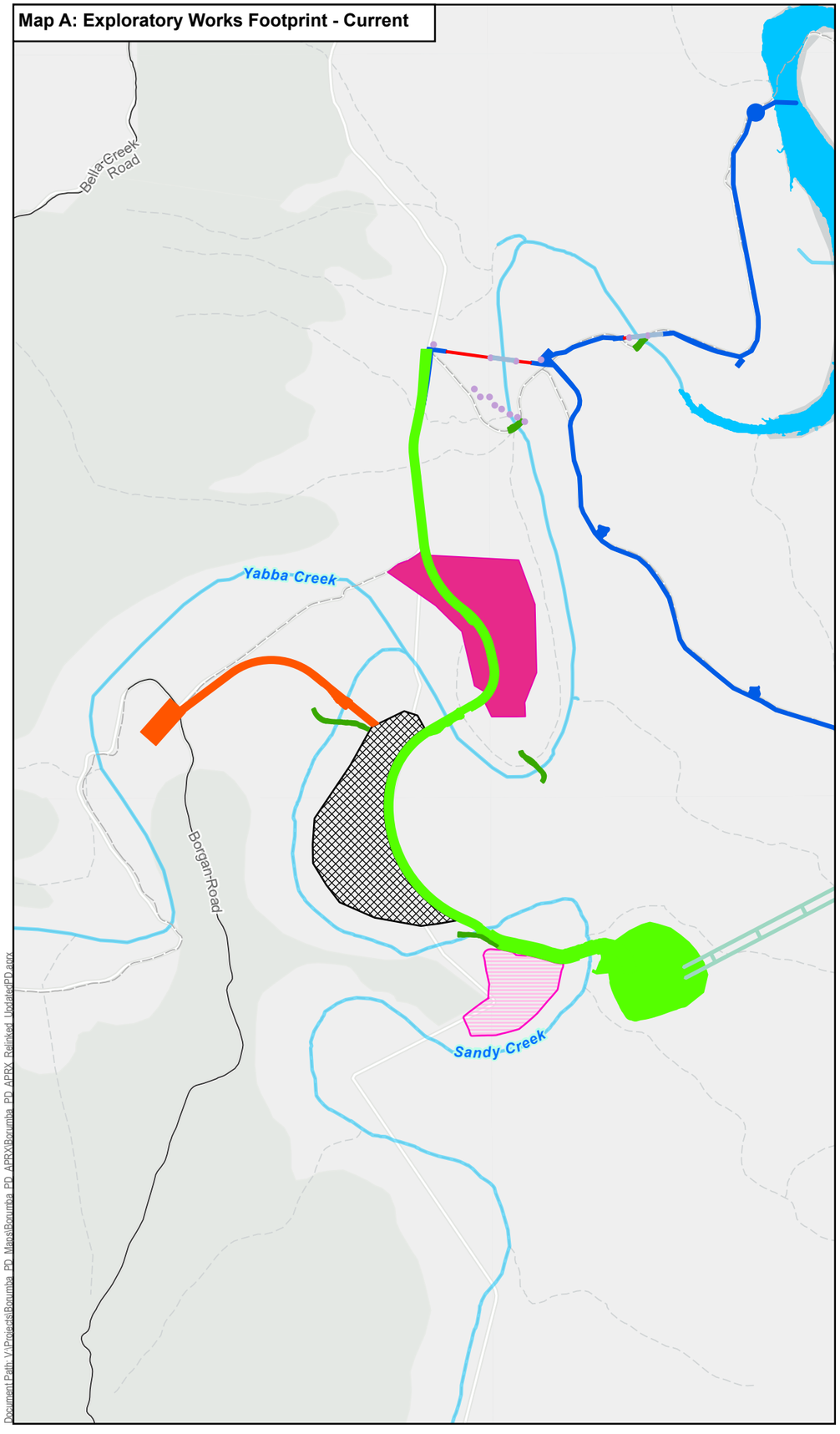
EXPLORATORY WORKS REFINEMENTS AND CHANGES SINCE THE REFERRAL
AREA 3 - WALKERS TOP

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 3/10/2025
REVISION:	A

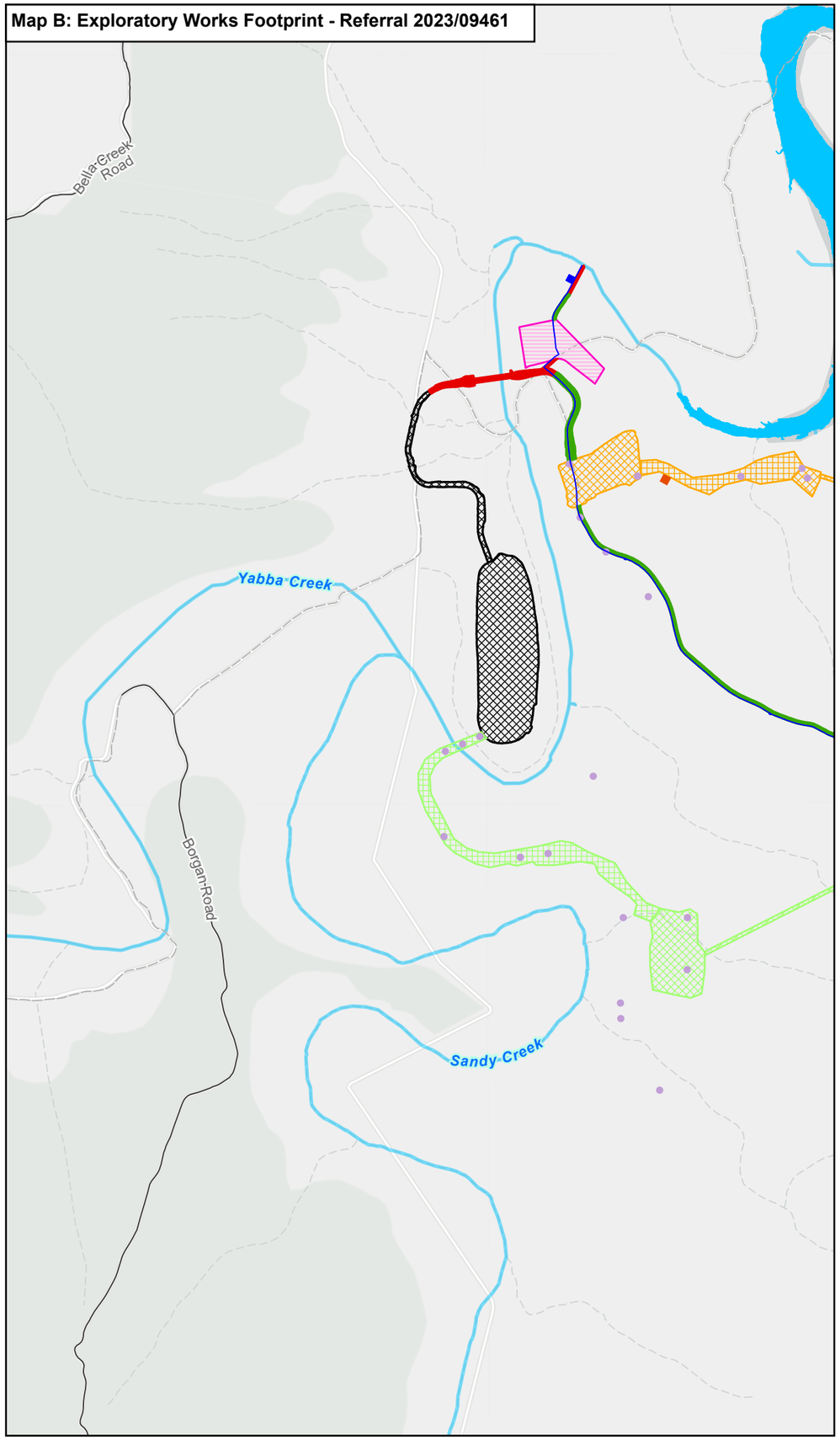
FIGURE 5c

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Map A: Exploratory Works Footprint - Current



Map B: Exploratory Works Footprint - Referral 2023/09461



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Map A: Exploratory Works Footprint - Current

- Construction Compound
- Existing Tracks to be Upgraded
- Explosive Store and Access Road
- Geotechnical Investigations
- New Tracks
- Portal Pad and Access Track
- Staging Pad
- Temporary Water Infrastructure
- Tunnel Spoil Disposal
- Exploratory Tunnel
- Underground Temporary Water Infrastructure

Map B: Exploratory Works Footprint - Referral 2023/09461

- Geotechnical Investigations
- Exploratory tunnel, portal pad and access road - Orange option
- Exploratory tunnel, portal pad and access road - Green option
- Existing Access Track Upgrades
- New Access Tracks
- Temporary Water Infrastructure
- Explosive store
- Staging pad
- Spoil disposal area

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
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Exploratory Works Project
Preliminary Documentation

EXPLORATORY WORKS REFINEMENTS AND CHANGES SINCE THE REFERRAL
AREA 4 - BORGAN

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 3/10/2025
REVISION:	A

FIGURE 5d

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1.4.2 Threatened species listings

Since the controlled action decision for the Project on 30 March 2023, two species acknowledged in the referral has been up listed and another three species have been added to the threatened species list under the EPBC Act.

The Coxen's fig-parrot (*Cyclopsitta diophthalma coxeni*) was listed as endangered at the time of the controlled action decision and up listed to critically endangered on 31 March 2023. In accordance with the EPBC Act, this Preliminary Documentation assesses the Coxen's fig parrot as per its listing status at the time of the controlled action decision.

The Mary River turtle (*Elusor macrurus*) was listed as endangered at the time of the controlled action decision and up listed to critically endangered on 4 September 2024. In accordance with the EPBC Act, this Preliminary Documentation assesses the Mary River turtle as per its listing status at the time of the controlled action decision.

The diamond firetail (*Stagonopleura guttata*) and the brown treecreeper (*Climacteris picumnus victoriae*) were not listed at the time of the controlled action decision; these species were added to the threatened species list as vulnerable species on 31 March 2023. The Conondale spiny crayfish, (*Euastacus hystricosus*) was also not listed as the time of the controlled action decision, with the species listed as endangered on 4 September 2024. In accordance with the EPBC Act, these species are not assessed in this Preliminary Documentation.

The Significant Impact Assessment in the EPBC referral report considered potential impacts to migratory species such as the white-throated needletail (*Hirundapus caudacutus*) and concluded that a significant impact would not be likely. Only listed threatened species and communities (sections 18 & 18A) were identified by the Minister as the relevant controlling provision for the Project in the controlled action decision. Listed migratory species (sections 20 & 20A) was not identified as a controlling provision, therefore migratory species, including the white-throated needletail, are not assessed in this Preliminary Documentation.

1.4.3 Likelihood of occurrence

The likelihood of occurrence (LOO) assessment has been updated based on information and feedback made available since the referral. The categories for the LOO have been changed from five in the referral to four in this Preliminary Documentation. The revised approach uses spatial and temporal cut-offs for records (i.e. <10 years, and <30 km) to categorise species. See Section 4.3 for further information on the updated LOO.

1.5 Content and structure

The content of this report addresses the request for further information received from DCCEEW on 24 April 2023 (Appendix A). Table 2 identifies where in the report each item is addressed.

This report includes information from the EPBC Act referral (EPBC 2023/09641) where it is relevant.

Table 2: Reference guide to information request responses

ID	Request	Location
1	This section of the RFI sets out the Preliminary Documentation's general content, format and style requirements, including the requirement for this reference table indicating where to find information that fulfills the request.	Section 1.5, Table 2
2	**Description of the action**	
If not previously provided in the referral documentation, the Preliminary Documentation must include:		
2.1	(a) description of the intended land uses proposed as part of the completed development, including any proposed open space and/or conservation areas and associated ongoing activities, and details of the intended party that would be responsible for future management activities.	Section 2.9
	(b) a description of all components of the proposed action (pre-construction, construction, operational and decommissioning), including the anticipated start and completion dates, duration and maximum life. This should include a detailed outline of the expected timing of any staged clearing over the construction period. This description should include at a minimum:	Section 2, Table 4, Figure 7
	i. all infrastructure to be constructed and construction methods.	Section 2.3 to 2.7
	ii. all new and existing roads, as well as details on which roads are sealed and unsealed, and anticipated traffic volume.	Section 2.5, Section 2.7.5, Section 2.7.6 Section 2.2.3 – Traffic volume
	iii. water infrastructure, all new and existing groundwater bores, stormwater infrastructure and drainage systems and transmission line trenching.	Sections 2.6.1 Section 2.4, Section 2.7.3
	iv. design and location of diversions or interception of overland flow and other water-related infrastructure.	Section 2.6.1 Section 2.4, Section 2.7.3
	v. all temporary and permanent fencing used, including a description of each fencing type and location. Include schematic diagrams of fence types and maps of where fences are proposed to be located.	Section 2.6.2, Section 2.7.6, Section 6.2.4
	vi. ancillary or supporting infrastructure including maintenance buildings, drill pads, construction camps and associated works or safety works including new construction and upgrades.	Sections 2.3, Section 2.5, Section 2.6
	vii. realignment or replacement of services, structures, access etc. required as a result of the action.	Section 2.5.2

ID	Request	Location
	viii. quarries and other resource extraction sites including locations, size, method of extraction of materials and transport of materials.	No resource extraction proposed
	ix. other such actions, including, but not limited to, use of explosives, changes to hydrological flow and groundwater, concrete batching plant, material storage, construction facilities, fine particle and dust control management.	Section 2.7
	x. actions related to waste management and management of spills/contaminants/pollutants, treatment of contaminated land and method of treatment, disposal of waste and contaminated material, standards and minimum thresholds required for removal/disposal.	Waste Management Plan in the CEMP (Appendix F)
	(c) the location, boundaries, and size (in hectares) of the disturbance footprint, and of adjoining areas and vegetation, which may be indirectly impacted by the proposal, including from material stockpiles, vehicle access and associated activities. Ensure that total areas of all Project components are consistent throughout the report to the nearest decimal point.	Section 2.2.1, Figure 8 and Table 3
	(d) a clear description of any material changes (e.g. total footprint, areas to be cleared) or planning changes (e.g. construction timeframes) between the referral and draft Preliminary Documentation submissions	Section 1.4.1
	(e) For all proposed tunnelling infrastructure, describe, map and illustrate: i. tunnel locations, depth, size and geology impacted (including long term stability of the geology of the Project area) ii. location in relation to groundwater iii. construction methodology iv. associated surface infrastructure.	Section 2.7.1
2.2	A decommission plan for the scenario that the Borumba Pumped Hydro Energy Scheme Project does not proceed. This should inform the rehabilitation of areas impacted by the Exploratory Works to ensure there are minimal long-term impacts on MNES. As well it should detail proposed treatment measures for spoils removed during the exploratory tunnel drilling works.	Section 6.3 Appendix C
2.3	Details of any local or State Government planning scheme, or plan or policy under any local or State Government planning system that applies to the proposed action, or that the proponent reasonably believes are likely to apply, to the proposed action. Details should include: (a) what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy; and (b) obtained approvals or additional approvals that are required.	Section 2.11
2.4	Relationship to other referrals or later stages of development.	Section 1.2

ID	Request	Location
3	**Description of the environment and Matters of National Environmental Significance**	
If not previously provided in the referral documentation, specific matters this section must address include:		
3.1	A description of any potential Matters of National Environmental Significance (MNES) (including but not limited to those listed in this request for information) that occur in the Project area and adjacent areas.	Section 4
3.2	A description and map of the current land use/s, land topography, surface and ground water bodies, permanent and ephemeral waterways and vegetation communities (habitat types as they relate to potentially impacted listed threatened species) on the proposed action site and adjoining areas.	Section 3
3.3	For listed threatened species and ecological communities that have the potential, or are likely, to be present at and in the vicinity of the Project site, including but not limited to those listed in this request for further information, this section must provide a likelihood of occurrence assessment based on the following:	
	(a) Information on the abundance, distribution, ecology and habitat preference of the species or communities.	Section 4, Section 7, Appendix D, Appendix E
	(b) Quantification of the extent of habitat (including maps identifying known or potential habitat).	Section 7, Appendix E
	(c) Assessment of the quality and importance of known or potential habitat for the species or communities within the proposed action site and surrounding areas.	Section 4, Section 7
	(d) Information detailing known populations or records within at least five kilometres of the development footprint and (if known) the size of these populations.	Section 4, Section 7
	(e) Information on relevant water dependant threatened species downstream of the development footprint.	Section 4.2.4, Section 7.3.1, Section 7.3.9, Section 7.3.10, Section 0
	(f) Information on the survey methodology used, including a map/s of survey points or transects, how the survey points or transects were selected, when surveys were conducted (e.g. dates, time of day, season, etc.) and search effort (e.g. 20 hours over eight days).	Section 4.1 Appendix M
	(g) An assessment of the adequacy of any surveys undertaken with reference to any relevant scientific literature and/or statutory documents. In particular, the extent to which these surveys were appropriate for the species and undertaken in accordance with relevant survey guidelines.	Appendix M
	(h) Results of any surveys undertaken.	Section 4.2 Appendix M

ID	Request	Location
	Note: Survey data should be as recent as possible and collected in the last five years. If adequate surveys of the Project site to confirm the presence/absence of the above listed threatened species and ecological communities are not undertaken, the department considers that, for the purposes of assessment under the EPBC Act, it may be appropriate to assume that those listed species and ecological communities are present at the proposed site.	Data includes results from surveys completed in 2022 to 2024.
3.4	*Lowland Rainforest of Subtropical Australia threatened ecological community* Please discuss how the extent and composition of the Lowland Rainforest of Subtropical Australia threatened ecological community (TEC) within the study area is consistent with the relevant statutory documents, specifically, how the community conforms with the key diagnostic characteristics noted in the Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia 2011. The department also notes that per the Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia 2011: "a minimum buffer zone that extends 50 metres (m) beyond the trunks of the outermost trees in the patch is defined to assist in the preservation of the patch. Fifty metres is the maximum likely height of a tree in the ecological community. The 50 m buffer zone will encompass an area large enough to protect the root zone of edge trees." In this regard, please ensure that the 50 m buffer has been applied to the quantum of impact for this TEC and the total disturbance footprint (ha).	Section 4.2.1, Section 6.2.3.1, Section 7.1.1
3.5	*Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions threatened ecological community* Please provide the total extent (in hectares) of the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC within the study area and disturbance footprint. In line with the Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions 2022, please describe how relevant buffer zones will be applied for the protection of a patch from potential impacts. Note: Regional Ecosystem 12.3.7 may be analogous with this TEC, which intersects with the development footprint. Please ensure all relevant Regional Ecosystems are considered in the assessment.	Section 4.2.1, Section 6.2.3.1, Section 7.1.2
4	**Impact Assessment**	
If not previously provided in the referral documentation, the Preliminary Documentation must:		
4.1	Assess the direct and indirect loss and/or disturbance of protected matters and their habitat as a result of the proposed action. This must include:	
	(a) the area (in hectares) and quality of the habitat to be impacted;	Section 0, Section 7
	(b) a quantification of the total individuals/populations to be impacted where practicable; and	Section 7
	(c) the impacts of habitat fragmentation in the Project area and surrounding areas, including consideration of species' movement patterns.	Section 5.3.1, Section 7

ID	Request	Location
4.2	Include current maps and coordinates/shapefiles of the proposed impact area and areas of habitat for MNES proposed to be retained. Maps must clearly identify development footprints, buffer zones, and any conservation areas where impacts will be avoided, and areas of adjacent habitat that would be subject to indirect impacts, including areas that are to be retained within and adjacent to the site.	Appendix E
4.3	Confirm the area of habitat that will be directly and indirectly impacted by the proposed action, including but not limited to areas where:	
	(a) Connectivity to surrounding habitat will be retained, removed or functionally lost.	Section 0, Section 7
	(b) Adjacent habitat will be subject to intensification of ongoing impacts (for example, through increased human and vehicle presence and the introduction of noise and vibration).	Section 5.3, Section 7
	(c) Habitat for relevant water dependant threatened species which exist downstream of the development footprint.	Section 4.2.4, Section 7.3.1, Section 7.3.9, Section 7.3.10, Section 7.3.11, Appendix E
	(d) Habitat will be impacted due to changes in surface water, groundwater and leachate within the site and the area surrounding the site.	Section 5.3.6 to 5.3.10
	(e) Specifically, provide information on impacts to drainage, water quality and hydrology on Yabba Creek, the Mary River and onto the Great Sandy Strait Ramsar Wetland.	Section 5.3.6 to 5.3.11
4.4	Details of any policy guidelines, relevant studies, surveys, or consultations with species experts/field specialists relevant to potential impacts.	Section 5.8
4.5	Provide an assessment of the direct and indirect impacts that may occur during construction and post-construction phases, including:	
	(a) The nature and extent of impacts (including direct, indirect* and facilitated impacts**), including timing and whether the impact is temporary or permanent. Consideration must be given to species habitat such as hollow bearing trees, nest trees, refuge habitat, breeding habitat, presence of preferred foraging trees and fungi, sheltering or other microhabitat features relevant to the species within and surrounding the development footprint (if applicable).	Section 5 Section 7
	(b) A local and regional scale analysis of likely impacts, with reference to the Project's potential contribution to cumulative impacts in the context of development patterns in the locality and region.	Section 5.5
	(c) An assessment of the likely duration of impacts to MNES as a result of the proposed action.	Section 5
	(d) Discussion of the risk of potential impacts as a result of the proposed action, including but not limited to the following: i. Edge effects – including the potential for the introduction of weed species and pathogens in the referral area and adjacent environment.	Section 5

ID	Request	Location
	ii. Vehicle movement – potential increase of vehicles to strike fauna in the preconstruction, construction, and operation phase of the Project. iii. Increased presence of threats such as Dogs and weeds – pre-construction, construction and operation phases have the potential to increase pest/threat presence in the referral area and adjacent environment. iv. Spread of diseases such as myrtle rust (*Austropuccinia psidii*) to scrub turpentine. v. Earthworks – potential to generate dust emissions from the removal of vegetation and movement of soil in the pre-construction and construction phase of the Project. vi. Impacts from the Project at the local scale and regional context including changes to water flow regime and water quality (including runoff from spoil such as sedimentation and acid sulphate soils as well as other potential contaminants from explosives). vii. Alterations to hydrology, surface water, groundwater and groundwater dependant flora and fauna. viii. Effects on riparian vegetation and alterations to bank and channel morphology. ix. How tunnelling, drilling and blasting activities will impact the long-term stability of the geology of the Project area including: • interactions with groundwater • subsurface impacts on root systems of overlying vegetation • direct clearing for associated surface infrastructure. x. Disturbance from increased noise, vibration, blasting, artificial light, sediment generation, dust and other relevant stressors during construction and operation of phases of the Exploratory Works. xi. Barriers to dispersal of fauna and flora, impacting on home ranges, breeding and genetic diversity.	
	(e) Identification of present impacts to MNES as well as the extent of current impacts. This includes baseline surveys for extent of weeds and pests.	Section 0
	(f) Identification of where relevant impacts are unknown or unpredictable.	Section 5.6
5	**Avoidance, mitigation and management measures**	
To clarify the proposed measures to avoid and mitigate impacts, the Preliminary Documentation must:		
5.1	Provide a consolidated assessment of all proposed measures to avoid and mitigate impacts, including those provided in the referral and any additional to those described in the referral. This should include:	
	(a) An outline of: i. all reasonable efforts that have been made to avoid impacts to MNES, shown via alternative Project designs; and ii. any remaining impacts to be mitigated to reduce the impacts on MNES.	Section 6.1
	(b) The viability and effectiveness of alternative strategies, plans and measures to avoid and mitigate impacts, and why the chosen avoidance and mitigation measures were more appropriate, including but not limited to:	Section 6.2.2 FFMP in Appendix F

ID	Request	Location
	i. avoidance of the removal of mature habitat trees on site. ii. avoidance of areas potentially containing the Lowland Rainforest of Subtropical Australia TEC. iii. avoidance of key features relevant to impacted threatened species such as hollow-bearing trees, denning structures, preferred foraging trees and fungi etc. iv. vegetation retained to maintain connectivity for species. v. effective use of buffers between disturbance areas and MNES to minimise edge effects.	
	(c) All proposed measures and outcomes of the avoidance and mitigation measures must be clearly listed, and follow the specific, measurable, achievable, relevant and timely (SMART) principle.	FFMP in Appendix F
	(d) Provide an assessment of the predicted effectiveness of each proposed avoidance or mitigation measure, noting that the effectiveness of a particular measure is a reflection of confidence in the nominated outcome. The assessment of effectiveness should be evidence based and include examples of demonstrated success of a particular measure to achieve the desired avoidance/mitigation outcome.	Section 6.2.2 FFMP in Appendix F
	(e) A description (including maps and imagery) of the location, boundaries and size of buffer areas or proposed exclusion zones, and details on how these areas will be enhanced, protected, and maintained. Also include a description of any fences or barriers which may be installed around areas where impacts will be avoided.	Section 6.2.3, Section 6.2.4
	(f) A risk assessment to determine appropriate buffer distances from areas containing environmental values and sensitive areas. This risk assessment should demonstrate that the environment will be protected and the amenity of the sensitive areas will not be adversely affected, based on the design or operational control measures proposed.	Section 6.2.3
	(g) Details on the management of spoil, actions for detecting contaminants, specifically acid sulphate soils, and proposed measures to appropriately dispose of contaminants.	Section 6.2.7 Spoil Management Plan in Appendix F
	(h) Discussion of avoidance and mitigation measures associated with the spoil disposal area located adjacent to Yabba Creek. Avoidance measures includes alternative sites which were not selected. Discussion on mitigation measures should include soil testing and buffers to be implemented.	Section 6.1.2.2, Section 6.2.8
	(i) Management plans outlining measures for changes to water quality as a result of increases in turbidity, sediment loads, nutrients, contaminants and other runoffs entering the waterway as a result of the action.	Section 6.2.9 Water Management Plan in Appendix F
	(j) Details of any ongoing mitigation and management measures during the construction phase of the Exploratory Works, including but not limited to: i. Details about pre-clearance and clearance procedures to ensure that species are detected and managed to minimise mortality, stress, injury, or introduction of disease. ii. Information on any buffer zones between the construction footprint and remaining habitat in the referral area and adjacent to the site.	Section 6.2.2 FFMP in Appendix F

ID	Request	Location
	iii. Measures to address the risk of impacted threatened species entering the development area and becoming trapped/isolated without resources for shelter while in the development area and safe movement opportunities to get out of the development area, sufficient information on the location and design of these measures and the guidelines that have informed these measures. iv. Management of direct and indirect impacts for the impacted threated species and threatened ecological communities, due to increased likelihood of human presence. v. Information on fauna safe road design and placement, including installation of wildlife crossing warning signs, wildlife threshold marking on road (include maps and imagery). vi. Details of how speed reduction is to be achieved (e.g. traffic calming devices) and plans showing the locations of each of these features and the manner in which they will be implemented). vii. Other mitigation measures proposed for the protection of species movement and remaining habitat on the referral site and adjacent to the site.	
	(k) Identify avoidance and mitigation measures for threatened flora species such translocation, propagation and disease control. This should include proposed management measures for multiple stages of the action (pre-clearance, clearance, operational, decommission).	Section 6.2.2 FFMP in Appendix F
	(l) As a part of these threatened flora management measures, actions should the measure not be successful (e.g. offset proposal for translocation failure).	FFMP in Appendix F
	(m) A risk analysis of impacts to water quality. This includes: i. Risks associated with the action that could lead to water quality contamination or degradation. This includes but is not limited to runoff from spoil, contaminants from explosives used during the tunnelling process, increased erosion and sedimentation, introduced acid sulphate soils, changes to water flow, salinity, oxygenation and algal blooms. ii. An assessment of the likelihood of water quality impacts. iii. Proposed avoidance and mitigation measures to reduce the likelihood of impacts to water quality. iv. How any residual risks will be addressed upon finalisation of the action and will be managed ongoing into the Borumba Pumped Hydro Energy Scheme Project.	Section 5.3.8 Section 5.3.9 Appendix G Water Management Plan in Appendix F
5.2	Include a detailed management plan on mitigation, revegetation and spoil treatment to rehabilitate the impacted area such that there are minimal residual impacts should the Borumba PHES Main Works not proceed.	Section 6.3, Appendix C
5.3	Provide management and mitigation measures relating to impacts of groundwater drawdown, groundwater contamination and surface water contamination on water resources. Specifically, the department requests the proponent include mitigation and/or management measures regarding the impacts on: (a) erosion (include how erosion control measures will be implemented to areas of erosion risk and identify where these measures are likely to be implemented); (b) potential Groundwater Dependent Ecosystems; and (c) potential contaminants (such as those extracted as a part of the tunnelling and spoil storage actions).	Section 5.3.10

ID	Request	Location
5.4	For each measure proposed, indicate the: (a) impact to be avoided and/or mitigated (b) responsible party (c) environmental outcomes to be achieved (d) milestones, performance, and completion criteria (e) an evidence-based likelihood of success and risk assessment (f) proposed monitoring and evaluation program (g) contingency measures (h) whether a management plan is required (i) where designs cannot be specified, the relevant guidelines that inform which designs will be used (for appropriate koala fencing the Queensland Department of Environment and Science's Koala-Sensitive Design Guideline 2022).	Appendix F FFMP in Appendix F
5.5	Any statutory or policy basis for the proposed measures, including reference to the SPRAT Database and relevant approved Conservation Advice, recovery plan or threat abatement plan, and a discussion on how the proposed measures are not inconsistent with relevant plans. For example, the National Recovery Plan for the Grey-Headed Flying Fox states an objective to: *'to improve the grey-headed flying-foxes national population trend by reducing the impact of the threats outlined in this plan on grey-headed flying-foxes through habitat identification, protection, restoration and monitoring'* Please provide a discussion on how the proposed action is consistent with relevant species' objectives or alternatively, how the proposed avoidance, mitigation/management and offsetting will compensate for any residual significant impact, thereby ensuring consistency with the objective for relevant EPBC Act species.	Section 6.2.2 Section 6.4
6	**Proposed offsets**	
Minimum Requirements for a draft Offset Management Strategy:		
6.1	Discuss how the proponent will provide offsets that meet the requirements of the EPBC Offsets Policy.	Section 8 Appendix I
6.2	If potential offset site/s are identified, as far as possible please provide: (a) A description of the proposed offset site(s) including location, size, condition, and relevant ecological/species habitat features, landscape context and cadastre boundaries of the offset site(s) (supported by mapping). (b) Information about how the proposed offset/s area will provide connectivity with other relevant habitats and biodiversity corridors. (c) Information how the proposed offset site/s contribute to relevant State and/or regional plan/s or initiatives for the conservation of the protected matter. (d) Evidence of the presence of, or usage by, relevant MNES on, or adjacent to the proposed offset site(s), and the presence and quality of habitat for MNES on the proposed offset site.	Section 8 Appendix I

ID	Request	Location
	(e) An assessment of how the offset and impacts sites are like-for-like, i.e. the environmental values for the MNES at the offset are of the same type or equivalent to that affected by the proposed action. (f) The methodology (described in section 7), with justification and supporting evidence, used to inform the inputs of the Offsets Assessment Guide in relation to the offset site for each relevant MNES, including: i. total area of habitat (in hectares); and ii. habitat quality (as discussed in section 8) iii. time over which loss is averted (max. 20 years); iv. time until ecological benefit; v. risk of loss (%) without offset; vi. risk of loss (%) with offset; and vii. confidence in result (%). (g) Details and execution timing of the mechanism to legally secure the environmental offset/s (under Queensland legislation or equivalent) to provide enduring protection for the potential offset area/s against development incompatible with conservation. (h) A description of how the offset management strategy directly addresses all the EPBC Environmental Offset policy principles and demonstrate how each principle will be met (including through quantitative means via the Offset Assessment Guide and Habitat Quality Score results).	
7	**Habitat Quality Assessment**	
	A methodology that is suitable for each listed threatened species or threatened ecological community (i.e. approved by the department or supported by literature) where there is a residual significant impact must be used to assess habitat quality, noting the same scoring mechanism must be used at both impact and offset sites	Section 9 Appendix I
8	**Economic and Social Matters**	
If not previously provided in the referral documentation, the Preliminary Documentation must:		
8.1	Provide details on the social and economic costs and/or benefits of undertaking the proposed action, including the basis for any estimations of costs and/or benefits. Where possible, please include the total economic capital investment and economic ongoing value of the Project.	Section 10.1
8.2	Identify if economic benefits and employment opportunities are in addition to what would have been expected if the action were not to take place.	Section 10.2
8.3	Provide details of any public stakeholder consultation activities, including the outcomes of those consultations.	Section 10.3
8.4	Provide details of any consultation with Indigenous stakeholders. <u>Indigenous engagement</u> Identify existing or potential native title rights and interests, including any areas and objects that are of particular significance to Indigenous peoples and communities, possibly impacted by the proposed action and the potential for managing those impacts.	Section **Error! Reference source not found.**

ID	Request	Location
	Describe any Indigenous consultation that has been undertaken, or will be undertaken, in relation to the proposed action and their outcomes. This should include: (a) details regarding the specific Indigenous groups and Traditional Owners consulted and an indication of the areas, both tangible and intangible, of cultural significance across the Project site; and (b) a discussion about how impacts to areas and/or objects of Indigenous cultural significance (tangible and intangible) are avoided, mitigated or minimised. The department considers that best practice consultation, in accordance with the Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act (2016) includes: (a) identifying and acknowledging all relevant affected Indigenous peoples and communities; (b) committing to early engagement; (c) building trust through early and ongoing communication for the duration of the Project, including approvals, implementation and future management; (d) setting appropriate timeframes for consultation; and (e) demonstrating cultural awareness. Please note that the department provided you with comments received from the National Indigenous Australian Agency on letter dated 30 March 2023 advising the decision on referral. We request that you consider the comments received from the Agency when addressing the above in the Preliminary Documentation. Describe any state requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action with regards to Indigenous peoples and communities.	
9	**Ecologically sustainable development**	
Ecologically sustainable development If not previously provided in the referral, the Preliminary Documentation must:		
9.1	Provide a description of how the proposed action meets the principles of ecologically sustainable development, as defined in section 3A of the EPBC Act, which are as follows: (a) decision making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (c) the principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making (e) improved valuation, pricing and incentive mechanisms should be promoted. Please note: Per section 391 of the EPBC Act, the minister must have regard to the precautionary principle when making a decision on whether or not to approve the taking of an action. The precautionary principle is that lack of full scientific	Section 11

ID	Request	Location
	certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.	
10	**Environmental record of the person proposing to take the action**	
10.1	Include details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: (a) the person proposing to take the action. (b) if the person is a body corporate—the history of its executive officers in relation to environmental matters. (c) if the person is a body corporate that is a subsidiary of another body or company (the parent body)—the history in relation to environmental matters of the parent body and its executive officers. (d) for an action for which a person has applied for a permit, the person making the application.	Section 12
11	**Ecological data provision**	
11	The Preliminary Documentation must include an appendix of occurrence records (both sightings and evidence of presence) for all listed threatened and migratory species identified during field surveys for the proposed action. This data may be used by the department to update the relevant species distribution models that underpin the publicly available Protected Matters Search Tool (PMST). The species occurrence records must be provided in accordance with the department's Guidelines for biological survey and mapped data (2018) using the species observation data template provided with this request for additional information. Sensitive ecological data must be identified and treated in accordance with the department's Sensitive Ecological Data – Access and Management Policy V1.0 (2016) or subsequent revision.	Section 13

2. Description of the Project

2.1 Controlled action

As identified in Section 1.2, the Project is one of two separate proposed actions required for the development and delivery of the Borumba PHES Project. The Project is solely focused on the technical investigations and includes the following activities:

- Geotechnical investigations – comprising test pits, boreholes (deep and shallow, including some conversion to groundwater monitoring bores), geophysics (Section 2.3).
- Spoil disposal – two dedicated areas (tunnel spoil disposal area and Kingaham spoil disposal area) for the storage and management of excess material from exploratory tunnelling, geotechnical drilling, and construction activities, as well as stockpiling of stripped topsoil (Section 2.4).
- Site access – activities associated with:
  - construction of new access tracks, and upgrades to existing tracks, including waterway crossings, to enable access to geotechnical investigation sites, spoil disposal areas, and supporting infrastructure (Section 2.5.1)
  - the realignment of a section of Bella Creek Road, referred to as the Kingaham Creek bypass (Section 2.5.2).
- Other supporting infrastructure – establishment of temporary water infrastructure (Section 2.6.1) and a civil construction compound (laydown area) (Section 2.6.2).
- Exploratory tunnel infrastructure – comprising a portal pad, staging pad, explosive store (also referred to as a magazine), and associated access tracks, and exploratory tunnels (Section 2.7).

Activities associated with routine management of Queensland Hydro land (such as fire breaks, property fencing, access track maintenance, and any other similar activities) do not form part of the referred action. The action also does not include activities associated with the Project that will be undertaken by other parties such as local councils.

Some preliminary activities proposed to occur in advance of the Exploratory Works are outside the scope of the referred action and they are therefore excluded from the action and the Preliminary Documentation. Refinement of the Exploratory Works design confirmed that these preliminary activities are not part of the action as:

- they will be used to plan the exploratory works and/or support the construction of the TWACs and cultural heritage and environmental assessments (e.g. groundwater monitoring bores)
- they are located within previously disturbed, cleared areas that would not involve significant impact on MNES
- self-assessments completed in accordance with the 'Significant Impact Guidelines 1.1 – MNES' confirmed that the activities would not impact MNES.

With the exception of the Kingaham Creek bypass, the Exploratory Works infrastructure is largely temporary in nature and is not intended to remain in use for an extended duration unless required for property access and maintenance (e.g. some access tracks). Should the Borumba PHES Project Main Works not proceed, the areas impacted by the Project will be remediated where appropriate (e.g. revegetation of cleared areas, plugging of boreholes and the exploratory tunnel entrance).

2.2 Project overview – RFI item 2.1(b)

The Project design process considered a number of factors including operational efficiencies, costs, risks (e.g. flooding), the environmental management hierarchy (refer to Section 1.4.1 and Section 6 for more information on the application of this hierarchy), cultural heritage values and future land uses based on the proposed Main Works design.

Where possible, the selection of areas with significant existing disturbance (e.g. cleared paddocks used for cattle grazing, existing roads and tracks), was prioritised for the Exploratory Works to avoid impacts to MNES values, with the majority of the works occurring in brownfield/cleared areas. However, due to the nature of the Borumba PHES Project design and the objectives of the Project (i.e. to assess the suitability of the proposed locations for Borumba PHES Project key infrastructure), it was not possible to locate all works in disturbed areas. Where works (e.g. geotechnical investigations and access tracks) are proposed in less disturbed areas they have been designed

to avoid environmental and cultural heritage values identified from the wide array of field surveys undertaken across the site.

Micro-siting of activities will be implemented within the Project area in response to safety concerns or results of initial geotechnical investigations, or to avoid impacts to environmental and/or cultural heritage values. Micro-siting will involve an onsite assessment of the area by the principal contractor, ecologists and culture heritage monitors to confirm construction methods, identify values of note, and confirm whether the values and/or impact can be avoided. The Project footprint is larger than the expected disturbance area in some locations as the final design is dependent on geotechnical and engineering information not yet available; this also allows for some flexibility to move infrastructure.

The Project infrastructure is mostly co-located with the proposed Main Works footprint as shown in Figure 3. All Project infrastructure (other than waterway crossings) is located outside areas at risk of inundation by flooding as identified in the Queensland Floodplain Assessment Overlay.

The Project activities are grouped by areas as summarised in Section 2.2.1 and described in detail in Sections 2.3 to Section 2.7.

The anticipated schedule for Project activities, subject to approval, is provided in Section 2.2.2.

Should the Borumba PHES Project Main Works not proceed, the areas impacted by the Project will be remediated where appropriate (e.g. revegetation of cleared areas, plugging of boreholes).

2.2.1 Project area – RFI item 2.1(c)

For the purposes of this Preliminary Documentation, the following terms have been used to describe the Project:

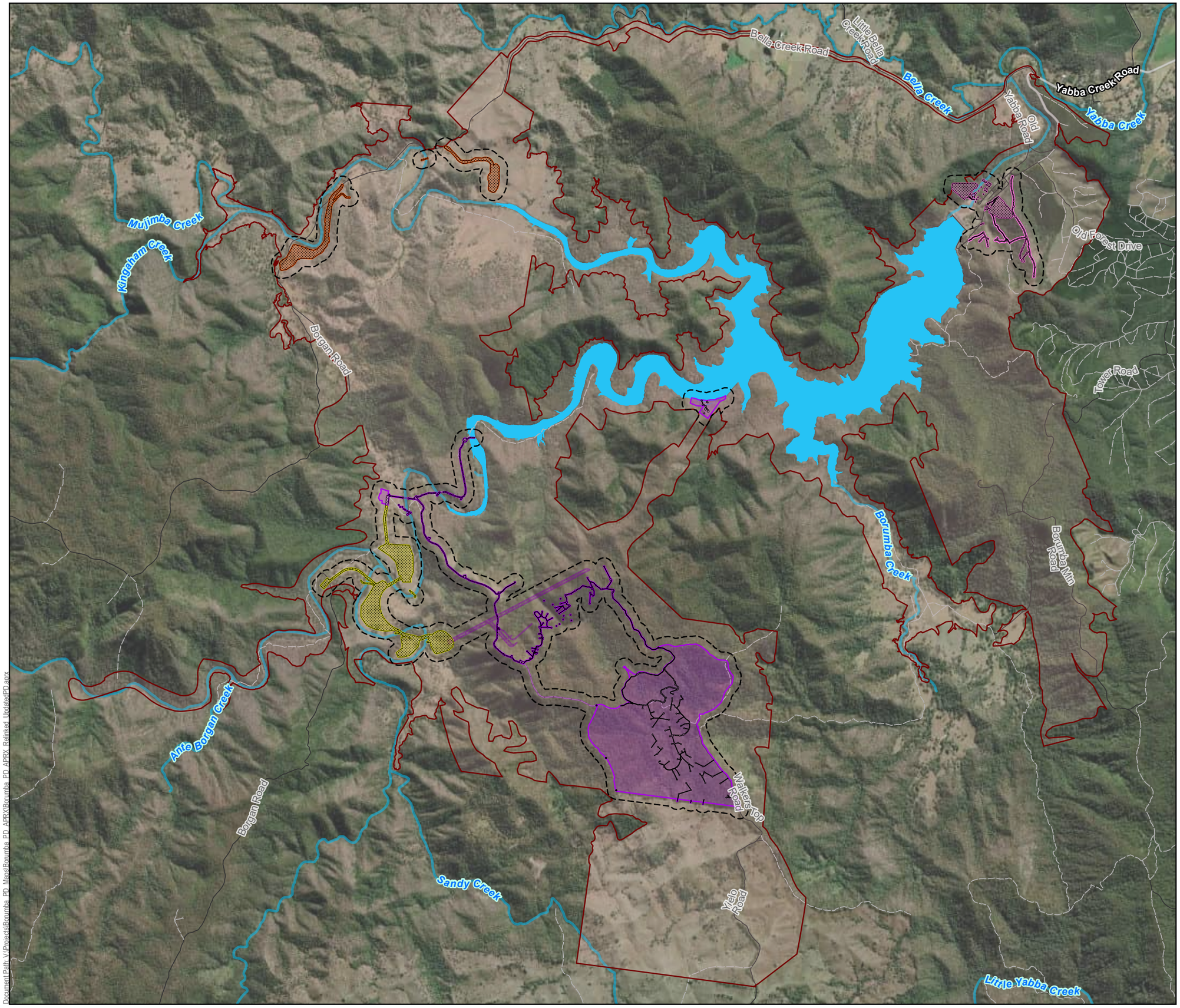
- **Study area** – This is a broad term intended to capture the area of influence within which the Project is located. The Study area does not have a defined boundary or distance from the Project area, as the area of influence is different for the various environmental factors, such as waterway catchments or fauna dispersal.
- **Borumba PHES Project Survey area** – This is the area surveyed by ecologists for the Borumba PHES Project as a whole. It includes areas surveyed for the Main Works Project.
- **Survey area / Exploratory Works Survey area** – This is the area surveyed by ecologists to gather ecological data for the Exploratory Works. The Survey area typically extends 100 m outside the Project footprint to capture environmental values both within, adjacent to or surrounding the Project footprint. The environmental values identified within the Survey area are reported in this report to provide context of the environment surrounding the Project footprint.
- **Project area** – The Project area is located wholly within the Survey area. The Project area is the boundary for all Project components, and the area within which the location of Project components can be micro-sited to minimise impacts to identified environmental values. The Project area has not been used to calculate the Project's impacts, as not all of the Project area will be directly impacted.
- **Project footprint** – The Project footprint is located wholly within the Project area and is the indicative area that will be disturbed for Exploratory Works activities. The Project footprint described in this Preliminary Documentation may be subject to design refinement and micro-siting within the Project area. Underground Project components have been excluded from this definition as they do not require ground disturbance. The indicative Project footprint (rather than the Project area) is used when determining the impact of the Project on MNES.

The survey areas and Project area are shown on Figure 6.

The Project area is divided into the following four work areas:

- Area 1 (Borumba Dam)
- Area 2 (Kingaham Creek)
- Area 3 (Walkers Top)
- Area 4 (Borgan).

Figure 7 summarises the activities associated with each work area and Figure 8 shows the location and indicative footprint of each activity.



Queensland Hydro

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Exploratory Works Project

- Project Footprint

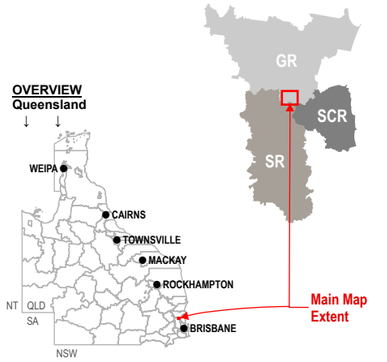
Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
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Exploratory Works Project
Preliminary Documentation

PROJECT AND SURVEY AREAS

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 6

Document Path: V:\Projects\Borumba_PD_Maps\Borumba_PD_APRX\Borumba_PD_APRX_ReLinked_UpdatedPD.aprx

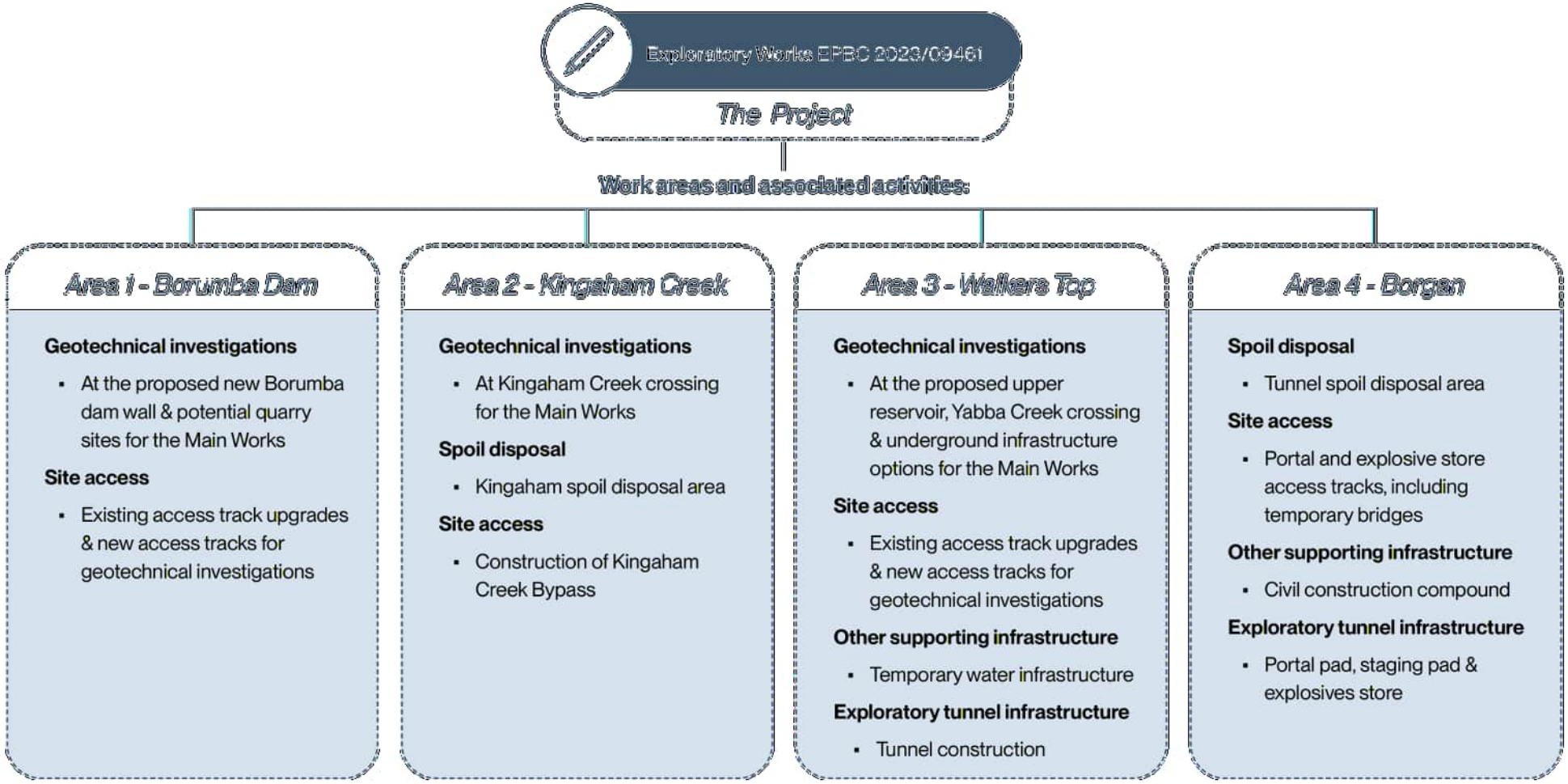


Figure 7: Definition of Project work areas and associated activities

Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads
- Lake Borumba (FSL 135.01m AHD)

Exploratory Works Project

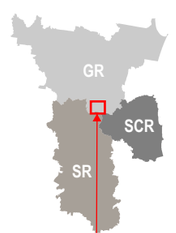
Project Footprint by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 4 - Borgan

Project Component - Underground

- Area 3 - Walkers Top

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
5. Basemap World Light Gray Canvas Base @ Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

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Exploratory Works Project
Preliminary Documentation

EXPLORATORY WORKS ACTIVITIES

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 29/09/2025
REVISION:	A

FIGURE 8

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The maximum surface disturbance area for the Project is 90.3 ha. Table 3 shows the indicative footprint associated the Project components in each work area.

Table 3: Exploratory Works Project indicative footprint areas

Project component	Indicative Project footprint (ha)
Area 1 – Borumba Dam	
Geotechnical investigations	10.3
Site access	2.9
Total disturbance for Area 1 – Borumba Dam	*13.1*
Area 2 – Kingaham Creek	
Geotechnical investigations	0.1
Spoil disposal	3.9
Site access	15.1
Total disturbance for Area 2 – Kingaham Creek	*19.1*
Area 3 – Walkers Top	
Geotechnical investigations	3.1
Site access	8.0
Other supporting infrastructure (temporary water infrastructure)	5.6
Exploratory tunnels (underground)	0.0
Total disturbance for Area 3 – Walkers Top	*16.7*
Area 4 – Borgan	
Spoil disposal	11.6
Site access	0.0
Other supporting infrastructure (civil construction compound, portal pad and access track, staging pad, explosive store and access track)	29.8
Total disturbance for Area 4 – Borgan	*41.4*
Total surface disturbance area for all works (Areas 1-4)	**90.3**

2.2.2 Project schedule

The anticipated Project schedule is provided in Table 4 and illustrated in Figure 9. The Exploratory Works will be staged over a period of approximately 51 months in total, from early 2026 to mid-2030, with surface geotechnical investigations prioritised and exploratory tunnelling proposed to occur at a later stage of the Project.

Durations for clearing provided in Table 4 also allow for the installation of erosion and sediment control measures.

Table 4: Anticipated Project schedule

Project components	Time period within which works are anticipated to occur		Life of component^	Anticipated timing and duration of associated clearing
	Start date	End date		
Geotechnical investigations				
All areas	Mar 2026	Oct 2027	16 months	Clearing will occur progressively, with each investigation site cleared before drilling/excavation and after an access track is established. Sites will be stabilised and where applicable rehabilitated once the investigation at that site is complete. Geotechnical investigations at Kingaham Creek will be undertaken within the footprint of proposed infrastructure.
Spoil disposal				
Kingaham Creek spoil disposal area	Jan 2027	Dec 2027	Permanent	Clearing for the spoil area will take approximately six months within this 12 month period.
Tunnel spoil disposal area	Jan 2027	Jun 2030	Permanent	Clearing will be completed in less than two weeks and take place within this 12 month period.
Site access				
Kingaham Creek bypass	Jan 2027	Dec 2027	Permanent	Clearing will be completed in less than two weeks and take place within this 12 month period.
Construction of new and upgrade to existing access tracks at Borumba Dam to service geotechnical investigations	Mar 2026	Aug 2027	10-16 months (some permanent) *	Construction of new access tracks and existing track upgrades will occur in stages. Tracks will be rehabilitated progressively, once geotechnical investigations are completed the track may be decommissioned.
Construction of new and upgrade existing access tracks at Walkers Top to service geotechnical investigations	Mar 2026	Aug 2027	10-16 months (some permanent) *	Construction of new access tracks and existing track upgrades will occur in stages. Tracks will be rehabilitated progressively, once geotechnical investigations are completed the track may be decommissioned.

Project components	Time period within which works are anticipated to occur		Life of component^	Anticipated timing and duration of associated clearing
	Start date	End date		
Other supporting infrastructure				
Temporary water infrastructure	Mar 2026	Dec 2029	24 months	Clearing for each component will be completed in less than two weeks.
Civil construction compound	Mar 2026	Feb 2029	24 months	Construction to be staged, with clearing for each section as required and undertaken over 24 months within this 36 month period.
Exploratory tunnel and supporting infrastructure				
Explosive store	Jun 2027	Jun 2030	24 months	Construction will occur over two months within this 36 month period, with clearing expected to be completed in less than four weeks.
Portal pad and staging area, portal access track	Jul 2027	Jun 2030	22 months	Construction will occur over four months within this 36 month period, with clearing expected to be completed in less than four weeks.
Tunnelling works#	Jul 2027	Jun 2030	Permanent	Tunnelling works will be underground and take 12-18 months. Clearing associated with tunnelling will occur during construction of the portal pad. Tunnelling would commence after the explosive store and portal pad, staging area and portal access track are complete.

^ If the Borumba PHES Project Main Works do not proceed.
* Where the Borumba PHES Project Main Works do not proceed. some access tracks may be retained for site maintenance, while others will be left to revegetate.
# Where the Borumba PHES Project Main Works do not proceed, the tunnels will be sealed, but will remain in place.

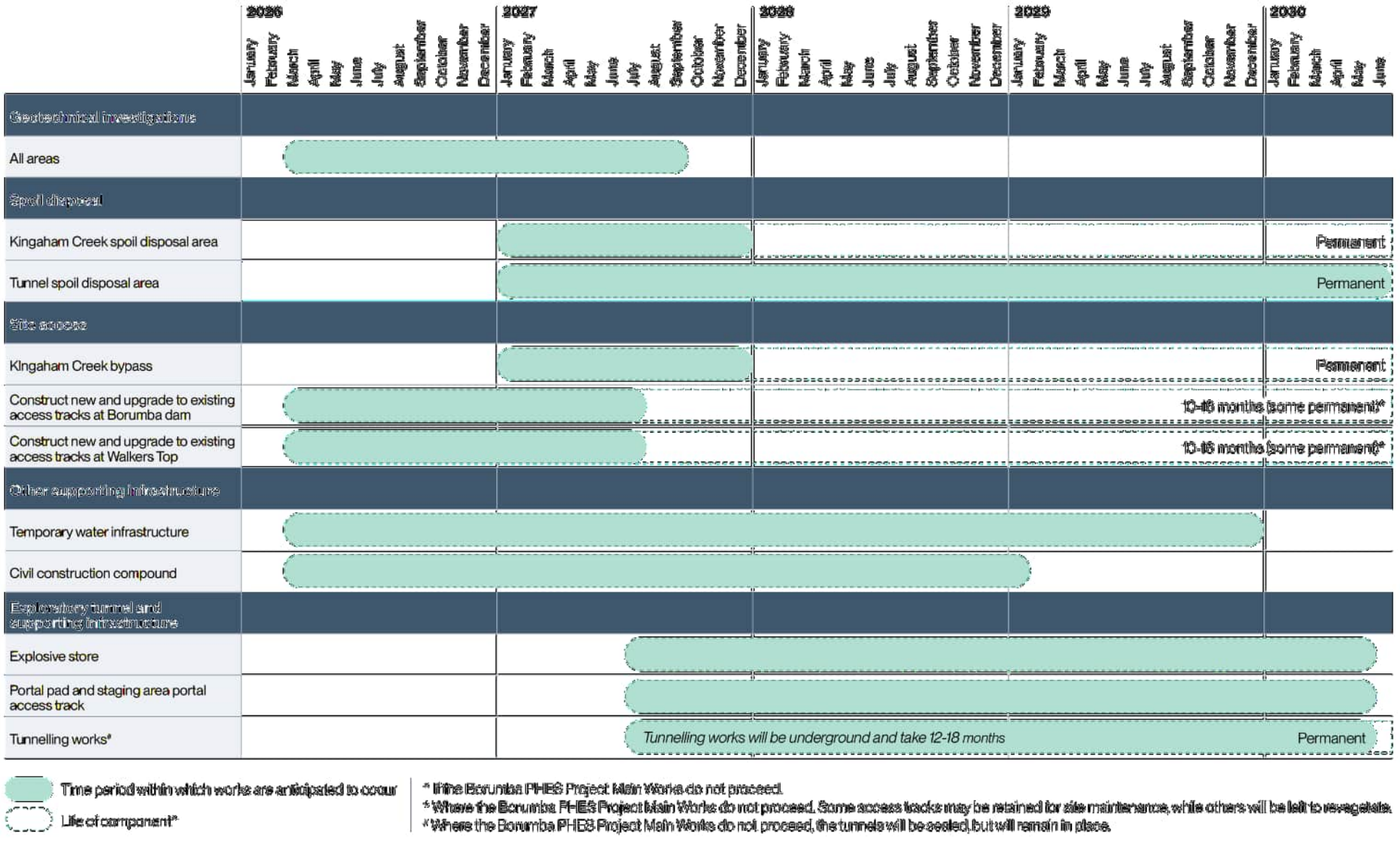


Figure 9: Illustration of anticipated Project schedule

2.2.2.1 Hours of work

Works for most Project components are expected to occur predominantly during standard construction hours over a seven-day work week with a rotating roster. However, some works outside of standard hours are expected during the Project. These include the activities associated with the exploratory tunnel and associated enabling works (e.g. shotcrete batching, spoil relocation and management), and some geotechnical drilling investigations (e.g. deep boreholes within Area 4). Work outside of standard hours is expected to occur 24 hours a day, seven days per week with a rotating roster.

The Project's construction program will be based on the following standard working hours (unless approved otherwise):

- General construction/surface works activities:
  - Monday to Sunday, 6.30am to 6.00pm
  - No work on public holidays.
- Geotechnical drilling:
  - Monday to Sunday, 6.00am to 6.00pm for boreholes less than 200 m deep (with some exceptions)
  - 24 hours a day, 7 days a week for boreholes equal to or more than 200 m deep and shallower boreholes by exception.
- Underground construction activities and associated enabling works:
  - 24 hours a day, 7 days a week.

Works outside of the above listed construction hours may occur during the Project. Reasons for this may include:

- movement of staff, as well as arrival and departure of construction staff during shift changes
- transport, assembly, or decommissioning of oversized plant, equipment, components or structures
- delivery of 'in time' material such as concrete, steel, and other construction materials delivered to site by heavy vehicles
- works requiring continuous construction support such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident
- on site movements of heavy plant, materials, and equipment
- works in a road reserve
- traffic control crews, including large truck mounted crash attenuator vehicles, medium rigid vehicles, and lighting towers
- emergency works and incident response including tow-trucks for light, medium, and heavy vehicles
- alternative construction rosters to suit delivery or in response to industrial relations issues
- various low-intensity activities.

Where work outside the standard hours (including night works) is required, the works will only proceed on an as required basis and with the appropriate state approval.

2.2.3 Project traffic

Access to the Project, which is approximately 2.5 hours by car from Brisbane, will be primarily from Imbil via Bella Creek/Borgan Road. Bella Creek Road is accessed from Yabba Creek Road and traverses the northern part of Lake Borumba. The road is a Gympie Regional Council-controlled single lane gravel road. Borgan Road is an unmaintained track, which diverges from Bella Creek Road. The Project's internal road network will start at the gate on Borgan Road located approximately 1.3 km from Bella Creek Road. Access to the Project will generally occur during standard working hours.

Access to the Project areas will be facilitated through use of these existing roads; however, minor upgrades to Bella Creek Road and the initial section of Borgan Road will be required. These upgrades are being completed by Gympie Regional Council.

Access to the Exploratory Works Project area from Jimna/Kilcoy will be via Kilcoy-Murgon Road, a State-controlled road, along with Sunday Creek Road and Yielo Road. Minor upgrades to Yielo Road and Sunday Creek Road are required and will be undertaken in consultation with Somerset Regional Council.

Table 5 summarises the estimated vehicle movements into and within site for the construction of the Project. Daily vehicle movements are estimated for on-site activity within each work area based on the following assumptions:

- vehicle movements are spread over 24 hours
- estimates are based on an average across the entire Exploratory Works program and do not consider staging of the works
- the count includes only loaded vehicles and does not capture unloaded vehicle movements
- the estimated volume per vehicle is based on the capacity of the assumed site-based vehicles
- the estimated volume of material is calculated using a conservative multiplier applied to the primary cut volumes.

Table 5: Estimated site vehicle movements

Location	Estimated vehicle movement forecast
Access to site	
Lower reservoir - access to Borumba Dam	Peak vehicle movement estimates: • 78 light vehicle trips / day • 83 heavy vehicle trips / day*
Upper reservoir - access via Yielo Road	Peak vehicle movement estimates: • 64 light vehicle trips / day • 41 heavy vehicle trips / day*
Access within site	
Area 1 Borumba Dam	• 10 light vehicle trips / day • 60 heavy vehicle trips / day
Area 2 Kingaham Creek	• 15 light vehicle trips / day • 50 heavy vehicle trips / day
Area 3 Walkers Top	• 15 light vehicle trips / day • 55 heavy vehicle trips / day
Area 4 Borgan	• 50 light vehicle trips / day • 380 heavy vehicle trips / day

* Based on peak month for heavy vehicle traffic.

2.3 Geotechnical investigations

2.3.1 Methods

The anticipated methods for geotechnical investigations are described below. Changes to these proposed methods may be considered provided they do not change the impact of the works.

2.3.1.1 Boreholes

Geotechnical boreholes will be used to investigate subsurface geological and geotechnical conditions and to develop an appropriate ground model. The ground model will include geological, geotechnical and groundwater information and will be used to inform the design of the Main Works. The total number of boreholes required is dependent on the results from initial drilling.

Boreholes will be classified into four main categories based on the available access and terrain at the drill location. These categories are identified in Table 6, with the geotechnical contractor to confirm the approach following appointment and subject to commitments and approval conditions. Further details on access are provided below in Section 2.5.

Each borehole will require a drill pad (up to 16 m in diameter) or a level working platform. These may be located on an existing access track, in previously cleared or modified areas, or in vegetated areas. In the first instance, the preference is to locate drill pads on access tracks or in areas that do not require clearing (i.e. where there are no

trees). However, due to the limited road and track network on site, boreholes will be required in areas without existing tracks.

The size and type of drill pad will be subject to ground conditions (in particular the terrain). Ground surface levelling is generally required to achieve suitable gradients for a drill rig. Vegetation clearing will also be required where drill pads extend outside an existing track or a borehole is in a vegetated area. Construction of safety bunds will be required where equipment is in proximity to slopes, or where there is a plant/personnel interface.

Within the drill site, different levels of ground disturbance may be required. This ranges from grass or vegetation slashing, temporary placement of vehicles, water tanks or other stationary equipment on grass/vegetation, to scraping or removal of vegetation and the construction of access pads and tracks using compacted gravel material. Photo 1 shows a typical geotechnical drilling rig set up on cleared and relatively flat land.

The geotechnical boreholes will be drilled with track and/or truck mounted drilling rigs, depending on the individual borehole requirements and specific site constraints. All-terrain vehicles (ATV) or other vehicles that require a smaller disturbance footprint may also be used for drilling at some locations. Temporary casing may need to be installed progressively through the soil profile if collapsing soils are encountered. Where competent rock is encountered, geotechnical boreholes will be advanced using wireline diamond drilling techniques. If not previously installed, temporary casing will be installed before diamond drilling begins, which allows for the recirculation of drilling fluids. Where hole stability allows, geotechnical boreholes proposed to be used for groundwater monitoring will be drilled using the air rotary method. All groundwater monitoring bores will be developed in accordance with the Minimum Construction Requirements for Water Bores in Australia (National Uniform Drillers Licensing Committee, 2020).

Drilling fluids (comprising water and biodegradable liquid polymers) are required throughout the drilling to aid in flushing cuttings from the hole, lubricating/cooling the drill bit, and stabilising the borehole walls. Water is anticipated to be sourced from the upper reaches of Lake Borumba (Yabba Creek arm) and pumped into holding tanks along Walkers Top Road for access during drilling (refer to Section 2.6.1). Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may enter a waterway, consistent with the mitigation measures described in Section 6.

The time required to complete each borehole (i.e. including mobilisation, set up, drilling, roster breaks, pack up, demobilisation) will depend on the target depth, in-situ testing required, and subsurface conditions encountered. An estimated productivity of between 8 m and 12 m drilled per working day has been assumed (excluding roster breaks, mobilisation etc.). For the deep boreholes, the duration of drilling and testing is expected to range from 75 to 110 days. The in-situ testing duration for shallower boreholes is likely to be around 18 days.

One drill rig will operate in an investigation area at a time, with up to an estimated 11 rigs operating in different areas at the same time across the broader Project area. Each rig will complete one borehole before moving to the next borehole. After drilling is complete, boreholes will be left open until all required downhole geophysical surveys and in-situ testing have been undertaken. Boreholes will then be either filled with cement grout or, where suitable, converted to enable groundwater monitoring. At these bores, groundwater monitoring instruments will be installed and secured with either a lockable steel monument, or a road box gatic cover. At the completion of the works, all drilling pads that are not located on access tracks will be stabilised and where required rehabilitated.

Table 6: Borehole categories and proposed associated works

	Borehole category			
	On track	**Off track – flat / near flat**	**Off track – moderate slope**	**Off track – steeply sloped**
Location	Boreholes located on an existing track. This may be a main track such as Walkers Top Road or a smaller, less used track. The nature of the track will determine the exact location of the borehole. The location will be micro-sited to avoid specific track features or adjacent trees.	Boreholes located off track on flat or near flat areas.	Boreholes located off track on moderate slopes. Most boreholes are expected to be in this category.	Boreholes located off track on steeply sloped surfaces or in areas where tracked equipment is either at or beyond operating limits in dry conditions.
Access	No new tracks are required to access the borehole. All vehicle access will be along the existing roads and tracks.	A new track will be constructed from the closest existing track to the borehole.	A new track will be constructed from the closest existing track to the borehole. For safe access, the tracks must meet specified design requirements for the slope, stability and surface type. Tracks are to be suitable for the type of equipment being used to carry out the geotechnical investigation, e.g. wheeled or tracked equipment.	Access will be via sled/rail, controlled lower, staircase or scaffolding (e.g. Photo 2). Where the expected rock type and/or drill depth require more powerful drilling equipment sled/rail access may be the only viable option.
Drill pad	Little to no works will be required to establish a drill pad on main tracks. If required, track mats may be used to avoid damage to the track surface. On smaller, less used tracks, gravel material will be placed and compacted to fill any uneven terrain.	Dependent on the ground conditions. On hard/rocky surfaces, grass or low growing vegetation will be trimmed for access around the drill rig. Soft surfaces may be covered with a thin layer of gravel material to ensure safe access. If soft material exceeds the founding requirements of the drill rig, the vegetation and topsoil will be removed and replaced with a layer of compacted gravel material.	Where the slope exceeds the drill rig specifications, a level drill pad will be constructed by placing and compacting multiple layers of gravel material. The drill pad will be kept as small as reasonably practical to perform the works.	A temporary platform will be constructed. This may be through compacted gravel material, “in cut” on the natural ground, or installing anchored scaffolding platforms capable of taking the weight of the drill rig, materials and personnel.

	Borehole category			
	On track	**Off track – flat / near flat**	**Off track – moderate slope**	**Off track – steeply sloped**
Drill site	The drill site will be temporarily fenced and signposted. Clean water (non-potable) will be stored in tanks at the site and refilled as required. All drilling fluids will be collected and stored in enclosed tanks for appropriate disposal. Environmental controls will be setup within the fencing where possible. Additional controls may be required outside the fenced area.	The drill site will be kept as small as possible and incorporate the new access track as far as reasonably practical. Temporary fencing, water and fluid storage and environmental controls will be as per on track sites.	The drill site will be kept as small as possible, with only necessary equipment and materials stored on site. Materials will be transported as required. If necessary, due to access, water storage tanks may be set up in an easily accessible area, with water pumped or gravity fed to the drill site using polyethylene pipe run along the ground. Drilling fluids will be collected from the drill site and stored at a central, easily accessible location until collection for appropriate disposal. Suitable environmental controls will be implemented for the slope and expected higher runoff velocity.	Safety handrails or fall protection will be used at the site instead of temporary fencing. Clean water (non-potable) will be stored in tanks, located along the upper access track which services the geotechnical sleds. Polyethylene pipes will be run along the sled track, providing water to the drilling operations. Alternate access considerations to manage water provision and collections includes use of staircase, scaffolding and ropes. The most suitable options will be based on the site data and level of risk. Drilling fluids will be collected from the drill site, transported to the upper access track via the sled, and stored at a central, easily accessible location until collection for appropriate disposal.

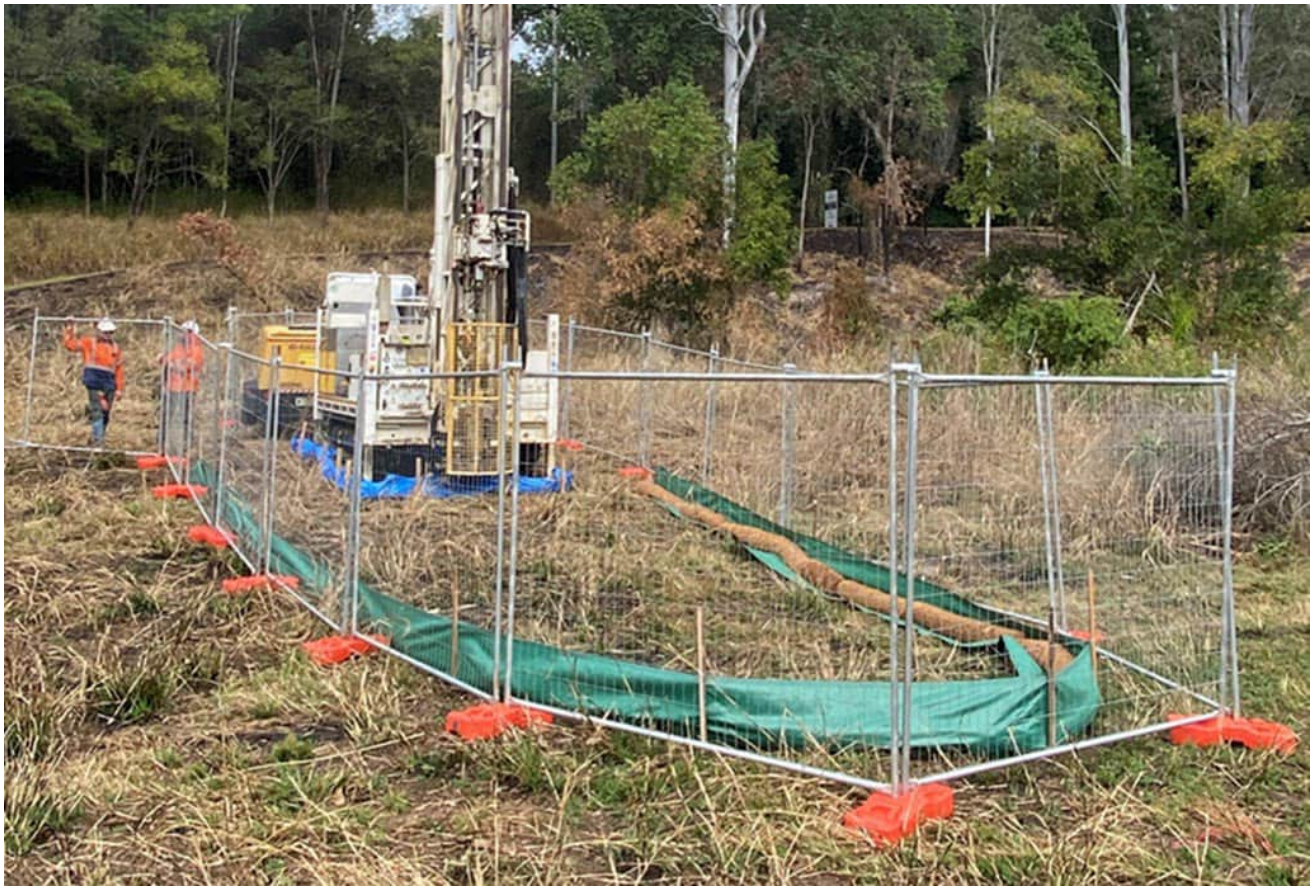


Photo 1: Typical geotechnical drilling rig set up on cleared and relatively flat land



Photo 2: Geotechnical drilling sled track and scaffolding

2.3.1.2 Test pits

Test pits will be established to investigate near surface geological conditions, particularly soil and rock composition, strength, weathering and excitability. Typically, test pits will be located along existing access tracks or new access tracks constructed as part of the borehole drilling works.

The disturbance footprint of the test pits will include an approximately 1 m wide by 4-5 m long test pit, where the topsoil will physically be removed. Some benching to maintain safety excavation entry practices may expand the width of some test pits up to approximately 3 m. Where possible, the excavated material will be stockpiled on the access track to avoid additional disturbance. The stockpile area would be approximately 5 m x 5 m. The surface underneath the stockpile will be disturbed during the backfill operation (material would be scooped up from the surface). If the excavator or backhoe cannot be parked on the access track, an additional disturbance footprint of approximately 3 m x 6 m may be required. The typical maximum disturbance area for all activities associated with establishing a single test pit is 58 m^2. Photo 4 shows an example of test pit excavation. Parking will preferentially be in an area that does not require clearing, but vegetation trimming may be necessary to ensure safe access (e.g. Photo 3).

It is anticipated that test pits will be excavated using a tracked excavator or rubber-tyred backhoe fitted with a standard, general purpose toothed bucket. A ripping tyne attachment may be required where rock or hard strata is encountered. Test pits will be excavated to refusal, limit of practical excavator reach, significant water ingress, or collapse of the excavation walls. Each excavator will complete one test pit before shifting to the next. It is assumed that each test pit will take approximately three hours to complete, including backfilling of the pit.

The depth of excavation will generally be restricted to 3 m to 5 m depending on the type and size of the plant used for excavation. The excavated material will be placed adjacent to the excavation, as long as it does not compromise the stability of the excavation, with rough separation of stockpiles based on the depth of removal. Any topsoil layers (if present) will be kept separate to allow this material to be placed at surface to encourage vegetation regrowth.

Dynamic Cone Penetrometer (DCP) testing will be undertaken adjacent to each test pit to aid in assessment of the consistency and relative density of the subsurface materials. DCP testing will be conducted to a maximum probably depth of 3 m, or to prior refusal.

Test pits will be backfilled as soon as possible in compacted layers, with the excavated spoil placed in reverse order to match the in-situ strata as best as practicable.



Photo 3: Example of preferred parking location



Photo 4: Example of test pit excavation

2.3.1.3 Geophysics

Geophysical surveys may be used in areas with challenging terrain to assess subsurface properties in a way that minimises environmental impact. The techniques involve the use of portable equipment and non-invasive probing, suitable for sensitive areas and are highly adaptable.

Geophysical survey lines are commonly used to map the depth to bedrock and inform material properties of the subsurface materials. Survey lines include but are not limited to the use of seismic and electromagnetic energy sources. On land, the survey line is developed using geophones installed in an array along a predefined profile. The geophones are inserted into the ground by a few centimetres (similar to a tent peg) and record the response from the energy source. The array typically comprises a cable with connected geophones (nominally spaced every 2-5 m, with a spike that is approximately 10 cm long and up to 2 cm in diameter), laptop and tools to read the response (e.g. a seismograph for seismic surveys), and the energy signal source. This method does not involve significant disturbance or excavation of the ground beyond placement of the apparatus. The energy source is typically in the form of a sledgehammer, with a sound exposure level of approximately 110 db at distance of 1 m. Similarly geophysical surveys can be completed over water, using an airgun as the energy source (70 db output confined to area approximately 10 m from source).

Geophysical surveys involve pushing the geophones into the existing surface soil profile at regular and evenly spaced intervals (based on the cable spacing). Generally, a small area of bare earth will be cleared at each geophone location (approximately 0.3 m x 0.3 m). Surveys are then conducted by generating energy into the ground. For example, a seismic survey is conducted by generating a series of seismic events, produced by an acoustic source, which are commonly in 20 second bursts. Acoustic energy is imparted to the subsurface by means of a sledgehammer striking a metal plate (approximately 1 m x 1 m x 0.02 m). The test may be conducted by moving the source location along the geophone array, and some additional clearing may be required at each source location to ensure an uninterrupted contact between the steel plate and surface level. Seismic lines can typically be orientated to avoid established native shrubs and trees, as well as other site features.

Geophysical surveys are adopted to provide information on the subsurface where intrusive investigation is not possible (i.e. due to terrain) or to gap fill between intrusive investigations. Best results are provided when there are some intrusive investigations to provide data calibration, otherwise the results are indicative only and prone to misinterpretation.

2.3.1.4 Backpack drilling

Backpack drilling methods may be employed where further information is needed in areas assessed through seismic testing. It will complement the seismic data with information on subsurface conditions in challenging locations, where required.

Backpack drilling provides small core samples (generally ranging from 25-51 mm in diameter) from the subsurface and are designed to operate in constrained and challenging environments (e.g. steep, rugged, or densely vegetated areas). These rigs are lightweight and portable and capable of performing a range of drilling techniques, including direct push and rotary drilling. Where used, backpack drilling will be to a depth of up to 25 m.

2.3.1.5 Heli Drilling

Heli-drilling has been identified as a contingency drilling method, reserved for situations where access to critical locations cannot be achieved using the preferred methods. Heli-drilling will be employed only when other methods, (e.g. conventional drilling, backpack drilling, or access via specialised equipment) are not feasible due to the terrain or environmental constraints.

Heli-drilling would comprise the transfer of equipment to a geotechnical investigation site by helicopter from a landing area in an existing cleared location outside the EPBC Referral area (e.g. paddock). The equipment would be lowered to a pad within the nominated geotechnical disturbance area, without the helicopter landing.

2.3.2 Investigation areas

The anticipated locations of geotechnical investigations are primarily determined by the proposed locations of key infrastructure for the Project's Main Works. The key Main Works infrastructure requiring geotechnical investigations includes:

- Dams and reservoirs – investigations will be concentrated in areas critical to dam stability, particularly at the dam axis, abutments, and within the reservoir footprint, to identify potential geological weaknesses or irregularities that might affect dam construction and long-term performance.
- Portals – at tunnel portal (entrance) locations and near-surface tunnel alignments to assess rock quality, fault zones, and other structural features that could impact design and excavation.
- Engineered pads – at areas designated for heavy equipment and temporary facilities to assess underlying ground conditions and soil-rock profiles to inform construction methods.
- Quarries – to assess the continuity and quality of rock formations to inform the selection of material for construction.
- Roads - to identify potential geological hazards and determine the thickness of soil and rock layers.

The final location of each geotechnical investigation site will be determined in the field considering the ground conditions, ecological constraints and access, as well as initial testing data, and will avoid vegetation clearing wherever possible. Cultural heritage assessments will also inform the final ground disturbance locations.

During a pre-works site visit by the geotechnical contractor, ecologists and cultural heritage monitors, the clearing and earthworks extent will be pegged out, with micro-siting to avoid ecological or cultural heritage values where possible. A large portion of the Project area is open eucalypt woodland and clearing may be able to avoid large trees depending on the terrain and safety requirements (e.g. Figure 11). The clearing and earthworks extent will be uploaded to a GIS portal, including potential exclusion and buffer zones, for reference during works.

Before clearing, barricade fencing and signage will be installed. These will be removed along with any waste following the completion of the investigations. Vegetation and spoil will be stockpiled at the geotechnical investigation site or transported to the spoil disposal area. The sites will be stabilised and rehabilitated in accordance with any approval conditions or access permits (e.g. under conditions of permits that allow access to land in the resources reserve or state forest) and the rehabilitation strategy for the area.



Photo 5: Example of open eucalypt woodland and demarcation of a restricted area

2.3.2.1 Area 1 (Borumba Dam)

Geotechnical investigations (boreholes and test pits) are required downstream of the existing Borumba Dam wall and on the north and south sides of Yabba Creek (Figure 10). Some proposed geotechnical investigation sites are located in the Conondale Resources Reserve and are subject to permitting requirements under the *Nature Conservation Act 1992* (Qld) (NC Act). Approval under the *Forestry Act 1959* (Qld) is also required for investigation sites within Imbil State Forest.

The size of the disturbance area within the resources reserve is driven by the steep terrain in this location and the need to ensure sufficient spacing for the safe operation of the drilling activities. Geophysical surveys may also be undertaken due to the steep terrain.

Geotechnical investigations may also be undertaken within the footprint of other proposed infrastructure (e.g. access tracks).

2.3.2.2 Area 2 (Kingaham Creek)

Geotechnical investigations (boreholes) are required for a bridge crossing included in the Main Works design at Kingaham Creek, which is required to accommodate the increase in the Lake Borumba full supply level (FSL).

Geotechnical investigations may also be undertaken within the footprint of other proposed infrastructure (e.g. Kingaham Creek bypass).

2.3.2.3 Area 3 (Walkers Top)

Geotechnical investigations (boreholes and test pits) are required at the proposed locations of the following key Main Works infrastructure:

- potential powerhouse cavern locations, and the upper reservoir main dam and associated saddle dams, which are located near Power Track and Dam Track, and in the Walkers Top area (Figure 11)
- intake / outlet location for water tunnels, which is located at the Lake Borumba water line (Figure 11)
- bridge crossings required for the Main Works at Yabba Creek, which are required to accommodate the increase in the Lake Borumba FSL (Figure 8).

The total number and final location of investigation sites will be dependent on the findings of the initial drilling, as well as safety considerations and micro-siting to avoid environmental impact. Wherever possible, the disturbance

areas for geotechnical investigation sites will be minimised by co-locating pads with existing or proposed new tracks and/or drilling multiple boreholes from the same drill pad.

Due to the steep terrain and presence of sensitive environmental and cultural heritage values, it is proposed that the footprint in the following areas be considered indicative and able to be adjusted as needed within the nominated Project area:

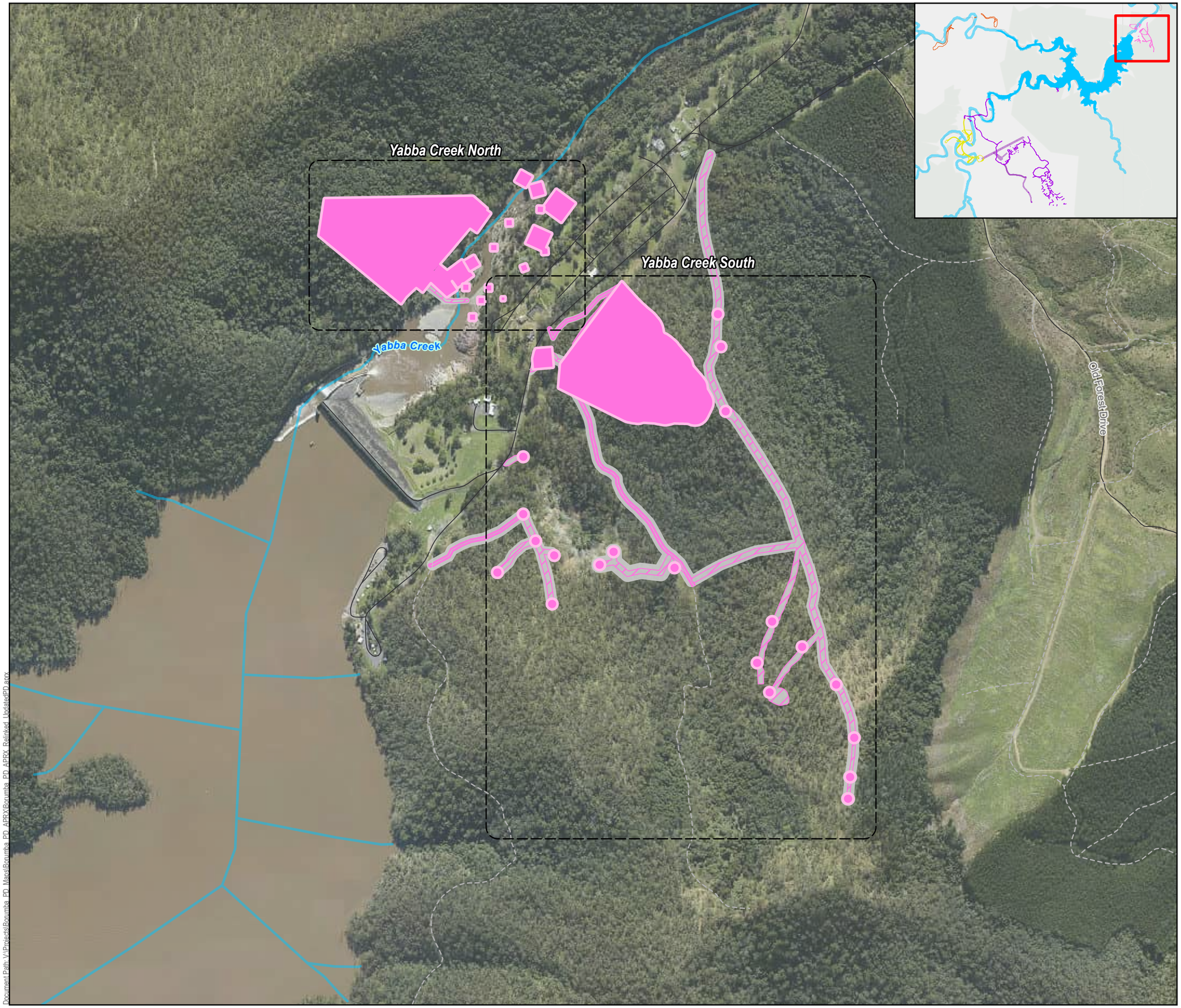
- intake / outlet location – maximum disturbance of 3.5 ha for geotechnical investigations and associated access tracks within the Project area defined in Figure 11c.
- upper reservoir main saddle dam – maximum disturbance of 10 ha for geotechnical investigations and associated access tracks within the Project area defined in Figure 11b.

Note that these disturbance allowances are greater than the current footprint area, but are not proposed as an increase to the overall disturbance for the Project, with the additional area only disturbed if there is a reduction in impact to the same MNES habitat at another Project location.

Geophysical surveys are proposed at the Lake Borumba waterline in addition to geotechnical drilling due to the difficult terrain and minimise disturbance to the lake environment.

2.3.2.4 Geotechnical investigations may also be undertaken within the footprint of other proposed infrastructure (e.g. access tracks).Area 4 (Borgan)

Geotechnical investigations in Area 4 are excluded from the action or will be within the footprint of other proposed infrastructure (refer to Section 1.4.1.2 and Section 2.1).



Queensland Hydro

GDA2020 MGA Zone 56

0 50 100 200 200 300 m

1:7,000 (when printed @ A3)

LEGEND

- Watercourses
- Local Roads
- Tracks

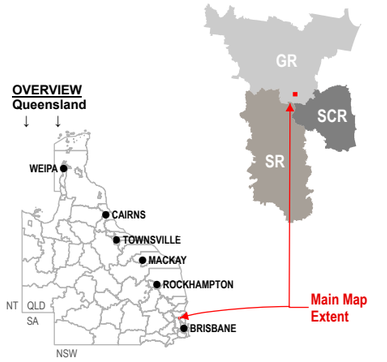
Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 1 - Geotechnical Investigations
- Area 1 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
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Exploratory Works Project
Preliminary Documentation

ANTICIPATED GEOTECHNICAL INVESTIGATION SITES IN AREA 1 (BORUMBA DAM)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 10a

Document Path: V:\Projects\Borumba_PD_Mapsl\Borumba_PD_APRX\Borumba_PD_APRX_Relinked_Updated\PD.aprx



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- Local Roads
- Tracks

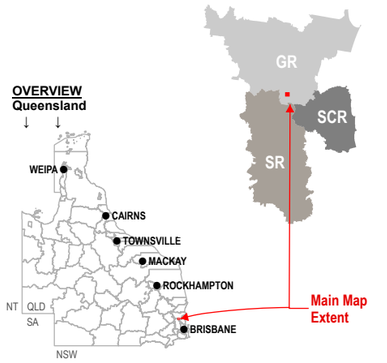
Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 2 - Geotechnical Investigations
- Area 2 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
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Exploratory Works Project
Preliminary Documentation

ANTICIPATED GEOTECHNICAL INVESTIGATION SITES IN AREA 2 (KINGAHAM CREEK)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 10b

Document Path: V:\Projects\Boruma_PD_Maps\Boruma_PD_APRX\Boruma_PD_APRX_Relinked_UpdatedPD.aprx

Yabba Creek

Walkers Top north

Power Track north

Dam Track north

Dam Track south

Yabba Creek

Sandy Creek

Queensland Hydro

GDA2020 MGA Zone 56

0 60 100 200 200 300 m

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LEGEND

- Watercourses
- Tracks

Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 3 - Geotechnical Investigations
- Area 3 - Other Activities
- Area 4 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional

OVERVIEW
Queensland

WEIPA
CAIRNS
TOWNSVILLE
MACKAY
ROCKHAMPTON
BRISBANE
NT
QLD
SA
NSW
GR
SCR
SR
Main Map Extent

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Exploratory Works Project
Preliminary Documentation

ANTICIPATED GEOTECHNICAL INVESTIGATION SITES IN AREA 3 (WALKERS TOP)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 11a

Document Path: V:\Projects\Boomba_PD_Mans\Boomba_PD_APRX\Boomba_PD_APRX_Relinked_UpdatedPD.aprx

Walkers Top central

Walkers Top south

Walkers Top Road

Queensland Hydro

GDA2020 MGA Zone 56

N

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LEGEND

- Local Roads
- Tracks

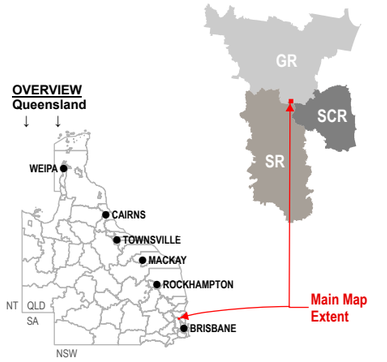
Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 3 - Geotechnical Investigations
- Area 3 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



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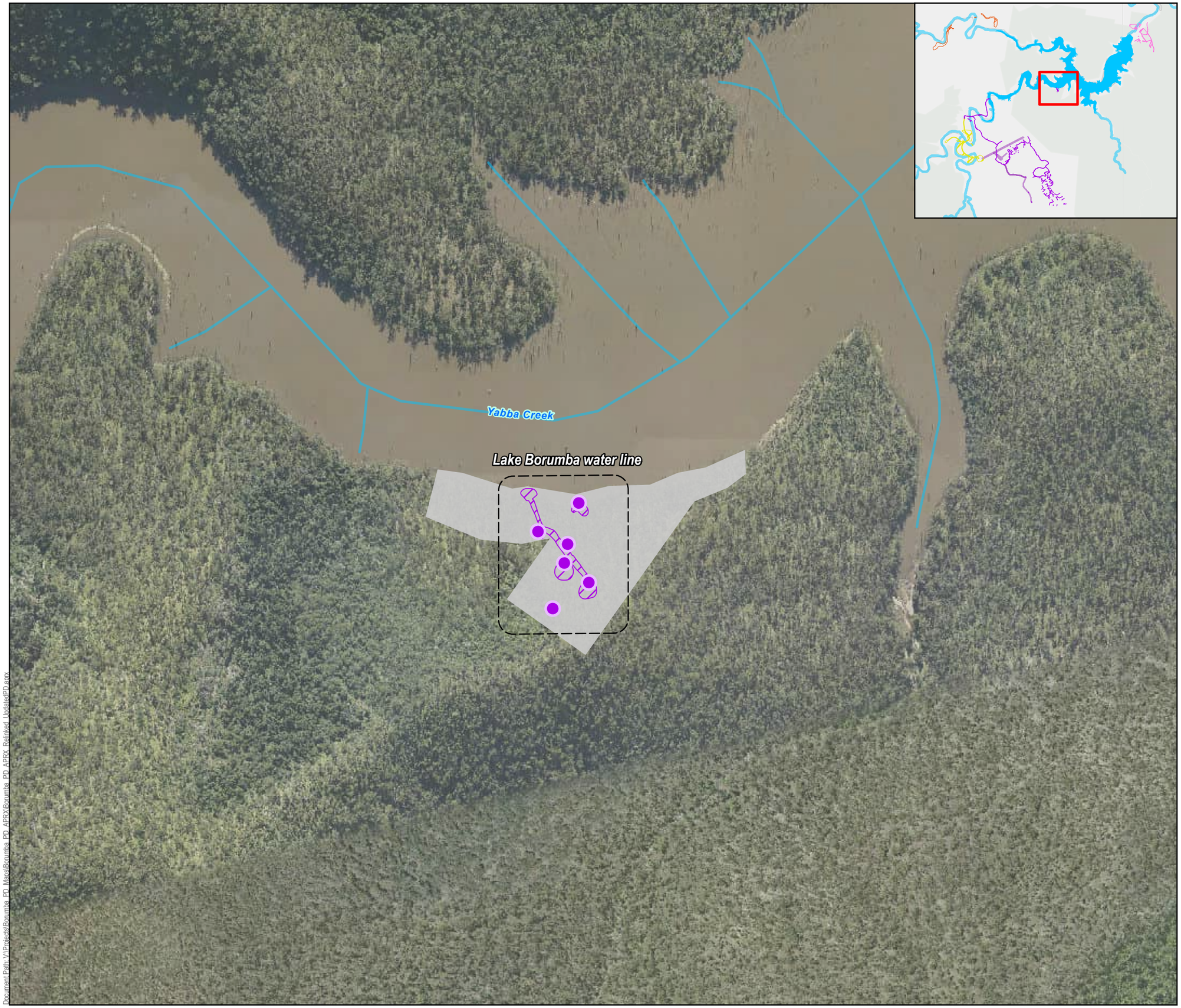
Exploratory Works Project
Preliminary Documentation

ANTICIPATED GEOTECHNICAL INVESTIGATION SITES IN AREA 3 (WALKERS TOP)

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CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 11b

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Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

Watercourses

Exploratory Works Project

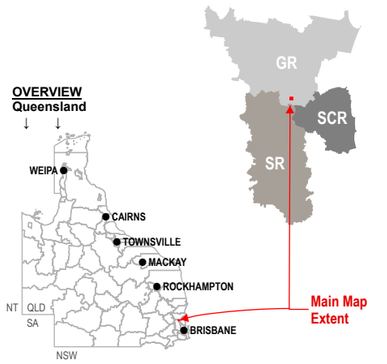
Project Area

Project Footprint by Work Area

Area 3 - Geotechnical Investigations

Area 3 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



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Exploratory Works Project
Preliminary Documentation

ANTICIPATED GEOTECHNICAL INVESTIGATION SITES IN AREA 3 (WALKERS TOP)

PROJECT #:	30032677/30032772
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FIGURE 11c

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2.4 Spoil disposal

A description of the proposed approach to spoil disposal for the Project is provided below. Changes to the proposed approach may be considered provided they do not change the impact of the works.

2.4.1 Area 4 (Borgan)

A tunnel spoil disposal area is proposed to be located on Lot 1723L37994 owned by Queensland Hydro, east of Borgan Road and south of the Yabba Creek and Sandy Creek confluence, as shown in Figure 12. The spoil disposal area is positioned close to the tunnel, increasing operational efficiencies, and the access track has been aligned to minimise vegetation clearing and avoid the need for a large hillside cutting.

The tunnel spoil disposal area will be sized to allow for:

- stockpiling of:
  - topsoil stripped from the disposal area footprint and left on site for future rehabilitation of the area
  - approximately 395,000 cubic metres (m^3) of excavated waste rock material (500 mm minus material) expected to be generated from the exploratory tunnel excavation that cannot be reused onsite (e.g. in proposed rehabilitation works such as reprofiling)
- water management (e.g. sediment basins, water treatment plant) and vehicle washdown and hardstand areas.

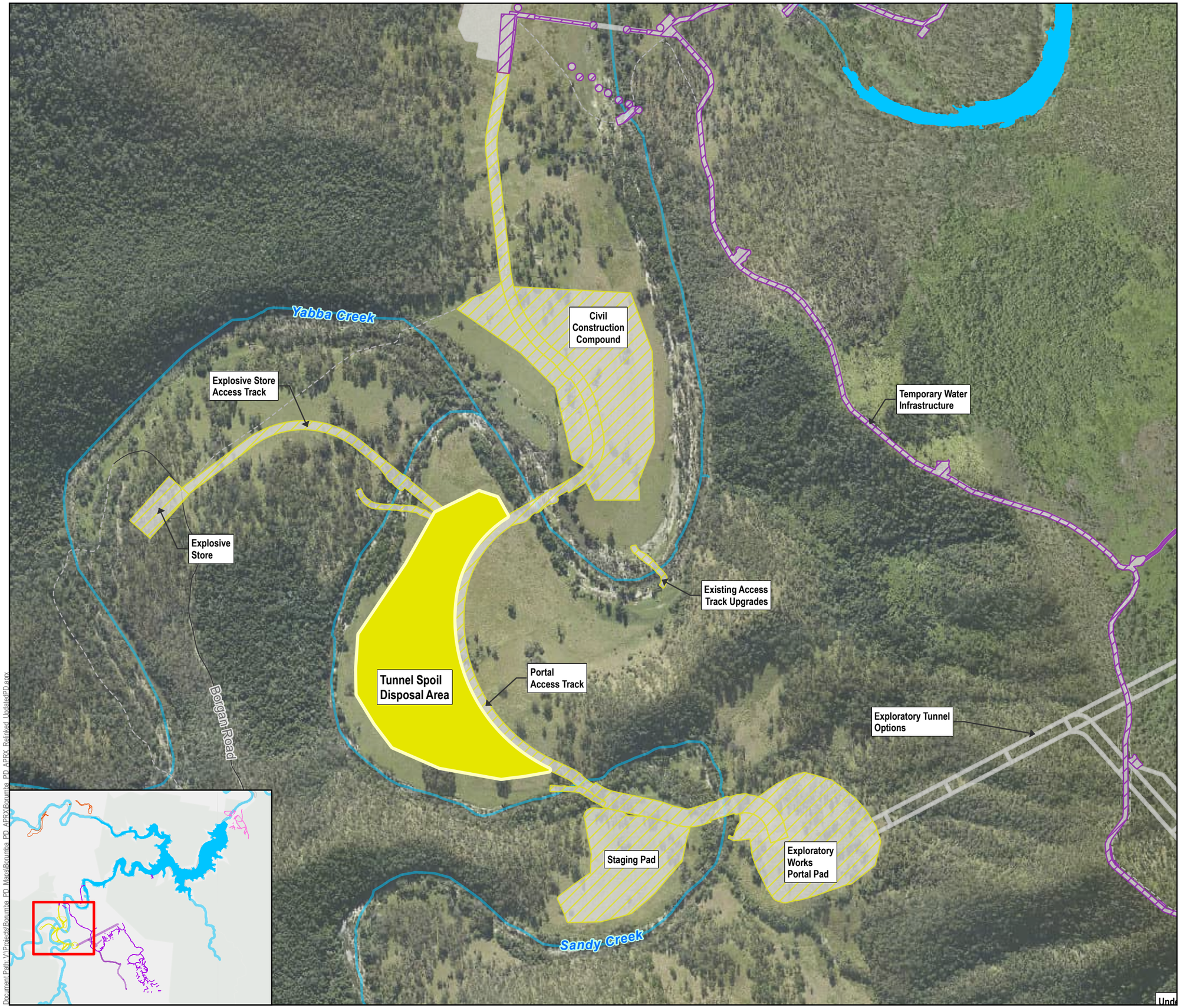
The volume of material will be confirmed during geotechnical investigations and tunnelling, including the volume of material that is considered to be spoil, with the stockpile area developed gradually from south to north as works on the exploratory tunnels progress.

The tunnel spoil disposal area is of sufficient size to allow for material to be segregated for contamination testing before being placed in the stockpiles. There is also an area set aside for the segregation of potential acid rock spoil. The spoil stockpile has been designed to allow a 50 m buffer to the riparian zone of Yabba Creek and Sandy Creek and is proposed to be lined with a Bentofix NSP 4900 or equivalent below a geogrid layer.

The proposed design of the stockpile is to a height of 5 m, with a maximum height of 7 m possible with appropriate management measures (e.g. stabilisation, water management). While not expected, a maximum height of 7 m would allow the tunnel spoil area to accommodate up to 160,000 m^3 of additional excess spoil if required.

Temporary stormwater management and erosion and sediment control will adhere to IECA best practice and be certified by an appropriately qualified Certified Professional in Erosion and Sediment Control. A longitudinal cut-off drain will be installed to minimise surface water runoff and erosion on the portal access track, which is adjacent to the tunnel spoil area. Internal drainage channels will flow directly to lined basins with secondary drains outside the spoil area confinement bunds. Water from the spoil pads will be directed to pump wells for pumping to the water treatment plant. An evaporation basin and an evaporator system may be established to support the management of runoff from the stockpile via erosion and sediment controls.

Consideration was given to the off-site disposal of spoil from the exploratory tunnel excavation. However, based on the volume of spoil and the transport vehicles required, it was determined that significant upgrades to Bella Creek Road beyond those identified in this documentation would be required to allow for off-site disposal. These upgrades would have included road widening and clearing vegetation that includes an EPBC Act listed threatened ecological community (TEC) (the endangered Subtropical Eucalypt Floodplain Forest and Woodland) as well as additional waterway crossing upgrades. Based on the extent of the works that would be required to Bella Creek Road to support off-site spoil disposal, on-site spoil disposal was identified as the preferred option.



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

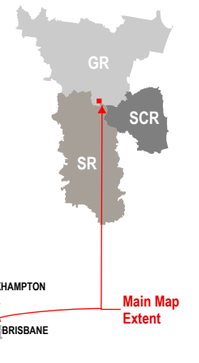
Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 3 - Other Activities
- Area 4 - Tunnel Spoil Disposal Area
- Area 4 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
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Exploratory Works Project
Preliminary Documentation

TUNNEL SPOIL DISPOSAL AREA (AREA 4 - BORGAN)

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CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 12

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2.4.1.1 Construction

The spoil disposal area will be prepared to receive spoil material by performing ground clearance work and minor ground levelling earthworks at the area, including the removal of a small number of trees. Bulk earthworks to accommodate movement of spoil from source location to the spoil management area will occur predominately during standard construction hours over a seven-day work week.

Topsoil will be progressively stripped from the area and stockpiled in a long narrow windrow along the spoil disposal area's western edge, creating a bund to contain future blasted rock material. The topsoil will be reused in covering and revegetating the finished spoil stockpile. Vegetation will also be stripped and stockpiled in the spoil disposal area for future use, though it is likely most material will be disposed of in accordance with the *Biosecurity Act 2014* (Qld) due to the prevalence of giant rat's tail grass (*Sporobolus pyramidalis*) in the spoil disposal area.

There are no waterways or drainage lines within the proposed spoil disposal area. To mitigate sediment transfer in runoff, erosion and sediment controls will be implemented to ensure that spoil placed in the disposal area remains within its required bounds and does not impact Sandy Creek or Yabba Creek. The stockpile:

- will be managed using a south to north progression method
- will be placed in accordance with Australian Standards and relevant engineering guidelines
- is proposed to be lined with a geogrid layer.

The spoil slopes will be battered and revegetated to minimise erosion or sediment transfer. Other additional measures may include sediment fencing, coir logs, catch drains, and rock check dams. Other mitigation measures proposed to manage spoil are described in Section 6.2.8 and Section 6.2.9.

2.4.1.2 Operation

Initially, the spoil disposal area will be accessed to stockpile topsoil. The spoil disposal area will then be used to stockpile blasted rock removed from the exploratory tunnel. Tunnel excavation works, including supporting activities such as spoil placement, are proposed to occur 24 hours a day, 7 days a week. The spoil stockpile will be progressively installed as the exploratory tunnelling progresses, with testing and management as follows:

- forward probing will be undertaken during tunnelling with cores extracted for geotechnical testing before blasting to enable avoidance of acid-forming rock
- stockpile material will be spot tested for acid sulphate soil (ASS), potential acid sulphate soil (PASS), potential acid forming rock, and contaminants (refer to the Spoil Management Plan attached to Appendix F)
- material found to contain contaminants will be treated appropriately for reuse, remediated and/or managed onsite or removed offsite and taken to a licensed facility for disposal
- material found to be free of contaminants will be combined into the main spoil stockpile
- the material within the stockpile may be processed (crushed) and used for sheeting of access tracks around the site or used in rehabilitation activities
- as material within the stockpile reaches the designed stockpile height, that area of the stockpile will be profiled and covered (e.g. topsoil and seeded with an approved grass seed) to mitigate dust pollution and runoff.

The stockpile design maximum height is 7 m, noting that the spoil stockpile formation will be set to ensure the completed stockpile is integrated as far as possible into the existing natural surface contours.

Initial investigations suggest that the particle size distribution of the spoil material would be reasonably uniform and range from fines/silt sized particles to 500 mm size rocks, but this is subject to ongoing assessment.

2.4.1.3 Decommissioning

Should the Main Works Project not proceed, the revegetated stockpile up to 7 m high will be left in place. The spoil material will be shaped to blend into the natural contours of the surrounding land, vegetated and mitigation measures implemented to limit impacts to existing drainage features. Queensland Hydro may also remove the spoil from the spoil disposal area to an area outside of the floodplain, or potentially pursue commercial sale of the material.

If the Main Works Project proceeds, the material within the stockpile will be assessed and, if suitable, reused. For example, the material may be processed (crushed) for sheeting of access tracks around the site. Any remaining spoil within the disposal area would be inundated by the reservoir after the new Borumba Dam wall is constructed.

2.4.2 Area 2 (Kingaham Creek)

A second spoil disposal area is proposed to be located on Lot 1RP98849 owned by the Queensland Department of Local Government, Water, and Volunteers (DLGWV), off Bella Creek Road, as shown in Figure 13. This spoil area is positioned close to the proposed Kingaham Creek bypass, to increase operational efficiencies and avoid the need for laden vehicles to travel through the switchback on Borgan Road. The access track is aligned to reduce the extent of vegetation clearing.

The Kingaham spoil disposal area will be approximately 200 m by 40 m to allow for the disposal of an estimated 95,000 m^3 of material generated from the construction of the Kingaham Creek bypass that cannot be reused onsite. The material placed in this area would be:

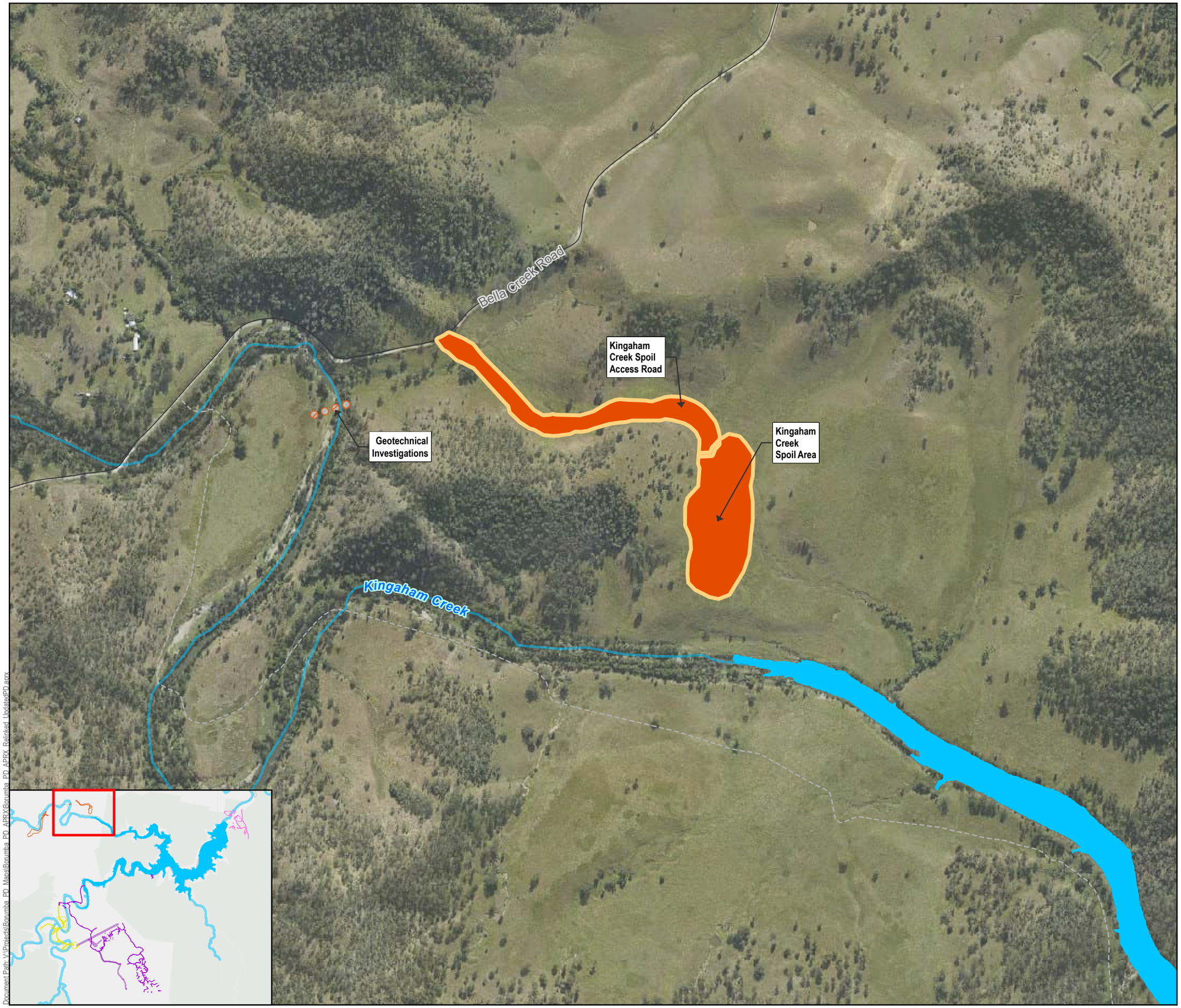
- general soil excavated from the Kingaham Creek bypass
- rock excavation from the Kingaham Creek bypass.

The spoil area is of sufficient size to allow for material to be segregated for contamination testing before being placed in the stockpiles and is proposed to be lined with a geogrid layer. The spoil stockpile has been located to allow a minimum 50 m buffer to the riparian zone of Kingaham Creek and is above the 1% (Annual Exceedance Probability (AEP)).

The estimated surface bulk earthworks material quantities are:

- total excavation – 435,000 m^3
- total fill – 340,000 m^3, comprising:
  - general fill – 300,000 m^3 (including for the civil construction compound)
  - material processed to produce road base – 15,000 m^3
  - topsoil to be respread – 25,000 m^3
- surplus material to be placed in stockpile – 95,000 m^3 (generated by the construction of the Kingaham Creek bypass).

The current design of the stockpile is to a height of 5 m, with a maximum height of 7 m possible with appropriate management measures (e.g. stabilisation, water management). There is capacity for additional materials not identified in the above to be incorporated as fill into the pad for the civil construction compound (Section 2.6.2). If needed, a further 200,000 m^3 can be placed in this pad, as the design footprint is larger than is currently required and the height of the pad can be adjusted.



Queensland Hydro

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LEGEND

- Watercourses
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 2 - Kingaham Creek Spoil Area and Access Road
- Area 2 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional

OVERVIEW
Queensland



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Exploratory Works Project
Preliminary Documentation

KINGAHAM SPOIL DISPOSAL AREA (AREA 2 - KINGAHAM CREEK)

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CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 13

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2.4.2.1 Construction

The spoil stockpile site will be prepared to receive spoil material by performing ground clearance work, minor ground levelling earthworks at the area, including the removal of a small number of trees.

Topsoil will be progressively stripped from the site footprint and stockpiled in a long narrow windrow along the spoil site's eastern and southern edge, creating a bund to contain future blasted rock material. The topsoil will be reused in covering and revegetating the finished spoil stockpile. Vegetation will also be stripped and stockpiled in the spoil disposal area for future use unless there is a biosecurity concern due to the presence of weeds.

The Kingaham Creek spoil access track is approximately 0.72 km in length and connects the Kingaham Creek spoil disposal area to the existing Bella Creek Road.

There are no waterways or drainage lines in the proposed spoil area, although a drainage line runs parallel to the spoil disposal area along the eastern side. Erosion and sediment controls will be implemented to ensure that spoil placed in the area remains within its required bounds and does not enter Kingaham Creek via runoff. The spoil slopes will be battered and revegetated to minimise erosion or sediment transfer. Other additional measures may include sediment fencing, coir logs, catch drains, and rock check dams. Other mitigation measures proposed to manage spoil are described in Section 6.2.8 and Section 6.2.9.

2.4.2.2 Operation

Initially, the spoil area will be accessed to stockpile topsoil. The spoil area will then be progressively installed as the construction of the road realignment progresses. The timing of construction and operation for the Kingaham Creek spoil area is summarised in Table 4.

The stockpile design maximum height is 7 m, noting that the spoil stockpile formation will be set to ensure the completed stockpile is integrated as far as possible into the existing natural surface contours.

2.4.2.3 Decommissioning

Should the Main Works Project not proceed, the revegetated stockpile will be left in place. The spoil material will be shaped to blend into the natural contours of the surrounding land, vegetated, and kept away from existing drainage features. Queensland Hydro may also remove the spoil from the spoil disposal area or potentially pursue commercial sale of the material.

If the Main Works Project proceeds, the material within the stockpile will be assessed and, if suitable, reused. For example, the material may be processed (crushed) for sheeting of access tracks around the site. Any remaining spoil within the disposal area would be inundated by the reservoir after the new Borumba Dam wall is constructed.

2.5 Site access

A description of the proposed approach to and methods for site access for the Project is provided in the sections below. Changes to the proposed approach or methods may be considered provided they do not change the impact of the works.

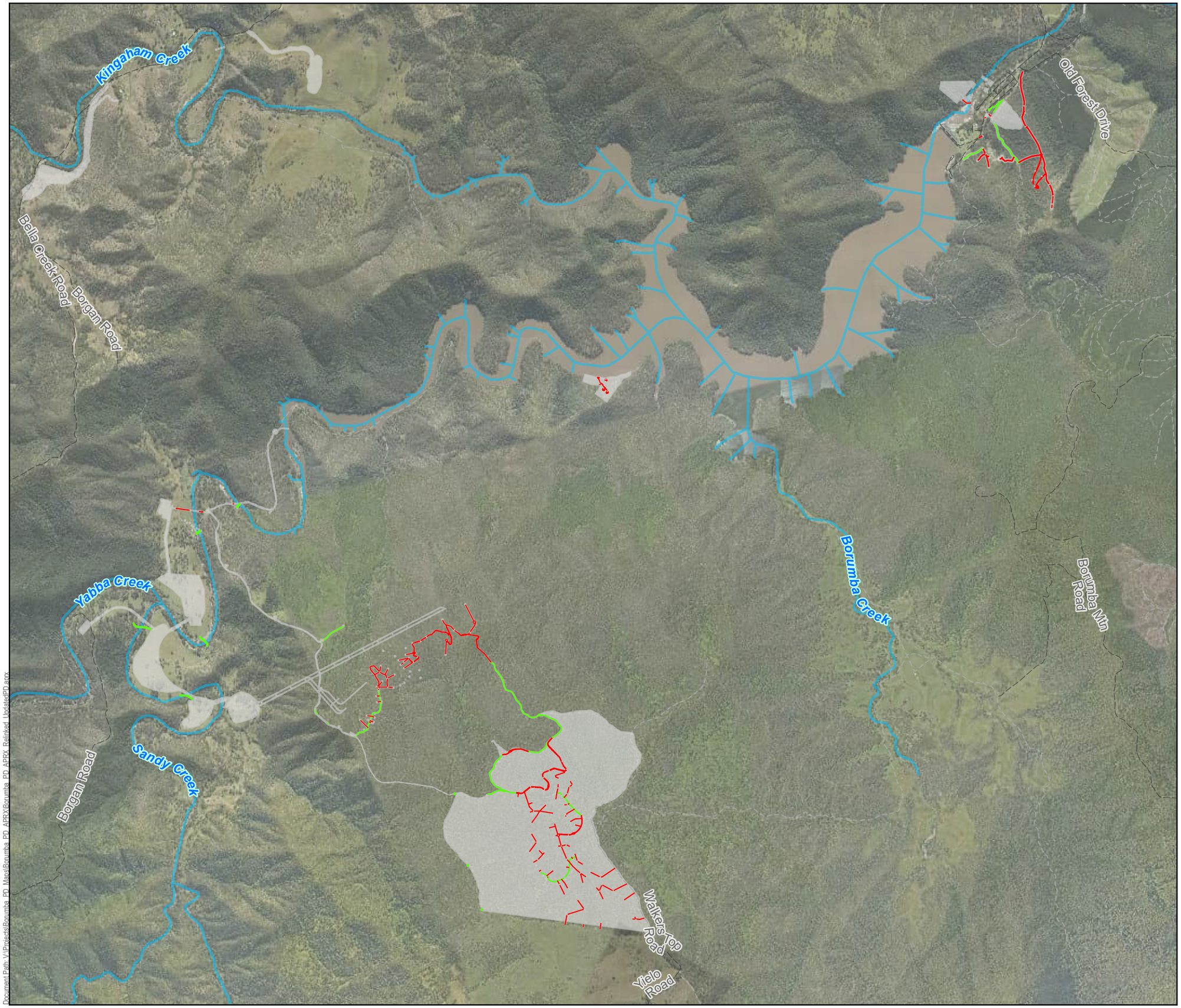
2.5.1 Areas 1 and 3 (Borumba Dam and Walkers Top)

A range of mostly temporary tracks are required to facilitate access for the geotechnical investigations (Figure 14). Works required to establish the tracks are described in the sections below. Most works are on Queensland Hydro land, with some also in Imbil State Forest and Conondale Resources Reserve.

Pre-clearance surveys by ecologists and cultural heritage monitors will be undertaken in consultation with the civil contractor to mark out the clearing extent, including micro-siting to avoid ecological or cultural heritage values. This extent will be uploaded to GIS and captured in construction drawings, including potential restricted areas.

If the Main Works Project does not proceed, most access tracks will be decommissioned and rehabilitated. Tracks that were installed before the Project will remain to provide access to the areas.

Access tracks will be subject to maintenance during the Exploratory Works.



Queensland Hydro

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

- Project Area

Project Footprint – Access Tracks

- Existing Tracks Upgrades
- New Access Tracks

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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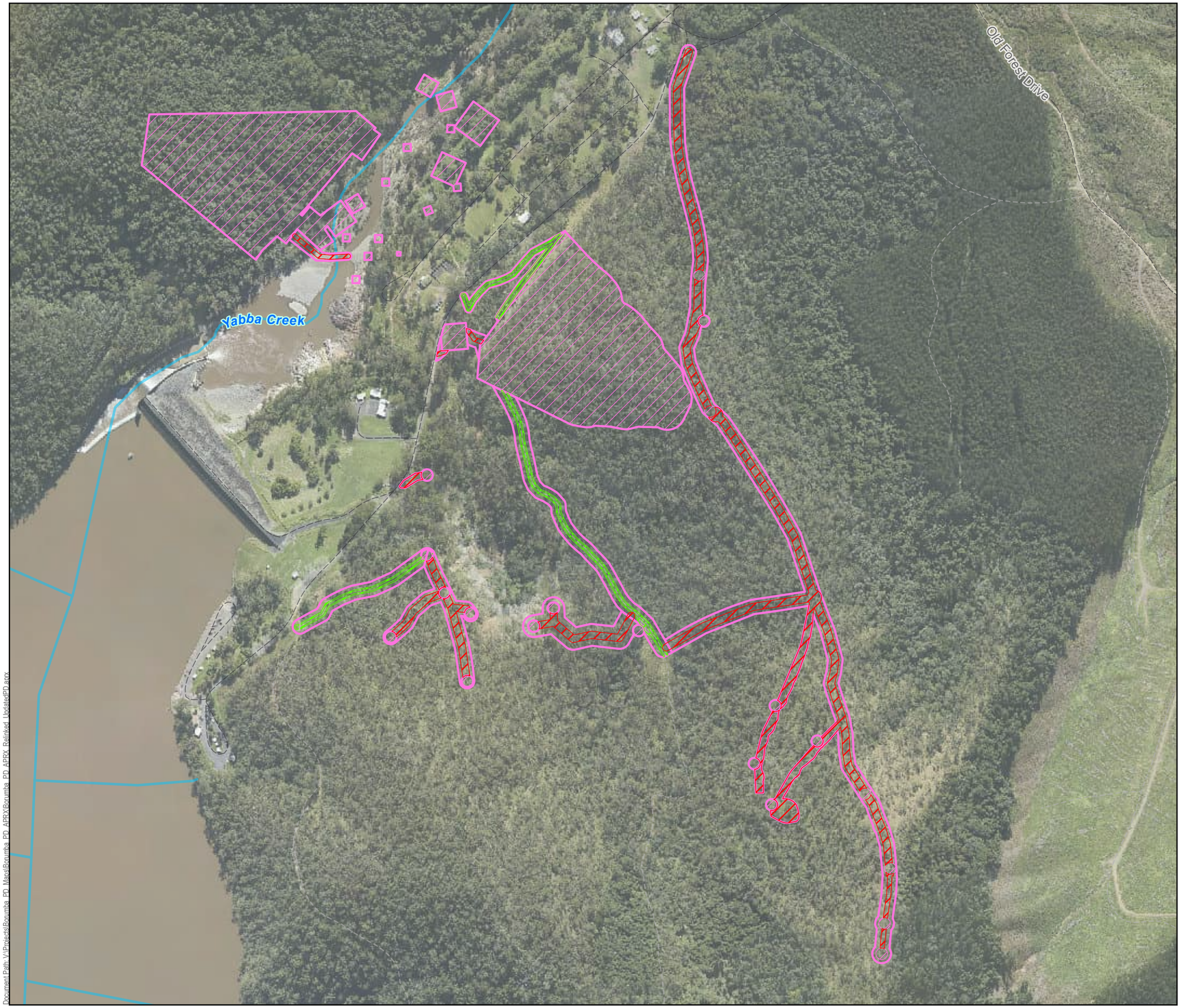
Exploratory Works Project
Preliminary Documentation

INDICATIVE ACCESS TRACKS OVERVIEW

PROJECT #:	30032677/30032772
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FIGURE 14a

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Queensland Hydro

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

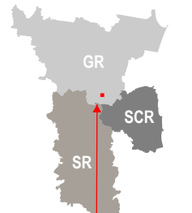
Project Footprint by Work Area

- Area 1 - Existing Tracks to be Upgraded
- Area 1 - New Tracks
- Area 1 - Other Activity

Project Area by Work Area

- Area 1 - Borumba Dam

OVERVIEW
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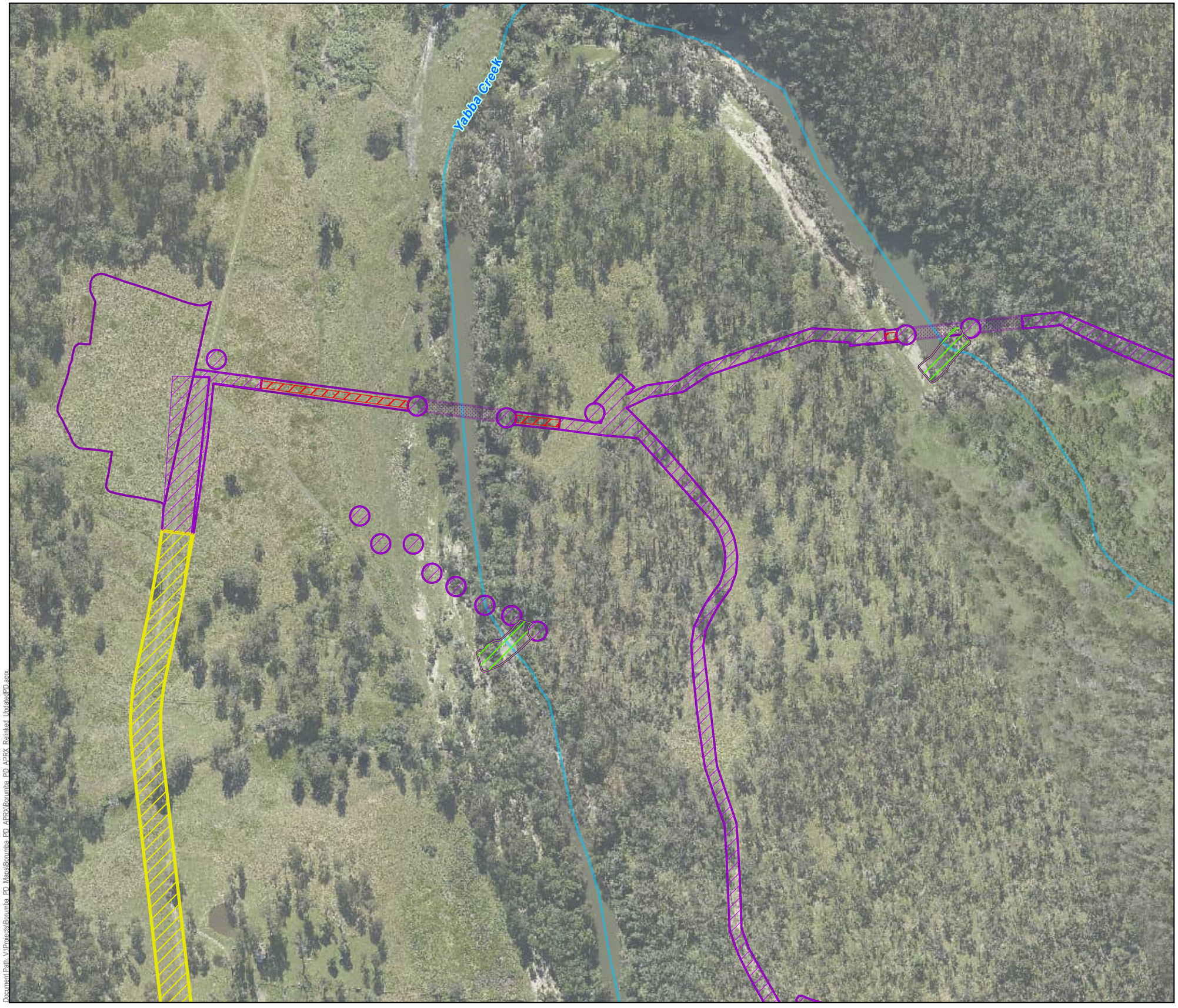
Exploratory Works Project
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INDICATIVE ACCESS TRACKS AREA 1 - BORUMBA DAM

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FIGURE 14b

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

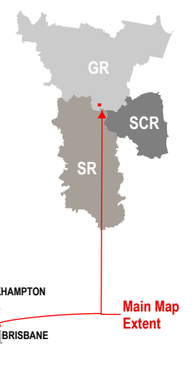
Project Footprint by Work Area

- Area 3 - Existing Tracks to be Upgraded
- Area 3 - New Tracks
- Area 3 - Other Activity
- Area 4 - Other Activity

Project Area by Work Area

- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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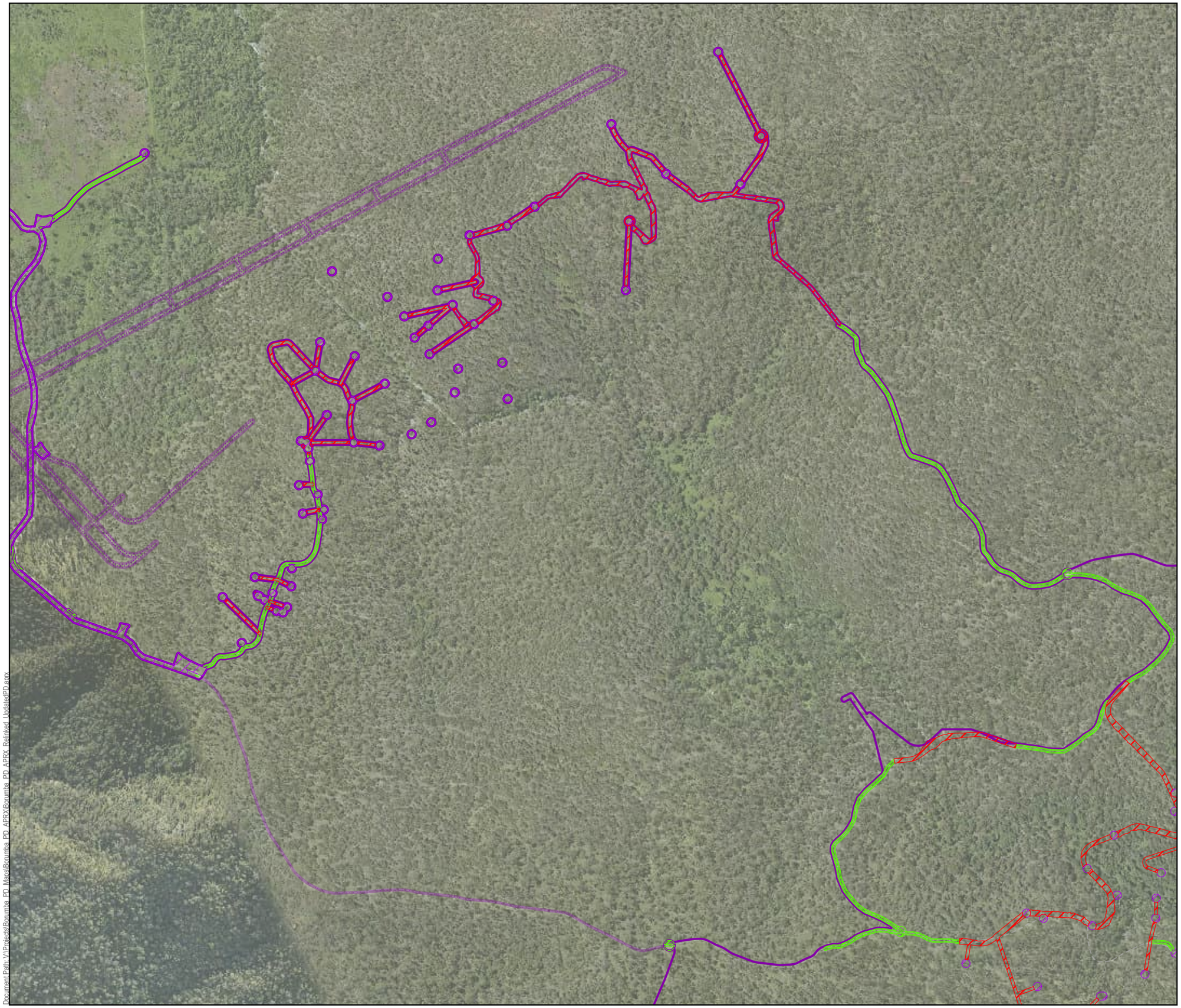
Exploratory Works Project
Preliminary Documentation

INDICATIVE ACCESS TRACKS
AREA 3 - WALKERS TOP (YABBA CREEK)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 14c

Document Path: V:\Projects\Boumbia_PD_Maps\Boumbia_PD_APRX\Boumbia_PD_APRX_Relinked_UpdatedPD.aprx



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

Project Footprint by Work Area

- Area 3 - Existing Tracks to be Upgraded
- Area 3 - New Tracks
- Area 3 - Other Activity

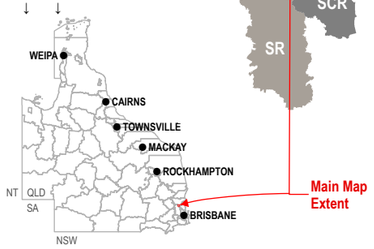
Project Area by Work Area

- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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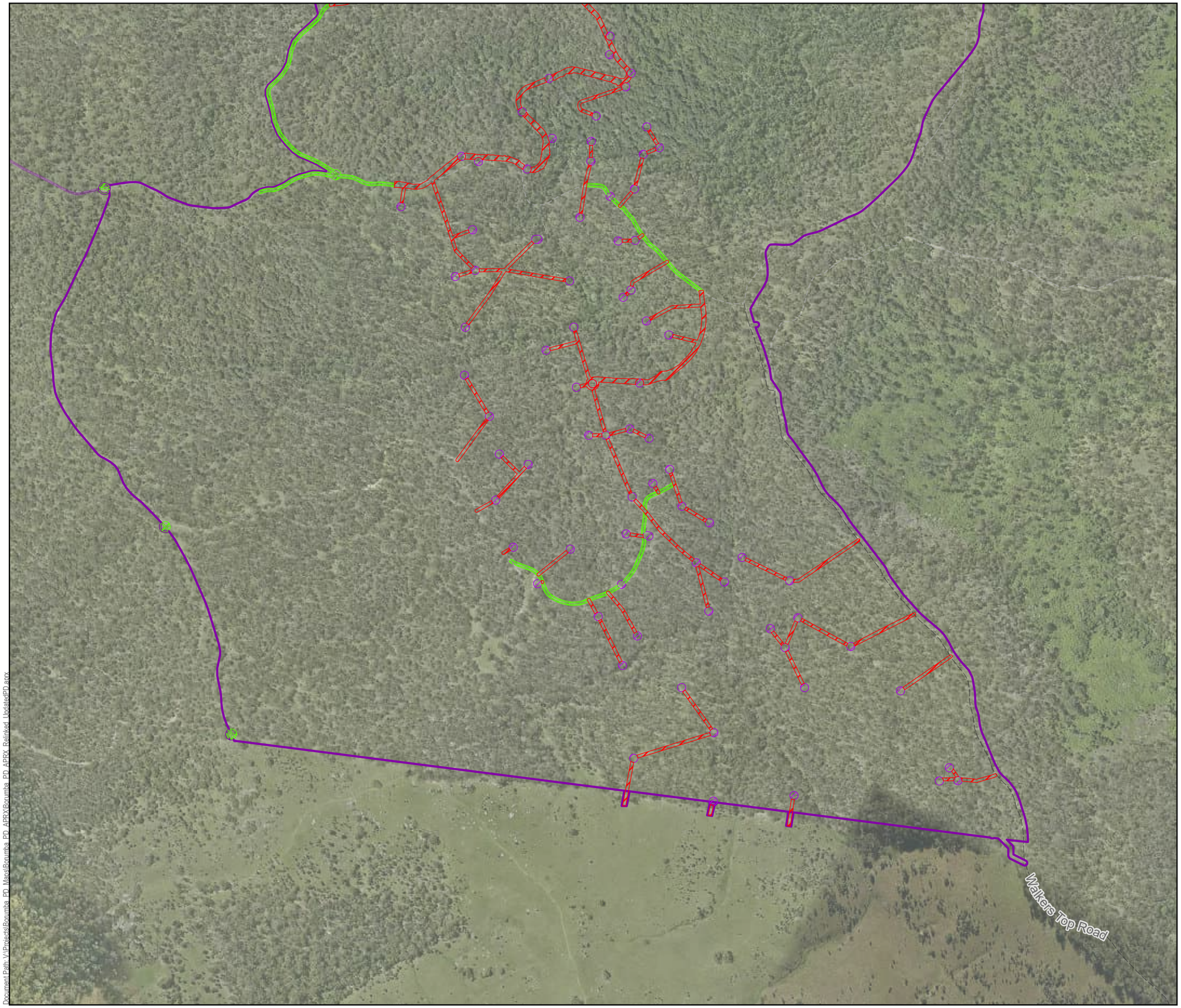
Exploratory Works Project
Preliminary Documentation

INDICATIVE ACCESS TRACKS AREA 3 - WALKERS TOP (NORTH)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 14d

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Queensland Hydro

GDA2020 MGA Zone 56

N

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

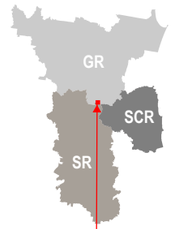
Project Footprint by Work Area

- Area 3 - Existing Tracks to be Upgraded
- Area 3 - New Tracks
- Area 3 - Other Activity

Project Area by Work Area

- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
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Exploratory Works Project
Preliminary Documentation

INDICATIVE ACCESS TRACKS AREA 3 - WALKERS TOP (SOUTH)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 14e

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Queensland Hydro

GDA2020 MGA Zone 56

N

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

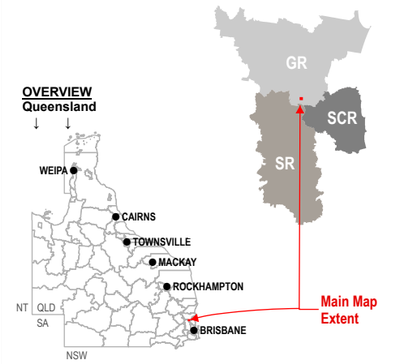
Project Footprint by Work Area

- Area 3 - New Tracks
- Area 3 - Other Activity

Project Area by Work Area

- Area 3 - Walkers Top

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland

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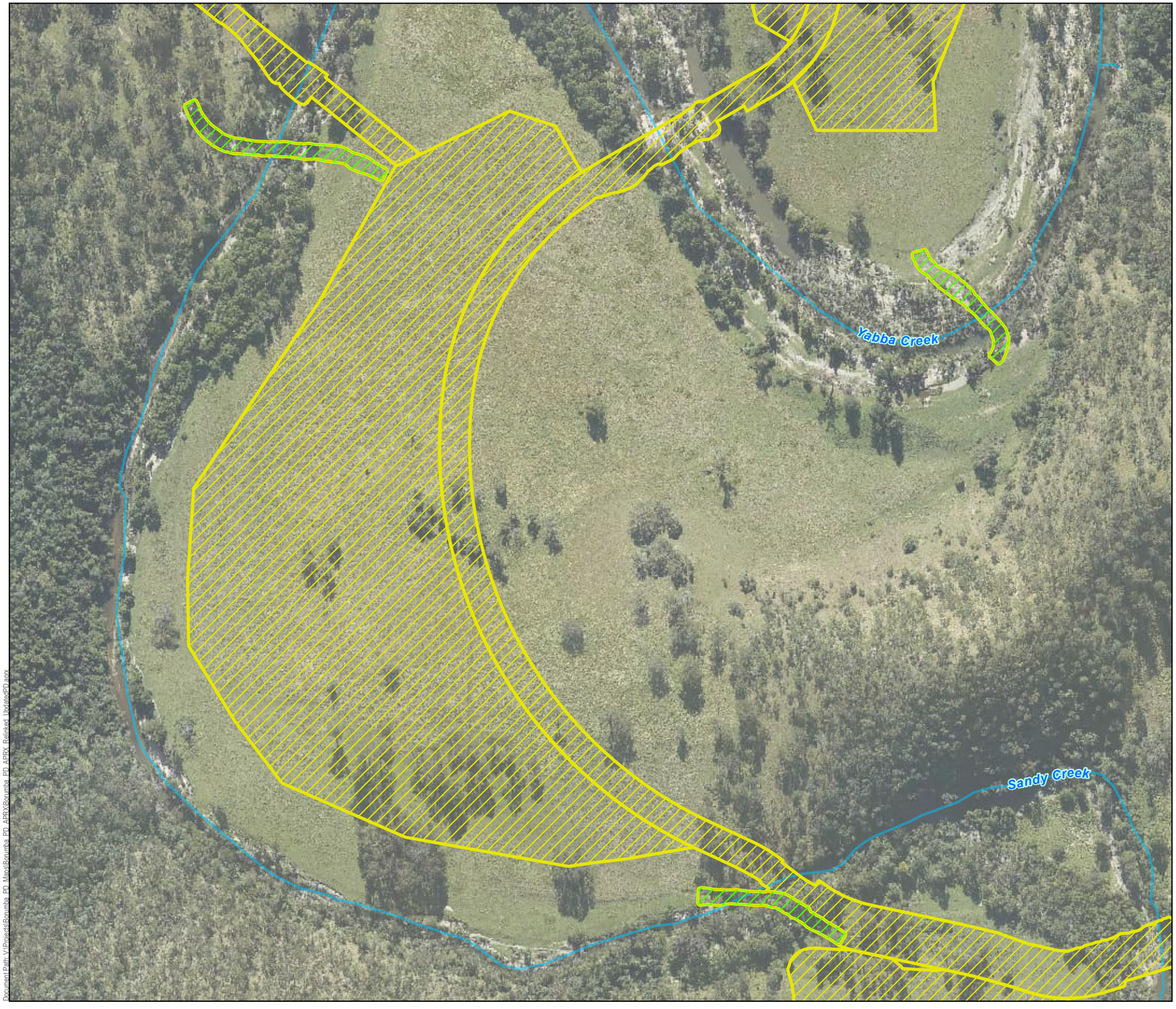
Exploratory Works Project
Preliminary Documentation

INDICATIVE ACCESS TRACKS AREA 3 - WALKERS TOP (LAKE BORUMBA WATER LINE)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 14f

Document Path: V:\Projects\Borumba_PD_Maps\Borumba_PD_APRX\Borumba_PD_APRX_Relinked_Updated\PD.aprx



Queensland Hydro

GDA2020 MGA Zone 56

0 20 40 60 80 100 m

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

Project Footprint by Work Area

- Area 4 - Existing Tracks to be Upgraded
- Area 4 - Other Activity

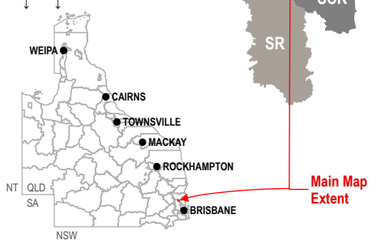
Project Area by Work Area

- Area 4 - Borgan

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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Exploratory Works Project
Preliminary Documentation

INDICATIVE ACCESS TRACKS
AREA 4 - BORGAN

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 14g

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2.5.1.1 Upgrades to existing access tracks

Access track upgrades are required to approximately 5 km of existing unsealed tracks in and around Area 1 and Area 3 (Figure 14).

In many instances, only minor work that does not affect vegetation will be required to improve the useability and grade of existing tracks for Project construction traffic (e.g. re-surfacing). However, some existing track sections require more intensive works (e.g. widening) to allow for their use as part of the Project. For example, in areas where there is difficult terrain a wider path is required to allow for batter slopes. In these areas vegetation removal may be required, but this will be reduced as far as practicable through micro-siting of the track alignment. An example of an existing track requiring upgrade is shown in Photo 6.

Across Areas 1 and 3 it has been assumed that the existing tracks have a 3 m wide lane and that track upgrades will require a disturbance width of 4 m (2 m each side of the existing track).. An allowance for additional clearing has been made in some locations where the terrain is very steep.



Photo 6: Example of access track for upgrade

2.5.1.2 New access tracks

While the network of existing tracks present on site will be used wherever possible, new tracks are needed to enable geotechnical investigations where the existing tracks are considered unsafe, to connect currently disconnected existing tracks, or where no tracks exist (Figure 14). An estimated 14 km of new tracks would be constructed in Areas 1 and 3.

The requirements for new access tracks to geotechnical investigation sites will depend on the borehole category, as follows:

- Off track (flat/near flat) – The access track will follow the shortest and straightest possible route to the investigation site, within the existing constraints (e.g. terrain, vegetation, ground conditions). Where possible, the track will be formed by only trimming grass to create a clear access route. If this is not possible (e.g. due to softer ground), vegetation and topsoil will be removed and the surface assessed further. It will then be left in that condition, if the surface can sustain minor traffic, or covered with a layer of compacted gravel material. Environmental controls will be implemented along the track.
- Off track (moderate slope) – To meet safety requirements, these tracks will likely require cutting into the slopes, removing topsoil material, and placing and compacting of gravel material. Small culverts or gabion baskets will be installed in gullies to prevent damage to the track during heavy rain events. If the track cannot be constructed within the requirements of typical vehicles, tracked equipment may be used to access the borehole. Environmental controls will be implemented along the access track.
- Off track (steeply sloped) – Safe access is a primary consideration in steeply sloped areas. Tracked equipment is expected to be at or beyond their limit in these areas, so alternative methods such as sled/rail, controlled lowering, staircases, or scaffolding access may be used. Sled/rail and/or controlled lowering are expected to be the preferred access method for most steep geotechnical investigation sites, but the approach used will depend on the site conditions.

The typical design criteria for the proposed new standard access tracks are:

- 4 m wide single traffic lane
- 6 m cleared width (traffic lane +1 m each side)
- maximum vertical grade of 25%
- gravel sheeting 4 m wide x 250 mm thick where vertical grade of the track alignment is 10% to 25%, or in areas found to be slippery when wet
- un-sheeted (natural ground) where the vertical grade of the track alignment is 0% (flat) to 10% grade.

It is expected that the standard tracks would be constructed/formed using appropriate plant (e.g. dozer with excavator, articulated dump truck and padfoot roller). The track alignment will be finalised onsite based on required grading and minimising vegetation clearing (i.e. avoiding large trees where possible and following terrain contours). Vegetation and spoil will be stockpiled along the edge of the tracks for future use or transported to the spoil disposal area.

Access via sled/rail or controlled lowering will involve the construction of a standard access track along a ridgeline or contour where tyred or tracked pieces of equipment can drive. From the access track a path to the borehole location will typically be constructed. This may include clearing a strip up to 5 m wide to accommodate the path of the sled and rig or moving the equipment across the existing landscape without clearing (e.g. with winches). Where possible, the boreholes will be locally moved (micro-sited) to avoid rocky outcrops or gullies along the access alignment. Once an access track is created, equipment will be moved to the drill location by placing a static anchor block or large, heavy piece of equipment fitted with a winch at the top of the access track. For sled access, all required equipment (drill rig, drill rods, water pumps, etc.) would be loaded onto a sled (a platform with metal skid rails underneath), pushed onto the sled track and winched down the slope using gravity and the weight of the sled (see Photo 2 for an example of a sled track). The equipment would then be offloaded onto a drill platform and the sled (empty or loaded with returning items) winched back up the track. For controlled lowering, a drill pad would first be established using either a spider excavator or a pioneering work crew that establishes an area suitable for a small excavator. Equipment would then be lowered directly or, if too heavy for the anchor, dismantled for lowering and reassembled on the pad.

Erosion and sediment control measures will be installed along the access and sled track alignment. Approval is required for new access tracks in protected areas (i.e. Imbil State Forest and Conondale Resources Reserve) with the design likely to be in accordance with Queensland Parks and Wildlife Service (2018) Road Design Guidelines.

2.5.1.3 Temporary bed level crossings

A temporary bed level crossing of Yabba Creek is proposed approximately 250 m downstream of the existing Borumba Dam wall in Area 1. This will be required to enable access to geotechnical investigation sites in the Conondale Resources Reserve on the northern side of Yabba Creek. The bed level crossing aligns with a track established by Seqwater for maintenance works associated with Borumba Dam .

The Yabba Creek bed level crossing would be designed to ensure that it does not act as a barrier to fish passage, with water flow not changed from the current conditions. The crossing would operate as a single-lane crossing and be approximately 7 m wide. It is expected to be formed by removing large rocks that are currently present and placing approximately 10-20 m^3 of D50-100 mm rock or similar on the bed, or a concrete bed level crossing, to allow 4WD vehicles and tracked drilling rigs to cross safely.

The crossing would nominally be in place for two to six months, including establishment and decommissioning, subject to the progress of the geotechnical investigations on the northern side of Yabba Creek.

Temporary waterway crossings of Yabba Creek will be required in Area 3 to facilitate vehicle access along existing tracks. This will involve upgrading existing bed level crossings through the temporary installation of gravel or concrete bed level crossings. The type of temporary crossing installed will be determined by the expected traffic volume at the crossing (i.e. gravel to be used where vehicle crossings are infrequent, and concrete crossings to be installed where there are frequent vehicle crossings). The temporary crossings will be removed after the completion of the Exploratory Works, unless the Main Works Project proceeds, in which case they may be retained.

These temporary crossings will also be subject to the accepted development requirements or development approval for waterway barrier works under the Queensland *Fisheries Act 1994* and *Planning Act 2016*.

2.5.2 Area 2 (Kingaham Creek)

The Kingaham Creek bypass is proposed on Lot 64LX2110 to avoid two crossings of Kingaham Creek and meet flood immunity requirements for access to the Project areas (Figure 15).

2.5.2.1 Construction

The construction of the Kingaham Creek bypass will be predominately in cut material. The construction process will require clearing and grubbing, vegetation and topsoil removal from the proposed road alignment. Controlled blasting may be used in rocky areas as needed. Material will be stockpiled at the Kingaham Creek spoil area. Erosion control measures, including silt fences and coir logs, will be implemented as needed to minimise sediment transport during construction.

Bulk earthworks will be carried out using suitable machinery based on the outcomes of site geotechnical investigations. Drainage systems will be installed to manage water flow and prevent erosion, with ditches and culverts used to collect surface runoff. The road subgrade will be prepared through compaction to achieve the required density, and stabilisation techniques applied as necessary.

Road design is expected to include an aggregate base compacted to create a stable foundation for the pavement, with quality control measures in place to ensure compliance with specifications. The road surface will then be constructed using asphalt or concrete, in accordance with the detailed road design, Austroads road design guidelines, and Australian Standards.

Additional supporting infrastructure, such as retaining walls for slope stability, will be determined if required based on the results of the geotechnical investigations. Road safety features, including guardrails and signage, will be installed according to Austroads road design guidelines, and road batter slopes will be revegetated as required to enhance stability and prevent erosion.

2.5.2.2 Operation

The realignment is approximately 1.4 km in length and adopts the approximate alignment proposed in the Main Works reference design for an access road for construction and operation. As geotechnical investigations have not been completed along the proposed alignment, the footprint may be subject to change as further information on ground conditions becomes available.

Kingaham Creek bypass will be dual lane road, have a minimum running width of 7 m and be designed to meet relevant Austroads standards. The road will include cut-off drains to direct surface water runoff from the road to drainage channels and sediment basins to avoid direct runoff to Kingaham Creek during rainfall.

2.5.2.3 Decommissioning

If the Main Works do not proceed, the road will remain in place and provide improved flood immunity for the local road network. Bella Creek Road will remain open for public use for the duration of the Project and will allow separation of public road users from Project vehicles.

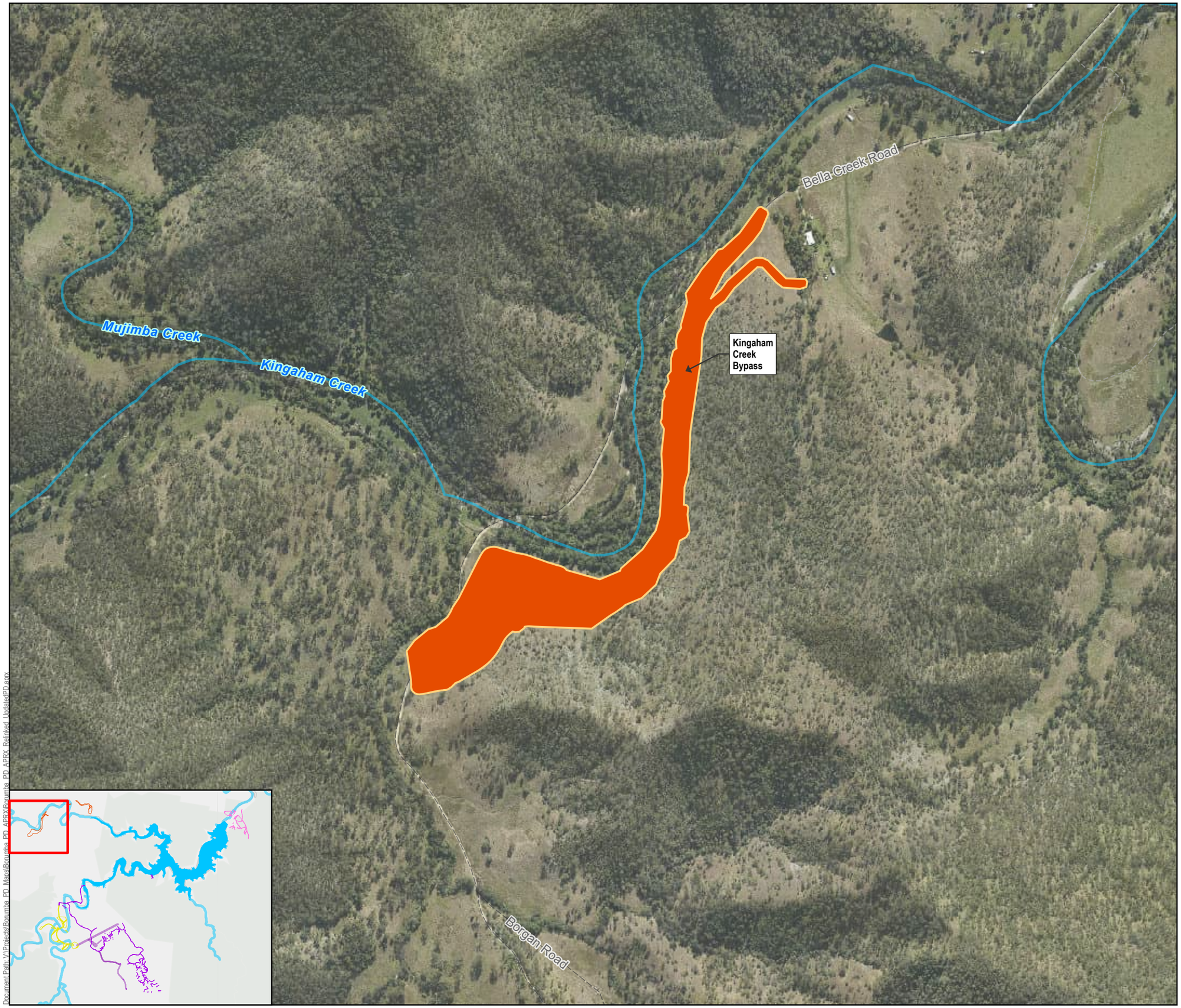
2.5.3 Area 4 (Borgan)

Access in Area 4 will be via the portal access track (refer to Section 2.7.5) and the explosive store access track (refer to Section 2.7.6).

2.5.3.1 Temporary bed level crossings

Temporary crossings at Yabba Creek and Sandy Creek will also be used to support the Project while the temporary bridges required for the portal access track (refer to Section 2.7.5) and explosive store access track (refer to Section 2.7.6) are installed. Temporary crossings will include the use of temporary culverts and/or concrete bed level crossings. Appropriately designed temporary culverts will be installed where the crossings support the construction of temporary bridges. These will consider flow velocities and aquatic fauna and have provisions such as baffles and roughened base slabs, on the alignment of the existing crossings. These will be in place for the duration of bridge construction. After bridge construction is complete, the temporary culverts will be removed and replaced with concrete bed level crossings.

These temporary crossings will also be subject to the accepted development requirements or development approval for waterway barrier works under the Queensland *Fisheries Act 1994* and *Planning Act 2016*.



Queensland Hydro

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LEGEND

- Watercourses
- Local Roads
- Tracks

Exploratory Works Project

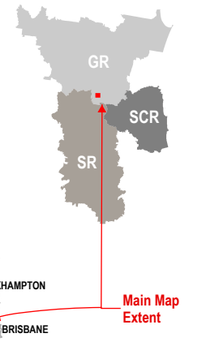
Project Footprint by Work Area

- Area 2 - Kingaham Creek Bypass

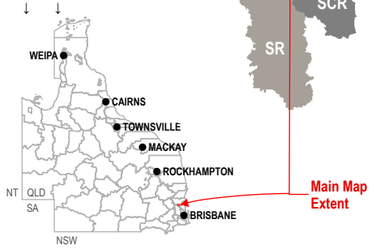
Project Area by Work Area

- Area 2 - Kingaham Creek Bypass

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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Exploratory Works Project
Preliminary Documentation

KINGAHAM CREEK BYPASS (AREA 2 - KINGAHAM CREEK)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 15

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2.6 Other Supporting Infrastructure

2.6.1 Temporary water infrastructure at Area 3 (Walkers Top)

Water is required for the exploratory tunnel and geotechnical drilling, civil construction works, and site facilities. Potable water for site facilities will be brought in by truck. Water for drilling and construction works does not need to be potable, with untreated (raw water) suitable for:

- operation of drilling rigs associated with the geotechnical borehole drilling
- operation of drilling rigs associated with the exploratory tunnelling
- dust suppression and materials moisture conditioning associated with the surface civil earthworks (roads and tracks).

Raw water will be sourced from Lake Borumba and/or groundwater ingress during the exploratory tunnelling. Water sourced from Lake Borumba will be supplied via temporary water infrastructure that includes pumps, pipelines, and storage tanks. It is proposed that the water pipeline will be predominately buried with some sections above ground around tank farms and at pump stations. The pipeline is designed to largely follow existing tracks from the upper section of Lake Borumba, then west to Borgan Road and south along Walkers Top Road (Figure 16). The water pipeline may also be extended to the portal pad and water management infrastructure within the footprint of the proposed portal access track (refer to Section 2.7.5 for the proposed alignment).

Water may also be sourced from Lake Borumba boat ramp using a water truck or removable pump, or from contingency water bores installed for the Project.

A description of the proposed temporary water infrastructure for the Project is provided in the sections below. Changes to the proposed approach or locations of the components may be considered provided they do not change the impact of the works.

All water take will be in accordance with a water permit or licence as required by the Queensland Department of Local Government, Water and Volunteers and/or the Borumba dam operator (Seqwater).

2.6.1.1 Construction

Vegetation clearing is required for the installation of the pipeline; the clearing area will be minimised as much as practicable and localised to the excavation required to bury the pipeline. Clearing will be required at the intake site where there is no clear path to the water, along the lower half of Walkers Top Road, and potentially at the lift stations/tank farms for pad formation.

The pipeline is expected to be approximately 300 mm in diameter. It will be shallow buried (approximately 400 mm cover to the ground surface and 600 mm cover under trafficked areas) to prevent ‘snaking’ of the pipeline from expansion and contraction due to temperature changes and protect the pipeline in the event of bushfire. The proposed design includes burying the pipeline beside Walkers Top Road from its start to near the intersection with the Dam Track (Figure 16). After the intersection with the Dam Track, where the terrain is flatter, the pipeline will be buried under the centre of Walkers Top Road.

Two pipeline crossings of Yabba Creek will be installed by either drilling under the creek to eliminate any disturbance of the watercourse or suspending the pipe overhead via a temporary steel bridging structure. These construction methods are intended to reduce the disturbance to Yabba Creek and the surrounding area.

Contingency water bores will be constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia (NUDLC, 2020). The bores will be drilled using rotary air drilling as a preference, but mud-rotary/dual rotary drilling may be required in alluvial areas). The use of drilling fluids will be kept to a minimum and avoided where the hole is stable.

The contingency water bores are proposed to be located in previously disturbed areas with no vegetation clearing required.

Pump Station
Balance Tank
Tank Farm
Balance Tank
Underground Temporary Water Infrastructure
Balance Tank and Lift Pump
Temporary Water Infrastructure
Balance Tank and Lift Pump
Balance Tank
Tank Farm
Underground Temporary Water Infrastructure
Bella Creek Road
Yabba Creek
Borgan Road
Sandy Creek
Walkers Top Road

Queensland Hydro

GDA2020 MGA Zone 56

N

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LEGEND

- Watercourses
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Exploratory Works Project

- Project Area

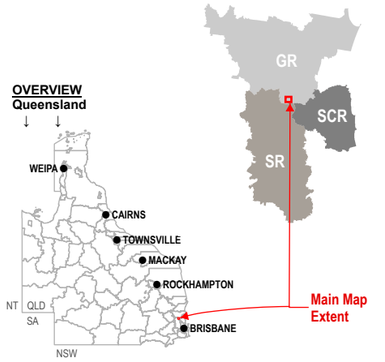
Project Footprint by Work Area

- Area 3 - Temporary Water Infrastructure
- Area 3 - Other Activities
- Area 4 - Other Activities

Project Component - Underground

- Area 3 - Temporary Water Infrastructure

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
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Exploratory Works Project
Preliminary Documentation

TEMPORARY WATER INFRASTRUCTURE (AREA 3 - WALKERS TOP)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 16

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2.6.1.2 Operation

Raw water for the access track construction and management, and exploratory tunnel and geotechnical drilling will be extracted from the upper reaches of Lake Borumba using a submersible pump. It is not proposed to treat this water. The pump design will allow the pump to rise and fall in line with water level changes within the lake (e.g. inflow events). The pump will operate intermittently, triggered by low levels in the water storage tanks. It will be powered by a diesel generator situated on the adjacent riverbank above the 1% AEP flood event margin. The generator will contain a bunded diesel fuel tank with a capacity of approximately 500-1,000 litres (L).

The pump will feed a set of water storage tanks near Borgan Road (Tank Farm 1) and the top of Walkers Top Road (Tank Farm 2) via pipeline. Tank Farm 1 will service the exploratory tunnelling and surface civil works and comprises approximately 4 x 150 kilolitre (kL) storage tanks (for a total of 600 kL of water storage). Tank Farm 2 will service the geotechnical drilling associated with the proposed upper reservoir and will comprise approximately 4 x 150 kL storage tanks (600 kL of water storage). Water storage requirements are summarised in Table 7 and Table 8.

Water will be pumped up to Tank Farm 2 (approximately 400 m in elevation) via a series of 'lift stations' consisting of a header tank (single or dual 50 kL polyethylene tank) and pump. Each lift station will contain a diesel pump with a bunded day tank (~500 to 1,000 L) to enable operation for one to two days before refuelling.

Each pump (extraction pump and lift station pumps) will incorporate telemetry to enable remote monitoring of pump performance and pump operation (i.e. remote start/stop). The pumps will operate at a low flow rate of ~2 to 5 L/sec.

During large rainfall events, vehicle crossing of Yabba Creek to refuel the extraction pump generator will not be possible until creek flows subside. Where this occurs operation of the extraction pump in Lake Borumba will cease. Operation of lift station pumps would continue until the storage within their header tanks are exhausted, at which time onsite drilling operations would then cease until creek water levels subside and access to the extraction pump is reinstated. This infrastructure will be in operation for the duration of the Project.

The Project will focus on maximising water reuse. The use of treated water captured from exploratory tunnelling and site runoff will be prioritised for use in dust suppression, process water, amenities across site, and potentially concrete production. Further information on water reuse is provided in Section 2.7.3.1.

Once the proposed contingency water bores are constructed, yield testing and a recharge/drawdown assessment will be undertaken to confirm the suitability of the bores for water take. If unsuitable, the bores will be decommissioned or converted for groundwater monitoring. If the bores are suitable for water take, they will be used for contingency purposes only, with the volume taken guided by the outcomes of the yield and recharge assessments.

Table 7: Exploratory Works Project water demand – initial construction and establishment phase

Location	Storage	Purpose	Demand	Redundancy
Tank Farm 1 (Borgan Road)	600 kL (4 x 150 kL tanks)	Direct take for road construction and dust suppression	500 kL/d	1 days' supply

Table 8: Exploratory Works Project water demand – investigative drilling

Location	Storage	Purpose	Demand	Redundancy
Tank Farm 1 (Borgan Road)	600 kL (4 x 150 kL tanks)	Exploratory tunnel excavation	55 kL/d	11 days' supply
Tank Farm 2 (Walkers Top Road)	600 kL (4 x 150 kL tanks)	Geotechnical drilling (upper reservoir area)	120 kL/d	5 days' supply
Walkers Top transfer pipeline lift stations	4 x stations, each with 2 x 50 kL tanks (400 kL total)	Transfer of water	120 kL/d	6.5 days' supply

2.6.1.3 Decommissioning

The temporary water infrastructure and contingency groundwater bores are required to be operational for the entire duration of the Exploratory Works. Should the Main Works proceed this water infrastructure is expected to be retained for use. If the Main Works does not proceed, decommissioning of the infrastructure will include:

- removal of the extraction pump including steel tube liner from within Lake Borumba
- removal of the extraction pump generator and each lift station pump
- removal of all water storage tanks
- excavation, removal of the shallow-buried water transfer pipeline and backfilling of the trench to natural ground levels
- pipe cut-off and capping of each underground crossing of Yabba Creek
- groundwater bore decommissioning (e.g. by capping or filling)
- return of landform to pre-disturbance state
- replanting of disturbed areas as required.

2.6.2 Civil construction compound at Area 4 (Borgan)

A civil construction compound will be established on Lot 3LX2754, to the north and west of Yabba Creek and between Borgan Road and Walkers Top Road (Figure 17). In the referral, this was the site of the spoil area, which was relocated south closer to the exploratory tunnels and portal pad to minimise risks associated with the movement of material.

A description of the construction and operation of the civil construction compound is provided in the sections below. Changes may be considered where they do not change the impact of the works.

2.6.2.1 Construction

The civil construction compound will comprise a flat pad located in an area that is largely cleared. The compound has a setback distance of 50 m from Yabba Creek on all sides. The terrain at the pad location is relatively flat so the disturbance area for construction will be only slightly larger than the pad.

Topsoil and vegetation will be stripped and stockpile at the spoil disposal area for future use, though it is likely most material will be disposed of in accordance with the *Biosecurity Act 2014 (Qld)* due to the prevalence of giant rat's tail grass (*Sporobolus pyramidalis*) in this area. Fill material will likely be sourced from the construction of the portal pad and other civil works. Material (consisting of rock and material 'other than rock') will be delivered by dump truck (either articulated dump trucks or rigid body trucks), spread by dozer and placed by compactor. Compacted gravel will be placed to provide all weather access.

A catch drain will be constructed at the high side of the pad to capture and divert runoff around the compound. Erosion and sediment control devices will also be installed around the perimeter to control sediment.

Fencing types that are to be employed are based on the suitability to the surrounding environment and policy requirements. A fauna exclusion fence, similar to that shown in Photo 7, will be installed around the perimeter of the compound.

2.6.2.2 Operation

The civil construction compound will be in operation for the duration of the Project. It will provide a laydown area for materials required for civil construction works and a site for water storage Tank Farm 1. Demountable facilities for the civil workforce will also be installed on the pad, including offices for management staff, workforce crib facilities and ablutions. Equipment located within the compound will be powered by generators.

2.6.2.3 Decommissioning

Should the Main Works not proceed, the civil construction compound will be removed, and the pad re-contoured to suit the natural surface levels. Topsoil will be respread or purchased, and the area revegetated with an appropriate seed stock.

If the Main Works does proceed, the compound is expected to continue to be used as a laydown area until works are complete.

Queensland Hydro

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0 75 150 m

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LEGEND

- Watercourses
- Local Roads
- Tracks

Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 3 - Other Activities
- Area 4 - Construction Compound
- Area 4 - Other Activities

Yabba Creek

Sandy Creek

Civil Construction Compound

Explosive Store Access Track

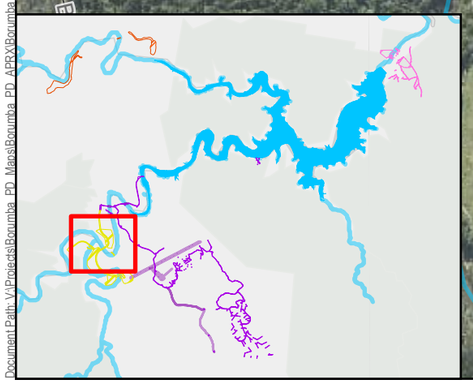
Temporary Water Infrastructure

Existing Access Track Upgrade

Existing Access Track Upgrade

Tunnel Spoil Disposal Area

Portal Access Track



OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
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Exploratory Works Project
Preliminary Documentation

CIVIL CONSTRUCTION COMPOUND (AREA 4 - BORGAN ROAD)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 17

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Photo 7: Example of temporary fauna exclusion fence

2.7 Exploratory tunnels and supporting infrastructure – RFI item 2.1(e)

Exploratory tunnel construction from a portal pad through to the proposed PHES powerhouse cavern location is required to appropriately assess the suitability of the geology for the proposed underground infrastructure that is planned as part of the Main Works.

The exploratory tunnel infrastructure comprises the following components, which are shown in Figure 18:

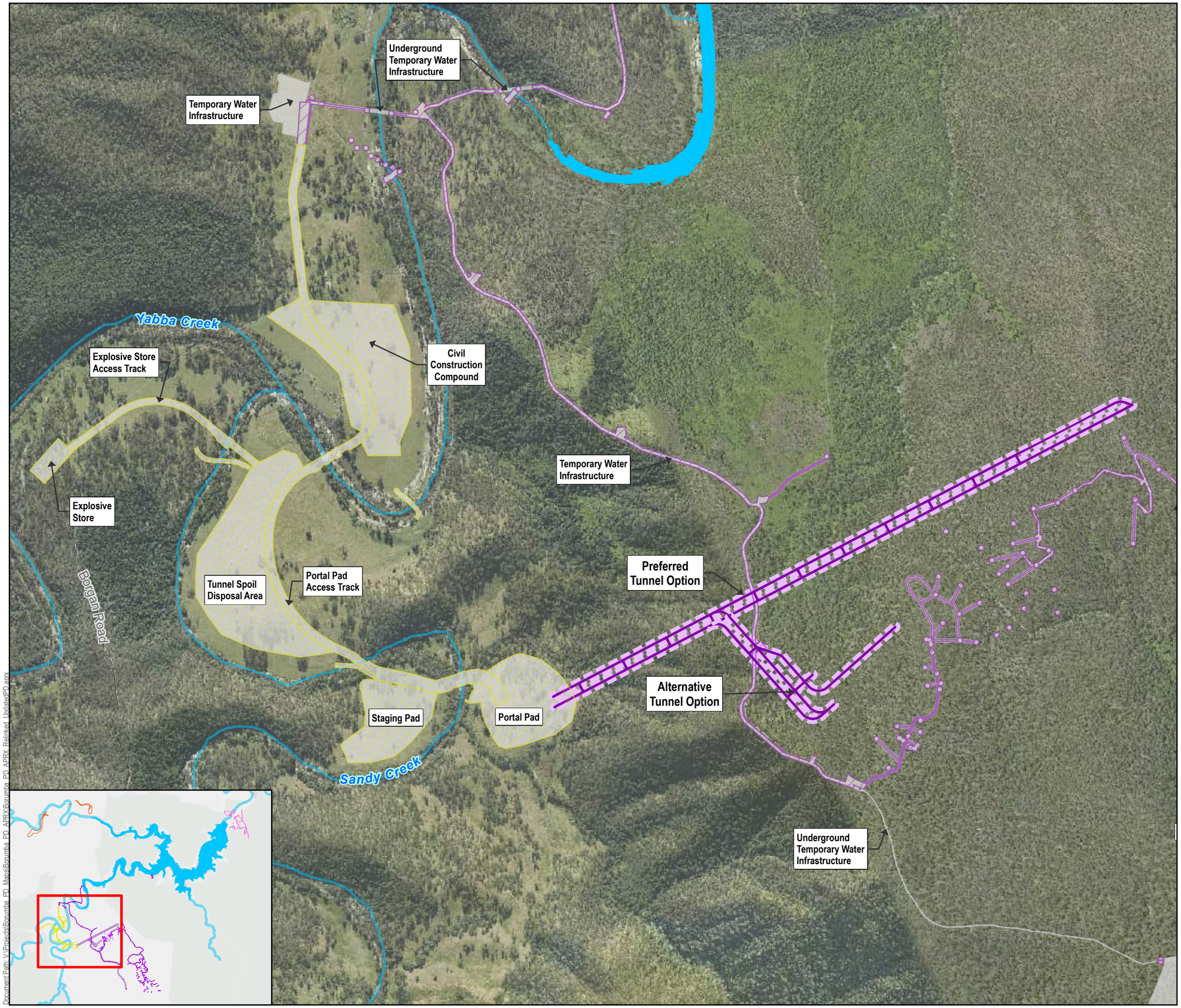
- exploratory tunnels – located west of Walkers Top Road and east of Sandy Creek on Lot 1723L37994, Lot 16LX1925 and Lot 1LX2754, up to approximately 2 km long, with orientation from northeast to southwest (Section 2.7.1)
- associated surface infrastructure –
  - portal pad – situated on Lot 1723L37994 and Lot 16LX1925 between the Sandy Creek oxbow and Walkers Top Road (Section 2.7.2)
  - staging pad – situated on Lot 16LX1925 between Yabba State Forest and the Sandy Creek oxbow (Section 2.7.4)
  - portal access track – from Borgan Road south to the portal pad, with crossings of Yabba Creek and Sandy Creek (Section 2.7.5)
  - explosive store and access track – situated on 3LX2754 on Borgan Road between Yabba Creek and Sandy Creek and upstream of the Yabba Creek and Sandy Creek confluence (Section 2.7.6).

The exploratory tunnel infrastructure is proposed be constructed in the following sequence:

1. Excavate and shape the surface infrastructure (portal access track, portal pad, staging pad, explosive store and associated access tracks).
2. Horizontal diamond drilling from the portal location in line with and in advance of the proposed tunnel route.
3. Portal and supporting portal pad plant, equipment and facilities establishment.
4. Tunnel excavation using drill and blast techniques, installation of ground support and services to permit advancement of the tunnel as well as underground diamond drilling.

Descriptions of the proposed approach and methods for the different aspects of the exploratory tunnel infrastructure (i.e. exploratory tunnels, portal pad, water management infrastructure, staging pad, portal access track, and explosive store and access track) are provided in the sections below. Changes may be considered where they do not change the impact of the works.

Discussion of avoidance measures applied during the design of the exploratory tunnels and supporting infrastructure is provided in Section 6.1.2.



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LEGEND

- Watercourses
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 3 - Other Activities
- Area 4 - Other Activities

Project Component - Underground

- Area 3 - Exploratory Tunnel Options

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
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Exploratory Works Project
Preliminary Documentation

EXPLORATORY TUNNELS AND ASSOCIATED SURFACE INFRASTRUCTURE (AREA 3 - WALKERS TOP AND AREA 4 - BORGAN)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 18

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2.7.1 Exploratory tunnels – Area 3 (Walkers Top)

The final alignment for the exploratory tunnels is dependent on the outcomes of geological site investigations and data analysis as little to no geotechnical data has been collected for the Main Works Project tunnels and powerhouse cavern. If the geological conditions are found to be unfavourable for either exploratory tunnelling or cavern excavation, the alignment may need to be changed. Consequently, two options are proposed for the exploratory tunnels. The first option has a similar orientation to the Green design option in the EPBC referral and is referred to as the preferred option. The second option is provided as an alternate option. Only one of the two options will be constructed.

Exploratory tunnel construction will create dual sloping underground tunnels, approximately 5.5 m wide and 6 m high, that extend from the surface to a depth of approximately 450 m below the surface. The tunnels for the preferred option will be approximately 2.0 km long, while the tunnels for the alternate option would be up to approximately 1.2 km long. Both options will follow the same alignment from the portal for approximately 600 m and have a finished face surface area of 32 m^2 each. The dual tunnels will run in parallel with connecting cross passages to improve ventilation and enable dual emergency egress. The alternate option includes a third section of tunnel (adit) that extends to the other site of the potential alternate cavern location. The projected volume of excavated material from the preferred tunnel option is approximately 395,000 m^3; less material would be excavated from the alternate option. The volume of excavated material will be confirmed as part of the geotechnical investigations before and during the tunnelling excavation works. As noted in Section 2.4.1, the excavated material will be tested and stockpiled at the spoil disposal area.

Figure 19 illustrates a long section for the preferred exploratory tunnel option and shows both the known geology and structures as well as a conceptual view that is to be confirmed via geotechnical drilling.

Figure 20 provides a preliminary cross section of the exploratory tunnels for the preferred option in relation to groundwater. The key elements of uncertainty in the conceptual hydrogeological model are groundwater level, quality, and hydraulic parameters of the hydrostratigraphic units, which determine the degree of connectivity between the tunnels and nearby receptors. Some groundwater bores have been installed to provide groundwater monitoring data, with additional bores planned to be installed. Refer to Section 3.7.2 for more information on groundwater.

A conceptual cross-section of the exploratory tunnels is shown in Figure 21. This is indicative only and the configuration within the tunnels may be subject to change. Note, the depiction of the powerhouse cavern is provided for context only and is not part of the Project.

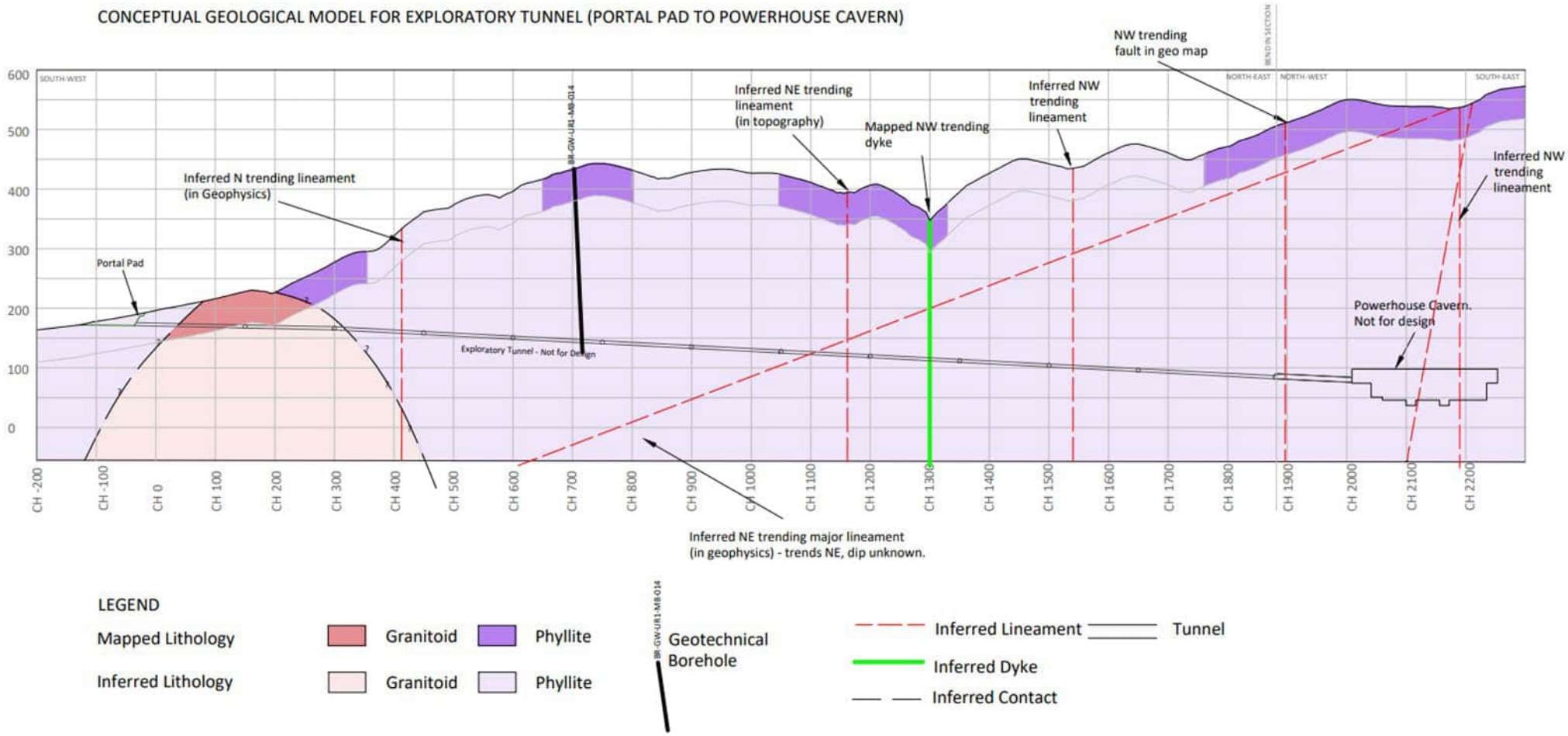


Figure 19: Conceptual long section of exploratory tunnel and geology

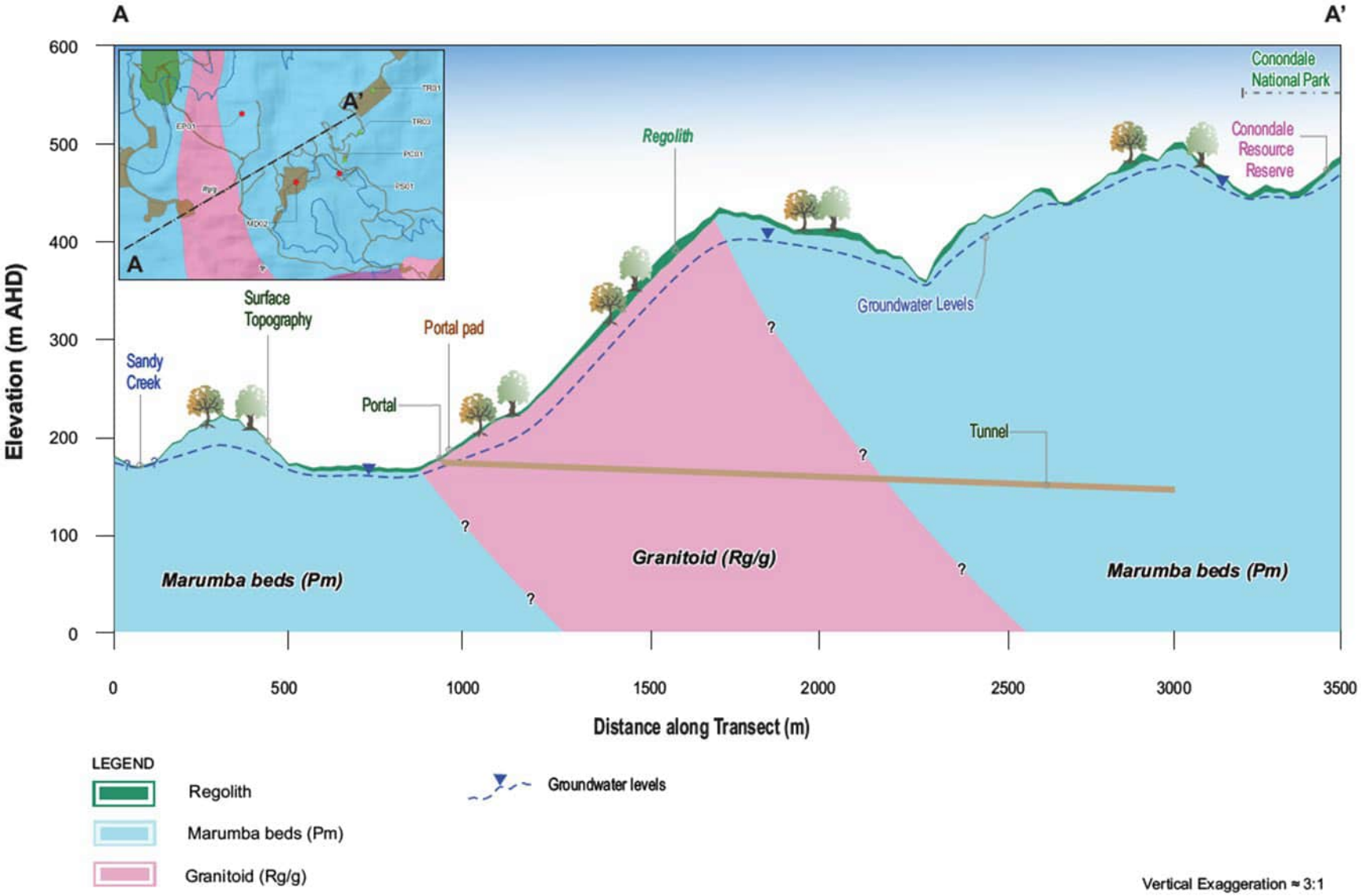


Figure 20: Groundwater in the vicinity of the exploratory tunnel based on conceptual hydrogeological model

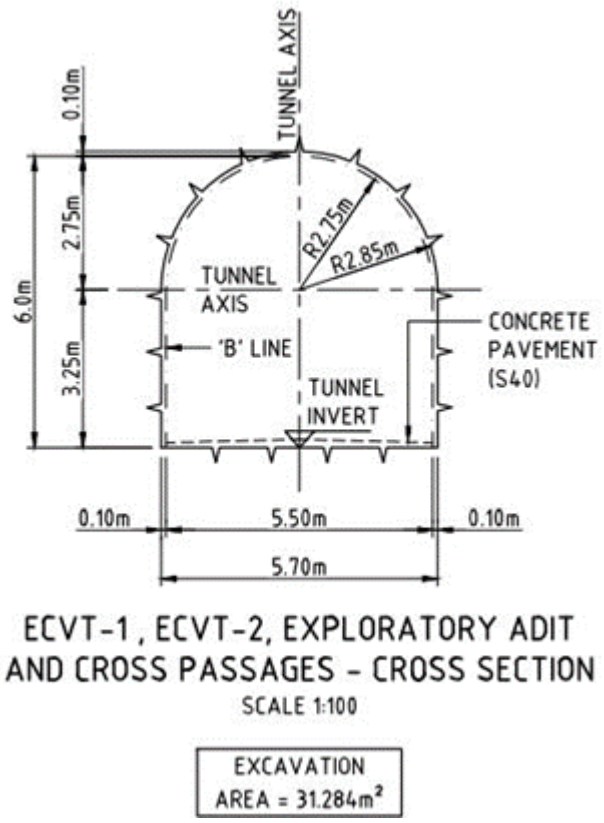


Figure 21: Conceptual cross-section of the exploratory tunnel

2.7.1.1 Construction

Construction will begin at the portal pad and will comprise:

- Diamond drilling along the proposed alignment using specialised diamond drill rigs – to minimise unplanned stoppages, diamond drilling will proceed along the route in advance of exploration drilling and blasting.
- Excavation of the exploratory tunnels using conventional underground mining equipment for drilling and blasting – this includes establishment and installation of ground support and services (e.g. ventilation fans and ducting, compressed air, water and dewatering services as well as electrical reticulation).

Exploratory tunnel construction proposes to use electro-hydraulic plant (drills) and conventional track and wheel mounted earthmoving equipment (e.g. loaders, trucks, graders and excavators). Underground excavation works will also include conventional underground drilling, charging and ground support equipment. Blasting works propose to use emulsion-based explosives delivered using emulsion pumping trucks. Supply and maintenance of electrical power (via diesel generators), communications equipment including leaky feeder and Wi-Fi, ventilation systems (including ventilation fans), raw water, and dewatering services are also planned to be used in support of the exploratory tunnel excavation.

Tunnelling via drilling and blast methods will result in a blast-induced damaged zone (BIDZ) around the perimeter of the tunnel. The BIDZ can have a negative impact on the performance of the tunnel. To address this, smooth wall blasting techniques will be used in the tunnelling. These techniques limit the width and depth of the fracture zone in the walls and roof caused by blasting. The development holes drilled at the perimeter of the excavation will be drilled closer to each other than the face holes and specially charged with specific smooth blasting products that minimise the amount of explosive energy that the surrounding host rock is exposed to. Firing of the perimeter holes will be timed so that they detonate last and simultaneously, resulting in a smooth excavation. The fractures that occur will originate from the remaining half-barrels of the perimeter holes. These blasting fractures are different from stress-induced or natural fractures and are radial in nature with different shapes and sizes. The fracture distribution will depend on the rock mass condition and the in-situ stress condition as well as the blasting parameters. In most cases where smooth wall blasting practices are implemented, the BIDZ is no greater than 1 m. Fracturing of the surrounding host rock will also be minimised through continual application of ground support as

the tunnel progresses. This will confine the host rock and prohibit unravelling, thereby ensuring the risk of subsidence is eliminated.

Ground support will comprise a mixture of shotcrete, rock bolts, spiling bars and lattice girders. The shotcrete will be applied initially and to a thickness that corresponds to the ground type encountered (i.e. ranging from 50 mm to 300 mm in thickness). The balance of the ground support will then be installed to meet the support class required for the specific ground type.

Solid material (500 mm minus shot rock) and residual drill cuttings coming out of the tunnelling operation will be placed in a temporary stockpile on the portal pad (~500 m^3) before transport to the spoil disposal area or taken directly to the spoil disposal area for testing prior to disposal. Disposal will be in the spoil disposal area or at an appropriate off-site facility if required (e.g. if contaminated).

2.7.1.2 Decommissioning

Once drilled, the exploratory tunnels will be permanent. Should the Main Works not proceed, the exploratory tunnel entrances (the portals) will be sealed with a reinforced concrete 'plug' prior to the portal pad being backfilled.

Once backfilled and returned to a pre-disturbance landform, the area would be stabilised to minimise erosion and sedimentation. Revegetation of the area back to a pre-disturbance land use status (i.e. grazing) would be undertaken.

Alternatively, should the Main Works proceed, the exploratory tunnels are likely to be repurposed for use as the emergency, cable and ventilation tunnels.

2.7.2 Portal pad – Area 4 (Borgan)

The creation of a suitable work pad is required to enable exploratory tunnel excavation to commence. The portal pad will be sized to support tunnel drilling and blasting activities and will comprise an approximately 100 m x 120 m flat pad, not including the temporary water storage area or sediment basin. However, as the pad is located in steep terrain, the disturbance area (encompassing the cut batters) will be larger than the final pad size. The portal pad site is shown in Photo 8.

There is an approximate allowance of 40 m x 40 m for a temporary water storage pond located adjacent to the portal pad. The portal pad generally has a 50 m setback distance from the nearest watercourse (Sandy Creek), except where an allowance has been made for access to the creek from the portal pad.

This portal pad area is required at the entrance of the exploratory tunnel portals for components such as:

- heavy plant and equipment park up
- raw water supply and compressed air infrastructure
- temporary stockpile of excavated material, if not directly removed by truck
- temporary water storage pond and water treatment and filtration equipment
- sediment basin
- a generator with fuel storage
- ventilation equipment.

Maintenance facilities and other supporting activities are expected to be situated at the staging pad due to the limited space available at the portal pad.



Photo 8: Proposed portal pad site

2.7.2.1 Construction

The portal pad is proposed to be constructed primarily in cut using standard earthmoving equipment. The total area suitable for the portal pad has been optimised based on engineering design development related to the portal face. As geotechnical information is received, the design will be further refined, and the area associated with the portal face modified to best suit the infrastructure.

Topsoil will be stripped and stored in a stockpile at the tunnel spoil disposal area. Overburden material (other than rock) will be dug by excavator and loaded into dump trucks (either articulated dump trucks or rigid body trucks) for removal. Weathered rock will be ripped by dozer while non-rippable rock will be loosened by drill-and-blast methods before being excavated and removed. Excavated material will be used in the construction of the staging pad (refer to description of the staging pad below) and potentially other areas of the Project depending on the materials suitability.

As the excavation for the portal pad increases in depth, the near-to-vertical face where the tunnel entrances (portals) are to be located is proposed to be supported by a grid of shotcrete and rock bolts. Compacted gravel will be placed on the surface of the portal pad to provide all weather access. Once completed, the portal pad will have a supported rock face and portal established that will be fit for purpose for the exploratory tunnel excavation.

A catch drain will be constructed at the high side of the portal excavation to capture runoff water and divert it around the portal pad. Erosion and sediment controls will be installed on the low side of the pad to control sediment and water from the pad.

Water treatment infrastructure is further described in Section 2.7.3.

2.7.2.2 Operation

The portal pad will operate 24 hours a day, seven days a week for the duration of the exploratory tunnelling operations.

Solid material (shot rock) coming out of the tunnel will be transported to the spoil disposal area for testing and then either stockpiled or sent offsite for disposal (if found to be contaminated). If necessary, material may be temporarily placed in a stockpile on the portal pad before transport to the spoil disposal area.

Equipment located on the portal pad will be powered by diesel generators. Fuel stored on the pad to operate the generators is proposed to be contained in a purpose made self-bunded storage tank of approximately 50-67 kL. This will be topped up as required by articulated bulk tanker trucks. Explosives required for the drill-and-blast operations will be stored at a separate location (refer to Section 2.7.5) and transported to the underground location as required.

A temporary water storage pond will provide approximately 5 megalitres (ML) of water storage directly adjacent to the portals. This is intended to be used for the day-to-day management of water requirements associated with the drill and blast tunnelling operations. Water management is further described in Section 2.7.3.

Runoff in the portal pad area will be generated from three main areas:

- the area above the portal pad – clean water from outside the operational area
- the bench cuts above the portal face – clean water from outside the operational area
- the portal pad area – potential for sediment and hydrocarbon contamination associated with works on the pad.

Clean runoff will be diverted around the portal pad (e.g. via a berm drain above the portal face) or captured and transferred to Sandy Creek (e.g. flow diverted to an up-gradient pit and piped beneath the pad). Runoff from the portal pad work area will be captured (e.g. in a spoon drain) and diverted to a sediment basin. Decommissioning

The portal pad is likely to be a permanent installation for the life of the Main Works. Should the Main Works not proceed, the portal pad would be rehabilitated, including backfilling to conform to the surrounding surface levels with material from the spoil stockpile. Topsoil would be respread, and the area re-vegetated with an appropriate seed stock.

2.7.3 Water management infrastructure – Area 4 (Borgan)

A holistic approach for water management is proposed, with infrastructure to be established for the management of groundwater ingress into the exploratory tunnels and site runoff. This will accommodate the collection, distribution and treatment of water for reuse or release to the environment. Recycle and reuse of water will be prioritised and maximised during the Project, with release to be kept as a final option. Proposed options for reuse include but are not limited to:

- recirculation within the underground drill and blast operations
- dust suppression across the Project area
- shotcrete production
- geotechnical drilling
- irrigation
- greywater (ablutions) for camp and site facilities
- potable water (drinking and showers) for camp and site facilities.

Water management infrastructure is proposed to be located across the portal pad and staging pad, with water from the exploratory tunnel excavation initially directed to a basin at the portal pad. Water will then be transferred to a water treatment plant for treatment to meet the required standard for the proposed reuse or release to the environment. Excess water (i.e. not required for reuse) will be treated to the appropriate Mary River Basin catchment/sub-catchment water standards as outlined by the *Mary River Environmental Values and Water Quality Objectives* for release to the environment.

The water treatment plant will be capable of treating water to the required standards (e.g. reverse osmosis treatment plant) and have a capacity of approximately 100 L/s to allow for typical inflow fluctuations. It is expected to be situated on the portal pad (Figure 18).

Stormwater is proposed to be managed in separate storage basins at the portal pad to limit or prevent any contamination by operational water, thereby reducing treatment requirements. Stormwater that exceeds the basin capacity will be incorporated into the operational water management. Stormwater management will be designed in accordance with Stormwater and Environmentally Relevant Activities guideline produced by the Queensland Department of the Environment, Tourism, Science, and Innovation (DETSI). Queensland Hydro's proposed system is based on a 24-hour storm event with an average recurrence interval (ARI) of 1 in 5 years This design will help mitigate the risk of erosion and sedimentation, protecting both the site and surrounding areas from potential runoff impacts.

Contingency measures to manage water during storm events that exceed the design capacity of the storage basins include multiple tank farms with contingent water capacity, mechanical evaporation, water treatment plant, temporary water infrastructure to enable water transfer, and water evaporation pond(s). HumeCeptors or similar will also be used in basins to remove hydrocarbons and suspended solids in runoff from the staging pad and portal areas.

Water management infrastructure such as storage basins, sediment dams, and tank pads to support water treatment infrastructure will be constructed at the same time as the portal pad and staging pad.

The water treatment plant and associated tanks will be installed after the construction of the portal pad and staging pad.

2.7.3.1 Operation

Water from the tunnelling operation (e.g. drilling water and groundwater seepage) will be transferred to a laminar clarifier or similar to treat coarser sediment before being discharged into a dirty water basin for temporary storage. Solids may also be dewatered using a belt filter press or dewatering bags made of geotextile before water is transferred to the dirty water basin. Water from the dirty water basin will be transferred to the water treatment plant for treatment. Treated water will be discharged via pump and pipeline to storage tanks for reuse. Sludge (rock particles and fines) will periodically be removed from the dirty water basin and stored in the spoil disposal area or disposed of off-site as dry sludge at an appropriately licensed facility.

Water required for use in tunnel drilling operations will be sourced from the treated water storage on the portal pad. If necessary, additional water may be supplied by truck from the temporary water infrastructure (Tank Farm 1) or the storage tanks at the staging pad. Clean water will be used to support the Project activities where possible. It is noted that water with a high mineral content containing nitrates from the use of emulsion explosives can be reused underground as service water.

If the ingress of water into the tunnel (from underground aquifers via fissures and fractures in the rock) exceeds the consumption of water, then excess water will be sent from the temporary water storage pond to the water storage tanks at the staging pad. It has been assumed that groundwater ingress, post underground grouting, will occur at a rate of two litres per second per kilometre. This will be confirmed as the groundwater assessment progresses and water balance modelling for the exploratory tunnels is refined.

Where water ingress into the tunnels exceeds the capacity of the storage tanks (e.g. in large rainfall event), alternative disposal methods will be utilised (e.g. release to the environment, trucking offsite, irrigation, additional storage at another location). All releases to the environment will be in accordance with relevant approval conditions, including applicable water quality guidelines.

A high-level water management schematic is provided in Figure **22**.

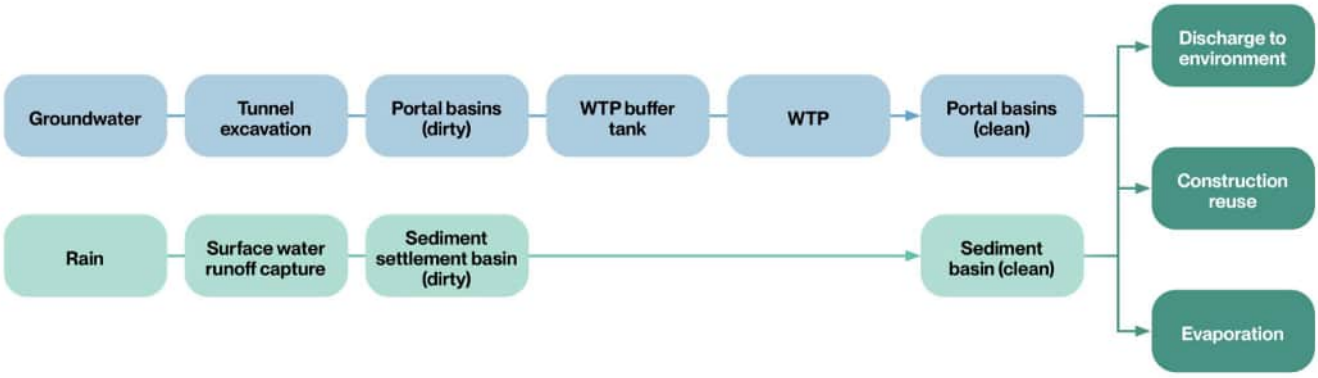


Figure 22: Water management schematic

2.7.3.2 Decommissioning

Should the Main Works not proceed, the water management infrastructure would be removed, the land rehabilitated, including backfilling to conform to the surrounding surface levels with material from the spoil stockpile. Topsoil would be respread, and the area re-vegetated with an appropriate seed stock.

If the Main Works proceed, the water management infrastructure will be retained for use during construction.

2.7.4 Staging pad – Area 4 (Borgan)

A staging pad is proposed to be located adjacent to the portal access track, near the portal pad, as shown in Figure 18. The staging pad will support tunnelling operations and may include components such as:

- plant and equipment maintenance facilities
- concrete batching plant
- raw materials stockpiles (for concrete production)
- potable water storage
- materials and consumables laydown and storage
- self-contained workforce amenities (office, crib sheds, ablutions)
- generator with fuel storage.

2.7.4.1 Construction

The staging pad will comprise an approximately 150 m x 195 m flat pad plus three water storage tanks (approximately 60 m diameter by 3 m tall, 18 ML volume capacity), in an area that is largely flat and cleared, with a setback distance of 50 m from Sandy Creek. Construction will take approximately four months.

The pad will be constructed primarily in fill, using excavated material from the portal pad. Topsoil will be stripped and stockpiled at the tunnel spoil disposal area. Material (consisting of rock material, and other than rock material) will be delivered by dump truck (either articulated dump trucks or rigid body trucks), spread by dozer, and placed by compactor. Compacted gravel will be placed on the pad to provide all weather access.

A catch drain will be constructed at the high side of the pad to capture and divert runoff around the pad. Erosion and sediment control devices will also be installed around the perimeter of the pad to control sediment and water from the pad. Exposed fill surfaces will be covered (e.g. topsoil and re-grassed).

2.7.4.2 Operation

The staging pad will operate 24 hours a day, seven days a week for the duration of the exploratory tunnelling operations.

A facility for the maintenance of tunnelling plant and equipment will be installed on the staging pad (e.g. an undercover igloo structure with container storage). A batching plant for the production of shotcrete and grout is also proposed to be situated at the pad, alongside stockpiles of raw feed materials (coarse aggregate, medium aggregate and sand), silos for cementitious materials (cement and fly-ash) and polyethylene tanks for storage of water.

Demountable facilities for the tunnelling workforce will be installed on the pad, including offices for management staff, workforce crib facilities and ablutions.

Equipment located on the staging pad will be powered by generators. Fuel stored on the pad to operate the generators will be contained in a 10 kL purpose made self-bunded storage tank, which will be topped up as required by rigid body service trucks. The infrastructure requirements for the staging pad will be confirmed by the tunnelling contractor.

The proposed water storage tanks are open-air, HDPE lined tank structures that will be located next to the staging pad and fed by a pump on the portal pad and a pipeline (nominally 300 mm diameter) between the pads. The pipeline will be strung to the bridge at the Sandy Creek bridge crossing. The water storage tanks are intended to capture excess water and prevent contaminated water discharge to Sandy Creek; they will be used when the ingress of water into the tunnelling operation is greater than the water consumption requirement for the drilling. The capacity of the water storage tanks enables the storage of tunnel ingress water at a rate of 25 L/s continuously over seven days duration.

Where not being reused for underground works, water from the tunnelling operation will be sent from the portal pad to the water storage tanks at the staging pad. The water will be left to evaporate (if the volumes are small) or, where water volumes exceed the capacity of the storage tanks, alternative disposal methods will be utilised as described in Section 2.7.3.

2.7.4.3 Decommissioning

In the event that the Main Works Project does not proceed, the staging pad will be removed. The fill material will be re-contoured to suit the natural surface levels. Topsoil will be respread, and the area re-vegetated with an appropriate seed stock.

If the Main Works Project proceeds, the staging pad will be retained for use during Main Works construction.

2.7.5 Portal access track – Area 4 (Borgan)

A temporary access track that can accommodate the exploratory tunnel excavation plant (including heavy and long vehicles) is required from the departure point on Borgan Road to the exploratory tunnel portal. Figure 18 shows the track's proposed alignment connecting the portal pad to Borgan Road via the spoil disposal area. This alignment requires three temporary waterway crossings (one crossing of Yabba Creek and two crossings of Sandy Creek).

2.7.5.1 Construction

A new, approximately 2.5 km, two lane, unsealed gravel access track would be constructed from Borgan Road north of Yabba Creek to the portal pad. Table 9 provides an overview of the work required to establish the portal access track.

Table 9: Works associated with the portal pad access track

Work element	Description
Earthworks	Clearing, grubbing, topsoil stripping, ground surface treatment and cut/fill bulk earthworks within the new road alignment, including at the waterway crossing locations
Pavement works	Gravel pavement to the full alignment
Road furniture	Road edge guideposts Traffic signage
New waterway crossings	Three single lane (~4.5 m wide) temporary (Bailey) bridges of varying length will be required to cross Yabba Creek and Sandy Creek, respectively; one multi-span bridge (~110 m long) and two dual span bridges (~64 m and ~73 m long). The bridge foundations will be positioned to minimise works within the banks of the waterways. A gravel bed-level pad will be initially constructed to enable construction access to each abutment position for each bridge. The bed-level pad will be in place for approximately six months. The temporary crossings (Section 2.5.3.1) will also support construction of the bridges. The proposed design of the bridge substructures is expected to comprise: • piles at each pier and abutment location to be installed by driving a steel liner to the required depth, with material within removed via auger • a prefabricated steel reinforcement cage lowered into the liner • liner filled with concrete via a concrete boom pump positioned on the bank of the watercourse. Piles at pier locations will be extended above ground level (as reinforced concrete columns) to a concrete headstock. There will not be any pile caps within the waterways. Piles at abutment locations are connected directly to the reinforced concrete abutment. The Bailey bridge superstructure (steel framed bridge) will sit directly on the abutments and pier headstocks. It will be incrementally launched from one abutment to the other opposite abutment (and over piers for bridges with more than one span).

2.7.5.2 Operation

As each temporary bridge will be single lane only, the approach to each will include a pull up zone to allow traffic on the bridge right-of-way.

The portal access track (including temporary bridges) is required to be operational for the entire duration of the exploratory tunnelling.

2.7.5.3 Decommissioning

Should the Main Works Project proceed, the track and Bailey bridges are expected to be retained with identical bridges constructed alongside the Exploratory Works bridges to create dual lane access for an increased level of traffic. These would then be removed once the permanent access roads have been constructed.

If the Main Works do not proceed, the track and Bailey bridges will be decommissioned. Decommissioning of the infrastructure will include:

- disassembly and removal of the steel superstructure
- demolition and removal of the concrete substructure above ground level, with foundation piles cut off at ground level and left in place
- backfilling to natural surface levels
- replanting of disturbed areas as required.

2.7.6 Explosive store and access track – Area 4 (Borgan)

An explosive store (also referred to as a magazine) and access track (approximately 1 km) will be established at the location shown in Figure 23. The explosive store will store explosive materials used for the exploratory tunnel drill-and-blast operations. The explosive store location was selected to ensure compliance with relevant Queensland legislation and Australian Standards and maintain a minimum separation distance of at least 612 m from other operational areas.

The explosive store will be approximately 130 m x 60 m, including a fire break. The infrastructure requirements for the explosive store will be finalised by the tunnelling contractor in accordance with relevant legislative requirements and Australian Standards.

2.7.6.1 Construction

Construction of the explosive store and access track will take approximately two months. The earthworks, including ground preparation and levelling works, for the explosive store pad and access track will be undertaken before the storage facilities are constructed on the pad. The facilities will comprise one or more lockable containers with nominally 1.8 m fencing around the perimeter. An overview of the works is provided in Table 10.

Table 10: Works associated with the explosive store and access track

Work element	Description
Earthworks	Clearing, grubbing, topsoil stripping, ground surface treatment and cut/fill bulk earthworks within the store pad and new track alignment.
Pavement works	Gravel pavement approximately 10 m wide to the full alignment
Road Furniture	Road edge guideposts Traffic signage
New waterway crossings	A single lane (~4.5 m wide), two-span (~55 m long) temporary (Bailey) bridge will be required to cross Sandy Creek. Construction of the waterway crossings will be as per the construction methodology of the bridges for the portal access track (Section 2.7.5.1).

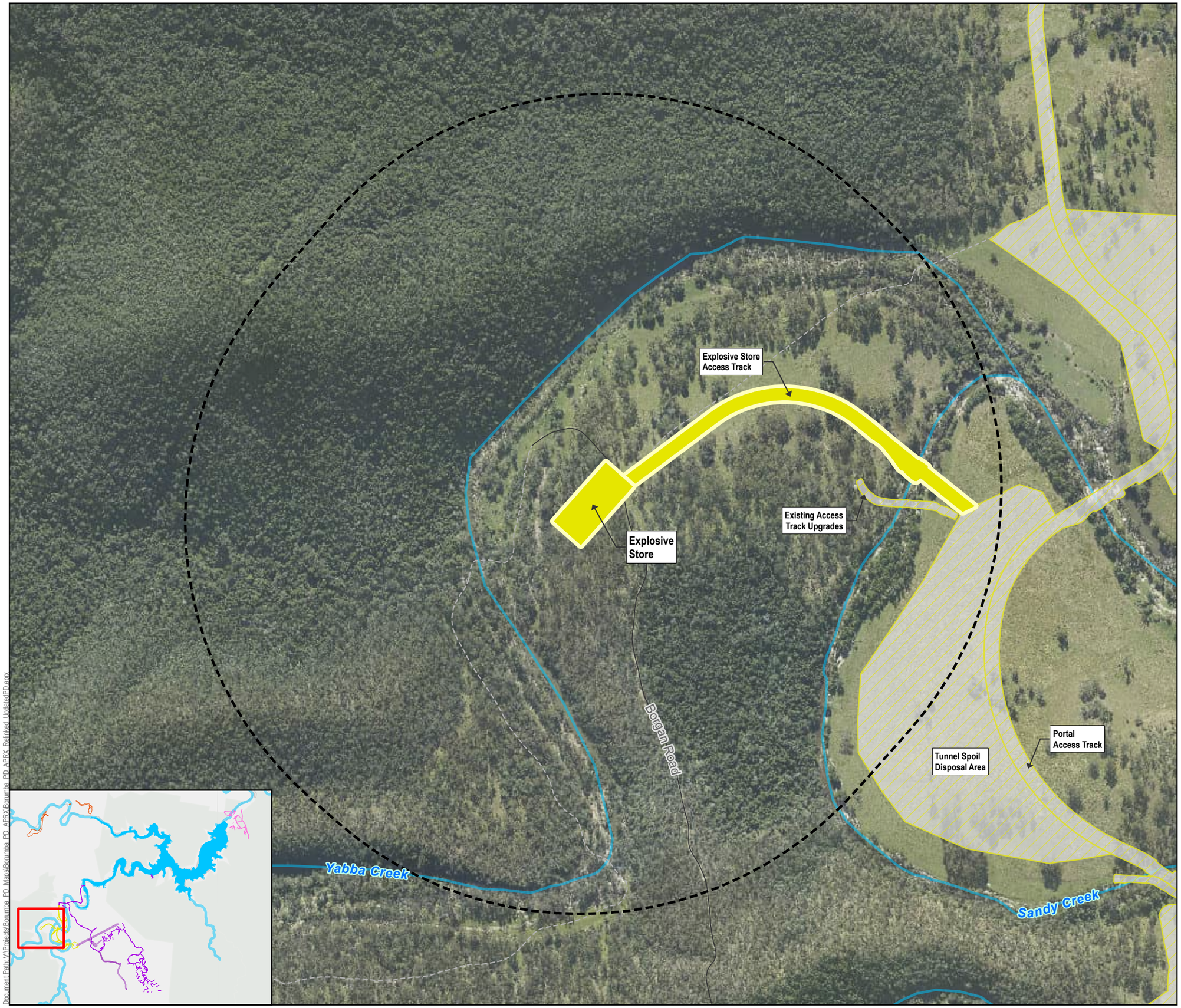
2.7.6.2 Operation

The explosive store will be in operation for the duration of the exploratory tunnelling operations and will be operated by an appropriately licenced contractor.

2.7.6.3 Decommissioning

Should the Main Works not proceed, the explosive store and Bailey bridge will be completely removed upon completion of the exploratory tunnelling. For the explosive store this will entail removal of the above ground facilities, re-contouring of the ground to natural surface levels, respreading topsoil, and re-vegetating with an appropriate seed/tube stock. The Bailey bridge will be decommissioned as per the bridges on the portal access track.

Should the Main Works Project proceed, the explosive store, along with the access track and Bailey bridge, will used to support Main Works construction.



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- Local Roads
- Tracks
- Blast exclusion zone

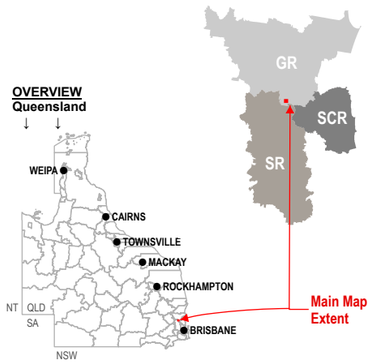
Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 4 - Explosive Store and Access Track
- Area 4 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland

Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
5. Basemap World Light Gray Canvas Base @ Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

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Exploratory Works Project
Preliminary Documentation

EXPLOSIVE STORE AND ACCESS TRACK (AREA 4 - BORGAN)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 23

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2.8 Decommissioning plan – RFI item 2.2

A decommissioning strategy for the Exploratory Works Project is provided in Appendix C.

2.9 Intended land use – RFI item 2.1(a)

Queensland Hydro owns/manages approximately 2,360 ha of land southwest of Lake Borumba that is reserved for a PHES development. Most of the Project components are located on land under Queensland Hydro jurisdiction which was secured in the 1980s for a potential future PHES site. Further to this, all properties impacted by the Project are either held by Queensland Government departments or Queensland Government owned corporations (Figure 24).

Table 11 lists the properties within the Exploratory Works Project area, with land use based on the Queensland Land Use Mapping.

As the Exploratory Works are largely temporary, they are not expected to change the existing land use and management for the underlying land parcels (refer to Section 3.2). For example, the geotechnical investigations within Imbil State Forest and Conondale Resources Reserve will not result in a permanent change in the land use of these areas with the impacted areas to be rehabilitated in accordance with relevant approval conditions and policies. Similarly, the tunnel excavation works will not change the current and intended land use of the Queensland Hydro-managed land parcels. The current grazing leases on these land parcels have been terminated as a result of the Project.

However, the Kingaham Creek bypass and proposed offsets will result in a change in land use. The bypass will impact existing freehold land, with the new section of road to be dedicated as a road under the *Land Act 1994* (Qld) and form part of the local road network managed by the local road authority (i.e. Gympie Regional Council). Some areas of selected lots are also proposed to be used as offset areas for the Project (refer to Section 8).

Queensland Hydro

GDA2020 MGA Zone 56

0 1 2 km

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

- Project Footprint

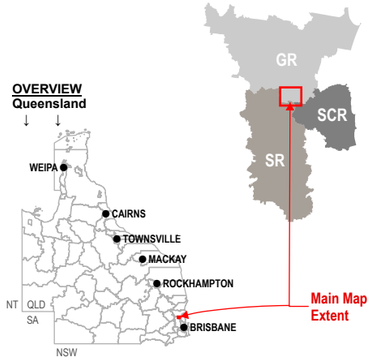
Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Land Owner / Manager

- Brisbane Girls Grammar School - BGGS
- Department of Environment and Science - QPWSP
- Department of Regional Development, Manufacturing and Water - DRDMW
- Department of Resources - DoR
- Private landholder
- Queensland Hydro
- Seqwater
- Roads

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
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Exploratory Works Project
Preliminary Documentation

LAND OWNER / MANAGER

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 24

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Table 11: Land parcels, tenure, and land use relevant to the Exploratory Works Project

Lot on plan	Property name	Land use*	Tenure	Works
1723L37994^	-	Grazing native vegetation	Freehold	Geotechnical investigations, spoil disposal area, access tracks, portal pad, tunnels
16LX1925^	-	Grazing native vegetation	Freehold	Geotechnical investigations, access tracks, tunnels, staging pad, portal pad (part), temporary water infrastructure
132LX2385	-	Intensive uses (services)	Freehold	Geotechnical investigations, access tracks
3AP23765	Conondale Resources Reserve	Nature conservation	National Park	Geotechnical investigations, access tracks
6AP23765	Conondale Resources Reserve	Nature conservation	National Park	Geotechnical investigations, access tracks
3LX2754^	-	Nature conservation	Reserve	Temporary water infrastructure, access tracks, explosives storage area, civil construction compound
20LX2359	-	Nature conservation	Reserve	Temporary water infrastructure, geotechnical investigations, access tracks
1LX2754^	-	Nature conservation	Reserve	Geotechnical investigations, access tracks, tunnels, temporary water infrastructure
135FTY1911	Imbil State Forest 1	Production native forests	State Forest	Geotechnical investigations, access tracks
64LX2110	-	Grazing native vegetation	Freehold	Bella Creek Road (Kingaham Creek bypass), geotechnical investigations
1RP98849	-	Grazing native vegetation	State Land	Kingaham spoil area and access track, geotechnical investigations
1RP194600 (in part)^	-	Grazing native vegetation	Freehold	Access tracks for geotechnical investigations
Yabba Creek, Sandy Creek, Kingaham Creek	-	Nature conservation	Watercourse	Geotechnical investigations, access tracks
Borgan Road	-	Grazing native vegetation	Road	Staging pad (part)

^ land owned or managed by Queensland Hydro
* as per Queensland Land Use Mapping

2.10 Native title

The Borumba PHES Project is situated on the traditional homelands of the Kabi Kabi People, who in mid-2024 received a native title determination from the Federal Court. This determination, which encompasses approximately 10,280 km^2 in south-east Queensland, grants the Kabi Kabi People the non-exclusive right to take resources from the Determination Area for any purpose, marking a historic advancement in their native title rights. It is important to note that these rights coexist with other interests in the area, and while the Kabi Kabi People cannot control access to the land, their native title rights will persist alongside existing land tenures, including valid grants of freehold.

The Project area includes locations where native title exists, such as the Conondale Resources Reserve and Imbil State Forest. Works in these areas (for clarity, this only relates to Exploratory Works included in the controlled action that is the subject of this Preliminary Documentation and the preliminary activities excluded from the action) are subject to an Indigenous Land Use Agreement (ILUA) executed by Kabi Kabi and Queensland Hydro in December 2023 and registered with the National Native Title Tribunal in June 2024. The ILUA, together with other measures, will ensure that the interests of the Kabi Kabi People are respected and acknowledged throughout the Project's development.

2.11 State and local approvals – RFI item 2.3

State and local approvals that may be required for the Exploratory Works are outlined in Table 12. It is noted that the requirement for some of the identified approvals is subject to the final design implemented by the contractor(s) undertaking the works (e.g. building permits associated with site facilities).

Table 12: State and local approvals required for the Project

Legislation	Responsible agency	Approval trigger	Relevance to Exploratory Works Project	Approval/ Authority/ Agreement Required	Comments
State (Queensland)					
Secondary approvals under the *Planning Act 2016*					
Planning Act 2016 Planning Regulation 2017 *Building Act 1975*	Building Certifier Gympie Regional Council Somerset Regional Council	Development approval for building works (if assessable under local council planning scheme).	The Exploratory Works Project requires construction of temporary offices and other infrastructure associated with the construction phase.	Yes	Building work is assessable development unless it is accepted development under the Planning Regulation 2017 or the *Building Act 1975*. Contractors engaged to establish temporary buildings will be responsible for obtaining the appropriate building permits, where required.
Planning Act 2016 Planning Regulation 2017 *Environmental Protection Act 1994*	Chief executive (the State Assessment and Referral Agency (SARA), as defined in the *Planning Act 2016*), Department of State Development, Infrastructure and Planning (DSDIP)	Development permit for a material change of use (MCU) for a prescribed environmentally relevant activity (ERA) that is a concurrence ERA. Also deemed to be an application for an environmental authority under the *Environmental Protection Act 1994* (refer to separate item below).	The Exploratory Works Project will require development approval and an Environmental Authority (EA) for a prescribed ERA – Extractive and screening activities (ERA 16) An EA can only be held by a registered suitable operator.	Yes	ERAs are assessable development and require development approval under the *Planning Act 2016* and an EA under the *Environmental Protection Act 1994*. They are assessable against State code 22 unless the activity meets relevant accepted development criteria, or an exemption otherwise applies under the Planning Regulation 2017 (e.g. development for a coordinated project under Schedule 24 section 3). The volume of materials expected to be extracted during the exploratory tunnel excavation will be assessable as an ERA (16) and will therefore require a development permit for an MCU and an EA under the *Environmental Protection Act 1994*. An application for this permit is currently being prepared.
Planning Act 2016 Planning Regulation 2017 *Fisheries Act 1994*	SARA, DSDIP	Operational work for constructing or raising waterway barrier works, unless the work complies with the document 'Accepted development requirements for operational work that is constructing or raising waterway barrier works'.	Multiple crossings of waterways mapped for fish passage are proposed for the Exploratory Works Project.	Yes (obtained)	The construction of a waterway barrier is assessable development and requires development approval under the *Planning Act 2016*. Development approval was required for two bridge crossings of Sandy Creek. The other bridges did not meet the definition of a waterway barrier. All other proposed crossings will comply with the design requirements in the 'Accepted development requirements for operational work that is constructing or raising waterway barrier works' or a development approval will be obtained.

Legislation	Responsible agency	Approval trigger	Relevance to Exploratory Works Project	Approval/ Authority/ Agreement Required	Comments
Planning Act 2016 Planning Regulation 2017 *Vegetation Management Act 1999*	SARA, DSDIP	Operational work for clearing native vegetation on prescribed land	Vegetation clearing for Exploratory Works Project activities.	Yes	The clearing of native vegetation (unless in a protected area as defined under the NC Act) is assessable development and requires development approval unless an accepted development vegetation clearing code applies and the works comply, or the operational work is exempt clearing work (e.g. geotechnical works where clearing is less than 100 m^2). Vegetation clearing will be required for the Exploratory Works for geotechnical investigations, access tracks, portal pad, staging area, explosive store, civil construction compound, spoil disposal area, and temporary water infrastructure. An application for this approval is currently being prepared.
Planning Act 2016 Planning Regulation 2017 *Water Act 2000*	Department of Local Government, Water, and Volunteers (DLGWV)	Operational work for taking or interfering with water in a watercourse, lake, or spring.	Water will be required for Exploratory Works Project activities and will be sourced from Lake Borumba or Yabba Creek.	Yes (obtained)	The Exploratory Works Project will involve the take of water in a watercourse. A water permit from DLGWV is in place to take water from Yabba Creek (Lake Borumba only). A contract is also in place to purchase water from Seqwater through a River Supply Contract (medium priority allocation). A development approval will also not be required if: • the taking or interfering is allowed under the *Water Act 2000*, Chapter 2, Part 3, Division 1 • the interfering is allowed under a water licence under the *Water Act 2000*, and the work complies with the conditions of the licence.
Planning Act 2016 Planning Regulation 2017 *Water Act 2000*	DLGWV	Removing quarry material from a watercourse or lake.	Materials may be extracted from the Yabba Creek or Sandy Creek beds during the construction of waterway crossings.	Yes	The removal of quarry materials from a watercourse or lake is assessable development and requires approval under the Planning Regulation 2017. A Quarry Material Allocation may be required before works begin if extracted material is used elsewhere for the Project.

Legislation	Responsible agency	Approval trigger	Relevance to Exploratory Works Project	Approval/ Authority/ Agreement Required	Comments
Planning Act 2016 Planning Regulation 2017 Gympie Regional Council Planning Scheme Somerset Region Planning Scheme	Gympie Regional Council Somerset Regional Council	Development approval for development made assessable by the relevant planning schemes, which may include: • operational work for excavation and fill • operational work for clearing of native vegetation.	The Exploratory Works activities will include excavation and fill and clearing of native vegetation.	No, if works are within the scope of the works regulation	Most Exploratory Works activities will occur in the Gympie Regional Council local government area. This includes geotechnical investigations and the construction of access tracks, portal pad, staging area, and explosive store. Construction of access tracks for geotechnical investigations will occur in the Somerset Regional Council local government area. However, a works regulation was made for the Exploratory Works under the *State Development and Public Works Organisation Act 1971* on 13 September 2024. Works covered by the works regulation are exempt from assessment under the planning schemes but will otherwise be assessable under the Planning Regulation 2017: schedule 6, part 5, section 25. Queensland Hydro will continue to work with the Office of Coordinator General to ensure that all works subject to the Works Regulation are undertaken in accordance win the requirements of the Works Regulation.
Planning Act 2016 *Planning Regulation 2017* *Work Health and Safety Regulations 2011* Gympie Regional Council Planning Scheme	SARA, DSDIP Gympie Regional Council	A development approval for: • MCU for a hazardous chemical facility is assessable development (code assessable) under the Planning Regulation • MCU for medium or high impact industry (if above the defined 10% threshold) under the planning scheme.	Storage of explosives – the explosive store will contain quantities above the defined threshold of 10% for the Exploratory Works Project.	Yes, under the Planning Regulation (obtained)	The Major Hazard Facilities Unit of the Office of Industrial Relations confirmed the proposed explosives quantities exceed the 10% threshold. The storage volumes of explosives exceed industry thresholds of the Gympie Regional Council planning scheme and would ordinarily constitute an MCU that is impact assessable development under the scheme. However, the facility is exempt from assessment under the planning schemes as a result of the Works Regulation, but will otherwise be assessable under the Planning Regulation

Legislation	Responsible agency	Approval trigger	Relevance to Exploratory Works Project	Approval/ Authority/ Agreement Required	Comments
Other approvals and requirements					
Aboriginal Cultural Heritage Act 2003	Department of Women, Aboriginal and Torres Strait Islander Partnerships and Multiculturalism	Requirement to comply with cultural heritage duty of care. Compliance via either a Cultural Heritage Management Plan, Native Title Agreement, or other agreement with an Aboriginal party is required.	The Exploratory Works Project will affect cultural heritage matters.	Yes	Kabi Kabi and Queensland Hydro have executed an Early Works Agreement (EWA) that outlines the cultural heritage assessment process for the Exploratory Works and will constitute 'another agreement' for the purposes of section 23(3)(a)(iii) of the *Aboriginal Cultural Heritage Act 2003*.
Biosecurity Act 2014	Department of Primary Industries (DPI)	Requirement to comply with the General Biosecurity Obligation (GBO).	The Exploratory Works have the potential to result in the spread of restricted biosecurity matters.	No	Biosecurity issues must be identified, and appropriate mitigation measures planned and implemented.
Environmental Offsets Act 2014	Department of Environment, Science, Tourism, and Innovation (DETSI)	Offset condition imposed under State legislation (e.g. *Nature Conservation Act 1992*) for a prescribed environmental matter that has not been assessed under the EPBC Act, for impacts to any MSES (e.g. of concern REs, Watercourse Vegetation, Protected Areas including resources reserve).	Subject to approvals and detailed design, environmental offsets will be provided for this residual impact, in accordance with the Queensland Environmental Offsets Policy (QEOP).	Yes	Environmental offsets are required where a prescribed activity (Schedule 1 of the Regulation) is likely to have a significant residual impact on prescribed environmental matters (Schedule 2 of the Regulation) following consideration of avoidance and mitigation and management measures. Environmental offsets for these MSES are proposed to be delivered in compliance with the QEOP and an Offset Delivery Plan will be finalised setting out how these offset requirements will be delivered.
Environmental Protection Act 1994	DETSI	EA for a prescribed ERA – Extractive and screening activities (ERA 16)	The construction of the exploratory tunnel will involve the extraction of materials over the threshold for an ERA 16.	Yes	A person must not carry out an ERA unless the person holds or is acting under an EA for the activity. ERAs are assessable development and require a development approval under the *Planning Act 2016*. They are assessable unless the activity meets relevant accepted development criteria, or an exemption otherwise applies under the Planning Regulation 2017. An application is currently being prepared.

Legislation	Responsible agency	Approval trigger	Relevance to Exploratory Works Project	Approval/ Authority/ Agreement Required	Comments
Environmental Protection Act 1994	DETSI	Soil disposal permit	Removal, treatment, or disposal of contaminated soil from land listed on the Environmental Management Register (EMR) or Contaminated Land Register, if required.	To be determined	Potential sources of contaminated land are present in the area (e.g. cattle dips, historic mines) and some land parcels where the Exploratory Works Project will occur are listed on the EMR. An assessment undertaken of the portal pad and the spoil disposal area in August 2023, and the civil construction compound and explosive store in April 2024 did not detect any exceedances of the relevant health and ecological investigation limits. Further assessment is being undertaken in areas of the Project footprint to determine if a disposal permit will be required.
Explosives Act 1999	Resources Safety and Health Queensland	An authority is required to use, possess, store or transport explosives	The Exploratory Works Project requires blasting activities to establish the exploratory tunnel, and potentially the Kingaham Creek bypass.	Yes	The requirements of the *Explosives Act 1999* would apply to blasting activities.
Forestry Act 1959	Queensland Parks and Wildlife Service (QPWS) DPI	Occupation permit under s35 of the *Forestry Act 1959*	Geotechnical investigations and access tracks are required in state forest tenure.	Yes (partially obtained)	Queensland Hydro has been granted an occupation permit for works within the section of Imbil State Forest in Area 1. The approval conditions outline specific requirements that Queensland Hydro and our contractors must comply with including biosecurity and rehabilitation works, along with where applicable the approval of relevant documents by the Chief Executive. Queensland Hydro will seek to amend this permit to reflect recent changes to the Exploratory Works footprint within Imbil State Forest, in consultation with Queensland Parks and Wildlife Service (QPWS) and other relevant stakeholders. Plantation Licence exists over portions of Imbil State Forest 1 with the licensee to be consulted as part of the permits assessment process. Queensland Hydro also has a permit to traverse sections of Imbil State Forest.

Legislation	Responsible agency	Approval trigger	Relevance to Exploratory Works Project	Approval/ Authority/ Agreement Required	Comments
Forestry Act 1959	DPI	Liaison / compensation for forestry timber.	Geotechnical investigations will occur within a plantation licence area.	Yes	A plantation licence exists in Imbil State Forest, with Queensland Hydro consulting with HQ Plantations regarding access to the licence area.
Nature Conservation Act 1992	DETSI	Clearing of protected plants.	The Exploratory Works will occur in high-risk protected plant areas and/or within 100 m of known protected plants.	Yes (partially obtained)	Targeted surveys are required to confirm presence of threatened plant species in trigger areas and within 100 m of known threatened species records. Most of the Project footprint has been surveyed and clearing permits are currently being prepared, along with the Impact Management Plans. Offset requirements will also be determined for impacts to protected plants under the NC Act, including whether the offset solutions proposed under the EPBC Act are sufficient.
Nature Conservation Act 1992	DETSI	Disturbance of breeding places for protected animals that are classified as extinct in the wild, critically endangered, endangered, vulnerable, near threatened, special least concern, colonial breeder or least concern.	The Exploratory Works Project is likely to impact breeding places for several species listed under the NC Act that are known to occur or have a high or moderate likelihood of occurrence within the Exploratory Works Project footprint.	Yes (obtained)	Targeted surveys are required to confirm the presence of animal breeding places. A Low Risk Species Management Program (SMP) for least concern species and a High Risk SMP for special least concern, critically endangered, endangered, vulnerable and near threatened fauna species have been obtained. These documents include measures to manage the impacts on fauna species listed under the EPBC Act. A damage mitigation permit is also likely to be required to tamper with animal breeding places.
Nature Conservation Act 1992	DETSI	Authority under s34	Geotechnical investigations are required in Conondale Resources Reserve	Yes (partially obtained)	has been granted for works within the section of Conondale Resources Reserve in Area 1, with a financial offset settlement under the Queensland Government Offset Framework provided. The approval conditions outline specific requirements that Queensland Hydro and our contractors must comply with including biosecurity and rehabilitation works, along with where applicable the approval of relevant documents by the Chief Executive. An authority will also be required for works within the section of Conondale Resources Reserve within Area 3.

Legislation	Responsible agency	Approval trigger	Relevance to Exploratory Works Project	Approval/ Authority/ Agreement Required	Comments
Water Act 2000	DLGWV	Excavation, placement of fill and the destruction or removal of vegetation within a watercourse – riverine protection permit.	Removal of vegetation and extraction of materials will be required for the construction of waterway crossings for Exploratory Works access tracks.	Yes (obtained)	It is an offence to destroy vegetation, excavate or place fill in a watercourse, lake or spring without a riverine protection permit (unless works comply with the relevant exemption requirements). This permit will be required for the construction of waterway crossings through Yabba Creek and Sandy Creek for the Exploratory Works Project.

3. Description of the environment – RFI item 3.2

3.1 Project locality

The Project is in the Yabba Creek catchment in the Upper Mary River Basin, approximately 258 km from the tidal barrage and 318 km from the mouth of the Mary River. The Mary River discharges into the Great Sandy Strait, a declared Ramsar wetland (Figure 25). The nearshore coastal environment comprises sensitive estuarine and freshwater ecosystems, with K'gari (formerly Fraser Island) a short distance offshore.

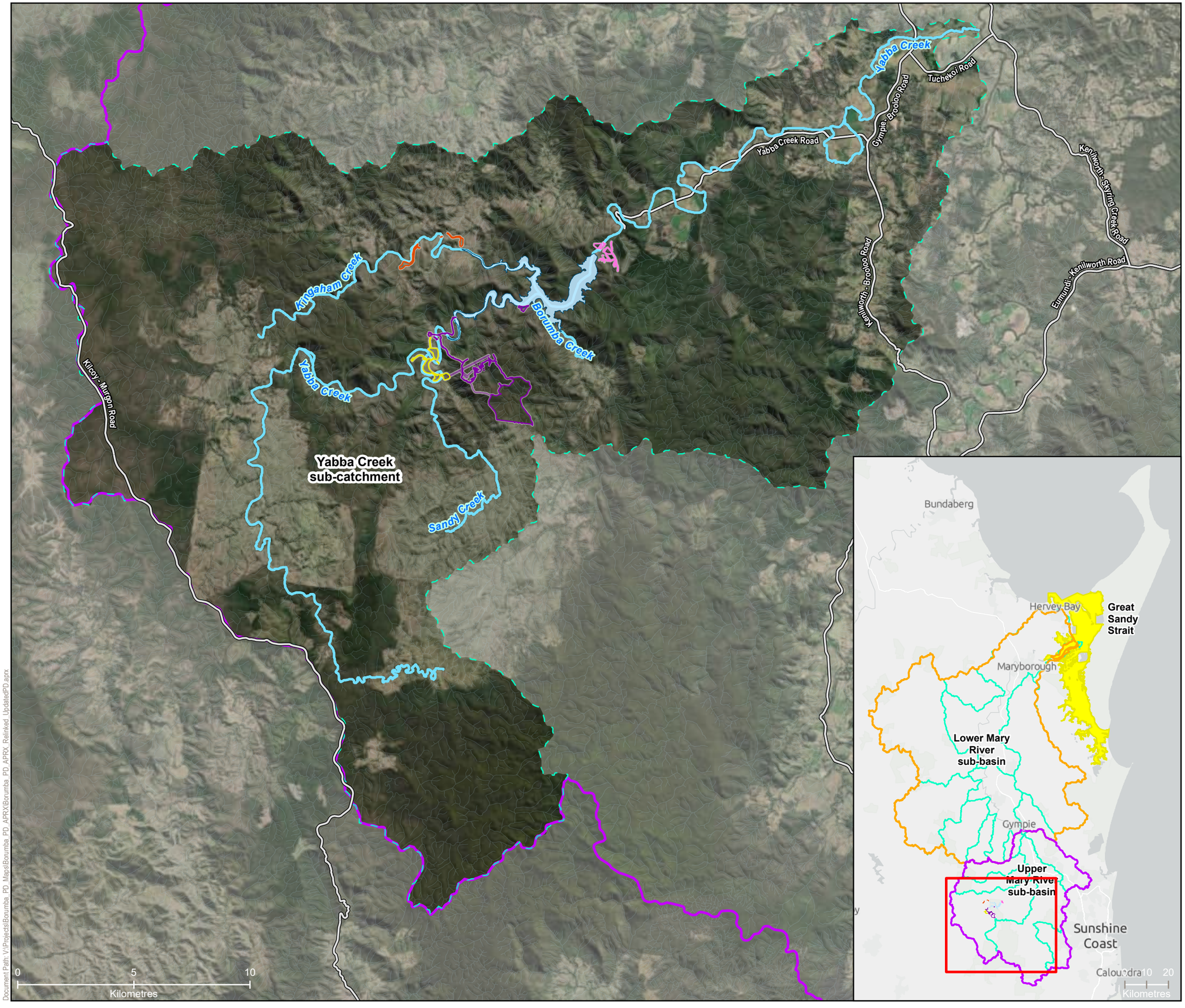
The Project is within the South East Queensland bioregion, which is characterised by moderate to high rainfall (between 800-1,500 mm per year) with warm to hot summers and cool winters. This bioregion comprises coastal plains, adjacent hills and ranges and the major drainage basins of Brisbane River, Mary River, Barambah Creek and Lower Burnett River. It also includes coastal mainland and island sand masses.

The region surrounding the Project is characterised by rural agricultural holdings, small towns, vegetation, and nature conservation areas. The current surrounding landscape comprises:

- agricultural land, predominately grazing operations
- large and small stands of vegetation
- watercourses
- scattered residential dwellings/outbuildings
- minor roads that connect smaller townships and residential areas to regional centres
- Lake Borumba and recreational facilities on the foreshores
- the peaks of Mount Kandanga (557 m) to the north, Mount Borumba (624 m) to the south and Yabba Range to the west.

The sensitive environmental values present within the area include:

- several state-wide riparian and terrestrial biodiversity corridors
- remnant vegetation, including endangered and of concern regional ecosystems (REs)
- State mapped essential habitat
- Conondale Resources Reserve and Conondale National Park
- Imbil State Forest
- Lake Borumba reserve, managed by Seqwater.



Queensland Hydro

GDA2020 MGA Zone 56

(scale displayed on each map view)

LEGEND

- Lake Borumba (FSL 135.01m AHD)
- Watercourse

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Sub-basin

- Lower Mary River
- Upper Mary River

Sub-catchment

- Mary Basin sub-catchments

Conservation Park Zone

- Great Sandy Strait Conservation Park Zone

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Roads (QRT) @ © State of Queensland (Department of Resources) 2021
3. Site Layout Items FEED 2 @ AFRY, Feb 2023 and GHD Nov 2022, SMEC 2024
4. Watercourses and Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2021
5. Drainage basin sub areas, Drainage basins © State of Queensland (Department of Resources) 2021
6. Marine Park Zoning © The State of Queensland 2024
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Exploratory Works Project
Preliminary Documentation

MARY RIVER CATCHMENT AND GREAT SANDY STRAIT

PROJECT #:	30032677
CREATED BY:	BM
LAST MODIFIED:	NC17428, 7/10/2025
REVISION:	A

FIGURE 25

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3.2 Land use

The dominant land uses within and surrounding the Project area include nature conservation areas, services, the Borumba reservoir/dam, grazing native vegetation, production native forests, plantation forestry, and recreation and camping (Figure 26).

Areas of nature conservation are contained within:

- Conondale National Park – covers an area of approximately 35,835 ha and is characterised by large areas of remnant vegetation, rugged mountain ranges and boulder lined creeks. The national park contains the popular Booloumba Creek camping and day-use area, walking tracks, lookouts, scenic drives and grassy camp sites. Exploratory Works activities are not located within the national park.
- Conondale Resources Reserve – four small parcels are located within the Conondale National Park. Three parcels and access alignments are located south of Lake Borumba and one parcel is located on the north bank of Yabba Creek (near the Borumba Dam wall). The resources reserve parcels were specifically created by the Queensland Government to allow for the Project.

The services located in the area include Seqwater's maintenance facilities associated with the dam and water supply scheme, recreational facilities associated with Lake Borumba, the Yabba Creek Rural Fire Service infrastructure, and the Lake Borumba Fish Stocking Association Clubhouse, which are located on the southern bank of Lake Borumba and Yabba Creek adjacent to the existing Borumba Dam wall. A low voltage (11 kv) powerline operated by Energy Queensland services the Seqwater infrastructure at the dam.

Lake Borumba is a reservoir in the Yabba Creek sub-catchment of the Mary River basin. Lake Borumba stores water for the Mary Valley Water Supply Scheme and provides a diverse array of recreational opportunities, including fishing, picnicking, paddle craft, sailing and motorised water sports and camping (Seqwater, 2023). The Lake Borumba Fish Stocking Association Clubhouse stocks the lake with Australian bass, golden perch, Mary River cod and silver perch (DAF, 2023). Further information about the reservoir is included in Section 3.7.

The Queensland Hydro-owned/managed land covers approximately 2,360 ha and is located west of Conondale National Park. The land was acquired and reserved in the 1980s for pumped hydro development.

Cleared areas are present in the locality and are where most of the proposed infrastructure for the Project is located. Historical imagery shows that the riparian zone of Yabba Creek and Sandy Creek were cleared in the past along with areas where the explosive storage site is located.

As part of grazing activities, the site has been frequently burned, with fires generally occurring in the winter months. There was a significant fire in 2014/2015, which impacted the area including the area of vegetation associated with Walkers Top Road.

There are existing access tracks in and around Lake Borumba and through the State Forests and Queensland Hydro-owned land. Existing access tracks are generally unsealed, single lane tracks.

Forestry activities occur in Yabba State Forest and Imbil State Forest. Yabba State Forest is located west of the Project area. Imbil State Forest borders the southern bank of Lake Borumba, east of the Conondale National Park. Access tracks and geotechnical drilling are both proposed within the Imbil State Forest at the existing dam wall site.

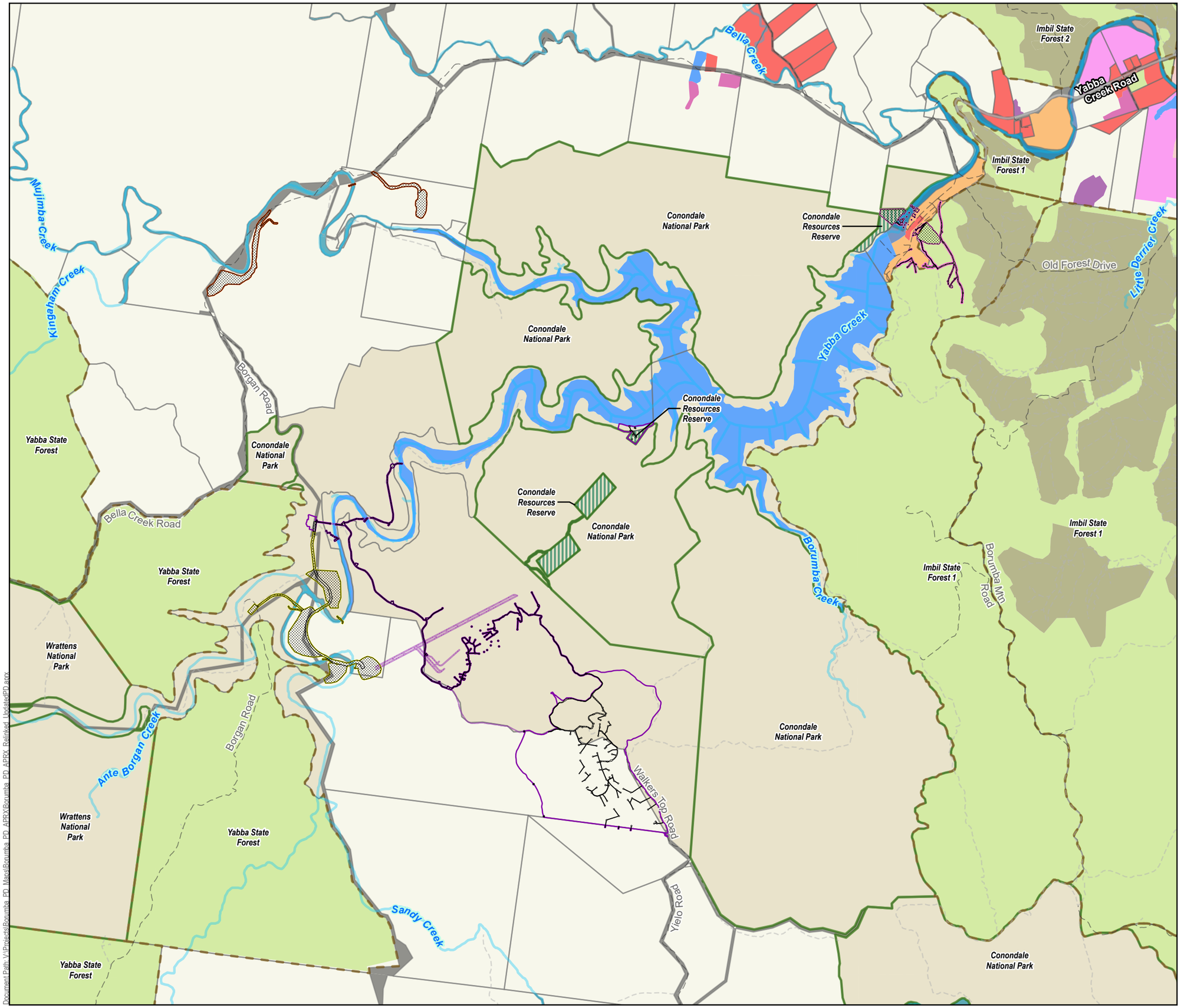
Lot 1LX2754 land and part of Lot 3LX2754 are mapped as a forest management unit under the *Forestry Act 1959*. Forest management units are areas where the State owns the forest products on the land and has a commercial interest in managing the forest products through the Forest Products unit within DPI. These two lots are reserves for electrical purposes, with Queensland Hydro the trustee.

There are no current mining leases, mining lease applications, key resource areas, or petroleum or gas pipelines within the Project footprint. However, there are the following four historical mining leases within the Project area:

- ML212846 on lot 7AP23628
- ML231555 on lot 3LX2754
- ML231568 on lot 3LX2754
- ML3717 on 3LX2754.

All mining activity is historical (generally several decades old). Including other nearby mine workings, the metals sought were gold, silver, manganese and nickel.

Queensland Hydro land was designated as a restricted area in August 1990 for the purposes of the Borumba Hydroelectric scheme under the *Mineral Resources Act 1989* and *Geothermal Energy Act 2010*. On the same date Lake Borumba was also designated as a restricted area, which prohibits applications under the *Mineral Resources Act 1989* and *Geothermal Energy Act 2010*.



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Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

- Project Footprint

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Land boundaries

Category

- National Park
- State Forest
- Conondale Resources Reserve
- Road
- Watercourse

Land use

- Nature conservation
- Other minimal use
- Grazing native vegetation
- Production native forests
- Plantation forests
- Grazing irrigated modified pastures
- Irrigated cropping
- Irrigated perennial horticulture
- Intensive animal production
- Residential and farm infrastructure
- Services
- Reservoir/dam
- River

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
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Exploratory Works Project
Preliminary Documentation

LAND USE

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 7/10/2025
REVISION:	A

FIGURE 26

3.2.1 Contaminated land

A preliminary contaminated land assessment of the DETSI's Environmental Management Register and Contaminated Lands Register identified, as of December 2023, there were no lots listed on the Contaminated Lands Register and the following three lots listed on the Environmental Management Register (Figure 27):

- Lot 3LX2754 – livestock dip, spray race, pastoral agriculture (notified for mineral processing)
- Lot 135FTY1911 – petroleum product or oil storage and waste storage, treatment or disposal
- Lot 1723L37994 – livestock dip, spray race, pastoral agriculture.

Site contamination investigations were completed in July and August 2023 targeting the spoil disposal area and portal pad on Lot 1723L37994. Fifteen sites at the portal pad and 25 sites at the spoil disposal area were sampled using hand augering to a depth of 1 m or refusal. Samples were collected at the surface (0-0.15 m), 0.5 m and 1.0 m with additional samples collected where the change in lithology and/or potential contamination was observed. Analysis of the samples found no sign of contamination, with all results except for metals below the laboratory limit of reporting, and the concentrations of all metals lower than the relevant ecological and human health criteria (SMEC, 2023; SMEC, 2024b).

A site contamination investigation completed in April 2024 targeted two potential areas of environmental concern associated with a livestock dip or spray race and pastoral agriculture on Lot 3LX2754. A total of 40 borehole locations were sampled using hand augering to a depth of 1 m or refusal. Samples were collected at the surface (0-0.15 m), 0.5 m and 1.0 m. Analysis of the samples found no sign of contamination, with all results except for metals below the laboratory limit of reporting, and the concentrations of all metals lower than the relevant ecological and human health criteria (SMEC, 2024a).

A preliminary contamination investigation of the dip area on Lot 3LX2754 was undertaken though no works are planned in this area as part of the Project.

A desktop review indicated that the following listed notifiable activities may have occurred on Lot 7AP23765 (Figure 27) (Conondale National Park, part thereof) at the Old Borumba Homestead and immediate surrounding where:

- petroleum storage may have occurred in the machinery shed
- chemical storage may have occurred in the machinery shed and the cattle dip
- waste disposal and/or release of septic waste may have occurred near the homestead buildings.

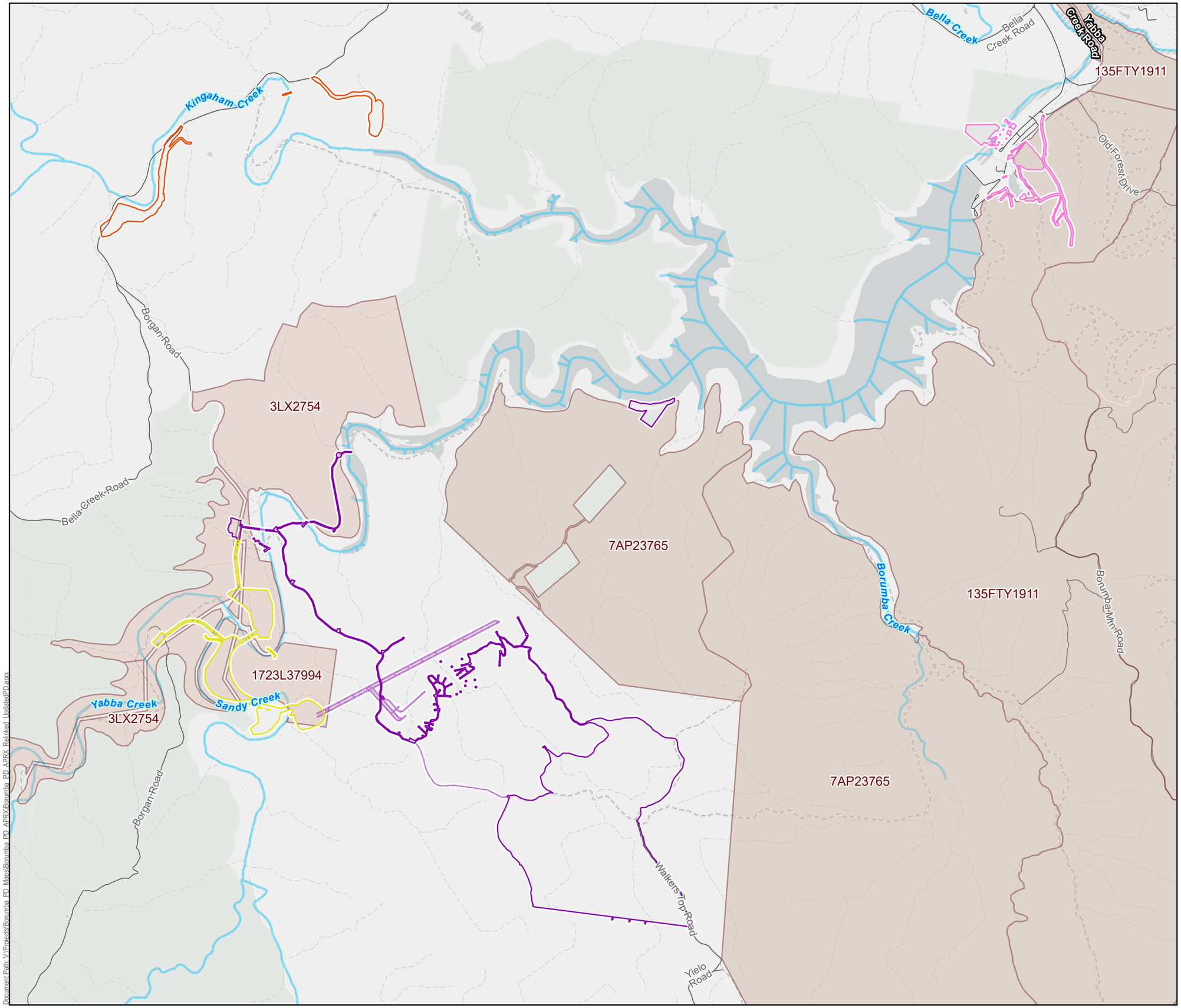
The temporary water pipeline (in part), spoil disposal area, portal pad, portal access track and civil construction compound are located on the same lots as those listed as potentially contaminated. However, the location of potential contamination sites are discrete areas that are easily identified and have been avoided.

Additional contaminated land assessments are being undertaken across the Main Works Project area in accordance with relevant guidelines and procedures in support of the Main Works Project's EIS, with this information to be used to finalise management strategies for the Exploratory Works Project (e.g. need for soil disposal permits and treatment of spoil).

A geotechnical report completed by ENGEO (2022) noted that while concentrations of the tested suite of metals were generally below any guideline, some samples contained cadmium, nickel, or copper which were above levels wherein the material was considered safe for re-use as fill. This aligns with the surface water quality and sediment quality results collected for the Project, and suggests those results are based on the natural geology of the underlying rock rather than sources of anthropogenic contamination.

To characterise spoil material, a total of 20 samples were analysed for net acid production potential, Net Acid Generation, and Acid Neutralising Capacity from nine locations. All samples were classified as non-acid-forming material. Therefore, there are no concerns in relation to the management of acid drainage from spoil stockpiles.

Geochemistry analysis of the geotechnical boreholes is currently planned as part of the future geotechnical investigations, including recently constructed boreholes. In addition, geochemistry analysis of excavated material will be undertaken progressively during the tunnelling works. This information will inform management measures such as the segregation, storage and treatment of the material at the spoil disposal area, as outlined in the Spoil Management Plan (refer to Appendix H of Appendix F).



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Queensland Hydro

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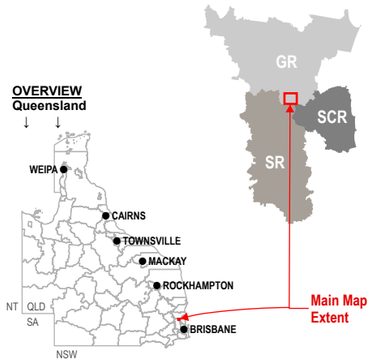
- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Potentially Contaminated Land (as listed on Queensland EMR)

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
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Exploratory Works Project
Preliminary Documentation

POTENTIALLY CONTAMINATED LAND

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 27

3.3 Native Title and cultural heritage

The Project is situated primarily within the bounds of the Kabi Kabi First Nation Traditional Owners Native Title Claim Group (Kabi Kabi) native title determination.

Queensland Hydro and Kabi Kabi have entered into an ILUA for the preliminary activities excluded from the action and the Exploratory Works. The ILUA was registered by the National Native Title Tribunal on 26 June 2024.

Queensland Hydro and Kabi Kabi also entered into a Cultural Heritage Agreement (or an Early Works Agreement (EWA)) (under section 23 of the *Aboriginal Cultural Heritage Act 2003* (Qld)) in October 2023.

Kabi Kabi have participated in a range of cultural heritage surveys and inspections of the Project footprint and the Main Works footprint. These investigations have confirmed the presence of tangible and intangible Aboriginal cultural heritage items, places and values that may be impacted by the Exploratory Works (noting that more extensive investigations are planned, including in relation to the Main Works).

The EWA is founded on an avoidance principle and includes provision for cultural heritage surveys (or early works inspections) and a process for Queensland Hydro and Kabi Kabi to agree management measures in relation to cultural heritage.

Queensland Hydro and Kabi Kabi are working together with a view to avoiding and/ or minimising impacts on the areas of cultural heritage significance. Queensland Hydro and Kabi Kabi are working together with some particular focus in relation to the proposed Exploratory Works in Area 3 (Walkers Top). As such a larger Project area has been identified established for this work area.

The Aboriginal and Torres Strait Islander Cultural Heritage Database and Register, managed by the Queensland Government, lists several sites of cultural heritage significance in the vicinity of the Project, including burials. The sites are located outside the Project footprint and will not be impacted by the Project.

A search of the Australian Heritage Database, the Queensland Heritage Register, and the Gympie Regional Council Heritage Database returned no results for European heritage places within the Project area. A historic heritage assessment undertaken by Niche supports this conclusion. The heritage assessment identified 18 items of interest, of which 11 may have local or regional heritage significance. These are located outside of the Project footprint.

Looking ahead to the Main Works, Kabi Kabi is actively participating in the EIS and undertaking a Kabi Kabi Indigenous Impact Assessment. Kabi Kabi is committed to being appropriately informed and engaging with the broader Kabi Kabi community before they will make any decisions in relation to the main works.

3.4 Topography

Accurate LiDAR data was obtained for the Project area. The terrain varies from flat alluvial land to step hillsides with the elevation ranging from approximately 120 mAHD up to 550 mAHD (Figure 28). Much of Lake Borumba (FSL 135.2 mAHD) is surrounded by the steep slopes of the Yabba Range, Conondale Range, and Kandanga Range to the south, southeast and north respectively. These ranges rise to in excess of 370 m above Lake Borumba surface level.

The open valleys on the main arms of Lake Borumba contain more gently sloping land, often associated with local alluvium.

Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Exploratory Works Project

- Project Footprint

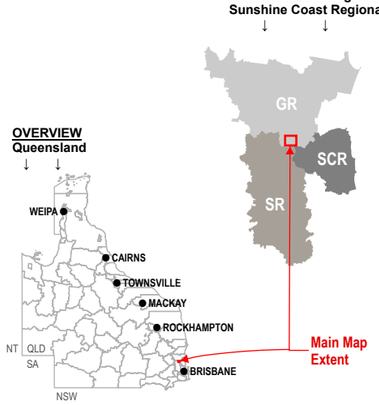
Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Contour Lines (25m)

- 100 - 195m
- 195 - 290m
- 290 - 400m
- 400 - 485m
- 485 - 620m

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
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Exploratory Works Project
Preliminary Documentation

TOPOGRAPHY

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 28

Document Path: V:\Projects\Borumba_PD_Mapsi\Borumba_PD_APRX\Borumba_PD_APRX_Relinked_UpdatedPD.aprx

3.5 Geology

The Queensland Government's Detailed Surface Geology identifies a range of geological rock units mapped in and around the Project area (Figure 29); these are identified in Table 13.

The presence of serpentinite (Table 13) can correlate with the presence of naturally occurring asbestos. Initial testing of soil outside the Project area has found naturally occurring asbestos. Testing will occur within the Project area before activities begin, and naturally occurring asbestos avoided or appropriate management measures implemented.

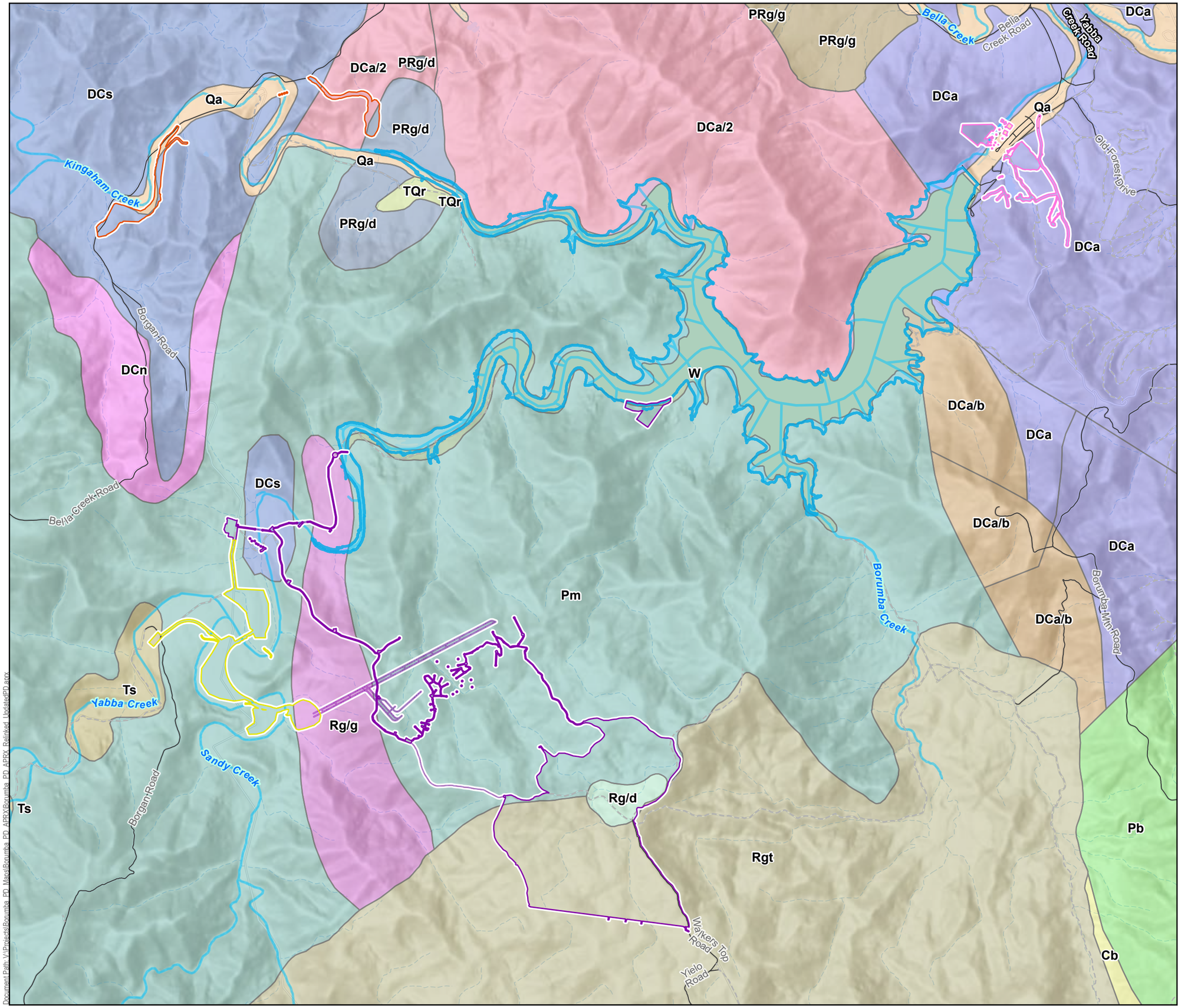
The soils vary from sandy loams to light to medium clays. The soil structure in the Project area ranges from moderately stable surface soils over dispersive subsoils to cohesive surface soils over dispersive subsoils. Acid sulphate soils (ASS) are not mapped within the Project area and have a low probability to extremely low probability of occurring, with very low to low confidence respectively. Despite this, the Project area is mapped within the State Planning Policy ASS trigger area. There has been no recorded evidence of salinisation of the lands around the Yabba, Conondale and Kandanga ranges.

Soil sampling in accordance with relevant guidelines and procedures is currently being undertaken across the Main Works Project area. The outcomes of the soil sampling will be used to finalise management strategies for the Project (e.g. erosion and sediment control).

Table 13: Detailed Surface Geology mapping within the Borumba PHES Survey area

Rock Unit Name	Lithological Summary	Dominant Rock	Age
Amamoor beds	Mudstone, slate, basic metavolcanics, chert, schist, jasper, greywacke	Mixed Sedimentary Rocks and Mafites	Late Devonian – Early Carboniferous
Quaternary alluvium	Clay, silt, sand and gravel; flood-plain alluvium	Alluvium	Quaternary
PRg/d-SEQ	Pyroxene-biote-hornblende diorite; hornblende diorite to clinopyroxene hornblendite	Dioritoid	Late Permian - Triassic
Amamoor beds/2	Buff shale, slate, siltstone and minor chert; locally phyllitic	Mudrock	Late Devonian – Early Carboniferous
Mount Mia Serpentinite	Serpentinite and serpentinite matrix melange with blocks of serpentinite, mafic greenschist, and locally phyllite; sporadic inclusions of blueschist, quartz-mica schist, marble, and quartzite; rare inclusions of gabbro, amphibolite, lherzolite, wehrlite	Ultramafic Rock	Late Devonian - Early Carboniferous
Marumba beds	Mudstone, sandstone, conglomerate, rhyolite	Mixed Sedimentary Rocks and Felsites	Early Permian
Rg/g-SEQ	Biotite-hornblende granodiorite	Granitoid	Middle Triassic - Late Triassic

Rock Unit Name	Lithological Summary	Dominant Rock	Age
Ts-QLD	Clayey, commonly poorly to semi-consolidated, sublabile to quartzose sandstone, sandy claystone, laminated siltstone, and local conglomerate	Arenite-Mudrock	Tertiary
Rg/d-SEQ	Equigranular to porphyritic microdiorite; porphyritic microdiorite; biotite-hornblende diorite	Dioritoid	Middle Triassic - Late Triassic
Tungi Creek Granodiorite	Biotite-hornblende granodiorite; hornblende-biotite granite	Granitoid	Late Triassic



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Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)

Exploratory Works Project

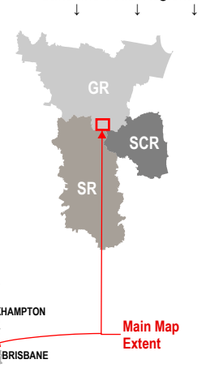
Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Detailed Surface Geology

- Amamoor beds (DCa)
- Amamoor beds/2 (DCa/2)
- Amamoor beds/b (DCa/b)
- Anderson Creek Phyllite (DCn)
- Booloumba beds (Cb)
- Cambroon beds (Pb)
- Marumba beds (Pm)
- Mount Mia Serpentinite (DCs)
- PRg/d-SEQ (PRg/d)
- PRg/g-SEQ (PRg/g)
- Qa-QLD (Qa)
- Rg/d-SEQ (Rg/d)
- Rg/g-SEQ (Rg/g)
- TQr-QLD (TQr)
- Ts-QLD (Ts)
- Tungi Creek Granodiorite (Rgt)
- Water body (unspecified) (W)

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
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Preliminary Documentation

GEOLOGY

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LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 29

3.6 Climate

The climate of the Project area is subtropical with warm summers and cold winters. Rainfall is summer-dominant with lower winter rainfall. During the wet season (December to March), the region typically experiences hot and humid summers, with heavy rainfall often accounting for approximately 55% of the annual rainfall. At Lake Borumba the mean annual rainfall is 1,155 mm. Localised flooding can occur in the region during heavy rainfall events. The dry season from May to November is generally cooler with less humidity and rainfall gradually decreasing until its lowest in August before increasing towards the wet season. During typical summer periods, average maximum monthly temperatures can reach over 31°C, while average monthly minimum temperatures can reach less than 7°C in winter.

The Project is located at the southern extent of Queensland's tropical cyclone region, which has mostly avoided the direct impacts of tropical cyclones. Since 1914, four tropical cyclone systems have passed within 50 km of the Project area. While there is no readily available data on the frequency of east coast lows, the Bureau of Meteorology indicates that on average they can occur several times a year. The Project area is likely to experience between 20 to 25 thunder days per year and 15 to 20 lightning flashes per km^2 per year.

The Queensland Government drought declaration records (1964-2022) indicate the region has been drought declared for approximately 30% of the time and was last declared drought free in April 2022 following significant and multiple flood events.

The Project area has been mapped by the Queensland Fire and Emergency Services as having medium, high, and very high potential bushfire intensity hazard areas. The areas to the south and west of Lake Borumba, in Conondale National Park and Yabba State Forest, have a very high potential bushfire intensity.

3.7 Surface and ground water

3.7.1 Surface water

The Project is located in the Upper Mary River sub-basin of the Mary Basin (Figure 30), which is a Great Barrier Reef Catchment Area. The Mary Basin encompasses approximately 9,500 km^2 and is comprised of 20 sub-catchments. The Upper Mary River Basin encompasses approximately 2,700 km^2, with the catchment upstream of Lake Borumba being 456 km^2.

Stream flow in the Mary Basin is highly seasonal and varies considerably from year to year and generally corresponds with rainfall events, with the wet season occurring between December and March.

Waterways in the basin range from ephemeral creek systems to permanent flowing rivers and creeks. The waterways in or near the Project area range from stream order 1 to 6 and include defined watercourses such as Yabba Creek, Kingaham Creek and Sandy Creek (Figure 30).

Most drainage lines associated with the upper slopes of the Project area are stream order 1 or 2 and are typically defined by rocky vegetated banks in moderately steep to steep gullies. In the Project area, Kingaham and Yabba creeks are mapped as stream order 5, and Yabba Creek within Lake Borumba and downstream of the existing dam wall are mapped as stream order 6.

The land surface within the Project area primarily drains towards Yabba Creek, with Kingaham Creek, and Sandy Creek being the main tributaries draining into Lake Borumba and Yabba Creek respectively. Stream flow in Yabba Creek is highly seasonal and varies considerably from year to year. Downstream of Borumba Dam, the streamflow is affected by storage within and releases/spillage from Borumba Dam.

The stream order 2 watercourse that flows through Area 3 (Walkers Top) (Figure 30) into Lake Borumba is locally known as Cedar Creek. It contains large cascades and small waterfalls along its length, as well as sections where the water is underground.

Water quality in downstream areas of the Mary Basin is generally affected by nutrient and sediment loading and pesticide and herbicide application, having negative impacts on the ecosystem function of the coastal ecosystems. These environmental stressors are typical as the catchment is host to primary industries including grazing, horticulture, forestry, and mining as well as rural and urban population centres.

Queensland Hydro

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LEGEND

- State Controlled Roads
- Local Roads
- Tracks
- Lake Borumba (FSL 135.01m AHD)
- High Ecological Significance Wetlands

Watercourse identification map [Water Act 2000]

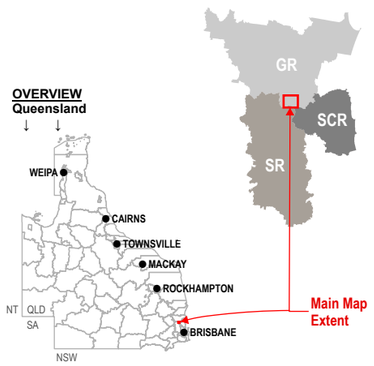
- Watercourse
- Drainage feature

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
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Exploratory Works Project
Preliminary Documentation

WATERCOURSES AND WETLANDS

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 30

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3.7.1.1 Lake Borumba

Lake Borumba is located immediately downstream of the Project area and is a reservoir with a storage capacity of approximately 46 GL and an inundation area of approximately 482 ha at FSL (135.01 mAHD). The Borumba Dam wall was constructed in 1963 and was upgraded to increase flood storage in 1997, with further works in 2009. The lake stores water (primarily for drinking and irrigation) for the Mary Valley Water Supply Scheme. The dam is not fitted with a fishway or a multi-level offtake (water is released from the bottom). The dam is an un-gated dam, meaning that when the dam reaches 100% capacity, water flows over the spillway and downstream (Seqwater, 2023).

Water quality in Lake Borumba is typical for a freshwater lake in this region with neutral pH and electrical conductivity levels between 250–300 Microsiemens per centimetre (µS/cm). Mild thermal stratification occurs within Lake Borumba. Stratification is most notable during the warmer months between December and March, with temperature fluctuations suggesting a thermocline at depths between 6-10 m (Hydrobiology, 2023). This stratification breaks down with inflows and the onset of cooler weather.

Nutrient levels recorded within the water column of the lake were found to exceed the water quality objectives (WQOs) for total nitrogen and total phosphorus (Hydrobiology, 2022 and 2023), and this has also been observed in monitoring results from 2024. Benzo, perylene and total polyaromatic hydrocarbons were detected in Lake Borumba sediment but below the default guideline values (Hydrobiology, 2022) and these have not been detected in water quality samples collected to date. Concentrations of some total and dissolved metals also exceed WQOs (Hydrobiology, 2023), with data from 2024 showing total manganese and nickel are often above the WQOs.

Water quality in the Mary Basin is generally influenced by nutrient and sediment loading and pesticide and herbicide application, with negative impacts on the ecosystem function of the coastal ecosystems. These environmental stressors are expected as the catchment is home to the primary industries of grazing, horticulture, forestry, commercial fishing, and mining (BMRG, 2019).

A desktop and field geomorphic assessment and hydraulic modelling was undertaken to assess the current geomorphic conditions and fluvial geomorphology. Borumba Dam currently influences sediment supply from 70% of the Yabba Creek catchment and a small proportion of the overall Mary River basin. The existing dam likely traps all coarse sediment (>30 micrometres (µm)) from within the catchment (Alluvium, 2022).

3.7.1.2 Sandy Creek

Sandy Creek, a major tributary of Yabba Creek upstream of Lake Borumba, intersects the Project area at three locations associated with works in Area 4 (Borgan). The junction of the two creeks lies approximately 3 km upstream of the upper extent of Lake Borumba. The morphology of Sandy Creek is controlled by bedrock spurs, allowing the development of only narrow floodplain deposits (Alluvium, 2022). The median flow rate for Sandy Creek is 0.01 m^3/s (Alluvium, 2022). The bedload sediments transported in these creeks to Lake Borumba range from fine sands through to cobbles, with an often highly mixed bedload. There are no identified gorges or waterfalls along the creek within the Project survey area.

Sandy Creek is a wandering gravel stream bed with generally good vegetation within the channel and along streambanks. The vegetation is predominantly *Melaleuca* spp. and *Casuarina* spp., with *Lomandra* spp. frequently stabilising the toe of streambanks.

Sandy Creek lies almost entirely over the sedimentary Marumba beds, which weather at a faster rate than the igneous formations, thus contributing a greater sediment supply than Yabba Creek (Alluvium, 2022). Vegetated islands and bars are particularly common within Sandy Creek and near the junction with Yabba Creek. There are also longitudinal and point bars in Sandy Creek. Longitudinal bars are usually formed when there is more sediment in a system than there is capacity to transport the sediment. The point bars in this reach store coarse sediment loads, ranging from gravels to cobbles. The coarse bedload gives rise to pools and riffles (Alluvium, 2022).

Water quality sampled in Sandy Creek in November 2022 generally met the WQO for protection of upland freshwaters, however dissolved oxygen levels were below the WQO while the *E. coli* levels exceeded the WQO (Hydrobiology, 2023). These exceedances indicate limited flows, which is expected for the late dry season. Subsequent sampling results from 2024 have shown total and dissolved manganese, as well as total coliforms and *E. coli* levels often exceed the WQOs.

3.7.1.3 Yabba Creek

3.7.1.3.1 Yabba Creek upstream of Lake Borumba

The morphology of Yabba Creek is controlled by bedrock spurs, allowing the development of only narrow floodplain deposits (Alluvium, 2022). The median flow rate for Yabba Creek is 0.30 cubic metres per second (m^3/s) (Alluvium, 2022). The bedload sediments transported in these creeks to Lake Borumba range from fine sands through to cobbles, with an often highly mixed bedload. Surveys along Yabba Creek upstream of Lake Borumba identified a number of natural barriers and waterfalls between the lake and Yabba Falls.

Land around Yabba Creek is mostly cleared on the alluvial flats, except for riparian vegetation, and used for cattle grazing. The upper slopes surrounding the creek are mostly vegetated.

Yabba Creek primarily lies over both Marumba beds and igneous ultramafic Mount Mia Serpentinite, a Tertiary Age poorly consolidated clayey unit, and an igneous granitoid unit, Capsize Creek Complex (Alluvium, 2022). On the narrow floodplains of Yabba Creek, downstream of the Sandy Creek tributary junction, there is evidence of inset floodplain features such as benches and bars being stripped during high flow events. Unrestricted stock access is likely to be causing sub-aerial erosion and contributing to the vulnerability of the sediments to stripping during flood events (Alluvium, 2022). Stream flow at Yabba Creek is highly seasonal and varies considerably from year to year.

Water quality in Yabba Creek upstream of Lake Borumba generally met WQOs during monitoring between 2022 and 2024, except for ammonia, total nitrogen, total and dissolved manganese, chlorophyll-a, and total coliforms, which frequently exceeded WQOs.

3.7.1.3.2 Yabba Creek downstream of the Borumba Dam wall

Yabba Creek downstream of the Borumba Dam wall is a permanently flowing watercourse even during periods of low rainfall due to outlet releases from Borumba Dam (Hydrobiology, 2022).

Water quality samples taken from Yabba Creek downstream of the Borumba Dam wall in June-July 2022 exceeded WQOs for suspended solids, chlorophyll-a and nutrients (Hydrobiology, 2022) (Figure 31). Samples taken in November 2022 show only exceedances for chlorophyll-a (Hydrobiology, 2023). In 2024, chlorophyll-a, nutrients and total and dissolved manganese also exceeded WQOs. This is consistent with the water quality of Lake Borumba and could also be affected by existing built infrastructure in the area.

3.7.1.4 Kingaham Creek

Kingaham Creek drains directly into Yabba Creek at Lake Borumba (Hydrobiology, 2022). Kingaham Creek at Area 2 (Kingaham Creek) is a stream order 5 watercourse and is a moderately incised stream, which gradually widens in size before reaching Lake Borumba. It has wider banks and deeper pool habitat alongside less riffle habitat and a gentler slope than Yabba Creek (Hydrobiology, 2022). The medium flow rate for Kingaham Creek is 0.13 m^3/s (Alluvium, 2022). Surveys along Kingaham Creek upstream of Lake Borumba identified several natural barriers and waterfalls along the creek.

The banks are generally well vegetated and stabilised by *Lomandra* spp.

The geology of Kingaham Creek differs from Sandy Creek and Yabba Creek, lying predominantly over the Mount Mia Serpentinite, an igneous ultramafic rock that has very low silica content (Alluvium, 2022). Igneous rocks are usually more resistant to weathering than sedimentary rocks, meaning that the Yabba Creek/Sandy Creek tributaries can be expected to supply more sediment to the system than Kingaham Creek (Alluvium, 2022).

Water quality sampling was undertaken within Kingaham Creek near the FSL of Lake Borumba after multiple significant flood events in the catchment (Hydrobiology, 2022) (Figure 31). Samples generally met the WQO for protection of upland freshwaters in the June (post-wet, winter) sampling event. However, chromium and nickel concentrations exceeded the derived guideline values (Hydrobiology, 2022). Sampling results for 2024 showed dissolved oxygen, nutrients, total and dissolved manganese, and total coliforms often did not meet WQOs.

3.7.1.5 Lake Borumba sediment nutrients and metal distribution

Surface sediment quality within Lake Borumba was analysed (average total concentrations) at eight sampling locations in June 2022, February 2023, and June 2024. Sediment quality heatmaps (1,000 m interpolation) were generated from this analysis, where the heatmaps show the distribution of metals and nutrients in sediment of Lake Borumba. The following observations were made:

- Nickel and chromium sediment concentrations exceeded the interim sediment guideline criteria (ISGC)-low and ISGC-high at several locations.
- Mercury was detected in Lake Borumba sediment and ranged from 0.02 to 0.95 mg/kg but was below the ISGC-low of 0.15 mg/kg.
- Sediment concentrations of other potential metals (arsenic, zinc, iron and aluminium) vary within Lake Borumba.
- The phosphorus sediment distribution showed the highest phosphorus concentrations were located at the area associated with water inputs from Borumba Creek.
- The nitrogen sediment distribution showed the highest nitrogen levels were located at the area associated with water inputs from Kingaham Creek. It should be noted that within the Kingaham Creek catchment, the land use is primarily grazing and native vegetation, which may act as the source of high nitrogen detected in this area of Lake Borumba.

3.7.1.6 Surface water quality monitoring

A Surface Water Monitoring Program has been implemented to collect monthly background surface water quality data for the Borumba PHES Project. The location of the water quality sampling sites is shown in Figure 31. The background data will be used to derive interim water quality guidelines, noting there is limited historical data for the waterways intersected by the Exploratory Works, other than that collected by Seqwater for Lake Borumba. Comparisons to these interim guidelines (once derived) will allow assessment of both the potential impacts to surface water, and the efficacy of environmental controls implemented as per the preliminary Construction Environmental Management Plan (CEMP) for the Exploratory Works. Surface sediment is also collected and analysed.

Sampling sites are located upstream and downstream of potentially impacted areas, including in Yabba Creek (both upstream and downstream of Lake Borumba), Kingaham Creek, Sandy Creek, and extending downstream to within the Mary River.

Surface water parameters monitored at each site include physicochemical parameters (dissolved oxygen (DO), pH, conductivity, turbidity), nutrients, total suspended solids, metals (total and dissolved), hydrocarbons, oil and grease, pesticides and *E. coli* bacteria and microbiology.

In the absence of interim guidelines, data is being assessed against the Mary River environmental values and water quality objectives (DERM, 2010), Australian and New Zealand guidelines for fresh and marine water quality (2018) 95% species protection and the Australian Drinking Water Guidelines (NHMRC, 2011). The following observations were recorded in the November and December 2023 results:

- Concentrations higher than the relevant guidelines were recorded for aluminium (dissolved), copper (dissolved), iron (total), manganese (total and dissolved) at most sites.
- Ammonia, total nitrogen and total phosphorus concentrations were higher than the relevant guidelines at most sites in November and December. Nitrate+nitrite was also higher than the guideline at most sites in December.
- Total suspended solids were higher than the guideline at most sites in Sandy Creek and Yabba Creek.
- *E. coli* bacteria was higher than the guideline at all sites.

Further water quality sampling was undertaken from February to May 2024, including at two additional sampling sites previously not accessible. The results were consistent with those from 2023, with the following observations recorded:

- Occasional exceedances of dissolved oxygen and chlorophyll-a at most sampling locations.
- Exceedances of total suspended solids were detected at several locations including upper reservoir within proposed raised FSL, downstream of Lake Borumba, Yabba Creek and far downstream of Mary River.
- Exceedances of chromium (total); zinc (total and filtered), nickel (total and filtered), copper (total and filtered), manganese (total and filtered) at most of the sampling locations.
- *E. coli* bacteria exceedances were recorded at most locations.
- Ammonia and total nitrogen exceeded the relevant water quality objectives at most locations during four rounds of sampling.

Results of ongoing water quality monitoring demonstrate that at most sampling sites within and surrounding Lake Borumba, some water quality parameters exceed relevant guideline values.

Inset A: Project Area

Inset B: Borgan

Queensland Hydro

GDA2020 MGA Zone 56

0 2 4 km

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LEGEND

- Watercourses
- State Controlled Roads
- Lake Borumba (FSL 135.01m AHD)
- Queensland Hydro Water Quality Sampling Sites
- Hydrobiology Water Quality Sampling Sites

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional

OVERVIEW
Queensland

GR
SCR
SR
WEIPA
CAIRNS
TOWNSVILLE
MACKAY
ROCKHAMPTON
BRISBANE
NT
QLD
SA
NSW
Main Map Extent

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Exploratory Works Project
Preliminary Documentation

WATER QUALITY SAMPLING SITES

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 31

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3.7.2 Groundwater

A description of the groundwater environment and a risk assessment considering potential impacts of the Exploratory Works Project to groundwater (and associated values) has been undertaken by AGE (2024). A summary of the existing groundwater environment is provided in the following sections.

3.7.2.1 Conceptual hydrogeology

A preliminary Conceptual Hydrogeological Model, which is an idealised and simplified representation of the natural system, has been developed for the hydrogeological study area to describe how the groundwater system operates. Table 14 provides an overview of the groundwater system for the Exploratory Works area, which identifies that the geological units can be grouped into three general hydrostratigraphic units based on their ability to store and transmit groundwater and the degree of weathering in bedrock. Figure 32 shows the geological units in the context of the Project area.

The Conceptual Hydrogeological Model indicates that groundwater is available from an aquifer associated with alluvial deposits on Yabba Creek and associated tributaries. Away from the Quaternary alluvium, groundwater occurs in discontinuous aquifers with limited yields. The hydraulic testing results to date do not show a discrete high permeability zone in the Exploratory Works area, therefore a distinct hydrogeologic unit representing a faulted geological unit has not been conceptualised.

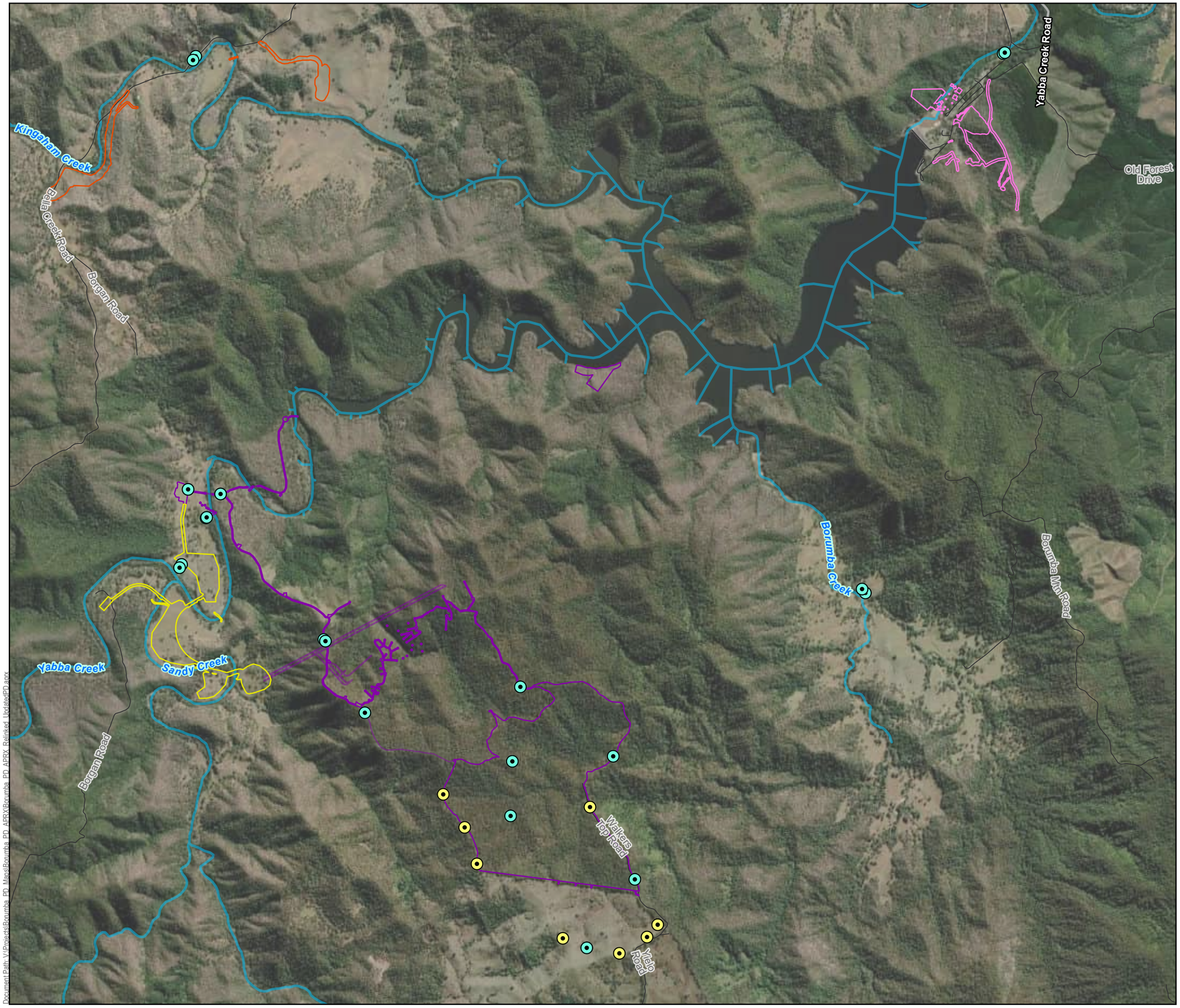
Table 14: Hydrostratigraphic units

Hydrostratigraphic unit	Type	Description (screened lithology)	Description
Quaternary alluvium	Aquifer – Unconfined, high permeability	Gravel sands	Forms a relatively thin aquifer system where it occurs along Yabba Creek and its tributaries
Weathered rock aquifer	Weathered rock aquifer – Unconfined, low to moderate permeability	Amamoor Beds Tungi Creek Granodiorite Granodiorite	Weathered rock aquifer
Fractured rock aquifer	Fractured rock aquifer – Unconfined, generally very low to low permeability	Marumba Beds Phyllite Amamoor Beds Phyllite Tungi Creek Granodiorite Granodiorite Mount Mia Serpentinite Serpentinite	They generally do not form significant aquifers but can have limited water yields from localised storage when faults and fractures are present within the rock mass

3.7.2.2 Groundwater bores

A search of the Queensland Groundwater database showed that there are no private registered bores in the Lake Borumba catchment. A total of 38 registered bores were recorded in the groundwater database in the downstream sub catchment between Lake Borumba and Imbil. Of these bores, 26 are existing sub artesian wells and 12 are listed as abandoned and destroyed (AGE, 2024). Most of the existing bores are in the Imbil area or northeast of Imbil, approximately 10 km north east of the Project area.

Figure 32 shows five registered bores within a 5 km radius from the Project area and groundwater bores installed for the Project in 2023. The specific groundwater use (e.g. stock, irrigation, domestic) and demand volumes for the five registered bores is not provided.



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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads

Exploratory Works Project

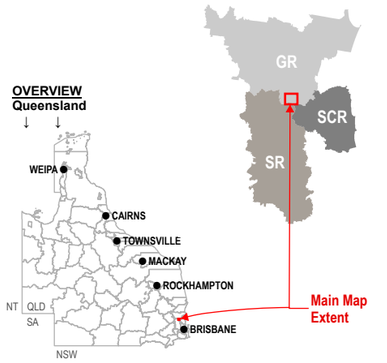
Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Project Groundwater Bores

- Registered
- Unregistered

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



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2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
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Exploratory Works Project
Preliminary Documentation

GROUNDWATER BORES

PROJECT #:	30032677/30032772
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LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 32

3.7.2.3 Groundwater flow

Figure 33 shows a scatter plot of the hydraulic conductivity values plotted against depth of investigation for groundwater bores installed for the Project. The wide range of measured hydraulic conductivity values reflects the heterogeneous nature of fractured rock groundwater systems, which is typical of fractured rock environments (AGE, 2024).

The distribution of hydraulic conductivity values by hydrostratigraphic unit indicates:

- generally low hydraulic conductivity values for the fractured rock aquifer, which is expected as groundwater occurrence is limited to secondary porosity (i.e. open fractures)
- the effect of weathering on these rocks is apparent, with average hydraulic conductivity values increasing in the weathered rock aquifer
- overall higher average hydraulic conductivity values are observed in the quaternary alluvium when compared to the fractured rock aquifer (AGE, 2024).

The alluvial aquifer is primarily recharged by rainfall. Diffuse recharge from rainfall to the alluvium in the area was estimated at an average rate of 138 millimetres per year (mm/yr), or 12.2% of the annual rainfall (1,133 mm). Recharge into the less permeable, clay dominant regolith is lower and is typically between 1% and 5% of annual rainfall and depends on the thickness and hydraulic properties (AGE, 2024). The estimate was provided using a simple moisture balance model which calculates the timing and magnitude of recharge events for the hydrogeological study area.

Groundwater is primarily discharged through evapotranspiration from vegetation, through localised springs and as baseflow seepage into the drainage lines around Lake Borumba (AGE, 2024). No known active groundwater abstraction currently occurs within the Project area.

Based on the current available information, groundwater flow direction is interpreted to follow the general topography. It is likely, however, that movement will also occur along structural features with continuity of flow determined by fracture frequency, connectivity, and orientation (AGE, 2024).

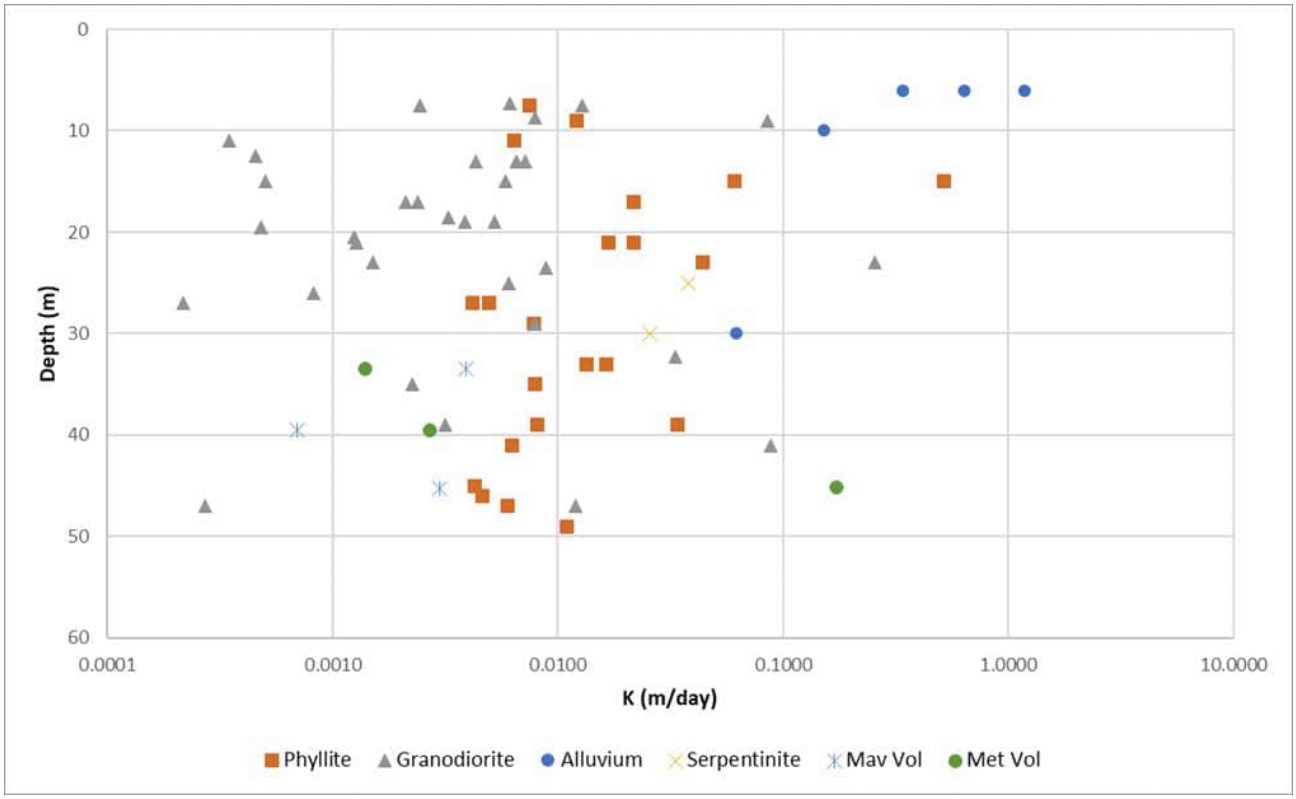


Figure 33: Scatter plot of hydraulic conductivity with depth

3.7.2.4 Depth to groundwater

Water level observations from groundwater monitoring bores that were installed in several geotechnical boreholes in 2022 (ENGEO, 2022) suggests that the alluvium immediately downstream of the existing dam is unsaturated due to limited thickness. The depth of alluvium thickens downstream towards Imbil where it is estimated to be up to 10 m thick (Wilford, Searle, Thomas, Pagendam, & Grundy, 2016). Historical data collected within the downstream areas suggests that the alluvium is saturated.

Depth to water levels in the bores identified in the Queensland Groundwater Database ranged between 4 m BGL and 10 m BGL in quaternary alluvium, while deeper water levels were typically recorded in the weathered rock aquifer and Fractured rock aquifer, ranging between 10 m BGL and 19 m BGL.

Groundwater level data for monitoring bores installed for the Project in 2023 are summarised in Table 15.

Table 15: Summary of groundwater level measurements per hydrostratigraphic unit

Geology	Hydrostratigraphic unit	Water level Depth (m BGL)		
		Minimum	Maximum	Average
Alluvium	QA	2.3	8.5	4.3
Amamoor Beds	WRA – AB	8.0	36.9	22.7
Amamoor Beds	FRA – AB	2.6	3.6	3.0
Granodiorite	WRA – TCGD	3.3	15.0	9.8
Granodiorite	FRA – TCGD	0.8	27.2	14.2
Phyllite	WRA - MB	14.1	32.3	25.0
Phyllite	FRA – MB	2.1	8.3	4.9
Serpentinite	FRA - MMS	2.3	8.5	4.3

Note: m BGL = metres below ground level, WL Depth = depth to water from ground surface, FRA = fractured rock aquifer, WRA = weathered rock aquifer, MS = metasediments, GD = granodiorite.

3.7.2.5 Groundwater quality

The nearest historical water quality sampling was undertaken at two registered bores (RN79680 and RN13810006) near the confluence of Yabba Creek and the Mary River, approximately 17 km northeast of the Exploratory Works Project (AGE, 2022). As there were only two water samples in the alluvium, conclusive classification of water quality types cannot be made.

A detailed summary of groundwater quality is provided in the groundwater impact assessment prepared by AGE (2024) (Appendix B). Groundwater quality parameters that exceeded relevant guidelines in more than 50% of the data collected included total dissolved solids (TDS), chloride, ammonia, total nitrogen, total phosphorus, organic nitrogen, aluminium, iron, manganese and zinc. Other results showed:

- Water quality in monitoring bores in Area 1 (Borumba Dam) is classified as freshwater, with TDS concentrations consistently less than 800 mg/L.
- Groundwater quality in Area 3 (Walkers Top) varies between fresh and brackish water, with brackish water as a result of consistently higher total dissolved solids, chloride and sodium.
- Ammonia, organic nitrogen, total nitrogen and total phosphorus concentrations typically exceeded the Valley guidelines and that the exceedances were generally in Area 3 (Walkers Top).
- There were consistently elevated ammonia concentrations at monitoring bores UR01-MB011 and UR01-MB013 (ranging between 6 and 136 mg/L) that were above the NHMRC drinking water (NHMRC, 2011) and ANZG fresh water aquatic guidelines (DCCEEW, 2019).
- Elevated concentrations of total aluminium, arsenic, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel and vanadium in several groundwater samples from monitoring bores in the Project area, with aluminium, iron and manganese typically elevated at most sites and associated with suspended material; all other metals were intermittently elevated.

- Concentrations of metals generally decrease significantly in the dissolved fraction, which confirms most of the total metals reported are attached to suspended materials in the water.
- It is likely that the metals recorded are a result of natural water-rock interaction.
- No evidence of contamination in groundwater bores near a potentially contaminated cattle dip.
- Most bores located around Area 1 (Borumba Dam) indicate calcium-magnesium-bicarbonate type water, which typically indicates recently recharged groundwater.
- Most of the bores in Area 3 (Walkers Top) are classified as sodium-potassium-chloride type, which typically indicates changed rainfall recharge or reduced recharge properties, although several bores in this area are classified as a mixed type.

Soil and rock samples were tested to assess the potential for acid mine drainage. A total of 20 samples, collected from nine locations, were analysed for net acid generation (NAG) potential and net acid production potential (NAPP). Results showed a low acid forming potential with negative NAPP results and NAG results with a pH above 4.5 in all samples (AGE, 2024).

3.7.3 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are defined as ecosystems (terrestrial, aquatic and subterranean) that rely in some part for their survival on groundwater. Groundwater dependence can range from complete to partial, particularly during times of drought.

Potential GDE occurrence relative to the Exploratory Works Project is mapped in Figure 34. The map includes areas of low to high potential GDEs mapped in the National Atlas of Groundwater Dependent Ecosystems (the Atlas). The Atlas shows known and potential GDEs and in most parts of Australia is the most comprehensive inventory of the location and characteristics of potential GDEs. More comprehensive mapping of GDEs has occurred in some areas of Queensland, including the south-east corner of the State, but the finer resolution information does not cover the Mary River Catchment.

Potential GDEs identified were as follows (AGE, 2024):

- Moderate potential aquatic GDEs associated with Lake Borumba, Yabba Creek, Kingaham Creek, Mujimba Creek, Ante Borgan Creek and Sandy Creek. These are all classed as Riverine GDEs which potentially require access to groundwater on a permanent or intermittent basis. Note: no exploratory activities are located within the reaches of Mujimba Creek or Ante Borgan Creek.
- The Study area is dominated by low to moderate potential terrestrial GDEs. High potential terrestrial GDEs are largely associated with the upstream sections of Yabba Creek but are also mapped across drainage lines and existing access tracks in the southern section of the Project footprint.
- Areas mapped as low to moderate terrestrial GDEs dominate the areas away from creeks.

The Atlas does not identify any subterranean GDEs in the vicinity of the Project.

Queensland Hydro

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Groundwater Dependent Ecosystems (from National Assessment)

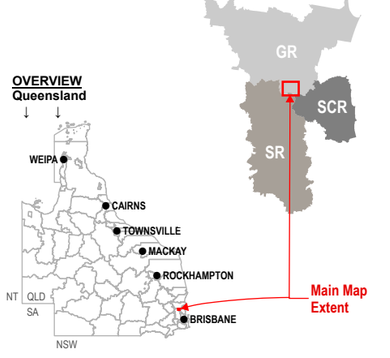
Terrestrial

- High potential GDE
- Moderate potential GDE
- Low potential GDE

Aquatic

- High potential GDE
- Moderate potential GDE
- Low potential GDE - from national assessment

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland

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6. Groundwater Dependent Ecosystems © Commonwealth of Australia (Bureau of Meteorology) 2017

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Preliminary Documentation

GROUNDWATER DEPENDENT ECOSYSTEMS

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FIGURE 34

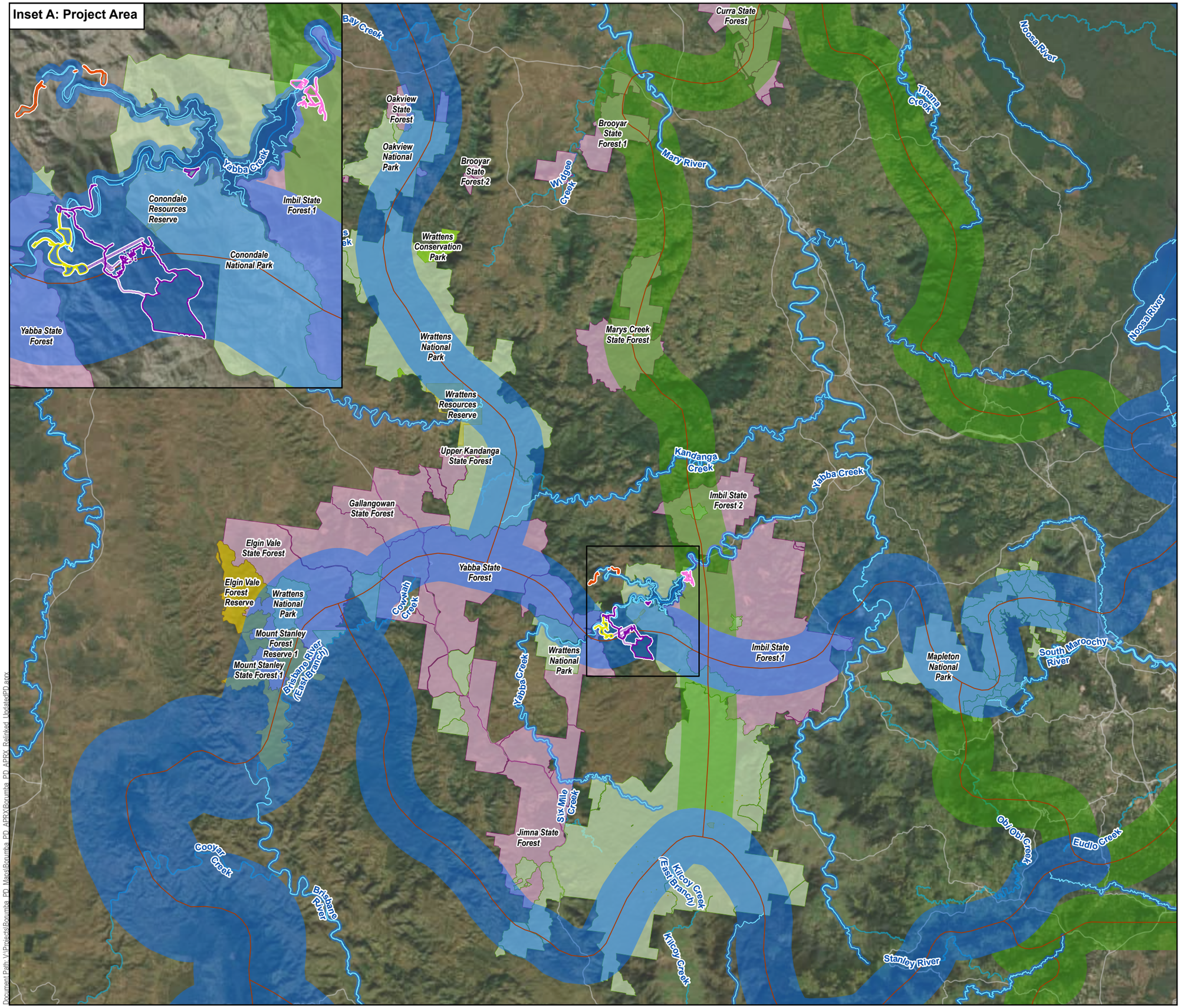
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3.8 Connectivity

The Project is located at the northern extent of the Conondale Range extending into Conondale National Park and bordered by Imbil State Forest, and Yabba State Forest. The surrounding state forest areas are production and plantation forests. The Project is the intersection of several mapped biodiversity significant terrestrial and riparian corridors, with contiguous vegetation providing a relatively connected corridor between Conondale National Park and Wrattens National Park within a mosaic of vegetated freehold land and state forest reserves (Figure 35).

The Project also intersects a state significant terrestrial corridor that runs east-west from the Elgin Vale State Forest to the coast at Peregian via Mapleton National Park, Imbil State Forest, Conondale National Park and Yabba State Forest. The purpose of this corridor is the linkage of four state and two regional terrestrial corridors, intersection with riparian corridors, incorporation of latitudinal and climatic gradients, connectivity of remnant vegetation, connectivity between coast and inland, linking of protected areas and estates; it falls partially within the Great Eastern Ranges corridor. The current extent of Lake Borumba acts as a barrier to terrestrial fauna movement from north to south.

Area 1 (Borumba Dam) is within a regionally significant terrestrial corridor that runs south-north from Imbil State Forest to Curra State Forest via Marys Creek State Forest and Brooyar State Forest.



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Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Major Watercourses
- State Controlled Roads

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

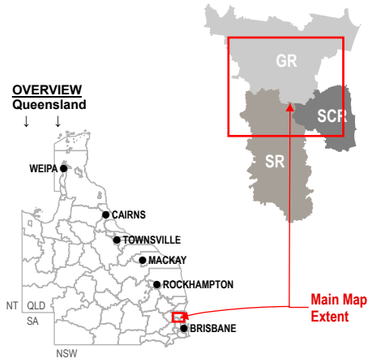
State and regional biodiversity corridor buffers

- Regional
- State
- Terrestrial Centrelines
- Riparian Centrelines

Protected areas and forests of Queensland

- Conservation Park
- Forest Reserve
- National Park
- Resource Reserve
- State Forest

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



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Exploratory Works Project
Preliminary Documentation

CONNECTIVITY

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FIGURE 35

3.9 Vegetation communities

This section describes the vegetation communities that occur within the Survey area including vegetation regulated under the *Vegetation Management Act 1999* (Qld) (VM Act), the broad habitat types identified, and the potential for the broad habitat types to conform to threatened ecological communities (TEC).

3.9.1 Regional ecosystems

A total of 25 unique REs and high value regrowth (HVR) vegetation communities have been mapped as present on the Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development Vegetation Management Supporting Map. Refer to Appendix M for the desktop survey results. The REs and HVR were confirmed in the field via Quaternary surveys and were found to be generally consistent with the Vegetation Management Supporting Map; however, there were small and large scale deviations in the extent of REs and localised variations in canopy species dominance. All mapped polygons of HVR were confirmed in the field as meeting remnant status.

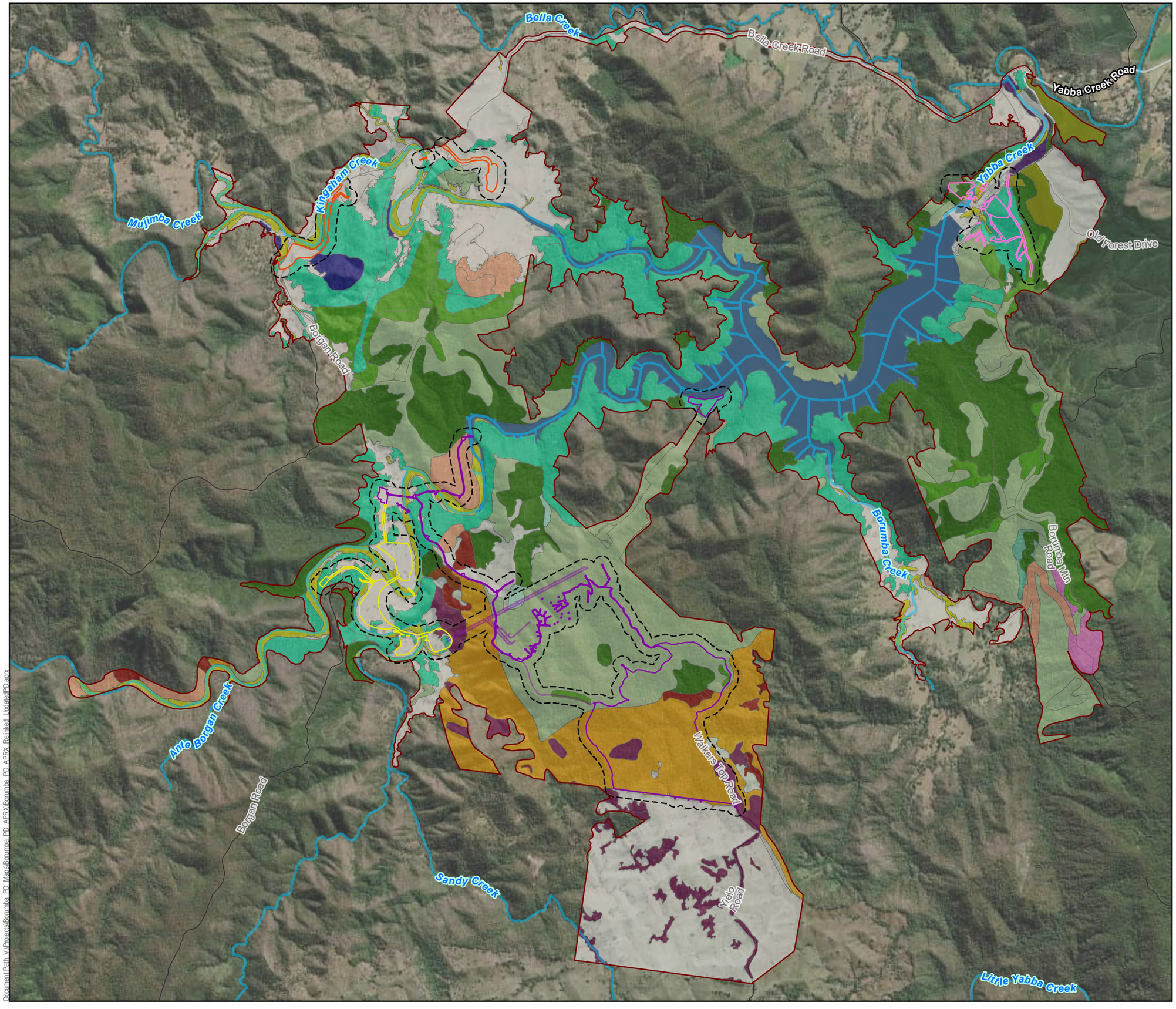
A total of 12 ground-truthed REs are present within the Exploratory Works Survey area. Table 16 lists the ground-truthed REs (GTRE), while Figure 36 shows the distribution of the GTRE within the Borumba PHES Survey area and Exploratory Works Survey area. It is recognised that some of these REs are analogous with two threatened ecological communities known to occur in the Survey area (Section 4.2.1).

Table 16: Ground-truthed regional ecosystems in the Exploratory Works Survey area and their extent in the Borumba PHES Survey area

Regional Ecosystem	VM Act Status	Description	Area (ha) within Exploratory Works Survey area	Area (ha) within Borumba PHES Survey area
12.3.1a	Endangered	Gallery rainforest (notophyll vine forest) on alluvial plains	0.4	12.8
12.3.7	Least concern	*Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana* +/- *Melaleuca* spp. fringing woodland.	52.4	209.0
12.11.3^	Least concern	*Eucalyptus siderophloia, E. propinqua* +/- *E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides* open forest on metamorphics +/- interbedded volcanics	242.1	1,089.7
12.11.9	Of concern	*Eucalyptus tereticornis subsp. Tereticornis or E. tereticornis subsp. Basaltica open forest on metamorphics* +/- interbedded volcanics	15.4	74.6
12.11.10	Least concern	Notophyll vine forest +/- *Araucaria cunninghamii* on metamorphics +/- interbedded volcanics	32.1	718.8
12.11.14	Of concern	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	117.9	822.3
12.11.15	Of concern	*Eucalyptus tereticornis, Corymbia intermedia* open woodland with *Xanthorrhoea johnsonii* understorey on serpentinite	2.3	27.3

Regional Ecosystem	VM Act Status	Description	Area (ha) within Exploratory Works Survey area	Area (ha) within Borumba PHES Survey area
12.12.12	Of concern	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra +/- Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	21.4	124.7
12.12.15	Least concern	Mixed open forest including combinations of *Eucalyptus propinqua*, *E. siderophloia*, *Corymbia intermedia*, *E. microcorys*, *Lophostemon confertus* open forest on Mesozoic to Proterozoic igneous rocks	196.4	429.1
12.12.15b	Least concern	*Lophostemon confertus* open forest +/- *Eucalyptus microcorys*, *E. siderophloia, E. carnea, E. propinqua* and vine forest species often present in understorey. Occurs in gullies and exposed ridges on Mesozoic to Proterozoic igneous rocks often amongst vine forest. Not a Wetland.	2.2	5.8
12.12.16	Least concern	Notophyll vine forest on Mesozoic to Proterozoic igneous rocks	8.3	36.0
12.12.23	Least concern	*Eucalyptus tereticornis subsp. Tereticornis or E. tereticornis subsp. Basaltica +/- E. eugenioides* woodland to open forest on crests, upper slopes and elevated valleys and plains on Mesozoic to Proterozoic igneous rocks	26.4	125.8
Total (ha)			**906.1**	**5,553.9**

^ Includes 12.11.3a



Queensland Hydro

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0 0.5 1 km

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LEGEND

- Watercourses
- Local Roads
- Tracks
- State Controlled Roads

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey area

Ground-truthed regional ecosystems

- RE 12.3.1a
- RE 12.3.7
- RE 12.8.16
- RE 12.11.1
- RE 12.11.3
- RE 12.11.3a
- RE 12.11.9
- RE 12.11.10
- RE 12.11.15
- RE 12.11.14
- RE 12.12.12
- RE 12.12.15
- RE 12.12.15b
- RE 12.12.16
- RE 12.12.23
- Non-remnant
- Plantation
- Water

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VEGETATION

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FIGURE 36

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3.9.2 Broad habitat types – RFI item 3.3 (a-c)

The vegetation (which includes non-remnant, REs, and HVR vegetation) observed during the field surveys has been categorised into the following broad habitat types based on dominant canopy species and vegetation structure:

- subtropical rainforest
- Eucalypt dominated woodlands and forests
- Eucalypt dominated forests and woodlands on alluvial flats
- non-remnant pastures
- plantations
- watercourses.

The broad habitat types, their corresponding RE, and the threatened flora and fauna species for which the broad habitat type provides suitable habitat are detailed in the following sections. The distribution of the broad habitat types within the Survey area is shown in Figure 37.

Queensland Hydro

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LEGEND

- Watercourses
- Local Roads
- State Controlled Roads

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

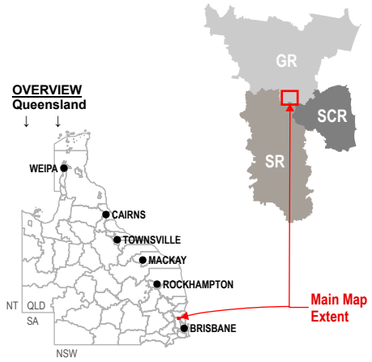
Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey area

Broad Habitat Types

- Eucalypt dominated forests and woodland on alluvial flats
- Eucalypt dominated woodlands and forests
- Subtropical rainforest
- Plantation
- Non-remnant
- Watercourses and Lake Borumba

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



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BROAD HABITAT TYPES

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FIGURE 37

Document Path: V:\Projects\Borumba_PD_Maps\Borumba_PD_APRX\Borumba_PD_APRX_ReLinked_UpdatedPD.aprx

3.9.2.1 Subtropical rainforest

This broad habitat type is associated with the GTREs RE 12.11.10 and RE 12.12.16 and dominated by a range of rainforest species including *Araucaria cunninghamii, Argyrodendron* spp., *Sloanea woollsii*, *Backhousia subargentea*, *Brachychiton discolor*, *Beilschmiedia obtusifolia*, *Diospyros pentamera*, *Grevillea robusta*, *Gmelina leichhardtii* and *Ficus macrophylla* forma *macrophylla*. The canopy height was variable and typically ranged between 16-26 m with a closed canopy. The dense understorey was dominated by a range of native rainforest species, while the sparse ground cover was dominated by native ferns, grasses, and *Lomandra* spp. Photo 9 shows the typical conditions of this broad habitat type.

Weeds were generally observed in only low densities in the ground cover in this habitat type and were restricted to the edge of the habitat type; however, there were some areas with high density weeds including *Lantana camara* (lantana).



Photo 9: Typical condition in the Subtropical rainforest habitat type

The Subtropical rainforest habitat type has the potential to conform to the key diagnostic criteria of the Lowland Rainforest of Subtropical Australia TEC (refer to Section 7.1.1).

The Subtropical rainforest habitat type is anticipated to provide suitable habitat for the threatened flora and fauna species identified in the desktop assessment and detailed in Table 17

Table 17: Threatened flora and fauna species for which the Subtropical rainforest provides suitable habitat

Common Name	Scientific Name	EPBC Act Status
MNES Flora		
Ball nut	*Floydia praealta*	Vulnerable
Blotched Sarcochilus	*Sarcochilus weinthalii*	Vulnerable

Common Name	Scientific Name	EPBC Act Status
Three-leaved bosistoa	*Bosistoa transversa*	Vulnerable
Hairy-joint grass	*Arthraxon hispidus*	Vulnerable
Macadamia nut	*Macadamia integrifolia*	Vulnerable
Nightcap coleus	*Coleus nitidus* (syn. *Plectranthus nitidus)*	Endangered
-	*Coleus omissus* (syn. *Plectranthus omissus)*	Endangered
Native guava	*Rhodomyrtus psidioides*	Critically endangered
Silver coleus	*Coleus torrenticola* (syn. *Plectranthus torrenticola)*	Endangered
Small-fruited Queensland nut	*Macadamia ternifolia*	Vulnerable
Scrub turpentine	*Rhodamnia rubescens*	Critically endangered
Quassia	*Samadera bidwillii*	Vulnerable
Small-fruited Queensland nut		
MNES Fauna		
Black-breasted button-quail	*Turnix melanogaster*	Vulnerable
Coxen's fig-parrot	*Cyclopsitta diophthalma coxeni*	Critically endangered
Giant barred frog	*Mixophyes iteratus*	Vulnerable
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable
Long-nosed potoroo	*Potorous tridactylus tridactylus*	Vulnerable

3.9.2.2 Eucalypt dominated woodlands and forests

This broad habitat type is associated with the following REs:

- RE 12.8.16
- RE 12.11.3
- RE 12.11.9
- RE 12.11.14
- RE 12.11.15
- RE 12.12.12
- RE 12.12.15
- RE 12.12.15b
- RE 12.12.23.

The habitat type was observed to be dominated by a range of myrtaceous species including *Corymbia intermedia, Eucalyptus tereticornis, Eucalyptus crebra, Corymbia tessellaris, Angophora leiocarpa, Angophora subvelutina*, *Eucalyptus siderophloia*, and *Eucalyptus propinqua*. The canopy height was variable and typically between 16-24 m and canopy cover between 20-70%. The sparse to mid-dense understorey was dominated by a range of native species including *Acacia* spp., *Alphitonia excelsa*, *Allocasuarina torulosa*, and *Glochidion* spp. In areas where impact of fire was limited or areas in close proximity to patches of rainforest, rainforest species were present in the understorey. Ground cover, which varied across the Survey area, was dominated by native ferns, grasses, and *Lomandra* spp.

Weeds were observed in varying densities in the ground cover within this habitat type, with some areas (typically drainage lines) containing high density weeds including *Lantana camara* (lantana), but most of the habitat containing only low-density weeds.

Photo 10 shows the typical conditions of this broad habitat type.



Photo 10: Typical condition in the Eucalypt dominated woodlands and forests habitat type

This habitat type does not have the potential to conform to the key diagnostic criteria of any TEC identified as potentially occurring in the Project area based on the EPBC Act Protected Matters Search Tool (PMST) (refer to Appendix N) or any other known TEC.

The Eucalypt dominated woodlands and forests habitat type is anticipated to provide suitable habitat for the threatened flora and fauna species identified the desktop assessment and detailed in Table 18.

Table 18: Threatened flora and fauna species for which the Eucalypt dominated woodlands and forests provides suitable habitat

Common Name	Scientific Name	EPBC Act Status
MNES Flora		
Austral toadflax	*Thesium australe*	Vulnerable
Three-leaved bosistoa	*Bosistoa transversa*	Vulnerable
Brush sophora	*Sophora fraseri*	Vulnerable
-	*Coleus omissus (syn. Plectranthus omissus)*	Endangered
-	*Coleus torrenticola (syn Plectranthus torrenticola)*	Endangered
Native guava	*Rhodomyrtus psidioides*	Critically endangered
Scrub turpentine	*Rhodamnia rubescens*	Critically endangered
Quassia	*Samadera bidwillii*	Vulnerable
MNES Fauna		
Australian painted snipe	*Rostratula australis*	Endangered
Glossy black-cockatoo	*Calyptorhynchus lathami lathami*	Vulnerable

Common Name	Scientific Name	EPBC Act Status
Greater glider (southern and central)	*Petauroides volans*	Endangered
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable
Koala	*Phascolarctos cinereus*	Endangered
Spotted-tail quoll	*Dasyurus maculatus maculatus*	Endangered
Northern quoll	*Dasyurus hallucatus*	Endangered
Yellow-bellied glider (south-eastern)	*Petaurus australis australis*	Vulnerable

3.9.2.3 Eucalypt dominated forests and woodlands on alluvial flats

This broad habitat type is associated with RE 12.3.7 and was observed to be dominated by *Eucalyptus tereticornis* with *Casuarina cunninghamiana* subsp. *cunninghamiana* either co-dominant or sub-dominant with associated *Melaleuca* species. However, there were large areas of this vegetation community where *Casuarina cunninghamiana* subsp. *cunninghamiana* was dominant and *Eucalyptus tereticornis* was absent in the canopy.

The canopy height was variable and typically ranged between 18-26 m. The sparse to mid-dense understorey was dominated by a range of native species including *Casuarina cunninghamiana* subsp. *cunninghamiana*, *Corymbia tessellaris*, *Melaleuca bracteata*, *Melaleuca viminalis*, *Angophora subvelutina*, with occasional rainforest species including *Aphananthe philippinensis*, *Cryptocarya* spp., and *Ficus* spp. The sparse to mid-dense ground cover was dominated by native ferns, grasses, and *Lomandra* spp.

Weeds were generally in low to moderate densities in this habitat type and were generally restricted to the ground cover stratum; however, there were some areas with high density weeds including *Lantana camara* (lantana) and exotic grasses.

Photo 11 shows the typical conditions of this broad habitat type.



Photo 11: Typical condition in the Eucalypt dominated forests and woodlands on alluvial flats

Where this habitat type is dominated by *Eucalyptus*, *Angophora*, and/or *Corymbia* species, the habitat type has the potential of conforming to the key diagnostic criteria of the Subtropical Eucalypt Floodplain Forest of the New South Wales North Coast and South East Queensland TEC (refer to Section 7.1.2).

The Eucalypt dominated forests and woodlands on alluvial flats habitat type is anticipated to provide suitable habitat for the threatened flora and fauna species identified in Table 19.

Table 19: Threatened flora and fauna species for which the Eucalypt dominated forests and woodlands on alluvial flats provides suitable habitat

Common Name	Scientific Name	EPBC Act Status
MNES Flora		
Hairy-joint grass	*Arthraxon hispidus*	Vulnerable
MNES Fauna		
Glossy black-cockatoo	*Calyptorhynchus lathami lathami*	Vulnerable
Greater glider (southern and central)	*Petauroides volans*	Endangered
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable
Koala	*Phascolarctos cinereus*	Endangered

3.9.2.4 Non-remnant pastures

This broad habitat type is associated with cleared areas and pastures, which are both mapped as non-remnant on the Vegetation Management Supporting Map. The habitat type was dominated by introduced pasture grasses and other weeds. Native mature and re-growth trees and shrubs are generally present in low densities or as scattered clumps.

Photo 12 shows the typical conditions of this broad habitat type, which is the dominant habitat type within the Project footprint.



Photo 12: Typical condition in the non-remnant pastures habitat type

This habitat type does not have the potential to conform to any of the TECs identified as potentially occurring in the Project area based on the PMST or any other known TEC.

The non-remnant pastures habitat type is anticipated to provide negligible habitat values for threatened flora and fauna species; however, a limited number of threatened fauna species may utilise the habitat for low value dispersal purposes.

3.9.2.5 Plantations

This broad habitat type is present associated with the hoop pine plantation and was dominated by a monoculture of hoop pine (*Araucaria cunninghamii*). The sparse understorey is actively managed with only low-density native shrubs, while the ground cover comprises a mix of native and non-native grasses, forbs, and ferns. There were areas of dense *Lantana camara* (lantana) in some areas. Photo 13 shows the typical conditions of this broad habitat type.



Photo 13: Typical condition in the Plantations habitat type

This habitat type does not have the potential to conform to any of the TECs identified as potentially occurring in the Project area based on the PMST or any other known TEC.

The hoop pine plantations habitat type is anticipated to provide negligible habitat values for threatened flora (due to the regular maintenance and existing use rights to the timber); however, it is likely to provide refugia and/or dispersal habitat for a limited number of threatened fauna species.

3.9.2.6 Watercourses and Lake Borumba

This broad habitat type is associated with Yabba Creek (upstream and downstream of the existing dam wall), Sandy Creek, Kingaham Creek, and a very restricted section of Lake Borumba.

Aquatic habitats generally varied between watercourses and with respect to their positioning in relation to Borumba Dam (e.g. sites upstream of the dam contrasted in habitat structure to those downstream of the dam). Microhabitat throughout the watercourses was generally dominated by undercut banks and large woody debris, and to a lesser extent small woody debris and detritus.

Riparian structure and cover differed notably between sites downstream and upstream of Borumba Dam with little tree vegetation found within sites downstream and greater areas of bare and grass coverage. At upstream sites the dominant vegetation was of tree form. This is likely due to the presence of bedrock (notably at sites in Area 3), less land clearing, and a lack of high flood conditions, which in the lower sub-catchment have uprooted and washed away many trees along already thin riparian extents along Yabba Creek.

Aquatic habitat associated with Lake Borumba comprised pool habitats, including deep pools of >10 m closer to the dam. Shallow pool depths typically ranged from 1-3 m in the branches of Kingaham Creek, and Yabba Creek recorded maximum depths of up to 6 m at the time of sampling.

Photo 14 shows Yabba Creek downstream of the dam wall where an access track to Conondale Resources Reserve will be constructed.



Photo 14: Yabba Creek downstream of the Borumba Dam wall

The habitat type does not have the potential of conforming to any of the TECs identified as potentially occurring onsite based on the PMST or any other known TEC.

The Watercourses and Impoundments habitat type is anticipated to provide suitable habitat for the threatened fauna species identified the desktop assessment and detailed in 4.2.4. No threatened flora species are anticipated to be present within the Watercourses habitat type.

Table 20: Threatened fauna species for which aquatic habitat in the Survey area provides suitable habitat

Common Name	Scientific Name	EPBC Act Status
Australian lungfish	*Neoceratodus forsteri*	Vulnerable
Mary River cod	*Maccullochella mariensis*	Endangered
Mary River turtle	*Elusor macrurus*	Endangered
White-throated snapping turtle	*Elseya albagula*	Critically endangered

3.10 Threats to MNES – RFI item 4.5(e)

There are a range of existing threats to MNES within the Survey area, which are predominantly associated with current land uses, introduced flora and fauna species, and feral animals. These threats are further discussed in the following sections.

3.10.1 Invasive species and disease

A broad range of invasive animals and plants are currently established within and surrounding the Survey area. In total, 52 invasive plant species were recorded during field surveys. Of these, seven terrestrial species are listed as Category 3 Restricted Plants under the *Biosecurity Act 2014* (Qld), two of which are also listed as Weeds of National Significance (WoNS). WoNS generally present a threat to MNES by degrading habitat quality.

Table 21 details the invasive flora species recorded or observed during the field surveys. Lantana (*Lantana camara*) and cat's claw creeper (*Dolichandra unguis-cati*) are widespread in the Survey area and, occur in high density patches in some areas, particularly along drainage lines and gullies. Four aquatic invasive plants are also listed as either Category 3[1] Restricted Plants or WoNS (Table 21).

Fourteen invasive animals were recorded during the field surveys with these species listed in Table 22.

Table 21: Invasive plant species recorded or observed during the field surveys

Species	Restricted Plant / WoNS
Terrestrial	
Camphor laurel (*Cinnamomum camphora*)	Category 3 Restricted Plant
Cat's claw creeper (*Dolichandra unguis-cati*)	Category 3 Restricted Plant and WoNS
Chinese celtis (*Celtis sinensis*)	Category 3 Restricted Plant
Lantana (*Lantana camara*)	Category 3 Restricted Plant and WoNS
Parthenium hysterophorus	Category 3 Restricted Plant and WoNS
Prickly pears (*Opuntia* spp.)	Category 3 Restricted Plant and WoNS
Rat's tail grasses including *Sporobolus fertilis, Sporobolus natalensis* and *Sporobolus pyramidalis*	Category 3 Restricted Plant
Aquatic	
Cabomba (*Cabomba caroliniana*)	Category 3 Restricted Plant and WoNS
Water hyacinth (*Eichhornia crassipes*)	Category 3 Restricted Plant
Hymenachne (*Hymenachne amplexicaulis*)	WoNS
Salvinia (*Salvinia molesta*)	Category 3 Restricted Plant and WoNS

Table 22: Invasive fauna species recorded during the field surveys

Species	Potential impact on MNES values
Terrestrial	
Cattle (*Bos taurus*)	Competition for resources Degradation of habitat
Cane toad (*Rhinella marina*)	Competition for resources Degradation of habitat
Dog (*Canis familiaris*)	Direct predation
Rusa Deer (*Cervus timorensis*)	Competition for resources Degradation of habitat
Cat *(Felis catus*)	Direct predation
European brown hare (*Lepus europaeus*)	Competition for resources

[1] Category 3 = includes noxious fish, weeds and pest animals. You must not distribute this restricted matter. This means it must not be given as a gift, sold, traded or released into the environment unless the distribution or disposal is authorised in a regulation or under permit.

Species	Potential impact on MNES values
Rabbit (*Oryctolagus cuniculus*)	Competition for resources Degradation of habitat
Pig (*Sus scrofa*)	Direct predation Competition for resources Degradation of habitat
Red fox (*Vulpes vulpes*)	Direct predation
Aquatic	
Guppy (*Poecilia reticulata*)	Direct predation Competition for resources
Mosquitofish (*Gambusia holbrooki*)	Direct predation Competition for resources
Platy (*Xiphophorus maculatus*)	Direct predation Competition for resources
Swordtail (*Xiphophorus helleri*)	Direct predation Competition for resources
Tilapia (*Oreochromis mossambica*)	Competition for resources Degradation of habitat

All of the invasive terrestrial fauna in Table 22 are widespread in the Borumba PHES Survey area and are anticipated to be an ongoing threat to MNES. Although cattle were recorded in the Survey area, they are being destocked from Queensland Hydro land and will likely not present an ongoing threat to MNES. Some of the species are also listed as restricted matters under the *Biosecurity Act 2014* and under the provisions of the Gympie and Somerset biosecurity policies and procedures.

The above-mentioned invasive aquatic species are present in Yabba Creek, Sandy Creek, and Kingaham Creek. Myrtle rust, which is a fungal disease that infects plants in the Myrtaceae family has been recorded throughout the Survey area and is considered to be widespread in the broader Borumba PHES Survey area and was observed actively impacting flora species, including MNES.

Toxoplasmosis (caused by *Toxoplasma gondii*) may be present in infected cats and other mammals.

3.10.2 Logging

Logging is a threat to MNES by removing potential breeding and foraging resources for MNES. Logging only occurs in the plantation forests at Imbil State Forest. Logging has previously occurred on Queensland Hydro-owned land and evidence of selective logging was observed on the grazing properties in the Survey area. However, logging and grazing have both ceased on Queensland Hydro-owned land and does not occur anywhere else in the Survey area.

As outlined in Section 3.2, Lot 1LX2754 is mapped as a Forestry Management Unit and as such the State has rights to the timber. Any harvesting would need to follow the code of practice for native forest timber production on Queensland's State Forest estate 2020 (DES, 2020). The code, which is maintained by DETSI and specifies, for example:

- at least half the forest stand must remain after harvesting
- setbacks from watercourses, where harvesting is not permitted, must be established
- harvesting on steep slopes must not occur to protect catchments and soils
- habitat-protection measures must be applied, including keeping and protecting habitat trees, and trees and shrubs with active bird nests
- soil disturbance must be rehabilitated.

3.10.3 Bushfire

Bushfires are a risk to MNES via direct mortality of individuals and a reduction in habitat quality, including breeding, foraging, and dispersal habitat. Fire also influences the structure and composition of the vegetation and may also amplify the impacts of, or change the responses to, other environmental stressors, including the increasing the exposure and vulnerability of susceptible plants to myrtle rust (*Austropuccinia psidii*).

The local graziers use prescribed burns to manage fuel load and pasture grasses, with the Queensland Hydro land regularly burnt by the leaseholder since the 1980s. However, there have been several bushfires since 1987. The more widespread bushfires occurred in 1991, 2000, 2001, 2002, 2004, 2006, and 2021 (Queensland Government, 2024). Information from community members indicates there was also a major bushfire in 2015/2016.

These fires have influenced the vegetation structure onsite and resulted in the reduction of Lowland Rainforest of Subtropical Australia on Lot 1LX2754. Photo 15 shows an example of a Lowland Rainforest of Subtropical Australia TEC patch (WT5) that has been impacted by fire.



Photo 15: Patch of Lowland Rainforest severely impacted by fire (WT5)

3.10.4 Water infrastructure

The existing Borumba Dam, which was constructed in 1963 and raised in 1997, does not provide for fish or turtle movement and is a complete barrier to the upstream movement of some aquatic species. The existing dam has significantly altered the hydrological regime of Yabba Creek and areas downstream from natural (pre-disturbance) conditions.

3.10.5 Recreational fishing

Lake Borumba is stocked with Australian bass, golden perch, Mary River cod, silver perch and saratoga for recreational fishing (Queensland Government, 2020). Stocking top end predators increases predatory pressure on juvenile threatened turtles and recreational fishing adds pressure to threatened fish populations and can cause hook injuries or death in threatened turtles.

4. Matters of National Environmental Significance

4.1 Survey methodology – RFI item 3.3(g)

4.1.1 Ecological Survey Methodology

Survey effort has covered the Exploratory Works Project footprint and the Exploratory Works Survey area (Survey area; 100 m buffer on the Project footprint), and a much broader area, which extends beyond the Exploratory Works Survey area and is largely associated with the Main Works Project (Borumba PHES Survey area). The survey effort undertaken within the Exploratory Works Survey area is important for assessing the direct and indirect impacts that may be anticipated to occur as a result of the proposed action on threatened MNES species and ecological communities. The survey effort beyond the boundary of the Exploratory Works Survey area is important for contextualising the potential impacts of the Project by providing habitat information and additional species occurrence observations.

The survey timings are considered adequate to measure taxa diversity and their repetition throughout the ecology study area. Field-based surveys associated with the Project complemented previous and concurrent ecological studies undertaken in the Project disturbance footprint (refer Section 4.1 and Appendix M).

The surveys were undertaken in accordance with the following guidelines and Conservation Advices:

- EPBC Act survey guidelines for Australia's threatened reptiles (DSEWPaC, 2011)
- EPBC Act survey guidelines for Australia's threatened birds (DEWHA, 2010)
- Target Survey Guidelines – Glossy black-cockatoo *Calyptorhynchus lathami* (DCCEEW, 2022)
- EPBC Act survey guidelines for Australia's threatened bats (DEWHA, 2010)
- EPBC Act survey guidelines for Australia's threatened mammals (DSEWPaC, 2011)
- EPBC Act Survey guidelines for Australia's threatened fish (DSEWPaC, 2011)
- EPBC Act Survey guidelines for Australia's threatened frogs (DEWHA, 2010)
- Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia, 2015)
- Flora Survey Guidelines – Protected Plants (DES, 2020)
- Guide to determining terrestrial habitat quality – Methods for assessing habitat quality under the Queensland Environmental Offsets Policy Version 1.2 (DES, 2017)
- Spot Assessment Technique: a tool for determining localised levels of habitat use by koalas (*Phascolarctos cinereus*) (Phillips, 2011)
- Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (DES, 2022)
- Optimal survey designs for environmental DNA sampling (Lugg, 2017)
- Biocondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual (Eyre, 2015)
- Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 7.0 (Neldner, et al., 2023)
- Terrestrial Ecology EIS Information Guideline (DES, 2022)
- Aquatic Ecology EIS Information Guidelines (DES, 2022)
- AusRivAS protocols for Queensland streams (DNRM, 2001)
- Australian River Assessment System: AusRivAS Physical Assessment Protocol (Parsons, Thoms, & Norris, 2002)
- Monitoring and sampling manual (DES, 2018).

The survey effort was assessed against the Commonwealth survey guidelines (where available) and all surveys were confirmed as meeting the survey requirements of the relevant survey guideline. Refer to Appendix M, Appendix K and Appendix L for more details.

4.1.1.1 Flora and vegetation mapping

The ecological survey methods targeting flora and vegetation communities onsite are outlined below, with the survey effort provided in Appendix M. Surveys have been ongoing since 2022 with some of the initial reports provided in Appendix K, including a memo outlining how the vegetation mapping has evolved.

Quaternary and secondary vegetation surveys

Quaternary and secondary surveys were undertaken in accordance with the Methodology for Surveying and Mapping Regional Ecosystems and Vegetation Communities in Queensland (Nelder, et al., 2023). The surveys were completed to assess the vegetation communities present and confirm the distribution and extent of REs mapped within the Exploratory Works Survey area, including the Project footprint. The vegetation mapping was updated to reflect the ground-truthed data including the RE, its extent and the size based on the Queensland Herbarium Regional Ecosystem Description Database. The information collected during these surveys has an accuracy of approximately 1:10,000 although it is noted that this is not uniform across the Project area. Where ground-truthing field work was not undertaken Queensland Government regional ecosystem mapping was used. The information collected during these surveys was used in conjunction with the habitat assessments to map suitable habitat for identified MNES threatened species and ecological communities.

A total of 578 quaternary surveys and 31 secondary surveys were undertaken.

BioCondition assessment

BioCondition assessments were undertaken in accordance with the BioCondition Assessment Manual (Eyre et al. 2015) within and immediately adjacent to the Project footprint. The assessments involved the collection of structural, floristic and habitat data within a 100 x 50 m plot. The sites of each assessment were determined by the RE.

A total of 156 BioCondition assessments were undertaken.

TEC assessments

TEC assessments were undertaken to verify if the mapped TECs were present within the Project footprint. The associated mapped RE's were first ground-truthed to validate their existence. Where associated REs were present, the vegetation composition and structure were assessed against the key diagnostic criteria and condition thresholds within the respect TEC Conservation or Listing Advice.

Targeted flora searches

Protected plant survey: Protected plant meanders were undertaken in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020). Timed 30-minute meanders were undertaken within areas of suitable habitat where the Project footprint (and 100 m buffer) and the protected plant trigger mapping intersected. There is a margin of error of 10 m for protected plant records, which has been considered in identifying the number of records within the Project footprint.

Threatened flora searches: Opportunities searches for threatened species likely or known to occur were undertaken while traversing the Project footprint.

A total of 230 protected plant meanders were undertaken in accordance with the Flora Survey Guidelines and opportunistic searches for threatened species were undertaken.

4.1.1.2 Terrestrial fauna

The ecological survey methods targeting terrestrial fauna are outlined below, with the survey effort provided in Appendix M. Surveys have been ongoing since 2022 with some of the initial reports provided in Appendix K. Noting that most of the reports are being updated for the purpose of the Main Works EIS.

Habitat assessments

Habitat assessments were undertaken in accordance with the Guide to determining terrestrial habitat quality – A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy Version 1.2 (DES, 2017) and the modified habitat quality assessment (MHQA) developed by DCCEEW. Assessments were undertaken across the Exploratory Works Survey area, including the Project footprint, primarily focused on representative habitat and impact areas. The purpose of these surveys was to characterise the suitability of the

various habitats present and identify whether they are likely to support populations of MNES flora and/or fauna species or communities. Incidental observations of other species and ecological values were also noted during these assessments.

A total of 240 habitat assessments were undertaken.

Koala Spot Assessment Technique (SAT) points

The SAT as described in Spot Assessment Technique: a tool for determining localised levels of habitat use by koalas (*Phascolarctos cinereus*) (Phillips & Callaghan, 2011) were used to assess if koalas were present within the Exploratory Works Survey area. This survey method involved a search around a central tree, and the nearest 29 suitable trees for koala scats. Surveys were undertaken in areas of Eucalypt woodland considered to be suitable habitat**.**

A total of 12 SAT surveys were undertaken.

Diurnal searches

Diurnal searches were conducted within each habitat type identified within the Exploratory Works Survey area. These searches primarily focused on detecting the potential presence of koalas, however the searches also aimed to detect other threatened flora and fauna species.

A total of 81 sites, 28.13 hours were conducted within each habitat type identified within the Borumba PHES Survey area.

Terrestrial spotlighting surveys

Spotlighting was undertaken within and adjacent to the Project footprint in areas of suitable habitat informed by the desktop survey. These surveys targeted the larger nocturnal species and any other values that may occur on site. A combination of walking and vehicle spotlighting was undertaken.

A total of 91.28 spotlighting hours were undertaken within and adjacent to the Project footprint.

Passive and active acoustic detection surveys

Anabat swift units were deployed in representative habitats that may provide potential roosting habitat or act as flyways for Microchiropteran bats. Detection was conducted across the Exploratory Works Survey area between dusk and dawn across all habitat types.

Targeted amphibian surveys

Targeted amphibian surveys were undertaken by two observers at drainage features and watercourses at the Walkers Top area. Amphibian species were detected both visually and by call.

Bioacoustic Surveys

Bioacoustics recording devices (BARs) were deployed across the Exploratory Works Survey area along creek lines associated with suitable habitat for target threatened amphibian species. BAR devices were set to a night-time recording schedule sampling for 10 minutes every hour from sunset to sunrise for a total of 50 minutes per night. Acoustic recordings collected during this survey included non-targeted species including non-targeted amphibian species, vocalising nocturnal mammals and vocalising nocturnal bird species.

Bioacoustics recording devices (BARs) were deployed across 1,298 trap nights.

Diurnal bird surveys

Full compositional bird surveys were undertaken usually during periods of peak bird activity (early morning or late afternoon) across the Exploratory Works Survey area. Birds were recorded aurally or visually with the aid of binoculars.

Bird surveys were undertaken for a total of 6.39 hours at 91 sites.

Camera trapping

Automated camera traps were deployed in areas of representative habitats to record visitation by nocturnal and diurnal animals. The cameras were baited with universal mammal bait (oats and peanut butter). Other bait types including chicken necks and sardines were also used in combination to capture a broader range of species. The camera trapping was used to detect the target threatened species and pest species.

Camera trapping was undertaken over 2,863 trap nights.

Elliot trap survey

Aluminium Elliot traps were placed at approximately 10 m intervals along two transects (10 per transect) at 23 sites. Traps were baited with universal mammal bait (a mixture of rolled oats, peanut butter, honey and vanilla essence), and checked each morning to identify and release captured fauna.

Elliott trapping was undertaken over 855 trap nights.

Pitfall trapping

Pitfall trapping was undertaken using three 20 litre (L) buckets at each site, spaced approximately 10 m apart and dug into the ground so they are flush with the surface. A drift fence, approximately 30 cm high, was erected between each bucket to direct small animals towards the pitfall traps. Traps were checked in the morning and evening to identify and release captured fauna.

Pitfall trapping was undertaken over 295 trap nights.

Thermal drones and koala detection dogs

Thermal drones were used to detect nocturnal arboreal species including koalas and greater gliders across most of the Exploratory Works Survey area and Borumba PHES Survey area (apart from the lower reservoir inundation area within the national park).

Koala detection dogs along with thermal drones have been used to collect genetic material in support of the Main Works EIS.

4.1.1.3 Aquatic fauna

The ecological survey methods targeting terrestrial fauna are outlined below, with the survey effort provided in Appendix M. Surveys have been ongoing since 2022 with some of the initial reports provided in Appendix L. Noting that most of the reports are being updated for the purpose of the Main Works EIS.

eDNA

Samples were collected using a Smith-Root eDNA sampler with 5 µm Smith-Root self-preserving filters following Smith-Root protocol (Smith-Root, 2022). Three filters were processed at each site, approximately 2 L per filter. Samples were collected from areas of likely fish and platypus habitat (amongst snags, large woody debris, macrophytes, downstream of riffles and boulders, undercut banks, etc.). Filtration was undertaken on-site to reduce DNA degradation during transport of whole water samples (Yamanaka et al. 2016).

Samples were collected at a total of 127 sites.

Fyke netting

Where sufficient water levels were present, two paired fyke nets were deployed at each waterway site, with entrances facing downstream. Two fyke net sizes were used in this study. One had two 5 m wings, with a 0.9 m drop and the other with a single 5 m wing and a 0.6 m drop. Both nets had 2 mm mesh. A float was placed in the cod end of each fyke net to provide an air space for air breathing fauna (turtles, platypus etc). Fyke nets were set in the afternoon and cleared the following morning. The combination of fykes used in each site varied on prevailing depth and width of available macrohabitat at each site.

Two paired fyke nets were deployed at a total of 47 sites.

Electrofishing (backpack)

Backpack electrofishing was in wadable areas using a Smith-root APEX backpack electrofisher fitted with a 28 cm anode ring and a tightly covered dip net (10 mm stretched mesh). Both frequency (300 Hz) and duty cycle (~50%) was fixed to maintain a constant pulse width, with voltage varying according to conductivity levels. Sampling effort aimed to be consistent across habitats, with approximately 600 seconds 'on time' at sites. Backpack electrofishing sampling were undertaken by senior electrofishing operators. Due to prevailing depths, backpack electrofishing was not undertaken at Lake Borumba.

Backpack electrofishing was undertaken at 49 sites.

Electrofishing (boat)

Boat electrofishing was undertaken via the use of a 5 m boat fitted with a 5 KVA generator and Smith–Root control box. Each standard boat electrofishing shot was completed in a structured fashion over a fixed area of 50 m by 15 m for a defined period of power – on time of approximately 300 seconds (± 5%). Where adequate sampling area was available, this was repeated five times. Applied voltage varied according to the prevailing conductivity and temperature conditions. Stunned fish were blind sweep-netted from the water with a 3 mm open–mesh dip net fitted to a fibreglass pole.

Boat electrofishing was undertaken at eight sites.

Cathedral traps

Cathedral traps were deployed overnight. Two vertically set traps (small and large sizes) were baited with a combination of fruit (apple and banana) and meat (beef heart and liver and washed sardines) to target herbivorous, carnivorous and omnivorous fish and turtles. Traps were deployed to ensure sufficient basking room was available the upper sections of the net for any air breathing fauna that might be captured.

Gill netting

Finnish gill nets of mesh sizes 13 mm, 19 mm and 25 mm were deployed. Nets were checked every 20 minutes to ensure that air-breathing fauna had not become entangled. Nets were retrieved and catch collected after one hour.

Angling

Angling was undertaken at dawn and dusk during peak cod activity. Angling techniques can be particularly useful for catching larger, predatory threatened fishes such as freshwater cod (Faragher et al. 1993; Douglas et al. 1994). Angling methods included actively fishing with a rod and reel using live and dead baits, and lures. Angling occurred for approximately 30 minutes. Angling was undertaken at 25 sites.

Hydroacoustics

Hydroacoustic surveys were conducted using a Biosonics DT-X echosounder package with a 6.4°m circular beam transducer operating at 201 kHz. The transducer was used at a ping rate of 5 s-1, a pulse length of 0.4 ms, a data collection threshold of -130 dB and salinity, temperature. Hydroacoustic 'pings' were positioned using a differential GPS. The transducer was attached to the port side of the survey vessel's transom at a depth of approximately 0.6 m, sufficient to avoid cavitation as a result of prop wash and water flowing underneath the hull and past the transducer and mount. The transducer was angled vertically so that the sound beam was directed straight down towards the lake bed.

Sonar data were analysed to provide mean values every 180 pings which, depending on boat speed resulted in a data point every 50 to 100 m.

Hydroacoustic surveys were undertaken at 11 sites.

Aquatic spotlighting

Nocturnal spotlighting involved searching suitable substrates for reptiles and platypus, using spotlights or head torches with a bright focussed beam. Suitable habitat was the primary focus of spotlighting efforts including, fallen logs and branches, rock outcrops and tree trunks, especially along roads and tracks. Other areas assessed were targeted including downstream of riffles in pool habitat and where macrophytes were noted.

Crab pots

During the spotlighting surveys, a total of three crab pots baited with pilchards were deployed within the previously identified areas of interest, usually around 7-8 pm, over a period of three nights. The traps were left in place for four hours and monitored hourly, though some were retrieved early due to the high abundance of *Mixophyes* sp. tadpoles present in the watercourse. These tadpoles quickly consumed the bait, rendering the traps ineffective.

Baited crab pots were deployed at 49 sites.

Macroinvertebrates

AusRivAS sampling of both bed and edge habitats in watercourse sites. Van veen grab collection within Lake Borumba.

AusRivAS sampling of both bed and edge habitats in watercourse was undertaken at 50 sites.

Microalgae

Surface sediment scrapes of biofilm in depositional microhabitats within watercourses. Deep water benthic grab samples within Lake Borumba.

Surface sediment scrapes of biofilm in depositional microhabitats was undertaken at 32 sites.

Water quality

Physicochemical parameters were measured with a multi-parameter water quality meter (YSi ProDSS), which was calibrated prior to use. Measured physicochemical parameters included: water temperature (°C), pH, electrical conductivity (µS/cm), dissolved oxygen (mg/L and % saturation), and turbidity (NTU).

Physicochemical parameters were measured at 55 sites.

General observations

Opportunistic records of other flora/fauna species were also made throughout the survey program.

4.1.1.4 Limitations

While the field surveys are spatially and temporally comprehensive and have been conducted in accordance with relevant guidelines, there remain some limitations, including:

- limited access due to steep terrain, lack of adequate access tracks, thick vegetation, boat access required and private property
- areas that were mostly cleared and therefore less likely to contain suitable habitat for threatened species were not surveyed
- cryptic species can be difficult to detect; absence of detection does not equate to absence of the species
- surveys involving acoustic devices rely on the target species vocalising while the devices were deployed
- species with expansive home ranges may not occur on site during survey periods.

It is acknowledged that the resolution currency of database information has its limitations, however these were minimised wherever possible by ensuring that the most recent datasets were used, datapoints with ambiguous metadata or of very low precision were excluded from analysis, and that any ground-truthed data was prioritised over that of desktop-based datasets. In addition, specimen backed records in excess of 30 years were excluded from analysis due to concerns related to currency and recent human induced disturbance to the broader area.

Further, the guidelines recommend surveys be undertaken in representative habitat away from ecotones and edges so as such some of the survey sites are located outside the Project footprint, which is predominately linear in nature (~10 m wide). Also, to meet conditions transects could be up to 100 m in length.

4.1.1.5 Habitat mapping

From the field surveys and the desktop assessment, along with the relevant habitat data from Conservation Advices and other sources habitat maps have been developed for each of the threatened species which have the potential to inhabit the Borumba PHES Survey area. The mapping rules are provided in Appendix E.

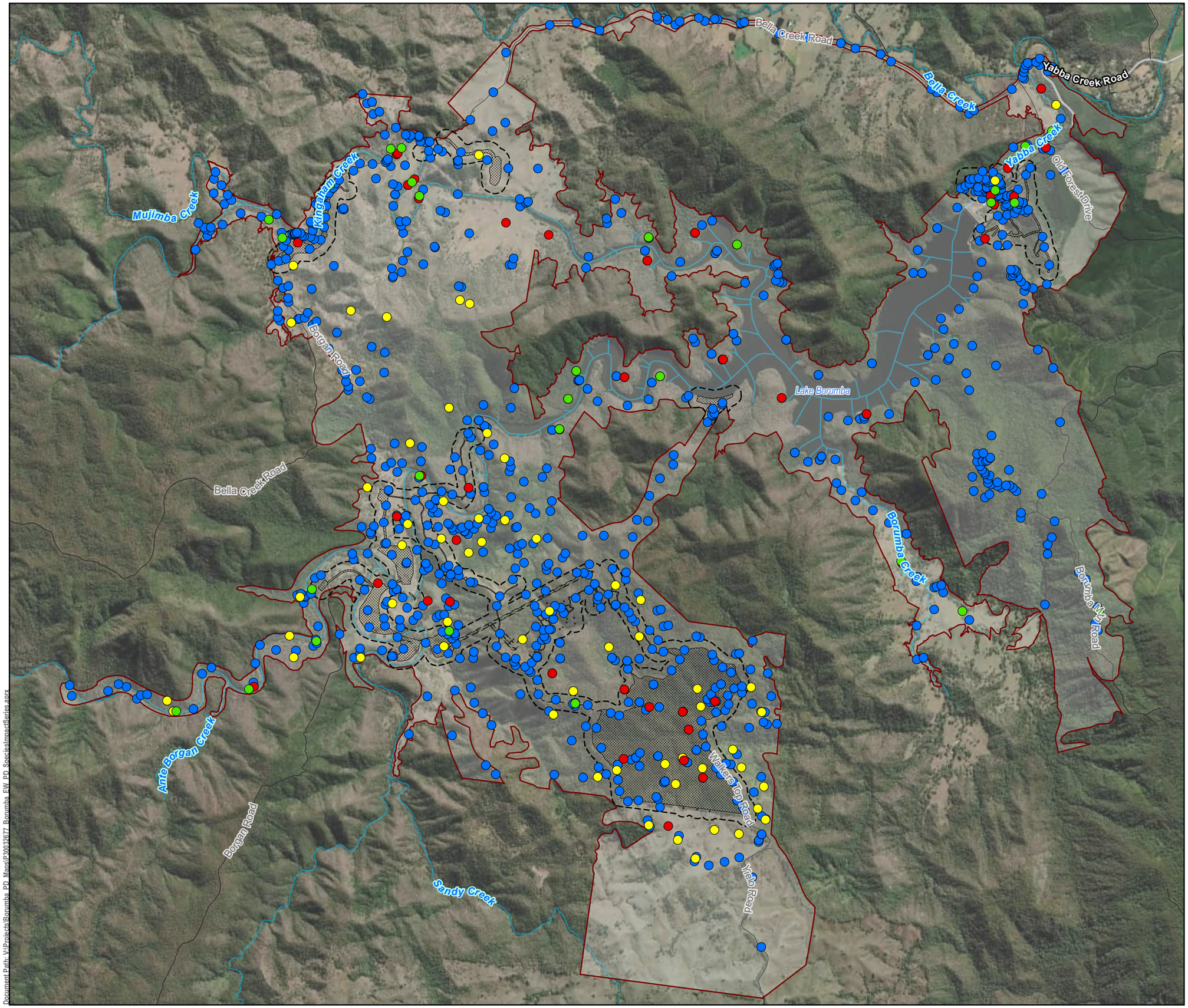
4.1.2 Other assessments

In addition to ecological surveys a number of other assessments have been undertaken in support of the Exploratory Works, and informed this assessment, including:

- groundwater water impact assessment including the establishment of groundwater bore across the site (Appendix B)
- contaminated land investigations
- a noise and vibration assessment
- a traffic impact assessment, with a road use management plan to be implemented
- a social impact assessment, with a social assessment management plan to be implemented.

Effectiveness is defined as the extent to which the goals of mitigation are reached. However, it is difficult to assess effectiveness without a specific and measurable goal. Therefore, Queensland Hydro recommends the SMART approach, that is, goals that are Specific, Measurable, Achievable, Realistic and Time framed. To assist this approach two monitoring programs have been implemented across the site:

- water quality monitoring – a water quality monitoring program has been developed in accordance with Monitoring and sampling manual (DES, 2018) and implemented for the Project
- groundwater monitoring of standing water levels and water quality conditions (AGE, 2024).



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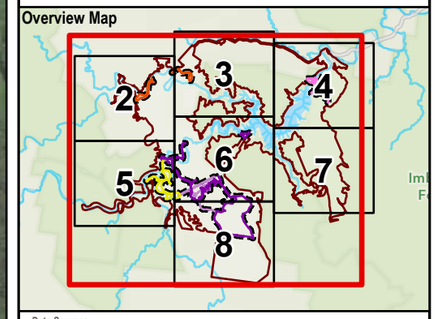
LEGEND

Exploratory Works Project
- Project Area
- Project Area (Underground)

Survey Areas
- Exploratory Works Survey Area
- Borumba PHES Survey Area

Flora surveys undertaken
- BioCondition
- Habitat Quality Assessment
- Quaternary
- Secondary

Overview Map



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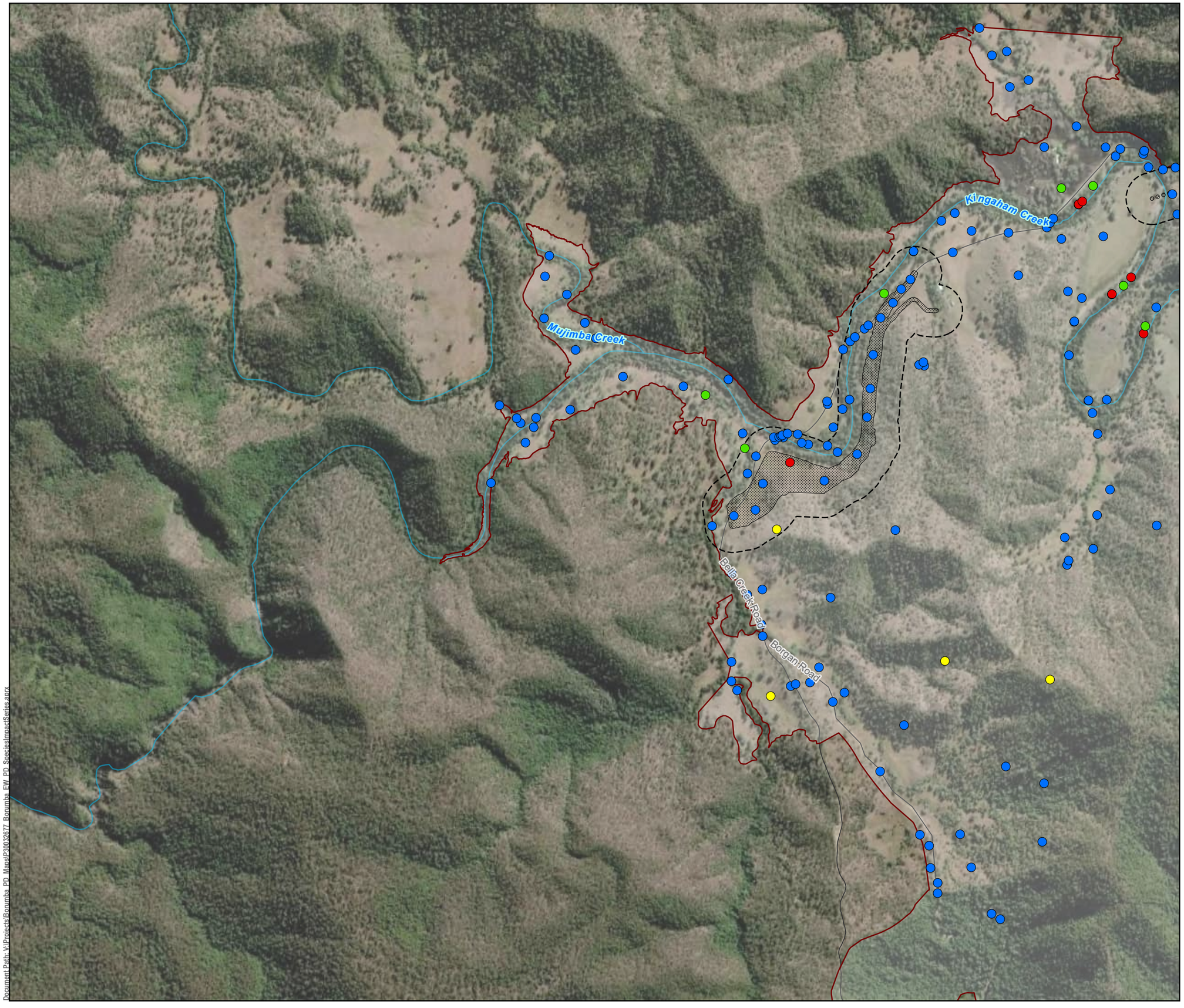
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FIGURE 38

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Exploratory Works Project

- Project Area

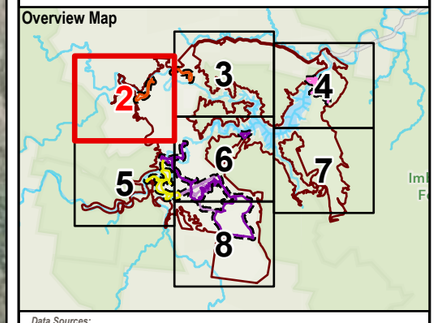
Survey Areas

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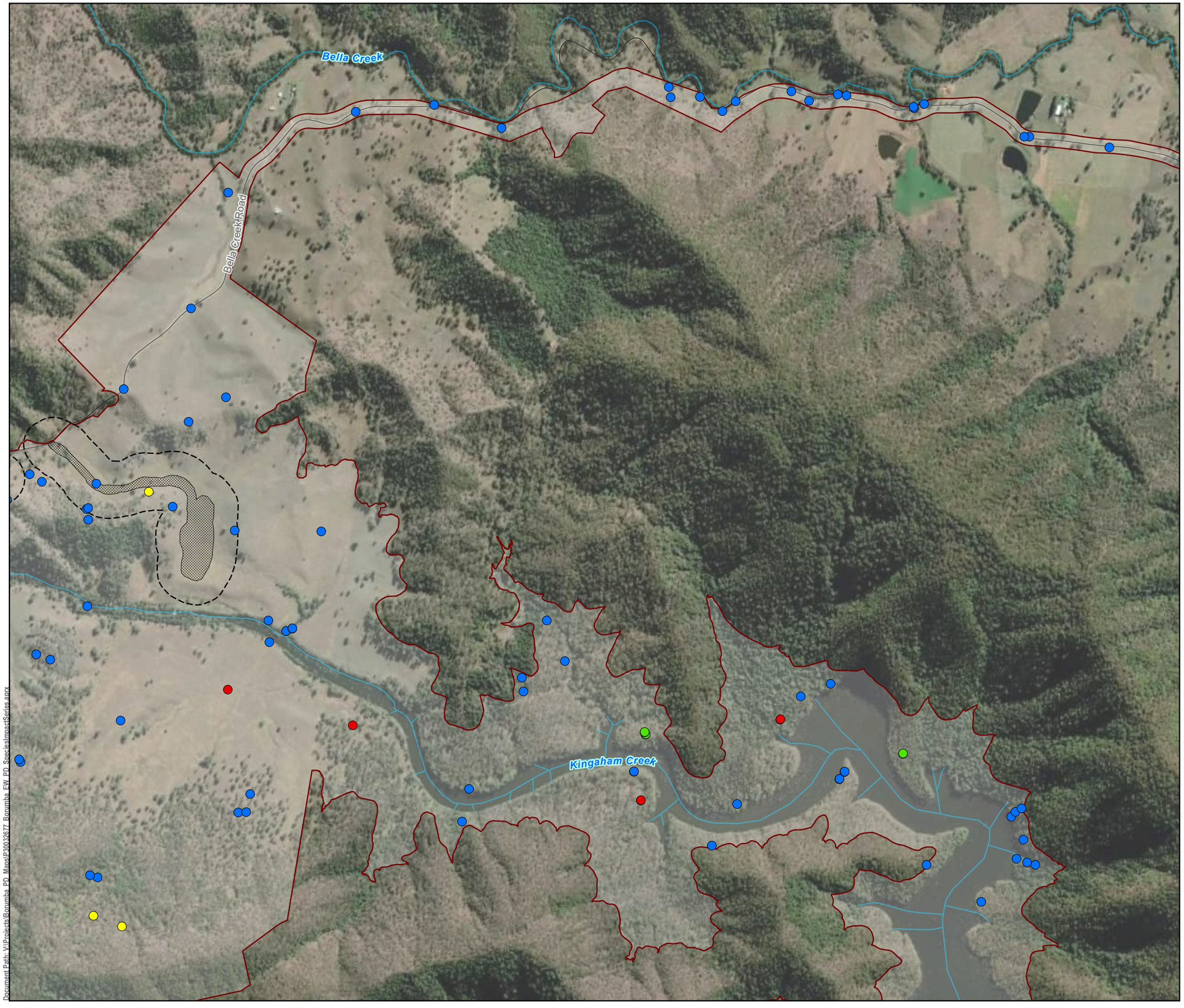
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Project Area

Survey Areas

Exploratory Works Survey Area

Borumba PHES Survey Area

Flora surveys undertaken

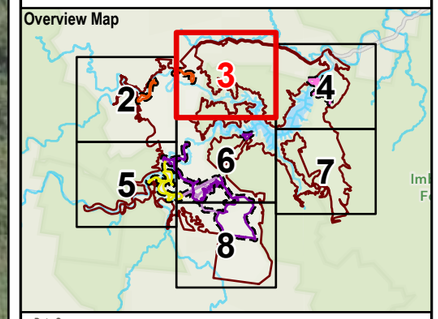
BioCondition

Habitat Quality Assessment

Quaternary

Secondary

Overview Map



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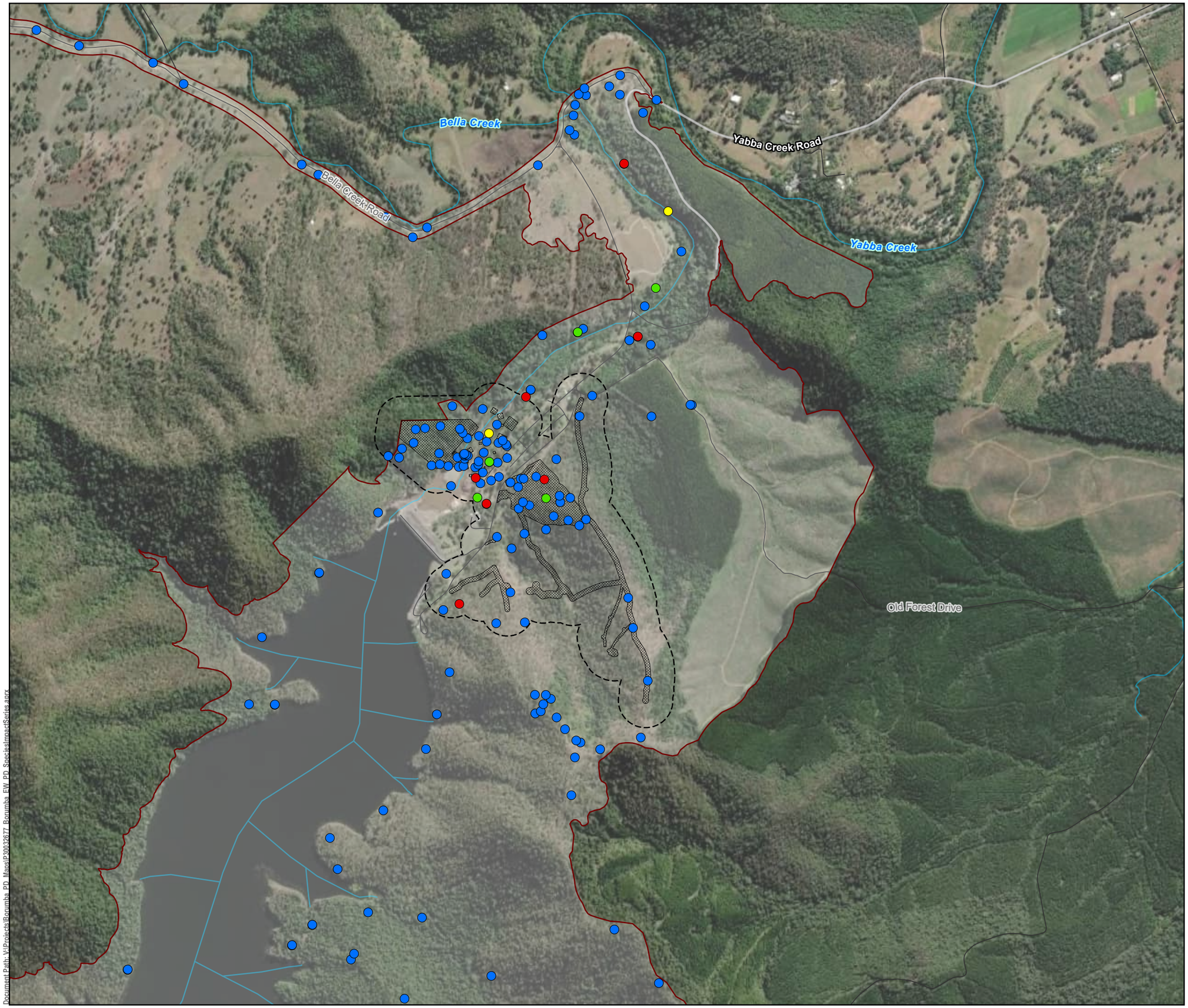
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Exploratory Works Project

- Project Area

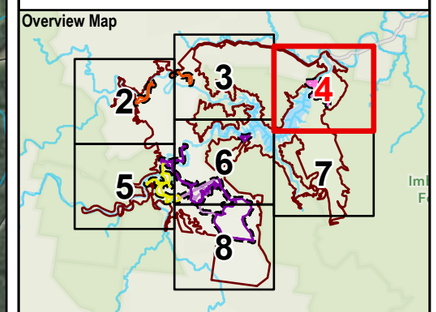
Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Flora surveys undertaken

- BioCondition
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- Quaternary
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Overview Map



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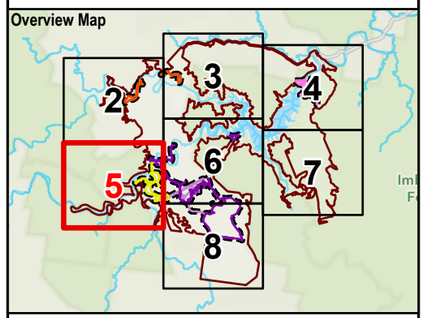
LEGEND

Exploratory Works Project
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Survey Areas
- Exploratory Works Survey Area
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Flora surveys undertaken
- BioCondition
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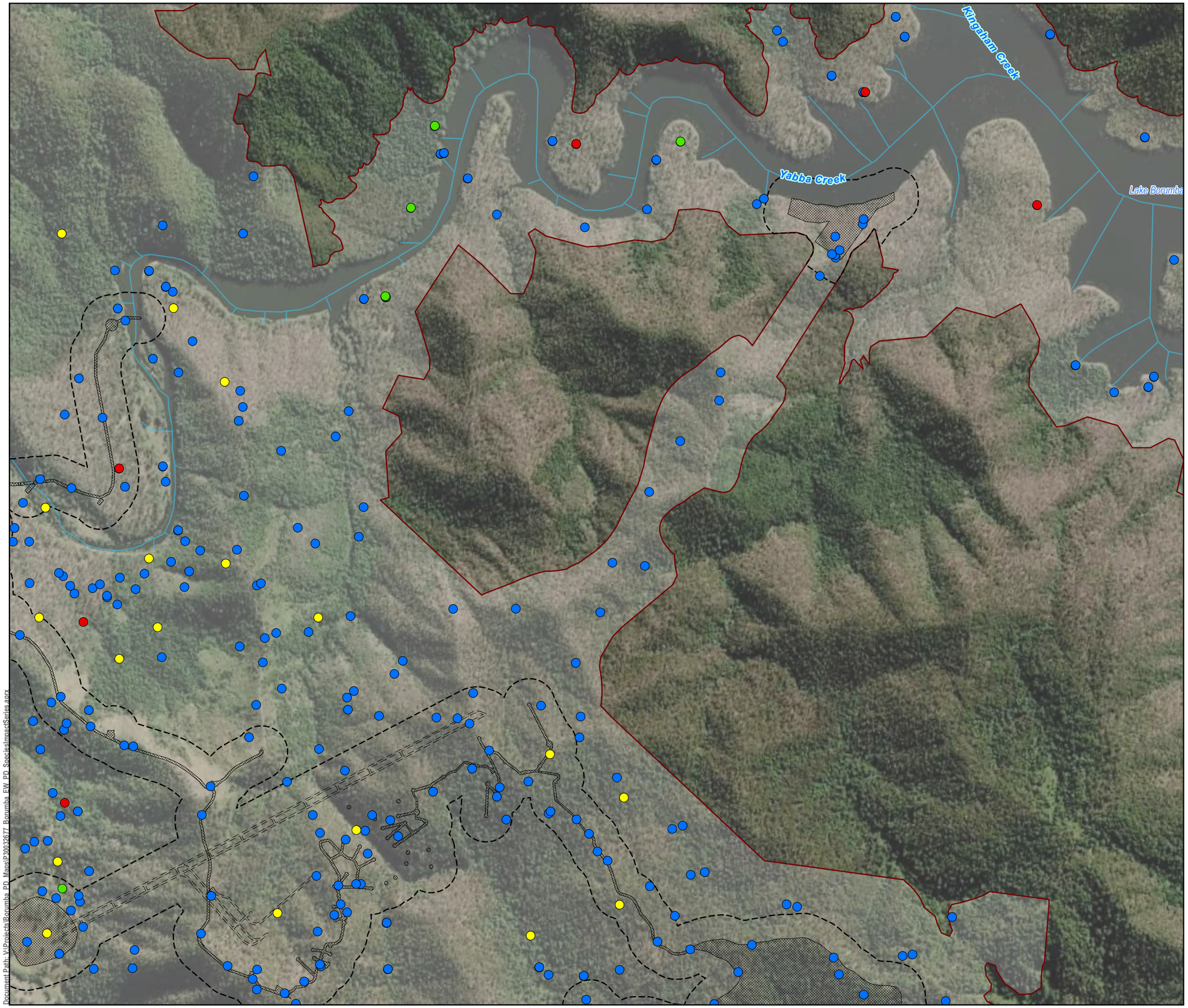
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Exploratory Works Project

- Project Area
- Project Area (Underground)

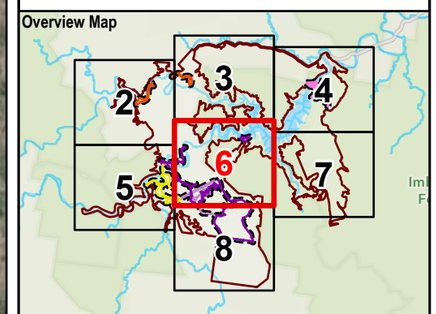
Survey Areas

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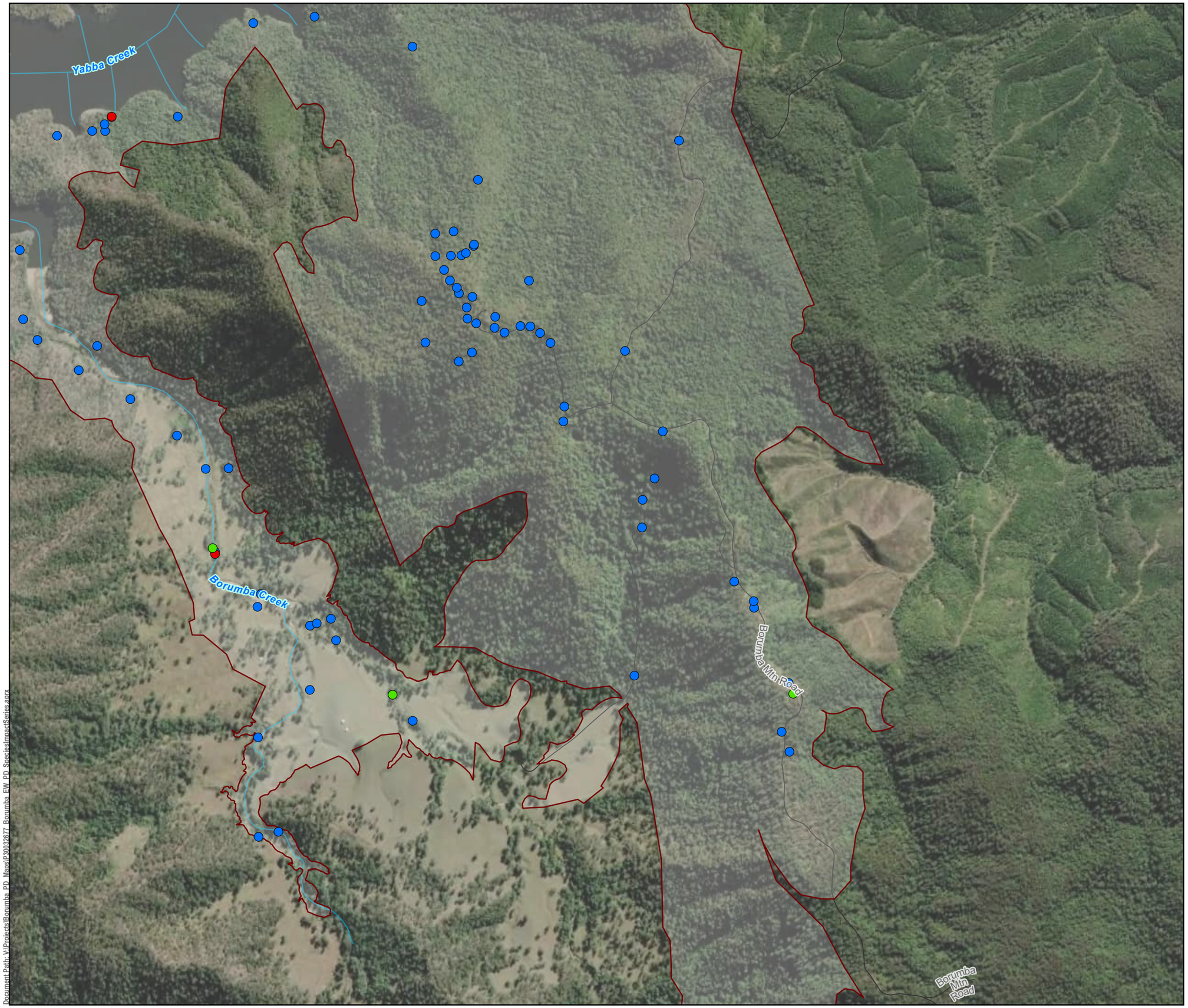
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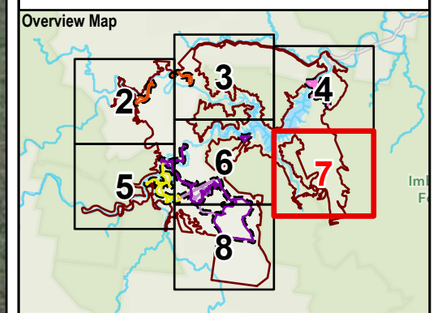
LEGEND

Borumba PHES Survey Area

Flora surveys undertaken

- BioCondition
- Quaternary
- Secondary

Overview Map



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FIGURE 38

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LEGEND

Exploratory Works Project
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Survey Areas
- Exploratory Works Survey Area
- Borumba PHES Survey Area

Flora surveys undertaken
- BioCondition
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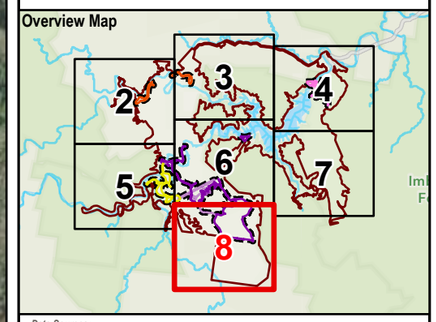
Walkers Top Road

Yielo Road

Yielo Road

Sandy Creek

Overview Map



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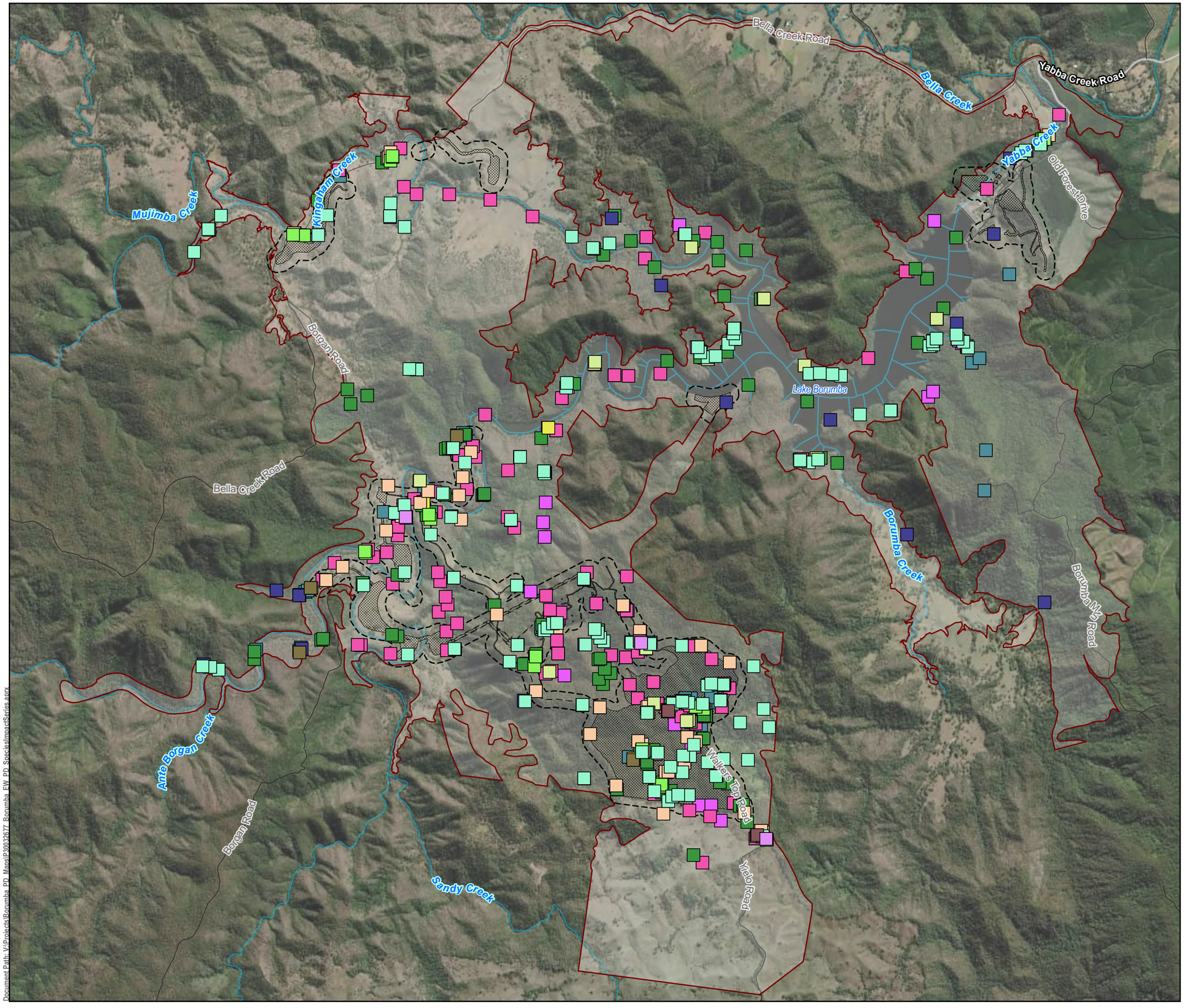
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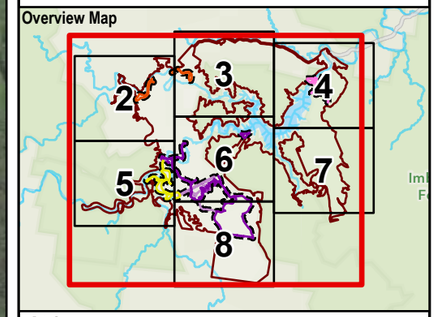
LEGEND

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Fauna Surveys Undertaken
- Active Diurnal Searches
- Amphibian Habitat Assessment
- Fauna Habitat Assessment
- Bird Survey
- Anabat Survey
- Bioacoustic Survey
- Terrestrial Spotlighting Survey
- Koala SAT
- Funnel or Pitfall Trapping
- Elliot Trapping
- Camera Trapping
- Mammal Trapping
- Systematic Trapping

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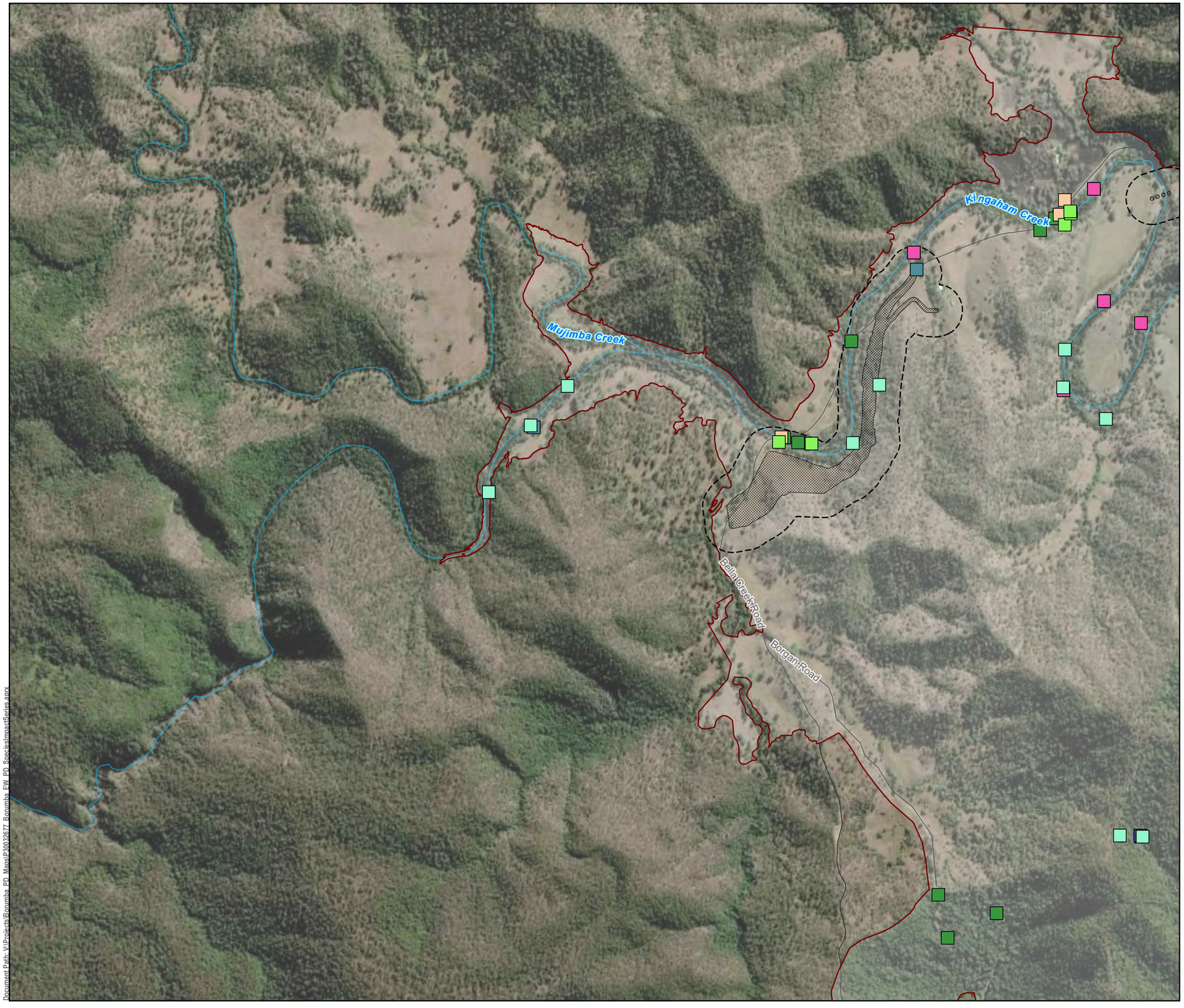
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Preliminary Documentation

TERRESTRIAL FAUNA SURVEY EFFORT
PAGE 1 OF 8

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FIGURE 39

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Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

Exploratory Works Project

- Project Area

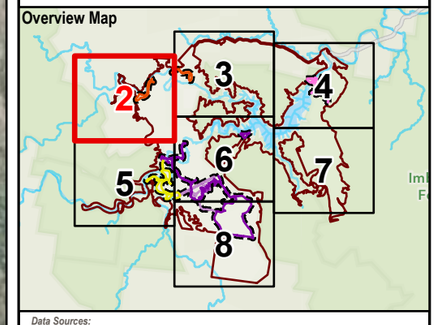
Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Fauna Surveys Undertaken

- Active Diurnal Searches
- Fauna Habitat Assessment
- Bird Survey
- Bioacoustic Survey
- Terrestrial Spotlighting Survey
- Elliot Trapping
- Camera Trapping

Overview Map



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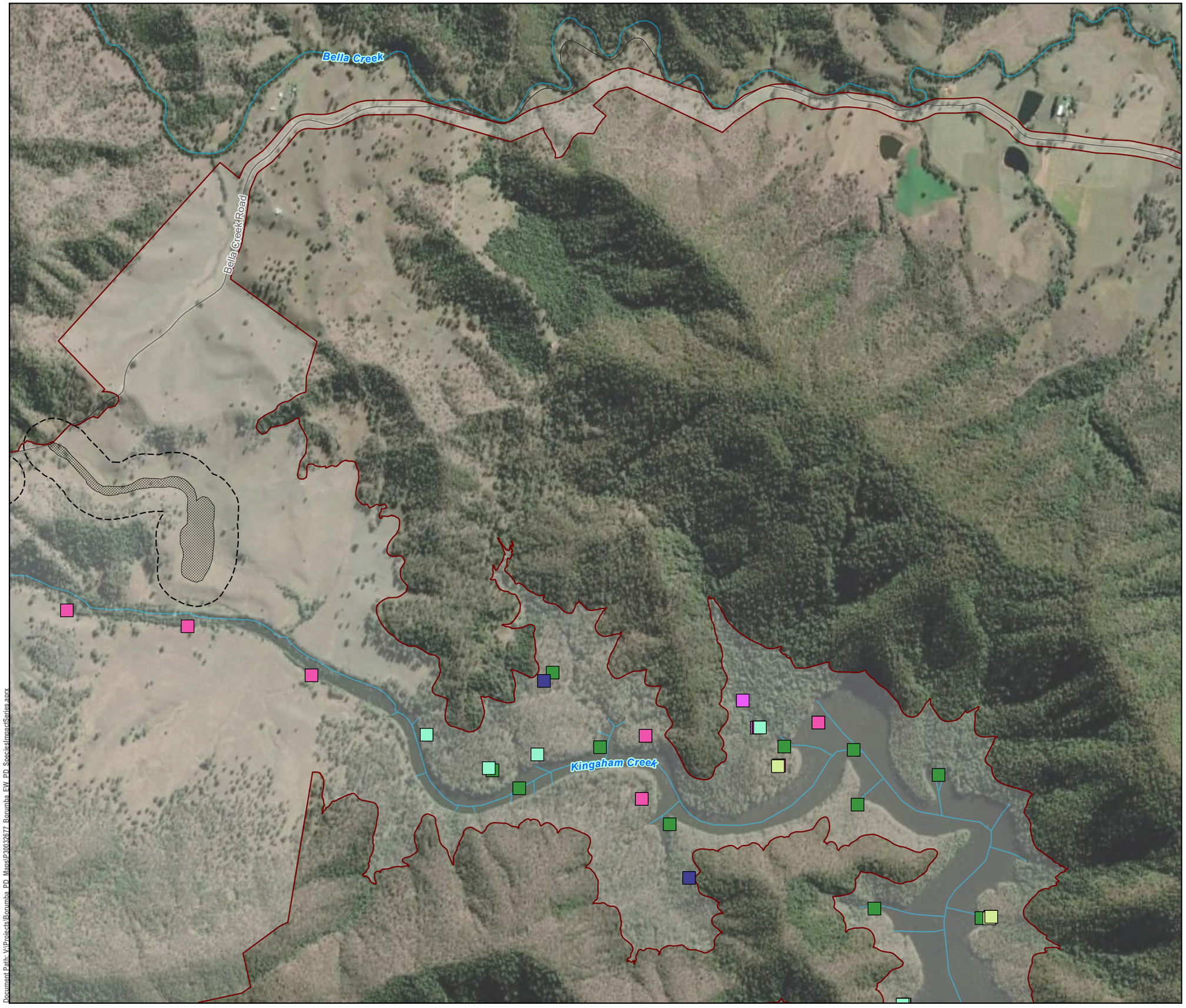
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FIGURE 39

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LEGEND

Exploratory Works Project

- Project Area

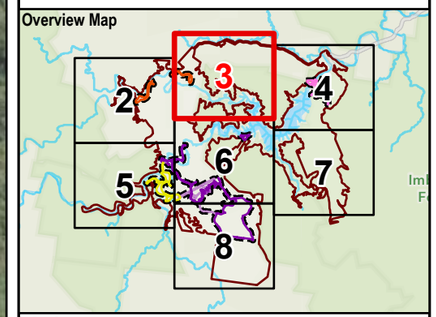
Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

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- Amphibian Habitat Assessment
- Fauna Habitat Assessment
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- Bioacoustic Survey
- Koala SAT
- Camera Trapping

Overview Map



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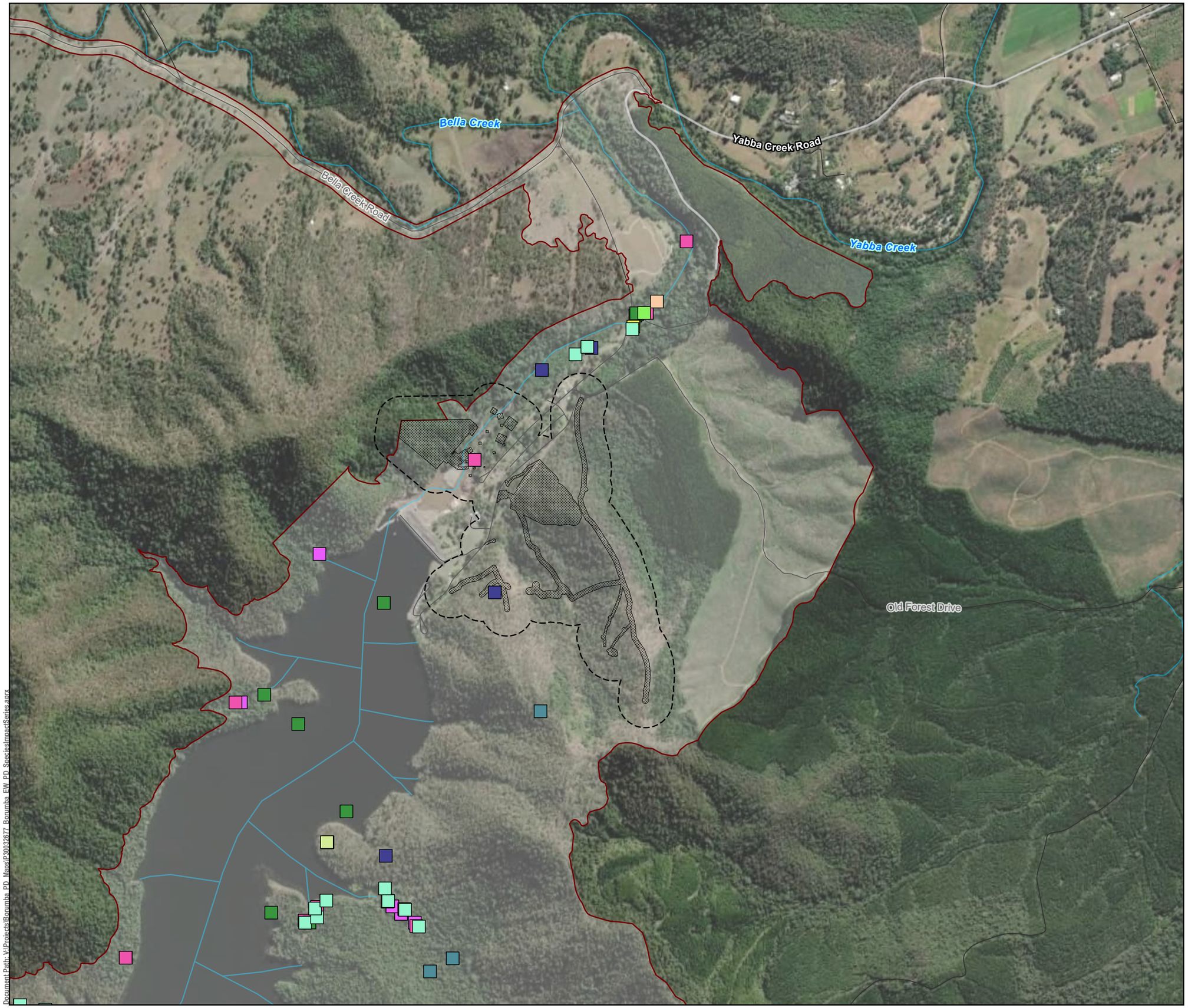
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FIGURE 39

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LEGEND

Exploratory Works Project

- Project Area

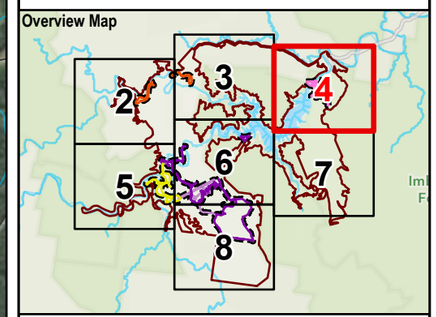
Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Fauna Surveys Undertaken

- Active Diurnal Searches
- Amphibian Habitat Assessment
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- Bird Survey
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Overview Map



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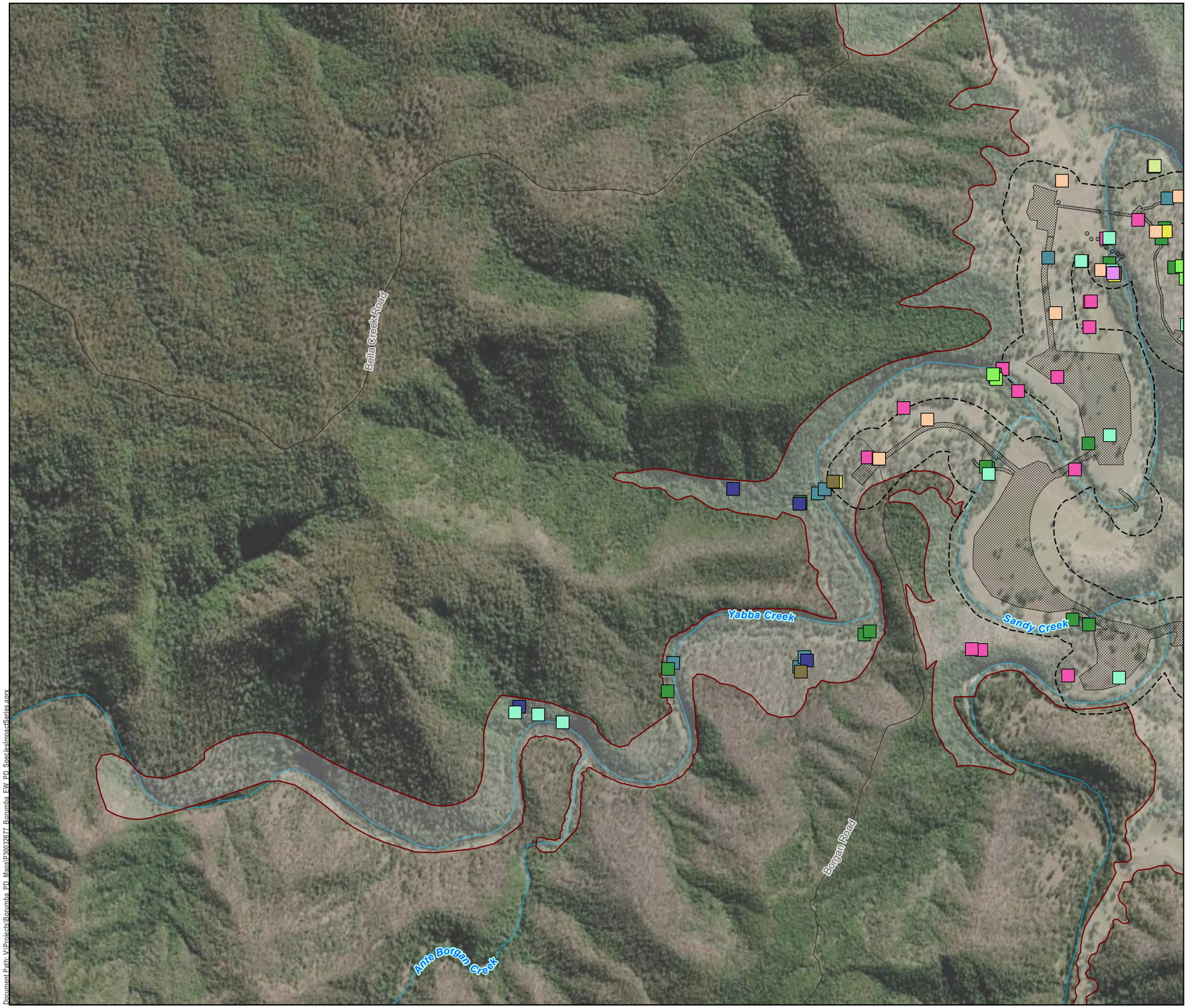
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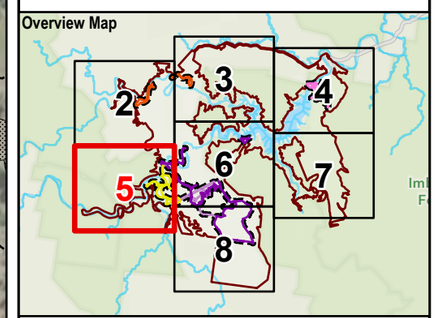
LEGEND

Exploratory Works Project
- Project Area
- Project Area (Underground)

Survey Areas
- Exploratory Works Survey Area
- Borumba PHES Survey Area

Fauna Surveys Undertaken
- Active Diurnal Searches
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- Camera Trapping
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- Systematic Trapping

Overview Map



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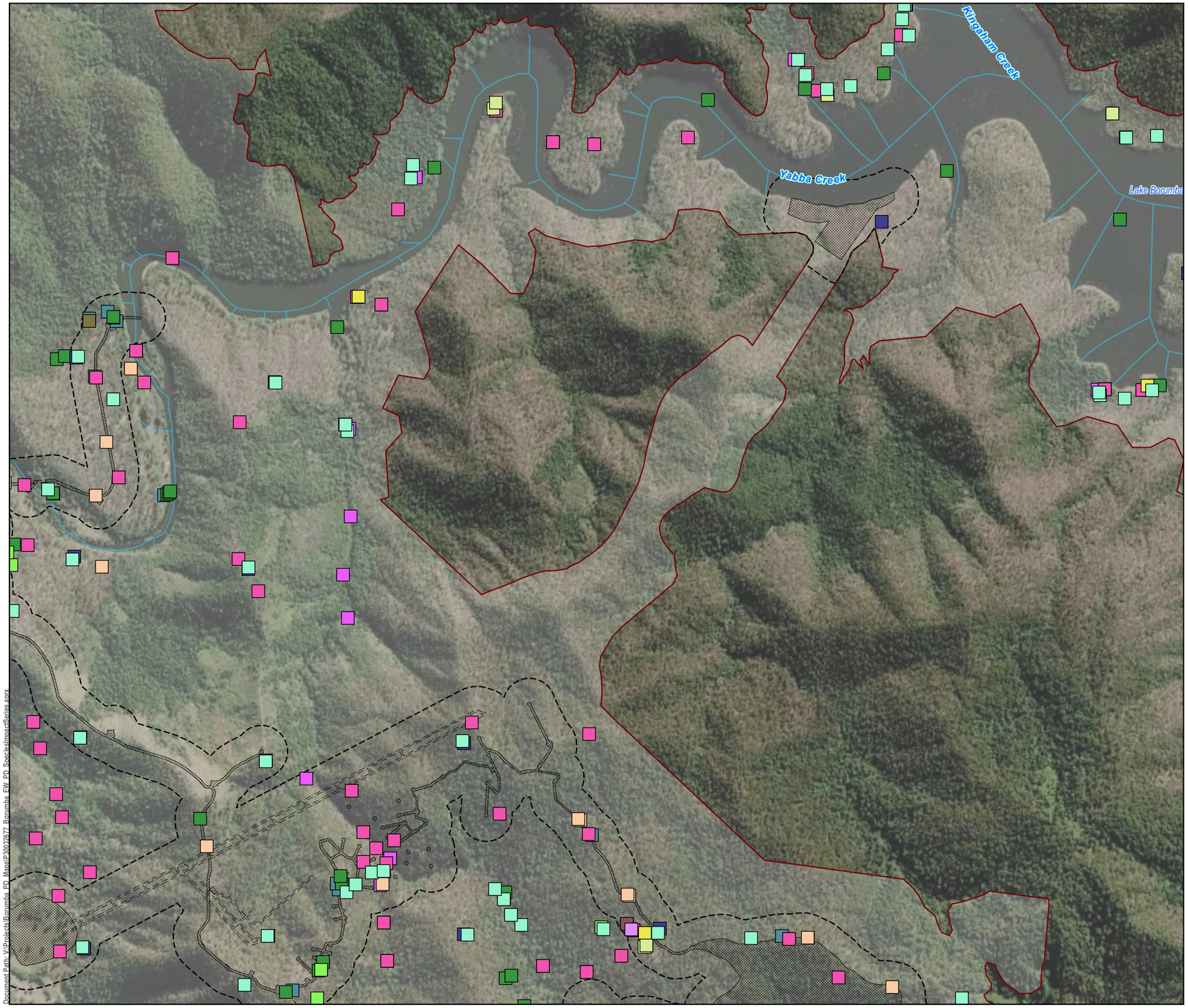
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FIGURE 39

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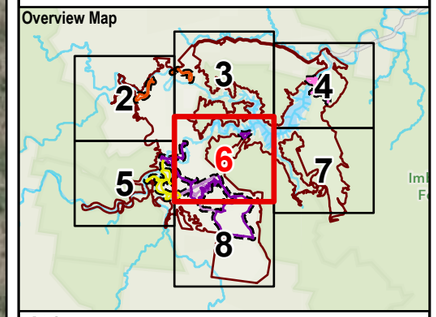
LEGEND

Exploratory Works Project
- Project Area
- Project Area (Underground)

Survey Areas
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Fauna Surveys Undertaken
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Overview Map



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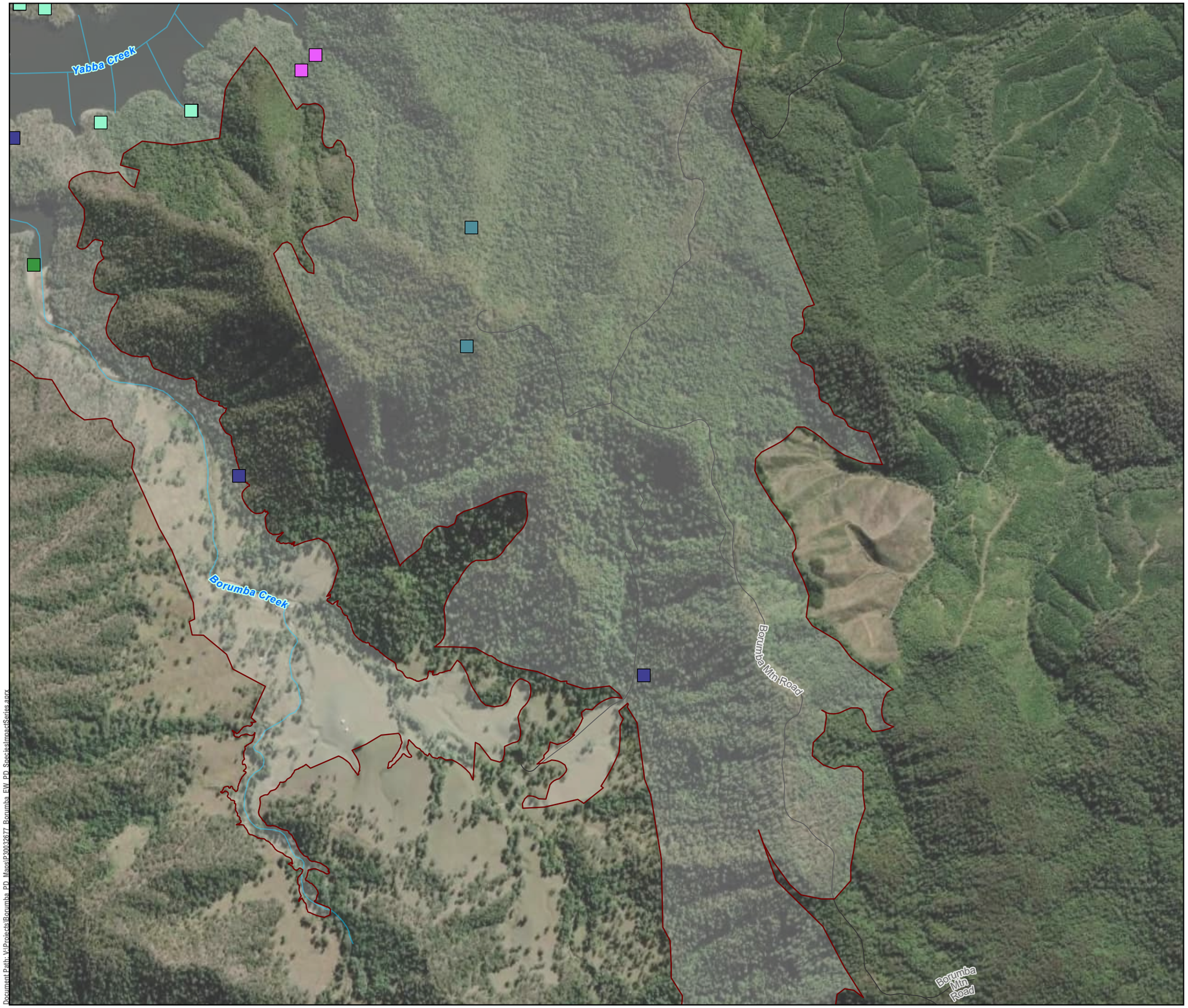
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FIGURE 39

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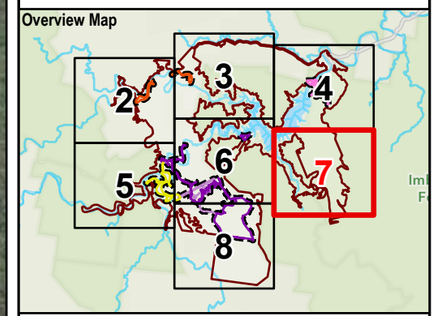
LEGEND

- Borumba PHES Survey Area

Fauna Surveys Undertaken

- Active Diurnal Searches
- Amphibian Habitat Assessment
- Fauna Habitat Assessment
- Bird Survey
- Bioacoustic Survey
- Camera Trapping

Overview Map



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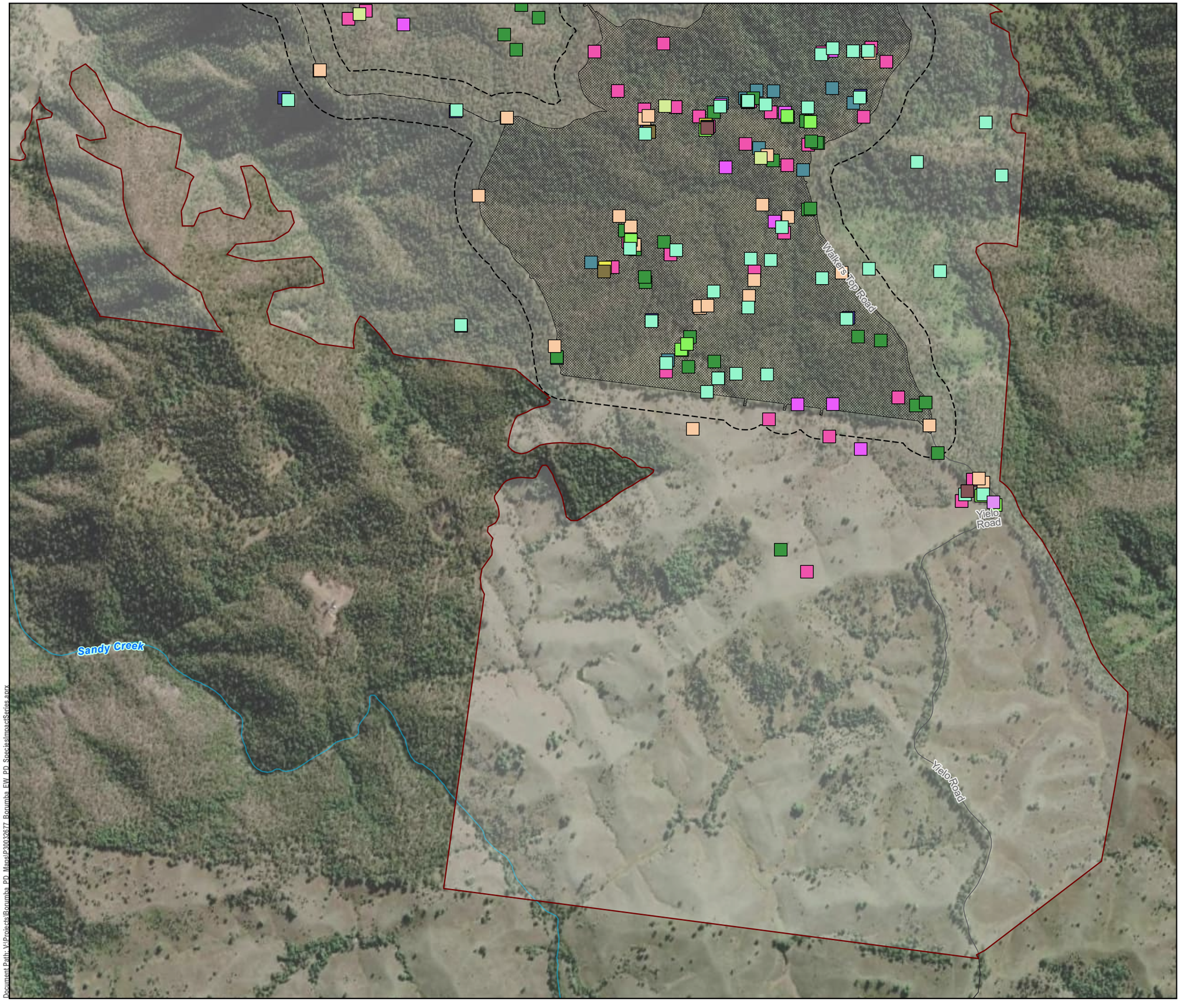
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FIGURE 39

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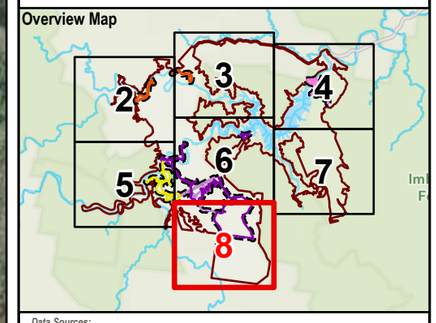
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Exploratory Works Project
- Project Area
- Project Area (Underground)

Survey Areas
- Exploratory Works Survey Area
- Borumba PHES Survey Area

Fauna Surveys Undertaken
- Active Diurnal Searches
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FIGURE 39

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Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top,Above Ground
- Area 3 - Walkers Top,No Clearing
- Area 4 - Borgan

Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Aquatic Raw Fauna Survey Data (Method)

- Cathedral Trap
- Electrofisher
- Fyke
- Small Fyke
- Large Fyke
- Gill net
- Observed
- eDNA
- Watercourse spotlighting sites
- Aquatic habitat walk

Data Sources:

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FIGURE 40

Overview

Main Map

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4.2 Results – RFI item 3.3(h)

4.2.1 Threatened ecological communities

4.2.1.1 Lowland Rainforest of Subtropical Australia

The Subtropical rainforest habitat type was identified during the field surveys as having the potential of conforming to the Lowland Rainforest of Subtropical Australia TEC and was therefore subject to targeted surveys to assess the potential TEC against the key diagnostic criteria and condition thresholds of the Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia.

There are several patches of the Lowland Rainforest of Subtropical Australia TEC patches within the Exploratory Works Survey area; however, only a single patch of the Lowland Rainforest of Subtropical Australia TEC is present within the Project footprint; this is in Area 1 (Borumba Dam).

Table 23 presents an assessment to confirm if the Subtropical rainforest habitat type within the Exploratory Works Survey area conforms to the key diagnostic characteristics contained in the Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia (DSEWPaC, 2011).

Table 23: Assessment against the key diagnostic characteristics of the listed ecological community (DSEWPaC, 2011)

Key Diagnostic Characteristics of the Listed Ecological Community	Assessment Outcome
Distribution of the ecological community is primarily in the NSW North Coast and South Eastern Queensland bioregions, according to Interim Biogeographic Regionalisation for Australia (IBRA) version 6.1 (2004).	**Conforms** The rainforest vegetation community is present within the South Eastern Queensland bioregions.
The ecological community occurs on: soils derived from basalt or alluvium; or enriched rhyolitic soils; or basaltically enriched metasediments.	**Uncertain** The Subtropical rainforest vegetation community is mapped as land zone 11 and occurring on several different geological units, with the main units being the Amamoor beds which includes basic metavolcanics, which can include basalt, the Marumba beds include rhyolite. In the absence of soil sampling and site-specific field validated geological data, a precautionary approach has been applied and the Subtropical rainforest vegetation community has been assumed to be present on either enriched rhyolitic soils or basaltically enriched metasediments.
The ecological community generally occurs at an altitude less than 300 m above sea level.	**Conforms** The rainforest vegetation community is generally present between the 150 m and 250 m contours; however, does extend above the 300 m contour in some places.
The ecological community typically occurs in areas with high annual rainfall (>1,300 mm).	**Does not conform** The mean annual rainfall recorded at the Imbil Post Office weather station (40099) is 1,180.9 mm. The median annual rainfall recorded at the Imbil Post Office weather station is 1,121.4 mm.
The ecological community is typically more than 2 km inland from the coast.	**Conforms** The Subtropical rainforest vegetation community is approximately 50 km from the coast.

Key Diagnostic Characteristics of the Listed Ecological Community	Assessment Outcome
The structure of the ecological community is typically a tall (20-30 m) closed forest, often with multiple canopy layers.	**Conforms** The structure of the Subtropical rainforest vegetation community was assessed as having a median canopy height of only 21 m with a range of between 15-25 m. The canopy cover was typically greater than 80%.
Patches of the ecological community typically have high species richness (at least 30 woody species from Appendix A of the Listing Advice).	**Conforms** Targeted surveys were undertaken to confirm species richness of the patches of the Subtropical rainforest vegetation community. All patches contained a minimum of 30 woody species from Appendix A of the Listing Advice.

The assessment undertaken in Table 23 identifies that the Subtropical rainforest conforms to the key diagnostic characteristics of the Lowland Rainforest of Subtropical Australia TEC (noting the precautionary principle being applied due to the uncertainty around the underlying geology and soils).

Surveys were undertaken within the Subtropical rainforest to assess the condition of the vegetation community to confirm if the vegetation community also meets the condition thresholds, which identified that all patches achieved a Condition class of either A or B. A list of all species identified within the Subtropical rainforest habitat type and their listing status on Appendix A of the Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia is provided in Appendix K. A total of 632.4 ha of the field validated TEC is present in the Borumba PHES Survey area. Within the Project footprint, 2.5 ha of the field validated TEC is present (patch YC4), while 33.5 ha of the TEC is present within the Exploratory Works Survey area across 16 patches. The 16 TEC patches that intersect with the Exploratory Works Survey area and their total patch size (including areas outside the Exploratory Works Survey area) are as follows:

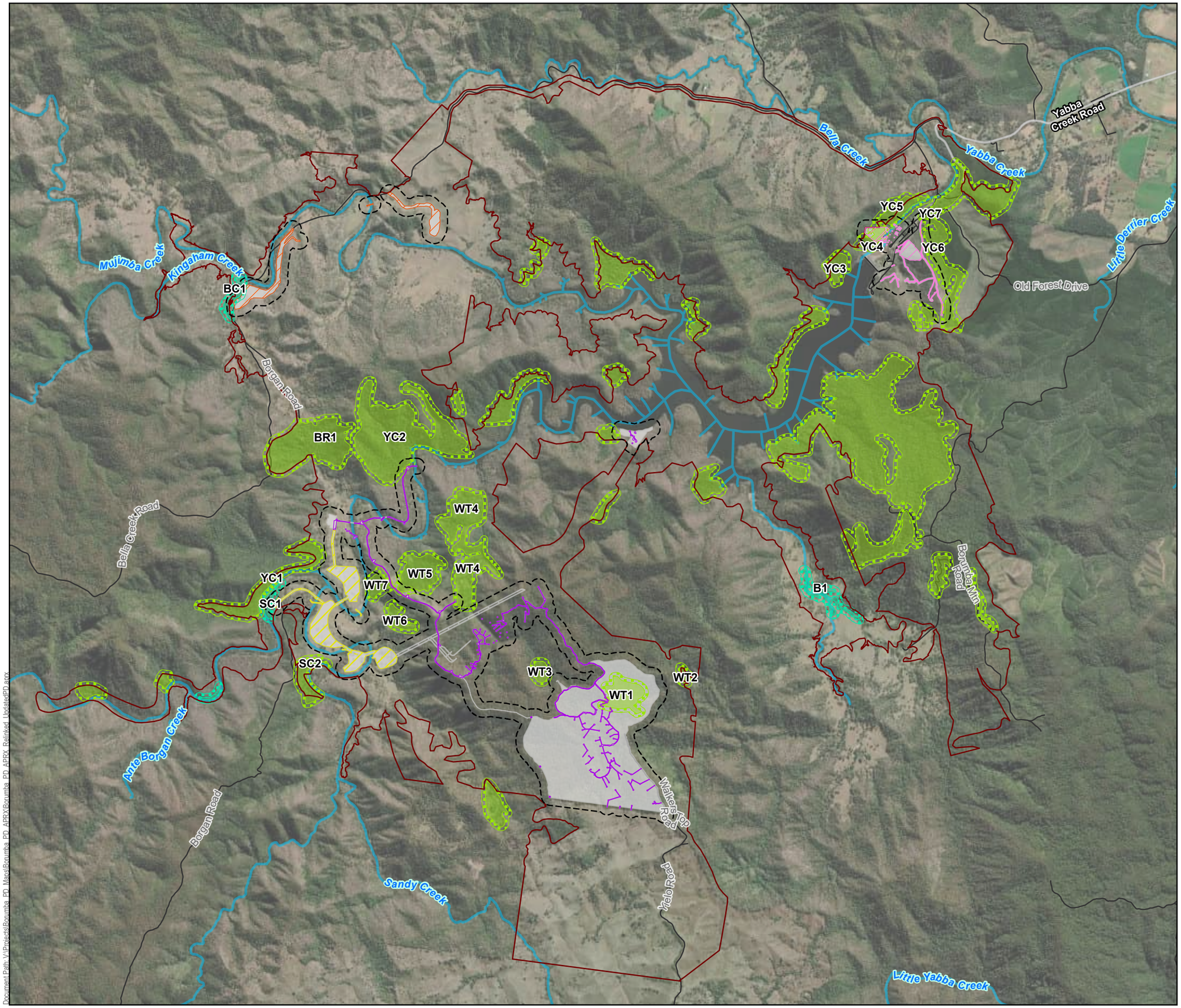
- Patch BR1 – total patch size is 52.5 ha
- Patch SC2 – total patch size is 9.8 ha
- Patch YC1 – total patch size is 22.7 ha
- Patch YC2 – total patch size is 91.4 ha
- Patch YC3 – total patch size is 6.7 ha
- Patch YC4 – total patch size is 4.8 ha
- Patch YC5 – total patch size is 10.5 ha
- Patch YC6 – total patch size is 22.5 ha
- Patch YC7 – total patch size is 9.2 ha
- Patch WT1 – total patch size is 16.1 ha
- Patch WT2 – total patch size is 2 ha
- Patch WT3 – total patch size is 4.4 ha
- Patch WT4 – total patch size is 45.4 ha
- Patch WT5 – total patch size is 20.8 ha
- Patch WT6 – total patch size is 5.4 ha
- Patch WT7 – total patch size is 6.0 ha.

Patch YC4 is the only patch within the Project footprint.

The Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia identifies that a minimum buffer zone of 50 m beyond the trunks of the outermost trees in the patch should be applied to assist in assessing impacts to the TEC and assist in the preservation of the patch. The 50 m buffer zone will encompass an area large enough to protect the root zone of edge trees, which is similar to the tree protection zone (TPZ). The TPZ is the calculated area above and below ground at a given distance from the trunk to provide for the protection of the tree's roots and canopy during construction works.

The TEC buffer zone extends into the Project footprint at several locations, noting for the purposes of the mapping the buffer zone is based on the edge of the patch which has been defined by the canopy of the trees and not the trunk. As such the mapping is conservative as the patch size already incorporates the TPZ.

The location and extent of the field validated Lowland Rainforest of Subtropical Australia TEC and the associated buffer zones are shown in Figure 41.



Document Path: V:\Projects\Borumba_PD_Maps\Borumba_PD_APRX\Borumba_PD_APRX_Relinked_UpdatedPD.aprx

Queensland Hydro

GDA2020 MGA Zone 56

0 400 900 1,000 2,000 m

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LEGEND

- Watercourses
- Local Roads
- State Controlled Roads

Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 4 - Borgan

Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Ground-truthed threatened ecological communities

- Lowland Rainforest of Subtropical Australia
- 50m buffer for lowland rainforest of subtropical Australia
- Subtropical eucalypt floodplain forest and woodland
- 50m buffer for Subtropical eucalypt floodplain

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
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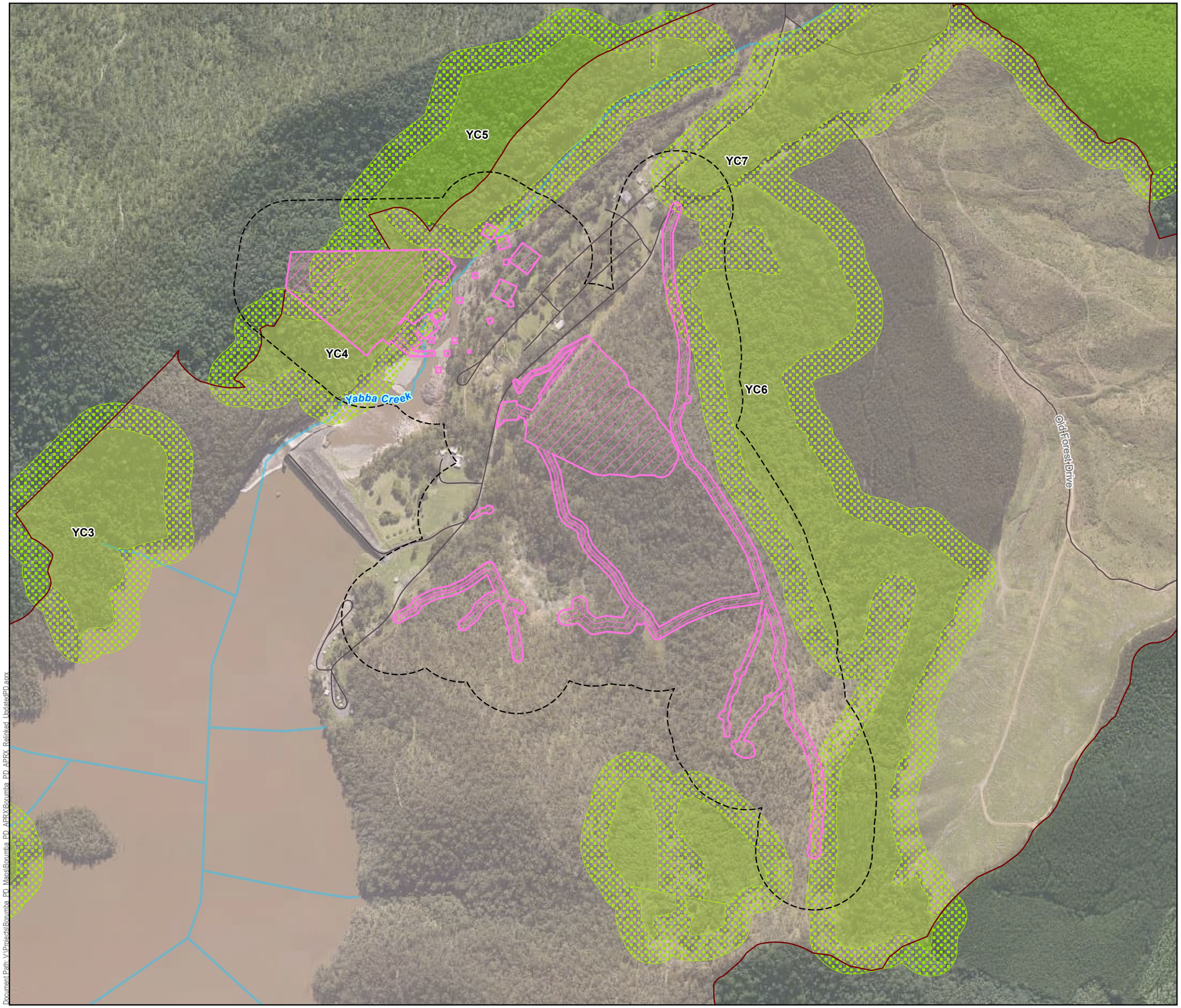
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Exploratory Works Project
Preliminary Documentation

THREATENED ECOLOGICAL COMMUNITIES OVERVIEW

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 41a



Queensland Hydro

GDA2020 MGA Zone 56

0 50 100 200 200 300 m

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LEGEND

Watercourses

Local Roads

Exploratory Works Project

Project Footprint by Work Area

Area 1 - Borumba Dam

Project Area by Work Area

Area 1 - Borumba Dam

Survey Areas

Exploratory Works Survey Area

Borumba PHES Survey Area

Ground-truthed threatened ecological communities

Lowland Rainforest of Subtropical Australia

50m buffer for lowland rainforest of subtropical Australia

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
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THREATENED ECOLOGICAL COMMUNITIES AREA 1 - BORUMBA DAM

PROJECT #:	30032677/30032772
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LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 41b

Document Path: V:\Projects\Borumba_PD_Maps\Borumba_PD_APRX\Borumba_PD_APRX_RelinkedUpdatedPD.aprx

Queensland Hydro

GDA2020 MGA Zone 56

N

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LEGEND

Watercourses

Local Roads

Exploratory Works Project

Project Footprint by Work Area

Area 2 - Kingaham Creek

Project Area by Work Area

Area 2 - Kingaham Creek

Survey Areas

Exploratory Works Survey Area

Borumba PHES Survey Area

Ground-truthed threatened ecological communities

Subtropical eucalypt floodplain forest and woodland

50m buffer for Subtropical eucalypt floodplain

Bella Creek Road

Kingaham Creek

BC1

Borgan Road

Bella Creek Road

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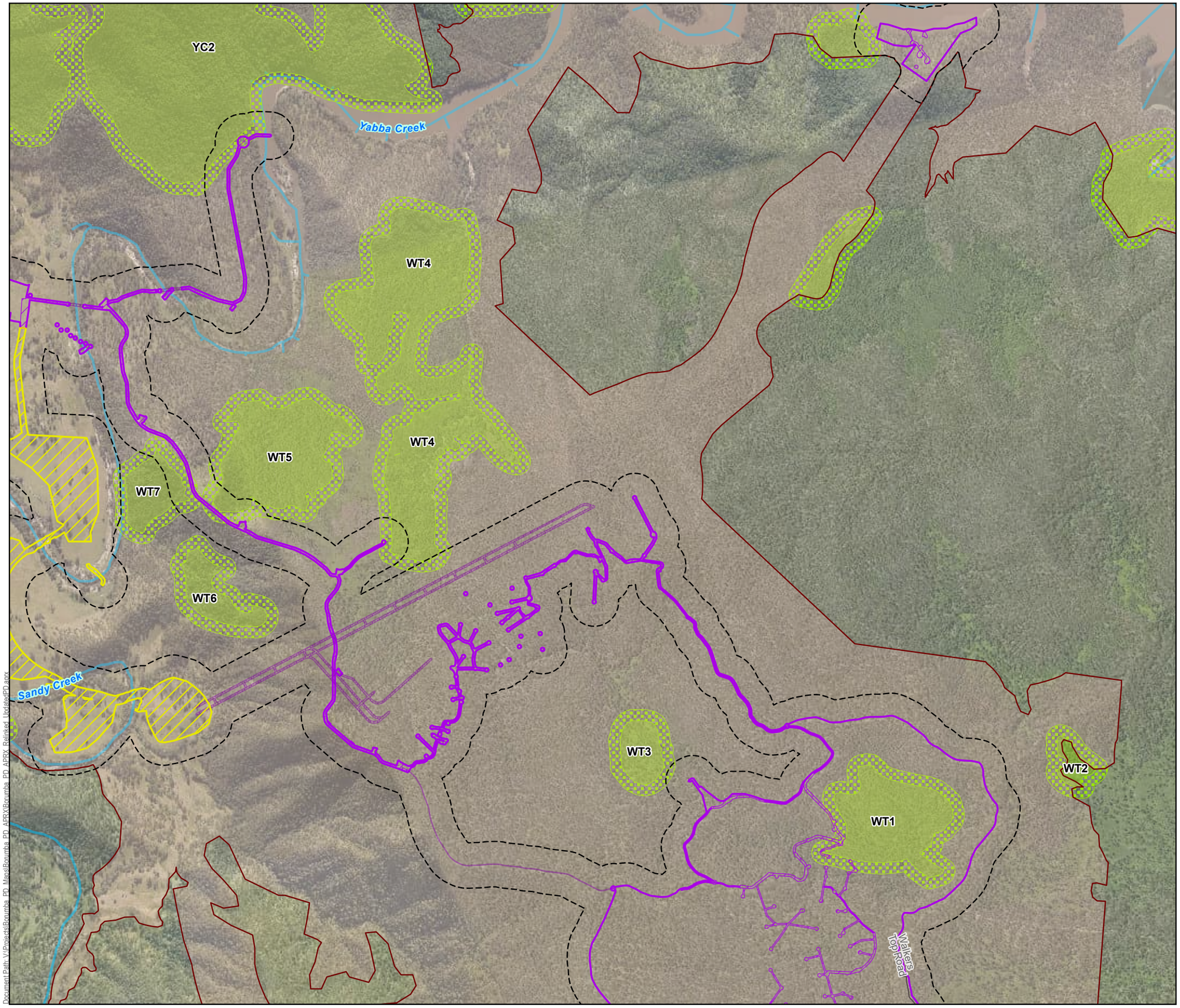
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Exploratory Works Project
Preliminary Documentation

THREATENED ECOLOGICAL COMMUNITIES AREA 2 - KINGAHAM CREEK

PROJECT #:	30032677/30032772
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LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 41c



Queensland Hydro

GDA2020 MGA Zone 56

N

0 100 200 400 500 600 m

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LEGEND

- Watercourses
- Local Roads

Exploratory Works Project

Project Footprint by Work Area
- Area 3 - Walkers Top
- Area 4 - Borgan

Project Area by Work Area
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Survey Areas
- Exploratory Works Survey Area
- Borumba PHES Survey Area

Ground-truthed threatened ecological communities
- Lowland Rainforest of Subtropical Australia
- 50m buffer for lowland rainforest of subtropical Australia

Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
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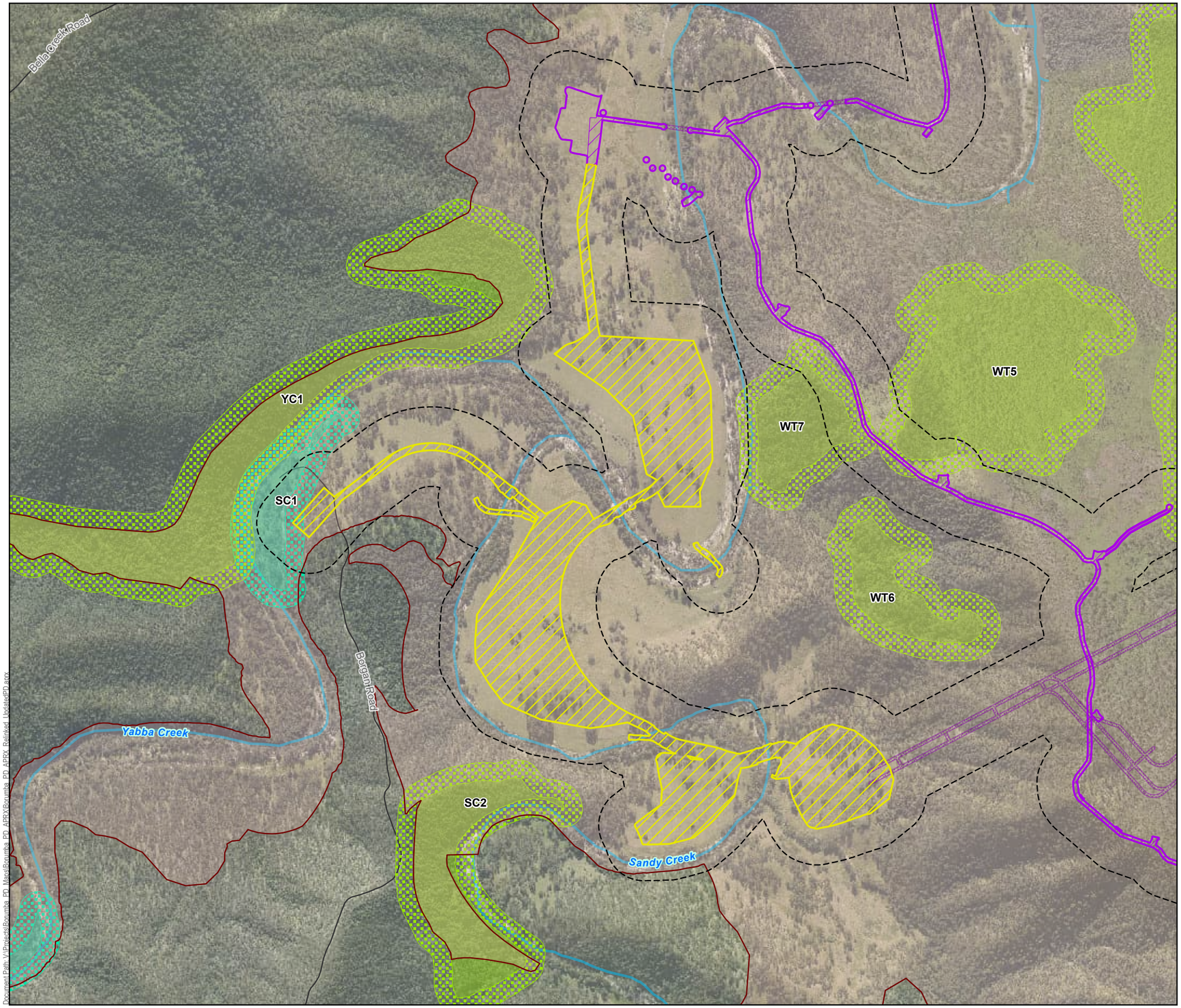
Exploratory Works Project
Preliminary Documentation

THREATENED ECOLOGICAL COMMUNITIES
AREA 3 - WALKERS TOP

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 41d

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Queensland Hydro

GDA2020 MGA Zone 56

0 70 100 200 300 400 m

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LEGEND

- Watercourses
- Local Roads

Exploratory Works Project

Project Footprint by Work Area
- Area 3 - Walkers Top
- Area 4 - Borgan

Project Area by Work Area
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Survey Areas
- Exploratory Works Survey Area
- Borumba PHES Survey Area

Ground-truthed threatened ecological communities
- Lowland Rainforest of Subtropical Australia
- 50m buffer for lowland rainforest of subtropical Australia
- Subtropical eucalypt floodplain forest and woodland
- 50m buffer for Subtropical eucalypt floodplain

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
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Exploratory Works Project
Preliminary Documentation

THREATENED ECOLOGICAL COMMUNITIES
AREA 4 - BORGAN

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 41e

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4.2.1.2 Subtropical Eucalypt Floodplain Forest of the New South Wales North Coast and South East Queensland

The Eucalypt dominated forests and woodlands on alluvial flats habitat type was identified as having the potential to conform to the Subtropical Eucalypt Floodplain Forest and Woodland of the New South Wales North Coast and South East Queensland Bioregions TEC.

The Eucalypt dominated forests and woodlands on alluvial flats habitat type is widely distributed within the Borumba PHES Survey area and the Exploratory Works Survey area.

Table 24 presents an assessment to confirm if Eucalypt dominated forests and woodlands on alluvial flats habitat type conforms to the key diagnostic characteristics contained in the Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions (DCCEEW, 2022).

Table 24: Assessment against the key diagnostic characteristics of the listed ecological community as defined by DCCEEW

Key Diagnostic Characteristics of the Listed Ecological Community	Assessment Outcome
It occurs in the New South Wales North Coast (NNC) and South Eastern Queensland (SEQ) IBRA2 bioregions, and on Curtis Island in the Brigalow Belt North IBRA Bioregion (BBN).	**Conforms** The Eucalypt dominated forests and woodlands on alluvial flats is present within the South East Queensland bioregion.
It occurs in the catchments of the eastern watershed of the Great Dividing Range, typically in their lower reaches,	**Conforms** The Eucalypt dominated forests and woodlands on alluvial flats is present in the catchments of the eastern watershed of the Great Dividing Range.
It occurs at elevations up to 250 m above sea level (ASL), most typically below 50 m ASL.	**Conforms** The Eucalypt dominated forests and woodlands on alluvial flats is present on the 150 m contour.
It occurs on alluvial landforms including river floodplains, riparian zones (e.g. along riverbanks, lake foreshores and creek lines), the floors of tributary gullies, floodplain pockets, alluvial flats, fans, terraces, and localised colluvial fans; as well as on localised depressions amongst low rises and on associated sites where water can pond	**Conforms** The Eucalypt dominated forests and woodlands on alluvial flats is present on the RE mapped land zone 3, which is an alluvial landform with alluvial soils, and on floodplain geology. Areas of the Eucalypt dominated woodlands and forests habitat type which is present on other land zones (i.e. land zone 8, 11, or 12) or other (non-floodplain geology) have been excluded from the TEC.
It occurs on alluvial soils of various textures including silts, clay loams, sandy loams, gravel and cobbles.	**Conforms`** The Eucalypt dominated woodlands and forests is present on the RE mapped land zone 3, which is an alluvial landform with alluvial soils, and on floodplain geology.
It does not typically occur on soils that are primarily marine or aeolian sands, but may occur on such substrates after they have been modified by fluvial activity.	**Conforms** There were no areas of the Eucalypt dominated woodlands and forests present on marine or aeolian sands (i.e. RE land zone 1 or 2 or estuarine geology).
It occurs as a tall closed-forest, tall open-forest, closed forest, open forest, tall woodland, or woodland (Specht 1970). The canopy has a crown cover of at least 20%.	**Conforms** The Eucalypt dominated woodlands and forests is present as an open forest to woodland vegetation community with a crown cover of at least 20%.

Key Diagnostic Characteristics of the Listed Ecological Community	Assessment Outcome
It has a canopy dominated by one or a combination of *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon* and/or *Syncarpia* tree species, but NOT dominated by *Eucalyptus robusta* (swamp mahogany). Other canopy tree species may be present, and in some areas rainforest trees may be prominent.	**Conforms** The Eucalypt dominated woodlands and forests was observed to be dominated by forest red gum (*Eucalyptus tereticornis*). Where the vegetation community was dominated or co-dominated by river sheoak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) or *Melaleuca* spp., these areas were excluded from the TEC. *Eucalyptus robusta* (swamp mahogany) is not dominant in the vegetation community.
A mid-layer (including a sub-canopy, and/or shrub-layer) may be present, sparse, or absent; and fauna may be abundant or rare.	**Conforms** The Eucalypt dominated woodlands and forests supported a mid-layer (including a subcanopy, and/or shrub-layer) which ranged from sparse to dense. A range of native fauna species were observed during the field surveys.

Table 24 identifies that where the Eucalypt dominated woodlands and forests habitat type was dominated by Eucalyptus species, these patches conform to the key diagnostic characteristics of the Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions.

Surveys were undertaken within the Eucalypt dominated woodlands and forests to assess the condition of the vegetation community to confirm if the vegetation community also meets the condition thresholds.

A total of 14 ha of the field validated TEC is present within the Borumba PHES Survey area. The TEC is not present within the Project footprint; however, 4.6 ha of the TEC has been recorded within the Exploratory Works Survey area across two patches. The two TEC patches that intersect with the Exploratory Works Survey area and their total patch size (including areas outside the Exploratory Works Survey area) are as follows:

- Patch BC1 – total patch size is 4.5 ha
- Patch SC1 – total patch size is 3.6 ha.

Two patches of vegetation initially classified as the Subtropical Eucalypt Floodplain TEC are no longer considered a TEC following additional fieldwork. This includes a patch downstream of Borumba Dam. Both patches were initially assigned to the lowest condition class for this TEC, namely ‘C2’, based on the field data collected at that time. Additional sample sites were subsequently completed within these patches, which captured the variation across the patch. The additional field data reduced the overall condition quality of the patch, and they were re-assessed as not meeting the lowest condition class ‘C2’ for the TEC. The data associated with these two patches is provided in Appendix K with the change reflective of local threats and the temporal change in conditions since the initial surveys in 2022.

This represents a change in the extent of the TEC since the submission of the EPBC referral. The change in extent of the TEC is due to further detailed surveys of the TEC, which led to the areas of the TEC failing the minimum condition thresholds and being removed from the TEC mapping.

The surveys identified that the two patches (BC1 and SC1) of the Eucalypt dominated woodlands and forests meet the minimum condition thresholds, achieving Condition Classes A2 and B3. Patches of the Eucalypt dominated woodlands and forests habitat type that did not conform to the condition thresholds generally did not meet the minimum ground cover species richness or number of very large or large trees.

The Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions identifies that a buffer zone of at least 50 m of native vegetation contiguous with the TEC is required to protect patches of the TEC from potential adverse impacts.

The location and extent of the field validated Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC and buffer zones are shown in Figure 41.

4.2.2 Terrestrial flora

The following threatened flora species protected under the EPBC Act were identified during the field surveys within the Borumba PHES Survey area:

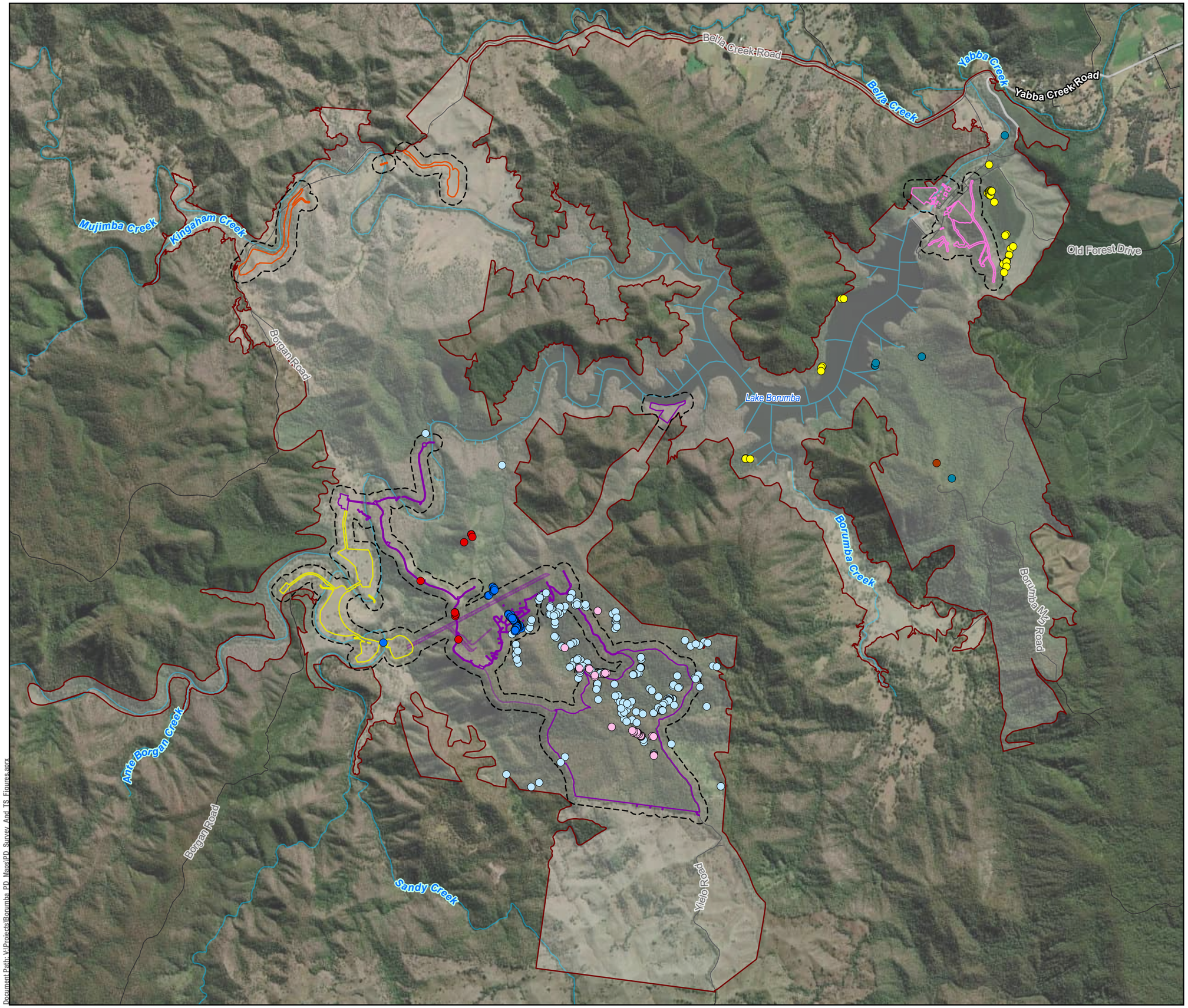
- ball nut (*Floydia praealta*), listed as vulnerable under the EPBC Act and NC Act
- brush sophora (*Sophora fraseri*), listed as vulnerable under the EPBC Act and NC Act
- *Coleus omissus*, listed as endangered under the EPBC Act and NC Act
- *Coleus torrenticola*, listed as endangered under the EPBC Act and the NC Act
- native guava (*Rhodomyrtus psidioides*), listed as critically endangered under the EPBC Act and the NC Act
- scrub turpentine (*Rhodamnia rubescens*), listed as critically endangered under the EPBC Act and the NC Act
- three-leaved bosistoa (*Bosistoa transversa*), listed as vulnerable under the EPBC Act and least concern under the NC Act.

The above threatened flora species are discussed in detail in Section 7, while a summary of their occurrence and extent of suitable habitat is provided in Appendix M. The locations of all recorded threatened flora species within the Borumba PHES Survey area are shown in Figure 42.

While the threatened flora species are further discussed in Appendix M and Section 7, additional details regarding the critically endangered native guava (*Rhodomyrtus psidioides*) and scrub turpentine (*Rhodamnia rubescens*) are provided in the sections below.

Table 25: Summary of all threatened flora species

Common Name Scientific Name	EPBC Act Status	NC Act Status	Number of individuals within Borumba PHES Survey area	Number of individuals within Exploratory Works Survey area
Ball nut *Floydia praealta*	Vulnerable	Vulnerable	63	0
Brush sophora *Sophora fraseri*	Vulnerable	Vulnerable	31	22
Coleus omissus	Endangered	Endangered	15	0
Coleus torrenticola	Endangered	Endangered	246	214
Native guava *Rhodomyrtus psidioides*	Critically endangered	Critically endangered	1,295	1,267
Scrub turpentine *Rhodamnia rubescens*	Critically endangered	Critically endangered	626	429
Three-leaved bosistoa *Bosistoa transversa*	Vulnerable	Least concern	14	0



Queensland Hydro

GDA2020 MGA Zone 56

0 0.5 1 Kilometres

1:45,000 (when printed @ A3)

LEGEND

- Local Roads
- State Controlled Roads
- Watercourses

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Flora

- Coleus omissus record
- Ball nut record
- Coleus torrenticola record
- Brush sophora record
- Native guava record
- Scrub turpentine record
- Three-leaved bosistoa record

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC, 2022
3. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Vegetation management regional ecosystem map - version 12.02 © State of Queensland (Department of Resources) 2022-11-07 (publication)
5. GTRE / GT TEC/ GT SPECIES @ Umwelt and Attexo, 2022
6. World Imagery Basemap @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Exploratory Works Project
Preliminary Documentation

THREATENED FLORA RECORDS

PROJECT #:	30032677
CREATED BY:	CW
LAST MODIFIED:	NC17428, 17/09/2025
REVISION:	F

FIGURE 42

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4.2.2.1 Native guava (*Rhodomyrtus psidioides*), critically endangered under the EPBC Act

A total estimation of 1,295 native guava (*Rhodomyrtus psidioides*) were identified from the Borumba PHES Survey area during the field survey. The individuals were generally observed along waterways and drainage lines within the Subtropical rainforest and Eucalypt dominated woodlands and forests broad habitat types within the proposed upper reservoir area.

Most of the native guava were seedlings less than 10 cm tall and juvenile individuals less than 0.5 m tall, clustered together in high density 'sucker fields' (refer to Photo 16). However, some individuals were 1.5-2 m tall. No mature individuals were observed. The sub-adult individuals (>0.5 m) generally showed signs of being impacted by myrtle rust, with spotting on leaves, and new leaves sprouting from woody stems; however, the seedlings and juvenile individuals generally appeared healthy with little-to-no signs of myrtle rust or spotting. No flowers or seeds were observed. Seeds produced in the wild by this species have been found to be unviable.

This species is known to sprout seedings from underground rootstock and form 'sucker fields' of high density seedlings and juveniles, with anecdotal evidence suggesting the suckers can persist in the wild for up to 7-10 years prior to succumbing to impacts from myrtle rust. While the seedlings are likely to be genetic clones, they were counted as individuals, rather than a single multi-stemmed individual (which is consistent with the Queensland Herbarium method of counting individuals).



Photo 16: High density native guava seedlings (within red circles)

4.2.2.2 Scrub turpentine (*Rhodamnia rubescens*), critically endangered under the EPBC Act

A total of 626 scrub turpentine (*Rhodamnia rubescens*) plants were identified from the Borumba PHES Survey area during the field surveys (Photo 17). The individuals were generally observed along waterways and drainage lines within the Subtropical rainforest and the ecotone between the Subtropical rainforest and the Eucalypt dominated woodlands and forests broad habitat types within the proposed upper reservoir area.

Most of the individuals were rejuvenating individuals between 0.5 m and 3 m in height, with a single mature individual up to 10 m observed. Most of the individuals showed signs of being impacted by myrtle rust, with new and old spotting on leaves, and irregular leaf growth. No flowers or seeds were observed.

The individuals observed during the survey were either single individuals or in clumps, which are likely to be suckering individuals from underground rootstock or a previously mature individual.



Photo 17: Scrub turpentine showing old and new myrtle rust infection

4.2.3 Terrestrial fauna

Fauna surveys recorded more than 200 terrestrial fauna species within the Borumba PHES Survey area, seven of which are MNES.

The following threatened fauna species protected under the EPBC Act and NC Act were identified during the field surveys within the Borumba PHES Survey area:

- black-breasted button-quail (*Turnix melanogaster*) – listed as vulnerable under the EPBC Act and the NC Act
- glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*) – listed as vulnerable under the EPBC Act the NC Act
- greater glider (southern) (*Petauroides volans*) – listed as endangered under the EPBC Act and NC Act
- grey headed flying fox (*Pteropus poliocephalus*) – listed as vulnerable under the EPBC Act and least concern under the NC Act
- koala (*Phascolarctos cinereus*) – listed as endangered under the EPBC Act and NC Act

- long-nosed potoroo (*Potorous tridactylus tridactylus*) – listed as vulnerable under the EPBC Act and the NC Act
- yellow-bellied glider (*Petaurus australis australis*) – listed as vulnerable under the EPBC Act and the NC Act

MNES fauna for which suitable habitat was observed:

- giant-barred frog (*Mixophyes iteratus*) – listed as vulnerable under the EPBC Act and NC Act
- Australian painted snipe (*Rostratula australis*) – listed as endangered under the EPBC Act and NC Act
- Coxen's fig-parrot (*Cyclopsitta diophthalma coxeni*) – listed as critically endangered under the EPBC Act and NC Act
- northern quoll (*Dasyurus hallucatus*) – listed as endangered under the EPBC Act and least concern under the NC Act
- spotted-tail quoll (*Dasyurus maculatus maculatus*) – listed as endangered under the EPBC Act and NC Act.

The locations of all threatened fauna observations are shown in Figure 43.

4.2.4 Aquatic flora and fauna

No aquatic flora considered to be MNES were recorded during field surveys, and none are documented to occur in the Yabba Creek catchment or more broadly in the Mary River system.

A total of 34 fish species were recorded during site surveys, representing 20 families. Two threatened fish species were recorded in field surveys:

- Australian lungfish (*Neoceratodus forsteri*) – listed as vulnerable under the EPBC Act
- Mary River cod (*Maccullochella mariensis*) – listed as endangered under the EPBC Act.

Six species of freshwater turtle were recorded during field surveys. Two threatened turtle species recorded in field surveys:

- Mary River turtle (*Elusor macrurus*) – listed as critically endangered under the EPBC Act and the NC Act.
- white-throated snapping turtle (*Elseya albagula*) – listed as critically endangered under the EPBC Act and the NC Act.

The location of all threatened aquatic species observations is shown in Figure 44.

4.2.5 Invasive flora and fauna

A broad range of invasive animals and plants are already established within and surrounding the Borumba PHES Survey area. In total, 52 invasive plant species were recorded in the Exploratory Works Survey area during field surveys. Of these, eight terrestrial species are listed as Category 3 Restricted Plants under the *Biosecurity Act 2014* (Qld), three of which are also listed as Weeds of National Significance (WoNS). Lantana and cat's claw creeper are widespread; however, they generally occur in higher density within rainforest and wet sclerophyll communities where clearing or natural disturbance has resulted in opportunities for these species to rapidly colonise exposed areas.

Four aquatic invasive plants are also listed as either Category 3 Restricted Plants or WoNS.

A total of 14 invasive animals were recorded within the Borumba PHES Survey area:

- cattle (*Bos taurus*)
- dog (*Canis familiaris*)
- Rusa deer (*Cervus timorensis*)
- cat (*Felis catus*)
- mosquitofish (*Gambusia holbrooki*)
- European brown hare (*Lepus europaeus*)
- tilapia (*Oreochromis mossambica*)
- rabbit (*Oryctolagus cuniculus*)

- guppy (*Poecilia reticulata*)
- cane toad (*Rhinella marina*)
- pig (*Sus scrofa*)
- red fox (*Vulpes vulpes*)
- swordtail (*Xiphophorus helleri*)
- platy (*Xiphophorus maculatus*).

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0 0.5 1 Kilometres

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LEGEND

- Local Roads
- State Controlled Roads
- Watercourses

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Fauna

- Black-breasted button-quail record
- Glossy-black cockatoo record
- Greater glider record
- Grey-headed flying-fox record
- Koala record
- Long-nosed potoroo record
- Yellow-bellied glider record

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC, 2022
3. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Vegetation management regional ecosystem map - version 12.02 © State of Queensland (Department of Resources) 2022-11-07 (publication)
5. GTRE / GT TEC/ GT SPECIES @ Umwelt and Attexo, 2022
6. World Imagery Basemap @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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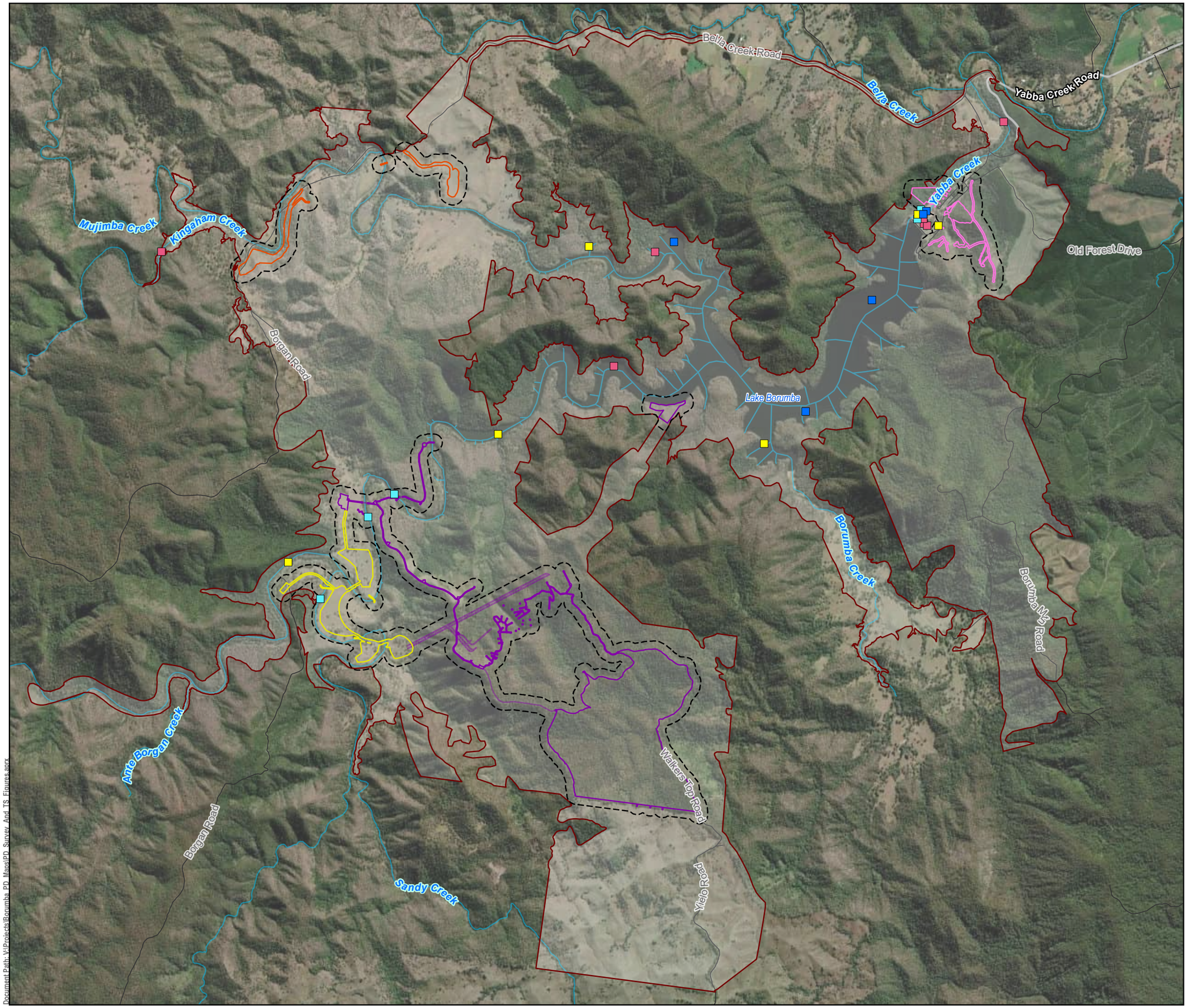
Exploratory Works Project
Preliminary Documentation

THREATENED TERRESTRIAL FAUNA RECORDS

PROJECT #:	30032677
CREATED BY:	CW
LAST MODIFIED:	NC17428, 16/09/2025
REVISION:	F

FIGURE 43

Document Path: V:\Projects\Borumba_PD_Mapsl\PD Survey And TS Figures.aprx



Queensland Hydro

GDA2020 MGA Zone 56

0 0.5 1 Kilometres

1:45,000 (when printed @ A3)

LEGEND

- Local Roads
- State Controlled Roads
- Watercourses

Exploratory Works Project

Project Area by Work Area

- Area 1 - Borumba Dam
- Area 2 - Kingaham Creek
- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Survey Areas

- Exploratory Works Survey Area
- Borumba PHES Survey Area

Aquatic Fauna

- Australian lungfish record
- Mary River cod record
- Mary River turtle record
- White-throated snapping turtle record

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC, 2022
3. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Vegetation management regional ecosystem map - version 12.02 © State of Queensland (Department of Resources) 2022-11-07 (publication)
5. GTRE / GT TEC/ GT SPECIES @ Umwelt and Attexo, 2022
6. World Imagery Basemap @ Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Exploratory Works Project
Preliminary Documentation

THREATENED AQUATIC FAUNA RECORDS

PROJECT #:	30032677
CREATED BY:	CW
LAST MODIFIED:	NC17428, 17/09/2025
REVISION:	F

FIGURE 44

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4.3 Likelihood of occurrence – RFI item 3.3(a-e)

A LOO assessment is provided in Appendix D. The LOO was undertaken based on information from Conservation Advices, recovery plans, draft referral guidelines and listing advices, threat abatement plans, SPRAT databases, recent scientific information available for each species, and has been informed by the GTRE mapping to determine the potential presence of MNES within the Exploratory Works Survey area. Habitat mapping rules and habitat maps are provided in Appendix E.

The LOO was updated on 3 May 2024 and considered all verified records on the Atlas of Living Australia available at that time. LOO definitions are described in Table 26.

A summary of the TECs and threatened flora and fauna species with a known, likely or possible LOO in the Exploratory Works Survey area are identified in Table 27, Table 28, and Table 29.

Table 26: Likelihood of Occurrence definitions

Potential to Occur	Description
Known	The species or community has been recorded within the Exploratory Works Survey area by a known source (i.e. by ecologists, or published in a report or scientific paper) **OR** Recent record(s) on ALA (<10 years) are present within the Exploratory Works Survey area.
Likely	For flora and fauna species, suitable habitat is present within the Exploratory Works Survey area AND recent records (<10 years) are present within the locality of the Project (<30 km) **OR** Historical records (>10 years) occur within the Exploratory Works Survey area. For TECs, constituent REs are mapped as occurring within the Exploratory Works Survey area.
Possible	For flora and fauna species, suitable habitat is present within the Exploratory Works Survey area AND recent records (<10 years) are not present within the locality of the Project (<30 km) but occur in the region (<50 km) **OR** Suitable habitat is present within the Exploratory Works Survey area AND historical records (>10 years) are present within the locality of the Project (<30 km).
Unlikely	For flora and fauna species, suitable habitat is not present in the Exploratory Works Survey area or is present, but highly modified and/or degraded or lacking specific habitat requirements for the species **OR** The species may be an occasional visitor but is unlikely to have a sedentary/resident population **OR** The species has a restricted range to discreet populations that are unlikely to occur within the Exploratory Works Survey area **OR** The current known range of the species does not overlap with the Exploratory Works Survey area. For TECs, constituent REs are not mapped within the Exploratory Works Survey area.

No TECs were assessed as having a 'Likely' or 'Possible' LOO. Two other TECs were considered unlikely to occur (Appendix D). Known TECs are identified in Table 27.

Table 27: Summary of TECs known to occur within the Exploratory Works Survey area

Threatened ecological community (TEC)	EPBC status
Known	
Lowland Rainforest of Subtropical Australia	Critically endangered
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered

Of the four threatened flora species assessed as being 'likely' to occur within the Exploratory Works Survey area (Appendix D), surveys undertaken have not identified the presence of two species, the macadamia nut and small-fruited Queensland nut. Although suitable habitat is present for these species, it is anticipated that they are either not present within the Exploratory Works Survey area or are present in only low numbers and/or low densities. A number of threatened flora species were considered unlikely to occur; these species are listed in Appendix D.

Table 28: Summary of LOO outcomes for threatened flora known, likely or possible to occur within the Exploratory Works Survey area

Common name	Scientific name	EPBC status
Known		
Ball nut	*Floydia praealta*	Vulnerable
Brush sophora	*Sophora fraseri*	Vulnerable
-	*Coleus torrenticola* (syn. *Plectranthus torrenticola*)	Endangered
Native guava	*Rhodomyrtus psidioides*	Critically endangered
Scrub turpentine	*Rhodamnia rubescens*	Critically endangered
Likely		
-	*Coleus omissus* (syn. *Plectranthus omissus*)	Endangered
Macadamia nut	*Macadamia integrifolia*	Vulnerable
Small-fruited Queensland nut	*Macadamia ternifolia*	Vulnerable
Three-leaved bosistoa	*Bosistoa transversa*	Vulnerable
Possible		
Austral toadflax	*Thesium australe*	Vulnerable
Hairy-joint grass	*Arthraxon hispidus*	Vulnerable
Nightcap coleus	*Coleus nitidus*	Endangered
Quassia	*Samadera bidwillii*	Vulnerable
Blotched sarcochilus	*Sarcochilus weinthalii*	Vulnerable

While the giant barred frog has been assessed as being 'likely' to occur within the Exploratory Works Survey area (Table 29), the species was not observed in targeted surveys undertaken in accordance with relevant State and Commonwealth survey guidelines. While suitable habitat is present for this species, it is anticipated the species is either not present within the Exploratory Works Survey area, is present in only low numbers/densities, or utilises the Exploratory Works Survey area infrequently. A number of threatened fauna species were considered unlikely to occur; these species listed in Appendix D.

Table 29: Summary of LOO outcomes for threatened fauna known, likely or possible to occur within the Exploratory Works Survey area

Common name	Scientific name	EPBC status
Known		
Australian lungfish	*Neoceratodus forsteri*	Vulnerable
Black-breasted button-quail	*Turnix melanogaster*	Vulnerable
Glossy black-cockatoo (south-eastern)	*Calyptorhynchus lathami lathami*	Vulnerable
Greater glider (southern and central)	*Petauroides volans*	Endangered
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable
Koala (combined populations of Qld, NSW, and the ACT)	*Phascolarctos cinereus*	Endangered
Long-nosed potoroo (northern)	*Potorous tridactylus tridactylus*	Vulnerable
Mary River cod	*Maccullochella mariensis*	Endangered
Mary River turtle	*Elusor macrurus*	Critically endangered
White-throated snapping turtle	*Elseya albagula*	Critically endangered
Yellow-bellied glider (southern subsp.)	*Petaurus australis australis*	Vulnerable
Likely		
Giant barred frog	*Mixophyes iteratus*	Vulnerable
Possible		
Australian painted snipe	*Rostratula australis*	Endangered
Coxen's fig-parrot	*Cyclopsitta diophthalma coxeni*	Critically endangered
Northern quoll	*Dasyurus hallucatus*	Endangered
Spotted-tail quoll (SE mainland population)	*Dasyurus maculatus maculatus*	Endangered

5. Impact assessment

5.1 Potential impacts

5.1.1 Risk of potential impacts – RFI item 4.5(d)

A risk assessment of the Project's potential impacts on MNES pre- and post-management was undertaken in accordance with the Environmental Management Plan Guidelines (DCCEEW, 2024) and is included in Appendix H. The risk assigned to impacts considers the likelihood of the impact occurring and the consequence of the impact on the MNES, as shown in Table 30. Definitions for the likelihood and consequence ratings are included in Appendix H.

Table 30: Environmental Management Plan Guidelines risk assessment matrix

		Consequence				
		Minor	Moderate	High	Major	Critical
Likelihood	Highly Likely	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Source: (DCCEEW, 2024)

As described in the Environmental Management Plan Guidelines (DCCEEW, 2024), the risks are described as either low, medium, high, or severe. Potential impacts with a lower risk rating are generally less likely to occur and have a lower consequence for the species. Whereas potential impacts with a higher risk rating are generally more likely to occur and have a greater consequence for the species.

More detailed information on measures and commitments to minimise and manage potential impacts with a higher risk rating are included in the Flora and Fauna Management Plan (FFMP) (Appendix D of the CEMP (Appendix F)).

5.1.2 Summary of potential impacts

Site establishment works are expected to occur simultaneously across the Project area. Constructing access tracks is expected to take the longest of the site establishment works to complete (approximately nine months) and will comprise the bulk of vegetation clearing.

Other than site establishment works for the exploratory tunnel portal, excavation of the exploratory tunnel is not expected to have direct impacts on MNES since the works will take place underground. However, indirect impacts may occur as a result of the tunnelling works, including ground borne noise and vibration and groundwater drawdown.

The total duration of the Exploratory Works Project from site establishment to the completion of geotechnical investigations is estimated to be approximately two years.

There are unlikely to be any direct impacts during the decommissioning phase of the Project.

If the Main Works Project does not proceed, infrastructure installed for the Exploratory Works Project will be decommissioned and the majority of areas disturbed by the Project will be rehabilitated to their pre-disturbance state (or better) as outlined in the Decommissioning and Rehabilitation Strategy (Appendix C).

If the Main Works Project proceeds, some features of the Exploratory Works Project will remain and form part of the existing environment for that Project. Components of the Exploratory Works Project that are not required for the Main Works, or by the landholders/asset managers of land the works have occurred on, will be decommissioned and rehabilitated.

The Kingaham Creek bypass will remain in place as permanent infrastructure no matter which scenario is progressed.

Table 3 identifies the indicative disturbance area associated with the Project footprint, while Table 4 outlines the proposed duration and permanence and nature of clearing for all Project components by work area. Where known, the number of trees in the Project footprint with hollows larger than 10 cm has been identified below, with the potential that these features could be avoided through micro-siting:

- Area 1 (Borumba Dam) – 52 trees with hollows larger than 10 cm identified in the Project footprint
- Area 2 (Kingaham Creek) – 7 trees with hollows larger than 10 cm identified in the Project footprint
- Area 3 (Walkers Top) – 66 trees with hollows larger than 10 cm in the Project footprint
- Area 4 (Borgan) – 11 trees with hollows larger than 10 cm identified in the Project footprint.

In the absence of appropriate mitigation and management measures, the impact pathways have the potential to result in:

- flora and fauna injury and/or mortality
- temporary or permanent loss of breeding, foraging, and sheltering or dispersal habitat
- habitat fragmentation and reduced connectivity
- temporary or permanent habitat degradation
- wildlife disturbance.

The potential impact pathways associated with each area of the Project are further summarised in Table 31.

Further discussion of the potential impact pathways associated with the Project are provided in subsequent sections of this report.

An assessment of the significance of impacts on MNES is provided in Section 7.

Table 31: Potential impact pathways in each work area

Potential impact pathways	Area 1 – Borumba Dam	Area 2 – Kingaham Creek	Area 3 – Walkers Top	Area 4 – Borgan
Vegetation clearing causing habitat loss	✓	✓	✓	✓
Vegetation clearing causing fragmentation	✓	✓	✓	-
Changes to habitat quality because of erosion and sedimentation	✓	✓	✓	✓
Barriers to movement	-	✓	-	✓
Spread of weeds due to topsoil movement and placement	✓	✓	✓	✓
Spread of weeds, pests and disease due to increased human activity	✓	✓	✓	✓
Displacement of individual fauna due to removal of habitat, increasing competition	✓	✓	✓	✓
Injury or mortality due to vehicle strike	✓	✓	✓	✓
Impacts to surface water quality and flows	✓	✓	✓	✓
Impacts to groundwater	✓	-	✓	✓

Potential impact pathways	Area 1 – Borumba Dam	Area 2 – Kingaham Creek	Area 3 – Walkers Top	Area 4 – Borgan
Release of contaminated water from construction areas	✓	✓	✓	✓
Habitat degradation from noise and vibration emissions	✓	✓	✓	✓
Habitat degradation from light emissions	✓	✓	✓	✓
Habitat degradation from dust emissions	✓	✓	✓	✓
Contamination from hazardous materials	✓	✓	✓	✓
Changes to the local bushfire regime	✓	✓	✓	✓

5.2 Direct impacts – RFI items 4.1, 4.3 and 4.5

The direct impacts on MNES from the Exploratory Works Project include vegetation clearing and topsoil removal, and injury and mortality. These impacts will occur as a result of site establishment works for all Project components, and potentially as a result of vehicle movements around the Project area during site establishment, construction and for the duration of geotechnical investigations.

5.2.1 Vegetation clearing and topsoil removal – RFI item 4.1(a-b) and 4.3(a)

As far as possible, the Project has been designed to minimise clearing of native vegetation. However, the location of geotechnical investigations is necessarily dictated by the location of the proposed infrastructure for the Main Works Project, which is located in vegetated areas and therefore requires vegetation clearing.

A total of 90.1 ha of vegetation, including 38 ha of remnant native vegetation, is anticipated to be impacted by the Project, with clearing required in all work areas. Table 32 lists the area of remnant native vegetation required to be cleared for each Project component. The area of remnant native vegetation to be cleared for some Project components is smaller than the Project footprint because some components are wholly or partially in previously cleared areas.

To show how vegetation clearing has been minimised to the greatest extent possible, Table 33 provides a comparison of the extent of vegetation that was proposed to be cleared at the referral stage with the current proposed clearing extent, and identifies the extent of remnant of vegetation compared to non-remnant vegetation and plantation.

Table 32: Project footprint and area of vegetation to be cleared by Project component

Project component	Project footprint (ha)	Area of remnant native vegetation to be cleared (ha)
Area 1 – Borumba Dam		
Geotechnical investigations	10.3	10.0
Site access	2.9	2.6
Total for Area 1 – Borumba Dam	*13.1*	*12.6*
Area 2 – Kingaham Creek		
Spoil disposal	3.9	0.0
Site access	15.1	4.1
Geotechnical investigations	0.1	0.0
Total for Area 2 – Kingaham Creek	*19.1*	*4.1*

Project component	Project footprint (ha)	Area of remnant native vegetation to be cleared (ha)
Area 3 – Walkers Top		
Geotechnical investigations	3.1	2.9
Site access	8.0	7.8
Other supporting infrastructure (temporary water infrastructure)	5.6	3.8
Exploratory tunnels (underground)	0.0	0.0
Total for Area 3 – Walkers Top	*16.7*	*14.6*
Area 4 – Borgan		
Spoil disposal	11.6	0.9
Site access	0.3	0.2
Other supporting infrastructure (civil construction compound, portal pad and access track, staging pad, explosive store and access track)	29.5	5.6
Total for Area 4 – Borgan	*41.4*	*6.7*
Total for all works (Areas 1–4)	**90.3**	**38.0**

Table 33: Extent of vegetation in the PHES Survey area and impacted by the Project footprint

Vegetation Type	Vegetation Extent (ha)		
	In the Borumba PHES Survey area	Impacted by the referral design	Impacted by the Project footprint
Remnant native vegetation	3,829.3	79.8	38.0
Native vegetation that is a TEC ^	646.4	2.9	2.5
(Subtropical eucalypt floodplain forest and woodland TEC)	*(14.0)*	*(0)*	*(0)*
(Lowland Rainforest of Subtropical Australia TEC)	*(632.4)*	*(2.9)*	*(2.5)*
Non-remnant	1,265.7	4.0	52.0
Plantation	47.45	0.1	0.1
Total vegetation (native + non-remnant + plantation)	**5,142.5**	**83.9**	**90.1***

^ The extent of remnant native vegetation includes the extent of TEC vegetation. The areas provided for TEC vegetation are components of the total area of remnant native vegetation.

* There is a difference in area between the Project footprint in Table 32 and the extent of vegetation impacted by the Project footprint in this table because the Project footprint includes 0.2 ha of water (e.g. where the water pipeline footprint is within Lake Borumba).

Vegetation to be cleared includes remnant vegetation such as eucalypt woodlands and subtropical rainforest, and non-remnant vegetation such as pasture grasses which support individual mature trees and low density native shrubs.

The remnant vegetation provides foraging, breeding, denning, nesting, sheltering and/or dispersal habitat for threatened fauna, and contains threatened flora species. Mature trees with hollows also occur in the landscape, which provide suitable denning habitat for greater glider and yellow-bellied glider, and suitable nesting habitat for glossy black-cockatoo.

Clearing is expected to occur in all four work areas simultaneously, with this to be confirmed by the civil contractor and subject to approval (i.e. secondary approvals are staggered). Clearing for access tracks will commence at the start of the track, continuing along the entire length of the track to the approved clearing width (no more than 6 m wide). Clearing for geotechnical pads will also be undertaken in a single pass.

There will be minimal clearing of native vegetation for supporting infrastructure for the exploratory tunnel due to their locations in previously cleared areas. However, hollow-bearing trees are anticipated to be cleared for the staging pad, spoil disposal area, construction compound and associated access tracks.

Clearing will likely involve a 30-tonne excavator with a grab and ripper (or mulching) attachment that will pass cleared vegetation to a secondary machine that will prepare the material for mulching. A dozer may also be used.

Topsoil will be removed, where required, for geotechnical boreholes located off track on flat or near flat ground and test pits. Topsoil will also be removed for construction of the following:

- Kingaham Creek bypass
- Borgan and Kingaham Creek spoil disposal areas
- new access tracks for geotechnical boreholes located off track on moderate slopes
- civil construction compound
- staging pad
- portal pad and portal pad access track
- explosive store and access track.

The relevant Project component descriptions in Section 2 describe how topsoil will be managed. Generally, it will be stored at the spoil disposal areas and respread over the disturbance areas during rehabilitation.

5.2.2 Injury and mortality – RFI item 4.5(d)ii

Clearing vegetation has the potential to result in direct injury or mortality to threatened terrestrial fauna if not appropriately managed (e.g. sequential clearing, fauna reduction survey and clearing in the presence of a fauna spotter catcher). The risk of fauna being injured or mortally wounded while undertaking Exploratory Works clearing activities is considered low after the implementation of relevant management measures, depending on the species. Further information is provided in Appendix H.

Collisions with vehicles also have the potential to cause direct injury or mortality to threaten terrestrial fauna. Ground-dwelling or slow-moving species may be particularly susceptible. The risk of fauna being injured or mortally wounded from being struck by a vehicle undertaking Exploratory Works activities is considered low, as speeds will be limited due to the nature of the roads and the local terrain, and a low number of vehicles will use the access tracks in areas of native vegetation per day. Further information is provided in Appendix H.

Constructing the temporary bed level crossing at Yabba Creek immediately downstream of the existing Borumba Dam wall involves removing large rocks and placing approximately 10-20 m^3 of D50-100 mm rock or similar on the creek bed. The four Bailey bridges across Sandy Creek and Yabba Creek also require temporary crossings during construction, including appropriately designed temporary culvert crossings that will be removed and replaced with concrete bed level crossings after the bridges are constructed. Concrete or gravel bed level crossings will also be installed across Sandy Creek and Yabba Creek at existing crossing locations not associated with the bridges.

During the construction of the bridges, there is potential to cause injury or mortality to aquatic fauna including the Australian lungfish, Mary River cod, Mary River turtle, and/or white-throated snapping turtle. There is also potential for vehicle strike during use of bed level crossings. The risk of these four aquatic species being injured or mortally wounded while undertaking Exploratory Works clearing activities is considered low, post implementation of relevant management measures. Further information is provided in Appendix H.

5.3 Indirect impacts – RFI items 4.1, 4.3 and 4.5

5.3.1 Habitat fragmentation – RFI item 4.1(c), 4.3(a) and 4.5(d)xi

Habitat fragmentation is a process by which large and contiguous areas of habitat are divided into smaller, isolated patches. The creation of these smaller habitat patches impacts on all species, their community structure, and the overall ecosystem of those fragments.

External fragmentation occurs at a landscape scale, where large tracts of habitat is cleared, and the remaining habitat patches are separated by extensive areas of unsuitable habitat through which species are unable/reluctant to pass. Internal fragmentation occurs within a habitat patch via the introduction of cleared areas and is the primary consideration for the Exploratory Works. Areas cleared for roads and access tracks have the potential to act as barriers to wildlife movement and sever ecosystem connectivity. However, as the access tracks are proposed to be no wider than 6 m, these access tracks are unlikely to act as a barrier to fauna movement for any of the MNES fauna species potentially impacted by the Project. All terrestrial MNES fauna species potentially impacted by the Project are mobile species that are anticipated to persist in the landscape following the installation and/or widening of access tracks. Therefore, clearing for the Exploratory Works Project will not affect home ranges or dispersal mechanisms of threatened terrestrial fauna.

Terrestrial habitat in the Project area is generally well connected with large tracts of contiguous vegetation acting as a corridor between Conondale National Park and Wrattens National Park within a mosaic of vegetated freehold land and state forest reserves (see Section 3.8). Lake Borumba fragments habitat north and south of the lake and areas predominantly cleared for grazing along Bella Creek Road and Borgan Road also fragment connectivity.

The Borumba Dam wall is an existing barrier for aquatic species that has been in place since 1963, preventing upstream and downstream movement for Australian lungfish and Mary River cod.

Habitat fragmentation at each area is further discussed in the following sections.

5.3.1.1 Area 1 (Borumba Dam)

Clearing vegetation for geotechnical investigations and access tracks in Area 1 will create two large, cleared areas in currently contiguous habitat on both sides of Yabba Creek. However, clearing for these activities will generally be undertaken along the edge of the vegetation patch. The clearing is unlikely to cause substantial fragmentation of the terrestrial habitat such that terrestrial species would not utilise or disperse through the remaining vegetation and large areas of contiguous vegetation adjacent to the works will not be impacted by the Project.

Vegetation clearing in this area is likely to fragment the Lowland Rainforest TEC into two separate patches, which is discussed in detail in Section 7.1.1. Both remaining patches will be greater than 2 ha, which is the minimum patch size for Condition Class C patches, and will both therefore retain their status as the TEC.

Several smaller areas of vegetation will be cleared for individual geotechnical borehole pads in disturbed areas adjacent to the Borumba Dam day use area. These areas will create discrete cleared areas fragmenting poor quality habitat.

The bed level crossing over Yabba Creek will be constructed to meet the Queensland Government's accepted development requirements for operational work that is constructing or raising waterway barrier works (ADR) (DAF, 2018). The requirements of the ADR ensure that fish passage is maintained, meaning that the bed level crossing is unlikely to prevent aquatic species movement upstream or downstream of the crossing. The bed level crossing is also unlikely to prevent turtle species from moving across the terrestrial landscape to access areas upstream or downstream of the bed level crossing.

5.3.1.2 Area 2 (Kingaham Creek)

The Kingaham Creek spoil disposal area is located in a predominantly cleared area, with minimal habitat proposed to be cleared. It is acknowledged that cleared areas provide dispersal habitat for koala, however there are large areas of more suitable habitat for koalas in the surrounding area that koalas are more likely to use to disperse through the landscape. The spoil disposal area will not impede fauna during construction and post construction. Construction of the Kingaham Creek spoil disposal area is therefore unlikely to fragment habitat.

Construction of the Kingaham Creek bypass avoids fragmenting riparian vegetation along Kingaham Creek. However, vegetation that provides habitat values for terrestrial fauna species is anticipated to be cleared for the bypass. The Kingaham Creek bypass will be permanent infrastructure and will introduce an approximately 60 m wide cleared area which has the potential to cause habitat fragmentation by creating a new linear clearing on the east side of Kingaham Creek. However, connectivity will be maintained along the riparian zone of Kingaham Creek, as the design in this area now avoids works in Kingaham Creek that were proposed in the EPBC referral and had the potential to impede fish passage and connectivity before the variation to include the bypass.

5.3.1.3 Area 3 (Walkers Top)

Clearing linear tracts up to 6 m wide for new access tracks, along with upgrading existing tracks has the potential to fragment habitat; however, as the tracks are limited to 6 m wide, this is unlikely to substantially cause habitat fragmentation such that fauna species are left with a reduced patch size. New tracks are only proposed in locations where existing tracks are not present. The track alignments will be optimised to minimise clearing, wherever safe to do so, and hollow-bearing trees will be avoided where possible.

Most of this clearing occurs in the same vegetation community (moist to dry open woodlands on metamorphic and volcanic rocks), which provides habitat for woodland birds, arboreal mammals and hollow nesting birds and ground dwelling fauna. The tracks are narrow enough to not prevent fauna and flora from dispersing through the area.

Impacts to MNES caused by habitat fragmentation are unlikely to be significant based on the narrow area of disturbance in large tracts of remnant vegetation which will otherwise remain undisturbed. Habitat fragmentation caused by narrow tracks is most significant when track networks are extensive and complex through a patch of remnant forest, for example informal networks of recreational trails with frequent traffic and poorly controlled spreading (Ballantyne, Gudes, & Pickering, 2014) or where the roads and tracks are substantial in width such that the tracks would prevent/deter fauna from moving across the road/track to access the habitat on the other side of the road/track.

The barrier effect of access tracks has been considered at a species-specific level. In general terms, mobile species such as birds are not likely to be isolated by the narrow gap created between habitat areas. The impact will be more significant for terrestrial species with limited mobility than for aquatic species. The potential impact of a 6 m wide track on threatened terrestrial fauna has been assessed and concluded that:

- Greater glider (southern) and yellow-bellied glider: Individuals and populations of the greater glider (southern) and yellow-bellied glider are not likely to be isolated as a result of the works. Both species are highly mobile, regularly cross natural gaps between trees and can cover considerable distances in a single glide.
- Koala: The koala is known to cross extensive cleared areas and travel 3 km between patches of suitable habitat. Gap crossing between preferred feed trees is a daily activity for this species and temporary access tracks are not likely to impact movement.
- Long-nosed potoroo (northern) and spotted-tail quoll: Both species are unlikely to be limited by a 6 m gap between habitat patches. Both species are known to cross forest roads and tracks – albeit at increased risk of vehicular mortality – throughout their range.
- The bird species in consideration all regularly travel greater distances between habitat patches than will be generated by these tracks.

Thus, on-going impacts to fauna accessing habitat or their dispersal through the landscape are unlikely due to the narrow width of the tracks.

Similarly, the access tracks are unlikely to isolate threatened flora populations by creating barriers for seed and fruit dispersal or access to individuals by pollinators. However, the access tracks may increase edge effects in some cases (e.g. weed encroachment, invasive animal grazing or trampling, and increase bushfire risk).

The bed level crossings over Yabba Creek will be constructed to meet the Queensland Government's requirements under the *Fisheries Act 1994*, either under the accepted development requirements for operational work that is constructing or raising waterway barrier works (DAF, 2018) or a development approval for waterway barrier works. These requirements ensure that fish passage is maintained, meaning that the bed level crossings are unlikely to prevent aquatic species movement upstream and downstream of the crossings.

5.3.1.4 Area 4 (Borgan)

The Project components required for the exploratory tunnel are predominantly located in cleared areas, which require limited vegetation to be cleared. In this regard, the works associated with the exploratory tunnel supporting infrastructure will not fragment habitat.

Riparian vegetation along Yabba Creek and Sandy Creek is required to be cleared to facilitate the creek crossings, which has the potential to fragment riparian habitat. The koala, greater glider (southern), and yellow-bellied glider are likely to be most impacted by the loss of connectivity along the creeks; however, are anticipated to still be able to utilise the riparian vegetation as a means of dispersal through the landscape.

The culvert and bed level crossings over Yabba Creek and Sandy Creek will also be constructed to meet the Queensland Government's performance outcomes requirements under the *Fisheries Act 1994*, meaning that the bed level crossings are unlikely to prevent aquatic species movement upstream and downstream. As a result, aquatic habitat fragmentation is not anticipated.

5.3.2 Edge effects – RFI item 4.5(d)i, iii, and iv and 4.5(f)

Indirect impacts to flora and fauna habitat may arise as a result of edge effects, which is the process of change that occurs on either side of an 'edge' dividing two different ecosystems (Laurance, 2000). These edges can be natural, such as those created by geology, groundwater, topology, climate or fire, or can be anthropogenic, created by clearing vegetation. Edge effects include abiotic changes (e.g. light increases, microclimate changes, and/or temperature changes) or biological changes (such as changes in species composition and/or abundance) (Murcia, 1995) and may lead to flora and fauna abundance and compositional alterations, increased access for weeds, pests, pathogens, and edge specialist species (Alignier & Deconchat, 2013; Gehlhausen, Schwartz, & Augspurger, 2000).

Edge effects typically include changes to light, airflow, temperature, humidity, noise, dust, weeds, invasive pests and pathogens within a vegetation community. These are further discussed in the following sections.

5.3.2.1 Light, airflow, temperature, humidity, noise and dust

Increased light due to reduced canopy cover at edges is most significant in cases where a soft or gradual edge is maintained or where the understory structure is particularly sparse compared to the canopy, allowing penetration deeper in from the edges (Murcia, 1995). Additionally, varied local topography significantly reduces the penetration of light from the edge (Pocock & Lawrence, 2005). Increased natural light can affect habitat for shade-preferring flora and fauna species such as three-leaved bosistoa (*Bosistoa transversa*) and the black-breasted button-quail (*Turnix melanogaster*) and reduce habitat quality for these species.

Airflow, temperature and humidity changes are most pronounced in similar conditions to that for light penetration (Gehlhausen, Schwartz, & Augspurger, 2000; Goosem M. , 2007). Changes to these factors are most likely to affect habitat for species which prefer a closed canopy such as *B. transversa* (a rainforest flora species) and the long-nosed potoroo (*Potorous tridactylus tridactylus*).

Noise can be a pervasive factor with deep penetration characteristics from an edge (Goosem M. , 2007). Increased noise in vegetation that is proximal to disturbance areas may lead to avoidance or adaptation behaviours in fauna (Parris & Scheider, 2009), particularly bird species that rely on auditory communication calls (Goosem M., 2012). However, noise can be attenuated by vegetation structure, the degree to which the edge is "sealed" and topography (Pocock & Lawrence, 2005). The frequency and volume of nearby noise sources such as geotechnical drilling machinery will also affect how far into vegetation noise travels. Increased noise into forest interiors has the potential to impact fauna species with particular noise sensitivity, such as yellow-bellied glider (*Petaurus australis australis*), and species that have an aversion to vegetation edges in general (Villaseñor, Driscoll, Escobar, Gibbons, & Lindenmayer, 2014).

Increased dust blowing into vegetation from an edge can result in accumulation on leaf surfaces and the ground, reducing photosynthesis and causing potential deterrence to ground dwelling fauna (Jones, Bernede, Bond, Dexter, & Strong, 2016). The depth of influence of dust is anticipated to be influenced by topography, vegetation structure, and how impenetrable the edge face is, but also by the nature of the land use on the other side of the edge, and how much dust is produced by those activities (Pocock & Lawrence, 2005). This threat may not be species specific for flora but is most likely to be a threat to smaller, understory plants, due to larger dust dispersion thinning at greater heights. Effects of minor to moderate dust increases on ground dwelling fauna may be temporary and not particularly severe (Jones, Bernede, Bond, Dexter, & Strong, 2016).

5.3.2.2 Weeds, invasive pests and pathogens

The changes to light, moisture, and airflow can result in changes to microhabitat in the margins near an edge, resulting in conditions that favour different flora species to those typically found in closed canopy vegetation communities (Alignier & Deconchat, 2013). This can lead to a reduction of shade tolerant species and an increase in those species preferring greater light and less moisture. These microclimate differences are likely to be starker in rainforest edges than eucalypt forest edges and thus result in more pronounced changes to species assemblages at the edge (Goosem M. , 2007). However, the depth of influence in subtropical rainforests of weed incursion will be lower due to the thicker understory resulting in less permeable edges (Murcia, 1995).

The introduction of weeds is typically associated with vegetation clearing and the exposure of topsoil, which is then colonised by fast growing weeds. Incursion by highly competitive weeds such as camphor laurel, cat's claw creeper, and lantana (which have all been recorded in the Project area) are a threat to many of the threatened species and ecological communities in the Project area. Weeds are currently present in varying densities across the Project area, with some areas host to high density weeds (including *Lantana camara*) and some areas host to low density/sparse weeds. Given the current distribution of weeds within the Project area, there is considered to be a low risk of further introduction of novel weeds into the Project area; however, there may be an increase in weeds along the edges of tracks and areas temporarily disturbed.

The exposure of previously sheltered plants at a new edge can also allow for pathogens to be introduced to remaining vegetated areas. The newly exposed plants can be under increased stress and experience exposure to wind and novel fauna near the edges that may carry pathogens from nearby areas. This is most likely to occur in areas cleared for new access tracks, where pest fauna use these as a dispersal vector, but may also be spread to edges by clearing and Exploratory Works activities. Myrtle rust has been observed on Myrtaceae species throughout the Project area and therefore the further spread of this pathogen is unlikely to pose additional risks. Toxoplasmosis may also be present in feral cats already in the Project area. Infected cats accessing new areas of habitat may threaten potentially susceptible species such as grey-headed flying-fox (*Pteropus poliocephalus*) or long-nosed potoroo (WHA, 2019); however, feral cats are known to be present throughout the Project area.

The creation of new edges provides access to previously internal forest locations for invasive pest fauna (Hannah, et al., 2007) (e.g. feral dog, cat, cane toad, etc. and edge specialist birds such as noisy miner (*Manorina melanocephala*) or pied currawong (*Strepera graculina*)) (DCCEEW, 2023). However, feral dogs, cats, and cane toads are known to be present throughout the Project area. Clearing for new access tracks is likely to be the highest risk Project activity for pest incursion edge effects. Pest fauna can impact many of the threatened species and communities in the Project area through predation and competition or habitat alteration. Secondary effects caused by pest fauna include weed and pathogen introduction.

5.3.2.3 Depth of edge influence

The depth of influence (into the remaining vegetation after clearing has occurred) and severity of edge effects is affected by the following factors:

- The disparity between vegetation and the land use on either side of the edge which influences the severity of edge effects (Parkins, York, & Di Stefano, 2018).
- The context of the vegetation/edge in the wider landscape which may promote more edge specialist species in the area or may lead to more fruit/seeds of pioneer/weed species available for spread by fauna (e.g. an edge that occurs within a mosaic of differing land use/ecosystems in the surrounding areas) (Murcia, 1995).
- The physical properties of the edge (e.g. the shape (convex/concave), the aspect, the physiognomy or "face" of the edge) can influence the significance of changes to abiotic and biotic factors (Murcia, 1995; Goosem M. , 2007).
- The size and shape of the remaining patch influences the depth of penetration of edge effects, with small or irregularly shaped (i.e. deviating from circular) patches surrounded by large cleared areas exhibiting more edge effects (Didham & Ewers, 2012; Laurance & Yensen, 1991).

Edge effects are typically associated with linear clearing, rather than large, cleared areas (Ballantyne, Gudes, & Pickering, 2014; Pickering, Castley, & Richardt, 2012; Pocock & Lawrence, 2005). Edge effects include increased light, air/humidity/temperature changes, increased noise/dust from vehicle use (where vehicles are present), weed/pest/pathogen incursion (Jones, Bernede, Bond, Dexter, & Strong, 2016; Pocock & Lawrence, 2005), and the increase in generalist fauna species (Goosem M. , 2007).

The depth of influence of edge effects is affected by the vegetation structure (i.e. closed forest, open forest, open woodland) and how 'solid' the edge is (Laurance & Yensen, 1991; Murcia, 1995). The subtropical rainforest habitat type is a closed forest that has a closed canopy with little light penetration and a dense understorey; this is inherently less susceptible to the deep influence of edge effects than the Eucalypt woodland and open-forest habitat types. The estimated depth of influence for edge effects is provided in Table 34, which has been developed with reference to published literature on edge effects and the factors driving each edge effect.

Table 34: Edge effect depth of influence

Edge effect	Source	Depth of Influence (m)	
		Eucalypt Woodland & Open Forest	Subtropical Rainforest
Increased light	Gehlhausen, Schwartz, & Augspurger, 2000; Goosem M., 2007; Pocock & Lawrence, 2005	10	8
Changes to temperature, humidity and airflow	Goosem M., 2007; Pocock & Lawrence, 2005	14	12
Noise	Alignier & Deconchat, 2013; Pocock & Lawrence, 2005	25 – 200	15 – 100
Dust	Jones, Bernede, Bond, Dexter, & Strong, 2016	15	10
Weed/pathogen incursion	Ballantyne, Gudes, & Pickering, 2014; Goosem M., 2007	25	12
Pest fauna incursion	Baker, French, & Whelan, 2002	25	15
Predicted depth of most significant edge effects		**25**	**15**
Estimated total area of edge effect impact		**121.8 ha**	**1.6 ha**

While Table 34 presents the depth of influence of edge effects into the dominant habitat types based on the literature available, the depth of edge effects experienced on site are anticipated to be influenced by the type of machinery and equipment used, the vegetation clearing methods, and the density of vegetation along the edge. Therefore, caution should be used in the strict interpretation and/or application of the depth of influence into habitat types to inform impact assessments (particularly since most of the edge effects are anticipated to be temporary and not result in the permanent loss of habitat).

The impacts of edge effects will not be uniform across the Project and, with the exception of weeds and invasive fauna, the edge effects will be temporary (for the life of the Project) and generally restricted to specific activities at specific locations (such as temporary lighting for deep drilling activities). Management measures will be put in place to minimise the impacts associated with noise and vibration, light and air, while measures will also be implemented to manage the impacts of invasive species, refer Section 6.

There is unlikely to be a permanent increase in artificial light, noise, and/or dust because of the Project. However, there is potential for a permanent increase in weeds along the edge of cleared areas and a potential for pest fauna to utilise cleared access tracks to encroach into previously undisturbed areas.

5.3.3 Indirect impacts from air, noise, vibration, and light emissions – RFI item 4.3 (b), 4.5(d)v and x

The Project has the potential to cause temporary indirect impacts to threatened fauna, flora, and TECs, including a temporary reduction of air quality via increased dust, temporary noise and vibration impacts, and a temporary increase in artificial lighting at night at limited works areas.

Dust emissions from vegetation clearing, earthworks and vehicle movements during construction have the potential to temporarily and locally impact habitat and threatened flora within 10-15 m (see Table 34) from the Project footprint. Dust is anticipated to be generated during vegetation clearing, site establishment works, and when vehicles travel along unsealed roads. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity and alter soil properties resulting in reduced vigour or mortality to threatened flora and degrade habitat for threatened species and TECs (Jones, Bernede, Bond, Dexter, & Strong, 2016). Impacts from dust are anticipated to be temporary and generally restricted to the drier months of the year where regular rainfall does not suppress the generation of dust from unsealed roads and does not regularly 'wash' the accumulated dust off leaves. Given the limited nature of activities that are likely to generate dust, impacts from dust are considered unlikely to cause the death of individual flora species, alter TECs species composition, or

permanently degrade fauna habitat such that threatened fauna species avoid those areas. The Project will also have some benefits via resheeting and upgrading roads, which are a known dust source such as Borgan Road which adjoins Conondale National Park and bisects a patch of Lowland Rainforest of Subtropical Australia TEC.

Noise and vibration will be generated by vehicles, operating machinery, excavations for the Kingaham Creek bypass, and drilling activities for the exploratory tunnel (noting the tunnel excavation will be at a sub-surface depth of more than 100 m below ground after the first month). This will vary from short intermittent bursts of noise from operational activities to more persistent noises from generators and may affect areas from 15-200 m (see Table 34) from the source of noise depending on intensity.

There are no current State or Commonwealth government policies or guidelines that recommend noise and vibration thresholds or limits associated impacts to fauna (including livestock). The Queensland Government's Environmental Protection (Noise) Policy 2019 does not have specific guidelines for fauna however, the policy states that for a protected area or critical habitat "*the level of noise that preserves the amenity of the existing area or place".* This is applicable to some of the Project area where the works are planned to occur in a protected area and near a protected area. The policy does not refer to vibration, while the Queensland Government *Guideline Noise and vibration from blasting* recommends 5 mm/second peak particle velocity for 9 out of 10 consecutive blasts during the day and 2 mm/second at night.

Noise and vibration modelling for the blasting activities indicates vibration would be up to 30 mm/sec peak particle velocity (PPV) based on a maximum in charge of 250 kg. The level of vibration meets the goal of 5 mm/sec 450 m from the tunnel alignment, and 2 mm/s is 800 m. The maximum in charge is anticipated to be no more than 60 kg and this level of vibration will be significantly lower than currently modelled. The maximum in charge weights will be controlled through the use of millisecond delay detonators to reduce the number of holes initiated at the same instant, which will further reduce ground vibration levels. Queensland Hydro has adopted a conservative buffer of 200 m buffer around the blasting and high intensity vibratory activities to guide mitigation measures.

While noise and vibration have not been identified as a specific threatening process for MNES fauna species that have potential to occur within the Exploratory Works Survey area, animals typically show avoidance behaviours to foreign stimuli, including noise and vibration. While such stimuli may result in little impact to vagile species such as the grey-headed flying-fox and other less vagile species, such as the koala and spotted-tail quoll, they may avoid areas that are subject to acute noise and vibration events. Avoidance of areas subject to such stimuli may occur during the construction phase and may result in a reduction in foraging efficiency. The generation of construction noise has the potential to interfere with threatened fauna communication behaviours, mask the sound of predators and prey, and cause avoidance reactions and displacement from habitat.

These disturbances are also anticipated to be temporary and localised with most of the activities occurring in the floodplain for Sandy Creek and Yabba Creek, away from known populations of threatened species. Given the limited nature of activities that are likely to generate noise and vibration, impacts from noise and vibration are considered unlikely to degrade fauna habitat such that threatened fauna species avoid those areas. Rather, noise and vibration impacts are anticipated to temporarily deter fauna from the works areas during the course of the noise and vibration generating activities.

Artificial lighting from infrastructure and machinery has the potential to impact fauna in the vicinity of the Project footprint during works. Artificial lighting has the potential to cause terrestrial fauna to avoid areas of habitat that they previously relied upon for foraging/breeding/sheltering, may lead to an increase in the risk of predation for some fauna species, and potentially disrupt breeding patterns or cause general disorientation. Artificial lighting impacts are anticipated to be isolated to the portal pad, staging pad, and the civil construction compound and in the vicinity of deep geotechnical boreholes that will be drilled through the night. Given the temporary and limited artificial light sources, impacts from increased lighting at night are considered unlikely to permanently degrade fauna habitat such that threatened fauna species permanently avoid those areas. Rather, lighting impacts are anticipated to temporarily deter fauna from the works areas during the course of the night works. There is unlikely to be a permanent increase in artificial lighting as a result of the works.

5.3.4 Invasive pests, weeds, and pathogens – RFI 4.5(d)iii and iv

Clearing and construction activities have the potential to increase the abundance and facilitate dispersal of invasive pests and pathogens in habitat in the Project area. As described in Section 5.3.2, this is generally associated with edge effects or may be through the Project activities themselves as discussed below.

5.3.4.1 Invasive pests and weeds

Movement of vehicles, equipment, and personnel through the Project footprint are the key vectors for dispersal of weeds. In particular, vehicles and equipment sourced from regions beyond the Project area could introduce new invasive flora (weeds). Many weed species thrive on disturbed ground and will rapidly colonise disturbed areas in advance of native species recolonisation. Seeds and fruits could be spread by clearing activities and vehicle movement, while establishment into previously unaffected areas is highly likely after heavy rainfall as several thousand seeds can be produced per square metre that can remain viable for several years. The potential risk of the Exploratory Works Project activities spreading invasive weeds into habitat around the footprint and into previously unaffected areas is considered low as weeds are currently widespread in and surrounding the Project area in varying densities. In this regard, the Project is unlikely to introduce new weeds to the Project area and is unlikely to further the spread of weeds into areas which currently are host to only low density weeds.

Linear clearing through contiguous vegetation could facilitate dispersal of invasive fauna (pest animals) through the landscape. Putrescible waste, if not properly managed, may also attract pest animals such as wild dogs. This could lead to increased competition with and predation of threatened fauna. Invasive fauna such as feral pigs and deer could also trample and graze on vegetation, degrading habitat for threatened species. The risk of the Exploratory Works Project activities further facilitating feral/pest fauna into the Project area and into previously unaffected areas is considered low as evidence of feral animals (including pigs, deer, dogs, and cats) have been recorded in all areas of the Project area. In this regard, the Project is unlikely to introduce new pest fauna to the Project area and is unlikely to further the spread of pest fauna.

5.3.4.2 Pathogens

Based on field surveys undertaken, the only known pathogen to occur within the in the Exploratory Works Survey area is myrtle rust (*Austropuccinia psidii*). Myrtle rust is a known threat to scrub turpentine (*Rhodamnia rubescens*) and native guava (*Rhodomyrtus psidioides*) and was recorded impacting the majority of *R. rubescens* and *R. psidioides* individuals observed in field studies. As myrtle rust has been recorded throughout the Project area, the risk of introducing or further facilitating the spread of myrtle rust into the Project footprint or to *R. rubescens* and *R. psidioides* individuals is considered low.

Other pathogens and/or species interactions that are recognised threats to threatened flora, fauna, and ecological communities that were not verified during field surveys (it is not standard practice to sample these pathogens) but may occur within or surrounding the Project area include the following:

- Bell miner-associated dieback (BMAD): bell miners (*Manorina melanophrys*) were recorded during surveys; however, more information is required to determine if any existing dieback is related to the existing population.
- Koala retrovirus (KoRV) and chlamydia (*Chlamydia percorum*): pathogens which are specific to koalas and varies across their range in Australia. A number of koalas were observed during the surveys; however, the health of the population is unknown as diagnosis is limited outside of a laboratory setting. There are currently no vaccines nor confirmation of vectors for transmission.
- Psittacine Beak and Feather Disease: distributed Australia-wide including Tasmania. Eradication is difficult once introduced to a population, as the level of threat and distribution is altered by the movement of common parrot species.
- Root rot (*Phytophthora cinnamomi*): *P. cinnamomi* is difficult to detect and can remain dormant for long periods during dry weather and is also difficult to eradicate from infested areas.
- *Toxoplasma gondii*: the threat and distribution of *Toxoplasma gondii* is altered by the movement of feral cats. Information on the prevalence of *T. gondii* infection in feral cat populations (and feral cat populations for that matter) across Queensland is currently unknown.

The Exploratory Works do not involve any activity that has the potential to facilitate the introduction and/or spread of any of the above pathogens/diseases and therefore the risk is considered low.

The Gympie Region Biosecurity Plan (2018-2022) (Gympie Regional Council, 2023) acknowledges both feral cats and wild dogs have established populations throughout the Gympie region and adjoining councils, while occasional sightings of ferrets (*Mustela furo*) have been recorded through Queensland. All three are recognised to potentially transmit disease to humans, livestock, and native species. These diseases are not described except for *Hydatidosis* and *Neospora* that can be spread by wild dogs however, these are not recognised threats to threatened species or ecological communities. Similarly, the Somerset Regional Council Biosecurity Plan – Invasive Plants and Animals 2020-2025 (Somerset Regional Council, 2023) and Sunshine Coast Council Local

Government Area Biosecurity Plan 2017 (Sunshine Coast Council, 2023) do not describe any pathogens within the area that may impact threatened species and ecological communities. The Exploratory Works do not involve any activity which has the potential to facilitate the introduction and/or spread of *Hydatidosis* and *Neospora* and therefore the risk is considered low.

5.3.5 Contamination from hazardous materials – RFI item 5.1(m)

Contamination risk relates to:

- disturbance of existing site contamination
- contamination caused by:
  - spillage or release of contaminants stored or being used on site (fuels, oils, explosives, cement etc)
  - spillage of contaminants or waste material being transported to or from site
  - contaminated runoff generated from waste (including spoil) storage areas.

Potential impacts of contamination on water quality are addressed in Section 5.3.8.

Exploratory Works activities are not proposed at or near areas of contaminated land, and therefore the Project will not disturb known areas of contamination.

Exploratory Works activities such as the tunnelling works, geotechnical investigations, and spillage, leakage or general release of contaminants from chemical and fuel storage facilities, along with equipment have the potential to accidentally release hazardous materials such as fuels, oils, explosives, cement, etc. These hazardous materials can lead to localised soil contamination and contamination of water resources, which in turn can cause injury, reduced vigour, or mortality to threatened flora and fauna and their habitat. The severity of the impact is dependent on the location and magnitude of the release and existing control measures.

The excavated material from the exploratory tunnel and earthworks for the Kingaham Creek bypass will be placed at the spoil disposal areas at Area 4 (Borgan) and Area 2 (Kingaham Creek), respectively. Excavated material will be tested for contaminants. Any material found to contain contaminants will be remediated as per the remediation action plan or removed offsite to a licensed facility for disposal. Excavated material found to be free of contaminants will be combined into each main stockpile by dozer push.

Installing and operating temporary water infrastructure, geotechnical drilling, constructing in-stream infrastructure and using bed-level crossings have the potential to accidentally release hazardous materials such as fuels and oils from vehicles and machinery. The risk of potential contamination impacts from these activities will be minimised through implementing measures described in the CEMP (Appendix F) and waste management plan. Contaminated material may be remediated in accordance with a remediation action plan prior to reuse.

5.3.6 Erosion and sedimentation

Vegetation clearing, earthmoving, and general construction activities may increase natural erosion and sedimentation in the vicinity of the Project footprint. The Project activities may change surface flows and stormwater runoff, including obstruction of surface flows. This can result in scouring or waterlogging occurring in some areas, potentially degrading terrestrial habitat and possibly affecting individual threatened flora specimens.

Impacts of erosion and sedimentation on water quality and aquatic habitat is addressed in Section 5.3.8.

5.3.7 Changes to bushfire regime

Fire is a natural part of the Australian landscape, and most vegetation communities are adapted to periodic fires. However, changes in the natural fire regime may result in changes in the species composition and/or structure of the vegetation. Threatened terrestrial flora and fauna are especially vulnerable to fires. Fires are a major threatening factor causing significant injury or mortality to flora and fauna, and can cause catastrophic loss and fragmentation of habitat, depending on the severity of the fire.

Most of the geotechnical activities are located in areas mapped as Very High Potential Bushfire Intensity, while tunnelling activities are located in Potential Impact Buffer based on the State Planning Policy mapping. Bushfire risk is actively managed on the properties where Exploratory Works Project activities are located, with prescribed burns occurring annually. The last bushfire that affected the Exploratory Works Survey area occurred in 2021.

The increased presence of construction vehicles and personnel in the Project area may increase fire risk through use of machinery that could generate sparks, use of flammable liquids and idling vehicles being present in areas of vegetation. The stockpiling of vegetation or mulch may also be a source of fire.

5.3.8 Impacts to surface water quality – RFI item 4.5(d)vi, viii, and 5.1(m)

The Exploratory Works activities that could impact on surface water quality include:

- soil disturbance during site establishment and construction of the supporting infrastructure for the exploratory tunnel, temporary water infrastructure, geotechnical investigations, Kingaham Creek bypass and access tracks
- construction of waterway crossings and runoff from Exploratory Works activities occurring near waterways or drainage lines
- accidental release of fuel, oil, waste or other chemicals
- discharge of surface/ground water collected during Project work (including from stormwater runoff from works areas, or wastewater from tunnelling or geotechnical activities)
- runoff from spoil stockpiles, which may be contaminated
- direct extraction of water from Lake Borumba, including disturbing the sediment
- sewage or greywater treatment and disposal from temporary construction camps (noting that the camps are not part of the action and that all sewage or greywater will be trucked offsite).

The activities described above are located at Yabba Creek and Sandy Creek in Area 3 (Walkers Top) and Area 4 (Borgan), and at Yabba Creek in Area 1 (Borumba Dam). These activities and their location with respect to surface water bodies are described in Table 35 and shown in Figure 30. A description of these surface water bodies is included in Section 3.7.

The Project could impact surface water quality through contamination and increasing erosion and sedimentation.

Appendix G provides a risk assessment of potential impacts to surface water quality.

Table 35: Exploratory Works within or adjacent to surface water bodies

Surface water body	Location and description of Exploratory Works	
	Within / crossings	Adjacent
Lake Borumba	• Nil	• Geotechnical drilling on the southern side of the lake within the Conondale Resource Reserve
Yabba Creek and Sandy Creek upstream of Lake Borumba	• Water intake pump in Lake Borumba and two pipeline crossings of Yabba Creek • One temporary bridge crossing Yabba Creek for the portal pad access track • Three Sandy Creek temporary bridge crossings including explosive store access track and portal pad access track • Four temporary culvert crossings and bed-level crossings associated with bridge construction • Two temporary bed-level crossings over Yabba Creek	• Portal pad • Staging pad • Spoil disposal area • Explosive store • Civil construction compound • Water infrastructure (tank farm and lift station)
Yabba Creek approximately 300 m downstream of the Borumba Dam wall	• Geotechnical drilling • Bed-level crossing	• Geotechnical drilling • New and existing access tracks
Kingaham Creek	• Geotechnical drilling	• Kingaham Creek bypass • Spoil disposal area and access track

5.3.8.1 Contamination

Surface water could become contaminated from accidental spillage, leakage or general release of contaminants from equipment and Exploratory Works activities including:

- explosives used in tunnelling and drill fluids used in geotechnical boring
- wastewater from tunnel excavation
- accidental spillage of fuels or oils
- spoil stockpiles.

The explosive store, staging pad, portal pad and spoil stockpiles areas are in cleared areas at least 50 m from watercourses to avoid potentially contaminating watercourses.

Contamination of watercourses, if it was to occur, has the potential to cause injury, reduce vigour or result in mortality to threatened aquatic fauna. However, through avoiding potential impacts by design (such as locating high risk activities at least 50 m from watercourses) and the implementation of mitigation measures (such as primary and secondary containment) the risk of water quality contamination impacting threatened aquatic species is considered low with any potential incidents likely to be minor and reversible with corrective actions. Further detail is provided in Appendix H.

5.3.8.2 Sedimentation

Exploratory Works activities located in and adjacent to surface water bodies could disturb soils, leading to sediments being transported into watercourses and Lake Borumba. Increased suspended sediments can reduce light penetration into the water column, reducing photosynthesis of aquatic macrophytes and decreasing dissolved oxygen levels, degrading habitat for threatened aquatic species.

Exploratory Works activities that could lead to sedimentation in watercourses and Lake Borumba include:

- construction of temporary bridges and culvert infrastructure at Yabba Creek and Sandy Creek upstream from Lake Borumba
- use of bed-level creek crossings
- installation and operation of temporary water infrastructure
- geotechnical drilling and test pits in Kingaham Creek, adjacent to Lake Borumba and downstream of the existing Borumba Dam wall.

Each time a vehicle crosses a bed-level crossing, some generation (e.g. washing of dust off the tyres and vehicle itself) and movement of sediment is expected. There are three temporary bed level crossings initially, to support geotechnical investigation access, one in Area 1 (Borumba Dam; downstream of the Borumba dam wall) and two in Area 3 (Walkers Top). Four temporary crossings will also be installed in Area 4 (Borgan) to support bridge construction at Yabba Creek and Sandy Creek. These crossings will ultimately be either gravel or concrete, with the type of crossing determined by the expected traffic volumes at the crossing; however, temporary culverts will initially be installed at the crossings supporting bridge construction. These culvert crossings will then be replaced by temporary bed level crossings. Concrete crossings will be used where traffic is more frequent to minimise disturbance associated with vehicle movements and in-stream. The use of temporary culverts will decrease the risk of materials being washed into the creek during crossings.

The bridges will be used for the entire duration of the exploratory tunnelling (approximately two years). Should the Main Works Project proceed, the bridges will remain in place while an identical bridge is constructed alongside to create dual land access to cater for increased traffic (however, for the purposes of this Project, the bridges are considered temporary). Should the Main Works not proceed, the bridges will be removed and the area rehabilitated, with the stream bed re-profiled to the pre-works state.

The access tracks across the site also intercept drainage lines and overland flow paths and there is a risk if the tracks are poorly constructed or are not effectively maintained sedimentation may occur.

Installation of temporary water infrastructure has been designed to avoid and minimise potential sedimentation impacts on water quality in Yabba Creek. The two pipeline crossings of Yabba Creek will be installed by directional drilling or suspended over the watercourse via a temporary steel bridging structure to eliminate any disturbance within the banks of the watercourse. The pipeline will also be shallow buried to prevent ‘snaking’ of the pipeline from expansion and contraction due to temperature changes. The extraction pump (fitted with a float) will be

loosely connected to a single steel tube liner which is driven into the waterway, enabling the pump to rise and fall in line with lake level changes from inflow events.

The risk of sedimentation on threatened aquatic species as a result of Exploratory Works activities is considered to be low (Appendix H) due in part to the works being located above the 1% AEP and the works being located at least 50 m from a watercourse. While sedimentation is possible, the risk has been mitigated through avoiding potential impacts by design (water infrastructure and temporary bridges) and applying measures to minimise (erosion and sediment control). Any potential impacts on aquatic habitats are likely to be minor and reversable (temporary).

5.3.9 Impacts to surface water flows – RFI item 4.5(d) vii, and 5.1(m)

The Project will have minimal impacts on surface water flows. Potential impacts could occur as a result of constructing bridges, temporary culverts and bed-level crossings, and installing temporary water infrastructure.

Exploratory Works activities with the greatest potential to impact surface water flows are creek crossings. All crossings, including bridges, culverts, and bed-level crossings, will be designed and constructed in accordance with relevant fish passage standards, which require flow to be maintained. Bridge construction is expected to occur during the dry season and cofferdams are not likely to be required. This means there will be no change in creek water flows from current conditions during bridge construction and operation.

Installing temporary water infrastructure involves two creek crossings. These will not impact surface water flows as they will be installed either via horizontal directional drilling (HDD) or suspended over the watercourse via a temporary steel bridging structure. Most of the pipeline outside of creek crossings will be shallow buried to prevent ‘snaking’ from expansion and contraction. Burying the pipeline also ensures no impacts on surface water runoff flows. The only sections of the pipeline that will not be buried are the sections connecting to pumping and lift station infrastructure.

Water extracted from Lake Borumba for the Project will be undertaken in accordance with water licence requirements coordinated with Seqwater or water permits from DLGWV. The volume of water taken from the lake will not impact on surface water flows. Water demand will be highest during construction and site establishment, which requires approximately 500 kL per day. This is very small compared to the volume available for take through water allocations under the Water Plan.

5.3.10 Impacts to groundwater – RFI item 4.5(d)vii and ix and 4.5(f)

Current knowledge of the existing groundwater environment and presence of GDEs in the Project area and wider Borumba PHES Survey area is limited. The purpose of the Exploratory Works is to investigate the geology of the area to inform the feasibility of the Main Works Project. This includes improving understanding of the area’s hydrogeology.

Further, the presence of GDEs has been determined from the National Atlas of Groundwater Dependent Ecosystems. Ecological surveys are required to confirm whether those vegetation communities mapped as GDEs are in fact dependent on groundwater, including the two TECs known to occur in the area. That is, changes to groundwater regimes are not known as a threat to these communities, however there is an indication from research on similar communities in other parts of Australia that these TECs can have a degree of reliance on local groundwater resources.

The assessment of potential impacts of the Exploratory Works on groundwater and GDEs is based on a conceptual model built that incorporates key findings of recent field investigations and an extended baseline monitoring dataset (Appendix B).

Potential groundwater impacts of the Exploratory Works activities include:

- Lowering of regional and local groundwater levels and associated impacts on sensitive terrestrial vegetation communities from excavating the exploratory tunnel. Groundwater impacts will be more pronounced around/along geological structures and likely localised.
- Altering hydraulic conductivity through drill and blast from excavating the exploratory tunnel.
- Leachate from explosives and oxidation of exposed bedrock resulting in contaminated water runoff and seepage from excavating the exploratory tunnel.
- Potential contamination of the aquifer from use of explosives and due to oxidation within the tunnel during drilling and poor quality leachate from spoils, stockpile materials, ablution facilities, fuel storage tanks and explosives

- Potential reduction in groundwater recharge from paving over recharge areas.

Excavating the exploratory tunnel could dewater the Marumba beds aquifer, which could lower groundwater levels locally (Appendix B). Groundwater levels range from 3.83 mBGL to 37.26 mBGL. The average groundwater level ranges from 10 to 13 mBGL (AGE, 2024). Groundwater drawdown will migrate radially outward but will be largely localised around the tunnel. It is not expected that the drawdown will propagate outward to the Conondale National Park (AGE, 2024).

Potential impacts to GDEs could occur through the construction of the exploratory tunnel resulting in groundwater drawdown lowering the groundwater level below the level accessed by the vegetation community. Lower groundwater levels could potentially cause GDEs, including the TECs, to lose connection with groundwater sources reducing their viability and potentially quality of vegetation and habitat for MNES. Where groundwater levels are relatively shallow (e.g. alluvium), all vegetation could be impacted. The risk to GDEs associated with Sandy Creek, Yabba Creek and Lake Borumba including the TECs is considered medium. Dewatering of the alluvium aquifer from excavating the exploratory tunnel could reduce baseflow seepage into the local creeks and reservoirs, potentially affecting associated GDEs. While dewatering is unavoidable, cementation of the tunnel and grouting fractures will reduce flows into the tunnel and drawdown. The impacts are likely limited in extent since only areas directly above and within direct vicinity of the tunnel are likely to be impacted. Further there will be a risk of short-term reduced water availability to potential GDEs limited to the areas above and the immediate surroundings to the tunnel.

A groundwater impact assessment has been undertaken for the Project (provided in Appendix B). The assessment concludes that the construction of the tunnel will include some dewatering of the Weathered Rock Aquifer and Fractured Rock Aquifer of the Marumba Beds, which will create localised groundwater impacts. The drawdown from the construction of portal overlaps a mapped TEC and high potential GDE. The impacts are likely limited in extent but there will be a risk of short-term reduced water availability to the mapped GDEs and TECs, limited to the areas above and immediate surroundings to the tunnel.

It is also important to note that the qualitative assessment used steady state applications and does not provide transient drawdown over time. Drawdown associated with the deep sections of the tunnel and the potential interconnectivity of this to surface and shallow aquifers are in progress through a MODFLOW USG 3D numerical groundwater model. Once sufficient geotechnical information is available to complete the numerical modelling the impact assessment from the tunnelling works will be revisited in consultation with the construction contractor.

The establishment of the geotechnical bores is not expected to result in groundwater drawdown of any significance, however the production of two boreholes within Area 4 (Borgan) will have a probable cone of depression, between 150 m and 300 m. Because the bores will not be able to sustain any significant production at the lower end of the hydraulic conductivity range (0.004 m/day), the range presented on the map used a higher hydraulic conductivity range of 0.11- 0.04 m/day.

From the preliminary analytical calculations, the zone of influence incorporates a portion of Yabba Creek (between 170 m and 500 m) and may result in some reduction of baseflow towards the creek during the dry season. It also includes a small mapped riverine wetland zone within the northern part of the predicted zone of influence.

Exploratory Works activities and infrastructure could potentially contaminate aquifers via infiltration from surface infrastructure or runoff. Potential sources of contaminants include:

- diesel storage tanks, spoil stockpiles, ablution facilities and the explosive store
- discharged dewatering water from excavating the exploratory tunnel (deeper aquifer may have higher salinity than shallow aquifer)
- oxidation of exposed bedrock, resulting in natural chemical changes within the host rock
- potential leakage of oils, lubricants and fuels from construction vehicles and at workshop areas.

The risk to GDEs and MNES that depend on GDEs for habitat from contaminating aquifers is considered low. The impact is possible since the Exploratory Works will use substances which could contaminate aquifers; however, the impacts would be minor after applying the proposed mitigation measures (described in Section 5).

Exploratory Works infrastructure including paved and hardened platforms for the spoil disposal area, explosive store, portal pad and staging area could result in a temporary reduction in baseflow seepage (groundwater recharge) over small areas. This could potentially affect the growth and quality of GDEs and habitat for threatened species. It could also potentially reduce baseflow to local creeks and Lake Borumba. The risk of reduced

groundwater recharge to GDEs and habitat for MNES is considered medium. The impact is possible but minor in consequence since the total area of hardened platforms is significantly smaller than the total likely recharge zone for the aquifers.

5.3.11 Downstream impacts – RFI item 4.3(c-e)

5.3.11.1 Surface water

The Exploratory Works Project will have a negligible impact on water quality and flows downstream including in the Yabba Creek catchment, the broader Mary River basin and Great Sandy Strait Ramsar wetland. Section 5.3.8 and Appendix G describe the Project's potential impacts on surface water quality.

The Project is approximately 31 km upstream from the confluence of Yabba Creek and the Mary River. From this location, it is a further approximately 227 km to the tidal barrage near Maryborough and a further approximately 40 km to the boundary of the Great Sandy Strait Ramsar wetland.

Further, water quality in Yabba Creek downstream of the existing Borumba Dam wall already exceeds WQOs for suspended solids (refer to Section 3.7.1.3.2) and MNES species are known to be present in this area (refer to Section 4.2.4). Where suitable management measures are implemented (as identified in the water quality risk assessment in Appendix G), the Exploratory Works are not expected to significantly increase suspended solids concentrations in Yabba Creek at this location. If the works do contribute to an increase in suspended solids, this will be localised and temporary. Downstream impacts are therefore also considered unlikely.

5.3.11.2 Groundwater and leachate

Exploratory Works will not change groundwater recharge or flows that would affect the Yabba Creek catchment. Therefore, the works are expected not to significantly impact on the hydrology in the Yabba Creek catchment and assessment of potential impacts on the Mary River and Great Sandy Strait Ramsar wetland is not required.

If undertaken, horizontal directional drilling of the water pipeline at the two Yabba Creek crossings could potentially affect the alluvium. However, the impact to groundwater flow and quality are unlikely to be significant due to the relatively small dimensions of the pipeline, the limited length of the crossing, and the temporary nature of the water infrastructure.

Potential sources of leachate into aquifers from Exploratory Works activities include spoil placed at the spoil disposal area, and explosives and oxidation of exposed bedrock in the exploratory tunnel.

Spoil placed at the spoil disposal area could potentially produce poor-quality leachate that seeps into shallow groundwater aquifers; however, the spoil disposal area will be lined with a Bentofix NSP 4900 or approved equivalent below a geogrid layer to prevent seepage of leachate into the aquifer. Internal drainage channels will flow directly to lined basins and water from the spoil pads will be able to be directed to pump wells for pumping to the water treatment plant, if required. Therefore, potential impacts on groundwater quality are unlikely.

Further, a management plan will be prepared and implemented for the Exploratory Works to ensure groundwater drawdown is monitored and managed. Its implementation will validate groundwater drawdown extent and groundwater quality during Exploratory Works activities.

Potential impacts of the Exploratory Works on groundwater are addressed in the Groundwater Impact Assessment Report contained in Appendix B.

5.4 Facilitated impacts – RFI item 4.5(a)

The Significant Impact Guidelines define facilitated impacts as impacts "which result from further actions (including actions by third parties) which are made possible or facilitated by the action". The Exploratory Works Project comprises the geological investigations, supporting infrastructure and activities needed to inform the development of the separate and related Main Works Project. There are potential facilitated impacts to housing and roads, which are addressed through a Workforce Accommodation and Housing Strategy and road upgrades.

As the Project will need accommodation to support the construction activities Queensland Hydro is preparing a Workforce Accommodation and Housing Strategy for the Exploratory Works. The strategy involves the construction of two TWACs, which are not considered to be part of the action and establishing an exclusive agreement with four existing accommodation providers for weekday lease of up to 50 beds within 30 km of the site. Local landowners, accommodation providers, and existing businesses around the Borumba PHES Project were invited to register their

interest and capacity. These options will remain subject to change as part of Queensland Hydro's ongoing due diligence process, procurement and leasing arrangements.

Upgrades to existing road network by the relevant road authorities are also required in support of the Project, with some of the upgrades required independent of the Project. However, the Project has facilitated the upgrade works earlier than originally scheduled with the road works aimed at improving road safety for staff working on the Project, along with local residents. Some of these works are not considered to be part of the action and were subject to a self-assessment that concluded there would be no impact to MNES.

No other facilitated impacts are anticipated as a result of the Exploratory Works Project.

The Exploratory Works Project infrastructure is largely temporary in nature and is not intended to remain in place for an extended duration, unless required for property access and maintenance (e.g. some access tracks). Should the Main Works Project not proceed, the areas impacted by the Exploratory Works Project (other than upgraded existing access tracks) will be remediated where appropriate (e.g. revegetation of cleared areas, plugging of boreholes).

5.5 Potential cumulative impacts – RFI item 4.5(b)

The region surrounding the Project is characterised by rural agricultural land uses, small towns, native vegetation, and nature conservation areas. Existing land uses and development in the region that have the potential to impact and/or are currently impacting on MNES include (but are not limited to) grazing operations, residential land uses and Lake Borumba, which was established in 1963 when the dam was constructed. Large areas of intact vegetation also occur in the region providing State-wide riparian and terrestrial biodiversity corridors of value for MNES. The total area of intact vegetation within protected area estates in the region is approximately 67,700 ha. Further information about the region and land uses is provided in Section 3.2.

Queensland Hydro reviewed the following sources of databases to identify local and regional developments relevant to the Exploratory Works:

- EPBC Public Portal
- Coordinated projects under the SDPWO Act
- State Assessment and Referral Agency database
- Projects planned under the EP Act
- Somerset and Gympie Regional Council development application databases.

Gympie Regional Council and Queensland Hydro have undertaken works in the vicinity of the Project area, for which self-assessments under the EPBC Act have been completed. These activities include road upgrades and geotechnical investigations in isolated locations in cleared areas.

Nearby developments which have been referred to DCCEEW under the provisions of the EPBC Act, include the Woolooga Solar Farm (formerly known as Lower Wonga Solar Farm) (EPBC 2019/8554) and Munna Creek Solar Farm (EPBC 2022/09418).

The Woolooga Solar Farm is located approximately 45 km north of the Exploratory Works, within the Wide Bay Creek catchment. The project was approved under the EPBC Act in 2021, with construction commencing in June 2021. The project will be developed in three stages and is approximately 500 ha in size. The EPBC approval permits clearing of no more than 176 ha of koala habitat and 83.38 ha of grey-headed flying-fox habitat. The project is also likely to impact on white-throated needletail, Mary River cod, Mary River turtle and Australian lungfish, however approval conditions do not require offsets for these MNES (Lightsource, 2023).

The Munna Creek Solar Farm is located approximately 70 km north of the Exploratory Works within Munna Creek catchment and occupies 467.52 ha. It was determined to not be a 'controlled action' under the EPBC Act due to no MNES occurring in the area, and any vegetation to be cleared is non-remnant (DCCEEW, 2022).

Therefore, potential cumulative impacts of the Exploratory Works on MNES, including koala and grey-headed flying-fox, are expected not to be significant locally or regionally.

5.6 Unknown or unpredictable impacts – RFI item 4.5(f)

In general, the Exploratory Works are routine geotechnical investigations that are regularly undertaken to inform infrastructure Projects. The impacts and risks associated with geotechnical works are generally well understood

and the mitigation measures to minimise impacts are routinely and effectively implemented with success. In this regard, the potential for unknown or unpredictable impacts is considered low and generally associated with the exploratory tunnel.

5.6.1 Groundwater drawdown impacts on root zones

The construction of the exploratory tunnel has the potential to cause short-term, localised impacts to habitats located above and adjacent to the tunnel alignment including groundwater drawdown affecting potential groundwater dependent ecosystems. The nearest TEC patch is at least 100 m from the exploratory tunnel and unlikely to be impacted by drawdown. Potential impacts from groundwater drawdown are discussed in Section 5.3.9 and in Appendix B.

5.6.2 Subsidence from the tunnelling works

Tunnel excavation has the potential to cause surface settlement and groundwater drawdown. Groundwater drawdown impacts due to groundwater inflow into the tunnels has the potential to cause surface settlement. Mitigation measures including forward probing to identify geological features during excavation and grouting of groundwater inflow will be implemented to minimise settlement impacts. Instrumentation of monitoring will be installed in the tunnel and will measure ground movements during excavation and inform the grouting volumes.

Impacts to native vegetation from potential surface settlement (in an unmitigated scenario) will be localised to a zone of influence directly above the tunnel. Potential impacts on remnant vegetation may include the following: trees may become destabilised by surface movement causing tree falls and slumping; surface or tension cracking may sever or damage vegetation root systems causing tree death; ground fracturing and surface cracking may cause localised changes to soil hydrology with follow-on adverse impacts to surface vegetation.

Reduced groundwater levels due to dewatering and/or seepage into the tunnel are not considered to present a risk of settlement due to the competent lithologies being excavated. The potential for settlement impacts due to ground subsidence from the tunnel excavation is unlikely. Potential for settlement will be confirmed as part of ongoing geotechnical investigations and tunnel ground support design.

5.7 Habitat and impact maps – RFI item 4.2

Appendix E includes habitat maps and the associated habitat mapping rules for species assessed in Section 7 and Appendix J.

5.8 Policy guidelines, relevant studies, surveys, and/or consultations – RFI item 4.4

Survey guidelines and outcomes of field surveys undertaken to inform the impact assessment are listed in Appendix M.

Relevant approved Conservation Advices, recovery plans, draft referral guidelines and listing advices, threat abatement plans, and the SPRAT database used to inform the impact assessment are referenced in the relevant species profiles and significant impact assessments in Section 7.

Technical reports that have informed the impact assessment include:

- Water quality risk assessment related to Borumba Pumped Hydro Exploratory Works Preliminary Documentation (EM, 2023)
- Borumba Dam Exploratory Works EPBC Referral – Groundwater Impact Assessment (AGE, 2024)
- Terrestrial Ecology Technical Report (Umwelt, 2022)
- Aquatic Ecology Technical Report (Hydrobiology, 2022).

The MNES risk assessment was completed for the Exploratory Works in accordance with the Environmental Management Plan Guidelines (DCCEEW, 2024).

The reference list includes a complete list of policy guidelines, studies and other literature that informed this assessment.

6. Avoidance, mitigation and management measures

Queensland Hydro implemented the mitigation hierarchy, as described below, when designing the Exploratory Works:

- Avoid – avoiding direct and indirect adverse environmental impacts where practicable.
- Minimise – minimise direct and indirect adverse environmental impacts through a reduction in the duration, intensity and/or extent of adverse impacts, where these cannot be avoided.
- Mitigate – implement mitigation and management measures to minimise direct, indirect and cumulative adverse impacts.
- Restore (remediate and rehabilitate) – actively remediate and rehabilitate impacted areas to promote and maintain long-term recovery.

Application of the mitigation hierarchy is embedded in Queensland Hydro's organisational leadership and processes, with it being a consideration in all phases of the Project. Some of the key design considerations during Project development included:

- Co-locating Exploratory Works infrastructure and activities with each other and/or the proposed Main Works footprint to reduce the potential for additional disturbance.
- Restricting the Project footprint to what is anticipated to be required to undertake the works in a safe and efficient manner.
- Restricting the Project footprint in sensitive areas to minimise the extent of disturbance to vegetation and habitat for critically endangered, endangered and vulnerable flora and fauna species and ecological communities, while also targeting cleared areas and utilising existing tracks.
- Allowing for the installation of scour protection measures around culvert entrances and exits, on disturbed stream banks, and around waterfront land, and minimising disturbance on steep slopes, to avoid erosion.

Where significant residual impacts are still likely to occur, MNES offsets will be provided in accordance with the EPBC Act Environmental Offsets Policy. MNES offset requirements are summarised in Section 4.5(a). An Offset Area Management Plan (OAMP) has been developed for the Project. The OAMP summarises proposed offsets, conservation outcomes to be achieved, and how the offset package is compliant with the EPBC Act Environmental Offsets Policy.

The Project will also align with all relevant Australian standards and environmental legislation and policies, including, but not limited to:

- ISO14001:2015 – Environmental management systems
- ISO45001:2018 – Occupational health and safety management systems
- *Environmental Protection Act 1994* (Qld).

Further information on the design changes and efforts undertaken by Queensland Hydro to avoid and mitigate impacts to MNES from the Project is provided below.

6.1 Avoidance – RFI item 5.1(a)

The proposed development of the Main Works Project involves the design of a number of critical infrastructure components, in particular those associated with the construction of the proposed upper and lower reservoirs, that have very limited or no flexibility in their siting. This limits the ability to completely avoid MNES for the Exploratory Works geotechnical investigations; however, supporting works, as well as assessment and construction methods and the siting of temporary construction infrastructure have followed the mitigation hierarchy.

Project components that have some flexibility in their siting include:

- Exploratory tunnels and supporting infrastructure – multiple options for the location of the exploratory tunnel, portal pad and staging pad were evaluated to reduce impacts to MNES and their habitat. The portal pad and staging pad are in cleared areas used for cattle grazing, with the staging pad relocated from an area containing suitable habitat for MNES species.

- Site access – existing tracks and roads were selected wherever possible to avoid/minimise impacts to MNES, while new tracks were designed to avoid TECs and known threatened species populations. Review of the requirements for access roads and tracks after the EPBC referral also allowed the reduction of the proposed footprint for access tracks. There will be opportunity to further refine the footprint of the tracks through micro-siting activities (e.g. avoiding hollow bearing trees or threatened flora species, where possible).
- Spoil disposal area – after consideration of several options, the site for disposal of spoil from exploratory tunnelling is in a cleared area used for cattle grazing.
- Other supporting infrastructure – the civil construction compound is located in a cleared area used for cattle grazing. The temporary water infrastructure can be micro-sited within the proposed footprint if required, and the alignment of the pipeline, which is located mostly adjacent to or within existing tracks, can be adjusted to avoid sensitive areas (e.g. habitat trees). It will also be directionally drilled under, or strung above, required crossings of Yabba Creek to avoid instream impacts. Emergency helipads were removed following review of safety management needs.

Project activities with very limited flexibility in their siting and therefore their ability to avoid MNES include:

- Geotechnical investigations – the geotechnical investigations are described in Section 2.1(b) and target the proposed Main Works infrastructure sites (e.g. proposed dam walls, bridges) and quarries to inform design of the Main Works Project. The mitigation hierarchy was implemented in a review of the approach to these investigations and micro-siting will be used during the Project to further minimise potential impacts.
- Explosive store – due to its use for storage of explosive materials, the explosive store must be located and constructed in accordance with relevant Queensland legislation (e.g. *Work Health and Safety Act 2011*, *Explosives Act 1999*) and Australian Standards. This includes maintaining the required separation distance from buildings or other operational areas for blast effects as defined in Australian Standard 2187.1 Explosives—Storage, transport and use. Based on the materials to be stored, the Project explosive store must be at least 560 m from other work areas (refer to Figure 18).

Further discussion of the above activities and the actions taken to avoid and minimise impacts to MNES associated with these activities is provided in the sections below.

6.1.1 Co-location of Exploratory Works and Main Works components

In addition to preferencing previously disturbed areas, Exploratory Works Project components were also co-located with each other and/or the Main Works Project footprint, wherever possible, to reduce the overall impact of the Exploratory Works. This included locating the:

- exploratory tunnel portal pad within the proposed permanent portal pad
- tunnel spoil disposal area largely within the proposed dam inundation area
- tracks (new and upgrades) on access routes that can be used during the construction of the Main Works Project (if approved to proceed)
- anticipated geotechnical investigation sites within access tracks or previously disturbed areas, where possible, and drilling multiple bore holes from a single pad.

Note that refinement of the Project design has resulted in some changes to the co-location of Exploratory Works and Main Works components since the EPBC referral submission; co-location has been prioritised where possible.

6.1.2 Alternative Project designs

6.1.2.1 Exploratory tunnel and supporting infrastructure options

The design and location of the exploratory tunnel portal was robustly evaluated to avoid and then minimise impacts to MNES following detailed ecological surveys; this included the consideration of buffer distances between disturbance areas.

The exploratory tunnel portal pad was initially located at the site shown in Figure 45 to align with the then proposed permanent portal pad location. However, ecological surveys determined that this location coincided with a patch of the Lowland Rainforest of Subtropical Australia TEC. Consequently, it was decided to relocate the permanent portal pad to a different site that would not directly impact the TEC. This alternative (the Orange option presented in the EPBC referral and shown in Figure 45) avoided the TEC but was within the 50 m buffer zone for this community.

After the above adjustment, the Borumba PHES Project design was considered further, resulting in a change to the size of the portal pad. The initial Project design included a portal pad with the same dimensions as the permanent portal pad for the Main Works. However, it was identified that the works associated with excavating the exploratory tunnels do not require a staging area equivalent to that proposed for the Main Works, and as a result the size of the Exploratory Works portal pad was reduced.

The review of the portal pad also led to the consideration of three alternative locations with improved construction and environmental conditions. These additional locations were assessed using a simplified, high-level multi-criteria analysis (MCA) that considered geotechnical, stakeholder, environmental, cultural heritage, hydrology and works constraints. Engineering design, cost and time constraints were not included as the engineering input was not available. The MCA resulted in two options being removed from consideration and one option (the Green option presented in the EPBC referral and shown in Figure 45) being retained for engineering input.

Since lodging the EPBC referral, further work has been undertaken to refine the location of the exploratory tunnel and portal pad, with a preferred location identified as described in Section 2.7. The new site is located in a cleared area previously used for cattle grazing, with sufficient space to construct the portal pad and a staging pad with minimal clearing (Figure 45). The local topography also reduces the amount of cut required for the works compared to the options presented in the EPBC referral and improves safety.

The proposed exploratory tunnel alignment and the proposed alternative also avoid being located underneath TECs, with the nearest patch of Lowland Rainforest of Subtropical Australia approximately 170 m north of the alignment. The previous exploratory tunnel alignment options would have been under patches of this community.

The access track to the portal will require additional crossings of Sandy Creek, however this solution avoids the substantial excavation and clearing that would have been required for the Green option as presented in the EPBC referral.

Queensland Hydro

GDA2020 MGA Zone 56

0 100 200 m

1:9,000 (when printed @ A3)

LEGEND

Watercourses
Tracks

Exploratory Works Project

Access track, portal, and exploratory tunnel
Current option
Orange option (Referral 2023/09461)
Green option (Referral 2023/09461)
Original design (2022)

Aquatic fauna records

Mary River turtle record

Flora records

Coleus torrenticola record
Brush sophora record
Native guava record
Scrub turpentine record

Fauna records

Black-breasted button-quail record
Glossy-black cockatoo record
Greater glider record
Grey-headed flying-fox record
Koala record
Long-nosed potoroo record
Yellow-bellied glider record

Ground-truthed threatened ecological communities

Lowland Rainforest of Subtropical Australia

Yabba Creek

Sandy Creek

Data Sources:
1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
4. Cadastre © State of Queensland (Department of Natural Resources, Mines and Energy) 2024
5. Basemap World Light Gray Canvas Base @ Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

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Exploratory Works Project
Preliminary Documentation

PORTAL OPTIONS

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 29/09/2025
REVISION:	A

FIGURE 45

Document Path: V:\Projects\Roma\Mapping\PD_APRX\Roma_PD_APRX_Relinked_Updated.aprx

6.1.2.2 Spoil disposal area options

Following detailed ecological surveys, and consideration of buffer distances from watercourses and areas of MNES habitat, the design and location of the tunnel spoil disposal area for the Project was robustly evaluated to avoid and then minimise impacts to MNES.

Feasible locations for the tunnel spoil disposal area were identified near the proposed portal location, with a preference for cleared land that likely has a lower MNES habitat value. Feasible locations for the tunnel spoil disposal area included the location identified in the EPBC referral, a location directly adjacent to the new portal pad location, and a location midway between these two options (Figure 46).

These options for the tunnel spoil disposal area were evaluated against the following criteria:

- presence of MNES values and extent of existing vegetation that would need to be cleared
- proximity to the portal pad (haulage distance of material)
- space/room for stockpile
- number of water crossings to traverse/safety considerations
- existing terrain (how level or undulating the ground is).

The chosen location for the tunnel spoil disposal area was the midway location (Figure 46), which is described in further detail in Section 6.2.7. The tunnel spoil disposal area has been located and designed to minimise impacts to MNES by being located in a predominantly cleared area where giant rat's grass is prevalent (refer to Section 3.9.2.4 for a description of this habitat type). It is also mostly co-located within the proposed inundation area for the Main Works lower reservoir to minimise the future total disturbance, thereby avoiding additional impacts if the Main Works Project is approved.

The tunnel spoil disposal area is located above the 1% AEP and has a buffer zone of 50 m to the riparian zone of Sandy and Yabba Creeks. A Spoil Management Plan has been prepared for the Project to minimise potential impacts on the environment (within Appendix F).

Consideration was also given to the off-site disposal of spoil from the exploratory tunnel excavation. However, based on the volume of spoil and the transport vehicles required, it was determined that significant upgrades to Bella Creek Road would be required to allow for off-site disposal. These upgrades would have included road widening and associated clearing of remnant vegetation that includes vegetation that meets the criteria for an EPBC Act listed TEC (the endangered Subtropical Eucalypt Floodplain Forest and Woodland) as well as additional waterway crossing upgrades. Based on the extent of the works that would be required to Bella Creek Road to support off-site spoil disposal, on-site disposal was identified as the preferred option.



Queensland Hydro

GDA2020 MGA Zone 56

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0 100 200 m

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LEGEND

- Watercourses
- Local Roads
- Tracks

Exploratory Works Project

Tunnel spoil disposal area and access track

- Current option
- Referral 2023/09461
- Option directly adjacent to the portal pad (2022)

Ground-truthed threatened ecological communities

- Lowland Rainforest of Subtropical Australia
- Subtropical eucalypt floodplain forest and woodland

Aquatic fauna records

- Mary River cod record
- Mary River turtle record

Flora records

- Coleus torrenticola record
- Brush sophora record

Fauna records

- Black-breasted button-quail record
- Grey-headed flying-fox record

Data Sources:

1. State controlled roads - Queensland © State of Queensland (Department of Transport and Main Roads) 2020
2. Site Layout Items @ SMEC/ GHD / AFRY, 2022-2023
3. Watercourses © State of Queensland (Department of Natural Resources, Mines and Energy) 2022
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Exploratory Works Project
Preliminary Documentation

SPOIL DISPOSAL AREA OPTIONS

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 29/09/2025
REVISION:	A

FIGURE 46

Document Path: V:\Projects\Boumba_PD_Mapsl\Boumba_PD_APRX\Boumba_PD_APRX_Relinked_Updated\PD.aprx

6.1.2.3 Supporting infrastructure

Water pipeline

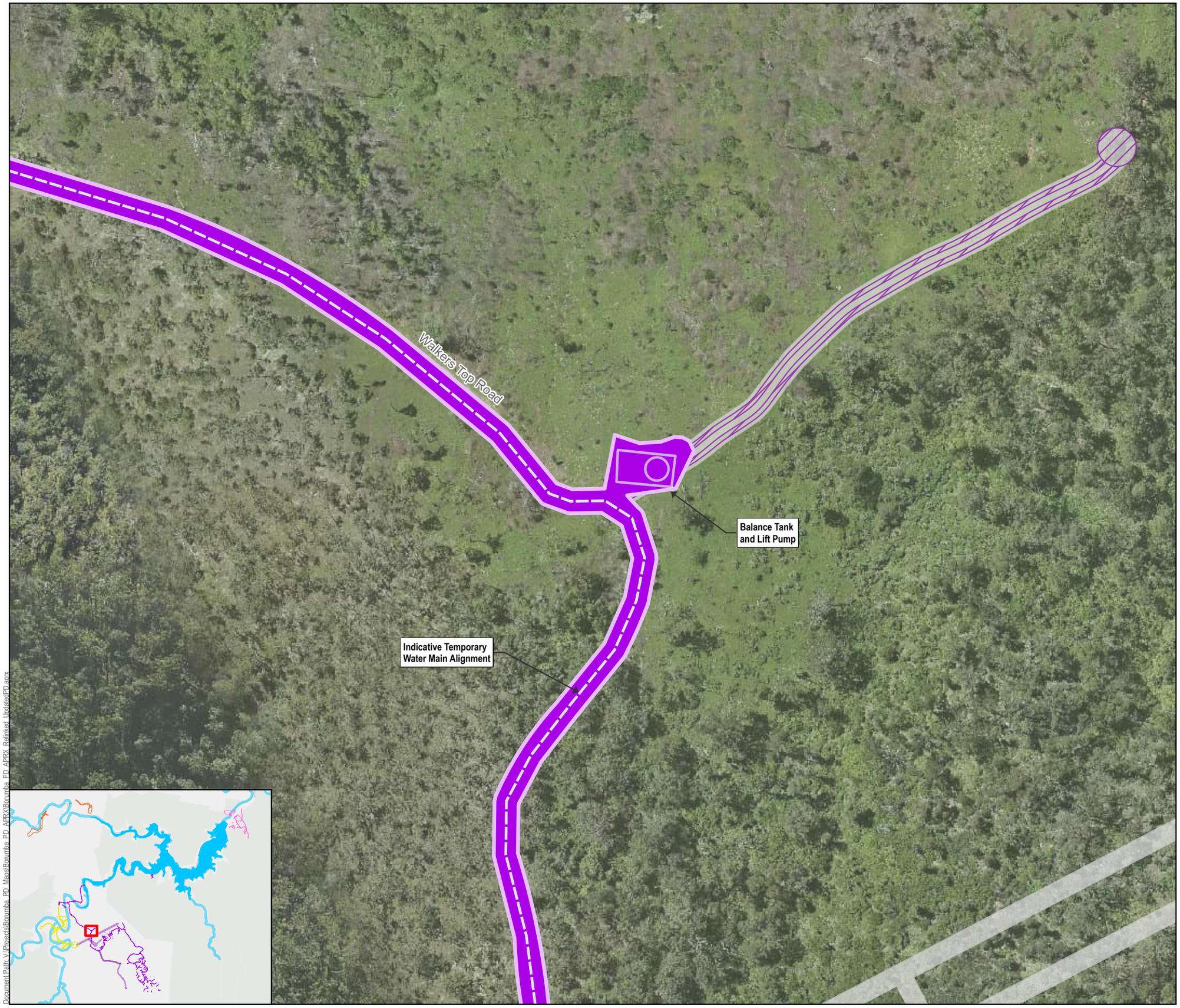
Non-potable water to be used for the access track construction, exploratory tunnel excavation and geotechnical drilling will be extracted by a pump located in the upper reaches of the existing Lake Borumba (Figure 16). The water pipeline connecting the extraction pump to water storage tank farms is expected to be roughly 300 mm diameter and approximately 10 km long. It will be shallow buried (approximately 200 mm below the ground surface) to prevent 'snaking' of the pipeline from expansion/contraction due to temperature changes.

To eliminate any disturbance within the banks and bed of Yabba Creek, two pipeline crossings will be installed by either drilling under the creek or suspending the pipe overhead via a temporary steel bridging structure. The alignment of the pipeline will also minimise potential impacts to MNES by following existing access tracks as much as possible (including Walkers Top Road and an un-named track on the northern side of Yabba Creek – Figure 16) to avoid creating new disturbance areas (refer to Section 2.6.1). Approximately 5 km of the pipeline is proposed to be shallow buried under the centre of the existing unsealed Walkers Top Road, where the terrain is less steep, to avoid disturbance of adjacent vegetation. Where the terrain is steep, the pipeline will be buried adjacent to the existing track.

Associated infrastructure such as the tank farms and lift stations will be located in cleared areas where possible to avoid/minimise potential impacts to MNES (e.g. as in Figure 47).

Emergency helipads

Emergency helipads, which comprised clearing of approximately 0.6 ha vegetation in two locations to allow helicopter landings for emergency evacuation, were included in the EPBC referral. However, subsequent review of the approach to site and safety management determined that these helicopter landing areas would not be required as cleared land adjacent to the Project (outside the referral area) is suitable for landing. As such, the emergency helipads were removed from the Exploratory Works Project.



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Balance Tank and Lift Pump
- Indicative Temporary Water Main Alignment

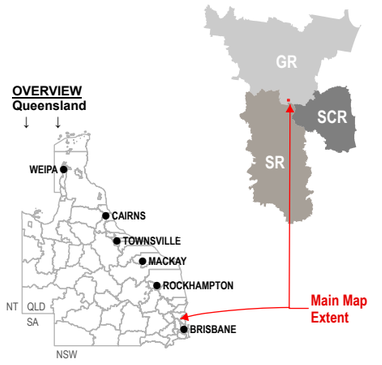
Exploratory Works Project

- Project Area

Project Footprint by Work Area

- Area 3 - Temporary Water Infrastructure
- Area 3 - Other Activities

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



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Exploratory Works Project
Preliminary Documentation

TEMPORARY WATER INFRASTRUCTURE PIPELINE AND LIFT STATION

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LAST MODIFIED:	NC17428, 3/10/2025
REVISION:	A

FIGURE 47

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6.1.3 Refinement of site access requirements

6.1.3.1 New access tracks

New access tracks are required to enable geotechnical investigations where the existing tracks are considered unsafe or where no tracks exist; however, following the controlled action decision, a review of access needs that included additional on-site assessment, was undertaken with the aim of reducing the number and size of new tracks wherever possible. Key considerations in this process included whether:

- Access was possible by existing tracks – if there was an opportunity to use an existing track with a less direct access route to an investigation site, this route and upgrade of the existing track was selected instead of the construction of a new track even if the travel time was longer.
- Tracks could be realigned to reduce the length and/or number of individual tracks – the EPBC referral included a number of new access tracks that were close to each other, but closer review of the terrain determined that in some cases multiple sites could be accessed via a single track with minor adjustments or that more direct routes were possible.
- Alternative access methods could be used – review of the geotechnical investigation methods (as described in Section 6.1.4) enabled the consideration of alternative options for drilling access in steep terrain, with narrower sled or controlled lower tracks that are able to convey equipment directly over steeper gradients determined to be suitable.
- The investigation location was required during the Exploratory Works – review of the new access tracks identified a number of areas with substantial construction challenges that would require extensive cut and fill; where this was the case, the need for geotechnical investigation to occur at the target destination was reviewed and it was agreed that some investigation sites could be deferred to the Main Works (if approved).

This review resulted in a decrease of approximately 15 ha in the footprint of new access tracks. Most of this reduction occurred in heavily vegetated areas (Figure 48).

New access tracks were also designed to avoid a threatened species (native guava) in the proposed footprint, with a number of tracks in Area 3 revised around records of this species.

6.1.3.2 Upgrades to existing tracks

Upgrades to almost all existing unsealed tracks were identified as being required for the Project in the EPBC referral. However, as with the new access tracks, a review of the need for these upgrades was undertaken after the controlled action decision. This review included consideration of:

- The standard of track required – it was determined that the design standard of unsealed tracks for the Exploratory Works could be downgraded, with narrower single lane tracks being suitable for the equipment proposed to be used.
- Whether track widening was necessary – review of the existing tracks determined that widening was not necessary in multiple locations and that surface upgrades were all that would be required to provide safe access for the Project.

This review resulted in a decrease of approximately 10 ha in the footprint of proposed track upgrades, with much of this reduction in heavily vegetated areas.

6.1.3.3 Yabba Creek crossing downstream of Borumba Dam

The Yabba Creek crossing downstream of Borumba Dam, and the associated access track, which are required to access geotechnical investigation sites in the Yabba Creek North area (Figure 10) have been relocated to avoid and reduce environmental impacts. The design proposed in the EPBC referral included a new access track that would require clearing of mature habitat trees.

On site assessment identified an existing track and suitable crossing location upstream of the location proposed in the EPBC referral (Figure 48). This existing track does not require any upgrade works to be suitable for use during the Project, therefore the previously proposed track has been removed from the Project footprint. The new crossing location is currently suitable for vehicle crossing but would require similar works as previously proposed to be suitable for the Project (refer to Section 2.5.1.3 for a description of the works needed).

This change resulted in a decrease in footprint of approximately 0.1 ha.

Inset A: Borumba Dam

Yabba Creek

Old Forest Drive

Yabba Creek

Yabba Creek Road

Old Forest Drive

Borumba Creek

Sandy Creek

Borgan Road

Walkers Top Road

Yfelo Road

Inset B: Walkers Top

Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- State Controlled Roads
- Local Roads
- Tracks

Exploratory Works Project

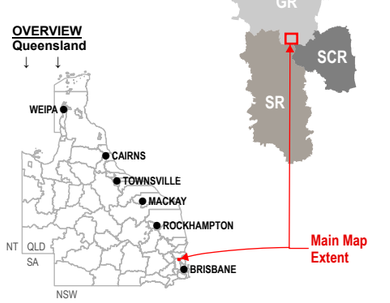
Exploratory Works Footprint - Current

- Existing Tracks to be Upgraded
- New Tracks

Exploratory Works Footprint - Referral 2023/09461

- Existing Access Track Upgrades
- New Access Tracks

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland

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Exploratory Works Project
Preliminary Documentation

CHANGES TO ACCESS TRACKS SINCE THE REFERRAL

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LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 48

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6.1.4 Approach to geotechnical investigations

Geotechnical investigations are required at key or critical design locations for the Main Works (e.g. proposed upper and lower reservoir dams, quarries (including an historical quarry location), bridge locations) to allow the development of an appropriate ground model. The ground model will be used to reduce the risk for the Main Works design. The geotechnical investigations include test pits, boreholes (deep and shallow, including some groundwater bores), and geophysical testing.

A description of the geotechnical investigations proposed, including a description of the methods, was included in the EPBC Exploratory Works Referral Report, Sections 1.5.4 pp. 16-25. Following the submission of the referral and the controlled action decision, the preferred option for the exploratory tunnel alignment and portal pad was selected and a number of the Project's supporting infrastructure components were relocated to previously cleared areas. This enabled some disturbance and clearing associated with geotechnical investigations to be avoided.

Further reductions in impacts caused by geotechnical investigations were achieved through a detailed review of proposed number of investigation sites, their locations, the need for investigation at those locations during the Exploratory Works phase, and the investigation methods/equipment. As a result of this review, it was determined that:

- Information from geotechnical drilling above the exploratory tunnel could initially be obtained through alternative methods used during the construction of the exploratory tunnel (i.e. diamond probe drilling ahead of drill and blast activities). This led to the exclusion of drill pads targeting the tunnel and their associated new access tracks from the Project.
- Information from geotechnical drilling in the Conondale Resources Reserve (5AP23765) above the proposed tailrace tunnel, could be deferred to the Main Works (if approved), with information obtained from drilling sites outside the resources reserve.
- The number of geotechnical investigation sites and the size of the drill pads could be reduced, with multiple boreholes drilled from a single drill pad and drill pads co-located with access tracks as much as possible.
- Costeans are not required during the Exploratory Works, with drilling and test pits providing sufficient information ahead of the Main Works.
- Geotechnical drilling in steep terrain could be undertaken using alternative equipment that can be transported down slopes via sled tracks or controlled lowering (if necessary).

Geotechnical investigations are described in Section 2.3. As a result of the avoidance and minimisation measures applied during the above review, the footprint associated with the geotechnical investigations was decreased by approximately 8.5 ha.

The exact locations of geotechnical investigation footprints including tracks, pads and boreholes will be preferentially selected to avoid impacts to MNES. Micro-siting of investigation sites will be undertaken with the aim of avoiding or minimising the removal of habitat features including, but not limited to mature habitat trees, hollow-bearing trees, denning structures, preferred foraging trees and fungi. Investigation sites in the Dam Track North area (Figure 11), which is south of the proposed Main Works upper reservoir main dam wall, have been verified in the field, avoiding the need to clear hollow-bearing trees and most canopy trees. This reflects the open nature of the woodland in this area compared to other sections of the footprint. Some field verification of investigation sites in the Yabba Creek North area in Area 1 (Borumba Dam) has also been undertaken, with confirmation that clearing of large trees and native vegetation can be avoided for some sites (e.g. some on the southern banks of Yabba Creek in Figure 10).

The size of the Project area was also increased in Area 3 (Walkers Top) to provide increased micro-siting opportunities. Due to the presence of sensitive environmental and cultural heritage values in and around the Power Track south geotechnical investigation area and the steep terrain adjacent to Lake Borumba (Figure 11) the nominated geotechnical locations and associated access tracks may need to be relocated. The increased Project area around these proposed investigation sites will improve the capacity for relocation without increasing the identified impacts associated with the current Project footprint.

6.2 Mitigation and management – RFI item 5.1(b-d and j-l)

6.2.1 Management plans

The following management plans and supporting plans have been developed for the Exploratory Works Project and outline the measures to manage potential impacts with a focus on MNES:

- Borumba Pumped Hydro Energy Storage Project – Exploratory Works Construction Environmental Management Plan
- Borumba Pumped Hydro Energy Storage Project – Exploratory Works Preliminary Erosion and Sediment Control Plan (PESCP)
- Borumba Pumped Hydro Energy Storage Project – Exploratory Works Spoil Management Plan
- Borumba Pumped Hydro Energy Storage Project – Exploratory Works Waste Management Plan
- Borumba Pumped Hydro Energy Storage Project – Exploratory Works Flora and Fauna Management Plan (FFMP)
- Borumba Pumped Hydro Energy Storage Project – Exploratory Works Water Management Plan.

The supporting plans identified above are subordinate to the CEMP, and all of the plans are provided in Appendix F.

Queensland Hydro has also received approval to disturb breeding places under the Queensland *Nature Conservation Act 1992* via a Species Management Program – High Risk of Impact.

Management measures are primarily provided within a set of supporting plans that are subordinate to the Exploratory Works Project CEMP. These are outlined in Table 8 of the Exploratory Works CEMP (Appendix F), while mitigation measures are also outlined for each species in Section 7. The likelihood of success of the management measures identified in the CEMP was assessed qualitatively into one of three categories based on the following:

- Low – indicates limited capacity in terms of on-ground implementation (i.e. management cannot be implemented with certainty).
- Moderate – indicates moderate capacity for on-ground implementation of management measures (i.e. where there is potential for complaint or required clearing of sensitive vegetation).
- High – indicates a high capacity for on-ground implementation of management measures (e.g. implementation of exclusion zones to prevent non-compliant clearing of vegetation).

All management measures were assessed as having a moderate or high likelihood of success.

Queensland Hydro is committed to implementing ongoing monitoring of the effectiveness of the measures with contingency (under an adaptive management framework) to change/improve management strategies where deleterious impacts to the identified environmental values are observed, or are not minimised, as per the objectives of the proposed measures.

Monitoring is a critical component of quantifying effectiveness of a specific mitigation measure (van der Ree, Clarkson, & Holland, 2008) (van der Grift, van der Ree, & Jaeger, 2015). This is because the success of mitigation measures are heavily reliant on factors such as existing environment, habitat, species, climate, design components of the linear infrastructure, and operational frequency of the transport; due to these factors it is not feasible to provide a quantification of effectiveness of the Project's mitigation measures (Ghent, 2018).

The management plans include standard environmental impact management measures and monitoring measures in accordance with best practice.

6.2.2 Flora and fauna management measures

The FFMP describes measures to minimise and mitigate potential impacts on flora and fauna, including general measures that apply to all MNES and measures for specific MNES.

General mitigation and management measures that apply to all MNES described in the FFMP include:

- Hygiene protocols are designed to manage the risk of introducing or spreading weeds and pathogens.

- Pre-clearance surveys to identify threatened species and habitat values so that measures can be implemented to minimise mortality, stress, injury, or introduction of disease.
- Micro-siting of geotechnical activities, access tracks, and infrastructure to avoid (in the first instance) and minimise impacts to vegetation (clearing), known and newly identified threatened flora records and habitat features such as hollow-bearing trees, wherever it is safe to do so.
- Restricted areas such as exclusion and buffers zones, including a clearing boundary around the Project footprint to protect MNES from accidental clearing and indirect impacts.
- Fauna exclusion fencing around active work areas that pose an ongoing safety risk to (primarily) ground-dwelling fauna and around turtle nesting areas, if detected during pre-clearance surveys.
- Progressive and sequential clearing to direct fauna into adjacent (retained) vegetation.
- Unexpected threatened species finds protocol to provide a procedure for addressing newly identified threatened species records in the Project footprint.
- Weed management to manage the risk of introducing or spreading weeds around the Project area.
- Vehicle operation and management, including installation of wildlife crossing warning signs and speed limits.
- Measures to mitigate potential indirect impacts including air quality, noise and vibration, and artificial lighting.
- Measures to mitigate and manage potential contamination, accidental bushfires, erosion and sedimentation, invasive pests and disease, water quality.

Measures such as hygiene protocols, pre-clearance surveys, fauna fencing, micro-siting, progressive clearing, weed management, erosion and sediment control, and vehicle management measures are all standard mitigation measures regularly implemented successfully across a wide range of construction activities (including Exploratory Works) to manage, mitigate, and minimise impacts on the environment. Their effectiveness at mitigating environmental impacts is well established and referred to in a range of MNES Conservation Advices, guidelines, and policies under the EPBC Act. In this regard, their effectiveness as suitable and appropriate mitigation measures is well understood.

The following sections describe how exclusion and buffer zones and fauna exclusion fencing will mitigate impacts on specific MNES. Also provided are descriptions of measures to manage the spread of myrtle rust and the tree hollow replacement strategy developed to provide additional nesting and denning habitat for MNES that use tree hollows.

6.2.3 Exclusion and buffer zones – RFI item 5.1(e-f)

Restricted areas such as an exclusion and buffer zones will be established as part of the Exploratory Works zones to protect MNES and their habitat in the vicinity of the Project footprint. These zones are shown in Figure 49 and defined as follows:

- **Exclusion zones** – Areas where no Project works, including clearing, will occur. They comprise areas of national park, sections of Conondale Resources Reserve lots where no works are proposed, and areas with specific values such as TECs, known populations of native guava and *Coleus torrenticola*, and their 'known' habitat (as defined in Appendix E), within the Borumba PHES Survey area.
- **Buffer zones** – Areas where clearing is preferably avoided or, if unavoidable, to be minimised. They comprise TEC buffer zones and areas with known populations of scrub turpentine and brush sophora and their 'known habitat' within the Borumba PHES Survey area.

Other restricted areas, including exclusion and buffer zones, are expected to be established during the Exploratory Works in response to the outcomes of on-going site assessments and pre-clearance surveys. In addition to the protection of the environmental values associated with exclusion and buffer zones, restricted areas may also be established to protect or prevent the disturbance of culturally sensitive areas, existing contamination from past activities, breeding places for threatened species, trees containing koalas, areas beyond the limit of clearing, or other matters. For example, if a turtle nest is identified during a pre-clearance survey, a restricted area will be established around the nest to prevent access and implement protective measures in accordance with the FFMP.

All restricted areas, including exclusion zones, will be clearly demarcated around the Project footprint using high visibility flagging/temporary fencing/bunting prior to any clearing occurring on site. The exclusion and buffer zones will be defined on construction drawings and georeferenced for use by onsite staff. Fencing and signage will be

regularly monitored and any damaged fencing, missing or fallen flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition and are visible to clearing contractors.

Exclusion zones and restricted areas around sensitive environmental areas are regularly implemented in construction projects and their effectiveness at managing potential direct and indirect impacts of construction activities is well known. The following sections describe how exclusion and buffer zones have been applied in the Project area with respect to TECs and threatened flora.

6.2.3.1 Threatened ecological communities

An exclusion zone has been applied to all patches of TEC that are not within the Project footprint. A 50 m buffer zone has been applied to all patches of TEC in the Borumba PHES Survey area. This is consistent with the Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia (TSSC, 2011) and Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions (DCCEEW, 2022).

The Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions (DCCEEW, 2022) states that a buffer zone of at least 50 m helps protect a patch from many potential adverse impacts and that a larger buffer zone (e.g. 100 m) should be applied, where practical, to protect patches of high conservation value or where indirect impacts are more extensive. The Conservation Advice states that judgement should be exercised to determine an appropriate buffer distance, depending on circumstances and how a patch may be detrimentally impacted. A 50 m buffer zone is deemed appropriate for the Project as the indirect impacts are anticipated to be minimal and impacts to the buffer zone are limited.

The Project components have been located to avoid TECs and their buffers, wherever possible. However, there are some exceptions where clearing within the 50 m buffer zone is required. This includes for the explosive store in Area 4 (Borgan), which must have a separate distance of at least 612 m from buildings and active working areas to ensure a safety buffer in accordance with health and safety requirements under Queensland legislation and Australian Standards. Some existing access tracks are also located within 50 m of TEC patches, therefore upgrades to these access tracks are unavoidably located within the buffer; however, widening of existing tracks requires only minimal vegetation clearing compared to new tracks. A limited number of new access tracks are also within 50 m of TEC patches due to the need to access critical geotechnical investigation sites; clearing in these areas will be minimised to the greatest extent possible.

The 50 m buffer is considered sufficient to protect the TEC patches from indirect impacts including dust, light, and weed incursion, which as described in Section 5.3.3, could affect vegetation approximately 25 m from the forest edge. These buffer and exclusion zones will also assist with preventing the spread of myrtle rust from infected areas of TEC to uninfected areas of TEC.

The TECs and the 50 m buffer around TECs in the vicinity of the Project footprint will be clearly demarcated ahead of clearing activities and will remain in place for the duration of the Project. Exclusion and buffer zone demarcations will be inspected daily on work days and repaired, if required.

6.2.3.2 Threatened flora

Buffers were applied to all threatened flora individuals recorded during the field surveys. The distance of the buffer zones considered potential edge effects (estimated at 25 m in Section 5.3.2) and suitable habitat for the species. A 30 m buffer was applied to the following four threatened flora species:

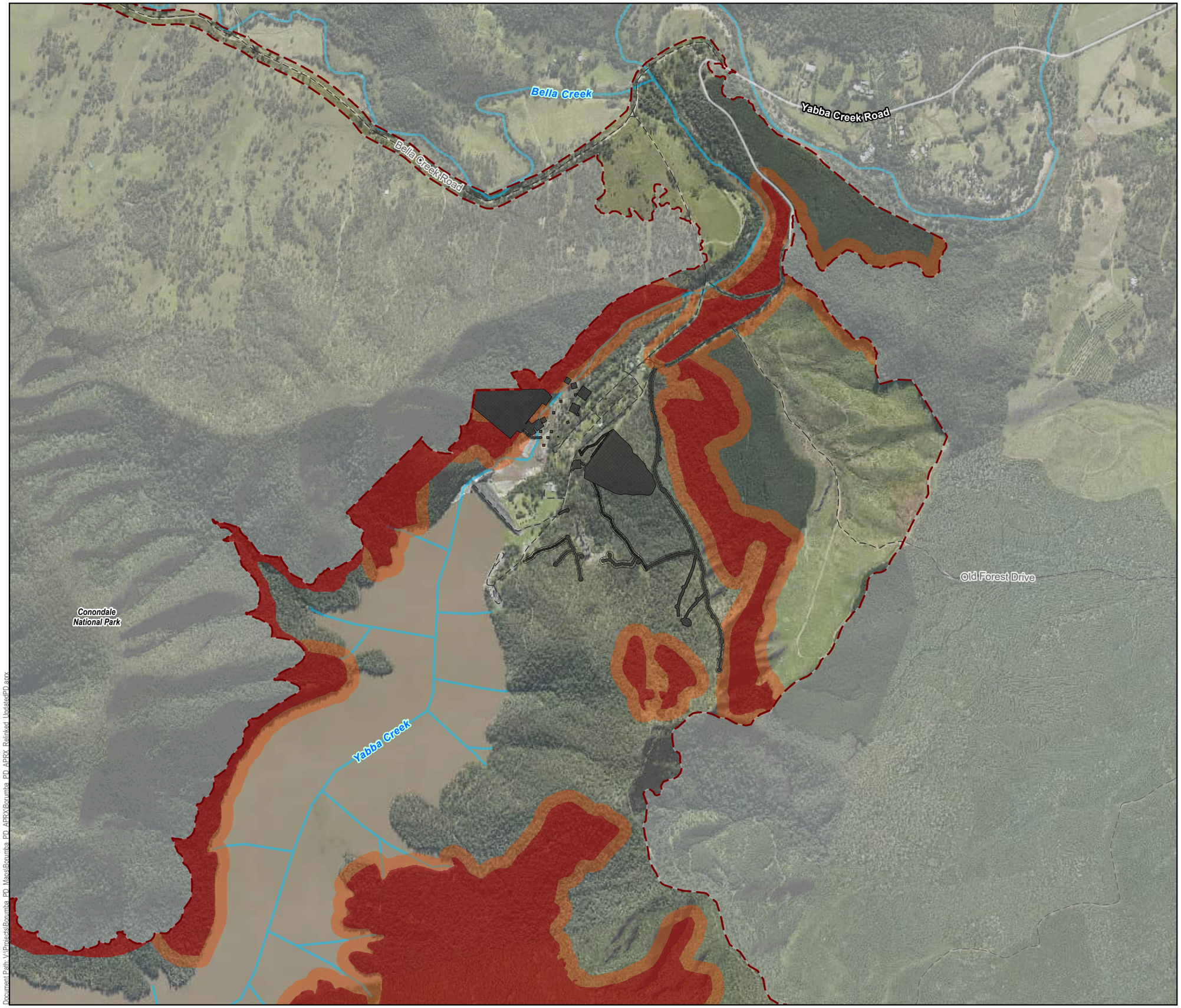
- *Coleus torrenticola*
- native guava (*Rhodomyrtus psidioides*)
- brush sophora (*Sophora fraseri*)
- scrub turpentine (*Rhodamnia rubescens*).

The buffers for *Coleus torrenticola* and native guava will be established as exclusion zones, while the buffers around brush sophora and scrub serpentine will be established as buffer zones.

Exclusion and buffer zones around threatened flora records will be clearly demarcated using temporary fencing, to restrict access around the records. Fencing will be inspected daily and repaired as required.

These zones will also assist with preventing the spread of myrtle rust from infected native guava and scrub turpentine plants to uninfected plants.

Further, the exclusion zones around known native guava records in Area 3 (Walkers Top) ensures that known native guava records will be protected from any changes to the Project footprint in Area 3 (Walkers Top).



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

- Watercourses
- Local Roads
- State Controlled Roads

Exploratory Works Project

- Project Footprint
- Project Area
- Borumba PHES Survey Area
- Exclusion Zones
- Buffer Zones
- Beyond Borumba PHES Survey Area

Note: This figure shows exclusion and buffer zones for the Exploratory Works Project only. These zones are not relevant the Main Works Project.

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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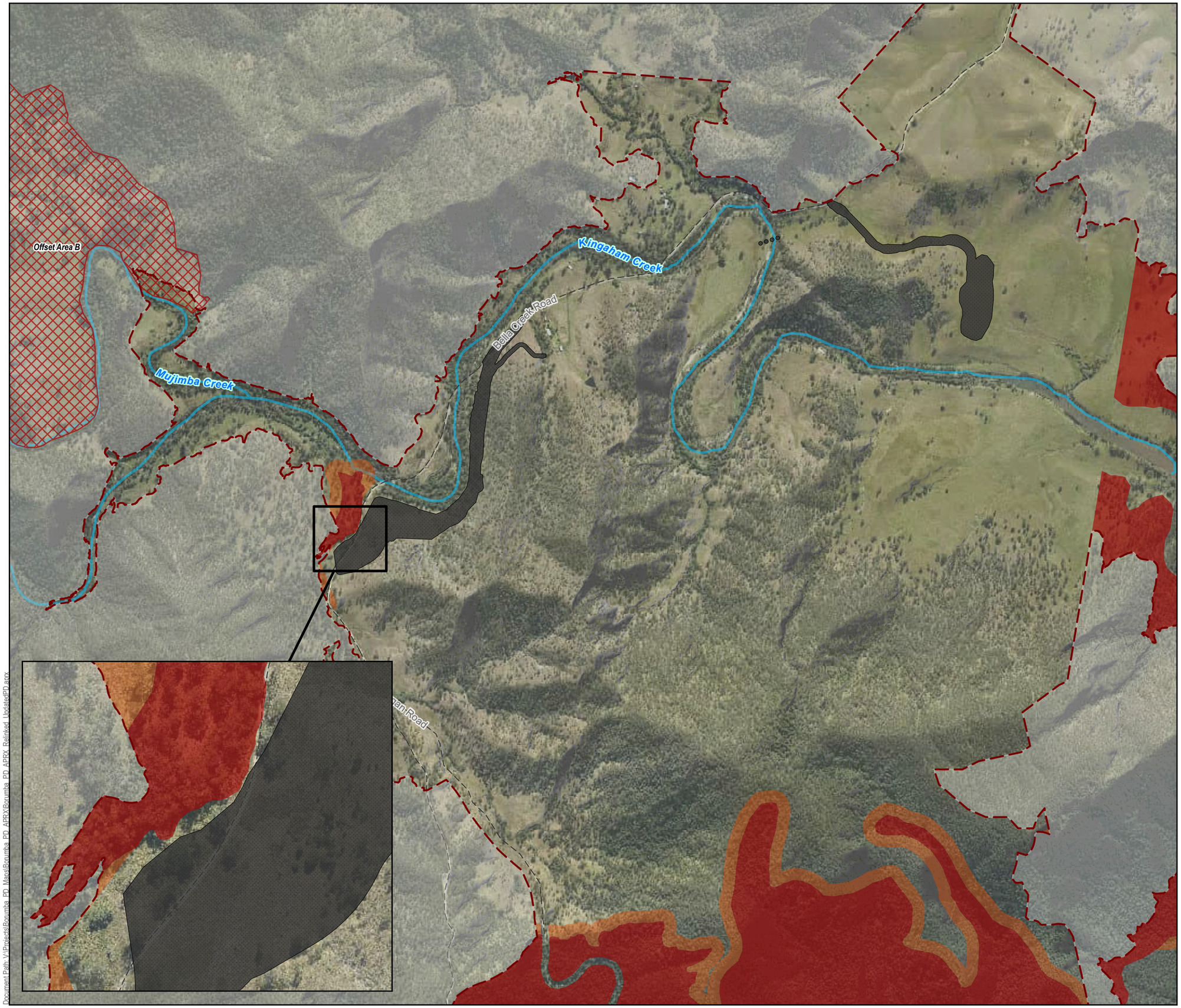
Exploratory Works Project
Preliminary Documentation

EXCLUSION AND BUFFER ZONES (AREA 1 - BORUMBA DAM)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 3/10/2025
REVISION:	B

FIGURE 49a

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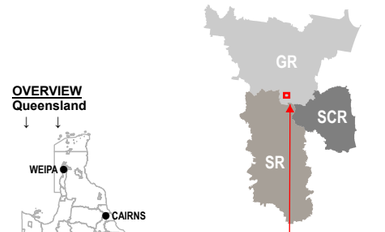
- Watercourses
- Local Roads

Exploratory Works Project

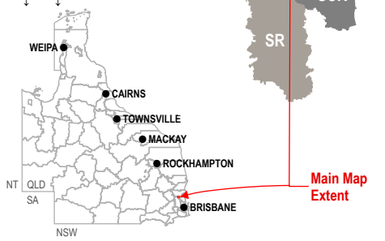
- Project Footprint
- Project Area
- Borumba PHES Survey Area
- Exclusion Zones
- Exclusion Zone (Offset Area)
- Buffer Zones
- Beyond Borumba PHES Survey Area

Note: This figure shows exclusion and buffer zones for the Exploratory Works Project only. These zones are not relevant the Main Works Project.

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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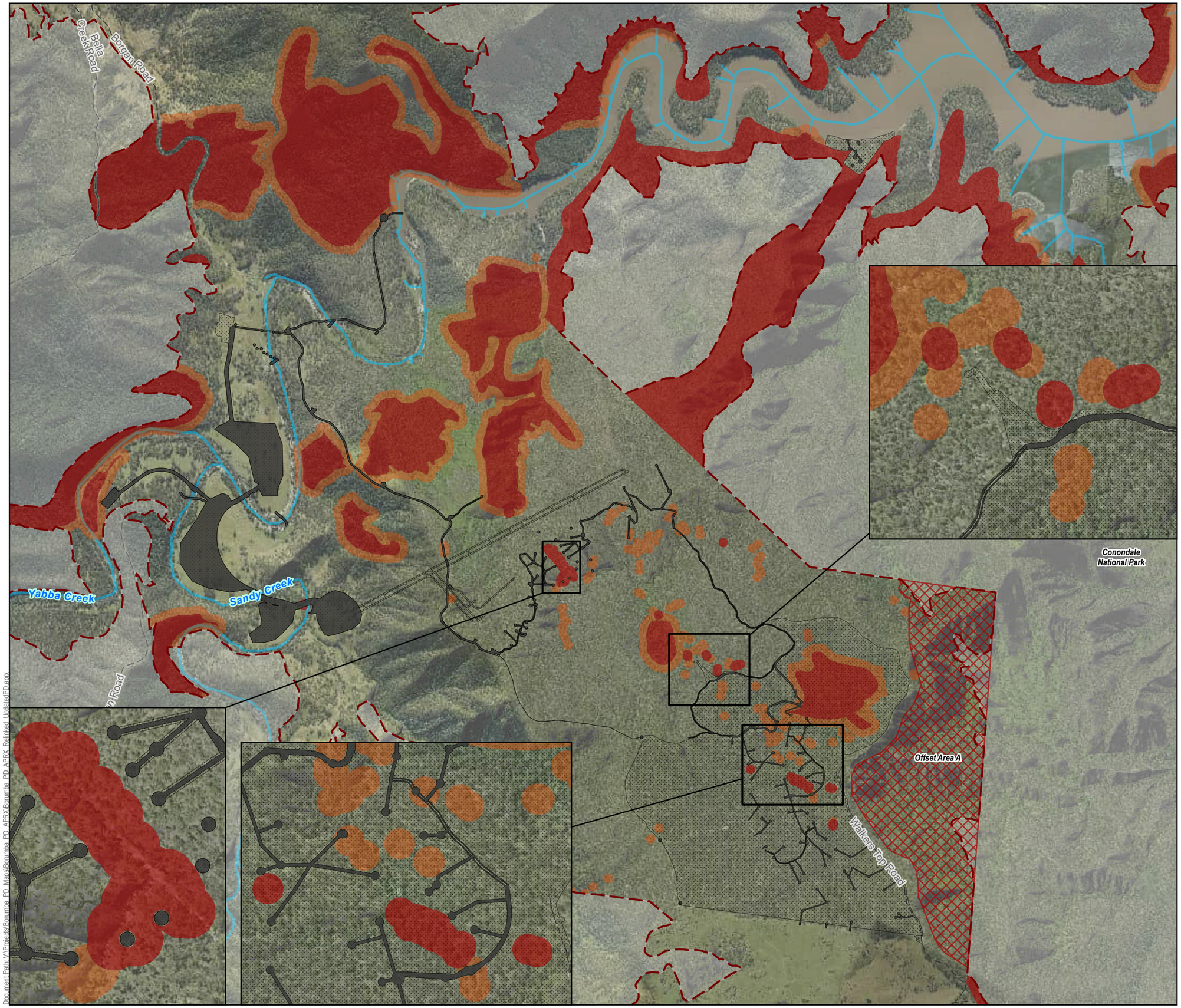
Exploratory Works Project
Preliminary Documentation

EXCLUSION AND BUFFER ZONES (AREA 2 - KINGAHAM CREEK)

PROJECT #:	30032677/30032772
CREATED BY:	BM
LAST MODIFIED:	NC17428, 3/10/2025
REVISION:	A

FIGURE 49b

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- Watercourses
- Local Roads

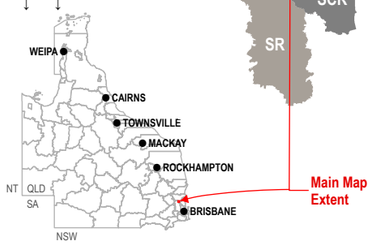
Exploratory Works Project

- Project Footprint
- Project Area
- Borumba PHES Survey Area
- Exclusion Zones
- Exclusion Zone (Offset Area)
- Buffer Zones
- Beyond Borumba PHES Survey Area

Note: This figure shows exclusion and buffer zones for the Exploratory Works Project only. These zones are not relevant the Main Works Project.

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional

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Exploratory Works Project
Preliminary Documentation

EXCLUSION AND BUFFER ZONES (AREA 3 - WALKERS TOP AND AREA 4 - BORGAN)

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FIGURE 49c

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6.2.4 Fauna exclusion fencing

6.2.4.1 Ground-dwelling terrestrial fauna

Fauna exclusion fencing will be installed at the civil construction compound, where there is a high level of regular vehicle and plant activity and stockpiled materials that could be attractive as refuge sites that pose an ongoing safety risk to (primarily) terrestrial fauna.

The location of fauna exclusion fencing is shown on Figure 50.

As most of the works will occur in an area mapped as koala habitat, fencing identified in Figure 50 will align with Koala Sensitive Design Guideline - A guide to koala-sensitive design measures for planning and development activities (DES, 2022). Best practice measures, which will be determined by the construction contractor, include:

- Fencing material consisting of brick, metal sheeting, Perspex or timber fencing with no gaps between palings creates a smooth unclimbable surface to koalas.
- Fencing supports and posts are located within the zone where koalas are being excluded, or they are fitted with a koala shield.
- Unclimbable sheeting (metal or Perspex) 600 mm or greater in width is retrofitted to the fencing and gates to prohibit climbing by koalas. The top of the sheeting is 1.5 m from the ground to prohibit koalas jumping up and grabbing the fencing material above the sheeting.
- Sheeting is fitted to fencing material at a height that is comfortable for a koala jumping from the fence to the ground. For example, 1.8 m high fencing should fit sheeting at 0.9 m to 1.5 m off the ground, not at the top of the 1.8 m high fence.
- Fencing is flush with a cement edging on the ground or retrofitted with additional wire to prohibit erosion and washouts where gaps under the fence will allow egress by koalas.
- Particular attention needs to be paid to gates to ensure it is not a point of entry for koalas, either when left open or where the gates provide gaps.
- Fencing is installed with a skirt of chain mesh (permanent) or corflute (temporary) of minimum 1.0 m width, that is fixed to the base of the fence (up to 300 mm) with the remainder resting on the ground, prohibiting the pushing or digging under the fence by animals. This is particularly necessary where the ground is uneven, or undulating or temporary/construction fencing is erected.
- Fencing has a 90 degree return of at least 50 m in length at the fencing boundaries to encourage koalas back into the bushland and not onto the road or other unsafe environment where the fence ends. Ideally the end of the return is angled back into the patch of habitat.
- Floppy top fencing – previously used in New South Wales (NSW Road and Maritime Services is now installing chain link with metal panel in preference to floppy-top fencing).
- Trees and shrubs are excluded from within 3 m of the fence and tree canopies of trees adjacent to the fence are trimmed to remove links to tree canopies on the other side of the fence.

Fauna exclusion fencing will also likely follow the design in some areas, such as where security fencing is required (Appendix J of the CEMP (Appendix F)).

These designs have been proven to be effective at preventing movement of most fauna from entering hazardous areas.

Fauna exclusion fencing will be inspected daily and maintained, as required.

6.2.4.2 Aquatic fauna

Turtle nesting areas will be identified during pre-clearance surveys and, where identified, will be fenced before the nesting season and before any works in the area of an identified turtle nesting habitat. In these locations, fauna exclusion fencing appropriate for turtles will be installed around the works area and perpendicular to the water's edge along the banks between instream works areas and nesting reaches. This will minimise safety risks to threatened turtles by preventing turtles from accessing the construction areas and prevent personnel, vehicles and machinery from approaching active turtle nesting areas. Fauna exclusion fencing for turtles is regularly applied and known to be effective at mitigating potential impacts on turtles.

Identified turtle nests will also be protected from predators by fixing 70-100 cm plastic or wire mesh covers with 5-10 cm grid-size over nests, which will be kept in place with turf pegs, tent pegs or something suitably similar (DAWE, 2020). The nest will be positioned in the centre of the mesh. The plastic mesh covers will render the nest areas easily visible to workers and prevent people/vehicles from disturbing the nests and prevent predators burrowing and accessing the eggs, while allowing emerging hatchlings to pass through the mesh. Mesh covers over turtle nests are regularly used in conservation efforts and are proven to be effective at protecting them from predators. They are a recommended measure for protecting nests for other freshwater turtle species including Bell's turtle (*Myuchelys bellii*) (Streeting, et al., 2021).

These mitigation measures were developed in accordance with the Conservation Advices for the Mary River turtle and white-throated snapping turtle.

6.2.5 Myrtle rust management

Myrtle rust is widespread throughout the Exploratory Works Survey area and difficult to contain as it is an airborne pathogen; however, management measures will be implemented to assist with managing its spread around and beyond the Project area.

Myrtle rust management includes installing buffer zones around all scrub turpentine (*Rhodamnia rubescens*) and native guava (*Rhodomyrtus psidioides*) records in the vicinity of the Project footprint and implementing hygiene protocols (described in the FFMP within Appendix F). Clearing will also be staged in a manner that minimises the movement of plant and equipment, along with the movement of material from infected areas to uninfected areas.

Material required for the Project including vegetation required for rehabilitation will need to be free of myrtle rust.

Queensland Hydro is currently consulting with Queensland DPI plant pathologists around the management of myrtle rust onsite, including whether the treatment of plants in the wild with a fungicide will be an effective control. Fungicide treatment in the wild is not an effective long-term solution and the application of fungicide will not be possible near a waterway and would generally require a rotation of fungicides containing different active ingredients to ensure fungicide applications remain effective.

For plants to be cleared fungicide treatments will likely be applied to allow the germplasm or seeds to be collected to secure genetic diversity for future populations. Though some material has already been collected by DPI from the scrub turpentine and native guava populations onsite, with the samples currently undergoing genetic analysis. These measures have been developed in accordance with the Conservation Advices for the species and the National Action Plan for myrtle rust (Makinson, Pegg, & Carnegie, 2020).



Queensland Hydro

GDA2020 MGA Zone 56

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LEGEND

Watercourses

Exploratory Works Project

Project Area by Work Area

- Area 3 - Walkers Top
- Area 3 - Walkers Top (Underground)
- Area 4 - Borgan

Fencing

- Barbed Wire
- Fauna Exclusion Fencing
- Standard Gate

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



OVERVIEW
Queensland



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Exploratory Works Project
Preliminary Documentation

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AREA 4 - BORGAN

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FIGURE 50a

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LEGEND

Watercourses

Exploratory Works Project

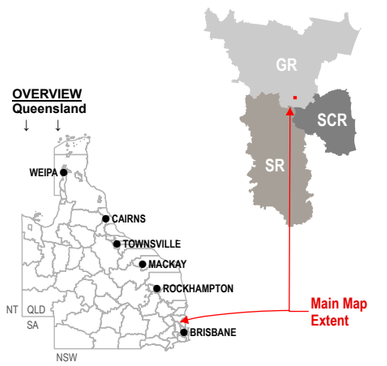
Project Area by Work Area

Area 1 - Borumba Dam

Fencing

Temporary Construction Fencing

OVERVIEW
Gympie Regional, Somerset Regional, Sunshine Coast Regional



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Exploratory Works Project
Preliminary Documentation

FENCING
AREA 1 - BORUMBA DAM

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CREATED BY:	BM
LAST MODIFIED:	NC17428, 1/10/2025
REVISION:	A

FIGURE 50b

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6.2.6 Tree hollow replacement strategy

A tree hollow replacement strategy will be implemented to mitigate the loss of hollow-bearing trees. Hollow-bearing trees provide potential denning habitat for greater gliders and yellow-bellied gliders, and potential nesting habitat for glossy black-cockatoos.

Replacement hollows will be installed in trees adjacent to the Project footprint in areas of contiguous suitable habitat that are to be retained into the future (including outside of areas proposed to be developed for the Main Works Project) and managed by Queensland Hydro. This will ensure the replacement hollows won't be disturbed by future works, have good connectivity for the species to other areas of habitat, and access will be available for maintenance and monitoring.

The first preference will be to 'salvage' the natural hollow from the tree once it is felled and attach it to a host tree. The benefit of natural hollows is that they are typically in a natural formed shape, with good thermal properties and are robust and generally last a long time in nature. Note that larger salvaged hollows (entrance diameter >10 cm) will be prioritised at the offset site. Any salvaged hollows not used at the offset site, including smaller salvaged hollows (entrance diameter <10 cm) will be installed in contiguous habitat adjacent to the Exploratory Works Project footprint.

The second preference is to create carved (e.g. chainsaw, entrance-drilling or using the HollowHog Tool) hollows. The benefit of carved hollows is that they provide a more stable thermal environment that is comparable to natural hollows (Griffiths, et al., 2018). They may also better mimic the physical appearance of a natural hollow, allow easy access and provide less exposure to predators compared to typical nest boxes (Terry, Goldingay, & van der Ree, 2021).

The third preference is the use of built boxes that are designed to cater for the target species and be installed using the specifications summarised in FFMP (Appendix J of the CEMP (Appendix F)). Built boxes can be built to required sizes and specifications (to reflect species specific requirements), they can be painted white with heat reflective paint to keep them cooler in hot temperatures, and they are light and more easily installed. Recycled plastic boxes can last up to 30 years.

There will be two nest box designs used – one for large gliders (greater gliders and yellow-bellied gliders) and one for glossy black-cockatoos.

Further information about the tree hollow replacement strategy and types of nest boxes to be used is provided in the FFMP (Appendix J of the CEMP (Appendix F)). It is noted that implementation of this hollow strategy has not been included as a contributing factor in the significant residual impact assessment for glider species.

Case studies suggest that glossy black-cockatoos readily use nest boxes (Berris, Barth, & Mooney, 2022) and there are results coming out of nest box programs in central Queensland, NSW and Victoria where greater gliders are successfully using replacement hollows including salvaged natural hollows, and installed nest boxes made from recycled plastic and plywood. In February and April 2022, 120 nest boxes were installed in fire-affected forests in Tallaganda National Park and state forest in NSW and a further 114 near Bendoc in East Gippsland, Victoria by World Wide Fund for Nature (WWF). It has been found that greater gliders are using the installed boxes. Some boxes were found supporting up to three gliders. These are likely to be a mating pair and an immature offspring (WWF, 2023). In central Queensland nest box monitoring, which has been conducted over 18 months, has found a number of individual greater glider in boxes, as well as female greater gliders and their young (Nottidge, 2024). Monitoring has also shown greater gliders to be using all nest box designs (Ezzy, 2024). Other studies have shown gliders tend to prefer salvaged hollows or carved hollows (DCCEEW, 2022; DCCEEW, 2022; Griffiths S., 2019, Terry, Goldingay, & van der Ree, 2021).

Emerging research found that the time for a nest box to be used by a greater glider was rapid, at an average of 34 days after time of installation, with camera monitoring over the course of a year revealing 100% colonisation across seasons regardless of nest box design (Ana Gracanin, 2025).

Monitoring of both natural and artificial hollows will be undertaken, drawing on established frameworks such as those outlined in the Habitat Survey for Bushfire Recovery for Wildlife and Habitat Community Grants Program (Croft, 2020) to guide effective placement and maintenance. Replacement hollows will be monitored every six months for the first two years following installation, with at least one round of monitoring will take place during the glossy black-cockatoo breeding season. Monitoring will record uptake by the target species (and non-target species) and note the integrity of the hollows. If any hollows show signs of deterioration or presence of exotic or

pest species, the hollows will be maintained and addressed as soon as practical to ensure replaced hollows are suitable for target species.

6.2.7 Management of spoil and contamination – RFI item 5.1(g)

The Spoil Management Plan (Appendix B of the CEMP (Appendix F)) describes how the Project proposes to manage potential impacts to the environment during the handling, transport, and emplacement of spoil, and seeks to maximise the beneficial use of spoil to reduce waste.

The plan outlines the approach for future investigations to ensure that contaminated materials are identified, that spoil management is in accordance with the waste hierarchy documented within Queensland's Waste Management Resource Recovery Strategy (Queensland Government, 2023) and that reuse/disposal is in accordance with relevant legislation and policies.

Rock geochemistry testing is currently in progress for some of the groundwater monitoring boreholes, which includes an assessment of sulphides to understand acid rock potential. Leachate testing for spoil stockpile contamination potential of reservoir waters is also currently in progress.

Future investigations will be undertaken to include sufficient sampling to enable in-situ waste classifications for material associated with bulk excavations at the specified excavation sites (to the extent possible).

During excavations, materials that are contaminated and not suitable for remediation and on-site storage will be loaded directly onto licensed transport vehicles for disposal at an appropriate licenced facility. Stockpiling of contaminated soils will be avoided where possible via the in-situ waste classification of potentially contaminated materials to rapidly remove all such materials identified.

Solid material coming out of the tunnelling operation (500 mm minus shot rock) will be placed in a temporary stockpile on the portal pad where each work day it will be loaded into trucks and taken to the tunnel spoil disposal area.

At the spoil disposal areas, the material (e.g. blasted rock) will first be put in a pile separate to the main stockpile and tested for contaminants. Any material found to contain contaminants will be segregated until the material is remediated in accordance with a remediation action plan or removed offsite to a licensed facility for disposal. Material found to be free of contaminants will be combined into the main stockpile by dozer push.

Raw water will be sourced from Lake Borumba, via the water pipeline infrastructure, for dust suppression and materials moisture conditioning associated with the surface civil works construction (roads and tracks) that occur before exploratory tunnelling begins. Raw water and recycled water from the groundwater ingress into the tunnel will also be used for dust suppression in other areas, weed washdown and to support drilling activities.

If ASS or acid forming rock are excavated, they will be reused on site, where possible, following remediation or transported offsite for reuse or disposal at an approved facility.

Stockpile material will be spot tested for ASS, PASS, potential acid forming rock, and contaminants. Spoil that is contaminated will be managed in accordance with the CEMP and, if required, disposed of in accordance with the Waste Management Plan. The Waste Management Plan (Appendix C of the CEMP (Appendix F)) provides a guideline for responsible management of waste generated during the Project and identifies that unusable spoil will be taken to an appropriate facility for processing and/or reuse.

Verification surveillance activities by independent certifiers shall be performed during work for the identification and handling of spoils from the Project.

6.2.8 Spoil disposal – RFI item 5.1(h)

The tunnel spoil disposal area in Area 4 (Borgan) is located off Borgan Road on the eastern side of Sandy Creek, before the confluence of Sandy Creek and Yabba Creek. The spoil area appears to be an alluvial floodplain on an inside bend of Sandy Creek.

The tunnel spoil disposal area has a 50 m setback from Sandy Creek and Yabba Creek and is above the 1% AEP to reduce the risk of impact on water quality and aquatic values. A catch drain and/or sedimentation basins is proposed to be constructed at the high side of the stockpile to capture runoff and divert it around the stockpile. Erosion and sediment control devices will also be installed to control runoff and sediment.

The proposed site was selected because of its proximity to the exploratory tunnel, the presence of only a small number of individual trees (previously cleared site), being outside the flood hazard mapping area, and if the Main Works Project proceeds, the spoil remaining in the spoil disposal area would be partially inundated. Further information on the selection process and evaluation of alternative sites for the spoil disposal area is presented in Section 6.1.2.2.

The Kingaham Creek spoil area has a 50 m setback from Kingaham Creek and is above the 1% AEP. The site was selected for its proximity to the Kingaham Creek bypass and because it is a previously cleared site with minimal clearing requirements.

Site specific erosion and sediment control measures for the spoil disposal areas will be included in an ESCP developed in accordance with the standards and requirements of the Preliminary Erosion and Sediment Control Plan (PESCP; Appendix G of the CEMP (Appendix F)). The ESCP will be prepared by a Certified Professional in Erosion and Sediment Control and in accordance with the International Erosion Control Association (IECA) 2008 Best Practice Erosion and Sediment Control Guidelines (Australasia).

Any active discharge of water from the Exploratory Works (i.e. where water is moved offsite via direct action such as pumping rather than flowing off the works as a result of heavy rainfall) is to achieve:

- 50 mg/L or less total suspended solids
- pH 6.5 to 8.5
- no visible trace of oils or grease.

The tunnel spoil disposal area will be initially accessed during surface civil works to stockpile topsoil. It will then be accessed again by the tunnelling contractor to stockpile the blasted rock coming out of the tunnel. The spoil stockpile will be progressively installed as the exploratory tunnelling progresses with the spoil disposal area providing sufficient area to segregate material as required.

The Kingaham Creek spoil disposal area will be initially accessed to stockpile topsoil from the construction of the Kingaham Creek bypass. Excavated rock material generated by the construction of the bypass will then be placed progressively as construction progresses.

Stockpile construction will follow the following steps:

- topsoil will be stripped, set aside for reuse in covering and regressing the finished stockpile
- geotextile liner will be placed to the floor of the stockpile
- stockpile material found to be free of contaminants will be combined into the main stockpile by dozer push
- as material within the stockpile reaches the designed stockpile height, that area of the stockpile will be profiled and covered (e.g. topsoil and seeded with an approved grass seed) or chemically treated.

As part of the decommissioning works the stockpile design heights and forms will be set to ensure the completed stockpile is integrated as far as possible into the existing natural surface contours and that the area is appropriately rehabilitated to reflect future land use.

6.2.9 Water quality management – RFI item 5.1(i) and 5.1(m)

Project design has aimed to locate infrastructure within cleared areas above the flooding extent for the local watercourses and at least 50 m from the high bank. The Project infrastructure has been designed to assist with the management of water quality, including water capture and treatment.

A water management plan is included in the CEMP (Appendix F). It outlines water management measures, including measures to manage impacts on water quality. The plan identifies the following primary infrastructure for ensuring water quality impacts are minimised:

- water treatment plant (e.g. RO plant) to treat water from the exploratory tunnels and work area runoff before reuse or release
- stormwater infrastructure such as diversion (catch) drains and sediment traps to intercept overland flow, to minimise sediment-laden water generation
- bunding
- tanks and lined water storages, for separating and holding clean and contaminated water
- erosion and sediment control infrastructure.

A PESCP (Appendix A of the CEMP (Appendix F)) has been developed in accordance with the IECA Best Practice Erosion and Sediment Control guidelines to manage risks from erosion and improper sediment control from Exploratory Works. Through the implementation of the PESCP it is not expected that there will be significant changes to water quality due to sedimentation impacts. Many of the works are located a significant distance from sensitive receiving environments and works in proximity to these environments will be managed with a higher level of controls to mitigate this risk.

The Spoil Management Plan also contains management measures to avoid impacts to water quality and describes how the Project proposes to manage potential impacts from spoil including the sampling and analysis, separation and handling of potentially contaminated material, and use of geotextile liners at the spoil disposal areas.

Any residual risks associated with potential sedimentation from erosion and contamination from dewatering the tunnel will be managed in accordance with relevant management plans. Specific measures to manage residual risks to water quality include:

- groundwater monitoring program to detect changes to groundwater levels and water quality
- surface water monitoring program to detect changes to surface water quality.

6.2.10 Groundwater drawdown and surface water contamination – RFI item 5.3

6.2.10.1 Erosion – RFI item 5.3(a)

A PESCP (Appendix A of the CEMP (Appendix F)) that details measures to control erosion, drainage and sediment in areas of erosion risk has been developed for the Project.

Common areas that present a high risk of soil erosion and resulting environmental impacts include areas of concentrated flows and locations where surface gradients and slope lengths combine to increase the erosive potential of stormwater runoff. For the Project these locations, may include:

- vegetation clearing limits particularly around existing creeks / floodway (e.g. for waterway crossings)
- road cuttings and embankments
- in-stream features within creeks and riparian corridors (i.e. temporary crossings at Yabba Creek and Sandy Creek).

The erosion control measures that will be implemented in areas of erosion risk are described in the PESCP. Key measures are listed below:

- implementing a 50 m set back around the spoil disposal areas so spoil is located a sufficient distance from the banks of Yabba Creek, Sandy Creek and Kingaham Creek
- avoiding blading and grubbing clearing methods (where practicable) to reduce direct mobilisation of soil and contaminants
- implementing soil erosion control measures for soils with dispersible subsoils, including limiting disturbance and the use of gypsum and covering of dispersive material
- sizing ESC components and water recycling / reuse components with appropriate redundancy/buffer capacity as determined by Queensland Hydro
- maintaining the ESC components via regular removal of water after storm events and de-silting
- a register that details sediment basin inspections, maintenance, discharge volumes and dates, flocculation details, discharge-water quality and volumes of sediment removed will be maintained
- designing and constructing waterway crossings in accordance with Riverine Protection Permit requirements (though exemptions from the need to obtain the permit may be available).

6.2.10.2 Groundwater dependent ecosystems and contaminants – RFI item 5.3(b-c)

The mitigation and control measures for groundwater have been developed following a review of the existing environment, a groundwater impact assessment (Appendix B), and a risk assessment (Appendix H) of the Project activities. These measures will be included in a water management plan and would also be relevant to GDEs. The proposed groundwater management measures presented in Table 36 cover potential impacts to groundwater levels and contamination from tunnelling, spoil storage, and contingency water bores.

The effectiveness of these management measures will be assessed through groundwater and surface water monitoring through the life of the Project.

The groundwater monitoring program has been designed in conformance with the Monitoring and Sampling Manual (DES, 2018) and Using Monitoring Data to Assess Groundwater Quality And Potential Environmental Impacts by DES (2021). The program is currently being implemented.

In principle, the groundwater monitoring design aims to detect groundwater impacts, so that appropriate trigger action response plans can be implemented, causes investigated and effectiveness of the water management plan evaluated. This may necessitate revision of groundwater controls to reduce impacts.

Table 36: Groundwater management measures

Project activity	Management and control measures
Spoil disposal	• Prevention measures include geotextile liner and geochemical testing of freshly excavated material at a frequency that ensures it can be correctly classified and managed. • Implementation of the Spoil Management Plan. • Sediment control devices will be in place. • Runoff will be diverted away from the spoil disposal area.
Explosive store	• Materials will be bunded. • Runoff will be diverted away from the explosive store.
Portal pad	• Runoff will be diverted away from the portal pad. • Sediment control devices in place. • Water from the tunnel will be diverted to dirty water containment and tested. Dirty water dam will be periodically cleaned, and sludge disposed in spoils area. Contaminated water will be diverted to water storage tanks at the staging pad. A suitably licenced waste collection contractor will be engaged to collect and remove general waste materials.
Support and staging area	• Contaminated land assessments are being undertaken to identify risks, potential contamination pathways and required treatments. • Runoff will be diverted away from the support and staging area. • Sediment control devices in place. • All containment facilities will be bunded.
Exploratory tunnel	• Inflow control measures including grouting of fractures. • Implementation of the Spoil Management Plan. • Groundwater emanating from the tunnel will be diverted to a dirty water containment dam and regularly tested for contaminants. The dirty water dam will be periodically cleaned and sludge disposed of in the spoil disposal area. • Contaminated water will be diverted to a water treatment plant (e.g. RO plant) for treatment before transfer to storage tanks for reuse or release to the environment. • A suitably licenced waste collection contractor will be engaged to collect and remove general waste materials. • A management plan will be prepared and implemented for the construction to ensure groundwater drawdown is monitored and managed. Its implementation will validate groundwater drawdown extent and groundwater quality during construction. In addition to water levels, groundwater quality at proposed groundwater monitoring bores will be monitored.
Contingency water bores	• Construct bores in accordance with the Minimum Construction Requirements for Water Bores in Australia. • Minimise use of drilling fluids, and preference air rotary drilling where possible. • Undertake yield testing and a recharge assessment to confirm suitability and appropriate limits for water take before use. • Undertake regular water level and quality monitoring in water bores. • Prepare and implement a management plan to monitor and manage potential groundwater drawdown.

6.3 Rehabilitation – RFI item 5.2

To ensure that, post works, areas are not left in a state that would result in environmental harm, a Decommissioning and Rehabilitation Strategy (Appendix C) has been developed for the Project. The overarching long-term objective of the strategy is to re-instate native vegetation in all temporarily disturbed areas.

A rehabilitation management plan will be developed for the Project with consideration to the approval conditions imposed by State Government agencies for works in Imbil State Forest and Conondale Resources Reserve.

6.3.1 Consultation

The strategy acknowledges that the Project involves a significant number of government agencies and stakeholders and provides detail on consultation requirements in the event of Project cancellation to ensure that decommissioning and rehabilitation expectations are aligned across all stakeholders.

6.3.2 Decommissioning methods

The strategy provides detail on the decommissioning methods for the Exploratory Works. These details are provided for each Project element type. Decommissioning methods include performance targets and corrective actions. Once stabilised and weed free, rehabilitation areas will be assessed to confirm which of the following is the most appropriate rehabilitation practice to apply:

- Management of retained vegetation – this rehabilitation option applies when, after inspection, it is shown that the disturbance area has good regrowth or healthy retained vegetation in generally good condition with only minor weed control work or management required.
- Assisted generation – areas that have the potential to naturally regenerate will be maintained and allowed to regenerate with only minimal maintenance (i.e. weed control). An initial 12-month period will be used to trial assisted regeneration in areas proposed for this treatment. This time period will allow areas to demonstrate regenerative potential through a complete cycle of seasons before any planting is considered. Any areas within seed-fall of mature vegetation are expected to yield strong regeneration following weed control and are highly unlikely to require any supplementary planting. If results show that this treatment is unlikely to satisfy performance criteria after 12 months supplementary planting will be undertaken.
- Revegetation – this treatment will be applied to areas where there is limited potential for natural recruitment of vegetation, where rapid stabilisation of the landform is required, or in areas with specific environmental values that would benefit from enhancement (i.e. areas adjoining habitat for conservation significant species).

6.3.3 Resource recovery

A resource recovery strategy is provided in the strategy, along with the Waste Management Plan and the Spoil Management Plan, to provide guidance on the recovery of disturbed soil and rock, temporary constructions and remaining material from vegetation clearing. These documents also provide for waste minimisation and recycling during and following decommissioning.

6.3.4 Rehabilitation methods

The rehabilitation management plan details methods to be used for rehabilitation and the areas expected to require rehabilitation following temporary works and those required following decommission/cancellation of the Exploratory Works Project. Rehabilitation methods include performance targets and corrective actions.

6.3.5 Rehabilitation monitoring

The rehabilitation management plan will include a monitoring program to ensure effective rehabilitation and decommissioning occurs. The monitoring program provides a strategy for corrective actions to be applied, where required, to ensure performance objectives are met.

6.4 Statutory or policy basis for the proposed measures – RFI item 5.5

Proposed species-specific management measures described in the FFMP (provided in Appendix D of the CEMP (Appendix F)) were informed by the SPRAT database and relevant approved Conservation Advice, recovery plan or threat abatement plans.

The following threat abatement plans were considered in the drafting of the FFMP:

- Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi* - 2018
- Threat abatement plan for predation by European red fox - 2008
- Threat abatement plan for predation by feral cats - 2015
- Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) – 2017.

The following Recovery Plans were considered in the drafting of the FFMP (provided in Appendix D of Appendix F) and development of species-specific mitigation measures:

- Coxen's Fig-Parrot *Cyclopsitta diophthalma coxeni* Recovery Plan 2001-2005
- Draft National Recovery Plan for the Australian lungfish (*Neoceratodus forsteri*)
- Draft National Recovery Plan for the Black-breasted button-quail
- Draft National Recovery Plan for the White-throated snapping Turtle (*Elseya albagula*)
- National Recovery Plan for Black-breasted button-quail (*Turnix melanogaster*)
- National Recovery Plan for the Grey-headed flying-fox *Pteropus poliocephalus*
- National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory)
- National Recovery Plan for the Spotted-tailed Quoll *Dasyurus maculatus*
- National Recovery Plan for Macadamia Species
- The Mary River cod Research and Recovery Plan.

7. Significant impact assessment

A significant residual impact assessment has been undertaken in accordance with the Significant Impact Guidelines 1.1 - Matters of National Environmental Significance for all matters relevant to the Project. The SRIs are outlined below and in Appendix J.

7.1 Threatened ecological communities

7.1.1 Lowland Rainforest of Subtropical Australia TEC – RFI item 3.4

The Project has the potential to significantly impact the Lowland Rainforest of Subtropical Australia TEC, which is listed as critically endangered under the EPBC Act. To assess the potential impacts of the Project to the TEC, this section provides the following:

- In Table 37, information on the TEC including a general description, distribution, key diagnostic characteristics, condition thresholds, and threats.
- In Table 38 an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 39 an assessment against the significant impact criteria for TECs listed as critically endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

The field verified extent of the TEC within the broader Borumba PHES Survey area and the Exploratory Works Project footprint is shown on Figure 41.

The significant impact assessment undertaken in Table 39 identified that the Project is **likely** to result in a significant impact.

Table 37: Description of Lowland Rainforest of Subtropical Australia TEC

Lowland Rainforest of Subtropical Australia	
Profile	**Conservation status:** Critically Endangered **General description:** The TEC is generally defined as a moderately tall to tall, closed forest vegetation community dominated by tree species with relatively large (notophyll to mesophyll) compound leaves such as *Dysoxylum mollissimum*, *Castanospermum australe* and *Diploglottis australis*. Buttress-supported tree species are also typically common as are vines and climbers. Species from the genera of *Eucalyptus*, *Melaleuca* and *Casuarina* are typically absent or occasionally sub-dominant or present as emergent (DSEWPaC, 2011). The TEC occurs on basalt and alluvial soils, including sand and old/elevated alluvial soils as well as floodplain alluvia, and occasionally on enriched rhyolitic soils and basaltically enriched metasediments. **Distribution:** The TEC occurs from Maryborough in Queensland south to the Bellinger and Hastings valleys of New South Wales. The TEC is typically found below 300 m but can extend above this limit (DSEWPaC, 2011). Key diagnostic characteristics: • Distribution of the ecological community is primarily in the NSW North Coast and South Eastern Queensland bioregions. • Associated with soils derived from basalt or alluvium; or enriched rhyolitic soils; or basaltically enriched metasediments. • Generally occurs at an altitude of less than 300 m above sea level within areas of high annual rainfall (>1,300 mm). • Usually occurs more than 2 km inland from the coast. • Vegetation structure consistent with a tall (>20 m) closed forest, often with multiple canopy layers. • High species richness (at least 30 woody species as per Appendix A of the listing advice) (TSSC, 2011). **Condition thresholds:** To meet the definition of this TEC, the following minimum condition thresholds must be met: • A patch size of ≥2 ha consisting of non-remnant vegetation that has recovered through natural regeneration and/or supplementary planting resultant in characteristic structural attributes (class C), OR • A patch size of ≥1 ha consisting of residual associated trees species (provided in Appendix B of listing advice) occurring via either natural or managed regeneration (class B), AND • ≥50% cover of native vegetation, AND • ≥30 native woody species identified in the listing advice, AND • ≥70% canopy cover (inclusive of emergent/canopy/subcanopy layers) (TSSC, 2011). For Patch Class A, the following minimum condition thresholds must be met: • A patch size of ≥0.1 ha consisting of natural remnant evident by the persistence of mature residual tree species (provided in Appendix B of the listing advice), AND • ≥70% cover of native vegetation, AND • ≥40 native woody species identified in the listing advice, AND • ≥70% canopy cover (inclusive of emergent/canopy/subcanopy layers) (TSSC, 2011). **Threats:** Conservation Advice for the TEC identifies vegetation clearing, impacts associated with fragmentation of remnants and weeds as the main ongoing threats in Queensland (DSEWPaC, 2011).

Lowland Rainforest of Subtropical Australia	
In the Survey area	**Survey effort:** Surveys to ground-truth vegetation communities and TECs were conducted across 12 rounds from May 2022 to June 2024. All surveys were conducted by experienced botanists with skills in the identification of rainforest species and communities. The surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area (refer Figure 38). Surveys included Quaternary, Secondary and BioCondition plots and recorded vegetation data to compare to the key diagnostic criteria and condition thresholds for the TEC to confirm their status following the *Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia* (TSSC, 2011). Further information on the survey effort is provided in Appendix M. **Occurrence and Habitat:** A total of 2.5 ha of Lowland Rainforest TEC occurs within the Project footprint. There is 33.5 ha of the TEC in the Exploratory Works Survey area and 632.4 ha in the Borumba PHES Survey area. All areas confirmed as the TEC were represented by the Subtropical rainforest habitat type. Some patches occur above the typical altitude (approximately 450- 500 m) and are below the average canopy height (20 m) but using conservative mapping rules, were still considered the TEC as they met both the remaining key diagnostic criteria and conditional thresholds. All patches associated with the Project footprint met the highest condition threshold identified for the community (class A). • Area 1 (Borumba Dam), the adjoining 4.8 ha and 10.5 ha patches (YC4 and YC5 respectively) to the north of Yabba Creek, the canopy was low (16 m). • Area 2 (Kingaham Creek) does not include any Lowland Rainforest of Subtropical Australia TEC. • Area 3 (Walkers Top), a taller patch (WT1) approximately 16.1 ha in size falls within 50 m of the Project footprint. Upgrades to existing access tracks in this work area includes works along approximately 500 m of tracks that fall within 50 m of a 45.4 ha patch of the TEC (WT4). Upgrades along Walkers Top Road to run temporary water infrastructure will fall within 50 m of two more patches of the TEC (WT5 – 20.8 ha and WT7 – 6.0 ha). • Area 4 (Borgan Road) does not include any disturbance within 50 m of the TEC. The state of the TEC patches varied slightly within the Borumba PHES Survey area. The majority of patches in Area 3 (Walkers Top) and Area 4 (Borgan) were relatively tall (to approximately 24 m) and patches Area 1 (Borumba Dam) ranged from 16 – 24 m in height. More broadly in the Borumba PHES Survey area, canopies were up to 24 m to the north of Lake Borumba, dominated by *Araucaria bidwillii*, *Araucaria cunninghamii* var. *cunninghamii* (hoop pine) and *Ficus obliqua*. Weeds. *Lantana camara* was persistent throughout. South of Lake Borumba, the canopy was to 22 m dominated by *A. bidwillii*, *A. cunninghamii* var. *cunninghamii*, *Ficus macrophylla* and *Vitex lignum-vitae*. **Present threats to the community:** • Weeds including *Lantana camara* (Category 3 and WoNS) were persistent throughout the Borumba PHES Survey area and Exploratory Works Survey area. Other weeds include corky passionflower (*Passiflora suberosa*) and Noogoora burr (*Xanthium occidentale*). • Myrtle rust affects plants in the Myrtaceae family, including those found in the Lowland rainforest TEC (TSSC, 2011) and is present throughout the Borumba PHES Survey area and Exploratory Works Survey area. • Disturbance from fire, grazing and logging were observed throughout the TEC patches.

Table 38: Assessment of potential impacts and mitigation options for Lowland Rainforest of Subtropical Australia TEC

Lowland Rainforest of Subtropical Australia TEC		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Project will clear 2.5 ha of the TEC. Clearing will only occur in the northwest of Area 1 (Borumba Dam) in patch YC4, as shown in Figure 41. Clearing in this location is unavoidable, as geotechnical works are required for the new Borumba Dam wall and topography in the area requires some levelling and stabilisation to allow the works to proceed. Also, as there is limited geotechnical data and engineering data relevant to the area a specific footprint cannot be defined at this time and worse case approach has been adopted. This patch is the only patch of the TEC that would be directly impacted by the Project and is anticipated to cause fragmentation of the existing patch. The works in YC4 have the potential to fragment the patch in half resulting in a smaller patch of 2.3 ha, separate from the previously connected 10.5 ha patch to the east (Patch YC5). Both areas will still be considered a TEC based on the minimum patch size of 0.1 ha. A total of 2.9 ha of vegetation within 50 m of the TEC is anticipated to be cleared at eight separate TEC patches, as shown in Figure 41 and listed below: • Patches WT5 and WT7 • Patch WT4 • Patch WT1 • Patch YC2 • Patch YC4 • Patch YC5 • Patch YC6. Disturbance in these locations is unavoidable, though not all involve significant clearing. Patches WT5 and WT7 (along Walkers Top Road) are within 10-50 m of the existing Walkers Top Road. The water pipeline alignment is constrained by topography in this area, and burial alongside or within Walkers Top Road is the safest option with least impact on habitat.	The proposed Project footprint has been redesigned to avoid as much TEC as possible. This includes relocating the portal pads and design access tracks to avoid this TEC where the proposed saddle dam is located. Where vegetation clearing is unavoidable, to mitigate the impact to the TEC, the following measures are proposed: • Avoidance The Project has avoided significant areas of the field validated extent of the TEC. Where the TEC has been identified, the works have been re-designed to avoid areas, where possible. • Minimising clearing requirements The Project footprint has been minimised to the greatest extent possible, including the use of sleds to access boreholes and has been limited to only those areas required for the works. Once the contractors are appointed and approval to access the area is provided by the State, Queensland Hydro will work to minimise the disturbance required in YC4. • Demarcation The boundaries of all TEC patches adjacent to works areas will be clearly marked to minimise the potential for incidental clearing and construction activities occurring outside of the approved Project footprint. The clearing boundaries of the Project footprint will be clearly demarcated prior to clearing works being undertaken.

Lowland Rainforest of Subtropical Australia TEC		
Potential Impact	**Assessment**	**Mitigation Options**
	Existing significant impacts from bushfire have been recorded in patches WT4 and WT5. As a result, there is obvious disturbance to the patches, where many of the burnt areas have been effectively cleared by the fire. This has led to a reduction in overall patch size, fragmentation of the patches and significant pressure from weed infestation into the areas that were burnt. Patch YC2 is within 5-50 m of an existing track to Yabba Creek. The water pipeline alignment in this location is co-located with the existing track, which has become overgrown. Only understorey vegetation will be cleared in this area. Large canopy trees will be retained. Patch YC5 is within 50 m of some very minor disturbance associated with two proposed boreholes in Area 1 (Borumba Dam). Approximately half of the 50 m buffer zone in this area is not vegetated as it includes Yabba Creek, but the remaining area of disturbance within the buffer zone is anticipated to require minimal clearing of canopy or subcanopy trees as, the area contains very few. Upgrade to an existing access track from Walkers Top Road for the north of the exploratory tunnel alignment runs within 5 m of Patch WT4. This area has been previously cleared and is mapped as non-remnant. Power Track South geotechnical investigations are located in Subtropical rainforest habitat adjacent to Patch WT1. These works include 5 boreholes and approximately 200 m of new access tracks. The disturbance at its closest is less than 10 m from the TEC patch. Geotechnical works are required adjacent to Patch YC6 in Area 1 (Borumba Dam). These works include two boreholes and approximately 300 m of new access tracks and a <0.2 ha pad to be cleared. This disturbance, at its closest, is less than 10 m from the TEC patch and will require clearing for the pad and access tracks within the TEC 50 m buffer.	

Lowland Rainforest of Subtropical Australia TEC		
Potential Impact	**Assessment**	**Mitigation Options**
Changes to habitat quality as a result of erosion and sedimentation	Dispersive soils have been identified as likely to occur throughout the Project footprint and particular attention to soil erosion control measures is required in these soils. Erosion and sedimentation risk is likely to be greatest in the vicinity of the Area 1 (Borumba Dam) geotechnical investigation areas, where part of two adjoining patches of TEC (YC4 and YC5) that are a total area of 15.3 ha is proposed to be cleared on steeply sloped land. Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur which may influence plant vitality and growth. Patches of TEC that are located outside and downslope of the Project footprint are at risk of topsoil being washed downstream from disturbed areas and smothering roots and ground cover vegetation. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required to maintain the occurrence of the TEC.	A preliminary Erosion and Sediment Control plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing To minimise erosion in or adjacent to the proposed Exploratory Works Project footprint, soil disturbance will be minimised and clearing methods of blading and grubbing are avoided. Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation.
Spread of weeds, pests and disease due to increased human activity	Weeds, pests and disease are identified as key threats to the TEC. The Project has the potential to increase the incidence of weeds, pests and diseases. Weeds including lantana, corky passionflower and Noogoora burr have been identified in the TEC patches. Myrtle rust is present and is known to affect plants typical of the Lowland rainforest TEC.	Hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of disease: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and existing site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites, will assist in minimising the spread of weeds and myrtle rust. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures.

Lowland Rainforest of Subtropical Australia TEC		
Potential Impact	**Assessment**	**Mitigation Options**
		• Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. • High risk areas Identified areas of high risk weed or disease infestations (including 50 m buffer zone from TECs) will be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works activities occurring within 50 m of TEC patches. Spraying herbicides, unless approved for use in the area including targeted spraying, will be avoided in these areas.
Indirect impacts through dust generation	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed roads and access tracks (e.g. Borgan Road). The initial and on-going generation of dust has the potential to impact the quality and integrity of the individual species which comprise the TEC.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation.

Lowland Rainforest of Subtropical Australia TEC		
Potential Impact	**Assessment**	**Mitigation Options**
		• Monitoring – Visual inspections of TECs adjacent to active geotechnical activities and road/access track construction (with visual inspections of TECs within 50 m of active geotechnical activities and road/access track construction) noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of buffers and exclusion zones (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater flows	Changes in surface and groundwater flows may influence the species composition of a TEC and a community's resilience to disturbance and continued viability. The Project will have minimal impacts to surface water flows. The groundwater assessment determined that construction of the exploratory tunnel will include some dewatering of the Marumba Beds aquifer, which will create localised groundwater impacts. Impacts are likely limited in extent but there is a risk of short-term reduced water availability to vegetation in the areas above and immediately surrounding the tunnel. This community does not occur above the tunnels and the nearest patch of the TEC is approximately 100 m from the tunnel (WT6). The groundwater modelling indicates that there is a risk of short-term reduced water availability to potential GDEs limited to the areas above and the immediate surroundings to the tunnel. Though not specifically recognised as a GDE there is a risk that changes to groundwater resources may adversely impact this TEC. Further detail is provided in Appendix B. There may also be some limited short-term reduction in groundwater availability along the edge of the YC4 patch that is contiguous with other native vegetation. This area is along a watercourse and likely receives surface water as well as groundwater.	The Project will improve the hydrology of Borgan Road which is surrounded by TEC. There are no changes to drainage lines associated with the patches of TEC. While changes to overland flow are also localised as most of the works near existing patches are located on existing roads. A Water Management Plan has been developed and will be implemented to monitor potential impacts on groundwater and outline measures to mitigate impacts. A groundwater assessment has informed the following mitigation measures: • Cementation of the tunnel and grouting fractures will reduce tunnel inflow and drawdown. It is also important to note that the qualitative assessment used steady state applications and does not provide transient drawdown over time. Drawdown associated with the deep sections of the tunnel and the potential interconnectivity of this to surface and shallow aquifers are in progress through a MODFLOW USG 3D numerical groundwater model. Once the modelling is completed the impact assessment from the tunnelling works will be revisited in consultation with the construction contractor. Monitor change in water levels within the creeks and adjacent boreholes during construction, operation and decommission phases to assess drawdown and rebound over time.

Lowland Rainforest of Subtropical Australia TEC		
Potential Impact	**Assessment**	**Mitigation Options**
Contamination from hazardous materials	The construction compound area, spoil disposal area and staging area are proposed in areas in close proximity to patches of the TEC in Area 4 (Borgan). Operation of these Project components pose the greatest risk of hazardous material release to the environment if containment and management is inadequate. Spills of chemicals may also be a particular risk for the TEC patches adjacent to the Area 1 (Borumba Dam) investigation areas and the Area 3 (Walkers Top) geotechnical investigation access tracks, where oil and other chemicals from the use of vehicles and machinery may enter the environment.	• Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Spill containment kits will be on-site. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release. • Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed) only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks. • Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise.
Changes to the local bushfire regime	Excluding fire from the TEC and buffer zones is a threat abatement action identified for the TEC. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. Landscape level fire susceptibility is unlikely to be increased by the clearing and construction in the area as there is no anticipated creation of flammable areas. Bushfires occurred in the area most recently in 2021.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project.

Table 39: Significant impact assessment for the critically endangered Lowland Rainforest of Subtropical Australia TEC

Lowland Rainforest of Subtropical Australia	
Impact criteria	**Assessment**
Reduce the extent of an ecological community	**Likely** The Project will reduce the extent of the TEC by clearing a total of 2.5 ha of TEC.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads	Likely The Project will fragment a Class A TEC patch (YC4) that is 4.8 ha by clearing 2.5 ha of the TEC, resulting in a smaller patch of 2.3 ha that will be separated from the previously connected patch to the east (Patch YC5), which is 10.5 ha. Both areas will still be considered a TEC based on the minimum patch size of 0.1 ha for a Class A TEC and 2 ha the minimum for Class C. Noting that both areas are considered to be Class A.
Adversely affect habitat critical to the survival of an ecological community	**Likely** The Exploratory Works Project is likely to adversely affect habitat critical to the survival of the ecological community (HCSEC). Although no HCSEC is nominated in the Conservation Advice (DCCEEW, 2022), the definition in the *MNES Significant Impact Guidelines* (DoE, 2013) of HCSEC is habitat that is necessary for: • the long-term maintenance of the ecological community (including species essential to the survival of the ecological community) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the ecological community. For the purposes of this assessment, all vegetation associated with the TEC is considered to be HCSEC and clearing 2.5 ha is likely to adversely affect HCSEC.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	**Unlikely** Construction of the exploratory tunnel will include some dewatering of the Marumba Beds aquifer, which will create temporary groundwater impacts limited to the areas above and immediately surrounding the tunnel. This community does not occur above the tunnels and the nearest patch of the TEC is approximately 100 m from the tunnel. There may be some limited short-term reduction in groundwater availability along the edge of the TEC that is contiguous with other native vegetation. However, this area is along a watercourse and likely receives surface water as well as groundwater. It is unlikely that the Project will modify or destroy abiotic factors necessary for the TEC's survival.

Lowland Rainforest of Subtropical Australia	
Impact criteria	**Assessment**
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	**Unlikely** The Exploratory Works Project is unlikely to cause a substantial change in the species composition of an occurrence of the TEC. While there is the potential for edge effects as a result of the fragmentation of patch YC4 and as a result of works in the buffer area, the impacts are not expected to cause a substantial change in the species composition of an occurrence of an ecological community as a result of effective management. Noting that there is evidence on site of limited changes to the species composition as a result of clearing for roads, with the main change in composition seemly associated with fire regimes resulting in weed encroachment. Weeds are currently present in all patches of the TEC, including some areas of high density lantana. Weed management measures will be in place to reduce the introduction and/or spread of weeds into the TEC.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • assisting invasive species, that are harmful to the listed ecological community, to become established, or • causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	**Unlikely** The Exploratory Works Project is unlikely to cause a substantial reduction in the quality or integrity of the occurrence of the TEC. Weeds and pests are already known to be present in the TEC and the broader landscape and the Project is unlikely to facilitate the further spread of weeds and pests into areas where they are not. However, the fragmentation of YC4 patch will pose a risk around the introduction and establishment of weeds, Myrtle rust or pest species in the area. Biosecurity management measures will be in place to reduce the introduction and/or spread of invasive species into the TEC. This will include the use of selective herbicides given the site is a water buffer supply area, along with targeted spaying and manual/mechanical removal. The Project is temporary and will not involve the permanent mobilisation of hazardous substances to the area.
Interfere with the recovery of an ecological community	**Likely** The Exploratory Works Project is likely to interfere with the recovery of the TEC. Clearing 2.5 ha of the TEC is likely to interfere with the recovery of the community. The Project may also assist in the recovery of existing patches by reducing threats such as cattle grazing, weeds and hydrology.
Recommendation:	Significant impact is **Likely**

7.1.2 Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC – RFI item 3.5

The Project has the potential to significantly impact the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland (Subtropical eucalypt floodplain forest) TEC, which is listed as endangered under the EPBC Act. This section provides the following:

- In Table 40, information on the TEC including a general description, distribution, key diagnostic characteristics, condition thresholds, and threats.
- In Table 41, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 42, an assessment against the significant impact criteria for TECs listed as endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

The field verified extent of the TEC within the broader Borumba PHES Survey area and the Exploratory Works Project footprint is shown Figure 41.

The significant impact assessment undertaken in Table 42 identified that the Project is **unlikely** to result in a significant impact.

Table 40: Description of Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and Southeast Queensland bioregions TEC

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC	
Profile	**Conservation status**: Endangered **General description:** A floodplain forest vegetation community with a canopy dominated by eucalypts and other myrtaceous tree species. Found on alluvial landforms and periodically flooded depressions, generally below 50 m elevation, although it can occur up to 250 m (DCCEEW, 2022). **Distribution**: Occurs from north of Newcastle, New South Wales in the south, to just north of Gladstone in Queensland. The ecological community has an estimated AOO of 2,770 km^2 (DCCEEW, 2022). **Key diagnostic characteristics:** • The TEC occurs in the New South Wales North Coast (NNC) and South Eastern Queensland (SEQ) IBRA bioregions, and on Curtis Island in the Brigalow Belt North (BBN) IBRA Bioregion. • It occurs in the catchments of the eastern watershed of the Great Dividing Range, typically in their lower reaches. • It occurs at elevations up to 250 m above sea-level (ASL), most typically below 50 m ASL. • It occurs on alluvial soils and landforms including river floodplains, riparian zones, the floors of tributary gullies, floodplain pockets, alluvial flats, fans, terraces, and localised colluvial fans; as well as on localised depressions amongst low rises and on associated sites where water can pond. • It does not typically occur on soils that are primarily marine or aeolian sands but may occur on such substrates after they have been modified by fluvial activity. • It occurs as a tall closed-forest, tall open-forest, closed forest, open forest, tall woodland, or woodland with a canopy crown cover of at least 20%. • It has a canopy dominated by one or a combination of Angophora, Corymbia, Eucalyptus, Lophostemon and/or Syncarpia tree species (areas dominated by *E. robusta* are excluded). Other canopy tree species may be present, and in some areas, rainforest trees may be prominent.

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC
• A mid-layer (including a sub-canopy, and/or shrub-layer) may be present, sparse or absent; and fauna may be abundant or rare (DCCEEW, 2022). **Condition thresholds:** To meet the definition of this TEC, the minimum condition thresholds described in the Conservation Advice for the TEC must be confirmed (DCCEEW, 2022): • A large patch (≥2 ha) OR small contiguous patch (≥0.5 ha) within larger area of native vegetation (≥5 ha) AND ground cover richness >10 native species per sample plot AND ≥20 large native trees per ha AND ≥80% of its total perennial understorey vegetation cover comprises native species (Class A1), OR • A large patch (≥2ha) OR small contiguous patch (≥0.5 ha) within larger area of native vegetation (≥5 ha) AND ground cover richness ≥6 native species per sample plot AND ≥10 large native trees per ha AND ≥50% of its total perennial understorey vegetation cover comprises native species AND ≥5 species of arboreal mammals detected in the patch (Class A2), OR • Small patch (≥0.5 ha) AND ground cover richness ≥10 native species per sample plot AND ≥20 large native trees per ha AND ≥80% of its total perennial understorey vegetation cover comprises native species (Class B1), OR • Small patch (≥0.5 ha) AND ground cover richness ≥6 native species per sample plot AND ≥10 large native trees per ha AND ≥50% of its total perennial understorey vegetation cover comprises native species AND ≥5 species of arboreal mammals detected in the patch (Class B2), OR • A large patch (≥2 ha) OR small contiguous patch (≥0.5) ha within larger area of native vegetation (≥5 ha) AND ground cover richness ≥6 native species per sample plot AND ≥10 large native trees per ha AND ≥50% of its total perennial understorey vegetation cover comprises native species (Class B3), OR • A small patch (≥0.5 ha) AND ground cover richness ≥6 native species per sample plot AND ≥10 large native trees per ha AND ≥50% of its total perennial understorey vegetation cover comprises native species (Class C1), OR • A large patch (≥2 ha) OR small contiguous patch (≥0.5 ha) within larger area of native vegetation (≥5 ha) AND ground cover richness ≥4 native species per sample plot AND at least one of: ≥6 very large native trees per ha and/or ≥30% of its total perennial understorey vegetation cover comprises native species (Class C2). Habitat critical to the survival of the ecological community • The habitat or areas most critical to the survival of the ecological community are those patches that are in the best condition (i.e. classes A and B in Table 2). These represent those parts of the ecological community that retain the highest diversity and most intact structure and ecological function and have the highest chance of persisting in the long-term. However, areas that otherwise meet the minimum condition thresholds (i.e. Class C in Table 2) are also important for the functioning and survival of the ecological community. These areas are critical to the survival of the ecological community: if they occur in locations or landscape positions that are particularly important for biodiversity or function; and/or contain suites of species, or habitat features, that are important in a regional or local context. **Threats:** Approved Conservation Advice for the TEC identifies the following threats (DCCEEW, 2022): • clearing • hydrological changes • fragmentation legacies • weeds • climate change • fire regimes that cause declines in biodiversity • invasive fauna • disturbance from urbanisation and recreational activity

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC	
	• diseases and pathogens • livestock grazing • vegetation and firewood removal and urban heat effects.
In the Survey area	**Survey Effort:** Surveys to ground-truth vegetation communities and TECs were conducted across 12 rounds from May 2022 to June 2024. All surveys were conducted by experienced botanists with skills in the identification of rainforest species and communities. The surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area (Figure 41). Surveys included Quaternary, Secondary and BioCondition plots and recorded vegetation data to compare to the key diagnostic criteria and condition thresholds for the TEC to confirm their status following the *Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions* (DCCEEW, 2022). Further information on the survey effort is provided in Appendix M. **Occurrence and Habitat:** No Subtropical eucalypt floodplain forest TEC occurs within the Project footprint. More broadly, 4.6 ha has been identified within the Exploratory Works Survey area, and a total of 14 ha has been mapped within the Borumba PHES Survey area. All areas confirmed as the TEC were represented by the Eucalypt dominated forests and woodlands on alluvial flats habitat type. The four patches in the Borumba PHES Survey area are associated with Borumba Creek, Kingaham Creek and Yabba Creek upstream of Lake Borumba. All sites consisted of remnant or regrowth watercourse fringing woodlands typified by a canopy dominated by *Eucalyptus tereticornis* and/or *Casuarina cunninghamiana* subsp*. cunninghamiana*. There are large areas of potential TEC where *Casuarina cunninghamiana* subsp*. cunninghamiana* and Eucalypts are either sub-dominant, present in low densities, or not present. These areas were excluded from the TEC as they do not meet the key diagnostic characteristics. Within the Exploratory Works Survey area, there are two patches of the TEC as detailed below. The TEC does not occur in Area 1 (Borumba Dam) and Area 3 (Walkers Top). Area 2 (Kingaham Creek), there is a 4.5 ha patch (Patch BC1) near the proposed Kingaham Creek bypass. Area 4 (Borgan), there is 3.6 ha patch (Patch SC1) of the TEC near the proposed explosive store. In addition, there is a 6.6 ha patch (Patch B1) associated with Borumba Creek, which is approximately 20.8 km from the nearest impact area for the Exploratory Works, and another un-named patch upstream of the Exploratory Works along Yabba Creek. The condition of the TEC varied between patches, three of the patches are condition Class C2, while the fourth patch has been determined to be condition Class A2 (see Section 4.2.1). **Present threats to the community:** • Disturbance from flooding was evident resulting in erosion in some areas. • Clearing and grazing severity was high in some areas where vegetation had been cleared to the stream bank and movement of cattle was evident along stream banks. Large areas have been cleared for grazing along the upper reaches of the creeks in the broader Borumba PHES Survey area. • Weed severity was generally low, though *Lantana camara* was noted in several areas. • Myrtle rust affects plants in the Myrtaceae family, including those found in the Subtropical eucalypt floodplain forest TEC (DCCEEW, 2022) and is present throughout the Borumba PHES Survey area and Exploratory Works Survey area. • Bell Miner Associated Die-back (BMAD) is listed in the Conservation Advice as a threat for eucalypt species in this TEC (DCCEEW, 2022). While few ALA bell miner records do exist in the in the Borumba Lake surrounds (ALA, 2023), BMAD is not known to occur in the Borumba PHES Survey area.

Table 41: Assessment of potential impacts, and mitigation options for Subtropical eucalypt floodplain forest TEC

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Project is anticipated not to result in clearing of the TEC. However, a total of 1.2 ha of buffer zone vegetation is anticipated to be cleared at two separate TEC patches, as shown in Figure 41 and listed below: • Patch BC1 • Patch SC1 Disturbance in these locations is unavoidable, though the total area of vegetation clearing within the 50 m buffer of the TEC is minimal. Approximately 1.1 ha of the Project footprint is anticipated to fall within 50 m of Patch BC1 of the TEC in Area 2 (Kingaham Creek) for the Kingaham Creek bypass. However, less than 0.3 ha of the footprint is anticipated to occur within remnant or regrowth vegetation within the 50 m buffer of the TEC, which falls within about 20 m of the TEC. The remaining area within the 50 m buffer of the TEC is represented by already disturbed areas. Approximately 0.1 ha of clearing is anticipated to occur within 50 m of Patch SC1 of the TEC in Area 4 (Borgan Road) for the explosive store pad, which falls within 21 m of the TEC. The TEC will effectively remain intact and impacts of fragmentation avoided.	The Project footprint is anticipated to avoid any clearing of the TEC, however, works within the 50 m buffer zone of the TEC are unavoidable (i.e. in avoiding works in Kingaham Creek, works are required within 50 m of patch BC1. The explosive store location was selected to ensure compliance with relevant Queensland legislation and Australian Standards to maintain a separation distance of at least 560 m from other operational areas). Where clearing within 50 m of the TEC is anticipated to occur, the following measures are proposed: • Avoidance The Project has avoided significant areas of the field validated extent of the TEC. Where the TEC has been identified, the works have been re-designed to avoid areas. Pre-clearance surveys will be conducted and infrastructure micro-sited (if required) to minimise impacts to vegetation within the buffer zones. • Minimising clearing requirements The Project footprint has been minimised to the greatest extent practicable and has been limited to only those areas required for the works. • Demarcation The boundaries of all TEC patches adjacent to works areas will be clearly marked to minimise the potential for incidental clearing and construction activities occurring outside of the approved Project footprint. The clearing boundaries of the Project footprint will be clearly demarcated prior to clearing works being undertaken.

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC		
Potential Impact	**Assessment**	**Mitigation Options**
Changes to habitat quality as a result of erosion and sedimentation	Dispersive soils have been identified as likely to occur throughout the Project footprint and particular attention to soil erosion control measures is required in these soils. Erosion and sedimentation risk for the Project is likely to be greatest in the vicinity of the Area 1 (Borumba Dam) geotechnical investigation areas, however there is no extent of the TEC in this area. The TEC exists in close proximity to Area 2 at the Kingaham Creek bypass and Area 4 at the proposed explosive store, where construction work required to establish these Project areas will require vegetation clearing and ground disturbance (excavation and earthworks). Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur, which may influence plant vitality and growth. Patches of TEC that are located outside and downslope of the Project footprint are at risk of topsoil being washed downstream from disturbed areas and smothering roots and ground cover vegetation. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required to maintain the occurrence of the TEC.	A preliminary Erosion and Sediment Control Plan has been developed for the Project **(**Appendix A of Appendix F**)** which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing To minimise erosion in or adjacent to the proposed Exploratory Works Project footprint, soil disturbance will be minimised and clearing methods of blading and grubbing are avoided. Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation.
Spread of weeds, pests and disease due to increased human activity	Weeds, pests and disease are identified as key threats to the TEC. The Project has the potential to increase the incidences of weeds, pests and diseases. Weeds including *Lantana camara* have been identified in the TEC patches. Myrtle rust is present and is known to affect plants typical of the Subtropical eucalypt floodplain forest TEC. Bell miner associated die-back (BMAD) is known to affect eucalypt species present in this TEC, however BMAD is not known to occur in the PHES Survey area.	Hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of weeds and pathogens: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and exiting site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites will assist in minimising the spread of weeds and myrtle rust.

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC		
Potential Impact	**Assessment**	**Mitigation Options**
		Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. • High risk areas Identified areas of high risk weed or disease infestations (including 50 m buffer zone from TECs) will be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works activities occurring within 50 m of TEC patches. Spraying herbicides, unless approved for use in the area including targeted spraying, will be avoided.
Indirect impacts through dust emissions	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed access tracks. The initial and on-going generation of dust has the potential to impact the quality and integrity of the individual species which comprise the TEC.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene – Resheeting and sealing of roads and tracks to minimise dust generation. – Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. – Regular cleaning of machinery and vehicle tyres to reduce dust emissions.

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC		
Potential Impact	**Assessment**	**Mitigation Options**
		• Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of TECs adjacent to active geotechnical activities and road/access track construction (with visual inspections of TECs within 50 m of active geotechnical activities and road/access track construction) noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of buffers and exclusion zones (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater flows	Changes in surface and groundwater flows may influence the species composition of a TEC and a community's resilience to disturbance and continued viability. The Project will have minimal impacts to surface water flows. The groundwater assessment determined that impacts to groundwater drawdown and reduced baseflow seepage as a result of the underground exploratory tunnel have the potential for short-term and localised impacts to TECs directly above and within the direct vicinity of the underground Exploratory Works only. No areas of the TEC fall directly above or within the direct vicinity of the underground Exploratory Works, with the nearest TEC patch over 1.7 km away. The TEC is anticipated not to experience impacts from reduced groundwater flows.	There are no changes as a result of the Project to flooding extents, drainage lines or overland flows relevant to these patches of TEC. With infrastructure located downgradient of the patches and above the 1% AEP. A Water Management Plan has been developed and will be implemented to monitor potential impacts on groundwater and outline measures to mitigate impacts.
Contamination from hazardous materials	The explosives storage area is proposed close to a patch of the TEC in Area 4 (Borgan Road). Operation of this Project component poses the greatest risk of hazardous material release to the TEC if containment and management is inadequate. Spills of chemicals may also be a risk for the TEC patch adjacent to the proposed Kingaham Road bypass in Area 2 (Kingaham Creek), where oil and other chemicals from the use of vehicles and machinery may enter the environment. Though this area	• Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Spill containment kits will be on-site. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release.

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC		
Potential Impact	**Assessment**	**Mitigation Options**
	already includes the existing Bella Creek Road, so some level of vehicle spillage already applies.	• Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise.
Changes to the local bushfire regime	Excluding fire from the TEC and buffer zones is a threat abatement action identified for the TEC. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. Landscape level fire susceptibility is unlikely to be temporarily increased during construction and operation from vehicles, work areas, and personnel.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management.

Table 42: Significant impact assessment for the endangered Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions TEC

Subtropical eucalypt floodplain forest and woodland of the NSW North Coast and SEQ bioregions	
Impact criteria	**Assessment**
Reduce the extent of an ecological community	**Unlikely** The Exploratory Works Project is unlikely to reduce the extent of the ecological community as no clearing of the TEC is anticipated.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads	**Unlikely** The Exploratory Works Project is unlikely to fragment or increase fragmentation of the ecological community as no clearing, fragmentation or isolation of the TEC is anticipated.

Subtropical eucalypt floodplain forest and woodland of the NSW North Coast and SEQ bioregions	
Impact criteria	**Assessment**
Adversely affect habitat critical to the survival of an ecological community	**Unlikely** Conservation Advice states that habitat critical to the survival of the ecological community (HCSEC) is restricted to the patches of the TEC and does not include buffer zone vegetation. The Project avoids direct impacts to the TEC and the impact to 1.2 ha of the buffer zone is not considered HCSEC.
Modify or destroy biotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	**Unlikely** The groundwater impact assessment has indicated that any potential groundwater drawdown or reduced baseflow seepage as a result of the Project is unlikely to extend beyond directly above and in the direct vicinity of the underground Exploratory Works. No patches of the TEC are directly above or within the direct vicinity of the underground Exploratory Works, therefore it is considered unlikely that the Project will modify or destroy groundwater factors necessary for the TEC survival. Similarly, drawdown as a result of the production wells and the works for Kingaham Creek bypass are unlikely to impact on the existing patches of TEC. The Exploratory Works Project is unlikely to modify or destroy other abiotic factors as the action is not likely to affect surface water drainage patterns or otherwise make unavailable surface water, nutrients, or soil. While the explosives will be stored in accordance with relevant standards and guidelines which will minimise the risk of contaminants such as nitrates and nitrites migrating into the alluvial aquifers which may service the local TECs.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	**Unlikely** There are no works in the patches of the TEC and for the Kingaham Creek bypass the area is already cleared and there is an existing road between the work activities and the patch of TEC. While for the area near the explosive storage area, vegetation will be retained between the storage area and the patch of TEC. As such the Exploratory Works Project is unlikely to cause a substantial change in the species composition of an occurrence of the TEC.

Subtropical eucalypt floodplain forest and woodland of the NSW North Coast and SEQ bioregions	
Impact criteria	**Assessment**
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • assisting invasive species, that are harmful to the listed ecological community, to become established, or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	**Unlikely** The Exploratory Works Project is unlikely to cause a reduction in the quality or integrity of an occurrence of an ecological community. While there is the potential for weeds to further encroach into the TEC from adjacent works, weed management measures will be in place to reduce the introduction and/or spread of weeds into the TEC. Weeds are currently present in all patches of the TEC, including some areas of high-density lantana. While there will be temporary storage of explosive material adjacent to the TEC, this is a short-term potential impact which will be removed following completion of the works. Sufficient management measures are in place to mitigate the identified potential impacts.
Interfere with the recovery of an ecological community	**Unlikely** The Exploratory Works Project is unlikely to interfere with the recovery of the TEC as no direct impacts to the TEC are anticipated. The Project may also assist in the recovery of existing patches by reducing threats such as cattle grazing and relocating Bella Creek Road further away from the patch associated with Kingaham Creek. The use of the road through the patch of TEC near the explosive area will also be reduced with this road to be closed as a result of the Project and to be used in emergency circumstances.
Recommendation:	Significant impact is **Unlikely**

7.2 Threatened flora – RFI item 3.1

This section provides for each threatened flora species known or likely to occur in the Exploratory Works Survey area:

- A description of the species and suitable habitat in the Exploratory Works Survey area
- An assessment of the potential impacts of the Project
- An assessment of the significant residual impacts.

Threatened flora species with a possible LOO are addressed in Appendix J.

7.2.1 Ball nut (*Floydia praealta*)

The Project has the potential to significantly impact the ball nut (*Floydia praealta*), which is listed as vulnerable under the EPBC Act. To assess the potential impacts of the Project to the species, this section provides the following:

- In Table 43, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 44, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 45, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of suitable habitat within the Borumba PHES Survey area, the Project footprint, and the location of *Floydia praealta* individuals recorded during field surveys are shown on Figure E-5, which is contained in Appendix E. It should be noted that the locations shown on Figure E-5 may represent more than one individual.

The significant impact assessment undertaken in Table 45 identified that the Project is **unlikely** to result in a significant impact on the ball nut (*Floydia praealta*).

Table 43: Description of ball nut (*Floydia praealta*)

Ball nut (*Floydia praealta*)	
Profile	**Conservation status:** Vulnerable **Habitat:** Habitat comprises floristically rich, tall, closed riverine to subtropical rainforest or coastal scrubs. The species is recorded on gently sloping alluvial levees to moderately sloped foot slopes and hillslopes, as well as steeply sloping scree slopes (DEWHA, 2008; DOE, Floydia praealta in Species Profile and Threats Database, 2024). **Distribution:** *Floydia praealta* occurs in small, scattered populations from Gympie, Queensland, south to the Clarence River, near Dorrigo in northeast New South Wales and appears to be naturally rare. Within the Queensland, approximately 250 mature individuals are known from 20 populations, in an area of about 9,000 km^2 (DEWHA, 2008).

Ball nut (*Floydia praealta*)	
	Previous records: The species has been previously recorded in the immediate vicinity of the Exploratory Works Project; however, records are historical (1918) (ALA, 2023). **Habitat Critical to the Survival of the Species:** The approved Conservation Advice does not define habitat critical to the survival of the species (DEWHA, 2008). However, the generic definition within the significant impact guidelines (Department of the Environment, 2013) defines habitat critical to the survival of a species as areas that are necessary: • for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species. The habitat within the Exploratory Works Survey area is unlikely to fall within the gamut of being habitat critical to the survival of the species, as none of the above apply to the individuals identified within the Borumba PHES Survey area. **Important Populations:** Important populations of *Floydia praealta* have not been defined. Accordingly, the generic definition of 'important population' set out in the Significant Impact Guidelines has been considered in this assessment. That is, an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: key source populations either for breeding or dispersal; populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species range. The Borumba PHES Survey area is on the limit of the species' range; therefore, the individuals within the Borumba PHES Survey area are considered to form part of an important population. **Main threats to the species** (DEWHA, 2008)**:** • fragmentation due to development, agriculture, roadworks and powerlines • invasion of weeds • grazing and trampling caused by livestock • fire.
In the Survey area	**Surveys:** Surveys were completed between November 2022 and July 2024, in all areas of suitable habitat to be impacted by the Main Works Project and Exploratory Works Project. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M. **Species occurrence:** A total of 63 *F. praealta* individuals have been observed within the Borumba PHES Survey area from multiple locations clustered around the edges of Lake Borumba and downstream of the lower dam wall. These records were all from within the Subtropical rainforest broad habitat type. No individuals were recorded within the Exploratory Works Survey area or within the Project footprint. **Habitat:** The Ball nut was found within the Borumba PHES Survey area on notophyll and microphyll vine forest. Known and potential habitat for the species was further refined and includes complex to simple notophyll and microphyll vine forest on metamorphic substrates and alluvial plains (REs 12.11.1, 12.11.10, 12.12.16, 12.3.1a). Known habitat is mapped habitat that meets potential habitat requirements within 100 m of a record. A total of 735 ha of potential habitat is present in the Borumba PHES Survey area, with 39.6 ha present in the Exploratory Works Survey area. A total of 2.7 ha of potential habitat is present in the Project footprint. There is no known habitat within the Project footprint. **Threats within the Survey area:** Weeds are persistent throughout the Survey area. A suite of invasive fauna present that may threaten *F. praealta* through grazing and/or trampling include European brown hare and rabbit, pig and Rusa deer. Bushfires occurred in the area most recently in 2021.

Table 44: Assessment of potential impacts, and mitigation options for ball nut (*Floydia praealta)*

Ball nut (*Floydia praealta*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Project is anticipated to clear 2.7 ha of potential habitat for the *Floydia praealta* in Area 1 (Borumba Dam) for geotechnical works and access tracks. The Project will not clear any known habitat where individuals have been identified. Clearing in this location is unavoidable, as geotechnical works are required for the new Borumba Dam wall and topography in the area requires some levelling and stabilisation to allow the works to proceed. The impact pathways include: • earthworks associated with the clearing of the area in Area 1 (Borumba Dam) for geotechnical works and access tracks.	The proposed Project footprint has been designed to avoid all known individual records and known habitat of the *Floydia praealta*. The Project has also aimed to minimise the clearing of potential habitat for this species. Where vegetation clearing for potential habitat of the *F. praealta* is unavoidable, to mitigate the impact to the species, the following measures are proposed with further details provided in the CEMP and associated management plans: • Pre-clearance survey Pre-clearance surveys will be undertaken by a suitably qualified ecologist to identify any additional *F. praealta* individuals within and adjacent to the Project footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). • Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition.

Ball nut (*Floydia praealta*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Unexpected find Works will be undertaken in accordance with the unexpected finds procedure, which involves: – stop works in the vicinity of the find – demarcate and prevent access to area – comprehensively survey the population of the threatened species to determine the number of plants potentially impacted and spatial extent – explore options for avoidance – if impacts cannot be avoided engage with DCCEEW and DETSI in relation to approvals to clear. Monitoring, of individuals retained adjacent to the Project footprint to track impacts during and following construction.
Changes to habitat quality as a result of erosion and sedimentation	Most of the Exploratory Works Project is located in areas that may contain soils with sodic subsoils that are highly erodible if exposed. Particular attention to soil erosion control measures is required in these areas. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works. Erosion and sedimentation risk is likely to be greatest in the vicinity of Area 1 (Borumba Dam) geotechnical areas, where 2.7 ha of potential habitat for the *F. praealta* is proposed to be cleared on steeply sloped land. Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur which may influence plant vitality and growth. However, the majority of the *F. praealta* individuals are located upslope or across slope of the works areas, and where they are located downslope of clearing, the clearing is generally only for access tracks and bore hole pads. Erosion and sedimentation may also reduce the availability of nutrients and other essential resources required to maintain the quality of the land.	A preliminary Erosion and Sediment Control Plan has been developed for the Project (Appendix A of the CEMP (Appendix F) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing To minimise erosion in or adjacent to the proposed Exploratory Works Project footprint, soil disturbance will be minimised and clearing methods of blading and grubbing are avoided. Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation. • Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to

Ball nut (*Floydia praealta*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • earthworks associated with the clearing of the area in Area 1 (Borumba Dam) for geotechnical works and access tracks.	settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. • Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/ maintenance of restricted areas.
Spread of weeds, pests and disease due to increased human activity	Habitat infestation by weeds is a key threatening process for the *F. praealta*. Lantana and cat's claw creeper (*Dolichandra unguis-cati*) are widespread, occurring in high densities in rainforest and wet sclerophyll communities where clearing or natural disturbance had occurred previously. A suite of invasive fauna is present within the Exploratory Works Project footprint that may threaten *F. praealta* through grazing and/or trampling include European brown hare, rabbit, pig and rusa deer. There are no known diseases for the *F. praealta* (DEWHA, 2008). The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation and management measures. Weeds may be further spread throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Use of construction vehicles and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Increased incidences of weeds and	In accordance with Queensland Hydro's Biosecurity Management Plan hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of invasive species: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and existing site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed, pest and pathogen spread.

Ball nut (*Floydia praealta*)		
Potential Impact	**Assessment**	**Mitigation Options**
	pests may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Pests may contribute directly to consumption and/or destruction of edible flora species. Inadequate decontamination of construction machinery and construction personnel may result in transmission of disease. Movement of diseased individuals (either through vegetation clearing or translocation activities) may also act to spread disease within the Project area. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	• Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint, unless approved for use in the area including targeted spraying. Particular care will be taken to ensure that any fill is sourced from areas free of lantana and other weed material which competes for similar habitat and is known to be a significant threat to the species in order to mitigate any impacts associated with Exploratory Works. Work with adjacent landholders and other stakeholders to align biosecurity measures including treatment timeframes and programs. Contaminated material to be disposed of in accordance with the *Biosecurity Act 2014* including by transporting it safely to a waste disposal facility or burying it or adding it to onsite mulching.
Reduced amenity through dust emissions	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed access tracks. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene – Resheeting and sealing of roads and tracks to minimise dust generation. – Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable.

Ball nut (*Floydia praealta*)		
Potential Impact	**Assessment**	**Mitigation Options**
	or result in mortality. It is noted that near the known populations access will not be ongoing. The impact pathways include: • vegetation clearing, and vehicle and machinery movement around the site may result in increased dust emissions.	– Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of *F. praealta* individuals adjacent to active geotechnical activities and road/access track construction noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of restricted areas (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Changes in surface and groundwater flows may influence the species resilience to disturbance and continued viability. The Project is anticipated to have minimal impacts to surface water flows (instream and overland). The groundwater assessment determined that impacts to groundwater drawdown are primarily associated with the tunnel. Drawdown from the tunnelling works is not a risk to the species or species habitat, however drawdown from the boreholes may occur in the vicinity of species habitat. It is however not expected to impact the species considering the depth of aquifers in the area. The impact pathways include: • works within waterways, drainage lines and overland flow paths, along with any works below the 1% AEP • groundwater drawdown associated with geotechnical investigations.	There are no specific management measures developed for surface water and groundwater specific to *F. praealta* however the following measures are relevant to avoiding to minimising impacts with further details provided in the CEMP and the associated management plans. There are anticipated to be minimal surface water and hydrology changes as a result of the Project with the potential to impact *Floydia praealta*. That is there are no impoundments or diversions planned within the drainage lines which feed into the gullies this population is recorded in. Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway.

Ball nut (*Floydia praealta*)		
Potential Impact	**Assessment**	**Mitigation Options**
Contamination from hazardous materials	Spills of chemicals may be a particular risk for individuals and habitat for the *F. praealta* adjacent to the Area 1 (Borumba Dam) investigation areas, where oil and other chemicals from the use of vehicles and machinery may enter the environment. Spills or leaks of chemicals required to support construction activities may result in degraded areas in the vicinity of Project works, reducing the availability and quality of habitat and resources available. The impact pathways include: • spills or leaks of chemicals required to support construction activities.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts as per the CEMP, including: • All machinery is required to be re-fuelled in designated, and bunded, areas away from *F. praealta*. • Spill containment kits will be kept on site and readily available in the event of fuel/oil spills. • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release. • Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed) only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks. • Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise. For example, drill muds and water will be stored in ICBs and vac trucks will be used to remove this material from site.

Ball nut (*Floydia praealta*)		
Potential Impact	**Assessment**	**Mitigation Options**
Changes to the local bushfire regime	Fire is a threat for this species. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.

Table 45: Significant impact assessment for the vulnerable ball nut (*Floydia praealta*)

Ball nut (*Floydia praealta)*	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** No individuals were recorded within the Project footprint. Therefore, no known individuals of *Floydia praealta* will be cleared as part of the Exploratory Works activities. As there are no individuals of *F. praealta* within the Project footprint and indirect impacts to an existing population will be controlled via the implementation of mitigation measures, it is unlikely the Exploratory Works Project will lead to a long-term decrease in the size of an important population.

Ball nut (*Floydia praealta*)	
Impact criteria	**Assessment**
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. Based on the ALA calculator the AOO for the species is estimated to be 556 km^2. The Exploratory Works Project will not directly impact any *Floydia praealta* individuals or known habitat for the species. As such, the Exploratory Works Project is unlikely to reduce the area of occupancy of an important population or the species in general.
Fragment an existing important population into two or more populations	**Unlikely** Sixty-three *Floydia praealta* individuals have been reported within the Borumba PHES Survey area from multiple locations clustered around the edges of Lake Borumba and downstream of the lower dam wall. The Exploratory Works Project will not fragment an existing important population into two or more populations as the works do not include any permanent barriers.
Adversely affect habitat critical to the survival of a species	**Unlikely** The approved Conservation Advice does not define habitat critical to the survival of the species (DEWHA, 2008). The habitat within the Exploratory Works Survey area is not considered to be habitat critical to the survival of the species, though habitat critical for the survival of the species does occur in close proximity to the Project footprint. That is, the records are mainly associated with patches of Lowland Rainforest which have been purposely avoided by the Project. Some of these patches are located in Imbil State Forest and are surrounded or directly adjacent by plantation works. The Project is generally undertaking limited geotechnical works in areas adjacent to habitat critical to the survival of the species and the works will be appropriately managed as per the CEMP to minimise any indirect impacts on these areas. Therefore, the Exploratory Works Project is unlikely to adversely affect habitat critical to the survival of the species.

Ball nut (*Floydia praealta)*	
Impact criteria	**Assessment**
Disrupt the breeding cycle of an important population	**Unlikely** As per the Conservation Advice the species may live for more than 100 years, with a juvenile period of 10 years. The plant germinates readily from fresh seed though suckering from the roots can occur. Seeds are most likely dispersed by birds with seed viability estimated to be three months. Flowering has been recorded from January to February and January to July, while fruiting has been recorded on plants between January and June, though it is suggested that fruit is present closer to June only. There is no clearing within known populations or habitat for this species, while the Project is not likely to impact on the seed dispersal mechanisms and pollinators in the short or long term. Noting that despite the logging in the area genetic flow and seed dispersal is maintained in the area based on the number of records in the patch within Imbil State Forest. Dust generated by the works has the potential to reduce individual plant vitality and has the potential to suppress flower and seed production. This impact, however, is unlikely since there are no *Floydia praealta* records within the vicinity of the footprint that could be affected. All records are at least 25 m from the footprint and buffered by vegetation which would reduce the likelihood of dust impacts on the plants. Therefore, the Exploratory Works Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** No known habitat will be removed as part of the Exploratory Works Project. The quality of potential habitat for *Floydia praealta* may decrease due to the indirect effects of erosion and sedimentation, spread of weeds and pests, dust emissions, changes in groundwater quantity and quality, and contamination from hazardous materials. However, these impacts are unlikely to lead to a long-term decrease in the size of an important population due to the implementation of mitigation measures. Furthermore, the local population has exhibited resilience as the surrounding areas is subject to logging. In this regard, the Exploratory Works Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** Weeds are present across all areas of the Project area and the works have limited potential to facilitate the further spread of weeds into areas such that the known and potential habitat of the species would become unsuitable for the species. Biosecurity management measures will be in place to reduce the introduction and/or spread of invasive species into the TEC which support this species. This will include the use of selective herbicides given the site is a water buffer supply area, along with targeted spaying and manual/mechanical removal. The Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.

Ball nut (*Floydia praealta*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** No diseases are listed as known threats to this species and no additional diseases are expected to be introduced as a result of the Exploratory Works Project.
Interfere with the recovery of the species	**Unlikely** There will be no direct impacts to any of the 63 individuals of *F. praealta* within the Borumba PHES Survey area or the habitat in which these population occur. The direct loss of 2.7 ha of potential habitat, within which the species was not identified, is unlikely to lead to long-term decrease in the size of population. Additionally, *F. praealta* habitat within the Project footprint is unlikely to fall within the gamut of being habitat critical to the survival of the species, though areas adjacent to one of the geotechnical boreholes in Imbil State Forest may be considered habitat critical to the survival of the species. Temporary impacts to the known and potential habitat of the *F. praealta* species as a consequence of erosion and sedimentation, spread of weeds and pests, dust emissions, changes in groundwater quantity and quality, and contamination from hazardous materials are unlikely to interfere with the recovery of the species due to the implementation of mitigation measures. However, dust generated by the works has the potential to reduce individual plant vitality and has the potential to suppress flower and seed production. This impact, however, is likely to temporary and unlikely to lead to long term/permanent impacts to the species or local population. Due to the reasons listed above, it is highly unlikely that the Exploratory Works Project will interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.2.2 Brush sophora (*Sophora fraseri*)

The Project has the potential to significantly impact brush sophora (*Sophora fraseri*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 46, information on the species including a habitat and general description, distribution, habitat critical to the survival of the species, important populations, and threats.
- In Table 47, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 48, an assessment against the significant impact criteria for TECs listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The locations of the species observations within the Borumba PHES Survey area, the Project footprint, and extent of known and potential habitat are shown in Figure E-1 (Appendix E). It should be noted that there are records of brush sophora adjacent to the mapped extent of potential habitat, but outside the potential habitat. This is likely due fertile material having become established in an area with suitable micro-habitat factors, in an area that that is not otherwise potential habitat.

The significant impact assessment undertaken in Table 48 identified that the Project is **unlikely** to result in a significant impact on the brush sophora (*Sophora fraseri*).

Table 46: Description of brush sophora (*Sophora fraseri)*

Brush sophora (*Sophora fraseri*)	
Profile	**Conservation status**: Vulnerable **Habitat:** *Sophora fraseri* grows in moist habitats, often in hilly terrain at altitudes from 60–660 m on shallow soils along rainforest margins in eucalypt forests or in naturally occurring and disturbance related canopy gaps in closed forests (DEWHA, 2008). **Distribution:** *S. fraseri* is restricted to south-eastern Queensland and north-eastern New South Wales where it occurs from the Casino area north to near Miriam Vale. Most collections are from the Conondale, D'Aguilar and Taylor Ranges, and the Great Dividing Range south of Toowoomba in southeast Queensland (DEWHA, 2008). **Previous records:** No previous records for this species occur within 10 km of the Exploratory Works Survey area. **Habitat Critical to the Survival of the Species:** The Conservation Advice does not define habitat critical to species (DEWHA, 2008). However, the generic definition within the significant impact guidelines (Department of the Environment, 2013) defines habitat critical to the survival of a species as areas that are necessary: • for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species. The habitat within the Exploratory Works Survey area is unlikely to fall within the gamut of being habitat critical to the survival of the species, as none of the above apply to the individuals identified within the Borumba PHES Survey area.

Brush sophora (*Sophora fraseri*)	
	Important Populations: There are no important populations identified for *S. fraseri* within the approved Conservation Advice (DEWHA, 2008). As such, the generic definition of an 'important population' has been utilised for this assessment. This is defined as a population that is necessary for a species' long-term survival and recovery and may include populations that are: • key source populations either for breeding or dispersal • populations that are necessary for maintaining genetic diversity • populations that are near the limit of the species range. There are multiple populations of the species known from the Conondale Range, including Imbil State Forest, with this broader population including all individuals associated with the Project footprint. This local population is considered to constitute an important population as they exist 'near' the limit of the species range (or at least near the beginning of a large gap in distribution). **Threats:** The main identified threats to *S. fraseri* are: • loss of habitat through clearing for agriculture and development • timber harvesting activities • weed infestation, such as lantana (Lantana camara) • grazing by livestock • inappropriate fire regimes • localised extinction of small populations.
In the Survey area	**Surveys:** Surveys were completed between November 2022 and July 2024 in all areas of habitat to be impacted by the Exploratory Works Project. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M. **Species occurrence:** A total of 31 individuals were identified during the surveys undertaken. With most of these records from ridgelines where there are existing tracks and the vegetation is open eucalypt woodland and where fire has been prominent. There were few records within area of preferred habitat as described above, though the records were generally within 50 m of patches of Lowland Rainforest. **Habitat:** Approximately 2,298.2 ha of potential habitat occurs in the Borumba PHES Survey area. There is 494.2 ha of potential habitat in the Exploratory Works Survey area and 16.8 ha of potential habitat in the Project footprint. Potential habitat is mapped as wet sclerophyll forest and Eucalypt forests (12.11.1, 12.11.3, 12.11.3a, 12.11.10, 12.12.16, 12.3.1a). Known habitat is mapped as a 30 m buffer around individuals recorded in field surveys. **Present threats to the species:** Weeds including *Lantana camara* are persistent throughout the Survey area. A suite of invasive fauna that may threaten *S. fraseri* through grazing are also present, including European brown hare and rabbit, pig, and rusa deer.

Table 47: Assessment of potential impacts, and mitigation options for brush sophora (*Sophora fraseri*)

Brush sophora (*Sophora fraseri*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing directly impacting individuals and causing habitat loss and habitat fragmentation	Given the location of the records along existing tracks and the need to upgrade the tracks vegetation clearing is anticipated to result in the direct impact to five individuals. Vegetation clearing is anticipated to result in the direct loss of 0.3 ha of known habitat, and 16.8 ha of potential habitat. The works are unlikely to fragment the existing individuals or create a barrier to seed and/or pollinator dispersal. The impact pathways include: • vegetation clearing and earthworks associated with the establishment of geotechnical disturbance areas and access tracks.	The clearing footprint has been minimised to the greatest extent possible, which has avoided 26 brush sophora that have been identified in the Borumba PHES Survey area. Accidental clearing will be avoided by establishing restricted areas (i.e. buffer zones) around areas of *Sophora fraseri* individuals/ populations near the Exploratory Works Project footprint. Should additional individuals of the species be found during pre-clearance surveys, appropriate actions will also be taken to avoid clearing them, otherwise appropriate approvals will be obtained to salvage those individuals (either the plant itself, or genetic material via seeds, cuttings or seedlings) with the aim for use in rehabilitation works. Specimens may also be sourced from local nurseries with *S. fraseri* readily available as nursery stock.
Changes to habitat quality as a result of erosion and sedimentation	The *S. fraseri* within the Borumba PHES Survey area are generally located along hill top ridges where access tracks are proposed to be widened. There is minimal erosion along the existing tracks and the proposed works on these tracks are not likely generate significant quantities of sediment or result in erosion especially if the roads are designed in accordance with relevant guidelines and standards and ESCP measures are implemented. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with the mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works. Erosion and sedimentation risk is likely to be greatest in the vicinity of Area 3 (Walkers Top) geotechnical investigation areas, where the species is known to occur. Erosion and sedimentation may also reduce the availability of nutrients and other essential resources required to maintain the quality of the land.	A preliminary Erosion and Sediment Control Plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation. • Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty

Brush sophora (*Sophora fraseri*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • vegetation clearing to establish access tracks and clearing associated with the geotechnical investigation areas.	water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. • Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/ maintenance of restricted areas, including buffer zones.
Spread of weeds, pests and disease due to increased human activity	The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation and management measures. Weeds may be further spread throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Use of construction vehicles and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Increased incidences of weeds and pests may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Pests may contribute directly to consumption and/or destruction of edible flora species. The spread of weeds is identified as a key threat to the species. Weeds including *Lantana camara* are persistent throughout the Survey area. A suite of invasive fauna that may threaten *S. fraseri* through grazing are also present, including European brown hare and rabbit, house mouse, pig and rusa deer.	In accordance with Queensland Hydro's Biosecurity Management Plan hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of invasive species: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and existing site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed, pest and pathogen spread.

Brush sophora (*Sophora fraseri*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Inadequate decontamination of construction machinery and construction personnel may result in transmission of disease. Movement of diseased individuals (either through vegetation clearing or translocation activities) may also act to spread disease within the Project area. The impact pathways include: • Transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area. • Facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	• Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint, unless approved for use in the area including targeted spraying. Particular care will be taken to ensure that any fill is sourced from areas free of lantana and other weed material which competes for similar habitat and is known to be a significant threat to the species to mitigate any impacts associated with Exploratory Works. Work with adjacent landholders and other stakeholders to align biosecurity measures including treatment timeframes and programs. Contaminated material to be disposed of in accordance with the *Biosecurity Act 2014* including by transporting it safely to a waste disposal facility or burying it or adding it to onsite mulching.
Reduced amenity through dust emissions	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed access tracks. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may have the	One of the key design measures that will assist with dust mitigation is the resheeting and sealing of roads and tracks to minimise dust generation. Noting that these plants are located on a main throughfare for the Project. Other measures will include but are not limited to the following, with further details provided in the CEMP (Appendix F): • Dust hygiene – Resheeting and sealing of roads and tracks to minimise dust generation.

Brush sophora (*Sophora fraseri*)		
Potential Impact	**Assessment**	**Mitigation Options**
	potential to cause reduced vitality, postpone flowering and/or seeding, or cause the death of individual plants. The impact pathways include: Vegetation clearing, and vehicle and machinery movement around the site may result in increased dust emissions.	– Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. – Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of *S. fraseri* individuals adjacent to active geotechnical activities and road/access track construction noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of restricted areas, including buffer zones (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Changes in surface and groundwater quality and quantity may influence a species' resilience to disturbance and continued viability. The Project is anticipated to have minimal impacts to surface water flows (instead and overland). The groundwater assessment determined that impacts to groundwater drawdown are primarily associated with the tunnel. The works are unlikely to change surface water or groundwater patterns near any brush sophora. Contaminated water is likely to have detrimental effects to the health and continued occurrence of a species, should it enter the environment in an uncontrolled manner. Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of	There are anticipated to be minimal surface water and hydrology changes as a result of the Project with the potential to impact *S. fraseri*. Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. Groundwater from the tunnelling activities will undergo treatment to meet relevant WQO prior to release or reuse on the site. Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. There are no specific management measures developed for surface water and groundwater specific to brush sophora as there

Brush sophora (*Sophora fraseri*)		
Potential Impact	**Assessment**	**Mitigation Options**
	vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water may also enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone. The impact pathways include: • Works within waterways, drainage lines and overland flow paths, along with any works below the 1% AEP groundwater drawdown associated with geotechnical investigations.	are anticipated to negligible changes to surface water and groundwater patterns as a result of the Project.
Contamination from hazardous materials	The construction compound area, spoil disposal area and staging area are proposed in Area 4 (Borgan Road). Operation of these Project components pose the greatest risk of hazardous material release to the environment if containment and management is inadequate. Species habitat in these areas are uphill and upstream from the work areas, and as such impacts from hazardous material runoff is unlikely. Spills of chemicals may also be a particular risk for individuals and species habitat adjacent Area 3 (Walkers Top) geotechnical investigation works, where oil and other chemicals from the use of vehicles and machinery may enter the environment. As the location of individuals and habitat in gullies and slopes is down-gradient of proposed geotechnical investigation access tracks and drilling areas in Walkers Top, there is a risk of impact from hazardous material contamination to this species. Spills or leaks of chemicals required to support construction activities may result in degraded areas in the vicinity of Project works, reducing the availability and quality of habitat and resources available. The impact pathways include: • spills or leaks of chemicals required to support construction activities.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts as per the CEMP, including: • All machinery is required to be re-fuelled in designated, and bunded, areas away from brush sophora. • Spill containment kits will be kept on site and readily available in the event of fuel/oil spills. • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release. • Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed) only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks.

Brush sophora (*Sophora fraseri*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise. For example, drill muds and water will be stored in ICBs and vac trucks will be used to remove this material from site.
Changes to the local bushfire regime	Inappropriate fire regimes are a threat for this species as too frequent fire depletes the soil seed bank. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within Imbil State Forest and Conondale Resources Reserve.

Table 48: Significant impact assessment for the vulnerable brush sophora (*Sophora fraseri)*

Brush sophora (*Sophora fraseri*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Likely** The direct impact to five individuals who form part of an important population is likely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	**Unlikely** The AOO is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The impact to five individuals, out of a known population of 31 within the Borumba PHES Survey area is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.
Fragment an existing important population into two or more populations	**Unlikely** The nature of clearing for the Exploratory Works Project is an important consideration in assessing the potential impacts of fragmentation. Access tracks will be maximum 6 m wide. There are no large clearing extents which will create large canopy gaps or cleared areas which would prevent the dispersal of this species or its potential pollinators. In this regard, the Exploratory Works Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely** The known and potential habitat present within the Project footprint is considered not to be habitat critical to the survival of the species. In this regard, the Exploratory Works Project is unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Likely** Dust generated by the works has the potential to reduce individual plant vitality and has the potential to suppress flower and seed production. This impact, however, is likely to be temporary and unlikely to lead to long term/permanent impacts to the species or local population. The Exploratory Works Project are unlikely to prevent or inhibit pollinators from accessing the species, nor does the Project have the potential to limit seed dispersal. In this regard, there is a possibility that the Exploratory Works Project disrupt the breeding cycle of an important population.

Brush sophora (*Sophora fraseri*)	
Impact criteria	**Assessment**
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Weeds are currently present across all areas of the Project area and the works have limited potential to facilitate the further spread of weeds into areas such that the known and potential habitat of the species would become unsuitable for the species. In this regard, the Exploratory Works Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** The Exploratory Works Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat. The Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.
Introduce disease that may cause the species to decline	**Unlikely** No diseases are listed as known threats to this species and no additional diseases are expected to be introduced as a result of the Exploratory Works Project.
Interfere substantially with the recovery of the species	**Likely** The direct impacts to five individuals and the clearing of 0.3 ha of known habitat and 16.9 ha of potential habitat is likely to interfere with the recovery of the species. The extent to which these impacts will *substantially* interfere with the recovery of the species is unknown. In this regard, there is uncertainty as to the extent to which the Project will interfere substantially with the recovery of the species, however following a conservative approach this impact criterion has been assessed as likely.
Recommendation:	Significant impact is **Likely**

7.2.3 *Coleus omissus* (syn. *Plectranthus omissus*)

The Project has the potential to significantly impact *Coleus omissus*, which is listed as endangered under the EPBC Act. This section provides the following:

- In Table 49, information on the species including a general description, distribution, key diagnostic characteristics, condition thresholds, and threats.
- In Table 50, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- Table 51, an assessment against the significant impact criteria for species listed as endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

Survey records and field verified suitable habitat within the broader Borumba PHES Survey area and the Exploratory Works Project footprint are shown on Figure E-5 (Appendix E). Note, that locations shown on Figure E-5 may represent more than one individual.

The significant impact assessment undertaken in Table 51 identified that the Project is **unlikely** to result in a significant impact on *Coleus omissus*.

Table 49: Description of *Coleus omissus*

Coleus omissus	
Profile	**Conservation status:** Endangered **Habitat:** Habitat comprises rocky outcrops in eucalypt open forests adjacent to vine forest (Booth, 2012). The species grows on rock outcrops in eucalypt open forest and adjacent to vine forest (DEWHA, 2008). **Distribution:** *Coleus omissus* is known from only six sites between the Sunshine Coast (SCC, 2021), Conondale Ranges and Gayndah, Queensland (Booth, 2012). All sites were previously under state forest tenure and are currently protected as forest reserves, with the exception of a population near Eudlo on the Sunshine Coast which is on a voluntary conservation agreement property (SCC, 2021). While active timber harvesting has ceased in these reserves, public access is increasing. The population at one site is estimated to be only 30-40 plants (DEWHA, 2008). The species has an area of occupancy (AOO) of approximately 700 km^2 (Halford, 1998). **Previous records:** The nearest record on the Atlas of Living Australia (ALA), from 1994, is approximately 16 km to the south in Conondale National Park (ALA, 2023). The nearest recent record is near Eudlo on the Sunshine Coast from 2021, approximately 46 km to the southeast of the Borumba PHES Survey area (ALA, 2023). **Habitat Critical to the Survival of the Species:** Neither state nor commonwealth species advice defines Habitat Critical to the Survival of the Species (HCSS) (Booth, 2012; DEWHA, 2008), however as the species is known from a very small number of isolated populations, the most critical habitat is likely to be those patches in which records have been observed (Halford, 1998). Therefore, areas containing *C. omissus* records are considered HCSS. **Population:** The population size is unknown with the species identified from seven sites including the records from Imbil State Forest. Population at one site is estimated 40 plants, while the population identified from the Borumba PHES Survey area was only 15 individuals. Based on this the population may be less than 300 plants. **Threats:** The main identified threats to the species are competition from introduced weeds including lantana and billy goat weed (*Ageratum houstonianum*), and inappropriate fire regimes (Booth, 2012; DEWHA, 2008; Halford, 1998).

Coleus omissus	
In the Survey area	**Surveys:** Surveys were completed between November 2022 and July 2024, in areas of habitat to be impacted by the Exploratory Works Project. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M. **Species occurrence:** The species has not been recorded within the Exploratory Works Project footprint. Approximately 15 individuals were observed on a rocky outcrop in open eucalypt forest (RE12.11.10) adjacent to vine forest approximately 3.2 km south of Area 1 (Borumba Dam) and 800 m west of Tower Road (>2.5 km outside of the Project footprint (see Appendix E). These records likely represent a new population. **Habitat:** Potential habitat is defined as rocky outcrops that are within 100 m either side of rainforest ecotones. A total of 149.3 ha of potential habitat for the species occurs within the Borumba PHES Survey area (see Appendix E). The species' known habitat does not occur within the Project footprint; however, 1.1 ha of potential habitat occurs within the Project footprint. **Present threats on the species:** *Lantana camara* and billygoat weed occur in areas of habitat for the species. Lantana is widespread throughout the Exploratory Works Project footprint.

Table 50: Assessment of potential impacts, and mitigation options for *Coleus omissus*

Coleus omissus		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	Vegetation clearing may result in the removal of habitat, or the direct removal of individuals, also reducing the area of occupancy of the species. Direct clearing of individual *Coleus omissus* individuals is not anticipated as the Exploratory Works Project footprint is >2.5 km from any known records. Disturbance to 1.1 ha of the potential habitat within the Project footprint, (mainly within Area 1, but also in Area 3 (Walkers Top) and Area 4 (Borgan Road)) is not likely to cause significant habitat loss or fragmentation. The rocky outcrops that make up the preferred habitat for the species, are naturally quite fragmented and sparse within the Borumba PHES Survey area and the small amount of disturbance spread across a number of areas, is not anticipated to exacerbate this.	The proposed Project footprint has been designed to avoid all known individual records of the *Coleus omissus* and has minimised the clearing of potential habitat. Where vegetation clearing for potential habitat of *Coleus omissus* is unavoidable, to mitigate the impact to the species, the following measures are proposed: • Pre-clearance survey Pre-clearance surveys will be undertaken by a suitably qualified ecologist to identify any additional *C. omissus* individuals within and adjacent to the Project footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*).

Coleus omissus		
Potential Impact	**Assessment**	**Mitigation Options**
		• Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition. • Unexpected find Works will be undertaken in accordance with the unexpected finds procedure, which involves: – stop works in the vicinity of the find – demarcate and prevent access to area – comprehensively survey the population of the threatened species to determine the number of plants potentially impacted and spatial extent – explore options for avoidance – if impacts cannot be avoided engage with DCCEEW and DETSI in relation to approvals to clear.
Changes to habitat quality as a result of erosion and sedimentation	Areas of suitable habitat may be subject to impacts due to erosion and sedimentation where it occurs adjacent to and downhill of the Project footprint. Habitat quality may decline as a result of erosion and sedimentation, flowing from inadequately managed construction (ground disturbance) areas. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required for species to thrive.	While erosion and sedimentation are considered unlikely to pose a risk to species habitat in most areas, due to its preferred habitat type, the following mitigation measures apply: • A preliminary Erosion and Sediment Control Plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures:

Coleus omissus		
Potential Impact	**Assessment**	**Mitigation Options**
	The recorded *C. omissus* in the PHES Survey area are located on a ridgeline 3.5 km to the south of Area 1 (Borumba Dam). Suitable habitat is defined as steep rocky outcrops and is mostly on upper slopes and ridges in areas adjacent to the Project footprint. The impact pathways include: • track widening and new track creation works near, steep rocky habitat in Area 4 (Borgan Road) and Area 3 (Walkers Top) are unlikely to pose a risk, but there may be some potential for sediment accumulation in the lower areas of mapped habitat in Area 1 (Borumba Dam).	– Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. – The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation. – Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway consistent. • Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/ maintenance of restricted areas.
Spread of weeds, pests and disease due to increased human activity	Competition from introduced weeds including *Lantana camara* and billy goat weed is identified as a key threat to the species. Weeds including lantana are persistent throughout the Borumba PHES Survey area. The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation and management measures. Weeds may be further spread throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with native flora species and reduced availability of suitable habitat and associated resources.	In accordance with Queensland Hydro's Biosecurity Management Plan hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of invasive species: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and existing site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs,

Coleus omissus		
Potential Impact	**Assessment**	**Mitigation Options**
	Use of construction vehicles and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Increased incidences of weeds and pests may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Pests may contribute directly to consumption and/or destruction of edible flora species.	especially when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed, pest and pathogen spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint, unless approved for use in the area including targeted spraying. Particular care will be taken to ensure that any fill is sourced from areas free of lantana and other weed material which competes for similar habitat and is known to be a significant threat to the species to mitigate any impacts associated with Exploratory Works. Work with adjacent landholders and other stakeholders to align biosecurity measures including treatment timeframes and programs. Contaminated material to be disposed of in accordance with the *Biosecurity Act 2014* including by transporting it safely to a waste disposal facility or burying it or adding it to onsite mulching.

Coleus omissus		
Potential Impact	**Assessment**	**Mitigation Options**
Reduced amenity through dust emissions	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed access tracks. The initial and on-going generation of dust has the potential to impact the quality and integrity of areas of suitable habitat. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive or result in mortality.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of vegetation adjacent to active geotechnical activities and road/access track construction (with visual inspections of vegetation within 50 m of active geotechnical activities and road/access track construction) noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Changes in surface and groundwater quality and quantity may influence a species' ability to thrive or cause mortality. The works are unlikely to change surface water or groundwater patterns near any *C. omissus*. Contaminated water is likely to have detrimental effects to the health and continued occurrence of a species, should it enter the environment in an uncontrolled manner. Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water may also	Hazardous materials are unlikely to be stored upslope or within 50 m of any of the identified *C. omissus* (as the only species records are >2.5 km away from the Project footprint and habitat mapped near likely sources of hazardous materials is mostly upslope). Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. Groundwater from the tunnelling activities will undergo treatment to meet relevant WQO prior to release or reuse on the site.

Coleus omissus		
Potential Impact	**Assessment**	**Mitigation Options**
	enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone.	Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. There are no specific management measures developed for surface water and groundwater specific to *Coleus omissus* as there are anticipated to be only negligible changes to surface water patterns and groundwater resources as a result of the Project.
Contamination from hazardous materials	The construction compound area, spoil disposal area and staging area are proposed in areas close to species habitat in Area 4 (Borgan). Operation of these Project components pose the greatest risk of hazardous material release to the environment if containment and management is inadequate. Species habitat in these areas is uphill from the works area, and so is unlikely to suffer from hazardous material runoff. Spills of chemicals may also be a particular risk for the species habitat adjacent to the Area 1 (Borumba Dam) investigation areas and the Area 3 (Walkers Top) geotechnical investigation access tracks, where oil and other chemicals from the use of vehicles and machinery may enter the environment.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts as per the CEMP, including: • All machinery is required to be re-fuelled in designated, and bunded, areas away from *Coleus omissus*. • Spill containment kits will be kept on site and readily available in the event of fuel/oil spills. • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release. • Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed)

Coleus omissus		
Potential Impact	**Assessment**	**Mitigation Options**
		only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks. • Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise. For example, drill muds and water will be stored in ICBs and vac trucks will be used to remove this material from site. Groundwater from the tunnelling activities will undergo treatment to meet relevant WQO prior to release or reuse on the site.
Changes to the local bushfire regime	While the species is likely to be vulnerable to bushfire, the preferred habitat may provide some natural protection, as the rocky outcrops are unlikely to sustain hot fire. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management with known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.

Table 51: Significant impact assessment for the endangered *Coleus omissus*

Coleus omissus	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The Exploratory Works Project is considered unlikely to lead to a long-term decrease in the size of a population as the only known record in the PHES Survey area is >2.5 km away from the Project footprint.
Reduce the area of occupancy of the species	**Unlikely** The Exploratory Works Project is considered unlikely to reduce the occupancy of the species as no direct impacts to individuals is anticipated.
Fragment an existing population into two or more populations	**Unlikely** The Exploratory Works Project is unlikely to fragment an existing population into two or more populations as the only records in the Borumba PHES Survey area are >2.5 km away from the Project footprint and no disturbance in the patch of habitat containing the records is expected.
Adversely affect habitat critical to the survival of a species	**Unlikely** As the Project is unlikely to directly or indirectly impact any known habitat of the species, which is considered HCSS, the Exploratory Works Project is considered unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	**Unlikely** The breeding cycle of the species is not well described; however, the main method of reproduction is via sexually produced seeds. Given the number of individuals recorded, breeding is assumed to occur. The Exploratory Works Project is considered unlikely to disrupt the breeding cycle of a population. No known populations have been recorded within 2.5 km of the Project.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The Exploratory Works Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species as the works are well separated from a known population and the associated habitat. The Project will impact 1.1 ha of potential habitat however this is unlikely to result in the decline of the species as these areas are generally isolated areas and not contiguous with the existing population. Additionally, weeds are currently present across all areas of the Project area and the works have limited potential to facilitate the further spread of weeds into areas such that the known and potential habitat of the species would become unsuitable for the species.

Coleus omissus	
Impact criteria	**Assessment**
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** The Exploratory Works Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat. The Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.
Introduce disease that may cause the species to decline	**Unlikely** No diseases are listed as known threats to this species and the Exploratory Works Project is considered unlikely to introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** Threats that may interfere with the recovery of this species have not been specifically identified in Conservation Advice, however no direct impacts to known individuals of the species and to impacts to the reproductivity for the species are expected as a result of the Exploratory Works Project. Therefore, the Exploratory Works Project is considered unlikely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.2.4 *Coleus torrenticola* (syn. *Plectranthus torrenticola*)

The Project has the potential to significantly impact *Coleus torrenticola*, which is listed as endangered under the EPBC Act. This section provides the following:

- In Table 52 information on the species including a general description, distribution, key diagnostic characteristics, condition thresholds, and threats.
- In Table 53, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 54, an assessment against the significant impact criteria for species listed as endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

Survey records and field verified suitable habitat within the Borumba PHES Survey area and the Exploratory Works Project footprint are shown on Figure E-5 (Appendix E). Note that the locations of *Coleus torrenticola* shown on Figure E-4 may represent more than one individual.

The significant impact assessment undertaken in Table 54 identified that the Project is **unlikely** to result in a significant impact *Coleus torrenticola*.

Table 52: Description of *Coleus torrenticola*

Coleus torrenticola	
Profile	**Conservation status:** Endangered **Habitat:** The Conservation Advice states that *Coleus torrenticola* is a slightly scented, multi-stemmed herb 30–50 cm in height (DEWHA, 2008). It grows in open heathland on rock outcrops, or in dappled shade under eucalypt open forest close to margins of rainforest and often along creek lines, at altitudes of 250–450 m. The species occurs on shallow soils and often, but not exclusively, near water (DEWHA, 2008). **Distribution:** The Conservation Advice states *C. torrenticola* is only known from eight locations in the Sunshine Coast hinterland of south-eastern Queensland, from the Blackall Range to Kin Kin. The population identified in the Exploratory Works Project footprint is outside the current limits of its known range (DEWHA, 2008). The records of the species within the Borumba PHES Survey area suggest a range extension and therefore the Exploratory Works Project is at the limit of the species range. The area of occupancy is estimated at 124 km^2. **Previous records:** The ALA database shows a record of this species from 2022 within the Borumba PHES Survey area, located to the east of Walkers Top Road in Area 4 (Borgan) (ALA, 2023). **Habitat Critical to the Survival of the Species:** Habitat critical to the survival of *C. torrenticola* is not defined in the approved Conservation Advice (DEWHA, 2008). In the absence of defined habitat critical to the survival of the species, it is necessary to consider the guidance in the Significant Impact Guidelines (1.1), which states 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community.'

Coleus torrenticola	
	In light of the above criteria, and given the population identified in the Borumba PHES Survey area is outside the species' current known range, habitat within 30 m of records is considered habitat critical to the survival of the species as it provides a buffer for suitable habitat and the individual plants that may support the long-term maintenance of the species. Other habitat that meets micro-climate conditions is considered potential habitat (suitable for the species). **Population:** There is no information on the abundance of *C. torrenticola*, although one source suggested that the species is "not common" at known sites. **Threats:** The Conservation Advice for the species identifies the main threats to the species as being: • weed invasion by Crofton Weed (*Ageratina adenophora*) and Mistflower (*Ageratina riparia*) • habitat degradation (trampling) • broad scale clearing • inappropriate fire regimes • degradation caused by feral pigs (*Sus scrofa*) • grazing pressure • restricted distribution • inappropriate timber harvesting.
In the Survey area	**Surveys:** Surveys were completed between November 2022 and July 2024 in all areas of suitable habitat to be impacted by the Exploratory Works Project. Surveys followed periods of high rainfall, which ensured that the species was readily detectable and identifiable from recent and active growth. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M. **Species occurrence:** A total of 246 individuals were recorded growing on the rocky edges of creeks in steep gullies (Figure E-4 in Appendix E). One individual is within the Exploratory Works Project footprint at a proposed crossing of Sandy Creek near the portal pad in Area 4 (Borgan). This individual was observed in a sandy bank of the creek. **Habitat:** The habitat in which the species was recorded is described as a rocky gully comprised of metamorphic rocks with running water and scattered *Syzygium australe* present along with a sparse distribution of lithophilic orchids, herbs and ferns. Adjacent vegetation RE 12.11.3. A total 142.9 ha of potential habitat, and 4 ha of known habitat occurs in the Borumba PHES Survey area. Potential habitat is limited to a 20 m buffer around rocky watercourses in open rainforest and wet sclerophyll forests. Known habitat is habitat within 30 m of records and represents habitat critical to the survival of that record. Known habitat includes suitable habitat (potential habitat) but may also include unsuitable habitat within 30 m, which provides a buffer to each species record. A total of 0.3 ha of known habitat and 5.8 ha of potential habitat is located within the Project footprint. **Present threats on the species:** Crofton weed and mistflower occur in the Borumba PHES Survey area and can outcompete *C. torrenticola* for areas of suitable habitat. A suite of other invasive fauna that may threaten *C. torrenticola* through grazing and/or trampling, including European brown hare and rabbit, pig and rusa deer, are also present in the Borumba PHES Survey area.

Table 53: Assessment of potential impacts, and mitigation options for *Coleus torrenticola*

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Project is anticipated to directly impact a single individual, 0.3 ha of known habitat and 5.8 ha of potential habitat. Approximately 142.9 ha of potential habitat for the species occurs in the Borumba PHES Survey area. A total of 246 individuals were recorded in the Borumba PHES Survey area, with all but one growing on the rocky edges of creeks in steep gullies. One record was observed on a sandy bank, within the Exploratory Works Project footprint at a proposed crossing of Sandy Creek near the proposed portal pad. This individual record is not associated with any other nearby records (despite thorough, targeted survey of the area) and is at a location outside of the preferred habitat for the species. The individual is likely a rogue specimen that likely washed downstream from more suitable habitat at an upstream location. There are no other records within the Project footprint, therefore the Exploratory Works Project is anticipated to cause the clearing of one individual *Coleus torrenticola*. While only one of the records are within the Exploratory Works Project footprint, most of the species' records are in close proximity to/between areas of proposed geotechnical investigation in Area 3 (Walkers Top). These investigations are not anticipated to result in habitat fragmentation for the species, given that the disturbance required in these areas would be temporary and spatially limited to the smallest area required to support drilling of boreholes. The Project is anticipated to clear 0.3 ha of known habitat (being vegetation within 30 m of a known record) and 5.8 ha of potential habitat for the species. Only a small proportion of the area mapped as potential habitat is likely to be occupied by this species due to specific microhabitat requirements observed during the field investigations – it is restricted to rocky gullies, rocky watercourses and rocky outcrops.	The Exploratory Works have been designed to avoid the known population and minimise the impact on habitat for the species. Noting that this population is located within the footprint of the main saddle dam for the upper reservoir. This area will be designated as an exclusion zone. Additional mitigation measures are outlined below, with further details provided in the CEMP and associated plans: • Pre-clearance survey Pre-clearance surveys to be undertaken by a suitably qualified ecologist to identify threatened flora within and adjacent the footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). • Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas, including exclusion zones and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition. • Monitoring Monitoring, of individuals retained adjacent to the Project footprint to track impacts during and following construction.

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
	As outlined within Table 52, mapped known habitat includes suitable habitat (i.e. potential habitat), but can also include unsuitable habitat that is within 30 m a species record. The proposed geotechnical investigation sites are situated approximately 10 m and 20 m upslope from a steep gully in which *C. torrenticola* has been recorded, in an open forest with a grass dominated understorey. However, in this case, the mapped known habitat is not an accurate representation of actual habitat, as the 30 m buffer within the mapping does not account for the topographic gradient. While the investigation sites are located within the mapped 30 m buffer, they are situated in areas containing unsuitable habitat for *C. torrenticola*. As such, there will be no impact to *C. torrenticola* habitat.	
Changes to habitat quality as a result of erosion and sedimentation	Most of the Exploratory Works Project is in areas that may contain soils with sodic subsoils that are highly erodible if exposed. Particular attention to soil erosion control measures is required in these areas. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with the mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works. A population of *C. torrenticola* is located immediately adjacent to the areas of proposed geotechnical investigation in Walkers Top, within steeply sloped gullies. A smaller population is also located immediately downstream. The location of these populations places them at risk of impacts from erosion and sedimentation from the proposed geotechnical investigations, where ground disturbance is required. Habitat quality may decline as a result of erosion and sedimentation, sourced from inadequately managed construction (ground disturbance) areas. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required for species to thrive.	To minimise erosion in or adjacent to the proposed Exploratory Works Project footprint, soil disturbance will be minimised and clearing methods of blading and grubbing are avoided. For example, the use of sleds and platforms are proposed in this area due to the steep slopes in preference to cut and fill activities. A preliminary Erosion and Sediment Control plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation.

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • earthworks associated with the clearing of the area in Area 3 (Walkers Top) for geotechnical works and access tracks.	• Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. • Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/ maintenance of restricted areas, including exclusion zones.
Spread of weeds, pests and disease due to increased human activity	Weed invasion by Crofton weed and mistflower and degradation caused by feral pigs (*Sus scrofa*) is identified as key threats to the species. Weeds are established throughout Walkers Top and the PHES Survey area, including in heavily vegetated areas. Pest fauna (including pigs) have also been recorded throughout the PHES Survey area. The populations of *C. torrenticola* in the vicinity of the Walkers Top geotechnical investigation works are within heavily vegetated areas. The Exploratory Works Project will introduce human activity in these areas, and although weeds and pests are already established and the works are temporally and spatially limited, the Project presents potential for increased incidences of weeds, pests and disease. The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation and management measures. Weeds may be further spread throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with	In accordance with Queensland Hydro's Biosecurity Management Plan hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of invasive species: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and existing site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures.

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
	native flora species and reduced availability of suitable habitat and associated resources. Use of construction vehicles and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Increased incidences of weeds and pests may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Pests may contribute directly to consumption and/or destruction of edible flora species. Inadequate decontamination of construction machinery and construction personnel may result in transmission of disease. Movement of diseased individuals (either through vegetation clearing or translocation activities) may also act to spread disease within the Project area.	• Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed, pest and pathogen spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint, unless approved for use in the area including targeted spraying. Particular care will be taken to ensure that any fill is sourced from areas free of lantana and other weed material which competes for similar habitat and is known to be a significant threat to the species in order to mitigate any impacts associated with Exploratory Works. Work with adjacent landholders and other stakeholders to align biosecurity measures including treatment timeframes and programs. Contaminated material to be disposed of in accordance with the *Biosecurity Act 2014* including by transporting it safely to a waste disposal facility or burying it or adding it to onsite mulching.
Reduced amenity through dust emissions	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed access tracks. The initial and on-going generation of dust has the potential to impact the quality and integrity of areas of suitable habitat.	A key mitigation measure for the species will be how the geotechnical works will occur in this area. That is, the design has changed from the use drill pads requiring cut and fill, due to in part to the steep slopes and to avoid/minimise impacts on *C. torrenticola* to geotechnical investigations using sleds and rail

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
	Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive or result in mortality. The populations of *C. torrenticola* in Walkers Top geotechnical investigation areas are within areas that are heavily vegetated and undisturbed. The Exploratory Works Project will introduce human activity in these areas, and although temporally and spatially limited, the work presents potential for increased dust generation and deposition, particularly on existing or new access tracks that are unsealed.	access. This minimises the extent of clearing and soil disturbance and also the movement of vehicles in the area. The following measures will also be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Daily visual inspections of vegetation adjacent to active geotechnical activities and road/access track construction (with visual inspections of vegetation within 50 m of active geotechnical activities and road/access track construction) noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of restricted areas, including exclusion zones.
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Changes in surface and groundwater quality and quantity may influence a species' ability to thrive or cause mortality. The works are unlikely to change surface water or groundwater patterns near any *C. torrenticola*. The populations of *C. torrenticola* in the vicinity of geotechnical investigation areas may be affected by changes in groundwater levels as a result of underground works. The populations are in close proximity to the underground tunnelling extent, which may also alter groundwater levels	There are no specific management measures developed for surface water and groundwater specific to *C. torrenticola* however the following measures are relevant to avoiding and minimising impacts with further details provided in the CEMP and the associated management plans. There are anticipated to be minimal surface water and hydrology changes as a result of the Project with the potential to impact *C. torrenticola*. That is there are no impoundments or diversions

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
	directly above and immediately adjacent its alignment. These impacts would be temporary in nature. Contaminated water is likely to have detrimental effects to the health and continued occurrence of a species, should it enter the environment in an uncontrolled manner. Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water may also enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone. The impact pathways include: • spilled or leaking chemicals required to support construction activities.	planned within the drainage lines which feed into the gullies this population is recorded in. Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway consistent. While drawdown from the tunnelling works is a risk to the species with drawdown to be managed primarily through tunnel design. A groundwater impact assessment has informed the following mitigation measures: • Cementation of the tunnel and grouting fractures will reduce tunnel inflow and drawdown. • A Water Management Plan has been developed and will be implemented to monitor potential impacts on groundwater and outline measures to mitigate impacts. • The plan will outline measures to monitor change in water levels within the creeks and adjacent boreholes during construction, operation and decommission phases to assess drawdown and rebound over time. • Groundwater from the tunnelling activities will undergo treatment to meet relevant WQO prior to release or reuse on the site.
Contamination from hazardous materials	The construction compound area, spoil disposal area and staging area are proposed in Area 4 (Borgan). Operation of these Project components pose the greatest risk of hazardous material release to the environment if containment and management is inadequate. Except for a vagrant specimen that is anticipated to be directly impacted by the Project footprint, species habitat in these areas are uphill and	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts as per the CEMP, including: • All machinery is required to be re-fuelled in designated, and bunded, areas away from *C. torrenticola*. • Spill containment kits will be kept on site and readily available in the event of fuel/oil spills.

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
	upstream from the work areas, and as such impacts from hazardous material runoff is unlikely. Spills of chemicals may also be a particular risk for individuals and species habitat adjacent Area 3 (Walkers Top) geotechnical investigation works, where oil and other chemicals from the use of vehicles and machinery may enter the environment. Given their location in steep gullies down-gradient of proposed geotechnical investigation access tracks and drilling areas in Walkers Top, the population of *C. torrenticola* are at risk of impacts from hazardous material contamination. Spilled or leaking chemicals required to support construction activities may result in degraded areas in the vicinity of Project works, reducing the availability and quality of habitat and resources available. The impact pathways include: • spilled or leaking chemicals required to support construction activities.	• Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release. • Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed) only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks. • Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise. For example, drill muds and water will be stored in ICBs and vac trucks will be used to remove this material from site.
Changes to the local bushfire regime	While the species is likely to be vulnerable to bushfire, the preferred habitat may provide some natural protection, as the rocky outcrops and proximity to water are less likely to sustain hot fire. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management.

Coleus torrenticola		
Potential Impact	**Assessment**	**Mitigation Options**
	Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within Imbil State Forest and Conondale Resources Reserve.

Table 54: Significant impact assessment for the endangered *Coleus torrenticola*

Coleus torrenticola	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The Exploratory Works Project is unlikely to lead to a long-term decrease in the size of the local population. The recorded population in Walkers Top is not anticipated to be impacted by the works in the area with the Project design and construction methodology purposely reconfigured to avoid any work in the gully which supports this species, noting that geotechnical data from the gully is critical for the Main Works. The works in this area will also involve sleds/rail access and likely a platform rig which further reduces the extent of clearing within and adjacent the habitat area. Indirect impacts will be sufficiently mitigated and monitored to ensure the size of the population does not decrease as a result of the Project. After thorough survey of the area, the individual anticipated to be directly impacted does not appear to be a part of a population, but rather a vagrant specimen and the direct impact to this individual is unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species	**Unlikely** The Exploratory Works Project is unlikely to reduce the area of occupancy of the species as the only anticipated direct impact to the species, is considered a vagrant specimen and therefore does not affect area of occupancy calculations.

Coleus torrenticola	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** The Exploratory Works Project is unlikely to fragment an existing population into two or more populations, as anticipated impacts to species habitat are minimal and do not include any fragmentation or isolation of existing populations. That is, the Project design and construction methodology purposely reconfigured to avoid any work in the gully which supports this species, noting that geotechnical data from the gully is critical for the Main Works. The works in this area will also involve sleds/rail access and likely a platform rig which further reduces the extent of clearing within and adjacent the habitat area.
Adversely affect habitat critical to the survival of a species	**Unlikely** The Exploratory Works Project is anticipated to directly impact 0.3 ha of known habitat, which is considered habitat critical to the survival of the species. With the Project design and construction methodology purposely reconfigured to avoid any work in the gully which supports this species, noting that geotechnical data from the gully is critical for the Main Works. The works in this area will also involve sleds/rail access and likely a platform rig which further reduces the extent of clearing within and adjacent the habitat area. Further it is noted that the mapping does not allow for the vertical separation as a result of the local topography with the boreholes which intersect habitat critical for the species located in open eucalypt woodland with no rocky outcrops present and upslope of the gully. In addition, indirect impacts such as weeds and changes to hydrology will be effectively managed through the implementation of the relevant mitigation measures as per the relevant management plans. As such the works are not expected to adversely affect habitat critical to the survival of *Coleus torrenticola*.
Disrupt the breeding cycle of a population	**Unlikely** The Exploratory Works Project is unlikely to disrupt the breeding cycle of a population. Disturbances nearby to the population in Walkers Top is considered unlikely to disrupt flowering, pollination or seed dispersal.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The Exploratory Works Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The disturbance to 0.3 ha of known habitat is not anticipated to have significant impact of the quality or availability of habitat in the Borumba PHES Survey area.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** The Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat as the Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat.

Coleus torrenticola	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** No diseases are listed as known threats to this species and the Exploratory Works Project is considered unlikely to introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** Threats that may interfere with the recovery of this species have not been specifically identified in Conservation Advice. Under the MNES significant impact guides HCSS and important populations of a species may be necessary for the recovery of that species. The species profile and threat database entry for C*oleus torrenticola* identifies that due to inadequate conservation of populations, it has been suggested that further protection is needed for the species long term survival and the maintenance of its genetic diversity (DOE, 2024). (DOE, Coleus torrenticola in Species Profile and Threats Database, 2024). The direct impact to a single vagrant individual and 0.3 ha of known habitat is anticipated as a result of the Exploratory Works Project; however, this is not expected to significantly impact HCSS, important populations of the species or to impede maintenance of the species' genetic diversity. With the Project design and construction methodology purposely reconfigured to avoid any work in the gully which supports this species, noting that geotechnical data from the gully is critical for the Main Works. The works in this area will also involve sleds/rail access and likely a platform rig which further reduces the extent of clearing within and adjacent the habitat area. As such the works are not expected to interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.2.5 Macadamia nut (*Macadamia integrifolia*)

The Project has the potential to significantly impact the macadamia nut (*Macadamia integrifolia*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 55, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 56 an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 57 an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of potential suitable habitat within the Borumba PHES Survey area and Project footprint, is shown on Figure E-6, which is contained in Appendix E.

The significant impact assessment undertaken in Table 57 identified that the Project is **unlikely** to result in a significant impact on macadamia nut (*Macadamia integrifolia*).

Table 55: Description of macadamia nut (*Macadamia integrifolia*)

Macadamia nut (*Macadamia integrifolia*)	
Profile	**Conservation status:** Vulnerable **Habitat:** The Conservation Advice states the species grows in remnant rainforest, including complex mixed notophyll forest, and prefers partially open areas such as rainforest edges (DEWHA, Approved Conservation Advice for Macadamia integrifolia, 2008). **Distribution:** The Conservation Advice identifies that the species is distributed along the foothills and coastal ranges of South East Queensland from the New South Wales border to Mount Bauple near Maryborough. According to the National Recovery Plan for Macadamia Species (DCCEEW, 2023) the current extent of occupied habitat is 1,500 ha while the modelled extent is 30,000 ha within an area of 6,800 km^2. **Previous records:** The species has been recorded 14 km southeast of the Exploratory Works Project (ALA, 2023). **Habitat Critical to the Survival of the Species:** Habitat critical to the survival of the species is defined in the National Recovery Plan for Macadamia Species (DCCEEW, 2023), and for *M. integrifolia* it is defined as RE 12.3.1, 12.8.3, 12.11.10 and 12.12.16. These RE's are all notophyll vine forest ecosystems. As such, the parts of the Exploratory Works Survey area that support the notophyll vegetation communities (e.g. the Subtropical rainforest vegetation community) are considered habitat critical to the survival of the species. **Important Populations:** The Recovery Plan for the species does not identify important populations, rather it identifies priority populations. For the purposes of this assessment, populations identified as "very high" in the Recovery Plan are considered "important populations" for the significant impact assessment. The nearest "very high" priority populations to the Exploratory Works Project is the Amamoor/Imbil population, with other 'very high' populations at Bauple and the Blackall Ranges. Threats: • land clearing, particularly where it places trees at greater risk of wind damage due to removal of the protective windbreak • weeds, including lantana and camphor laurel (*Cinnamomum camphora*) • fire • soil damage via compaction.

Macadamia nut (*Macadamia integrifolia*)	
In the Survey area	**Surveys:** Surveys were completed between November and July 2024. Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M. **Species occurrence:** Despite extensive surveys within the Borumba PHES Survey area, inclusive of the Exploratory Works Survey area, the species was not recorded. The species is considered likely to occur due to presence of suitable habitat and a recent nearby record (14 km southeast of the Exploratory Works Project). As there were no records of this species in the Borumba PHES Survey area, there is no important population within the Borumba PHES Survey area. **Habitat:** A total of 775.8 ha of potential habitat occurs within the Borumba PHES Survey area, while 40.9 ha of potential habitat occurs within the Exploratory Works Survey area. A total of 2.7 ha potential habitat is present within the Project footprint. **Present threats on the species:** Weeds including *Lantana camara* are widespread throughout the Borumba PHES Survey area.

Table 56: Assessment of potential impacts, and mitigation options for *Macadamia integrifolia*

Macadamia nut (*Macadamia integrifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	No *Macadamia integrifolia* individuals are anticipated to be directly impacted by the Project. The Project is anticipated to clear 2.7 ha of potential habitat for the macadamia nut in Area 1 (Borumba Dam) and Area 4 (Borgan) for geotechnical works and access tracks. As no individuals have been recorded anywhere in the Exploratory Works Survey area and the Project will not clear any known habitat. Clearing in the locations of potential habitat is unavoidable, as geotechnical works are required for the new Borumba Dam wall and topography in the area requires some levelling and stabilisation to allow the works to proceed, and tracks are necessary to access areas.	Where vegetation clearing for potential habitat of the macadamia nut is unavoidable; to mitigate the impact to the species, the following measures are proposed with further details provided in the CEMP and associated management plans: • Pre-clearance survey Pre-clearance surveys will be undertaken by a suitably qualified ecologist to identify any additional *M. integrifolia* individuals within and adjacent to the Project footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*).

Macadamia nut (*Macadamia integrifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Consequently, the proposed action is anticipated to reduce the availability of potential habitat for the macadamia nut. The impact pathways include: • earthworks associated with the clearing for geotechnical works and access tracks.	• Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition. • Unexpected find Works will be undertaken in accordance with the unexpected finds procedure, which involves: – stop works in the vicinity of the find – demarcate and prevent access to area – comprehensively survey the population of the threatened species to determine the number of plants potentially impacted and spatial extent – explore options for avoidance – if impacts cannot be avoided engage with DCCEEW and DETSI in relation to approvals to clear.
Changes to habitat quality as a result of erosion and sedimentation	The Exploratory Works Project is located in areas that may contain soils with sodic subsoils that are highly erodible if exposed. Particular attention to soil erosion control measures is required in these areas. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with the mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works.	A preliminary Erosion and Sediment Control plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing

Macadamia nut (*Macadamia integrifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Erosion and sedimentation risk is likely to be greatest in the vicinity of Area 1 (Borumba Dam) geotechnical areas, where potential habitat for the macadamia nut is proposed to be cleared on steeply sloped land. Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur which may influence plant vitality and growth. Erosion and sedimentation may also reduce the availability of nutrients and other essential resources required to maintain the quality of the land. The impact pathways include: • vegetation clearing to establish access tracks and clearing associated with the geotechnical investigation areas.	Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation. • Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. • Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/maintenance of restricted areas.
Spread of weeds, pests and disease due to increased human activity	Habitat infestation by weeds is a key threatening process for the *M. integrifolia*. Lantana and cat's claw creeper are widespread, occurring in high densities in rainforest and wet sclerophyll communities where clearing or natural disturbance had occurred previously. A suite of invasive fauna present within the Exploratory Works Project footprint, that may threaten the species through grazing and/or trampling, include European brown hare, rabbit, pig and rusa Deer. There are no known diseases for the species. The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation and management measures. Weeds may be further spread	In accordance with Queensland Hydro's Biosecurity Management Plan hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of invasive species: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and exiting site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially

Macadamia nut (*Macadamia integrifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with native flora species and reduced availability of suitable habitat and associated resources. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed, pest and pathogen spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint, unless approved for use in the area including targeted spraying. Particular care will be taken to ensure that any fill is sourced from areas free of lantana and other weed material which competes for similar habitat and is known to be a significant threat to the species to mitigate any impacts associated with Exploratory Works. Work with adjacent landholders and other stakeholders to align biosecurity measures including treatment timeframes and programs. Contaminated material to be disposed of in accordance with the *Biosecurity Act 2014* including by transporting it safely to a waste disposal facility or burying it or adding it to onsite mulching.

Macadamia nut (*Macadamia integrifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
Reduced amenity through dust emissions	Areas of potential habitat may be at risk of dust deposition impacts. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive or result in mortality. The impact pathways include: • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce air emissions • vegetation clearing, and vehicle and machinery movement around the site.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of *M. integrifolia* individuals adjacent to active geotechnical activities and road/access track construction noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of restricted areas (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water may also enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone.	There are no specific management measures developed for surface water and groundwater specific to *M. integrifolia* however the following measures are relevant to minimising impacts with further details provided in the CEMP and the associated management plans. Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards.

Macadamia nut (*Macadamia integrifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Changes in surface and groundwater quality and quantity are unlikely; however, may influence a species' ability to thrive or cause mortality, while contaminated water is likely to have detrimental effects to the health and continued occurrence of a species, should it enter the environment in an uncontrolled manner. The impact pathways include: • spilling or leaking of chemicals required to support construction activities.	Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway.
Contamination from hazardous materials	Spills of chemicals may be a particular risk for potential habitat for the species adjacent to the Area 1 (Borumba Dam) investigation areas, where oil and other chemicals from the use of vehicles and machinery may enter the environment. The impact pathways include: • spilling or leaking of chemicals required to support construction activities.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts as per the CEMP, including: • All machinery is required to be re-fuelled in designated, and bunded, areas away from sensitive areas. • Spill containment kits will be kept on site and readily available in the event of fuel/oil spills. • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release. • Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed) only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks.

Macadamia nut (*Macadamia integrifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise. For example, drill muds and water will be stored in ICBs and vac trucks will be used to remove this material from site.
Changes to the local bushfire regime	*M. integrifolia* are highly susceptible to fire damage. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within Imbil State Forest and Conondale Resources Reserve.

Table 57: Significant impact assessment for the vulnerable macadamia nut (*Macadamia integrifolia*)

Macadamia nut (*Macadamia integrifolia*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** The species was not identified during the extensive surveys undertaken. As this species is not present, Project is unlikely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	**Unlikely** As no individuals were observed within the Exploratory Works Survey area, the works are unlikely to impact any individuals and therefore are unlikely to reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	**Unlikely** The species was not recorded in the Borumba PHES Survey area. As such, although potential habitat will be cleared for the Project, clearing will not fragment any known existing population. The Exploratory Works Project is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** Notophyll vine rainforest vegetation (which is considered to be habitat critical to the survival of the species and analogous with the Subtropical rainforest vegetation community) is anticipated to be directly impacted by the works. As such, it is likely habitat critical to the survival of the species will be adversely affected. However, no individuals were recorded within the Subtropical rainforest vegetation.
Disrupt the breeding cycle of an important population	**Unlikely** No individuals were recorded within the Borumba PHES Survey area. In this regard, the Exploratory Works Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Given that no individuals were recorded during the field surveys undertaken within the Borumba PHES Survey area, the removal of vegetation is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to an extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** Given that no individuals were recorded during the field surveys undertaken within the Borumba PHES Survey area, the Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.

Macadamia nut (*Macadamia integrifolia*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** Given that no individuals were recorded during the field surveys undertaken within the Borumba PHES Survey area, the Exploratory Works Project is unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely** As the species was not observed within the Borumba PHES Survey area, the Project is unlikely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.2.6 Native guava (*Rhodomyrtus psidioides*)

The Project has the potential to significantly impact native guava (*Rhodomyrtus psidioides*), which is listed as critically endangered under the EPBC Act. This section provides the following:

- In Table 58, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 59, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 60, an assessment against the significant impact criteria for species listed as critically endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of suitable habitat within the Borumba PHES Survey area and Project footprint, and the location of species observations are shown on Figure E-7, which is contained in Appendix E. It should be noted the species observation shown on the Figure E-7, may represent numerous individuals (e.g. up to 150 individuals) and that there are species records outside of the mapped extent of potential habitat. This is primarily due to the presence of this species associated with some wet gullies which do not have distinguishable features (including canopy, sub-canopy, or shrub species or otherwise) which would allow the gullies to be mapped separately. In this regard, the potential habitat has been mapped associated with the typical habitat for the species, which is Subtropical rainforest habitat.

The significant impact assessment undertaken in Table 60 identified that the Project is **unlikely** to result in a significant impact to Native guava (*Rhodomyrtus psidioides*).

Table 58: Description of native guava (*Rhodomyrtus psidioides*)

Native guava (*Rhodomyrtus psidioides*)	
Profile	**Conservation status:** Critically endangered **Habitat:** The Conservation Advice for the species states habitat for native guava comprises rainforest vegetation classes such as subtropical, warm temperate, and littoral rainforests. It also occurs in association with wet sclerophyll forest, especially those adjoining areas of suitable rainforest (TSSC, 2020). The species has been described as a pioneer species in disturbed environments, and is locally common in disturbed areas, such as regrowth and rainforest margins (TSSC, 2020). *Rhodomyrtus psidioides* is known to occur in rainforest and adjoining margins of sclerophyll vegetation, often near creeks and drainage lines. **Distribution:** *R. psidioides* has a wide distribution, occurring in coastal and sub-coastal areas between Maryborough, Queensland and Gosford, NSW (TSSC, 2020). Native guava populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW (TSSC, 2020). **Previous records:** The ALA database shows no records of the species within the Borumba PHES Survey area. The nearest record is in West Cooroy State Forest, some 25 km to the east of the Project location. **Habitat Critical to the Survival of the Species:** The Conservation Advice does not define habitat critical to the survival of the species. In the absence of defined habitat critical to the survival of the species, it is necessary to consider the guidance in the Significant Impact Guidelines (1.1), which states 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal

Native guava (*Rhodomyrtus psidioides*)	
	• for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community. The habitat within which the individuals have been recorded is likely to fall within the gamut of being habitat critical to the survival of the species. **Population:** The Conservation Advice notes that the number of distinct populations of *R. psidioides* is unknown but is expected to be large given the wide distribution of the species and that the species is contiguous across the species distribution range. **Threats:** The Conservation Advice for the species identifies mortality caused by infection by myrtle rust (*Austropuccinia psidii*) as the key threat. It is also noted that some populations of the species may have declined as a result of historical threatening processes such as land clearing, habitat fragmentation and weed invasion (TSSC, 2020).
In the Survey area	**Survey effort:** Surveys were completed between November 2022 and July 2024 throughout the Borumba PHES Survey area, which includes the Exploratory Works Project footprint. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M. **Species occurrence:** A total of 1,295 individuals were recorded within the Borumba PHES Survey area, of which 1,267 individuals were recorded within the Exploratory Works Survey area. The Project footprint has been redesigned to avoid all direct impacts to known individuals. As such, none are located in the Project footprint. **Habitat:** A total of 4.5 ha of known habitat occurs within the Borumba PHES Survey area, of which 4 ha occurs within the Exploratory Works Survey area. A total of 1,483 ha of potential habitat is present in the Borumba PHES Survey area. There is no known habitat in the Project footprint (known habitat associated with gullies in the upper reservoir where rainforest species are present), however 10 ha of potential habitat occurs within the Project footprint. **Present threats on the species:** Myrtle rust (*Austropuccinia psidii*) was identified on the majority of individuals and was observed to be impacting plant health. Weeds are also widespread throughout the Borumba PHES Survey area.

Table 59: Assessment of potential impacts, and mitigation and management options for native guava (*Rhodomyrtus psidioides*)

Native guava (*Rhodomyrtus psidioides*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Project has avoided direct impacts to individuals and has avoided the clearing of known habitat. A total of 4 ha of potential habitat for *Rhodomyrtus psidioides* across three work Areas (Area 1 (Borumba Dam), Area 3 (Walkers Top), and Area 4 (Borgan)) is anticipated to be impacted. Clearing in these locations is unavoidable, as geotechnical works are required for the new Borumba Dam wall and topography in the area requires some levelling and stabilisation to allow the works to proceed, while access tracks are required in Area 3 and Area 4 to facilitate geotechnical works. The works are unlikely to fragment the existing individuals or create a barrier to seed and/or pollinator dispersal. The impact pathways include: • earthworks associated with the clearing for geotechnical works and access tracks.	The proposed Project footprint has been designed to avoid all known individual records of *Rhodomyrtus psidioides* and known habitat for the species, with area to be designed as an exclusion zone, The Project has also minimised the clearing of potential habitat. Where vegetation clearing for potential habitat of *R. psidioides* is unavoidable; to mitigate the impact to the species, the following measures are proposed with further details provided in the CEMP and associated management plans: • Pre-clearance survey Pre-clearance surveys will be undertaken by a suitably qualified ecologist to identify any additional *R. psidioides* individuals within and adjacent to the Project footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). • Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition. • Unexpected find Works will be undertaken in accordance with the unexpected finds procedure, which involves: – stop works in the vicinity of the find

Native guava (*Rhodomyrtus psidioides*)		
Potential Impact	**Assessment**	**Mitigation Options**
		– demarcate and prevent access to area – comprehensively survey the population of the threatened species to determine the number of plants potentially impacted and spatial extent – explore options for avoidance – if impacts cannot be avoided engage with DCCEEW and DETSI in relation to approvals to clear.
Changes to habitat quality as a result of erosion and sedimentation	The Exploratory Works Project is located in areas that may contain soils with sodic subsoils that are highly erodible if exposed. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with the mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works. Erosion and sedimentation risk is likely to be greatest in the vicinity of Area 3 (Walkers Top) geotechnical areas, where potential habitat for *R. psidioides* is proposed to be cleared on steeply sloped land. Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur which may influence plant vitality and growth; however, there are no known individuals at this location. Where individuals are known to occur, the works are generally limited to access tracks and work pads. Erosion and sedimentation may also reduce the availability of nutrients and other essential resources required to maintain the quality of the land. The impact pathways include: • vegetation clearing to establish access tracks and clearing associated with the geotechnical investigation areas.	A preliminary Erosion and Sediment Control Plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation. • Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway.

Native guava (*Rhodomyrtus psidioides*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/maintenance of restricted areas, including exclusion zones.
Spread of weeds, pests and disease due to increased human activity	Habitat infestation by weeds is a key threatening process for the species and lantana (*Lantana camara*) is widespread, occurring in high densities within the Borumba PHES Survey area where clearing or natural disturbance had occurred previously. Native guava is presently growing in areas where lantana is present in high densities, often grown under thick stands of lantana. A suite of invasive fauna is also present within the Exploratory Works Project footprint that may threaten the species through grazing and/or trampling including the European brown hare, rabbit, pig and rusa deer. Mortality caused by infection by myrtle rust is identified as a key threat to the species. Most *R. psidioides* individuals showed signs of impacts from myrtle rust. Myrtle rust is known to be present throughout the Borumba PHES Survey area. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	The following mitigation measures are proposed: • Pre-clearance surveys to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed. • Washdown procedures for vehicles and machinery. • Regular cleaning regimes. • Training and inductions for contractors. • Potential to implement wet decontamination, heat and/or fumigation procedures, as required. • Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Implementing biosecurity hygiene procedures during construction. • Decontamination practices for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites. • Hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of disease. • Annual fungicide treatment regime for plants in or within 50 m of the Exploratory Works Project footprint. • Gather and store seeds (if available) to secure genetic diversity for future populations.

Native guava (*Rhodomyrtus psidioides*)		
Potential Impact	**Assessment**	**Mitigation Options**
Reduced amenity through dust emissions	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed access tracks. This species is confined to Area 3 (Walkers Top) and the specimens in this area are at highest risk of impacts from dust emissions. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive or result in mortality. It is noted that near the known populations access will not be ongoing. The impact pathways include: • vegetation clearing, and vehicle and machinery movement around the site may result in increased dust emissions.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of *R. psidioides* individuals adjacent to active geotechnical activities and road/access track construction noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of restricted areas, including exclusion zones (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Changes in surface and groundwater quality and quantity may influence a species' ability to thrive or cause mortality. The works are unlikely to change surface water or groundwater patterns near any *R. psidioides*. The populations of *R. psidioides* in the vicinity of geotechnical investigation areas may be affected by changes in groundwater levels as a result of underground works. The populations are not in close proximity to the underground tunnelling extent; however the tunnelling works may alter groundwater levels directly above and immediately adjacent its alignment including in close proximity to these records. These impacts would be temporary in nature.	There are anticipated to be minimal surface water and hydrology changes as a result of the Project with the potential to impact *R. psidioides*. That is there are no impoundments or diversions planned within the drainage lines which feed into the gullies this population is recorded in. There are no specific management measures developed for surface water and groundwater specific to *R. psidioides* however the following measures are relevant to avoiding and minimising impacts with further details provided in the CEMP and the associated management plans: • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards.

Native guava (*Rhodomyrtus psidioides*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Contaminated water is likely to have detrimental effects to the health and continued occurrence of a species, should it enter the environment in an uncontrolled manner. Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water may also enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone. The impact pathways include: • spilling or leaking of chemicals required to support construction activities.	• Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway.
Contamination from hazardous materials	Spills of chemicals may be a risk to individuals as they are in proximity to where oil and other chemicals from the use of vehicles and machinery may enter the environment. The impact pathways include: • spilling or leaking of chemicals required to support construction activities	To mitigate the risk of contamination from hazardous materials, controls will be implemented to limit the likelihood of hazardous materials spilling and contaminating proximate waterways. Controls will include storage and handling requirements, spill kits, trained personnel handling hazardous materials, and the development of emergency response protocols to respond to and contain spills.
Changes to the local bushfire regime	Fire is a threat to the species both directly and indirectly through the promotion of myrtle rust as a result of new growth. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management.

Native guava (*Rhodomyrtus psidioides*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within Imbil State Forest and Conondale Resources Reserve.

Table 60: Significant impact assessment for the critically endangered native guava (*Rhodomyrtus psidioides*)

Native guava (*Rhodomyrtus psidioides*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The Project has avoided all direct impacts to individuals. Any indirect impacts are unlikely to cause the death of individuals. As no individuals will be cleared as part of the proposed works and the Project is not likely to exacerbate the impact from myrtle rust on the existing population, the works are unlikely to lead to a long-term decrease in the size of the population. The main risk to the population is the presence of myrtle rust which has reduced the population to root suckers. The Conservation Advice for the species noted that populations of native guava are projected to rapidly decline due to myrtle rust and within three generations, assuming a generation time of 20 years, a quantitative estimate of decline of 99% has been made based on documented rates of mortality across the range.
Reduce the area of occupancy of the species	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The AOO was estimated to be 884 km^2. The Exploratory Works Project will not directly impact any native guava individuals and the Project is not likely to exacerbate the impact from myrtle rust on the existing population. As such, the Exploratory Works Project is unlikely to reduce the area of occupancy of the species, with the main risk being the presence of myrtle rust. The Conservation Advice for the species noted that populations of native guava are projected to rapidly decline due to myrtle rust and within three generations, assuming a generation time of 20 years, a quantitative estimate of decline of 99% has been made based on documented rates of mortality across the range. The population on site has been reduced to root suckers due to the presence of myrtle rust.

Native guava (*Rhodomyrtus psidioides*)	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** The Conservation Advice notes that the number of distinct populations of *R. psidioides* is unknown but is expected to be large given the wide distribution of the species and that the species is contiguous across the species distribution range. The Project footprint has been designed to avoid the densely populated areas of native guava individuals, both located within Area 4 (Borgan), and as such, is considered unlikely to fragment an existing population into two or more populations. In addition, the Project is not likely to impede dispersal mechanism along the existing gullies in this area.
Adversely affect habitat critical to the survival of a species	**Unlikely** There is no known habitat within the Project footprint and the Project is not likely to exacerbate the impact from myrtle rust on the existing population. In this regard, the Project is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of a population	**Unlikely** Dust generated by the works has the potential to reduce individual plant vitality and has the potential to suppress flower and seed production; however, flowering and fruiting of *R. psidioides* is rare due to impacts from myrtle rust and the majority of the individuals were seedlings less than 0.5 m tall. The Exploratory Works Project are unlikely to prevent or inhibit pollinators from accessing the species, nor does the Project have the potential to limit seed dispersal. Therefore, the Exploratory Works Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The Project is anticipated to impact 10 ha of potential habitat, within which the species was not recorded. The loss of potential habitat is unlikely to decrease the availability of habitat to the extent the species is likely to decline. Similarly, the quality of known habitat and potential habitat for *R. psidioides* may decrease due to the indirect effects of erosion and sedimentation, spread of weeds and pests, dust emissions, changes in groundwater quantity and quality, and contamination from hazardous materials. However, these impacts are unlikely to lead to a long-term decrease in the size of a population due to the implementation of mitigation measures. Noting that the works within and adjacent the population are limited to a number of geotechnical investigation bores and upgrades to existing tracks, with the works to be localised and contained. The works have also aimed to avoid known records and key habitat features such as gullies and rainforest areas which support the species. In this regard, the Exploratory Works Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Native guava (*Rhodomyrtus psidioides*)	
Impact criteria	**Assessment**
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** There are a range of weeds and pest fauna currently within the Borumba PHES Survey area including within the and adjacent the population of *R. psidioides*. The Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.
Introduce disease that may cause the species to decline	**Unlikely** Myrtle rust is a known threat to the species and was observed to be already established within the *R. psidioides* population. The Project is unlikely to exacerbate the already established threat of myrtle rust to the extent it will cause the species to decline. While protocols will be put in place to ensure other diseases/pathogens are not introduced.
Interfere with the recovery of the species	**Unlikely** As the Exploratory Works Project will avoid direct impacts to individuals, it is considered highly unlikely the proposed Action will interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.2.7 Scrub turpentine (*Rhodamnia rubescens*)

The Project has the potential to significantly impact the scrub turpentine (*Rhodamnia rubescens*), which is listed as critically endangered under the EPBC Act. This section provides the following:

- In Table 61, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 62, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 63, an assessment against the significant impact criteria for species listed as critically endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of suitable habitat within the Borumba PHES Survey area, the Project footprint, and the location of all scrub turpentine individuals recorded during field surveys are shown on Figure E-2, which is contained in Appendix E. It should be noted that the locations shown on Figure E-2 may represent more than one individual.

The significant impact assessment undertaken in Table 63 identified that the Project is **likely** to result in a significant impact on scrub turpentine.

Table 61: Description of scrub turpentine (*Rhodamnia rubescens*)

Scrub turpentine (*Rhodamnia rubescens*)	
Profile	**Conservation status:** Critically endangered **Habitat:** The species occurs in warmer rainforest and on rainforest margins, often in coastal locations. It also occurs as a pioneer in adjacent areas of dry sclerophyll and grassy woodland associations (TSSC, 2020). **Distribution:** *Rhodamnia rubescens* is known to occur from coastal districts of New South Wales north from Batemans Bay to Bundaberg in Queensland. The distribution of *R. rubescens* occasionally extends inland onto the escarpment up to 600 m above sea level in areas with rainfall of 1,000-1,600 mm. *R. rubescens* has a large geographic distribution. The area of occupancy (AOO) was estimated to be 3,360 km^2 (TSSC, 2020). **Previous records:** Four records for this species occur within 10 km to the east of the Exploratory Works Project. **Habitat Critical to the Survival of the Species:** Habitat critical to the survival of *R. rubescens* is not defined in the Conservation Advice (TSSC, 2020). However, the generic definition within the significant impact guidelines (Department of the Environment, 2013) defines habitat critical to the survival of a species as areas that are necessary: • for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species. The individuals within the Borumba PHES Survey area are unlikely to be required for the long-term maintenance of the species or to maintain genetic diversity. As myrtle rust is prevalent in the Survey area, any individuals introduced are likely to succumb to impacts from myrtle rust. In this regard, the vegetation within the Borumba PHES Survey area is unlikely to be classified as habitat critical to the survival of the species. While the presence of myrtle rust also limits the areas value for the reintroduction of the species and the species recovery as whole.

Scrub turpentine (*Rhodamnia rubescens*)	
	Population: The Conservation Advice notes that the number of distinct populations of *Rhodamnia rubescens* is unknown but is expected to be large given the wide distribution of the species and that the occurrences of the species is contiguous across the distribution range with not significant disjunctions. **Threats:** Mortality caused by infection by myrtle rust (*Austropuccinia psidii*) and genetic diversity impacts due to restricted range and small population sizes.
In the Survey area	**Surveys:** Surveys were completed between November 2022 and July 2024 throughout the Borumba PHES Survey area, which includes the Exploratory Works Project footprint. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M. **Species occurrence:** A total of 626 individuals of *R. rubescens* were recorded within the Borumba PHES Survey area, with 429 of these individuals within the Exploratory Works Survey area and 207 within the Project area. There is a single record within the Exploratory Works Project footprint; however, as the Project footprint at Area 3 (Walkers Top) is yet to be finalised, and pre-clearance surveys have not been undertaken, the Project has assumed that five (5) individuals will be cleared following the implementation of relevant management measures, such as micro-siting. **Habitat:** A total of 3,057.9 ha of potential habitat and 35.8 ha of known habitat occurs within the Borumba PHES Survey area. This species is often found in wet sclerophyll associations in rainforest transition zones and creek side riparian vegetation but is known to be a pioneer in adjacent areas of dry sclerophyll and this is evident onsite with the species found in the ecotone between Subtropical Rainforest and gullies and the adjacent dry sclerophyll woodland (i.e. where rainforest species were part of the understorey or the canopy). Where the dry sclerophyll understorey became sparse or absent this species was not observed which may be attributed in part fires in the area. To account for the patches of rainforest across the site, areas of dry sclerophyll woodland have been mapped as potential habitat and where there is a confirmed record the area is mapped as known habitat to reflect the niche requirements this species needs to colonise these areas (i.e. generally in close proximity to a patch of rainforest or a gully dominated by rainforest species). **Present threats on the species:** Myrtle rust was recorded during the site assessments and is present in broad areas within the areas surveyed. The majority of individuals observed were either mildly or severely impacted by myrtle rust, with leaf spotting, leaf drop, and irregular growth observed.

Table 62: Assessment of potential impacts, and mitigation and management options for scrub turpentine

Scrub turpentine (*Rhodamnia rubescens*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Exploratory Works are anticipated to directly impact a single individual. However, as the Project footprint at Area 3 (Walkers Top) is yet to be finalised, the Project has included allowance for impacts to up to five (5) individuals in this area, and the removal of 0.7 ha of known habitat and 30.9 ha of potential habitat. The works are unlikely to fragment the existing individuals or create a barrier to seed and/or pollinator dispersal.	The clearing footprint has been minimised to the greatest extent possible, which has avoided 625 scrub turpentine which have been identified in the Borumba PHES Project area. Where vegetation clearing for potential habitat of the *Rhodamnia rubescens* is unavoidable; to mitigate the impact to the species, the following measures are proposed with further details provided in the CEMP and associated management plans: • Pre-clearance survey Pre-clearance surveys will be undertaken by a suitably qualified ecologist to identify any additional *R. rubescens* individuals within and adjacent to the Project footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). • Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Accidental clearing will be avoided by establishing buffer zones around areas of *R. rubescens* populations near the Exploratory Works Project footprint. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate buffer zones and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition.

Scrub turpentine (*Rhodamnia rubescens*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Should additional individuals of the species be found during pre-clearance surveys, appropriate actions will also be taken to avoid clearing them, otherwise appropriate approvals will be obtained to salvage those individuals (either the plant itself, or genetic material via seeds, cuttings or seedlings) with the aim of future translocation. In Area 3 (Walkers Top), where there is uncertainty in the Project footprint, an allowance of impacts to five (5) individuals has been proposed. The following is proposed within Area 3 (Walkers Top): a) Where a scrub turpentine individual is proposed for clearing and is assessed as not showing any signs of myrtle rust impacts, the plant will be avoided, and germplasm will be collected as part of research into myrtle rust. b) Where a scrub turpentine individual is proposed for clearing and is assessed as showing signs of myrtle rust impacts, the individual will be cleared, and germplasm will not be collected.
Changes to habitat quality as a result of erosion and sedimentation	The Exploratory Works Project is located in areas that may contain soils with sodic subsoils that are highly erodible if exposed. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with the mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works. Erosion and sedimentation risk is likely to be greatest in the vicinity of Area 3 (Walkers Top) geotechnical areas, where scrub turpentine is known to occur and is proposed to be cleared on steeply sloped land. Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur which may influence plant vitality and growth; however, there are no known individuals at this location. Where individuals are known to occur, the works are generally limited to access tracks and work pads.	A preliminary Erosion and Sediment Control plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation.

Scrub turpentine (*Rhodamnia rubescens*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Erosion and sedimentation may also reduce the availability of nutrients and other essential resources required to maintain the quality of the land. The impact pathways include: • vegetation clearing to establish access tracks and clearing associated with the geotechnical investigation areas.	• Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. • Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/ maintenance of buffer zones.
Spread of weeds, pests and disease due to increased human activity	The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation and management measures. Weeds may be further spread throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Use of construction vehicles and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Increased incidences of weeds and pests may result in competition with native flora species and reduced availability of suitable habitat and associated resources. Pests may contribute directly to consumption and/or destruction of edible flora species. Myrtle rust is widespread in the Borumba PHES Survey area and the majority of *R. rubescens* individuals are currently suffering impacts from the fungus, including the five (5)	The following mitigation measures are proposed: • Pre-clearance surveys to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed. • Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Washdown procedures for vehicles and machinery. • Regular cleaning regimes. • Training and inductions for contractors on weed, pest and pathogen identification. • Implementing biosecurity hygiene procedures during works. • Decontamination practices for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites. • Hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of disease.

Scrub turpentine (*Rhodamnia rubescens*)		
Potential Impact	**Assessment**	**Mitigation Options**
	individuals within the footprint. Works are unlikely to further the spread of the fungus. The spread of weeds is identified as a key threat to the species. Weeds including *Lantana camara* are persistent throughout the Exploratory Works Survey area. A suite of invasive fauna that may threaten scrub turpentine through damage and/or grazing are also present. Inadequate decontamination of construction machinery and construction personnel may result in transmission of disease. Movement of diseased individuals (either through vegetation clearing or translocation activities) may also act to spread disease within the Project area.	• Particular care will be taken to ensure that any fill is sourced from areas free of *Lantana camara* which competes for similar habitat. • Cattle will be destocked from Queensland Hydro-owned land, removing grazing pressures on threatened flora habitat.
Reduced amenity through dust emissions	The Project has the potential to generate dust during vegetation clearing and initial earthworks and via the on-going use of unsealed access tracks. This species is confined to Area 3 (Walkers Top) and the specimens in this area are at highest risk of impacts from dust emissions. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive or result in mortality. It is noted that near the known populations access will not be ongoing. The impact pathways include: • vegetation clearing, and vehicle and machinery movement around the site may result in increased dust emissions.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of *R. rubescens* individuals adjacent to active geotechnical activities and road/access track construction noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.)

Scrub turpentine (*Rhodamnia rubescens*)		
Potential Impact	**Assessment**	**Mitigation Options**
		– evidence of disturbance/maintenance of restricted areas, including buffer zones (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Changes in surface and groundwater quality and quantity may influence a species' ability to thrive or cause mortality. The works are unlikely to change surface water or groundwater patterns near any scrub turpentine individuals. Contaminated water is likely to have detrimental effects to the health and continued occurrence of a species, should it enter the environment in an uncontrolled manner. Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water may also enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone.	Hazardous materials are unlikely to be stored upslope or within 50 m of any of the identified individuals. There are no specific management measures developed for surface water and groundwater specific to the species as there are anticipated to be negligible changes to surface water and groundwater patterns as a result of the Project. However, the following measures are relevant to avoiding and minimising impacts with further details provided in the CEMP and the associated management plans: • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway.
Contamination from hazardous materials	The construction compound area, spoil disposal area and staging area are proposed in Area 4 (Borgan Road). Operation of these Project components pose the greatest risk of hazardous material release to the environment if containment and management is inadequate. Species habitat in these areas are uphill and upstream from the work areas, and as such impacts from hazardous material runoff is unlikely. Spills of chemicals may also be a particular risk for individuals and species habitat adjacent Area 3 (Walkers Top) geotechnical investigation works, where oil and other	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts as per the CEMP, including: • All machinery is required to be re-fuelled in designated, and bunded, areas away from scrub turpentine. • Spill containment kits will be kept on site and readily available in the event of fuel/oil spills. • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards.

Scrub turpentine (*Rhodamnia rubescens*)		
Potential Impact	**Assessment**	**Mitigation Options**
	chemicals from the use of vehicles and machinery may enter the environment. Given the location of individuals and habitat in gullies and slopes is down-gradient of proposed geotechnical investigation access tracks and drilling areas in Walkers Top, there is a risk of impact from hazardous material contamination to this species. Spilling or leaking of chemicals required to support construction activities may result in degraded areas in the vicinity of Project works, reducing the availability and quality of habitat and resources available. The impact pathways include: • Spilling or leaking of chemicals required to support construction activities.	• Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release. • Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed) only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks. • Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise. For example, drill muds and water will be stored in ICBs and vac trucks will be used to remove this material from site.
Changes to the local bushfire regime	Fire is a threat to the species both directly and indirectly through the promotion of myrtle rust as a result of new growth. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within Imbil State Forest and Conondale Resources Reserve.

Scrub turpentine (*Rhodamnia rubescens*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	

Table 63: Significant impact assessment for the critically endangered scrub turpentine (*Rhodamnia rubescens*)

Scrub turpentine (*Rhodamnia rubescens*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The Conservation Advice for the species notes that the species is projected to undergo a 96–99% reduction in population size across its range within three generations as a result of myrtle rust. Myrtle rust is already established onsite and as such there is a high likelihood that the local population will decrease in size without any interference from the Project. The Project has aimed to avoid the local population and known habitat for the species and will adopt measures to ensure impacts from Myrtle rust are not exacerbated, as such the Project is unlikely to lead to a long term decrease in the size of a population.
Reduce the area of occupancy of the species	**Unlikely** The AOO is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The impact to five individuals, out of a known population of 626 within the Borumba PHES Survey area is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. The Conservation Advice for the species notes that the species has already undergone a population reduction of approximately 10% across a five-year period and that declines of greater than 80% of individuals may occur within three generations. In this regard, the works are unlikely to reduce the AOO of an important population.

Scrub turpentine (*Rhodamnia rubescens*)	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** The Conservation Advice notes that the number of distinct populations of *Rhodamnia rubescens* is unknown but is expected to be large given the wide distribution of the species and that the species is contiguous across the species distribution range. The nature of clearing for the Exploratory Works Project is an important consideration in assessing the potential impacts of fragmentation. Access tracks will be maximum 6 m wide. There are no large clearing extents which will create large canopy gaps or cleared areas which would prevent the dispersal of this species or its potential pollinators. In this regard, the Exploratory Works Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely** The known and potential habitat present within the Project footprint is considered not to be habitat critical to the survival of the species. In this regard, the Exploratory Works Project is unlikely to adversely affect habitat critical to the survival of the species. From a conservative view, the suitable habitat for the species such as Subtropical Rainforests and gullies could be considered habitat critical for the survival of the species, while the adjacent dry sclerophyll woodland which is mapped as potential habitat is not considered to be habitat critical to the survival of the species. The Project has been designed and will be constructed in a manner which avoids and minimise impacts to habitat critical for the survival of the species, with the works also temporary and/or localised (i.e. most of the works in this area relates to the upgrade of existing tracks or the re-establishment of old tracks, plus geotechnical investigations using sleds/rail access to minimise clearing on slopes where this species occurs downgradient). Based on this the Project is unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	**Unlikely** Dust generated by the works has the potential to reduce individual plant vitality and has the potential to suppress flower and seed production. This impact, however, is likely to be temporary and unlikely to lead to long term/permanent impacts to the species or local population. Additionally, flowering and fruiting of the species is unlikely due to the existing impacts from myrtle rust with no evidence of flowering or fruiting observed. The Exploratory Works Project is unlikely to prevent or inhibit pollinators from accessing the species, nor does the Project have the potential to limit seed dispersal. In this regard, the Exploratory Works Project is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Weeds are currently present across all areas of the Project area and the works have limited potential to facilitate the further spread of weeds into areas such that the known and potential habitat of the species would become unsuitable for the species. Similarly, the quality of known habitat and potential habitat for the scrub turpentine may decrease due to the indirect effects of erosion and sedimentation, spread of weeds and pests, dust emissions, changes in groundwater quantity and quality, and contamination from hazardous materials. However, these impacts are unlikely to lead to a long-term decrease in the size of a population due to the implementation of mitigation measures.

Scrub turpentine (*Rhodamnia rubescens*)	
Impact criteria	**Assessment**
	Noting that the works within and adjacent the population are limited to a number of geotechnical investigation bores and upgrades to existing tracks, with the works to be localised and contained. The works have also aimed to avoid known records and key habitat features such as gullies and rainforest areas which support the species. In this regard, the Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** The Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat. Noting that a number of threats to the species are already established in the area, including potentially as a result of the loss of this species to myrtle rust. The Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.
Introduce disease that may cause the species to decline	**Unlikely** Myrtle rust is main identified threat to the species and is widespread throughout the Borumba PHES Survey area and has infected the local *R. rubescens* population. The Project is unlikely to further facilitate the spread of this fungus into other areas, while protocols will be put in place to ensure other diseases/pathogens are not introduced.
Interfere with the recovery of the species	**Likely** The direct impacts to up to five individuals and the clearing of 0.7 ha of known habitat and 31.9 ha of potential habitat is likely to interfere with the recovery of the species. The Conservation Advice notes that it is expected that surviving plants and populations of *R. rubescens* will continue to be subject to a significant spore load and this continued exposure severely reduces the likelihood of population recovery in *R. rubescens.* While it is unclear how direct impact to 5 individuals will further interfere with the recovery of this species, following a conservative approach suggests that removing any individuals from a very challenged reproductive pool will be likely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Likely**

7.2.8 Small-fruited Queensland nut (*Macadamia ternifolia*)

The Project has the potential to significantly impact the small-fruited Queensland nut (*Macadamia ternifolia*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 64, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 65, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 66, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of potential suitable habitat within the Borumba PHES Survey area and Project footprint, is shown on Figure E-8, which is contained in Appendix E.

The significant impact assessment undertaken in Table 66 identified that the Project is **unlikely** to result in a significant impact small-fruited Queensland nut (*Macadamia ternifolia*).

Table 64: Description of small-fruited Queensland nut (*Macadamia ternifolia*)

Small-fruited Queensland nut (*Macadamia ternifolia*)	
Profile	**Conservation status**: Vulnerable **Habitat:** The Conservation Advice for the species states *Macadamia ternifolia* habitat is fragmented and found within lowland warm complex notophyll vine forest and *Araucarian notophyll* vine forest on basic and intermediate volcanic soils and alluvia in high rainfall areas of south-east Queensland (DOE, 2023). **Distribution:** The Conservation Advice states the species is endemic to Queensland with populations restricted to an area between Mount Pinbarren (northern extent) and Mary Cairncross Park near Maleny (DOE, 2023). **Previous records:** A historical record occurs immediately adjacent to the Borumba PHES Survey area (ALA, 2023). **Habitat Critical to the Survival of the Species:** Habitat critical to the survival of the species is defined in the National Recovery Plan for Macadamia Species (DCCEEW, 2023), and for *M. ternifolia* it is defined as: "*Macadamia ternifolia* is identified in the Queensland Herbarium REDD as occurring in endangered RE 12.3.1 (see Table 7), though it is also frequently found in RE 12.8.3, 12.11.10, 12.12.1 and 12.12.16 ", which are rainforest vegetation communities. As such, the parts of the Exploratory Works Survey area that support the Subtropical rainforest vegetation community are considered habitat critical to the survival of the species. **Important Populations:** The Recovery Plan for the species does not identify important populations, rather it identifies priority populations. For the purposes of this assessment, populations identified as "very high" in the Recovery Plan are considered "important populations". The nearest "Very high" priority populations to the Exploratory Works Project is the Conondale National Park population. While the Exploratory Works Project is located outside the Conondale National Park, the Borumba PHES Survey area is connected to this area and therefore there is potential that any individuals form part of this important population. However, as no individuals were identified during the field survey, an important population is not present.

Small-fruited Queensland nut (*Macadamia ternifolia*)	
	Threats: The Conservation Advice (DEWHA, 2008) for the species identifies the following threats: • habitat loss, disturbance and modification • invasive weeds • fire.
In the Survey area	**Surveys:** Surveys were completed between November and July 2024. Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M **Species occurrence:** Despite extensive surveys within the Borumba PHES Survey area, inclusive of the Exploratory Works Survey area, the species was not recorded. Protected plant surveys in accordance with the Flora Survey Guidelines - Protected Plant also failed to identify this species from within the Project footprint and the 100 m buffer. Despite this, the species is considered likely to occur due to presence of suitable habitat and a recent nearby record (14 km south east of the Exploratory Works Project). **Habitat:** A total of 775.8 ha of potential habitat occurs within the Borumba PHES Survey area, while 40.9 ha of potential habitat occurs within the Exploratory Works Survey area. A total of 2.7 ha potential habitat is present within the Project footprint. **Present threats on the species:** Weeds are widespread throughout the Borumba PHES Survey area.

Table 65: Assessment of potential impacts, and mitigation options for small-fruited Queensland nut (*Macadamia ternifolia*)

Small-fruited Queensland nut (*Macadamia ternifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Project is anticipated to clear 2.7 ha of potential habitat for *Macadamia ternifolia* in Area 1 (Borumba Dam) and Area 4 (Borgan) for geotechnical works and access tracks. As no individuals have been recorded anywhere in the Exploratory Works Survey area despite extensive survey effort, the Project will not clear any known habitat. Clearing in the locations of potential habitat is unavoidable, as geotechnical works are required for the new Borumba dam wall and topography in the area requires some levelling and stabilisation to allow the works to proceed, and tracks are necessary to access areas. Consequently, the proposed action is anticipated to reduce the availability	Where vegetation clearing for potential habitat of *Macadamia ternifolia* is unavoidable; to mitigate the impact to the species, the following measures are proposed with further details provided in the CEMP and associated management plans: • Pre-clearance survey Pre-clearance surveys will be undertaken by a suitably qualified ecologist to identify any additional *M. ternifolia* individuals within and adjacent to the Project footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*).

Small-fruited Queensland nut (*Macadamia ternifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	of habitat for *M. ternifolia* and cause limited fragmentation in a single area (north of the dam wall). The impact pathways include: • earthworks associated with the clearing for geotechnical works and access tracks.	• Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition. • Unexpected find Works will be undertaken in accordance with the unexpected finds procedure, which involves: – stop works in the vicinity of the find – demarcate and prevent access to area – comprehensively survey the population of the threatened species to determine the number of plants potentially impacted and spatial extent – explore options for avoidance – if impacts cannot be avoided engage with DCCEEW and DETSI in relation to approvals to clear.
Changes to habitat quality as a result of erosion and sedimentation	Most of the Exploratory Works Project is in areas that may contain soils with sodic subsoils that are highly erodible if exposed. Particular attention to soil erosion control measures is required in these areas. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with the mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works.	A preliminary Erosion and Sediment Control Plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures).

Small-fruited Queensland nut (*Macadamia ternifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Erosion and sedimentation risk is likely to be greatest in the vicinity of Area 1 (Borumba Dam) geotechnical areas, where potential habitat for *M. ternifolia* is proposed to be cleared on steeply sloped land. Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur which may influence plant vitality and growth. Erosion and sedimentation may also reduce the availability of nutrients and other essential resources required to maintain the quality of the land. The impact pathways include: • vegetation clearing to establish access tracks and clearing associated with the geotechnical investigation areas.	• Controls during construction and clearing Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation. • Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. • Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/ maintenance of restricted areas.
Spread of weeds, pests and disease due to increased human activity	Habitat infestation by weeds is a key threatening process for the small-fruited Queensland nut. Lantana and cat's claw creeper are widespread, occurring in high densities in rainforest and wet sclerophyll communities where clearing or natural disturbance had occurred previously. A suite of invasive fauna is present within the Exploratory Works Project footprint that may threaten the species through grazing and/or trampling include European brown hare, rabbit, pig and rusa deer. There are no known diseases for the species. The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation	In accordance with Queensland Hydro's Biosecurity Management Plan hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of invasive species: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when

Small-fruited Queensland nut (*Macadamia ternifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	and management measures. Weeds may be further spread throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with native flora species and reduced availability of suitable habitat and associated resources. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed, pest and pathogen spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint, unless approved for use in the area including targeted spraying. Particular care will be taken to ensure that any fill is sourced from areas free of lantana and other weed material which competes for similar habitat and is known to be a significant threat to the species to mitigate any impacts associated with Exploratory Works. Work with adjacent landholders and other stakeholders to align biosecurity measures including treatment timeframes and programs. Contaminated material to be disposed of in accordance with the *Biosecurity Act 2014* including by transporting it safely to a waste disposal facility or burying it or adding it to onsite mulching.

Small-fruited Queensland nut (*Macadamia ternifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
Reduced amenity through dust emissions	Areas of potential habitat may be at risk of dust deposition impacts. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive or result in mortality. The impact pathways include: • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce air emissions • vegetation clearing, and vehicle and machinery movement around the site.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of individuals adjacent to active geotechnical activities and road/access track construction noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of restricted areas (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water may also enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone. Changes in surface and groundwater quality and quantity are unlikely; however, may influence a species' ability to thrive or cause mortality, while contaminated water is likely to have detrimental effects to the health and continued	There are no specific management measures developed for surface water and groundwater specific to *M. ternifolia*; however, the following measures are relevant to avoiding and minimising impacts with further details provided in the CEMP and the associated management plans. • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic

Small-fruited Queensland nut (*Macadamia ternifolia*)		
Potential Impact	**Assessment**	**Mitigation Options**
	occurrence of a species, should it enter the environment in an uncontrolled manner. The impact pathways include: • spilling or leaking of chemicals required to support construction activities.	fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway.
Contamination from hazardous materials	Spills of chemicals may be a particular risk for potential habitat for the species adjacent to the Area 1 (Borumba Dam) investigation areas, where oil and other chemicals from the use of vehicles and machinery may enter the environment. The impact pathways include: • spilling or leaking of chemicals required to support construction activities.	To mitigate the risk of contamination from hazardous materials, controls will be implemented to limit the likelihood of hazardous materials spilling and contaminating proximate waterways. Controls will include storage and handling requirements, spill kits, trained personnel handling hazardous materials, and the development of emergency response protocols to respond to, and contain, spills.
Changes to the local bushfire regime	Inappropriate fire regimes are a recognised threat to the species. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within Imbil State Forest and Conondale Resources Reserve.

Table 66: Significant impact assessment for the vulnerable small-fruited Queensland nut (*Macadamia ternifolia*)

Small-fruited Queensland nut (*Macadamia ternifolia*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** Despite extensive survey efforts, the species was not observed in the Borumba PHES Survey area. As such, as stated in Table 64, it is considered highly unlikely the Exploratory Works Survey area supports an important population. Consequently, the direct loss of 2.7 ha of potential habitat within which the species was not identified is unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of an important population	**Unlikely** As no individuals were observed within the Exploratory Works Survey area, the works are unlikely to impact any individuals and therefore are unlikely to reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations	**Unlikely** The species was not recorded in the Borumba PHES Survey area. As such, although potential habitat will be cleared for the Project, clearing will not fragment any known existing population. The Exploratory Works Project is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** A total of 2.7 ha of Subtropical rainforest vegetation (which is considered to be habitat critical to the survival of the species) is anticipated to be directly impacted by the works. No individuals were recorded within the Subtropical rainforest vegetation.
Disrupt the breeding cycle of an important population	**Unlikely** No individuals were recorded within the Borumba PHES Survey area. In this regard, the Exploratory Works Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Given that no individuals were recorded during the field surveys undertaken within the Borumba PHES Survey area, the removal of vegetation is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to an extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** Given that no individuals were recorded during the field surveys undertaken within the Borumba PHES Survey area, the Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.

Small-fruited Queensland nut (*Macadamia ternifolia*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** Given that no individuals were recorded during the field surveys undertaken within the Borumba PHES Survey area, the Exploratory Works Project is unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely** As the species was not observed within the Borumba PHES Survey area, the Project is unlikely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.2.9 Three-leaved bosistoa (*Bosistoa transversa*)

The Project has the potential to significantly impact the three-leaved bosistoa (*Bosistoa transversa*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 67, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 68, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 69, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of suitable habitat within the Borumba PHES Survey area, the Exploratory Works Survey area, Project area, and Exploratory Works Footprint, and the location of three-leaved bosistoa recorded during field surveys are shown on Figure E-9, which is contained in Appendix E.

The significant impact assessment undertaken in Table 69 identified that the Project is **unlikely** to result in a significant impact on the three-leaved bosistoa (*Bosistoa transversa*).

Table 67: Description of three-leaved bosistoa (*Bosistoa transversa*)

Three-leaved bosistoa (*Bosistoa transversa*)	
Profile	Conservation status: Vulnerable **Habitat:** The Conservation Advice for *Bosistoa transversa* states it grows in wet sclerophyll forest, dry sclerophyll forest and subtropical rainforest up to 300 m above sea level. In Queensland, the species is associated with complex notophyll vine forest (DEWHA, 2008)**.** **Distribution:** The species distribution ranges from northern New South Wales to south-east Queensland (DEWHA, 2008)**.** **Previous records:** The ALA database shows there are several records of the species within 10 km of the Borumba PHES Survey area (ALA, 2023). **Habitat Critical to the Survival of the Species:** The Conservation Advice does not define habitat critical to the survival of the species. In the absence of defined habitat critical to the survival of the species, it is necessary to consider the guidance in the Significant Impact Guidelines (1.1), which states 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community. Considering the above criteria and the absence of species observations recorded in the Borumba PHES Survey area, it is considered unlikely the Exploratory Works Survey area comprises habitat that may be considered critical for the survival of the species.

Three-leaved bosistoa (*Bosistoa transversa*)	
	Important Populations: The Conservation Advice does not define any important populations for the species. In the absence of a defined important population, it is necessary to consider the definition of an 'important population' as described in the Significant Impact Guidelines (1.1), which states "an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • key source populations either for breeding or dispersal • populations that are necessary for maintaining genetic diversity • populations that are near the limit of the species range. Considering the above criteria and the absence of species observations recorded in the Exploratory Works Survey area, it is considered highly unlikely the Borumba PHES Survey area supports an important population of the species. **Threats:** The Conservation Advice (DEWHA, 2008) for the species identifies the following threats: • habitat loss, disturbance and modification • invasive weeds • fire • cattle trampling, browsing and grazing.
In the Survey area	**Survey effort:** Surveys were completed between November and April 2024. Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area. Noting that the Project footprint and 100 m buffer has been comprehensively surveyed in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020) for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). Further information on the survey effort is provided in Appendix M**.** **Species occurrence:** A total of 14 individuals were identified in the Borumba PHES Survey area. No individuals are present in the Exploratory Works Survey area, or Project footprint. The nearest record is approximately 1 km from the footprint. **Habitat:** Approximately 1,195.7 ha of potential habitat (i.e. potential habitat) occurs within the Borumba PHES Survey area. No 'known habitat' for the species occurs in the Exploratory Works Survey area. A total of 7.3 ha of potential habitat is present in the Project footprint. **Present threats on the species:** Weeds are widespread throughout the Borumba PHES Survey area. The last bushfire that affected the Borumba PHES Survey area occurred in 2021.

Table 68: Assessment of potential impacts, and mitigation options for three-leaved bosistoa (*Bosistoa transversa*)

Three-leaved bosistoa (*Bosistoa transversa*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing causing habitat loss and fragmentation	The Project will clear 7.3 ha of potential habitat for the *Bosistoa transversa* in Area 1 (Borumba Dam) for geotechnical works and access tracks. The Project will not clear any known habitat where individuals have been identified. Clearing in this location is unavoidable, as geotechnical works are required for the new Borumba Dam wall and topography in the area requires some levelling and stabilisation to allow the works to proceed. The proposed action will reduce the availability of habitat for the *B. transversa* and cause fragmentation and loss of connectivity of the forest areas that provided potential habitat for the species within the landscape. The impact pathways include: • earthworks associated with the clearing of the area in Area 1 (Borumba Dam) for geotechnical works and access tracks.	Where vegetation clearing for potential habitat of the *Bosistoa transversa* is unavoidable; to mitigate the impact to the species, the following measures are proposed with further details provided in the CEMP and associated management plans: • Pre-clearance survey Pre-clearance surveys will be undertaken by a suitably qualified ecologist to identify any additional *B. transversa* individuals within and adjacent to the Project footprint. Noting that the Project footprint and 100 m buffer has already been comprehensively surveyed for the purposes of protected plants (i.e. clearing permit under the *Nature Conservation Act 1992*). • Minimising clearing requirements Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss. Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Flagging tape, fencing, fluorescent markers and signage will be inspected daily and any damaged fencing, missing flagging tape or fluorescent markers will be repaired to ensure they remain in serviceable condition. • Unexpected find Works will be undertaken in accordance with the unexpected finds procedure, which involves: – stop works in the vicinity of the find – demarcate and prevent access to area – comprehensively survey the population of the threatened species to determine the number of plants potentially impacted and spatial extent

Three-leaved bosistoa (*Bosistoa transversa*)		
Potential Impact	**Assessment**	**Mitigation Options**
		– explore options for avoidance – if impacts cannot be avoided engage with DCCEEW and DETSI in relation to approvals to clear.
Changes to habitat quality as a result of erosion and sedimentation	The Exploratory Works Project is located in areas that may contain soils with sodic subsoils that are highly erodible if exposed. Particular attention to soil erosion control measures is required in these areas. Soil assessments have been undertaken across the site and analysis of the soil is currently in progress with the mapping outputs to be used to microsite infrastructure and to confirm appropriate treatment for the works and post the works. Erosion and sedimentation risk is likely to be greatest in the vicinity of Area 1 (Borumba Dam) geotechnical areas, where 7.3 ha of potential habitat for *B. transversa* is proposed to be cleared on steeply sloped land. Due to the nature of the work proposed, there is a high likelihood that without mitigation, erosion of soil would occur which may influence plant vitality and growth. Erosion and sedimentation may also reduce the availability of nutrients and other essential resources required to maintain the quality of the land. The impact pathways include: • vegetation clearing to establish access tracks and clearing associated with the geotechnical investigation areas.	A preliminary Erosion and Sediment Control plan has been developed for the Project (Appendix A of the CEMP (Appendix F)) which includes the following mitigation measures: • Minimising risk of dispersible subsoils Strategies to minimise risk include limiting their disturbance, use of gypsum and covering dispersive material (e.g. buried under a minimum of 100 mm layers of non-dispersive soils before placing any revegetation or erosion control measures). • Controls during construction and clearing Activities will be scheduled, where practicable, to avoid the summer months where high intensity storms are more prevalent. The use of control measures such as sediment traps/rock filter dams/modular sediment traps, along with soil management and stockpiling practices will be implemented to minimise erosion and sedimentation. • Controls during drilling Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway. • Monitoring Daily visual inspections of records next to works areas noting: – evidence of dust/sediment deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc) – evidence of disturbance/ maintenance of restricted areas.

Three-leaved bosistoa (*Bosistoa transversa*)		
Potential Impact	**Assessment**	**Mitigation Options**
Spread of weeds, pests and disease due to increased human activity	Habitat infestation by weeds is a key threatening process for *B. transversa*. Lantana and cat's claw creeper are widespread, occurring in high densities in rainforest and wet sclerophyll communities where clearing or natural disturbance had occurred previously. A suite of invasive fauna is present within the Exploratory Works Project footprint that may threaten the species through grazing and/or trampling include European brown hare, rabbit, pig and rusa deer. There are no known diseases for the *B. transversa.* The removal of topsoil from excavated areas may act to spread weeds, without the application of suitable mitigation and management measures. Weeds may be further spread throughout the environment, or introduced to new areas, depending on the location of temporarily placed topsoil. Increased incidences of weeds may result in competition with native flora species and reduced availability of suitable habitat and associated resources. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	In accordance with Queensland Hydro's Biosecurity Management Plan hygiene control procedures will be in place throughout multiple stages of the Exploratory Works Project activities, including measures to reduce potential for introduction and spread of invasive species: • Decontamination Washdown facilities will be installed at the two entrances to Queensland Hydro land so all vehicles will be washed prior to entry and existing site. Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed, pest and pathogen spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material. Identified areas of high risk weed infestations will also be signed and demarcated where required to avoid transporting plant reproductive material from these areas to areas that are not infested. • Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint, unless approved for use in the area including targeted spraying. Particular care will be taken to ensure that any fill is sourced from areas free of lantana and other weed material which competes for similar habitat and is known to be a significant threat to the species in order to mitigate any impacts associated with Exploratory Works.

Three-leaved bosistoa (*Bosistoa transversa*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Work with adjacent landholders and other stakeholders to align biosecurity measures including treatment timeframes and programs. Contaminated material to be disposed of in accordance with the *Biosecurity Act 2014* including by transporting it safely to a waste disposal facility or burying it or adding it to onsite mulching.
Reduced amenity through dust emissions	The *B. transversa* records identified during surveys are located away from existing roads and proposed Exploratory Works Project construction areas and are unlikely to be impacted by dust emissions. However, other areas of potential habitat in work Area 1 (Borumba Dam) may be at risk of dust deposition impacts. Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and coat vegetation nearby. In the absence of mitigation, this may hinder plants' ability to photosynthesise, which may compromise their ability to thrive or result in mortality. The impact pathways include: • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce air emissions • vegetation clearing, and vehicle and machinery movement around the site.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts, including: • Dust hygiene Resheeting and sealing of roads and tracks to minimise dust generation. Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable. Regular cleaning of machinery and vehicle tyres to reduce dust emissions. • Speed limits Enforced speed limits across the disturbance area to minimise dust generation. • Monitoring Visual inspections of *B. transversa* individuals adjacent to active geotechnical activities and road/access track construction noting: – evidence of dust deposition on plants – plant health generally (evidence of dead/dying individuals, flowering, seeding, etc.) – evidence of disturbance/maintenance of restricted areas (e.g. introduction or proliferation of weeds).
Impacts to surface and groundwater quality and quantity, release of contaminated water from construction areas	Unauthorised or accidental releases of contaminated water from construction areas may enter the surrounding environment, and depending on the nature of the contaminated water, compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby.	There are no specific management measures developed for surface water and groundwater specific to *B. transversa*, however the following measures are relevant to avoiding and minimising impacts with further details provided in the CEMP and the associated management plans: • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Drilling fluids will be recirculated within purpose-built mud tanks during the drilling, which will allow sediments and cuttings to settle

Three-leaved bosistoa (*Bosistoa transversa*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Unauthorised contaminated water may also enter waterways or the water table, which may have flow-on effects for vegetation in areas surrounding or downstream of the initial contamination zone. Changes in surface and groundwater quality and quantity are unlikely; however, may influence a species' ability to thrive or cause mortality, while contaminated water is likely to have detrimental effects to the health and continued occurrence of a species, should it enter the environment in an uncontrolled manner. The impact pathways include: • spilling or leaking of chemicals required to support construction activities.	out. Vacuum trucks or similar will be used to remove dirty water and cuttings from the mud tanks for disposal. Sediment and erosion controls such as coir logs, jute meshing, or synthetic fencing will be installed downgradient of all drill pads (and on access tracks) where overland flow may directly enter a waterway.
Contamination from hazardous materials	Spills of chemicals as a result of works in Area 4 (Borgan) and Area 1 (Borumba Dam) investigation areas may be a particular risk for potential habitat for the species, where oil and other chemicals from the use of vehicles and machinery may enter the environment. Release of water and runoff from the tunnelling activities may also be a source of hazardous materials. The impact pathways include: • spilling or leaking of chemicals required to support construction activities	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures will be implemented to mitigate these impacts as per the CEMP, including: • All machinery is required to be re-fuelled in designated, and bunded, areas away from sensitive habitats such as waterways and rainforest areas. • Spill containment kits will be kept on site and readily available in the event of fuel/oil spills. • Chemicals, fuels and other sources of contaminates will be stored and handled in accordance with relevant guidelines and standards. • Vehicles and machinery Speed limits enforced throughout the Project area will reduce the risk of accidental chemical release from vehicle and machinery incidents. Vehicles and machinery will be regularly maintained and kept in good working order. Regular inspection and cleaning of vehicles and machinery will reduce the likelihood of chemical release.

Three-leaved bosistoa (*Bosistoa transversa*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Chemical use in the Project area Spraying of herbicides, aerosols and other chemicals will be limited to suitable weather conditions (i.e. low wind speed) only. Selection of herbicides, aerosols and other chemicals will be made with consideration of contamination risks. • Contaminated water Spoil and potentially contaminated material will be handled and stored assuming it is contaminated until contamination tests can confirm otherwise. For example, drill muds and water will be stored in ICBs and vac trucks will be used to remove this material from site.
Changes to the local bushfire regime	Fire is a recognised threat to the species. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • Introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within Imbil State Forest and Conondale Resources Reserve.

Table 69: Significant impact assessment for the vulnerable three-leaved bosistoa (*Bosistoa transversa*)

Three-leaved Bosistoa (*Bosistoa transversa*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** While the species was recorded in the Borumba PHES Survey area, extensive survey efforts have not identified any records of the species in the Exploratory Works Survey area or Project footprint. Regardless of whether any individuals would be considered as part of an important population, the works have avoided all direct impacts to the species and is therefore unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of an important population	**Unlikely** As no individuals were observed within the Exploratory Works Project footprint, the works are unlikely to impact any individuals and therefore are unlikely to reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	**Unlikely** While three isolated observations of the species were recorded more than 1 km from the Exploratory Works Project footprint in the Borumba PHES Survey area, the species was not recorded in the Exploratory Works Survey area. As such, although potential habitat will be cleared for the Project, clearing will not fragment any known existing population. The Exploratory Works Project is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely** The Exploratory Works Survey area is unlikely to support habitat critical to the survival of the species as the species was not observed despite extensive survey efforts. As such, it is considered unlikely the Exploratory Works Project will adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Unlikely** There are no individuals within or directly adjacent to the Exploratory Works Survey area and therefore it is unlikely the Exploratory Works Project will disrupt the breeding cycle of an important population via indirect impacts.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Given that no individuals were recorded during the field surveys undertaken within the Exploratory Works Survey area, the removal of vegetation is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to an extent that the species is likely to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	**Unlikely** There are a range of weeds and pest fauna currently within the Borumba PHES Survey area. The Exploratory Works Project is unlikely to result in invasive species that are harmful to the species becoming established in its habitat.

Three-leaved Bosistoa (*Bosistoa transversa*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** There are no known diseases that impact the species. The Exploratory Works Project is unlikely to introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** As the species was not observed within the Exploratory Works Survey area, the Project is unlikely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.3 Threatened fauna – RFI item 3.1

For each threatened fauna species known or likely to occur in the Exploratory Works Survey area, this section provides:

- a description of the species and suitable habitat in the Exploratory Works Survey area
- an assessment of the potential impacts of the Project
- an assessment of the significant residual impacts.

Threatened fauna with a possible LOO are addressed in Appendix J.

7.3.1 Australian lungfish (*Neoceratodus forsteri*)

The Project has the potential to significantly impact the Australian lungfish (*Neoceratodus forsteri*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- Table 70 – information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- Table 71 – an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- Table 72 – an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act.

The extent of suitable spawning and foraging habitat within the Borumba PHES Survey area, the Survey area, Project area, and Project footprint, and the locations of Australian lungfish recorded during field surveys are shown on Figure E-13, which is provided in Appendix E. There is a record of an Australian lungfish in Lake Borumba outside of areas mapped as suitable habitat. This record is from ALA, which generalises data to 1 km or 10 km, meaning that the point shown does not represent the exact location of the record. Based on this, the record is considered to be from Yabba Creek or suitable habitat in Lake Borumba.

It is noted that most of the works for the Project are on land and above the 1% AEP and as such as unlikely to have an impact on flood conditions or the health of the waterways. In addition, as noted in Section1.4.1 the design has avoided the construction of barriers through Kingaham Creek.

The significant impact assessment in Table 72 determined that the Project is **unlikely** to result in a significant impact to the Australian lungfish.

Table 70: Description of the Australian lungfish (*Neoceratodus forsteri*)

Australian lungfish (*Neoceratodus forsteri*)	
Profile	**Conservation status**: Vulnerable **Habitat:** As stated in the Conservation Advice (DOE, 2014), the Australian lungfish inhabits freshwater streams, preferring areas of flowing water where overhanging riparian vegetation grows along the bank, and areas where woody debris and dense macrophyte beds are found in water. While the species has been recorded living successfully within impoundments (reservoirs behind dams and weirs), more fish have been recorded from the shallow headwater areas of impoundments, where more complex habitats are available, than in deeper areas (DOE, 2014). The Australian lungfish requires clear or turbid, low-flow or still, vegetated, shallow pools to support spawning and feeding (DOE, 2023). Adult lungfish favour submerged logs, dense banks of aquatic vegetation, or underwater caves formed by bed scouring under submerged logs. While lungfish can be found in both pools and riffles, their preferred habitats are pools of 3-10 m depth. In habitats such as these, they can often live in large groups (Kemp, 1986). Macrophytes are essential for reproduction with submerged or emergent variants providing nesting surfaces for egg laying and refuges for juveniles (DOE, 2023). Juvenile lungfish are almost always found in dense macrophyte bed cover or similar in water of 500 mm depth or less. Within the Mary River and its tributaries, lungfish were found to be predominately in pool habitat of an average depth of 1.8 m (67%), with remaining individuals being found in runs of an average depth of 1.2 m (21%), riffles (11%), and backwaters (1%); the average stream width of these environments was less than 30 m (DOE, 2023). **Distribution:** The Conservation Advice states the Australian lungfish is known only to occur in a few river systems in south-eastern Queensland (DOE, 2014). Naturally occurring populations exist only in the Burnett and Mary River systems. **Previous records:** Recent records occur within Lake Borumba and downstream of Lake Borumba in Yabba Creek (ALA, 2023). **Wildnet Records:** There is one Wildnet record of the species in Yabba Creek upstream of Lake Borumba on the Biomaps portal (DES, 2024). **Habitat Critical to the Survival of the Species:** The Draft National Recovery Plan for the Australian lungfish (*Neoceratodus forsteri*) for the identifies habitat critical for the species as: *All known populations of Australian lungfish are considered under threat, habitat critical to the survival of the Australian lungfish includes:* • Any breeding or foraging habitat in areas where the species occurs (as defined by the distribution map provided in Figures 1-4 [in the recovery plan]); and • Any newly discovered breeding or foraging locations. Habitat critical for the species includes the Burnett, Mary, Brisbane and North Pine rivers. For the Borumba PHES Survey area, which is in the Mary River basin, habitat critical for the species includes Yabba Creek, Kingaham Creek, and Lake Borumba, but does not include Bella Creek or Sandy Creek. However, sections of Bella Creek and Sandy Creek may be considered habitat critical to the survival of the species based on habitat assessments undertaken in these waterways for the Project and their connectivity with Lake Borumba and Yabba Creek. **Important Populations:** The Conservation Advice for the species does not define an important population and there is no adopted Recovery Plan for the species. As such, to be conservative, given the limited distribution of the species, all individuals are considered part of an important population.

Australian lungfish (*Neoceratodus forsteri*)	
	Threats: The Conservation Advice (DOE, 2014) for the species identifies the following threats: • habitat loss • barriers to movement caused by construction of man-made dams and weirs along waterways without effective fish transfer facilities provided • natural or human-caused reductions in water levels during spawning periods, resulting in the death of fertilised eggs when exposed to air • competition and predation on juveniles by alien fish species, such as tilapia (*Oreochromis mossambicus*) • loss and fragmentation of riparian vegetation along banks, including roots that provide shelter and habitat • human activity-induced sedimentation increases resulting from development within the catchment • spread of alien aquatic species • illegal and incidental capture by recreational fishing of wild populations. The recovery plan identifies the following threats to the Mary Basin population: habitat degradation, flow regulation, increases in fragmentation from damming, stocking or predatory species, and proliferation of aquatic weed species.
In the Survey area	**Survey effort:** Surveys and habitat assessments were undertaken between June 2022 and May 2024 in accordance with the Survey Guidelines for Australia's Threatened Fish (DSEWPaC, 2011), the monitoring and sampling manual (DES, 2018), and guidance from subject matter experts at EnviroDNA (concerning eDNA sample collection and analysis). The surveys were undertaken within in areas of suitable habitat (Lake Borumba, Yabba Creek and tributaries that feed into Lake Borumba) in the Borumba PHES Survey area (Figure 40). Surveys involved visual observations of the Australian lungfish via kayaking in the Kingaham, Yabba and Sandy Creeks, eDNA surveys, fyke netting, cathedral trapping, electrofishing (backpack and boat-based electrofishing), snorkelling, angling, and box trapping (Hydrobiology, 2023). Further information on the survey effort is provided in Appendix M. **Species occurrence:** Five observations of the Australian lungfish were recorded within Lake Borumba and downstream of the lake in Yabba Creek. Of these five, one observation was recorded within the Borumba PHES Survey area, directly downstream of the dam wall. The other four observations were recorded within Lake Borumba. **Habitat:** 278.4 ha of foraging habitat and 21.6 ha of foraging/spawning habitat occurs within the Borumba PHES Survey area. Of this 4.6 ha of foraging habitat and 5.5 ha of foraging/spawning habitat occurs within the Exploratory Works Survey area, and 0.2 ha of foraging habitat and 0.3 ha of foraging/spawning habitat occurs within the Exploratory Works Project footprint. Habitat within the Borumba PHES Survey area includes areas upstream of Lake Borumba in Yabba Creek, Kingaham Creek, and Sandy Creek, areas of Lake Borumba, and downstream of Borumba Dam in Yabba Creek. Suitable habitat attributes for foraging habitat includes shallow or deep pools with the following overlapping features: large woody debris, overhanging vegetation, and undercut banks. Specific spawning habitat includes shallow pools, deep pools or waterways with riffles associated with aquatic plants (instream submerged and semi-emergent forms), particularly Hydrilla and Vallisneria beds. **Present threats on the species:** The main threats to the Australian lungfish include the loss of habitat and barriers to movement caused by the construction of man-made dams and weirs along waterways without effective fish transfer facilities (DOE, 2014). Lake Borumba, adjacent to the Exploratory Works Survey area, is an existing impoundment on Yabba Creek. Additionally, competition and predation on juveniles by tilapia (*Oreochromis mossambicus*) is a current threat to the species (DOE, 2014), and tilapia is present in Yabba Creek downstream of the Borumba Dam wall.

Table 71: Assessment of potential impacts, and mitigation options for Australian lungfish (*Neoceratodus forsteri*)

Australian lungfish (*Neoceratodus forsteri*)		
Potential Impact	**Assessment**	**Mitigation Options**
Instream earthworks causing habitat loss and fragmentation	Civil works associated with waterway crossings have the potential to remove habitat and introduce barriers to fish passage. As such, the final design has considered these risks to aquatic fauna with the use of design and construction measures to avoid or minimise impacts to habitat and fish/turtle passage (e.g. bed level crossings and bridges). The Project involves the construction of four temporary bridges and upgrades to seven existing creek crossings over Yabba and Sandy creeks to support access and infrastructure development across Area 1 (Borumba Dam), Area 3 (Walkers Top) and Area 4 (Borgan). The four bridges are in Area 4 (Borgan), with three of these locations associated with an existing crossing. The bridge crossings will utilise prefabricated Bailey bridges and be removed following the completion of the works. Four existing crossings, which are required to support bridge construction, will be upgraded to temporary piped culverts before being converted to concrete bed level crossings. The three other existing bed level crossings will also be upgraded to roughened concrete or compacted gravel improve access around the Project site. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). All bed level crossings will be placed in line with the existing bed level crossings and be constructed in accordance with the Queensland *Fisheries Act 1994,* which requires a provision for aquatic passage*,* and the *Planning Act 2016* (including the ADR) (refer to 2.11). Earthworks associated with these crossings have the potential to remove habitat and introduce barriers to fish passage, leading to fragmentation of the species. However, as all crossings have been designed to avoid the introduction of barriers to fish passage and the works are in small, discrete locations, habitat loss would be minimal (up to 0.5 ha) and fragmentation of the population will not occur.	To mitigate impacts of instream earthworks, the following measures are proposed: • No bank or instream disturbance will be undertaken until a suitably qualified person has checked for suitable breeding places, as outlined within the FFMP. A minimum of 30 m upstream and downstream of the Exploratory Works in creeks will be inspected. • Restricted areas: – Riparian areas near work areas will be marked as restricted areas to ensure no clearing or works in these areas. – Clearing boundary maps and restricted areas will be provided to contractors, with permitted personnel only allowed access on foot beyond the boundary of the restricted areas. • Work sites will be micro-sited to avoid potential breeding and/or foraging habitat, wherever possible. • Bailey bridges will be installed across Yabba Creek and Sandy Creek, with the bridges designed to minimise changes to flows (e.g. velocity, depth etc.) and water quality, which have the potential to impede fish movement. • As the bridges are prefabricated, works necessary to install the bridges will mainly be isolated to the stream banks. • Limited bed level crossings (associated with and independent of Bailey bridges): – Bed level crossings will be constructed in accordance with the ADR. – All bed level crossings will be constructed to avoid the introduction of barriers to fish movement, including vertical drops between upstream and downstream reaches. As such, the works are not anticipated to create barriers that may lead to species fragmentation. The bed level crossings required for the Project will be rehabilitated. • Directional drilling under or suspension over Yabba Creek for the pipeline crossings will minimise the extent of disturbance and prevent the introduction of structures into the waterway that could serve as a barrier to movement for the species.

Australian lungfish (*Neoceratodus forsteri*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • earthworks associated with the construction of waterway crossings.	
Changes to habitat quality as a result of erosion and sedimentation	Habitat quality may decline due to erosion and sedimentation resulting from ground disturbance associated with the proposed Project. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required for the species to thrive. However, as seven of the proposed crossings are at existing vehicle crossing points within the Project site, their upgrade will help reduce long-term erosion and sedimentation impacts associated with the current design. The upgrades will also reduce the requirement for ongoing maintenance works, which will ultimately provide a better outcome for water quality in the creeks compared to the current crossings. The impact pathways include: • erosion and sedimentation associated with earthworks, vegetation clearance, and poor rehabilitation measures has the potential to lead to turbid runoff entering adjacent waterways, resulting in changes to water quality.	Erosion and sediment control measures, outlined in an Erosion and Sediment Control Plan, will be implemented to mitigate impacts on habitat quality. Measures will include: • Undertaking clearing for the geotechnical investigation areas immediately before the investigation to limit the time bare ground is exposed to rain, which can lead to erosion. • Rehabilitating exposed areas as soon as possible to further reduce the likelihood of erosion and sedimentation causing turbid runoff to enter waterways. • Installing suitable site-specific controls, which may include earth basins, filters, rock check dams, sediment fences, and sediment traps.
Barriers to movement	In the absence of appropriate design and mitigation measures, Project components constructed within waterways could act as barriers to aquatic species movement in the absence of appropriate design and mitigation measures. Barriers to movement can act to isolate species, hindering their ability to thrive. The four bridge crossings will utilise prefabricated Bailey bridges and have been designed to allow aquatic fauna passage. These structures will be removed following the completion of the works. The four existing crossings of Yabba and Sandy creeks that are required to support bridge construction will be upgraded to temporary piped culverts before being converted to concrete bed level crossings that comply with the ADR. Other existing crossings of Yabba Creek will be upgraded in accordance with the ADR, which will also reduce ongoing maintenance issues	The installation of Bailey bridges to cross Yabba Creek and Sandy creek avoids the introduction of barriers to movement being introduced into the waterways. Should the Main Works not proceed, the bridges will be removed and the area rehabilitated. The bed-level crossings will be constructed in accordance with the ADR which prohibits the introduction of barriers to fish movement, including vertical drops between upstream and downstream reaches. The ADR also outlines requirements for the temporary impoundment of creeks for the safe construction of waterways. Utilising a piped-culvert design that is consistent with the outcomes required by the *Fisheries Act 1994* during the construction of the Bailey bridges will help to maintain aquatic passage, while also lowering the risk of any interactions with vehicles and minimising negative impacts on water quality and sedimentation. Furthermore, the water infrastructure pipeline crossings of Yabba Creek will be via directional drilling or suspended above the creek to

Australian lungfish (*Neoceratodus forsteri*)		
Potential Impact	**Assessment**	**Mitigation Options**
	with the existing crossings. No other waterways in the Project footprint can support this species. All bed level crossings will comprise either roughened concrete or gravel placed and will be placed in line with the existing bed level crossings. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). While upgrades to the existing crossings may temporarily cause a barrier to species movement, this impact will be short-term and confined to the construction period only. The impact pathways include: • structures associated with the construction of waterway crossings (i.e. Bailey bridges temporary piped culverts, and bed level crossings, sediment fences, bunds).	avoid instream disturbance and the introduction of structures into the waterway that could serve as a barrier to movement for the species.
Spread of weeds, pests and disease due to increased human activity	Activities undertaken within watercourses may act to spread aquatic weeds without the application of suitable mitigation and management measures. An increased incidence of weeds may cause reduced availability of suitable habitat and resources for the species. Tilapia is present in Yabba Creek, downstream of Borumba Dam wall. It is not expected that the Project will exacerbate the presence of this pest species. Use of construction machinery and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. The impact pathways include: • Transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area. • Facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	Hygiene control procedures will be in place throughout multiple stages of the Project activities, including measures to reduce potential for introduction and spread of pests: • Decontamination Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material.

Australian lungfish (*Neoceratodus forsteri*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint.
Injury or mortality to individuals	The use of construction machinery within waterways has the potential to directly result in fauna injury or mortality. Aquatic species, including the Australian lungfish, are also at risk of injury or mortality from vehicle strike at bed level crossings. The impact pathways include: • Vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site, working within or crossing Yabba Creek and Sandy Creek.	To mitigate to risk of injury or mortality to the species at the site of the bed level crossing, the following measures are proposed: • Vehicles will only traverse the bed level crossing when low flows permit. In such periods, it is expected that there will be visibility of the stream bed that will allow for a visual inspection of any species present. • Should any individuals be present, vehicle movements across the stream will be halted until the species moves either upstream or downstream to avoid the risk of injury or mortality. • Should any individuals be observed to be injured at the site of the stream bed crossing, the injured individual will be transported to a vet, if possible. • Minimise instream and riparian works during breeding seasons (August to December) for Australian lungfish. • Relocate aquatic fauna from areas where Exploratory Works activities are to occur in accordance with the Fish Salvage Guideline (DAF, 2024).
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in a temporary increase in elevated noise, vibration, air, and light emissions, which could impact Australian lungfish habitat and impact the species. However, as the Project is largely outside the creeks, with setbacks to work areas, and suitable mitigation controls will be implemented, it is not anticipated that unwanted emissions will impact the species. Any additional habitat degradation resulting from air, noise, and vibration emissions associated with the upgrade of crossings in Area 1 (Borumba Dam), Area 3 (Walkers Top), and Area 4 (Borgan) will be short-term and confined to the construction period. As the crossings are already in existence and utilised by vehicles traversing the site, any additional impacts from air, noise and vibration emissions are expected to be negligible.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions include: • Light: instream construction activities will be limited to daytime hours as far as practicable, and only minimal lighting will be installed around buildings at night (which will be on motion sensor to further reduce light emissions). Additionally, shades/shields to direct light downward will be installed, and bright white lights avoided in favour of orange or amber hue lighting where worker safety is not compromised. • Noise: dampening fences will be installed at significant noise sources (e.g. drilling sites/tunnelling sites). Tunnelling activities near the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to

Australian lungfish (*Neoceratodus forsteri*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • the introduction of artificial lighting to illuminate night work (drilling the deep bore holes) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	result in vibration emissions at the surface that will impact the species). • Air: regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e. low wind speed) only.
Contamination from hazardous materials	There is a risk of chemicals, required to support construction activities, spilling or leaking and entering suitable Australian lungfish habitat. There is also a risk of contaminated water from the Project being unintentionally released directly into waterways or via runoff. The harm such contamination would cause the species is variable, and contingent on the extent of the spill or release and nature of the contamination. However, it is reasonable to assume that without suitable mitigation, the impacts of such contamination could result in significant mortality to the species. The impact pathways include: • hazardous materials associated with the use of vehicles, machinery, and Project activities may spill or leak onto the ground and run off into adjacent waterways • contaminated water from the Project (e.g. runoff from work areas, water stored in basins, water from tunnelling activities) being unintentionally released to water or land.	To mitigate the risk of contamination from hazardous materials, controls will be implemented to limit the likelihood of hazardous materials spilling and contaminating waterways. Controls will include storage and handling requirements, spill kits, trained personnel handling hazardous materials, and the development of emergency response protocols to respond to, and contain, spills. To minimise the risk of the accidental release of contaminated water from the Project, a range of water management infrastructure is proposed to capture and treat dirty water (see Section 2.7.3). This includes a water treatment plant capable of treating water to required environmental standards for the Yabba Creek catchment and basins to store dirty and clean water.

Table 72: Significant impact assessment for the vulnerable Australian lungfish (*Neoceratodus forsteri*)

Australian lungfish (*Neoceratodus forsteri*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** Naturally occurring populations are in the Mary and Burnett catchment systems, which are geographically isolated from one another. It is estimated that the population is less than 10,000 individuals (DOE, 2014). Given the limited distribution of the species, all individuals are considered part of an important population. Approximately 0.2 ha of foraging habitat and 0.3 ha of spawning/foraging habitat for the Australian lungfish will be disturbed. Eight waterway crossings are proposed, including upgrades to seven existing crossing locations, with a combination of bridge structures, temporary piped culverts, or bed level crossings. Additionally, there are proposed temporary water pipeline crossings at Yabba Creek that will either be directionally drilled under the creek or suspended over the creek. The direct disturbance of 0.2 ha of foraging habitat and 0.3 ha of spawning/foraging habitat is unlikely to lead to a long-term decrease in the size of an important population as the species is likely to persist in the area in the remaining 278.4 ha of foraging habitat and 21.6 ha of spawning/foraging habitat within the Borumba PHES Survey area, as well as within the greater Mary River catchment. Upgrades to existing bed level crossings and the installation of temporary piped culvert crossings in accordance with the ADR or *Fisheries Act 1994* performance outcomes will not impede passage and will reduce ongoing maintenance requirements and the risk to aquatic fauna. The Bailey bridge design does not impede environmental flows, and the placement of piers either do not meet the criteria for a waterway barrier or conform with performance outcomes required to maintain fish passage under the Queensland *Fisheries Act 1994*. After the Project the bridges will be decommissioned if the Main Works Project does not go ahead. Due to the temporary nature of the proposed action and the proposed management measures, any indirect impacts (e.g. temporary changes of water quality or light emissions) associated with the Project that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The area of occupancy for the species has not been defined. The direct disturbance of 0.2 ha of foraging habitat and 0.3 ha of spawning/foraging habitat across four work areas is unlikely to result in any changes to the species AOO as there are extensive areas of suitable habitat present within the Borumba PHES Survey area and connected waterways. The direct disturbance of 0.2 ha of foraging habitat and 0.3 ha of spawning/foraging habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.

Australian lungfish (*Neoceratodus forsteri*)	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** Due to the existing barrier to fish passage between Lake Borumba and downstream habitat in Yabba Creek, it is considered likely that there are two discrete subpopulations of Australian lungfish within the Borumba PHES Survey area. As no permanent barriers to fish passage will be installed as part of the proposed action, it is considered highly unlikely that either of the existing populations will become fragmented into two or more populations. All bed level crossings, temporary piped culverts, and temporary bridges will be constructed to maintain suitable fish passage and therefore allow the Australian lungfish to pass. As such, it is considered highly unlikely that either of the existing populations will become fragmented into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely** Habitat critical to the survival of the species includes mapped foraging and spawning habitat, which meets the requirements stated in Table 70. Eight waterway crossings are proposed, including upgrades to seven existing crossing locations, with a combination of bridge structures, temporary piped culverts, or bed level crossings. Four temporary piped-culvert crossings within Area 4 (Borgan) will be used until Bailey bridges are implemented, after which the crossings will be converted back to bed level crossings. The Bailey bridges were selected because they can be removed and have a smaller footprint than other bridges. The design of the bridges means they will not impede flow, disturbance from their construction will largely be on the high banks, and they conform with performance requirements under the Queensland *Fisheries Act 1994*. The bridges will be removed at the completion of the Project if the Main Works do not proceed, and the area rehabilitated (Appendix C). Furthermore, preliminary modelling for the bridges shows no notable change to the flow when the bridges are installed to cross Yabba and Sandy creeks. The bed level crossing at Area 1 (Borumba Dam) will be in place for the duration of the Project (~ 2 years). It is an area accessed for maintenance of Borumba dam and will be constructed by placing gravel or roughened concrete on the bed, which will minimise disturbance of fine sediments on the bed. Upgrades to the bed level crossings over Yabba Creek in Area 3 (Walkers Top) and Area 4 (Borgan) will also comprise either gravel or roughened concrete. The selection of material for the bed level crossings will be decided in line with anticipated traffic levels (i.e. gravel for low-traffic and concrete for high-traffic areas). While isolated sections of suitable habitat for the species will be temporarily affected (i.e. bed level crossing downstream of the Borumba Dam wall), it is not expected that the impacts of the proposed action will adversely affect habitat critical to the survival of the species.

Australian lungfish (*Neoceratodus forsteri*)	
Impact criteria	**Assessment**
Disrupt the breeding cycle of an important population	**Unlikely** Unlike Australian lungfish populations in the Burnett catchment, the Mary catchment population is not known to undertake spawning migrations (Kind, 2003). The Australian lungfish requires clear or turbid, low-flow or still, vegetated, shallow pools to support spawning, and will move between different parts of the river if their usual home range lacks adequate spawning habitat in a given year (DOE, 2023; Brooks & Kind, 2002). There is no evidence they successfully recruit in dams (DAF, 2017). The Australian lungfish was found in Lake Borumba and downstream extents of Yabba Creek. The species was not observed in Yabba Creek or Sandy Creek upstream of Lake Borumba, although habitat is present. Recruitment throughout the Borumba PHES Survey area is limited, with no juveniles caught (Hydrobiology, 2023). It is estimated that there has been a 26% or reduction in the amount of breeding and nursery habitat for the Australian lungfish (the main channels of the Burnett and Mary Rivers). As a result, the adult breeding population is likely to undergo a substantial decline within the next three generations (Department of the Environment and Heritage, 2003). Approximately 0.3 ha of suitable spawning/foraging habitat is mapped within the Exploratory Works Project footprint, specifically in, Area 4 (Borgan), Area 2 (Kingaham Creek), and Area 1 (Borumba Dam). The macrophyte density in Yabba Creek in Area 4 (Borgan) was lower than in Area 1 (Borumba Dam), with both areas having macrophyte density less than 40% (Hydrobiology, 2023). There are currently no active breeding sites within the Exploratory Works Survey area. The works do not involve the construction of any permanent barriers that would impede Australian lungfish movement. Furthermore, as the Australian lungfish within the Mary River do not seasonally migrate to spawn, breeding is anticipated to occur within, or not far from, their usual home range. Indirect impacts resulting from the proposed works, including water quality changes, and dust, light, air, and noise emissions may temporarily disrupt the breeding cycle for the Australian lungfish, especially as the species will not spawn in turbid conditions (DOE, 2014). To manage this, controls for erosion and sedimentation, leaks and spills of hazardous chemicals or waste, and the unintentional release of contaminated water will be implemented to ensure water quality downstream of site establishment works does not decrease from pre-construction levels. Also, the removal of habitat features for breeding (riparian and instream vegetation and debris) will be avoided (such as restricted areas) during site establishment works. With these mitigation measures, the Project is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The Exploratory Works Project will disturb 0.2 ha of suitable foraging habitat and 0.3 ha of suitable spawning/foraging habitat for the species. Seven bed level crossings, all of which are upgrades to existing crossings, and four temporary Bailey bridges are proposed. Four of these crossings will initially have temporary piped culverts installed to provide access during bridge construction at Yabba and Sandy Creek in Area 4 (Borgan) after which the crossings will be converted back to bed level crossings. The Bailey bridges were selected because they can be removed and have a smaller footprint than other bridges. The design of the bridges means they will not impede flow and disturbance from their construction will largely be on the high banks. The bridges will be removed at the completion of the Project if the Main Works do not proceed and the area rehabilitated

Australian lungfish (*Neoceratodus forsteri*)	
Impact criteria	**Assessment**
	(Appendix C). Furthermore, preliminary modelling for the bridges showed no notable change to the flow when the bridges are installed to cross Yabba and Sandy creeks. The bed level crossing at Area 1 (Borumba Dam) will be in place for the duration of the Project (~ 2 years). It is an area accessed for maintenance of Borumba dam and will be constructed by placing gravel on the bed, which will minimise disturbance of fine sediments on the bed. Upgrades to the two bed level crossings over Yabba Creek (Area 3 (Walkers Top)) will be comprised of either gravel or roughened concrete and will not disturb any segment of waterway not already utilised and disturbed as a crossing. The temporary water pipeline crossings of Yabba Creek will be via directional drilling or suspended overhead, minimising the extent of disturbance. These structures will be removed following the completion of the works if the Main Works do not proceed. While isolated sections of suitable habitat for the species will be temporarily modified (i.e. bed level crossing below the current dam wall), it is not expected that the impacts of the proposed action will result in changes to the habitat of the species that will cause the species to decline. Indirect impacts resulting from the proposed works, including changes to water quality and dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** Tilapia, an invasive pest species, is known to occur within Australian lungfish habitat below the existing dam wall. It is not expected the action will exacerbate the presence of tilapia below or upstream of the dam wall. It is also not expected that the proposed action will result in additional invasive pest species becoming established in the habitat of the Australian lungfish. A range of biosecurity control measures will be implemented including pest flora and fauna management actions.
Introduce disease that may cause the species to decline	**Unlikely** The Conservation Advice (DOE, 2014) for the species does not identify any disease threats for Australian lungfish. As such, it is considered highly unlikely the Project will introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** A Recovery Plan for the species is yet to be adopted. However, given the isolated and temporary nature of the works it is considered highly unlikely the proposed action will disrupt the breeding cycle of the species, result in significant injury or mortality to the species, or permanently remove a significant area of critical habitat to the species, which could reasonably be considered as factors that might interfere with the recovery of a species.
Recommendation:	Significant impact is **Unlikely**

7.3.2 Black-breasted button-quail (*Turnix melanogaster*)

The Project has the potential to significantly impact the black-breasted button-quail (*Turnix melanogaster*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 73, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 74, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 75, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of potential habitat within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and the Project footprint, and the location of black-breasted button-quail recorded during field surveys are shown on Figure E-14, which is contained in Appendix E. It should be noted there is a single record of a black-breasted button-quail outside, but immediately adjacent to, the mapped extent of potential habitat. The record is a platelet recorded under a dense stand of *Lantana camara*, which is a weed of national significance and, while black-breasted button-quails are known to utilise thickets of *Lantana camara*, this area does not contain the full suite of habitat requirements to be mapped as potential habitat. In this regard, this record is likely to be an individual temporarily venturing outside the species' potential habitat, rather than indicative of an individual permanently residing in areas of unsuitable habitat. This area is not impacted by the Exploratory Works Project and therefore the inclusion of this record as potential habitat would not alter impact area calculations.

The significant impact assessment undertaken in Table 75 identified that the Project is **likely** to result in a significant impact on the black-breasted button-quail.

Table 73: Description of the black-breasted button-quail (*Turnix melanogaster*)

Black-breasted button-quail (*Turnix melanogaster*)	
Profile	**Conservation status:** Vulnerable **Habitat:** The Conservation Advice for the black-breasted button-quail states the habitat for the species includes vine thicket rainforests that have a largely closed canopy and deep leaf litter in areas that receive 800-1,200 mm annual average rainfall (TSSC, 2015). They also occur in softwood scrubs in the Brigalow belt; vine scrub regrowth; mature hoop pine (*Araucaria cunninghamii*) plantations, especially where there is dense cover of lantana (*Lantana camara*); dry sclerophyll forest adjacent to rainforest; and *Acacia* and *Austromyrtus* scrubs on sandy coastal soils. Foraging is undertaken via a pivoting digging action whereby foraging individuals leave distinctive dish-like depressions known as platelets. Breeding is undertaken in similar habitats but typically include sites with a dense understorey of shrubs and forbs such as *Lantana camara* and bracken fern (*Pteridium esculentum*). **Distribution:** The Conservation Advice states that the species is distributed across south-eastern Queensland from near Byfield in the north to the Border Ranges rainforests in the south, generally east of the Great Dividing Range; although there are records up to 200 km inland at locations at Palmgrove National Park and Barakula State Forest in Queensland (TSSC, 2015) **Previous records:** The Atlas of Living Australia (ALA) database shows recent records of the species occurring within 20 km of the Exploratory Works Project (ALA, 2023). There are no records of the species in the Exploratory Works Survey area on the Biomaps portal (DES, 2024).

Black-breasted button-quail (*Turnix melanogaster*)	
	Habitat Critical to the Survival of the Species: The National Recovery Plan for black-breasted button-quail (DCCEEW, 2022) defines that habitat considered critical to the survival of the species includes: • Vine thickets and rainforest vegetation types that are periodically water-stressed. These include semi-evergreen vine thicket, low microphyll vine forest, Araucarian microphyll vine forest, Araucarian notophyll vine forest and Brachychiton scrubs that may incorporate bottle trees (*Brachychiton sp*.), brigalow (*Acacia harpophylla*) and belah (*Casuarina cristata*). • Low thickets or woodlands with a dense understorey but little ground cover, typically dominated by *Acacia spp*. • In littoral situations, dry vine scrubs, acacia thickets and areas densely covered in shrubs, particularly midgen berry (*Austromyrtus dulcis*). **Important Populations:** The National Recovery Plan for the black-breasted button-quail states the populations of the Yarraman-Nanango, Jimna-Conondale Range and Great Sandy regions are important due to their size and the land on which they occur being state owned. In addition, the populations in Palmgrove National Park, Barakula State Forest and all populations in NSW are considered important. Given the proximity of the Project to the Jimna-Conondale Range, the individuals observed within the Borumba PHES Survey area are likely to be part of the population in the Jimna-Conondale Range. **Threats:** The Conservation Advice for the species identifies the following threats: • habitat degradation as a result of domestic livestock and feral pigs (*Sus scrofa*) • habitat loss or degradation from fires of increasing intensity or frequency • predation by feral animals such as feral Cats (*Felis catus*) and foxes (*Vulpes vulpes*) • clearance of forest for agriculture and forestry.
In the Survey area	**Survey effort:** Surveys including habitat assessments were undertaken between May 2022 and July 2024 in accordance with *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2010). Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary. Figure E-14 presents the Exploratory Works Survey area and the Borumba PHES Survey area. Further information on the survey effort is provided in Appendix M**.** **Occurrence of the species in the Survey area:** While 10 black-breasted button-quail individuals were detected and platelets were observed in two separate locations within the Borumba PHES Survey area, no species observations were recorded in the Exploratory Works Survey area. The species observations outside the Exploratory Works Survey area were along the edges of Lake Borumba, and near Walkers Top Road. Figure E-14 presents the observations and the respective work areas. **Habitat:** 659.9 ha of habitat occurs within the Borumba PHES Survey area, of which 32.2 ha of habitat occurs in the Exploratory Works Survey area. A conservative approach was taken to mapping habitat. Habitat is comprised of areas of remnant rainforest vegetation with a closed canopy and leaf litter is more than 0.5 cm deep, which would provide suitable shelter and breeding habitat. **Present threats on the species:** • feral pigs may degrade habitat for the species within the Borumba PHES Survey area • the last bushfire that affected the Borumba PHES Survey area occurred in 2021 • feral animals including Cats and foxes may predate on the species • habitat has been cleared previously for agriculture (grazing) and forestry occurs nearby and outside of the Borumba PHES Survey area.

Table 74: Assessment of potential impacts and mitigation options for the black-breasted button-quail (*Turnix melanogaster*)

Black-breasted button-quail (*Turnix melanogaster*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project is anticipated to result in the clearing of 0.2 ha of suitable habitat for black-breasted button-quail. The removal of habitat for the species has the potential to adversely impact the species as it could potentially increase pressure on the remaining available habitat able to be utilised by individuals. Clearing within patches of potential habitat also has the potential to introduce edge effects. Edge effects, such as greater incursion of weeds, predators, and light along the edges of newly opened areas, are known to impact species, including cryptic species like the black-breasted button-quail, by altering the composition of habitat and facilitating increased predation (DCCEEW, 2022). Due to the minor amount of habitat to be cleared that will be across a series of smaller clear areas adjacent to larger habitat areas, it is expected that edge effects in potential habitat for the species will be minimal in extent. The impact pathways include: • vegetation clearing of potential habitat to establish access tracks and clearing associated with the geotechnical investigation areas.	Clearing of suitable black-breasted button-quail habitat has largely been avoided through considered design. The area of suitable black-breasted button-quail habitat that could not be avoided includes a narrow, linear area associated with an access track near Borumba Dam. In the area where black-breasted button-quail habitat is proposed to be removed; contiguous sections of potential habitat will be retained around the proposed works which will provide similar habitat values. Lantana control at forest edge margins known or likely to support the black-breasted button quail will be minimised, with clearing in these areas using a staged approach that will aim to remove lantana over several phases to minimise impacts on suitable habitat for the species. Where vegetation clearing is unavoidable, to avoid the impact of direct habitat loss, prior to the commencement of vegetation clearing, clearing boundaries will be delineated using flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will also be installed to clearly delineate exclusion/buffer zones. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. To mitigate the impacts of clearing on breeding, the clearing of potential habitat will be timed to avoid the species breeding period (September to April-May), where possible. Prior to clearing, a fauna spotter catcher (FSC will check proposed work areas immediately prior to clearing for presence of black-breasted button-quail individuals and habitat features (i.e., platelets). If present, works will cease until the area is clear of the species. Weed control measures, including washdown requirements, will be implemented in accordance with the Biosecurity Management Plan to reduce the threat of weed dispersal throughout the Project area.

Black-breasted button-quail (*Turnix melanogaster*)		
Potential Impact	**Assessment**	**Mitigation Options**
		To further mitigate the loss of habitat values for the species, Queensland Hydro will destock its land, as habitat loss and degradation due to domestic stock is a known threat to habitat for the species.
Habitat fragmentation	The Project is anticipated to result in the clearing of 0.2 ha of suitable habitat for the black-breasted button-quail. Habitat clearing has the potential to result in habitat fragmentation for species, if patches of potential habitat become isolated from other areas of potential habitat. As the proposed works will retain large tracts of contiguous potential habitat that provides connectivity to adjacent potential habitat, it is unlikely fragmentation of the black-breasted button-quail habitat will occur. The impact pathways include: • vegetation clearing of potential habitat to establish access tracks and clearing associated with the geotechnical investigation areas.	Clearing of suitable black-breasted button-quail habitat has largely been avoided through considered design. The area of suitable black-breasted button-quail habitat that could not be avoided includes a narrow, linear area associated with an access track near Borumba Dam. In the area where black-breasted button-quail habitat is proposed to be removed, contiguous sections of potential habitat will be retained around the proposed works to provide connectivity, allow continued species movement and negating potential isolation.
Injury or mortality to individuals	During vegetation clearing, there is potential for direct mortality if black-breasted button-quail individuals are present. However, the implementation of appropriate controls is expected to reduce the likelihood of injury or mortality to low. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site • injury or death during tree felling procedures, necessary for clearing works.	Clearing of habitat could potentially result in injury or death to black-breasted button-quail without the implementation of suitable controls. The following mitigation measures are proposed with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • General Minimise works in black-breasted button-quail habitat during the breeding period (September to April-May). Off-track driving will not be permitted and reduced speed limits will be enforced near potential habitat, with appropriate signage on site. Undertake a prestart toolbox at commencement of works to inform the work party of potential presence of black-breasted button-quails and key habitat features in the area and planned procedure to manage these values. • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim of identifying, mapping, and

Black-breasted button-quail (*Turnix melanogaster*)		
Potential Impact	**Assessment**	**Mitigation Options**
		marking out nest sites and restricted areas to inform the approach to vegetation clearing. Potential nest sites will be marked and GPS. • Micro-siting Works will minimise clearing of habitat for the through micro-siting infrastructure. • Clearing Prior to clearing, a FSC will check proposed work areas immediately prior to clearing for presence of black-breasted button-quail individuals and habitat features (i.e., platelets). If present, works will cease until the area is clear of the species. Undertake a prestart toolbox at commencement of works to inform the work party of the potential presence of quails in the area. If a quail is sighted within 50 m of the activity: – stop works until a suitably qualified FSC is consulted and advises on next steps – quails to be left to self-disperse or unless otherwise directed by FSC – works to commence following the approval from the FSC or the environmental officer – capture and release those healthy individuals (any injured animals will be taken to a wildlife carer and/or a vet for treatment). • Other works If a quail is sighted within 50 m of the activity: – Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc). Visual monitoring of the quail shall occur until advised by environmental officer. – Based on ongoing risk from proposed works and quail behaviour, environmental officer may request works to stop.

Black-breasted button-quail (*Turnix melanogaster*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Works shall recommence following advice from a suitability qualified FSC. – Undertake a prestart toolbox with workers to inform the work party of presence of quails in the area. • Active breeding location discovery If any active breeding locations are identified, a restricted area will be established, and works will be halted until the animals have moved on or can be safely relocated. This may include clearing around the habitat tree and leaving for a period of 24-48 hours to allow the animals to move on. Platelets within confirmed breeding activities will be recorded in the Animal Breeding Place Register and discussed in the Exploratory Works SMP and reported to DETSI/DCCEEW as required.
Spreading pests and weeds	The spread of pests and weeds, particularly cats and foxes, is a known threat to the species. Project activities have the potential to facilitate the spread of weeds and attract pest fauna from areas adjacent to the Project area. However, the strict implementation of appropriate biosecurity measures on machinery, vehicles and material movement is expected to reduce the likelihood pests and weeds will adversely impact the species. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* and has developed a Biosecurity Management Plan which aims to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on black-breasted button-quail. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures.
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to the black-breasted button-quail. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed

Black-breasted button-quail (*Turnix melanogaster*)		
Potential Impact	**Assessment**	**Mitigation Options**
	flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • Introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with "hot-work" activities.	by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.
Habitat degradation through air, noise, and vibration, and light emissions	Project activities are likely to result in a temporary increase in elevated noise, vibration, air, and light emissions, which each have the potential to impact the black-breasted button-quail. As a ground-dwelling species, black-breasted button-quails are sensitive to vibration impacts, such as those associated with blasting. Given their shy disposition, noise and light emissions also have the potential to disrupt the natural behaviour of the species. Without the implementation of appropriate controls, these impacts are likely to adversely affect the species. Most of the emissions sources are associated with the tunnelling works down in the Sandy Creek and Yabba Creek floodplain where this species has not been previously recorded, though habitat is mapped as being present. Further, tunnelling activities in proximity to the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). While high intensity vibratory works are not currently anticipated onsite. The impact pathways include: • the introduction of artificial lighting to illuminate night work (e.g. drilling the deep boreholes and tunnelling works) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions, including but not limited to below with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Light Construction activities will be limited to daytime hours as far as practicable however some works will be 24/7 and lighting will be required. In these areas lighting will be designed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023) and with consideration to worker safety. This includes directional lighting (shielding where possible), limiting blue, violet or ultraviolet lights, limiting intensity and managing timing where possible. Most of the lighting impacts will be in the area. • Noise/Vibration: Works will be undertaken outside of breeding periods, where possible. Prior to blasting or other high intensity vibratory works commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring within 200 m of the works. No blasting or other high intensity vibratory works will be undertaken within 200 m of known active breeding sites during breeding seasons unless otherwise approved by a noise/vibration specialist and experienced ecologist.

Black-breasted button-quail (*Turnix melanogaster*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 75: Significant impact assessment for the vulnerable black-breasted button-quail (*Turnix melanogaster*)

Black-breasted button-quail (*Turnix melanogaster*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** The individuals within the Borumba PHES Survey area are likely to form part of the Jimna-Conondale important population, as defined in the Conservation Advice. The Project is anticipated to clear 0.2 ha of suitable habitat in the Project footprint located in Area 1 (Borumba Dam) (Figure 8). The direct loss of 0.2 ha of suitable habitat is unlikely to lead to a long-term decrease in the size of an important population as the species is likely to persist in the area in the remaining potential habitat. Noting that the two adjoining patches of rainforest in this area total 15.3 ha in size and the works will result in fragmentation of patch into two patches of 2.4 ha and 10.5 ha. Due to the temporary nature of the proposed action, any indirect impacts associated with the proposed action that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of an important population.

Black-breasted button-quail (*Turnix melanogaster*)	
Impact criteria	**Assessment**
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The Conservation Advice states that the estimated (2011), AOO for the black-breasted button-quail was 750 km^2 (75,000 ha). The clearing of 0.2 ha of suitable habitat within which the species has been recorded is unlikely to result in any changes to the species AOO as there are extensive areas of potential habitat present within the Borumba PHES Survey area and in the surrounding area. The removal of 0.2 ha of suitable habitat is unlikely to change the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.
Fragment an existing important population into two or more populations	**Unlikely** While the total number of individuals within the Conondale-Jimna 'important population' is unknown, the Recovery Plan states it is known to be a big population, and the presence of large parts of that population's extent is protected (National Park). The Exploratory Works Project is unlikely to result in the establishment of any barriers to movement between the individuals observed in the Borumba PHES Survey area and nearby protected areas. As such, the Exploratory Works Project is unlikely to cause fragmentation such that the existing populations would form sub-populations. Dispersal across the available habitat will remain following the completion of works. In this regard, it is considered unlikely the proposed action will result in the fragmentation of an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** Notophyll vine forests are present in the Exploratory Works Project footprint and considered to be habitat critical to the survival of the species. A total of 0.2 ha is anticipated to be cleared for the Exploratory Works Project. Further, while mitigation options will be implemented to reduce indirect impacts, such as dust generation, while only temporary, it is possible that dust deposition in potential habitat will occur, which could adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Unlikely** While the total number of individuals within the Conondale-Jimna 'important population' is unknown, the Recovery Plan states it is known to be a big population, and the presence of large parts of that population's extent is protected (National Park). As such, while the Exploratory Works Project is anticipated to clear potential habitat for the species, within which the species is anticipated to breed, the works are limited in extent and duration and any impact to the species' breeding cycle is likely to be temporary and not cause significant disruptions. Following the completion of works, it is anticipated there will be no long-term impacts to the species' breeding cycle.

Black-breasted button-quail (*Turnix melanogaster*)	
Impact criteria	**Assessment**
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While clearing approximately 0.2 ha of suitable habitat for the species is anticipated to result in a decrease in the availability of habitat for the species, this relatively minor amount of clearing is unlikely to result in a decline in the species. Indirect impacts resulting from the proposed works, including dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** A broad range of introduced pest animal and plant species are already established in the Exploratory Works Survey area and surrounds. The Exploratory Works Project is expected not to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat as introduced pest animals are currently present in the area. A range of biosecurity control measures are included in the CEMP which will be implemented to manage risk with regard to pest fauna and invasive weeds.
Introduce disease that may cause the species to decline	**Unlikely** The National Recovery Plan (DCCEEW, 2022) does not identify any disease threats to the species. A range of biosecurity control measures will be implemented during the works to minimise the potential of introducing new and/or exacerbating existing diseases that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely** The National Recovery Plan (DCCEEW, 2022) identifies the following Recovery Plan Objectives: • By 2032, maintain and improve the extent, condition and connectivity of habitat of the black-breasted button-quail. • By 2032, demonstrably reduce the severity of identified anthropogenic threats across the extent of the species' range. By 2032, achieve, measure and sustain a stable or positive trend in area of occupancy and population size (assessed by new baseline counts) in the number of mature individuals of the black-breasted button-quail. The clearing of 0.2 ha of habitat critical to the survival of the species is likely to interfere with the objective to 'maintain and improve the extent, condition and connectivity of habitat'. However, the clearing of a relatively small area of potential habitat in an area with large extents of potential habitat (which will remain in the area) is unlikely to *substantially* interfere with the recovery of the species.
Recommendation:	Significant impact is **Likely**

7.3.3 Giant barred frog (*Mixophyes iteratus*)

The Project has the potential to significantly impact the giant barred frog (*Mixophyes iteratus*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 76, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 77, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 78, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of potential habitat within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and Exploratory Works Footprint, is shown on Figure E-15, which is contained in Appendix E.

The significant impact assessment undertaken in Table 78 identified that the Project is **unlikely** to result in a significant impact to the giant barred frog.

Table 76: Description of the giant barred frog (*Mixophyes iteratus*)

Giant barred frog (*Mixophyes iteratus*)	
Profile	**Conservation status:** Vulnerable **Habitat:** The Conservation Advice for the giant barred frog states that the species is a large, ground-dwelling frog, often found in lowland open wet-forests (rainforest and wet sclerophyll forest) and less frequently in cleared areas, but always close to permanent flowing drainage lines (TSSC, 2021). Preferred drainage line types range from shallow, rocky rainforest streams to slow-flowing rivers. The species is a habitat specialist, confined to the narrow strip of riparian vegetation bordering streams and rivers, and is mostly associated with pools in larger streams. Necessary microhabitat features typically include deep, damp leaf litter used for both foraging and shelter. Giant barred frog is occasionally found in other riparian habitats, such as drier forest, around dams, or degraded riparian remnants (TSSC, 2021). **Distribution:** The Conservation Advice states the giant barred frog is sparsely distributed from Doongul Creek (near Hervey Bay), south-east Queensland, south to Warrimoo (in the Blue Mountains), New South Wales. The species has been recorded at elevations between 100 – 1,000 m, although in Queensland subpopulations are restricted to lower elevations (below 300 m). In Queensland, the majority (approximately 65%) of the species' population occurs in the Mary River catchment. Other populations south of this catchment occur in the headwaters of the Brisbane River and in coastal streams north of Brisbane. The next population occurs further south near the Queensland-NSW border. **Previous records:** There are several historical records of the species Conondale National Park (ALA, 2023). There are no Wildnet records of the species near the Borumba PHES Survey area on the Biomaps portal (DES, 2024). Recent observations of the species (in 2023 and 2024) have been made in Imbil State Forest and near Yabba Creek (iNaturalist, 2023), less than 10 km from the Exploratory Works Project footprint. However, as these observations were lodged through a secondary source, they are subject to confirmation. **Habitat Critical to the Survival of the Species:** The species' recovery plan (Hines, H. B. & the South-east Queensland Threatened Frogs Recovery Team, 2002) only defines habitat critical for breeding.

Giant barred frog (*Mixophyes iteratus*)	
	The critical breeding habitat includes permanent freshwater streams from 0-700 m in altitude, in rainforest and other forest communities of the McPherson, Main, D'Aguilar, Blackall and Conondale Ranges and the Bunya Mountains. This may include narrow riparian rainforest remnants along the following streams and their major tributaries: Maroochy River, Mary River, Stanley River downstream to Kilcoy, Caboolture River, Burpengary Creek, Coomera River and Nerang River. While the Project area is near the Conondale Ranges in the Mary River catchment, as the species was not detected within the Borumba PHES Survey area despite extensive survey effort, and no records of the species have been recorded in the Exploratory Works Survey area, it is considered unlikely the Exploratory Works Survey area supports habitat critical to the survival of the species. **Important Populations:** The Conservation Advice for the species does not define an important population. However, it does identify key populations of giant barred frog, which include the Mary River, Stanley River, and Coomera River populations. In the absence of a defined important population, these populations are considered 'important populations' for the purpose of this assessment. Given the proximity of the Project footprint to the Mary River, should any individuals utilise habitat within the Exploratory Works Survey area, they would form part of the Mary River 'important population'. **Threats:** The Conservation Advice for the species identifies threats (in approximate order of severity of risk) as: • habitat loss and fragmentation, including large-scale clearing resulting in discontinuous patches of habitat, and mortality associated with sensitivity to disturbance • increases in temperature, changes in heat wave, drought, and bushfire frequency/intensity and changes to precipitation patterns associated with climate change • disease including chytridiomycosis caused by chytrid fungus • invasive species including habitat damage by feral Pigs and cattle, invasive weeds, predation by introduced and native species including feral Cats, freshwater yabby and predatory fish species.
In the Survey area	**Survey effort:** Surveys including habitat assessments were undertaken between May 2022 and July 2024. Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary. Figure E-15 presents the Exploratory Works Survey area and the Borumba PHES Survey area. Further information on the survey effort is provided in Appendix M. **Species occurrence:** This species was not detected within the Borumba PHES Survey area despite extensive survey effort. However, due to the presence of 0.6 ha of potential habitat within the footprint and records from the area, the species is considered likely to occur within the Exploratory Works Project footprint. Figure E-15 presents the respective work areas. **Habitat:** As stated in the Conversation Advice, the species prefers deep, permanent pools in streams. Surveys have observed few instances of this type of habitat feature in the Borumba PHES Survey area. However, a conservative approach has been taken to mapping potential habitat for the species in the Exploratory Works Survey area as all shallow rocky stream with permanent flow has been considered potential habitat. Accordingly, it has been calculated that 118 ha of habitat occurs within the Borumba PHES Survey area, of which 7.6 ha of habitat occurs in the Exploratory Works Survey area. Figure E-15 presents potential habitat within the respective work areas. **Present threats to the species:** Feral animals presenting threats of predation and/or habitat degradation have been recorded in the Exploratory Works Survey area. Invasive weeds are also present in the Exploratory Works Survey area.

Table 77: Assessment of potential impacts and mitigation options for the giant barred frog (*Mixophyes iteratus*)

Giant barred frog (*Mixophyes iteratus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project is anticipated to result in the clearing of 0.6 ha of potential habitat for the giant barred frog. The removal of habitat for the species has the potential to adversely impact the species as it could potentially increase pressure on the remaining available habitat able to be utilised by individuals. Clearing within patches of potential habitat also has the potential to introduce edge effects. Edge effects, such as greater incursion of weeds, predators, and light along the edges of newly opened areas, can impact species such as the giant barred frog by altering the composition of habitat and facilitating increased predation. However, due to the minor amount of habitat to be cleared, it is expected that edge effects in potential habitat for the species will be minimal in extent. The impact pathways include: • vegetation clearing of potential habitat to establish access tracks, install Bailey bridges, temporary water infrastructure, bed level crossings and culvert crossings..	Extensive clearing of giant barred frog potential habitat has been avoided through considered design, including: • Limiting stream disturbance To minimise disturbance to instream habitat, the Exploratory Works Project proposes to use four Bailey bridges to cross Yabba Creek and Sandy Creek. The bridges are all located outside suitable giant barred frog habitat. The proposed temporary culvert crossings and bed level crossings of Yabba Creek and Sandy Creek have been sited outside of suitable giant barred frog habitat and are aligned with existing crossings. • Avoiding instream works associated with the temporary water infrastructure by opting to either bury the pipes via directional drilling under Yabba Creek or suspending the pipe overhead via temporary steel bridging structure. By avoiding laying the pipe on the streambed, disturbance of potential habitat for the species will be limited to only minor riparian vegetation clearing on the stream banks. • Unavoidable clearing of potential habitat will be limited to two discrete and narrow areas associated with the installation of the temporary water infrastructure pipeline. To mitigate the risk of clearing, the following measures are proposed: – No clearing or disturbance will be undertaken until a suitably qualified person has checked for suitable breeding places, as outlined within the FFMP. – Riparian areas or potential habitat in proximity to clearing areas will be marked as restricted areas, to ensure no clearing or work occurs. – Clearing boundary maps and restricted areas will be provided to contractors, with permitted personnel only allowed access on foot beyond the boundary of these restricted areas.

Giant barred frog (*Mixophyes iteratus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Habitat fragmentation	Given the relatively small and isolated nature of the clearing, it is unlikely fragmentation of the population will occur as contiguous adjacent habitat will be retained which will provide connectivity for the species. The impact pathways include: • vegetation clearing of potential habitat to establish access tracks and tunnel infrastructure.	The Project design has largely avoided direct impacts to giant barred frog habitat. Unavoidable clearing of potential habitat will be limited to two discrete and narrow areas associated with the temporary water infrastructure pipeline, neither of which would be expected to result in habitat fragmentation, as much larger adjacent tracts of habitat will be retained.
Injury or mortality to individuals	During vegetation clearing for the construction of the access track, and when the access tracks are utilised, there is potential for direct mortality if giant barred frogs are present. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site.	Clearing of habitat could potentially result in injury or death to giant barred frog individuals. To mitigate the risk of injury for giant barred frogs that may be present in or near the Project footprint during the works, the following mitigation measures are proposed with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • General All handling and management of amphibian species will be undertaken in accordance with the Technical Manual - Interim hygiene protocols for handling amphibians (DEHP, no date). Conduct works during dry/low flow periods where possible. Conduct instream and riparian works outside the breeding season (spring to autumn), where possible. If it is not possible to undertake works outside breeding seasons, pre-clearance surveys upstream and downstream from the works area will identify, map and mark out potential and active breeding habitat. Off-track driving will not be permitted and reduced speed limits will be enforced near potential habitat, with appropriate signage on site. Undertake a prestart toolbox at commencement of works to inform the work party of potential presence of frogs and key habitat features in the area and planned procedure to manage these values. • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim of identifying, mapping, and marking

Giant barred frog (*Mixophyes iteratus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		out restricted areas, and potential habitat to inform the approach to vegetation clearing. • Restricted areas A restricted area will be installed around instream works to limit disturbance to the waterway and potential direct impacts to the species. This may include the erection of turtle fencing which would exclude frogs; however, frog friendly fencing may also be installed. • Micro-siting Works will minimise clearing habitat trees through micro-siting infrastructure. Habitat trees will be clearly marked, and GPS locations recorded. • Clearing Clearing will be carried out sequentially in the presence of an FSC. No bank disturbance will be undertaken until a suitably qualified person has checked the banks (minimum of 30 m upstream and downstream of the work area(s)) for the species and suitable breeding places. Where adult frogs have previously been recorded and/or found and relocated outside the Exploratory Works Project footprint, temporary frog exclusion fencing will be installed for the duration of works to prevent re-entry to the works area. Eggs of the applicable species and the substrate upon which the eggs are attached will be removed and placed in a suitable container with water sourced from the location of the eggs. Once removed, the eggs and substrate are to be immediately relocated to potential habitat. The substrate upon which the eggs have been laid is to be affixed in the relocated habitat to minimise potential for the substrate to become un-useable. Potential habitat is to be identified by the suitably qualified and licensed FSC, who is also responsible for the removal and relocation of the eggs. The location of the eggs and the location of the release site are to be recorded via GPS and included in the reporting.

Giant barred frog (*Mixophyes iteratus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		If a giant barred frog is sighted within 50 m of the activity: – Stop works until a suitably qualified FSC is consulted and advises on next steps. – Frogs to be left to self-disperse or unless otherwise directed by FSC. – Works to commence following the approval from the FSC or the environmental officer. – Capture and release those healthy individuals. Any injured animals will be taken to a wildlife carer and/or a vet for treatment. • Other works If a giant barred frog is sighted within 50 m of the activity: – Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc). Visual monitoring of the frog shall occur until advised by environmental officer. – Based on ongoing risk from proposed works and frogs' behaviour, environmental officer may request works to stop. Works shall recommence following advice from a suitability qualified FSC. – Undertake a prestart toolbox with workers to inform the work party of presence of giant barred frogs in the area
Spreading pests and weeds	The spread of pests and weeds, particularly cats and predatory fish, is a known threat to the species. Project activities have the potential to attract pest fauna from areas adjacent to the Project area. However, the strict implementation of appropriate biosecurity measures is expected to reduce these risks. The impact pathways include: • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* and has developed a Biosecurity Management Plan which aims to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on frogs. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures.

Giant barred frog (*Mixophyes iteratus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to the giant barred frog. The Project is not expected to increase the risk of high intensity bushfires capable of destroying giant-barred frog habitat. The impact pathways include: • Introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with "hot-work" activities.	Increased bushfire risk or changes to natural fire regimes will be managed by not parking or idling vehicles in areas of long grass, maintenance of firebreaks along access tracks, fence lines and overhead powerline easements, monitoring and management of fuel loads through weed management, slashing and low intensity burns, no smoking on site, and the completion of risk assessments for "hot-work" activities.
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in elevated noise, vibration, air and light emissions, which each have the potential to impact the giant barred frog. As a ground-dwelling species, giant barred frogs are highly sensitive to activities that cause vibration, such as blasting. Vibration impacts studied in other frog species demonstrated a clear negative effect of vibrations on communication (Caorsi, 2019). However, as the species respires through its skin and tends to be more active at night, it is also highly sensitive to dust and light emissions. Impacts of artificial light on other frog species have confirmed artificial light can affect physiology and animal behaviour (Baker, 2006). Though only temporarily, it is likely that these indirect impacts could disrupt the natural behaviour of the species in the absence of suitable mitigation controls. The impact pathways include: • the introduction of artificial lighting to illuminate night work (drilling the deep boreholes and the tunnelling works) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions, including but not limited to below with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Light Construction activities will be limited to daytime hours as far as practicable however some works will be 24/7 and lighting will be required. In these areas lighting will be designed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023) and with consideration to worker safety. This includes directional lighting (shielding where possible), limiting blue, violet or ultraviolet lights, limiting intensity and managing timing where possible. Lighting impacts will be isolated to the portal pad, staging pad, and civil construction compound and in the vicinity of deep geotechnical boreholes that will be drilled through the night. • Noise/Vibration Works will be undertaken outside of breeding periods, where possible. Prior to blasting or other high intensity vibratory works commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring within 200 m of the works.

Giant barred frog (*Mixophyes iteratus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		No blasting or other high intensity vibratory works will be undertaken within 200 m of known active breeding sites during breeding seasons unless otherwise approved by a noise/vibration specialist and experienced ecologist. • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 78: Significant impact assessment for the vulnerable giant barred frog (*Mixophyes iteratus*)

Giant barred frog (*Mixophyes iteratus*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** While no giant barred frog individuals were observed within the Borumba PHES Survey area, should any be present, it is expected they would form part of the Mary River important population, as defined in the Conservation Advice. The Project is anticipated to clear 0.6 ha of suitable giant barred frog habitat in Area 4 (Walkers Top) (Figure 8). The direct loss of 0.6 ha of potential habitat is unlikely to lead to a long-term decrease in the size of an important population as the species is likely to persist in the area in the remaining potential habitat. Due to the temporary nature of the proposed action, any indirect impacts associated with the proposed action that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of potential habitat currently occupied by the taxon. The species' Conservation Advice (TSSC, 2021) estimates the AOO of the giant barred frog to be at least 1,908 km^2. The clearing of 0.6 ha of suitable giant barred frog habitat is unlikely to result in any changes to the species AOO as there are extensive areas of potential habitat present within the Borumba PHES Survey area and in the surrounding area. The removal of 0.6 ha of potential habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.
Fragment an existing important population into two or more populations	**Unlikely** As no giant barred frogs were observed in the Borumba PHES Survey area, despite extensive survey efforts, it is considered unlikely the Exploratory Works Survey area supports a resident important population. If the species is present, disturbance associated with burying the temporary water pipeline and installing the Bailey bridges is unlikely to create a barrier for species movement. Dispersal across the habitat will remain following the completion of Works. As such, it is considered unlikely the proposed action will result in the fragmentation of an existing population into two or more populations.

Giant barred frog (*Mixophyes iteratus*)	
Impact criteria	**Assessment**
Adversely affect habitat critical to the survival of a species	**Unlikely** As stated above in Table 76, the Exploratory Works Survey area is not considered to support habitat critical to the survival of the species. As such, the proposed Exploratory Works Project is not expected to adversely affect habitat critical to the survival of the species. Regardless, impacts on the potential habitat for the species have been avoided where possible, including the utilisation of directional drilling or overhead suspension under Yabba Creek and Sandy Creek to avoid any disturbance of the watercourse which could support the species.
Disrupt the breeding cycle of an important population	**Unlikely** While the species was not recorded within the Borumba PHES Survey area, to be conservative, if the species is present, it is acknowledged that the Exploratory Works Project is anticipated to clear potential habitat for the species, within which the species could potentially breed. However, as the works are limited in extent and duration, any impact to the species' breeding cycle is likely to be temporary and not cause significant disruptions. Following the completion of works, it is anticipated there will be no long-term impacts to the species' breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The species was not recorded within the Borumba PHES Survey area, despite extensive survey effort. Therefore, while clearing approximately 0.6 ha of potential habitat for the species is anticipated to result in a decrease in the availability of potential habitat for the species, this relatively minor amount of clearing is unlikely to result in a decline in the species. Indirect impacts resulting from the proposed works, including dust, light, air, and noise emissions may temporarily decrease the quality of immediately adjacent habitat for the species, however, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** Pest species, including cats, that are known to be harmful to the giant barred frog are already established in the Exploratory Works Survey area and surrounds. The Exploratory Works Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat.

Giant barred frog (*Mixophyes iteratus*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** The Conservation Advice (TSSC, 2021) identifies chytridiomycosis caused by the chytrid fungus as an infectious disease threatening the Giant barred frog. It is noted in the advice that the disease has increased virulence under cooler, moist conditions; this is consistent with populations at higher altitudes in mesic environments being more susceptible to decline. The majority of the remaining population of the species occurs at altitudes less than 300 m, and therefore the ongoing vulnerability of the species to the disease may be tempered. The activities associated with the proposed action are unlikely to result in the introduction of a disease, including chytridiomycosis, that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** The Recovery plan for stream frogs of south-east Queensland 2001-2005 (Hines, H. B. & the South-east Queensland Threatened Frogs Recovery Team, 2002) identifies the following broad actions to support recovery of the species and other stream frogs in the region: • Action 1 – Manage the recovery process • Action 2 – Monitor populations • Action 3 – Gain information required for management • Action 4 – Protect populations and manage habitat • Action 5 – Provide education and information. Of these, Action 4 is most relevant to the Exploratory Works Project and includes measures such as controlling feral Pigs in the Conondale Ranges and managing populations of the giant barred frog on private land. The species was not recorded in the Exploratory Works Survey area despite extensive survey efforts. Therefore, there are no known populations to manage. The Exploratory Works Project will support delivery of Action 4 through managing feral pigs and other pest fauna in accordance with the FFMP (Appendix J of Appendix F) and the threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) (DEE, 2017). Further, the Exploratory Works Project will not exacerbate threats to the species as identified in the Conservation Advice (TSSC, 2021). Installing the temporary water infrastructure will not result in habitat loss or fragmentation as burying the pipeline involves only minor ground disturbance. Feral pigs and weeds are already present in the Exploratory Works Survey area and Exploratory Works Project footprint and will be managed in accordance with the FFMP (Appendix J of the CEMP (Appendix F). Therefore, the Exploratory Works Project is considered unlikely to interfere with the recovery of the species.
Recommendation:	Significant impact is **unlikely**

7.3.4 Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*)

The Project has the potential to significantly impact the glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 79, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 80, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 81, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of suitable habitat (i.e. breeding and foraging habitat) within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and Exploratory Works Footprint, and the location of glossy black-cockatoo (south-eastern) recorded during field surveys are shown on Figure E-16, which is contained in Appendix E. It should be noted that there is a single record of a glossy black-cockatoo (south-eastern) outside the mapped extent of the suitable habitat. This record is from a single bird observed flying overhead.

The significant impact assessment undertaken in Table 81 identified that the Project is **likely** to result in a significant impact glossy black-cockatoo.

Table 79: Description of the glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*)

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*	
Profile	Conservation status: Vulnerable **Habitat:** The Conservation Advice for the glossy black-cockatoo (south-eastern) states the species relies on nine species of sheoaks (*Allocasuarina* spp. and *Casuarina* spp.) for feeding, and the species generally utilises nesting hollows in narrow-leaved ironbark (*Eucalyptus crebra*) species. Hollows require a minimum entrance diameter of 15 cm (DCCEEW, 2022). As such, due to its specific habitat preferences, habitat for the species must include these species and attributes. **Distribution:** The Conservation Advice for the species states the glossy black-cockatoo (south-eastern) can be found from Mitchell, Queensland, through to East Gippsland, Victoria. The species has an Area of Occupancy of 40,000 km^2 (DCCEEW, 2022). **Previous records:** The ALA database shows records of species within 20 km of the Exploratory Works Project (ALA, 2023). There are no Wildnet records of the species near the Borumba PHES Survey area on the Biomaps portal (DES, 2024). **Habitat Critical to the Survival of the Species:** The Conservation Advice for the glossy black-cockatoo (south-eastern) has identified two types of habitat that are critical for the survival of the species. Foraging habitat Foraging habitat for the glossy black-cockatoo (south-eastern) in south-east Queensland and north-east New South Wales primarily includes black sheoak (*Allocasuarina littoralis*) and forest sheoak (*A. torulosa*). However, there are also records of the species feeding on stringybark sheoak (*A. inophloia*), coastal sheoak, and to a lesser extent river sheoak (*C. cunninghamiana*) and swamp sheoak (*C. glauca*) during limited times of the year.

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*	
	Breeding habitat The Conservation Advice states that more research is needed to understand critical breeding habitat for the species in South-East Queensland, however as a guide potential nest hollows for subspecies have the following traits: • >8 m above ground • located in branches >30 cm in diameter • branch or stem no more than 45 degrees from vertical • minimum entrance diameter of >15 cm (trees may be living or dead (DCCEEW, 2022)). **Important Populations:** The Conservation Advice for the species does not identify an important population of the species, and there is no published Commonwealth Recovery Plan for the species relevant to the Project area. In the absence of a defined important population, it is necessary to consider the definition of an 'important population' as described in the Significant Impact Guidelines (1.1), which states "an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • key source populations either for breeding or dispersal • populations that are necessary for maintaining genetic diversity • populations that are near the limit of the species range." With respect to the first criterion, the Atlas of Living Australia (ALA) occurrence records map shows there are highly concentrated areas of records of the species near Toowoomba and in the Currumbin Valley, in the Gold Coast hinterland. Given the density of records in these areas, it is considered more likely that individuals within these localities could be considered key source populations for breeding or dispersal. As such, individuals observed near the Borumba PHES Survey area are unlikely to be considered as an "important population" based on this criterion. With respect to the second criterion, as the species has a large range from Fraser Island to southern Victoria (ALA, 2023), it is considered unlikely individuals that may frequent habitat near the Borumba PHES Survey area are necessary for the maintenance of genetic diversity of the species. Therefore, the individuals are unlikely to be considered as an 'important population' based on this criterion. Finally, the glossy black-cockatoo population near Lake Borumba is located approximately 100 km south of the known northern limit of the species' range and almost 500 km from the western extent (ALA, 2023). Therefore, the population is unlikely to be considered as an "important population" based on this criterion. As such, it is considered unlikely that the individuals observed near the Borumba PHES Survey area are part of an 'important population' of the species. **Threats:** The Conservation Advice (DCCEEW, 2022) for the species identifies the following threats: • habitat loss, degradation and fragmentation including inappropriate fire regimes (uncontrolled wildfires), clearing of native vegetation/timber harvesting, habitat fragmentation, grazing and invasive weeds • climate change including increased likelihood of extreme events (i.e., heatwave and drought), and temporal or spatial shift of resource availability as a result of climate change • competition for resources including competition for nest hollows • diseases including Psittacine Beak and Feather Disease • predation • illegal avian trade including bird and egg collection.

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*	
In the Survey area	**Survey effort:** Surveys were undertaken between May 2022 and July 2024 in accordance with *Targeted Survey Guidelines – Glossy black-cockatoo Calyptorhynchus lathami* (Hourigan, 2012) within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary. Figure E-16 presents the Exploratory Works Survey area and the Borumba PHES Survey area. Further information on the survey effort is provided in Appendix M. **Species occurrence:** Thirty-nine (39) observations of glossy black-cockatoo (south-eastern) were recorded within the Borumba PHES Survey area, while 30 species observations were recorded in the Exploratory Works Survey area. No species observations were recorded within the Project Footprint. It is important to note these observations were recorded across several surveys, and therefore may not represent 30 individuals. The observations were all associated with habitat near Area 4 (Borgan). Figure E-16 presents the observations within the respective work areas. **Habitat:** 2,722.8 ha of breeding habitat occurs within the Borumba PHES Survey area, of which 643 ha of habitat occurs in the Exploratory Works Survey area. Additionally, 101.8 ha of foraging habitat occurs within the Borumba PHES Survey area, with only 2.3 ha of this habitat intersecting with the Exploratory Works Survey area. A conservative approach was taken in mapping habitat for the species, which includes woodland and forest communities with large eucalypts that may contain hollows that provide suitable shelter and breeding habitat, and remnant, high-value regrowth and regrowth vegetation that support *Allocasuarina* and/or *Casuarina* spp. that provide foraging habitat. **Present threats on the species:** Habitat in the Borumba PHES Survey area is affected by weed infestation and grazing by invasive fauna such as rusa deer, pig, rabbits and European brown hare. Other species (invasive and native) may compete with glossy black-cockatoos for nest hollows.

Table 80: Assessment of potential impacts and mitigation options for the glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*)

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project is anticipated to result in the clearing of 27.8 ha of potential breeding habitat and 0.1 ha of suitable foraging habitat for the glossy black-cockatoo (south-eastern). The removal of suitable breeding habitat for the species has the potential to adversely impact the species as the area available to breed will be reduced. Such a reduction could potentially put pressure on the remaining available habitat able to be utilised by individuals and increase competition between individuals in the species. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks, and to facilitate the geotechnical investigation areas.	Clearing of suitable glossy black-cockatoo (south-eastern) foraging habitat has been avoided to the greatest extent possible through considered design. The areas of breeding habitat that could not be avoided have generally been contained to narrow, linear areas associated with access tracks and geotechnical works areas. Contiguous sections of suitable habitat will be retained around the proposed works which will provide similar habitat values. In areas where glossy black-cockatoo (south-eastern) is proposed to be removed, habitat trees will be identified during pre-clearing surveys and marked for inspection during clearing activities. Large

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*		
Potential Impact	**Assessment**	**Mitigation Options**
		hollow bearing trees will be avoided, wherever possible, in accordance with the Conservation Advice. • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim to identify, map, and mark out restricted areas, and potential habitat trees (i.e. feed trees and hollows-bearing trees) to inform the approach to vegetation clearing. • Works micro-siting Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss and fragmentation. Works will aim to avoid the clearing of feed trees and hollow-bearing trees (>0.5 m DBH) in accordance with the Conservation Advice for this species. Feed trees and hollow-bearing trees will be clearly marked, and GPS locations recorded and all effort will be made to avoid these trees, with a preference given to clearing smaller (non-hollow bearing trees) over mature hollow bearing trees. • Restricted areas Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. • Hollow salvaging Where hollow-bearing tree removal cannot be avoided, the hollow to be impacted will be assessed prior to clearing to determine if they meet the minimum requirements for a glossy black-cockatoo . Where possible, suitable hollows will be salvaged and installed on a nearby tree in suitable habitat. Nest boxes and/or carved hollows will also be installed on a 1:1 basis at a minimum to replace cleared hollows as per the hollow replacement strategy described in the FFMP (Appendix J of CEMP (Appendix F).

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*		
Potential Impact	**Assessment**	**Mitigation Options**
		These added mitigation measures have not been considered in deciding the actions SRI. Monitoring of both natural and artificial hollows will be undertaken, drawing on established frameworks such as those outlined in the Habitat Survey for Bushfire Recovery for Wildlife and Habitat Community Grants Program (Croft, 2020) to guide effective placement and maintenance.
Habitat fragmentation	The Project is anticipated to result in the clearing of 27.8 ha of breeding habitat and 0.1 ha of foraging habitat for the glossy black-cockatoo (south-eastern). Habitat clearing has the potential to result in habitat fragmentation for species if patches of suitable habitat become isolated from other areas of suitable habitat. As the proposed works will retain large tracts of contiguous suitable habitat that provides connectivity to adjacent suitable habitat, it is unlikely fragmentation of the glossy black-cockatoo (south-eastern) habitat will occur. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks, spoil areas and facilitate the geotechnical investigation works.	Project design has avoided clearing of glossy black-cockatoo (south-eastern) foraging habitat. Where clearing of breeding habitat was unavoidable, it has been limited to comprise clearing for linear tracks (no more than 6 m width), a spoil area in Area 4 (Borgan), and clearing for geotechnical investigation sites in Area 1 (Borumba Dam). Where larger tracts of habitat are proposed to be removed (i.e., Area 1), contiguous sections of suitable habitat will be retained around the proposed works to allow continued species movement and negate potential habitat fragmentation.
Injury or mortality to individuals	During vegetation clearing, there is potential for direct mortality if glossy black-cockatoo (south-eastern) are present and appropriate mitigation controls are not in place. It is considered highly unlikely that injury or mortality will occur to foraging individuals as only 0.1 ha of foraging habitat is likely to be disturbed. Should individuals be present in dens, it is expected they would fly away from the disturbance area. However, mitigation measures will be implemented to further reduce the risk of injury or mortality to the species prior to habitat clearing. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site	To mitigate the risk of injury or death glossy black-cockatoo (south-eastern) that may be present in or near the Project footprint during vegetation clearing, the following mitigation measures are proposed with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • General Minimise works in glossy black-cockatoo habitat during the breeding period (March to September). Minimise clearing hollow-bearing trees and large trees (i.e. >50 cm DBH in case hollows are not visible). Avoid clearing of known feed sites. Off-track driving will not be permitted and reduced speed limits will be enforced near suitable habitat, with appropriate signage on site.

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*		
Potential Impact	**Assessment**	**Mitigation Options**
	• injury or death during tree felling procedures, necessary for clearing works.	Undertake a prestart toolbox at commencement of works to inform the work party of potential presence of glossy-black-cockatoos and key habitat features in the area and planned procedure to manage these values. • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim of identifying, mapping, and marking out restricted areas, and potential habitat trees (i.e. feed trees and hollows- bearing trees) to inform the approach to vegetation clearing. • Micro-siting Works will minimise clearing suitable hollow-bearing trees and feed trees through micro-siting infrastructure. These trees will be clearly marked, and GPS locations recorded. • Clearing Where not in use, hollows that meet the species' requirements will be 'blocked' to prevent breeding during Exploratory Works activities. When Exploratory Works activities are completed in the area, blocked hollows will be reopened as part of site reinstatement / rehabilitation activities. All hollows will be checked by an ecologist and/or FSC prior to the trees being felled. With the FSC to oversee the clearing works. If a glossy black-cockatoo is sighted within 50 m of the activity: – stop works until a suitably qualified FSC is consulted and advises on next steps. – glossy-black-cockatoos to be left to self-disperse or unless otherwise directed by FSC. – works to commence following the approval from the FSC or the environmental officer. Suitable glossy-black-cockatoos hollows will be replaced on a 1:1 basis with suitable nest boxes for the species based on current best practice, or salvaged hollows from the cleared area. Capture and release those healthy individuals. Any injured animals will be taken to a wildlife carer and/or a vet for treatment.

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*		
Potential Impact	**Assessment**	**Mitigation Options**
		• Other works If a glossy-black-cockatoos is sighted within 50 m of the activity: – Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc). Visual monitoring of the glossy-black-cockatoo shall occur until advised by environmental officer. – Based on ongoing risk from proposed works and glossy-black-cockatoos' behaviour, environmental officer may request works to stop. Works shall recommence following advice from a suitability qualified FSC. – Undertake a prestart toolbox with workers to inform the work party of presence of glossy black-cockatoos in the area. • Active breeding location discovery If any active breeding locations are identified, a restricted area will be established, and Works will be halted until the animals have moved on or can be safely relocated. This may include clearing around the habitat tree and leaving for a period of 24-48 hours to allow the animals to move on. Trees within confirmed breeding activities will be recorded in the Animal Breeding Place Register and discussed in the Exploratory Works SMP and reported to DETSI/DCCEEW as required.
Spreading pests and weeds	The spread of pests and weeds, particularly grazing species such as rusa deer, is a known threat to the species. Project activities have the potential to facilitate the spread of weeds and attract pest fauna from areas adjacent to the Project area. However, the strict implementation of appropriate biosecurity measures on machinery, vehicles and material movement is expected to reduce these risks. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* and has developed a Biosecurity Management Plan which aims to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on glossy-black-cockatoo. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures.

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*		
Potential Impact	**Assessment**	**Mitigation Options**
	• facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to the glossy black-cockatoo (south-eastern). The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with "hot-work" activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for "hot work" activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in elevated noise, vibration, air and light emissions, which each have the potential to impact the glossy black-cockatoo (south-eastern). As an aerial species, that is often very vocal, the species is likely to be most sensitive to noise emissions as loud noises may mute its feeding or contact calls. Vibration, light, and dust emissions may also impact the behaviour of the species. The impact pathways include: • the introduction of artificial lighting to illuminate night work (drilling the deep bore holes) • Tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions include: • Light Construction activities will be limited to daytime hours as far as practicable, and only minimal lighting will be installed around buildings at night (which will be on motion sensor to further reduce light emissions). Additionally, shades/shields to direct light downward will be installed, and bright white lights avoided in favour of orange or amber hue lighting where worker safety is not compromised. • Noise/vibration Works will be undertaken outside of breeding periods, where possible. Where it is not possible, noise and vibration will be minimised during night hours. Prior to work commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring for any species. FSC and/or suitably

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami)*		
Potential Impact	**Assessment**	**Mitigation Options**
		qualified ecologist to advise on appropriate location specific management measures. Further, tunnelling activities in proximity to the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 81: Significant impact assessment for the vulnerable glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*)

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** The glossy black-cockatoo (south-eastern) individuals observed within the Borumba PHES Survey area are not identified as part of an important population. As such, the direct loss of suitable habitat for the species and any temporary indirect impacts associated with the proposed action is considered highly unlikely to lead to a long-term decrease in the size of an important population of the species. Due to the temporary and in some case localised nature of the Project, any indirect impacts associated with the works that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population. However, the Project is anticipated to clear 27.8 ha of suitable breeding habitat and 0.1 ha of suitable foraging habitat across four separate work areas. The Project also proposes to clear a number of hollow-bearing trees which has the potential to adversely impact the local population(s).

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*)	
Impact criteria	**Assessment**
	The loss of breeding habitat and the number of hollows to be cleared however is not likely to lead to the decline in the species with hollows present in adjacent areas in high abundance. There is an opportunity to micro-site the works to avoid the clearing of canopy trees and hollows given the open nature of the vegetation communities in some areas. Further Queensland Hydro will look to replace any lost hollows as per the hollow strategy outlined in the FFMP, located in Appendix J of the CEMP (Appendix F): As such, the proposed action is unlikely to lead to a long-term decrease in the size of the local population.
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy for the glossy black-cockatoo (south-eastern) is estimated to be 40,000 km^2 (4 million ha) (DCCEEW, 2022). However, as the location of the proposed action is not considered to support an important population of the species, it is considered highly unlikely that the works will reduce the area of occupancy of an important population. Further the works are not considered likely to reduce the area of occupancy for the species.
Fragment an existing population into two or more populations	**Unlikely** Glossy black-cockatoo (south-eastern) individuals routinely fly over potential barriers and habitat gaps. The removal of trees (habitat to be cleared) for the Exploratory Works Project will occur in limited and isolated areas within extensive contiguous habitat. As glossy black-cockatoo (south-eastern) movement in the landscape is not anticipated to be impacted by these cleared areas, it is considered highly unlikely the Project will result in fragmentation of a population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** Approximately 27.8 ha of habitat that contains breeding values will be cleared for the Exploratory Works Project. As stated in Table 79, foraging and breeding habitat is considered habitat critical to the survival of the species. As the proposed action is anticipated to clear breeding habitat values, habitat considered critical to the survival of the species is likely to be adversely impacted by the Exploratory Works Project.
Disrupt the breeding cycle of an important population	**Unlikely** As the site is not considered to support an 'important population', it is highly unlikely the action would result in disruption to the breeding cycle of an important population. Part of the Project footprint and surrounds is however recognised as breeding habitat for the species and the works may disrupt breeding as a result of the clearing works including the removal of hollow bearing trees which are used as breeding site and as a result of indirect impacts such as noise and light as the species is sensitive to disturbance when nesting.

Glossy black-cockatoo (south-eastern) (*Calyptorhynchus lathami lathami*)	
Impact criteria	**Assessment**
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While clearing approximately 27.8 ha of suitable breeding habitat and 0.1 ha of suitable foraging habitat for the species is anticipated to result in a decrease in the availability of habitat for the species, this clearing is unlikely to result in a decline in the species, given the spatial extent of the clearing and the large areas of suitable habitat that will remain in the landscape. The Project also proposes to clear a number of hollow-bearing trees which has the potential to adversely impact the local population(s). The number of hollows to be cleared however is not likely to lead to the decline in the species with hollows present in adjacent areas in high abundance, while there is an opportunity to micro-site the works to avoid the clearing of canopy trees and hollows given the open nature of the vegetation communities in some areas. Further Queensland Hydro will look to replace any lost hollows as per the hollow strategy outlined in Appendix J in the CEMP (Appendix F). Indirect impacts resulting from the proposed works, including dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary and localised nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** A broad range of introduced pest animal and plant species are already established in the Borumba PHES Survey area and surrounds. The Exploratory Works Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat.
Introduce disease that may cause the species to decline	**Unlikely** The Conservation Advice identifies one disease in the list of threats impacting glossy black-cockatoo (south-eastern): Psittacine Beak and Feather Disease. As the virus is transmitted by birds orally or in faeces or feathers (DCCEEW, 2004) it is considered highly unlikely the Exploratory Works Project will influence the occurrence or severity of this disease.
Interfere substantially with the recovery of the species	**Unlikely** The species' Conservation Advice (DCCEEW, 2022) specifies that 'actions that remove habitat critical to survival would interfere with the recovery of glossy black-cockatoo (south-eastern) and reduce the area of occupancy of the subspecies'. As the Exploratory Works Project is anticipated to clear 27.8 ha of 'habitat critical to survival' of the species (i.e. areas used for breeding), in line with the Conservation Advice, the proposed action is considered likely to have some limited potential to interfere with the recovery of the species. However, due to the isolated nature of the clearing, it is considered unlikely that the Exploratory Works will '*substantially*' interfere with the recovery of the species.
Recommendation:	Significant impact is **Likely.**

7.3.5 Greater glider (southern and central) (*Petauroides volans*)

The Project has the potential to significantly impact the greater glider (southern and central) (*Petauroides volans*), which is listed as endangered under the EPBC Act. This section provides the following:

- In Table 82, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 83 an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 84, an assessment against the significant impact criteria for species listed as endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of suitable habitat (i.e. foraging and denning habitat) the Borumba PHES Survey area and Project footprint, and the location of greater gliders recorded during field surveys are shown on Figure E-17, which is contained in Appendix E

The significant impact assessment undertaken in Table 84 identified that the Project is **likely** to result in a significant impact on greater gliders.

Table 82: Description of greater glider (southern and central) (*Petauroides volans*)

Greater glider (southern and central) (*Petauroides volans*)	
Profile	**Conservation status**: Endangered **Habitat:** As stated within the Conservation Advice (DCCEEW, 2022) for the species**,** greater gliders (southern and central) are largely restricted to eucalypt forests and woodlands of eastern Australia. The species is typically found in taller, montane, moist eucalypt forests on fertile soils, with mature trees and abundant hollows. The availability of hollows is particularly important for the greater glider (southern and central), with the species requiring large hollows for denning and breeding (DCCEEW, 2022). Preferred foraging habitats consist of woodlands and forests that support high diversity of mature myrtaceous trees from the genera of *Eucalyptus, Corymbia, Angophora, Lophostemon, Syncarpia*, and *Melaleuca*. Breeding habitat comprises foraging habitat that supports large hollow-bearing trees, which are in the Conservation Advice (DCCEEW, 2022) as those above 30 cm diameter at breast height (DBH). Greater glider (southern and central) feed from a restricted range of eucalypt species, with *Eucalyptus moluccana* (grey box) preferred in south-eastern Queensland (DCCEEW, 2022). **Distribution:** The Conservation Advice states the greater glider (southern and central) has a broad distribution, occurring from around Proserpine in Queensland, south through New South Wales and the Australian Capital Territory (ACT), to Wombat State Forest in central Victoria (DCCEEW, 2022). The species has an AOO of approximately 15,316 km^2 (DCCEEW, 2022). **Previous records:** Records from the ALA database indicate the closest observation of the species was recorded approximately 8 km southeast of the Project Footprint (Area 4 (Borgan Road)), in the Conondale National Park (ALA, 2023). There are no Wildnet records of the species near the Borumba PHES Survey area on the Biomaps portal (DES, 2024).

Greater glider (southern and central) (*Petauroides volans*)	
	Habitat Critical to the Survival of the Species: Habitat critical to the survival of greater glider (southern and central) includes any of the following (DCCEEW, 2022): • Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees. • A diverse range of preferred food species in a particular region. • Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonisation. • Cool microclimate forest/woodland areas (e.g. protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes). • Areas identified as refuges under future climate changes scenarios. • Short-term or long-term post-fire refuges (i.e. unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas. As the Borumba PHES Survey area supports large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees, it is considered to support habitat critical to the survival of the species. **Population:** The Conservation Advice states that all populations/subpopulations of the greater glider (southern and central) are important for the conservation of the species across its range (DCCEEW, 2022). In this regard, any populations within the Exploratory Works Survey area are considered to be important populations. **Threats:** The Conservation Advice for the species identifies the following threats: • habitat loss, disturbance and modification including inappropriate fire regimes, habitat clearing and fragmentation, timber harvesting, barbed wire fencing (entanglement) • climate change including increased temperatures and changes to rainfall patterns • over-abundant native species including hyper-predation by owls and competition from sulphur-crested cockatoos (*Cacatua galerita*) • introduced species including predation by feral cats (*Felis catus*) and red foxes (*Vulpes vulpes*).
In the Survey area	**Survey effort:** Surveys and habitat assessments were undertaken between May 2022 and July 2024 in accordance with the Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011). Thermal drone surveys have also been undertaken targeting this species and other arboreal mammals. The surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary (refer Figure E-17) and included methods such as: • diurnal habitat searches of potentially suitable habitat resources and signs of activity • terrestrial spotlighting surveys. Further information on the survey effort is provided in Appendix M. **Species occurrence:** A total of five records of greater glider (southern and central) were detected within the Borumba PHES Survey area. One observation was recorded in the Exploratory Works Survey area along Walkers Top Road in Area 3 (Walkers Top). Figure E-17 presents the observations within the respective work areas. The remaining observations were made outside the Exploratory Works Survey area near Power Track South geotechnical investigation area in Area 3 (Walkers Top) and at Area 2 (Kingaham Creek).

Greater glider (southern and central) (*Petauroides volans*)	
	Habitat: 3,066.2 ha of habitat occurs within the Borumba PHES Survey area, of which 676.7 ha of habitat occurs in the Exploratory Works Survey area. Approximately 35.2 ha of habitat is within the Project footprint. All areas of woodland and forest communities that are expected to support hollow-bearing trees were considered habitat for the species, including both remnant and regrowth vegetation. This approach is conservative, as typically only older, remnant vegetation supports hollows large enough for greater gliders to use as denning habitat. This was also confirmed in survey findings with most hollows observed being unsuitable small hollows, with few large hollows sighted within the Borumba PHES Survey area. **Present threats to the species:** Sulphur-crested cockatoos are a widespread species and were recorded onsite; however, evidence of competition for hollows was not observed. Cats and red fox have been recorded within the Borumba PHES Survey area and within the Exploratory Works Survey area. Barbed-wired fencing is also present within the Borumba PHES Survey area mainly associated with existing Borumba Dam infrastructure.

Table 83: Assessment of potential impacts and mitigation options for the greater glider (southern and central) (*Petauroides volans*)

Greater glider (southern and central) (*Petauroides volans*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project is anticipated to result in the clearing of 33.9 ha of foraging and denning habitat for greater glider (southern and central). The removal of foraging and denning habitat for the species has the potential to adversely impact the species as the area available for foraging and denning will be reduced, potentially putting pressure on the remaining available habitat able to be utilised by individuals. The impact pathways include: • vegetation clearing of suitable habitat to establish roads, access tracks and facilitate the geotechnical investigations • clearing up to 11 hollow-bearing trees for supporting infrastructure in Area 4 (Borgan), and up to 66 for temporary water infrastructure, access tracks and geotechnical investigations in Area 3 (Walkers Top).	The proposed Project footprint has been redesigned to avoid as much habitat for species, including the greater glider (southern and central), as possible. Where vegetation clearing is unavoidable, to mitigate the impact of direct habitat loss, the following measures are proposed to minimise the clearing of vegetation, with further information provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim to identify, map, and mark out restricted areas, and potential habitat trees (i.e. hollow-bearing trees) to inform the approach to vegetation clearing. • Works micro-siting Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss and fragmentation. Works will aim to avoid the clearing of hollow-bearing trees (>1 m DBH) in accordance with the Conservation Advice for this species.

Greater glider (southern and central) (*Petauroides volans*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Hollow-bearing trees will be clearly marked, and GPS locations recorded, and all effort will be made to avoid these trees, with a preference given to clearing smaller (non-hollow bearing trees) over mature hollow bearing trees. • Restricted areas Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. • Hollow salvaging Where hollow-bearing tree removal cannot be avoided, the hollow to be impacted will be assessed prior to clearing to determine if they meet the minimum requirements for a greater glider. Where possible, suitable hollows will be salvaged and installed on a nearby tree in suitable habitat. Nest boxes and/or carved hollows will also be installed on a 1:1 basis at a minimum to replace cleared hollows as per the hollow replacement strategy described in the FFMP (Appendix J of CEMP (Appendix F). It is noted the replacement of hollows is an added measure and does not contribute to the impact assessment on the species. There is evidence that greater gliders are using nest boxes. Emerging research found that the time for a nest box to be used by a greater glider was rapid, at an average of 34 days after time of installation, with camera monitoring over the course of a year revealing 100% colonisation across seasons regardless of nest box design (Ana Gracanin, 2025). Monitoring of both natural and artificial hollows will be undertaken, drawing on established frameworks such as those outlined in the Habitat Survey for Bushfire Recovery for Wildlife and Habitat Community Grants Program (Croft, 2020) to guide effective placement and maintenance.

Greater glider (southern and central) (*Petauroides volans*)		
Potential Impact	**Assessment**	**Mitigation Options**
Habitat fragmentation	The Project is anticipated to result in the clearing of 35.2 ha of denning and foraging habitat for the greater glider (southern and central). Habitat clearing has the potential to result in habitat fragmentation for the species if patches of suitable habitat become isolated from other areas of suitable habitat. However, as the proposed works will retain large tracts of contiguous suitable habitat that provides connectivity to adjacent suitable habitat, and the majority of the works comprise narrow tracks (<6 m wide) with only a few areas where clearing is >6 m, it is unlikely fragmentation of greater glider (southern and central) habitat will occur. The width of clearing in greater glider habitat is unlikely to exceed the mean gliding distances (typically up to 1.2 times the height of the adjacent canopy (Taylor, 2009)) of the species and is therefore unlikely to present a barrier to glider movement/dispersal. The impact pathways include: • vegetation clearing of suitable habitat to establish roads, access tracks, and facilitate the geotechnical investigations.	Clearing in greater glider (southern and central) habitat will primarily consist of creating narrow, linear tracks (generally no more than 6 m wide) in vegetation. As the species is known to glide up to 100 m, these narrow gaps are expected not to substantially interfere with species movement or act as a barrier to movement across the landscape. Where larger tracts of greater glider (southern and central) habitat are proposed to be removed (i.e. near the Borumba Dam), contiguous sections of suitable habitat will be retained around the proposed works to allow continued species movement and negate habitat fragmentation. In this regard, the Project is unlikely to cause habitat fragmentation such that the species is likely to avoid areas of previously suitable habitat. Despite this, measures are outlined in the CEMP which will facilitate movement including micro-siting of works to avoid and/or minimise clearing.
Injury or mortality to individuals	During vegetation clearing, there is potential for direct mortality if greater glider (southern and central) are present (i.e. denning in hollow-bearing trees to be cleared). However, the implementation of appropriate controls is expected to reduce the likelihood of injury or mortality to low. The risk of vehicle strike or machinery strike is considered negligible. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site • injury or death during tree felling procedures, necessary for clearing works.	To mitigate the risk of injury or death to greater glider (southern and central) that may be present in or near the Project footprint during the works, the following mitigation measures are proposed with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • General Minimise works in glider habitat during the breeding period (spring – summer). Works will aim to avoid the clearing of hollow-bearing trees (>1 m DBH) in accordance with the Conservation Advice for this species. Avoid clearing large trees (>30 cm DBH). Wherever possible, the use of barbed wire fencing will be avoided across the Exploratory Works.

Greater glider (southern and central) (*Petauroides volans*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Off-track driving will not be permitted and reduced speed limits will be enforced near suitable habitat, with appropriate signage on site. Undertake a prestart toolbox at commencement of works to inform the work party of potential presence of gliders and key habitat features in the area and planned procedure to manage these values. • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim of identifying, mapping, and marking out restricted areas, and potential habitat trees (i.e. hollow-bearing trees) to inform the approach to vegetation clearing. • Micro-siting Works will minimise clearing suitable hollow-bearing trees through micro-siting infrastructure. Hollow-bearing trees will be clearly marked, and GPS locations recorded. • Clearing Where not in use hollows that meet the species' requirements will be 'blocked' to prevent breeding during Exploratory Works activities. When Exploratory Works activities are completed in the area, blocked hollows will be reopened as part of site reinstatement / rehabilitation activities. All hollows will be checked by an ecologist and/or FSC prior to the trees being felled. With the FSC to oversee the clearing works. Queensland Hydro will also look at the use of drones to minimise the risk of clearing trees with arboreal species residing in them. Undertake a prestart toolbox at commencement of works to inform the work party of the potential presence of gliders in the area. If a glider is sighted within 50 m of the activity: – Stop works until a suitably qualified FSC is consulted and advises on next steps.

Greater glider (southern and central) (*Petauroides volans*)		
Potential Impact	**Assessment**	**Mitigation Options**
		– Gliders to be left to self-disperse or unless otherwise directed by FSC. – Works to commence following the approval from the FSC or the environmental officer. Suitable greater glider hollows will be replaced on a 1:1 basis with suitable nest boxes for the species based on current best practice, or salvaged hollows from the cleared area. Capture and release those healthy individuals. Any injured animals will be taken to a wildlife carer and/or a vet for treatment. • Other works If a glider is sighted within 50 m of the activity: – Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc). Visual monitoring of the glider shall occur until advised by environmental officer. – Based on ongoing risk from proposed works and glider behaviour, environmental officer may request works to stop. Works shall recommence following advice from a suitability qualified FSC. – Undertake a prestart toolbox with workers to inform the work party of presence of gliders in the area. • Active breeding location discovery If any active breeding locations are identified, a restricted area will be established, and Works will be halted until the animals have moved on or can be safely relocated. This may include clearing around the habitat tree and leaving for a period of 24-48 hours to allow the animals to move on. Trees within confirmed breeding activities will be recorded in the Animal Breeding Place Register and discussed in the Exploratory Works SMP and reported to DETSI/DCCEEW as required.

Greater glider (southern and central) (*Petauroides volans*)		
Potential Impact	**Assessment**	**Mitigation Options**
Spreading pests and weeds	The spread of pests and weeds, particularly cats and foxes, and species that compete for tree hollows, is a known threat to the species. Project activities have the potential to facilitate the spread of weeds and attract pest fauna from areas adjacent to the Project area. However, pests (including cats and foxes) are currently in the area, and the strict implementation of appropriate biosecurity measures on machinery, vehicles and material movement is expected to reduce these risks. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest fauna species through via cleared access tracks and roads, night works, and potential attractants.	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* and has developed a Biosecurity Management Plan which aims to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on gliders. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures.
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to greater glider (southern and central). The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with “hot-work” activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.

Greater glider (southern and central) (*Petauroides volans*)		
Potential Impact	**Assessment**	**Mitigation Options**
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in elevated noise, vibration, air, and light emissions, which each have the potential to impact the greater glider with the species sensitive to disturbance. The introduction of these emission sources may impact the natural behaviour of the species, including their movement, foraging, and breeding habits, or reduce habitat suitability. Most of the emissions sources are associated with the tunnelling works down in the Sandy Creek and Yabba Creek floodplain where this species has not been previously recorded, though habitat is mapped as being present. Further, tunnelling activities in proximity to the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). While high intensity vibratory works are not currently anticipated onsite. The impact pathways include: • the introduction of artificial lighting to illuminate night work (e.g. drilling the deep boreholes and tunnelling works) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions, including but not limited to below with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Light Construction activities will be limited to daytime hours as far as practicable however some works will be 24/7 and lighting will be required. In these areas lighting will be designed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023) and with consideration to worker safety. This includes directional lighting (shielding where possible), limiting blue, violet or ultraviolet lights, limiting intensity and managing timing where possible. Most of the lighting impacts will be in the area. • Noise/Vibration: Works will be undertaken outside of breeding periods, where possible. Prior to blasting or other high intensity vibratory works commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring within 200 m of the works. No blasting or other high intensity vibratory works will be undertaken within 200 m of known active breeding sites during breeding seasons unless otherwise approved by a noise/vibration specialist and experienced ecologist. • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 84: Significant impact assessment for the endangered greater glider (southern and central) (*Petauroides volans*)

Greater glider (southern and central) (*Petauroides volans*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The size of the greater glider (southern and central) population in the Project footprint is unknown, but it is considered likely to form part of a broader population encompassing the Conondale Range. The direct loss of 35.2 ha of suitable habitat across four work areas is unlikely to reduce available breeding, foraging, or dispersal resources such that this loss would likely to lead to a long-term decrease in the size of a population, as the species is likely to persist in the area in the remaining suitable habitat. The Project also proposes to clear a number of hollow-bearing trees which has the potential to adversely impact the local population(s). The number of hollows to be cleared however is not likely to lead to the decline in the species with hollows present in adjacent areas in high abundance, while there is an opportunity to micro-site the works to avoid the clearing of canopy trees and hollows given the open nature of the vegetation communities in some areas. Further Queensland Hydro will look to replace any lost hollows as per the hollow strategy outlined in the FFMP, located in Appendix J of the CEMP (Appendix F). Due to the temporary and in some case localised nature of the Project, any indirect impacts associated with the works that may disturb the species are unlikely to lead to a long-term decrease in the size of a population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	**Unlikely** The AOO is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The Conservation Advice states that the AOO for the greater glider (southern and central) is estimated to be 15,316 km^2 (1.5 million ha) (DCCEEW, 2022). The clearing of 35.2 ha of suitable habitat across four work areas is unlikely to result in any changes to the species AOO as there are extensive areas of suitable habitat present within the Borumba PHES Survey area and in the surrounding area. The removal of 35.2 ha of suitable habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of the species.
Fragment an existing population into two or more populations	**Unlikely** As per the Conservation Advice for the greater glider this species is sensitive to fragmentation and can become locally extinct in small and fragmented habitat patches. The species disperses poorly across vegetation that is not native forest, and as such do not readily recolonise isolated sites from which they have been lost. Studies have found that the probability of occurrence of greater gliders increased as the area of remnant habitat increased. This is likely evident onsite with the species only recorded from habitat in in the proposed upper reservoirs rather than the Sandy

Greater glider (southern and central) (*Petauroides volans*)	
Impact criteria	**Assessment**
	Creek and Yabba Creek floodplains despite the riparian zones of these creeks and areas of previously cleared vegetation being mapped as denning habitat, Although 35.2 ha of suitable greater glider (central and southern) habitat is anticipated to be cleared, the clearing will occur over four areas and in limited and isolated areas within extensive contiguous habitat. The cleared areas will generally create only narrow gaps (<6 m) in vegetation and are expected not to interfere with the species movement. Where larger tracts of greater glider (central and southern) habitat are proposed to be removed (i.e. Area 1 (Borumba Dam)), contiguous sections of suitable habitat will be retained around the proposed works that will support species movement. Further, the glide distance of greater glider (southern and central) can reach 100 m, if required, but tend to glide no further than 30 m. As such greater gliders are likely to be capable of gliding across most gaps created by Exploratory Works within suitable habitat areas. The Project will not introduce any barriers which would permanently fragment the existing population/subpopulations. Therefore, the removal of vegetation for the Exploratory Works Project is anticipated not to create a habitat gap or other barrier that would result in fragmentation of the population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** The Borumba PHES Survey area supports large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees. This vegetation is considered to be habitat critical to the survival of the species. As such, the clearing of 33.9 ha of this habitat associated with the Exploratory Works Project is considered likely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	**Likely** Females give birth to a single young from March to June. Their relatively low reproductive rate may render isolated populations in small remnants prone to extinction (DCCEEW, 2022). Measures to manage potential impacts are outlined in the tables above however the vegetation clearing works and the noise and vibration caused during the course of works have the potential to temporarily disrupt the breeding cycle of any greater gliders (southern and central) within the Exploratory Works Survey area.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While clearing the of 35.2 ha of suitable habitat for the species is anticipated to result in a decrease in the availability of habitat for the species, this clearing is unlikely to result in a decline in the species, given the spatial extent of the clearing and the large areas of suitable habitat that will remain in the landscape. The Project also proposes to clear a number of hollow-bearing trees, which has the potential to adversely impact the local population(s). The number of hollows to be cleared however is not likely to lead to the decline in the species with hollows present in adjacent areas in high abundance, while there is an opportunity to micro-site the works to avoid the clearing of canopy trees and hollows given the open nature of the vegetation communities in some areas.

Greater glider (southern and central) (*Petauroides volans*)	
Impact criteria	**Assessment**
	Further Queensland Hydro will look to replace any lost hollows as per the hollow strategy outlined in the FFMP, located in Appendix J of the CEMP (Appendix F). Indirect impacts resulting from the proposed works, including dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary and localised nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** A broad range of introduced pest animal and plant species are already established in the Borumba PHES Survey area and surrounds. The Exploratory Works Project is expected not to exacerbate any existing threats or lead to any new invasive species becoming established in the endangered species' habitat as introduced pest animals are currently present in the area. A range of biosecurity control measures will be implemented including pest flora and fauna management actions.
Introduce disease that may cause the species to decline	**Unlikely** The Conservation Advice does not identify any specific diseases that impact this species. The Exploratory Works Project is considered unlikely to introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Likely** A recovery plan has not been adopted for the species. However, as the Exploratory Works Project will clear habitat that is considered critical to the survival of the species, a conservative approach suggests the proposed action could interfere with the recovery of the species.
Recommendation:	Significant impact is **Likely**

7.3.6 Grey-headed flying-fox (*Pteropus poliocephalus*)

The Project has the potential to significantly impact the grey-headed flying-fox (*Pteropus poliocephalus*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 85, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 86, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 87, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of foraging habitat within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and the Project footprint, and the location of grey-headed flying-fox are shown on Figure E-10, which is contained in Appendix E.

The significant impact assessment undertaken in Table 87 identified that the Project is **unlikely** to result in a significant impact on grey-headed flying-fox.

Table 85: Description of grey-headed flying-fox (*Pteropus poliocephalus*)

Grey-headed flying-fox (*Pteropus poliocephalus*)	
Profile	Conservation status: Vulnerable **Habitat:** As there is no approved Conservation Advice for the species, habitat information for the species has been described in the Recovery Plan for the grey-headed flying-fox. The Recovery Plan divides the habitat for the grey-headed flying-fox into foraging habitat and roosting habitat (DAWE, 2021). Roosting habitat Grey-headed flying-foxes roost in large aggregations, known as camps, in the exposed branches of trees. The locations of camps have generally been stable through time, with some sites known to have been occupied for over 100 years. The species shows flexibility in their choice of camp vegetation. Foraging habitat Foraging habitat for the grey-headed flying-fox alters when native food sources are scarce as the species has no adaptation to withstand food shortages. The mean distance the species has been recorded to fly to forage is 10.7 km, although the species is known to fly as far as 40 km to feed, before returning to their roost the same night. The species primarily feed on blossoms and fruit in canopy vegetation and supplements this diet with leaves. The major food plants include *Ficus spp*., and blossoms of myrtaceous species, such as *Eucalyptus*, *Corymbia*, *Angophora*, melaleucas, banksias, and the fruit and flowers of *Syzygium spp*. **Distribution:** The species occurs in the coastal belt from Rockhampton, Queensland to Melbourne, Victoria (DOE, 2023). **Previous records:** There is a record in the ALA database of the species foraging immediately downstream of the Borumba Dam wall (ALA, 2023).

Grey-headed flying-fox (*Pteropus poliocephalus*)	
	The DCCEEW National Flying Fox Monitoring Viewer (DCCEEW, 2024) shows there is a nationally important camp located at Kandanga, approximately 17 km north-east (DOE, 2023), and another camp at Imbil (not nationally important), approximately 12 km north-east of the Project footprint. **Habitat Critical to the Survival of the Species:** Habitat critical to the survival of the grey-headed flying-fox is defined in the recovery plan and it includes (DAWE, 2021): • Winter and spring flowering vegetation communities – those that contain *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora, C. eximia, C. maculata, Grevillea robusta, Melaleuca quinquenervia* or *Syncarpia glomulifera*. • Contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May). • Contain native species used for foraging and occur within 20 km of a defined nationally important camp. • Contain native and/or exotic species used for roosting at the site of a defined nationally important grey-headed flying-fox camp as described above. **Important Populations:** Currently there is no definition for an important population for the species. However, as the grey-headed flying-fox is considered to be a single, mobile population within individuals distributed across Queensland, New South Wales, Victoria, South Australia, Tasmanian and the ACT, for the purposes of this assessment, all grey-headed flying-fox individuals are considered to form a single important population. **Threats:** The Recovery Plan for the species states the following are key threats: • habitat loss and degradation including loss and degradation of foraging and roosting habitat, specifically winter and spring foraging resources • human interaction including camp disturbance, and mortality from electrocution on power lines and entanglement with netting and barbed-wire • climate change effects including increasing temperatures, storms, bushfires and floods and drought conditions degrading habitat and encouraging foraging in commercial orchards, and heat stress and heat related mortality (DAWE, 2021).
In the Survey area	**Survey effort:** Surveys including habitat assessments were undertaken between May 2022 and July 2024. Surveys were undertaken in accordance with the Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011) and included methods such as: • diurnal habitat searches or potentially suitable habitat resources and signs of activity • terrestrial spotlighting surveys. Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary. Figure E-10 presents the Exploratory Works Survey area and the Borumba PHES Survey area. Further information on the survey effort is provided in Appendix M. **Species occurrence:** Eighteen (18) observations of grey-headed flying-fox were detected within the Borumba PHES Survey area, with 17 of the species observations recorded in the Exploratory Works Survey area. In addition, a large colony was recorded 8 km downstream of Borumba Dam wall (outside of the Borumba PHES Survey area), flying in a northwest to northeast direction. Figure E-10 presents the observations within the respective work areas.

Grey-headed flying-fox (*Pteropus poliocephalus*)	
	Habitat: Habitat in the Borumba PHES Survey area supports foraging habitat only, with approximately 3,829.1 ha mapped within the Borumba PHES Survey area, and approximately 717.4 ha mapped within the Exploratory Works Survey area. There is 38 ha of foraging habitat mapped in the Project footprint. There is no roosting habitat mapped within the Borumba PHES Survey area, with roosting occurring at the camps located at Imbil and Kandanga (outside the Borumba PHES Survey area). As the habitat within the Exploratory Works Survey area supports tree species known to provide important winter and spring foraging resources such as *Eucalyptus tereticornis, E. crebra, E. robusta, E. siderophloia, Corymbia citriodora, Grevillea robusta,* and *Castanospermum australe,* **and** because the habitat is within 20 km of a known camp location, all habitat in the Exploratory Works Survey area is considered "critical to the survival of the species". **Present threats on the species:** Barbed wire is present near the Exploratory Works Survey area, and it is mainly located around the existing Borumba Dam infrastructure.

Table 86: Assessment of potential impacts and mitigation options for the grey-headed flying fox (*Pteropus poliocephalus*)

Grey-headed flying-fox (*Pteropus poliocephalus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project is anticipated to result in the clearing of 38 ha of foraging habitat for grey-headed flying-fox. The removal of foraging habitat for the species has the potential to adversely impact the species as it could increase pressure on the remaining available habitat able to be utilised by individuals. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks, spoil areas, and clearing associated with the lower dam.	Project design has been optimised to minimise clearing to the greatest extent possible. Where unavoidable, vegetation clearing of suitable grey-headed flying-fox foraging habitat generally includes narrow, linear areas associated with access tracks and geotechnical works areas. In areas where grey-headed flying-fox habitat is proposed to be removed, contiguous sections of suitable habitat will be retained around the proposed works which will provide similar habitat values. Where vegetation clearing is unavoidable, to mitigate the impact of direct habitat loss, the following measures are proposed to minimise the clearing of vegetation, with further information provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim to identify, map, and mark out habitat values on onsite and restricted areas to inform the approach to vegetation clearing.

Grey-headed flying-fox (*Pteropus poliocephalus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Works micro-siting Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss and fragmentation. • Restricted areas Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits
Habitat fragmentation	The Project is anticipated to result in the clearing of 38 ha of foraging habitat for the grey-headed flying-fox. If extensive, the removal of foraging habitat could fragment available habitat, and negatively impact the species. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks, spoil areas, and clearing associated with the lower dam.	Unavoidable clearing of grey-headed flying-fox foraging habitat will primarily consist of creating narrow, linear tracks (generally, no more than 6 m width) in vegetation, with several larger areas to be cleared for the proposed spoil area and lower dam wall investigation area. Where larger tracts of habitat are proposed to be removed (i.e., lower dam wall), extensive contiguous sections of suitable habitat will be retained around the proposed works to allow continued species movement and negate potential habitat fragmentation. In this regard, the Project is unlikely to cause habitat fragmentation such that the species is likely to avoid areas of previously suitable habitat. Despite this, measures are outlined in the CEMP which will facilitate movement including micro-siting of works to avoid and/or minimise clearing.
Injury or mortality to individuals	There is potential for the species to be injured during clearing necessary for the Project should the species be present in the area being cleared. However, given the mobility of the species, the likelihood of injury or death during vegetation clearing is considered to be low. There is also potential for the species to be injured or killed due to entanglement with barbed wire fencing to be installed near the explosive store. However, it should be noted that mitigation	To mitigate the risk of injury or death to grey-headed flying-fox that may be present in or near the Project footprint during vegetation clearing, the following mitigation measures are proposed: • General Wherever possible, the use of barbed wire fencing will be avoided across the Exploratory Works.

Grey-headed flying-fox (*Pteropus poliocephalus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	measures will be added to newly installed and existing barbed wire present within the Exploratory Works Survey area. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site • injury or death from entanglement in barbed wire fencing • injury or death during tree felling procedures, necessary for clearing works.	Any injured animals will be taken to a wildlife carer and/or a vet for treatment. • Clearing If a grey-headed flying-fox is sighted within 50 m of the activity: – Stop works until a suitably qualified FSC is consulted and advises on next steps. – Flying foxes to be left to self-disperse or unless otherwise directed by FSC. – Works to commence following the approval from the FSC or the environmental officer. • Other works If a grey-headed flying-fox is sighted within 50 m of the activity: – Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc.). Visual monitoring of the shall occur until advised by environmental officer. Based on ongoing risk from proposed works and grey-headed flying-fox behaviour, environmental officer may request works to stop. Works shall recommence following advice from a suitability qualified FSC. – Undertake a prestart toolbox with workers to inform the work party of presence of grey-headed flying-foxes in the area. If a camp / roost is identified within the Project footprint, operational activities in these areas will be ceased immediately to prevent the risk of injury to any animals. DETSI/DCCEEW will be notified immediately. In the instance where an individual is found to be injured, it will be captured and taken to a vet for treatment. Only qualified and licenced FSC will handle animals and co-ordinate any vet treatment. Should an individual become entangled on a barbed wire fence, a rescue organisation will be called to remove and care for the individual.

Grey-headed flying-fox (*Pteropus poliocephalus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to the grey-headed flying-fox. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with "hot-work" activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for "hot work" activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in elevated noise, vibration, air, and light emissions, which each have the potential to impact the grey-headed flying-fox to varying degrees. Noise emissions are known to agitate flying foxes, especially excessively loud, sharp, or sudden bursts such the noises associated with blasting (Ecosure, 2021). Excessive anthropogenic noise has also been associated with the cessation of vocalising in flying fox camps when the noise is more than 100% of the noise from the camp This effect, named the *silentium effect*, is unlikely to result from the expected noise emissions of the Project, due to the spatial distance between the nearest camp and the source of noise emissions from the Project. Light emissions are known to impact many animals, including nocturnal animals such as the grey-headed flying-fox. There is evidence to suggest that light pollution can deter bats from reaching their preferred foraging habitat. However, given the abundance of foraging habitat that will be unimpacted from light emissions, it is considered unlikely that this impact will adversely affect the species.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions, including but not limited to below with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Light Construction activities will be limited to daytime hours as far as practicable however some works will be 24/7 and lighting will be required. In these areas lighting will be designed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023) and with consideration to worker safety. This includes directional lighting (shielding where possible), limiting blue, violet or ultraviolet lights, limiting intensity and managing timing where possible. Lighting impacts will be isolated to the portal pad, staging pad, and civil construction compound and in the vicinity of deep geotechnical boreholes that will be drilled through the night.

Grey-headed flying-fox (*Pteropus poliocephalus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact of dust emissions on bats is understudied, but studies in birds are assumed to be a reasonable proxy due to their similarly high metabolic rates. Research has concluded that the ingestion of dust may affect birds through ingestion of fine particles into the lungs. Additionally, dust may impact visual and olfactory cues necessary for navigation. The implementation of suitable mitigation for these impacts is expected to reduce the risk of adverse impacts to the species to negligible. Finally, vibration emission impacts on bats are also understudied, though given the spatial distance between a known population and the source of vibrations on site (i.e., tunnelling activities), it is unlikely to result in a material impact to the species. The impact pathways include: • the introduction of artificial lighting to illuminate night work (drilling the deep bore holes) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	• Noise/Vibration Works will be undertaken outside of breeding periods, where possible. Prior to blasting or other high intensity vibratory works commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring within 200 m of the works. No blasting or other high intensity vibratory works will be undertaken within 200 m of known active breeding sites during breeding seasons unless otherwise approved by a noise/vibration specialist and experienced ecologist. • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 87: Significant impact assessment for the vulnerable grey-headed flying-fox (*Pteropus poliocephalus*)

Grey-headed flying-fox (*Pteropus poliocephalus*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** Individuals that utilise foraging habitat within the Exploratory Works Survey area are considered to form part of an important population. The Project is anticipated to clear 38 ha of grey-headed flying-fox foraging habitat across the four work areas. The direct loss of 38 ha across these relatively small areas of suitable habitat is unlikely to lead to a long-term decrease in the size of an important population as the species is likely to utilise the plentiful foraging habitat that will be retained adjacent to the Exploratory Works Survey area. Due to the temporary nature of the proposed action, any indirect impacts associated with the proposed action that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. Currently, no information exists to define area of occupancy for this species. Notwithstanding, the clearing of 38 ha of suitable habitat within which the species has been recorded is unlikely to result in any changes to the species AOO as there are extensive areas of suitable habitat present within the Exploratory Works Survey area and in the surrounding area. The removal of 38 ha of suitable habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.
Fragment an existing population into two or more populations	**Unlikely** As described above, the species is highly mobile and routinely flies more than 10 km to forage, crossing potential barriers and habitat gaps to do so. Although approximately 38 ha of foraging habitat will be cleared, clearing will occur in limited and scattered, isolated areas within extensive contiguous habitat. Cleared areas will create only relatively narrow gaps in vegetation compared to the landscape. As such, it is not expected that the proposed action will fragment an existing population of the species into two or more populations.

Grey-headed flying-fox (*Pteropus poliocephalus*)	
Impact criteria	**Assessment**
Adversely affect habitat critical to the survival of a species	**Likely** All habitat within the Exploratory Works Project footprint is considered to be habitat critical to the survival of the species as it contains winter and spring flowering communities and is within 20 km of a defined grey-headed flying-fox camp. The Project footprint is likely to result in disturbance of only 38 ha of potential foraging habitat, out of the 3,829.1 ha of foraging habitat mapped in the Borumba PHES survey area. This relatively small direct loss of habitat would constitute adversely affecting habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Unlikely** The species are seasonal breeders, with a single breeding event each year and most births occurring from October to December (McIlwee & Martin, 2002; Divljan, 2008). Failed births are known to occur in response to environmental stress such as disturbance to camps and habitat clearing. Camps provide resting habitat, sites of social interactions, and refuge for animals during significant phases of their annual cycle, such as birth, lactation, and conception (Parry-Jones & Augee, Movements of grey-headed flying-foxes (Pteropus poliocephalus) to and from a Colony Site on the Central Coat of New South Wales, 1992) (Parry-Jones & Augee, 2001). As described above, camps are located well outside of the Exploratory Works Project footprint and thus the Exploratory Works Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While clearing approximately 36.8 ha of foraging habitat for the grey-headed flying-fox is anticipated to result in a decrease in the availability of habitat for the species, this relatively minor amount of clearing, relative to the available habitat (3,829.1 ha) in the broader Borumba PHES Survey area, is unlikely to result in a decline in the species. Indirect impacts resulting from the proposed works, including dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** A broad range of introduced pest animal and plant species are already established in the Borumba PHES Survey area and surrounds. The Exploratory Works Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat as introduced pest animals are currently present in the area. A range of biosecurity control measures will be implemented including pest flora and fauna management actions.
Introduce disease that may cause the species to decline	**Unlikely** Disease is not recognised as a threat to the species, nor are there any diseases that impact the species (DAWE, 2021). A range of biosecurity control measures will be implemented during the works to minimise the potential of introducing new diseases that may cause the species to decline.

Grey-headed flying-fox (*Pteropus poliocephalus*)	
Impact criteria	**Assessment**
Interfere substantially with the recovery of the species	**Unlikely** The Recovery Plan states the following recovery objectives for the species: • Identify, protect and increase native foraging habitat that is critical to the survival of the grey-headed flying fox. • Identify, protect and increase roosting habitat of grey-headed flying-fox camps. • Determine trends in the grey-headed flying-fox population so as to monitor the species' national distribution, habitat use and conservation status. • Build community capacity to coexist with flying-foxes and minimise the impacts on urban settlements from new and existing camps while avoiding interventions to move on or relocate entire camps. • Increase public awareness and understanding of grey-headed flying-foxes and the recovery program and involve the community in the recovery program where appropriate. • Improve the management of grey-headed flying-fox camps in areas where interaction with humans is likely. • Significantly reduce levels of licenced harm to grey-headed flying-foxed associated with commercial horticulture. • Support research activities that will improve the conservation status and management of grey-headed flying-foxes. • Reduce the impact on grey-headed flying foxes of electrocution on power lines, and entanglement in netting and on barbed-wire. The proposed action is anticipated to interfere with Objective 1 and Objective 9. With regard to Objective 1, the proposed action will result in the direct loss of 38 ha of habitat that is critical to the survival of the species. With regard to Objective 9, the proposed action will result in the addition of barbed wire, associated with the security requirements related to the explosive store. However, it is considered unlikely that the relatively minor amount of foraging habitat to be cleared, and the small amount of barbed wire to be installed, will *substantially* interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.3.7 Koala (*Phascolarctos cinereus*)

The Project has the potential to significantly impact the koala (*Phascolarctos cinereus*), which is listed as endangered under the EPBC Act. This section provides the following:

- In Table 88, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 89, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 90, an assessment against the significant impact criteria for species listed as endangered under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of suitable habitat (i.e. foraging and breeding habitat and dispersal and refuge habitat) within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and Exploratory Works Footprint, and the location of koalas are shown on Figure E-11, which is contained in Appendix E. It should be noted there are multiple records of koalas outside, but generally on the edge of, the mapped extent of suitable habitat. These are likely to be records of individuals temporarily venturing outside the species' suitable habitat, rather than indicative of individuals permanently residing in areas of unsuitable habitat. All records of koalas outside the mapped extent of suitable habitat are not impacted by the Project and therefore the presence of these individuals would not alter impact area calculations.

The significant impact assessment undertaken in Table 90 identified that the Project is **likely** to result in a significant impact on koalas.

Table 88: Description of koala (*Phascolarctos cinereus*)

Koala (*Phascolarctos cinereus*)	
Profile	Conservation status: Endangered **Habitat:** The Conservation Advice for the koala states that in Queensland koalas inhabit moist coastal forests, southern and central western subhumid woodlands, and a number of eucalypt woodlands adjacent to waterbodies in the semi-arid western parts of the state (DAWE, 2022). The wide-ranging distribution of koalas has resulted in a diverse range of habitat associations across different bioregions, influenced by local climate, topographical and landscape associations. **Distribution:** The Conservation Advice for the koala states the distribution of the species includes Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia, although the Victorian and South Australian populations are not listed under the EPBC Act. In Queensland, the species distribution is widespread, typically in moist coastal forests, southern and central western subhumid woodlands, and a number of eucalypt woodlands in the semi-arid western parts of the state (DAWE, 2022). Populations are usually low in density and fragmented. **Previous records:** The ALA database shows there are recent records of the species being observed near the Borumba PHES Survey area (ALA, 2023). **Habitat Critical to the Survival of the Species:** The Conservation Advice (DAWE, 2022) for the koala sets out the following to be considered when evaluating whether habitat is critical to the survival of this species: • whether the habitat is used during periods of stress (e.g. flood, drought or fire) • whether the habitat is used to meet essential life cycle requirements (e.g. foraging, breeding, social behaviour, dispersal)

Koala (*Phascolarctos cinereus*)	
	• the extent to which the habitat is used by important populations • whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development • whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements • whether the habitat is necessary to ensure the long-term future of the species through reintroduction or recolonisation • any other way in which habitat may be critical to survival. As the Exploratory Works Survey area provides habitat that koala could use to meet essential life requirements, the Exploratory Works Survey area is considered to support habitat critical survival of the species. **Population:** As at March 2024, the latest estimate of population size for koalas in Queensland, New South Wales and the Australian Capital Territory (the listed population), without any additional assumptions, is between 95,000 and 238,000. The Australia Koala Foundation estimates that the koala population in Wide Bay is between 250 and 400 individuals (Australian Koala Foundation, 2021). **Threats:** The Conservation Advice (DAWE, 2022) for the koala identifies the following threats to the species: • climate change driven processes and drivers including loss of climatically suitable habitat; increased intensity/frequency of drought, heatwaves and bushfire; and declining nutritional value of foliage • human related activities including clearing and degradation of koala habitat, and mortality from interactions with vehicles and dogs • disease and health including koala retrovirus (KoRV) and chlamydia (*Chlamydia percorum*).
In the Survey area	**Survey effort:** Surveys were undertaken between May 2022 and July 2024 in accordance with the Survey Guidelines for Australia's Threatened Mammals and the Koala Spot Assessment Technique (SAT). Thermal drone surveys and detector dogs have also been undertaken targeting this species. Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary. Figure E-11 presents the Exploratory Works Survey area and the Borumba PHES Survey area. Further information on the survey effort is provided in Appendix M**.** **Species occurrence:** While 67 records of koala were detected within the Borumba PHES Survey area, 33 species observations were recorded in the Exploratory Works Survey area. Observations were made in habitat associated with Area 1 (Borumba Dam), Area 3 (Walkers Top), and Area 4 (Borgan). Figure E-11 presents the observations within the respective work areas. **Habitat:** Approximately 3,026.6 ha of foraging and breeding habitat and 1,516 ha of dispersal and refuge habitat occurs within the Borumba PHES Survey area, of which 676.5 ha of foraging and breeding habitat and 202.8 ha of dispersal and refuge habitat occurs in the Exploratory Works Survey area. A conservative approach has been taken to mapping habitat for the species. Foraging habitat has been defined using REs that are known to provide foraging resources, including locally important koala food trees, and are dominated by eucalypts. Remnant, HVR and regrowth woody vegetation have been used to map foraging and breeding habitat as koala habitat can include non-remnant areas, and they can forage on younger vegetation. Other cleared areas, including those that may support individual paddock trees have been included into the dispersal and refuge' category. Further detail is provided in Appendix M. **Present threats on the species:** Wild dogs are present within the Borumba PHES Survey area.

Table 89: Assessment of potential impacts and mitigation options for the koala (*Phascolarctos cinereus*)

Koala (*Phascolarctos cinereus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project is anticipated to result in impacts, including clearing, to 35.3 ha of foraging and breeding habitat for koala, and impacts, including clearing, to 52.3 ha of dispersal and refuge habitat for the species. The removal of foraging and breeding habitat and impacts to dispersal and refuge habitat for the species has the potential to adversely impact koala as it could potentially put pressure on the remaining available habitat able to be utilised by individuals. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks and facilitate the geotechnical investigations.	The proposed Project footprint has been redesigned to avoid as much habitat as possible for threatened species, including koalas. Where vegetation clearing is unavoidable, to mitigate the impact of direct habitat loss, the following measures are proposed to minimise the clearing of vegetation, with further information provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim to identify, map, and mark out restricted areas, and potential habitat to inform the approach to vegetation clearing. Thermal drones will also be used to understand the local koala population, with this data currently available. • Works micro-siting Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss and fragmentation. • Restricted areas Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits.

Koala (*Phascolarctos cinereus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Habitat fragmentation	The Project is anticipated to result in impacts, including clearing, to 35.3 ha of foraging and breeding habitat for koala, and impacts, including clearing, to 52.3 ha of dispersal and refuge habitat for the species. As large tracts of suitable contiguous habitat will be retained outside the Project footprint, it is unlikely habitat fragmentation will occur as a result of the proposed action. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks, and to support geotechnical investigations.	The clearing of koala habitat that could not be avoided includes narrow, linear areas associated with access tracks and widely scattered geotechnical investigation areas. In all areas where koala habitat is proposed to be removed, contiguous sections of suitable habitat will be retained around the proposed works to provide connectivity, allow continued species movement and negating potential habitat fragmentation. Exploratory Works Project activities will implement relevant measures and principles identified in the Koala Sensitive Design Guideline (DES, 2022). While laydown areas and stockpile areas will be designed to minimise any impediment to movement and dispersal of koalas.
Injury or mortality to individuals	During vegetation clearing, there is potential for direct mortality if koala are present and appropriate mitigation controls are not implemented. However, the implementation of appropriate controls is expected to reduce the likelihood of injury or mortality to low. The impact pathways include: • Injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site. • Injury or death during tree felling procedures, necessary for clearing works.	To mitigate the risk of injury or death to koalas that may be present in or near the Project footprint during vegetation clearing, the following mitigation measures are proposed with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • General Off-track driving will not be permitted and reduced speed limits will be enforced near suitable habitat, with appropriate signage on site. Undertake a prestart toolbox at commencement of works to inform the work party of potential presence of koala and key habitat features in the area and planned procedure to manage these values. • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim of identifying, mapping, and marking out restricted areas, and koala habitat to inform the approach to vegetation clearing. • Micro-siting Works will minimise clearing of koala habitat.

Koala (*Phascolarctos cinereus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Clearing A suitably qualified FSC will be present during clearing as per the Nature Conservation (Koala) Conservation Plan 2017. The area will be inspected for koalas prior to clearing with the assistance of drones as required. Sequential clearing as per the Nature Conservation (Koala) Conservation Plan 2017: – clearing of koala habitat trees is carried out in a way that ensures koalas occupying the area that is being cleared have enough time to move out the area being cleared without human intervention – if the area being cleared is more than 3 ha the clearing must be carried out in stages – if the area being cleared is less than 6 ha, no more than 50% of the area being cleared can be cleared in any one stage – if the area being cleared is more than 6 ha, no more than 3 ha or 3% of the area being cleared (whichever is the greater) can be cleared in any one stage – between each stage and the next there is at least one period of 12 hours (starting at 6pm in a day and ending at 6am on the following day) during which no trees are cleared on the site – while the clearing is being undertaken, the clearing of koala habitat trees must be carried out in a way that ensures appropriate habitat links are maintained within the area being cleared and the adjacent area to ensure any koalas occupying the site can safely move off of the site – if a koala is in a tree, that tree is not to be cleared – if the crown of a tree overlaps with a tree that a koala is in, that tree is not to be cleared. Only sick or injured koalas will be moved as the process of relocation is stressful and can cause the koala to become sick. If a koala is sighted within 50 m of the activity: – Stop works until a suitably qualified FSC is consulted and advises on next steps.

Koala (*Phascolarctos cinereus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		– Koalas to be left to self-disperse or unless otherwise directed by FSC. – Works to commence following the approval from the FSC or the environmental officer. Capture and release those healthy individuals. Any sick, injured animals will be taken to a wildlife carer and/or a vet for treatment. • Other works If a koala is sighted within 50 m of the activity: – Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc). Visual monitoring of the koalas shall occur until advised by environmental officer. – Based on ongoing risk from proposed works and koala behaviour, environmental officer may request works to stop. Works shall recommence following advice from a suitability qualified FSC. – Undertake a prestart toolbox with workers to inform the work party of presence of koalas in the area. • Fauna exclusion fencing Exploratory Works Project activities will implement relevant measures and principles identified in the Koala Sensitive Design Guideline (DES, 2022). For example, fauna exclusion fencing will be installed around the civil construction compound, explosive store, and portal pad and exploratory tunnel to restrict the entry of koalas into these areas.
Spreading pests and weeds	The spread of pests, particularly dogs, is a known threat to the species. Project activities have the potential to attract pest fauna from areas adjacent to the Project area. However, the strict implementation of appropriate biosecurity measures on machinery, vehicles and material movement is expected to reduce these risks.	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* and has developed a Biosecurity Management Plan which aims to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on koalas.

Koala (*Phascolarctos cinereus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area.	Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures.
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to koalas. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021. The impact pathways include: • introduction of ignition sources into the area, including vehicles and machinery, and heat elements associated with "hot-work" activities.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for "hot work" activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in elevated noise, vibration, air, and light emissions, which each have the potential to impact the koala. Artificial lighting is known to impact wildlife, including the nocturnally active koala, by making the species more vulnerable to predation, causing disorientation and interfering with navigation, and increasing stress and decreasing health (Biodiversity Council, 2023). Excessive dust inhalation can harm the respiratory systems of wildlife, while noise and vibration emissions can cause the species to become stressed and change their normal behaviours. Most of the emissions sources are associated with the tunnelling works down in the Sandy Creek and Yabba Creek	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions, including but not limited to below with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Light Construction activities will be limited to daytime hours as far as practicable however some works will be 24/7 and lighting will be required. In these areas lighting will be designed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023) and with consideration to worker safety. This includes directional lighting (shielding where possible), limiting blue, violet

Koala (*Phascolarctos cinereus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	floodplain where this species has not been previously recorded, though habitat is mapped as being present. Further, tunnelling activities in proximity to the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). While high intensity vibratory works are not currently anticipated onsite. The impact pathways include: • the introduction of artificial lighting to illuminate night work (e.g. drilling the deep boreholes and tunnelling works) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	or ultraviolet lights, limiting intensity and managing timing where possible. Lighting impacts will be isolated to the portal pad, staging pad, and civil construction compound and in the vicinity of deep geotechnical boreholes that will be drilled through the night. • Noise/Vibration Works will be undertaken outside of breeding periods, where possible. Prior to blasting or other high intensity vibratory works commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring within 200 m of the works. No blasting or other high intensity vibratory works will be undertaken within 200 m of known active breeding sites during breeding season unless otherwise approved by a noise/vibration specialist and experienced ecologist. • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 90: Significant impact assessment for the endangered koala (*Phascolarctos cinereus*)

Koala (*Phascolarctos cinereus*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The Project is anticipated to clear 35.3 ha of vegetation that provides foraging and breeding habitat and 52.3 ha of habitat which might be used for dispersal or refuge (including rainforest areas and regrowth). The habitat clearing and impacts are divided across the four work areas. While there is a total of 87.6 ha suitable koala habitat (foraging/breeding habitat and dispersal/refuge habitat) being impacted, the impact occurs across four Project areas and includes impacts to relatively small, scattered areas of suitable habitat located within broader, extensive areas of suitable habitat. The areas which are already cleared (48.4 ha) and used for dispersal will still be dispersal pathways during and post the construction works, with fauna friendly fencing to be used to guide the species away from high use areas. Due to the temporary nature of the proposed action, any indirect impacts associated with the proposed action that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The area of occupancy for the koala is estimated to be 19,400 km^2 (1.94 million ha) (DAWE, 2022). The clearing of 87.6 ha of suitable habitat within which the species has been recorded is unlikely to result in any changes to the species AOO as there are extensive areas of suitable habitat present within the Borumba PHES Survey area and in the surrounding area. The removal of 87.6 ha of suitable habitat across a number of small widely distributed locations is unlikely to alter the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.

Koala (*Phascolarctos cinereus*)	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** The action is unlikely to fragment an existing population into two or more populations. While it is anticipated there will be an impact to 87.6 ha of suitable koala habitat, the clearing will occur in limited and isolated areas within extensive contiguous habitat. Cleared areas will create only relatively narrow gaps in vegetation compared to the surrounding landscape. It is not expected the clearing will interfere with species movement as koalas routinely descend from trees and travel along the ground to ascend a new tree and are known to disperse across distances of 1-3 km or more (DAWE, 2022). Noting that approximately 52 ha of mapped koala habitat is already cleared land. Therefore, the limited scale and isolated nature of clearing of habitat for the Exploratory Works Project will not create significant gaps in existing habitat or create other barriers that would cause fragmentation of an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** Habitat within the Exploratory Works Survey area is used to meet the essential life cycle requirements of the koala (e.g. foraging, breeding, social behaviour, dispersal), as such it is considered habitat critical to the survival of the species. A total of 87.6 ha is anticipated to be cleared for the Exploratory Works Project across four work areas. Further, while mitigation options will be implemented to reduce indirect impacts, such as dust generation, while only temporarily it is possible that dust deposition in suitable habitat will occur, which could adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	**Unlikely** While the Exploratory Works Project is anticipated to clear suitable habitat for the species, within which the species is anticipated to breed, the works are limited in extent and duration and any impact to the species' breeding cycle is likely to be temporary and not cause significant disruptions. Following the completion of works, it is anticipated there will be no long-term impacts to the species' breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Despite the proposed action clearing up to 87.6 ha of habitat and resulting in temporary indirect impacts to habitat (e.g., dust emissions) suitable for the species, given the isolated and temporary nature of the works, it is not expected that the Exploratory Works Project will adversely affect habitat to the extent that it will decrease the availability or quality of habitat to such that the species is likely to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** A broad range of introduced pest animal and plant species are already established in the Exploratory Works Survey area and surrounds with no apparent current negative impact on koala habitat. The Exploratory Works Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat.

Koala (*Phascolarctos cinereus*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** The Conservation Advice identifies two diseases affecting koalas, including: Koala retrovirus (KoRV) and Chlamydia (*Chlamydia percorum*). KoRV is inherited and may also be transmitted from dam (mother) to joey through pouch contact and milk consumption (Wildlife Health Australia, November 2023). Chlamydia is transmitted by direct contact (during mating) or via aerosol. It may also be spread to juveniles during birth (Wildlife Health Australia, September 2023). These diseases are likely already present in the local population as they are commonly occurring pathogens in the species, though sick koalas were rarely encountered during the survey works. However, the local koala groups and carers have confirmed the presence of these diseases in the local population. Regardless, if the local population does not carry these diseases, the Exploratory Works Project is unlikely to facilitate transmission since translocating koalas to the local area will not occur as part of the Exploratory Works Project. As such, the Exploratory Works is unlikely to introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** The National Recovery Plan for the koala outlines the direct threats to the species as follows: • climate change (heatwaves and drought) • land use change (for urban development, agriculture, transportation and service corridors, mining and energy) • natural systems modification (native forestry and altered fire regimes) • other (disease, dogs and vehicles). The landscape effects of these threats include habitat loss, fragmentation, and degradation impact on the recovery of the species. While the Exploratory Works Project will not permanently change the land use in the local area, clearing approximately 87.6 ha of habitat will contribute to minor habitat loss and potentially result in indirect impacts (e.g., dust emissions) on adjacent habitat during construction. Despite the Exploratory Works Project contributing to minor habitat loss and temporary degradation, these impacts are unlikely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Likely**

7.3.8 Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)

The Project has the potential to significantly impact the long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*), which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 91, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 92, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 93, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act, which is informed by the information presented in the preceding two tables.

The extent of potential habitat within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and the Exploratory Works Footprint, and the locations of long-nosed potoroo are shown on Figure E-18, which is contained in Appendix E.

The significant impact assessment undertaken in Table 93 identified that the Project is **likely** to result in a significant impact on long-nosed potoroos.

Table 91: Description of long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)	
Profile	**Conservation status**: Vulnerable **Habitat:** The Conservation Advice for the species states that long-nosed potoroos (northern) are found in coastal heaths and wet and dry sclerophyll forests (DAWE, 2022). The species prefers habitat comprising dense canopy and shrub cover with a ground layer possessing low floristic diversity. Flora within preferred habitat may include grass-trees, sedges, ferns or heath and low shrubs such as tea trees or melaleucas. The ground vegetation is typically dense, commonly growing on a sandy loam soil type. **Distribution:** The Conservation Advice for the species states that long-nosed potoroos (northern) are generally found up to 800 m above sea level in varied habitats from wet eucalypt forests to coastal heaths and scrubs, provided annual rainfall is greater than 760 mm. The species has a highly fragmented distribution across two major bioregions (South East Queensland and New South Wales north coast) and occurs between Many Peaks Range (near Gladstone) in the north to the northern boundaries of the Sydney Basin in the south. In Queensland, a few populations of the long-nosed potoroo (northern) exist in lowland heath and coastal habitats (Wide Bay Military Reserve in Tin Can Bay and nearby K'gari (Fraser Island)). The species has an AOO of approximately 512 km^2 (DAWE, 2022). Long-nosed potoroos (northern) are mostly solitary animals with limited dispersal capabilities, high site fidelity and a small home range of between 0.19 km^2 (for females) and 1 km^2 (for males) (DAWE, 2022)' **Previous records:** The ALA database shows the species has been previously recorded within 10 km of the Borumba PHES Survey area (ALA, 2023). **Habitat Critical to the Survival of the Species:** The Conservation Advice for the species states that no "critical habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat". However, the Conservation Advice does state that habitat critical to the survival of the long-nosed potoroo (northern) includes occupied forested habitats larger than 0.1 km^2 (Bennett 1990a;1990b; Martin & Temple-Smith 2012). Unoccupied forested areas (larger than 0.1 km^2), which are either adjacent or proximal to extant subpopulations, may also be

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)	
	considered critical if they have the potential to provide future habitat for the long-nosed potoroo (northern) as either a natural range expansion or as a translocation site for at-risk populations. Areas of habitat that supported the long-nosed potoroo (northern) in the past, but from which they are now absent, for example, because of high predation following a bushfire event, are also habitat critical, as the species could be reintroduced to these sites in the future. As surveys have confirmed the presence of the species, the majority of the Borumba PHES Survey area can be considered as "occupied forest habitat" and thus considered habitat critical to the survival of the species. **Important Populations:** As per the Conservation Advice (DAWE, 2022) an important population is one that is important for the survival of the species. These may include: • populations at the limits of the species' range • outlying populations • stronghold populations • island populations • research populations • other populations where recovery actions, such as predator control and reintroductions, are being implemented. In Queensland, six important populations of long-nosed potoroo (northern) are recognised, with the Sunshine Coast hinterlands population the closest to the Exploratory Works Project footprint. It is likely long-nosed potoroo (northern) within and near the Borumba PHES Survey area are part of the Sunshine Coast hinterlands important population. **Threats:** Conservation Advice (DAWE, 2022) for the species identifies the following threats: • fire including inappropriate fire regimes (too frequent and broadscale), and increased frequency and intensity of bushfires • invasive and domestic species including predation by European red fox (*Vulpes vulpes*), cats (*Felix catus*), wild dogs (*Canis familiaris*); herbivory and trampling by livestock; competition with feral pigs (*Sus scrofa*); and invasive weeds • changing weather patterns including increasing drought and mean temperatures, and decreasing precipitation • habitat loss, degradation and fragmentation including land clearing (from urban, residential and agricultural land development and change) causing habitat fragmentation, forest dieback caused by *Phytophthora cinnamomi* (root rot) or *Manorina melanophrys* (bell miner), and timber harvesting • predation and competition from native species including competition with overabundant native species for fungal food resources • disease including toxoplasmosis caused by *Toxoplasma gondii*.
In the Survey area	**Survey effort:** Surveys were undertaken between May 2022 and July 2024 in accordance with the Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011). Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary. Figure E-18 presents the Exploratory Works Survey area and the Borumba PHES Survey area. Further information on the survey effort is provided in Appendix M. **Species occurrence:** Seven records of long-nosed potoroo (northern) were detected within the Borumba PHES Survey area, with six of the species observations occurring within the Exploratory Works Survey area. Species observations near the Exploratory Works Survey area were recorded in Area 3 (Walkers Top) and Area 4 (Borgan). Figure E-18 presents the observations within the respective work areas.

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)	
	Habitat: 3,775.1 ha of habitat occurs within the Borumba PHES Survey area, of which 715.1 ha of habitat occurs in the Exploratory Works Survey area. A conservative approach was taken to mapping habitat for this species. Habitat is mapped as consisting of all woodland and forest communities with a dense understorey, which is essential for shelter and breeding. These areas also support eucalyptus trees, which are associated with the fungi that form an important part of the long-nosed potoroo's diet. **Present threats on the species:** Several invasive / pest fauna species that may directly impact the species or degrade habitat were observed within the Exploratory Works Survey area and include feral cat, dingo, fox, European brown hare and rabbit, cattle, pig and rusa deer. Weeds are also widespread within the Borumba PHES Survey area. *Phytophthora cinnamomi* or bell miner associated forest dieback are not known to be present within the Exploratory Works Survey area; however, *Toxoplasma gondii* could be potentially present within the Exploratory Works Survey area if infected cats and other mammals are present.

Table 92: Assessment of potential impacts and mitigation options for the long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project would result in the clearing of 38 ha of habitat for the long-nosed potoroo (northern). Clearing within patches of potential habitat also has the potential to introduce edge effects. Edge effects, such as greater incursion of weeds, predators, and light along the edges of newly opened areas, are expected to impact ground-dwelling species, such as the long-nosed potoroo (northern), by altering the composition of habitat and facilitating increased predation. Due to the minor amount of habitat to be cleared, it is expected that edge effects in potential habitat for the species will be minimal in extent. The impact pathways include: • vegetation clearing of potential habitat to establish access tracks and clearing associated with the geotechnical investigation areas.	Project design has been optimised to avoid and minimise impacts to suitable long-nosed potoroo habitat including the use of and collocation with existing tracks. The areas of long-nosed potoroo (northern) habitat that could not be avoided include narrow, linear area associated with access tracks and geotechnical works associated with the lower dam wall and the upper reservoir. In areas where long-nosed potoroo (northern) habitat is proposed to be removed, contiguous sections of potential habitat will be retained around the proposed works which will provide similar habitat values. Lantana control at forest edge margins known or likely to support the long-nosed potoroo will be minimised, with clearing in these areas using a staged approach that will aim to remove lantana over several phases to minimise impacts on suitable habitat for the species. The following measures are proposed to minimise the clearing of vegetation, with further information provided in the FFMP, located in Appendix J of the CEMP (Appendix F):

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim to identify, map, and mark out restricted areas, and potential habitat trees to inform the approach to vegetation clearing. • Works micro-siting Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss and fragmentation. • Restricted areas Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. Weed control measures, including washdown requirements, will be implemented in accordance with the Biosecurity Management Plan to reduce the threat of weed dispersal throughout the Project area.
Habitat fragmentation	The Project would result in the clearing of 38 ha of habitat for the long-nosed potoroo (northern). Habitat clearing has the potential to result in habitat fragmentation for species, if patches of potential habitat become isolated from other areas of potential habitat. As the proposed works will retain large tracts of contiguous potential habitat that provides connectivity to adjacent potential habitat, it is unlikely fragmentation of long-nosed potoroo (northern) habitat will occur. The impact pathways include: • vegetation clearing of potential habitat to establish access tracks and to facilitate geotechnical investigation areas.	As per the Conservation Advice for the species, the long-nosed potoroo has limited dispersal capability and fragmentation within habitat can still impact the species. Clearing in long-nosed potoroo (northern) habitat will primarily consist of creating narrow, linear tracks (no more 6 m width) in vegetation that can be easily traversed by the species, and as such, is unlikely to result in fragmentation. The creation and maintenance of roads and tracks may also enhance access by predators and result in road deaths.

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Where larger tracts of long-nosed potoroo (northern) habitat are proposed to be removed (i.e., the geotechnical investigation areas within Area 1 (Borumba Dam), and in Area 4 (Borgan)), contiguous sections of potential habitat will be retained around the proposed works to allow continued species movement and negate potential habitat fragmentation.
Injury or mortality to individuals	During vegetation clearing, there is potential for direct mortality if long-nosed potoroo (northern) are present and appropriate mitigation controls are not implemented. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site • injury or death during tree felling procedures, necessary for clearing works.	To mitigate the risk of injury or death to long-nosed potoroo that may be present in or near the Project footprint during the works, the following mitigation measures are proposed with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • General Minimise clearing of mature trees known to be associated with Mycorrhizal fungi (i.e. habitat trees) – the preferred food of the long-nosed potoroo. Off-track driving will not be permitted and reduced speed limits will be enforced near potential habitat, with appropriate signage on site. Undertake a prestart toolbox at commencement of works to inform the work party of potential presence of potoroos and key habitat features in the area and planned procedure to manage these values. • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim of identifying, mapping, and marking out restricted areas, and potential habitat to inform the approach to vegetation clearing.

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Micro-siting Works will minimise clearing habitat trees through micro-siting infrastructure. Habitat trees will be clearly marked, and GPS locations recorded. • Clearing Clearing will be carried out sequentially in the presence of an FSC. Undertake a prestart toolbox at commencement of works to inform the work party of the potential presence of potoroos in the area. If a potoroo is sighted within 50 m of the activity: – Stop works until a suitably qualified FSC is consulted and advises on next steps. – Potoroos to be left to self-disperse or unless otherwise directed by FSC. – Works to commence following the approval from the FSC or the environmental officer. – Capture and release those healthy individuals. Any injured animals will be taken to a wildlife carer and/or a vet for treatment. • Other works If a potoroo is sighted within 50 m of the activity: – Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc). Visual monitoring of the potoroo shall occur until advised by environmental officer. – Based on ongoing risk from proposed works and potoroo behaviour, environmental officer may request works to stop. Works shall recommence following advice from a suitability qualified FSC. – Undertake a prestart toolbox with workers to inform the work party of presence of potoroos in the area.

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Spreading pests and weeds	The spread of pests and weeds, particularly cats and foxes, is a known threat to the species. Project activities have the potential to facilitate the spread of weeds and attract pest fauna from areas adjacent to the Project area. However, the strict implementation of appropriate biosecurity measures on machinery, vehicles and material movement is expected to reduce these risks. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	The Project area is already subject to widespread weed and pest occurrence. The creation and maintenance of roads and tracks may also enhance access by predators. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* and has developed a Biosecurity Management Plan which aims to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on potoroos. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures.
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to the long-nosed potoroo (northern). The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in elevated noise, vibration, air and light emissions, which each have the potential to impact the long-nosed potoroo (northern). As a ground-dwelling species, long-nosed potoroo (northern) is more sensitive to impacts that cause vibration, such as blasting. However, given their shy disposition, noise and light emissions are likely to disrupt the natural behaviour of the species if appropriate mitigation controls are not implemented.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions include: • Light Construction activities will be limited to daytime hours as far as practicable, and only minimal lighting will be installed around buildings at night (which will be on motion sensor to further reduce light emissions). Additionally, shades/shields to direct

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	Most of the emissions sources are associated with the tunnelling works down in the Sandy Creek and Yabba Creek floodplain where this species has not been previously recorded, though habitat is mapped as being present. Further, tunnelling activities in proximity to the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). While high intensity vibratory works are not currently anticipated onsite. The impact pathways include: • the introduction of artificial lighting to illuminate night work (e.g. drilling the deep boreholes and tunnelling works) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	light downward will be installed, and bright white lights avoided in favour of orange or amber hue lighting where worker safety is not compromised. • Noise/Vibration Works will be undertaken outside of breeding periods, where possible. Where it is not possible, noise and vibration will be minimised during night hours. Prior to work commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring for any species. Further, tunnelling activities in proximity to the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 93: Significant impact assessment for the vulnerable long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** The individuals within the Borumba PHES Survey area are likely to form part of the Sunshine Coast hinterland important population, as defined in the Conservation Advice. The Project is anticipated to clear 38 ha of potential habitat for the species across all four work areas. While there is a total of 38 ha long-nosed potoroo (northern) potential habitat being impacted, the impact occurs across four work areas and includes relatively small areas of potential habitat located within broader areas of extensive potential habitat. The direct loss of 38 ha across four relatively small areas of potential habitat is unlikely to lead to a long-term decrease in the size of an important population as the species is likely to persist in the area in the remaining potential habitat. Due to the temporary nature of the proposed action, any indirect impacts associated with the proposed action that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of the important population.
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of potential habitat currently occupied by the taxon. The area of occupancy for the long-nosed potoroo (northern) is estimated to be 512 km^2 (51,200 ha) (DAWE, 2022). The clearing of 38 ha of potential habitat within which the species has been recorded is unlikely to result in any changes to the species AOO as there are extensive areas of potential habitat present within the Exploratory Works Survey area and in the surrounding area. The removal of 38 ha of potential habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.
Fragment an existing population into two or more populations	**Unlikely** As the Exploratory Works Project is unlikely to result in the establishment of any barriers to movement, the Exploratory Works Project is considered unlikely to cause fragmentation such that the existing populations would form sub-populations. The ability for the species to disperse across the existing habitat will remain following the completion of works. As such, it is considered unlikely the proposed action will result in the fragmentation of an existing population into two or more populations.

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)	
Impact criteria	**Assessment**
Adversely affect habitat critical to the survival of a species	**Likely** Within Area 4 (Borgan), long-nosed potoroo (northern) was confirmed as present within 60 m of the Project footprint (i.e., habitat is 'occupied') and habitat is larger than 0.1 km^2. Therefore, vegetation associated with Area 4 (Borgan) is considered to be 'habitat critical to survival'. As such, the proposed action is likely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Unlikely** The species is known to produce a single young, and have between two and three offspring per year, with breeding occurring throughout the year. While the Project is anticipated to clear potential habitat for the species, within which the species is anticipated to breed, the works are scattered and limited in extent and duration. Any impact to the species' breeding cycle is likely to be temporary and not cause significant disruptions. Following the completion of works, it is anticipated there will be no long-term impacts to the species' breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While clearing approximately 38 ha of potential habitat for the species is anticipated to result in a decrease in the availability of habitat for the species, this relatively minor, widely scattered amount of clearing is unlikely to result in a decline in the species. Indirect impacts resulting from the proposed works, including dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** Fox, dogs and cats are recognised threats to the species (DAWE, 2022). All of these invasive species are present already. The biosecurity measures proposed for the Project will reduce their presence and manage populations of pests while the Project progresses. As such it is not expected that the Exploratory Works Project will exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat.
Introduce disease that may cause the species to decline	**Unlikely** The Conservation Advice only identifies one disease, Toxoplasmosis, caused by *Toxoplasma gondii,* as a threat to the long-nosed potoroo (northern). The spread of this disease is generally associated with feral cats which are already established in the area. Feral cats will be managed as part of the Project biosecurity measures. As such, it is unlikely the Exploratory Works Project will introduce additional disease vectors that may cause the species to decline.

Long-nosed potoroo (northern) (*Potorous tridactylus tridactylus*)	
Impact criteria	**Assessment**
Interfere substantially with the recovery of the species	**Unlikely** While there is no adopted Recovery Plan for the species, the primary conservation outcomes as per the Conservation Advice (DAWE, 2022) include: • populations across the range of the species, including coastal as well as inland populations, are stable or increasing in potential habitats managed appropriately for the species • habitat is protected to prevent further loss or fragmentation of the species. Despite the Exploratory Works Project clearing habitat critical to the survival of the species, clearing will not create areas of habitat that will be too small to support a subpopulation (DAWE, 2022), and large tracts of suitable, contiguous habitat will be retained that is likely to provide reliable refuge for the species. It is considered unlikely the Exploratory Works Project will interfere *substantially* with the recovery of the species.
Recommendation:	Significant impact is **Likely**

7.3.9 Mary River cod (*Maccullochella mariensis*)

The Project has the potential to significantly impact the Mary River cod *(Maccullochella mariensis)*, which is listed as endangered under the EPBC Act. This section provides the following:

- In Table 94, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In
- Table 95, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 96, an assessment against the significant impact criteria for species listed as endangered under the EPBC Act.

The extent of suitable habitat (i.e. foraging and spawning habitat) within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and the Project footprint, and the locations of Mary River cod are shown on Figure E-19, which is contained in Appendix E. There are two records located on land downstream of the Borumba Dam wall. These records are from the ALA and are noted to be 'preserved specimens'. ALA generalises data from 1 km to 10 km meaning that the points do not represent the exact location. It is likely that the records come from Yabba Creek.

It is noted that most of the works for the Project are on land and above the 1% AEP and as such as unlikely to have an impact on flood conditions or the health of the waterways. In addition, as noted in Section1.4.1 the design has avoided the construction of barriers through Kingaham Creek.

The significant impact assessment undertaken in Table 96 identified that the Project is **unlikely** to result in a significant impact on the Mary River cod.

Table 94: Description of Mary River cod (*Maccullochella mariensis*)

Mary River cod (*Maccullochella mariensis*)	
Profile	**Conservation status**: Endangered **Habitat:** The species prefers deep, shaded, slow flowing pools supported with large woody debris, overhanging vegetation, and dense macrophyte beds. Two habitat types have been identified: • Foraging habitat – all watercourses from high gradient, rocky, upland streams to, large, slow-flowing pools in low land areas with structures of varying complexity that provide predation opportunities (ambush) such as undercut banks, overhanging vegetation, macrophytes (instream submerged and semi-emergent forms), boulders, and large woody debris. • Spawning habitat – presumed to primarily be associated with submerged hollow logs, however, reproductive information for wild populations is limited (TSSC, 2016). **Distribution:** Mary River cod occurs in Southeast Queensland in the Mary River system: Tinana-Coondoo Creek, Six Mile Creek, and upper Obi Obi Creek (TSSC, 2016) **Previous records:** Records of this species include the upstream reaches of Yabba Creek, Lake Borumba, to downstream of the dam in Yabba Creek and the Mary River.

Mary River cod (*Maccullochella mariensis*)	
	Habitat critical to the survival of the species: No habitat critical for the survival of this species is defined in the threatened species Conservation Advice, or the Mary River cod Research and Recovery Plan, although it was stated that "designated critical habitat of the Mary River cod" are "to be determined" (Simpson & Jackson, 1996). For the purposes of defining habitat critical to the survival of the species, the following is considered: • all watercourses from high gradient, rocky, upland streams to large, slow-flowing pools in low land areas; with • riparian vegetation that provides shade; and • in-stream structure and debris such as hollowed timber and vegetation for nesting. **Important Populations:** Important populations for the species have not been defined in material from DCCEEW. As such, given the endangered status of the species, for the purpose of this assessment all populations of the species are considered 'important populations'. **Threats:** Conservation Advice (TSSC, 2016) for the species identifies the following threats: • habitat loss and fragmentation from impoundment of streams and changes to flow regimes, loss of riparian and in-stream vegetation • invasive species including grazing and disturbance of banks from cattle, introduced fish species (native and non-native) • overfishing from recreational fishers.
In the Survey area	**Survey effort:** Targeted surveys and habitat assessments were undertaken between June 2022 and May 2024 in accordance with the Survey Guidelines for Australia's Threatened Fish (DSEWPaC, 2011), the monitoring and sampling manual (DES, 2018), and guidance from subject matter experts at EnviroDNA (concerning eDNA sample collection and analysis), in areas of suitable habitat (Lake Borumba, Yabba Creek, and tributaries that flow into Lake Borumba). Surveys involved visual observations of the Mary River cod via kayaking in the Kingaham, Yabba and Sandy creeks, eDNA surveys, fyke netting, cathedral trapping, electrofishing (backpack and boat-based electrofishing), snorkelling, angling, and box trapping (Hydrobiology, 2023). **Species occurrence:** Mary River cod were located within the upper reaches of Yabba Creek, Kingaham Creek, Lake Borumba, and downstream of the dam wall in Yabba Creek, and the Mary River. **Habitat:** 269.7 ha of foraging habitat and 26.1 ha of spawning/foraging habitat occurs within the Borumba PHES Survey area, of which 0.2 ha of foraging habitat and 0.2 ha of spawning/foraging habitat occurs in the Exploratory Works Project footprint. Records of this species span a wide range of the region from the upstream reaches of Yabba Creek, Lake Borumba, to downstream of the dam in Yabba Creek and Mary River. Suitable habitat attributes for foraging habitat includes shallow or deep pools with the following features: undercut banks, overhanging vegetation, macrophytes (instream submerged and semi-emergent forms) and boulders and large woody debris. There are no recorded observations of spawning behaviour of wild Mary River cod in a non-captive environment, however, data from hatcheries suggests that the Mary River cod uses hollow logs as a spawning substrate (Simpson & Jackson, 1996). **Present threats on the species:** • habitat loss and fragmentation from the impoundment of streams. Lake Borumba, adjacent to the Project footprint, is an existing impoundment on Yabba Creek • changes to flow regimes, such as the removal of water for irrigation and urban use changes the composition of macrophyte beds, riffle and pool zones, and creates temperature changes that in turn effects breeding conditions for the Mary River cod • invasive species are present in the area including cattle that may graze along the banks in the upper reaches of Yabba Creek and introduced fish including the guppy (*Poecilia reticulata*), swordtail (*Xiphophorus helleri*) and mosquitofish (*Gambusia holbrooki*) are in Lake Borumba • overfishing by recreational fishers in impoundments and rivers (Simpson & Jackson, 1996).

Table 95: Assessment of potential impacts, and mitigation options for the Mary River cod (*Maccullochella mariensis*)

Mary River cod (*Maccullochella mariensis*)		
Potential Impact	**Assessment**	**Mitigation Options**
Instream earthworks causing habitat loss and fragmentation	Earthworks and installation of infrastructure (i.e. bridge piers) associated with waterway crossings have the potential to remove habitat and introduce barriers to fish passage. The introduction of barriers to fish passage could lead to fragmentation of the species. As such, the final design has considered these risks to the species and designed out the requirement for extensive instream works and barriers to fish passage. The Project involves the construction of four temporary bridges and upgrades to seven existing creek crossings over Yabba and Sandy creeks to support access and Exploratory Works activities across Area 1 (Borumba Dam), Area 3 (Walkers Top) and Area 4 (Borgan). The four bridges are in Area 4 (Borgan), with three of these locations associated with an existing crossing. The bridge crossings will utilise prefabricated Bailey bridges and be removed following the completion of the works. Four existing crossings, which are required to support bridge construction, will be upgraded to temporary piped culverts before being converted to concrete bed level crossings. The three other existing bed level crossings will also be upgraded to roughened concrete or gravel to improve access around the Project site. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). All bed level crossings will be placed in line with the existing bed level crossings and be constructed in accordance with the Queensland *Fisheries Act 1994,* which requires provision for aquatic passage, and the *Planning Act 2016* (including the ADR). The crossing upgrades will also reduce ongoing maintenance required for the existing crossings. While the Project includes four bridge crossings and upgrades to several existing bed level crossings (all on Yabba Creek and Sandy Creek), most suitable habitat for the species will be	To avoid extensive instream earthworks, the following measures are proposed: • No bank or instream disturbance will be undertaken until a suitably qualified person has checked for suitable breeding places, as outlined within the FFMP. A minimum of 30 m upstream and downstream of the Exploratory Works in creeks will be inspected. • Restricted areas – Riparian areas near work areas will be marked as restricted areas to ensure no clearing or works in these areas. – Clearing boundary maps and restricted areas will be provided to contractors, with permitted personnel only allowed access on foot beyond the boundary of the restricted areas. • Work sites will be micro-sited to avoid any potential breeding and/or foraging habitat. • Bailey bridges will be installed across Yabba Creek and Sandy Creek, with the bridges designed to minimise changes to flows (e.g. velocity, depth) and water quality, which have the potential to impede fish movement. As these are prefabricated bridges, instream works needed to install the bridges are reduced and will occur in isolated locations (e.g. at pier location and on banks only). • Bed level crossing upgrades (associated with and independent of Bailey bridges) – The Project has been designed to include bed level crossings constructed in accordance with the ADR. – As these design requirements prohibit the introduction of barriers to fish movement, including vertical drops between upstream and downstream reaches, the Project is not anticipated to result in any barriers to fish passage being introduced that may lead to species fragmentation. • The water pipeline crossings of Yabba Creek will be via directional drilling or overhead suspension to minimise the extent of disturbance and prevent the introduction of structures into the

Mary River cod (*Maccullochella mariensis*)		
Potential Impact	**Assessment**	**Mitigation Options**
	retained. Some disturbance of discrete parts of suitable Mary River cod habitat will occur; however, given the isolated nature of the potential impacts, and the design of the crossings to avoid the introduction of barriers to fish passage, it is unlikely the disturbance would lead to population fragmentation. The impact pathways include: • earthworks associated with the construction of waterway crossings.	waterway that could serve as a barrier to movement for the species.
Changes to habitat quality as a result of erosion and sedimentation	Habitat quality may decline as a result of erosion and sedimentation from inadequately managed construction areas. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required for species to thrive. The impact pathways include: • erosion and sedimentation associated with earthworks, vegetation clearance, construction of waterway crossings, and poor rehabilitation measures has the potential to lead to turbid runoff entering waterways, resulting in changes to water quality.	Erosion and sediment control measures, outlined in an Erosion and Sediment Control Plan, will be implemented to mitigate the impacts on habitat quality. Measures will include: • Undertaking clearing for the geotechnical investigation areas immediately before the investigation to limit the time bare ground is exposed to rain, leading to erosion. • Rehabilitating exposed areas as soon as possible to further reduce the likelihood of erosion and sedimentation causing turbid runoff entering waterways. • Installing suitable site-specific controls, that may include earth basins, filters, rock check dams, sediment fences, and sediment traps.
Barriers to movement	In the absence of appropriate design and mitigation measures Project components constructed within waterways could act as barriers to aquatic species movement in the absence of appropriate design and mitigation measures. Barriers to movement can act to isolate species, hindering their ability to thrive. The four bridge crossings will utilise prefabricated Bailey bridges and have been designed to allow aquatic fauna passage. These structures will be removed following the completion of the works (if the Main Works do not proceed). The four existing crossings of Yabba and Sandy creeks that are required to support bridge construction will be upgraded to temporary piped culverts before being converted to concrete bed level crossings. Other existing crossings of Yabba Creek will be upgraded in accordance with the ADR, which will also reduce ongoing maintenance issues with the existing crossings.	The installation of Bailey bridges to cross Yabba Creek and Sandy creek avoids the introduction of barriers to movement being introduced into the waterways. Should the Main Works not proceed, the bridges will be removed and the area rehabilitated. Bed-level crossings will be constructed in accordance with the ADR, which prohibits the introduction of barriers to fish movement, including vertical drops between upstream and downstream reaches. The ADR also outlines requirements for the temporary impoundment of creeks for the safe construction of waterways. Utilising a piped-culvert design during the construction of the Bailey bridges will also help to maintain aquatic passage, while also lowering the risk of any interactions with vehicles and minimising negative impacts on water quality and sedimentation. Furthermore, the pipeline crossings of Yabba Creek will be via directional drilling or overhead suspension to avoid instream

Mary River cod (*Maccullochella mariensis*)		
Potential Impact	**Assessment**	**Mitigation Options**
	No other waterways in the Project footprint can support this species. All bed level crossings will be comprised of either roughened concrete or gravel placed and will be placed in line with the existing bed level crossings. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). While upgrades to the existing crossings may temporarily cause a barrier to species movement, this impact will be short-term and confined to the construction period only. The impact pathways include: • structures associated with the construction of waterway crossings (i.e. Bailey bridges and bed level crossings, sediment fences, bunds).	disturbance and the introduction of structures into the waterway that could serve as a barrier to movement for the species.
Spread of weeds, pests and disease due to increased human activity	Activities undertaken within watercourses may act to spread aquatic weeds without the application of suitable mitigation and management measures. An increased incidence of weeds may cause reduced availability of suitable habitat and resources for the species. Tilapia is present in Yabba Creek, downstream of Borumba dam wall. It is not expected that the Project will exacerbate the presence of this pest species. Use of construction machinery and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Pests may contribute directly to injury or mortality of aquatic species. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014*. Hygiene control procedures will be in place throughout multiple stages of the Project activities, including measures to reduce potential for introduction and spread of pests: • Decontamination Decontamination practices will be implemented for all personnel and regular vehicle and machinery wash downs, especially when transferring between sites will assist in minimising the spread of weeds. Multiple methods are available for treatment of vehicles including wet decontamination, heat and/or fumigation procedures. • Training Training and inductions for site employees and contractors to educate on the risks and mitigation requirements for weed spread. • Preclearing surveys and weed treatment Pre-clearance surveys will be performed to identify weeds, and large infestations to be treated prior to clearing to minimise the spread of weed seed and material.

Mary River cod (*Maccullochella mariensis*)		
Potential Impact	**Assessment**	**Mitigation Options**
		• Weed management Weeds will be actively monitored and managed adjacent to Exploratory Works Project footprint. Spraying herbicides will be avoided on the edge of the Project footprint.
Injury or mortality to individuals	The use of construction machinery in waterways has the potential to directly result in fauna injury or mortality. Aquatic species, including the Mary River cod, are also at risk of injury or mortality from vehicle strike at the site of the proposed bed level crossings. The impact pathways include: • vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site, working within or crossing Yabba Creek and Sandy Creek.	To mitigate the risk of injury or mortality to the species at the site of the bed level crossing, the following measures are proposed: • Vehicles will aim to traverse the bed level crossing when low flows permit. In such periods, it is expected that there will be visibility of the stream bed that will allow for a visual inspection of any species present. • Should any individuals be present, vehicle movements across the stream will be halted until the species moves either upstream or downstream to avoid the risk of injury or mortality. • Should any individuals be observed to be injured at the site of the stream bed crossing, the injured individual will be transported to a vet, if possible. • Activities will be minimised during breeding seasons (August to October for Mary River cod). If it is not possible to undertake works outside breeding seasons, pre-clearance surveys upstream and downstream from the works area will identify, map, and mark out potential and active breeding habitat. • Relocate aquatic fauna from areas where Exploratory Works activities are to occur in accordance with the Fish Salvage Guideline (DAF, 2024).
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in a temporary increase in elevated noise, vibration, air, and light emissions, which could impact Mary River cod habitat and impact the species. However, as the proposed Exploratory Works Project is largely sited away from Mary River cod habitat, and suitable mitigation controls will be implemented, it is not anticipated that unwanted emissions will impact the species. Additional habitat degradation resulting from air, noise, and vibration emissions associated with the upgrade of crossings in Area 1 (Borumba Dam), Area 3 (Walkers Top), and Area 4 (Borgan) will be short-term and largely confined to the construction period. As the crossings are already in existence and utilised by vehicles traversing the site, any additional	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions include: • Light Instream construction activities will be limited to daytime hours as far as practicable, and only minimal lighting will be installed around buildings at night (which will be on motion sensor to further reduce light emissions). Additionally, shades/shields to direct light downward will be installed, and bright white lights avoided in favour of orange or amber hue lighting where worker safety is not compromised.

Mary River cod (*Maccullochella mariensis*)		
Potential Impact	**Assessment**	**Mitigation Options**
	impacts from air, noise and vibration emissions are expected to be negligible. The impact pathways include: • the introduction of artificial lighting to illuminate night work (drilling the deep bore holes) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	• Noise Dampening fences will be installed at significant noise sources (e.g. drilling sites/tunnelling sites). Tunnelling activities near the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e. low wind speed) only.
Contamination from hazardous materials	There is a risk of chemicals, required to support construction activities, spilling or leaking and contaminating suitable Mary River cod habitat. There is also a risk of contaminated water from the Project being unintentionally released directly into waterways or via runoff. The harm such contamination would cause the species is variable, and contingent on the extent of the spill or release and nature of the contamination. However, it is reasonable to assume that without suitable mitigation, the impacts of such contamination could result in significant mortality to the species. The impact pathways include: • hazardous materials associated with the use of vehicles, machinery, and Project activities may spill or leak onto the ground and run off into adjacent waterways • contaminated water from the Project (e.g. runoff from work areas, water stored in basins, water from tunnelling activities) being unintentionally released to water or land.	To mitigate the risk of contamination from hazardous materials, controls will be implemented to limit the likelihood of hazardous materials spilling and contaminating waterways. Controls will include storage and handling requirements, spill kits, trained personnel handling hazardous materials, and the development of emergency response protocols to respond to, and contain, spills. To minimise the risk of the accidental release of contaminated water from the Project, a range of water management infrastructure is proposed to capture and treat dirty water (see Section 2.7.3). This includes a water treatment plant capable of treating water to required environmental standards for the Yabba Creek catchment and basins to store dirty and clean water.

Table 96: Significant impact assessment for the endangered Mary River cod (*Maccullochella mariensis*)

Mary River cod (*Maccullochella mariensis*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** There are no estimates on the population of the Mary River cod within the Mary River catchment. Surveys for the species in Widgee, Glastonbury, Amamoor, Yabba Creek and other parts of the Mary River suggest that numbers of the species are very low (Simpson & Jackson, 1996). Approximately 0.2 ha of foraging habitat and 0.2 ha of spawning/foraging habitat for the Mary River cod will be disturbed across the four work areas. Eight waterway crossings are proposed, including upgrades to seven existing crossing locations through a combination of bridge structures, temporary piped culverts, or bed level crossings. Additionally, there are proposed temporary water pipeline crossings at Yabba Creek that will either be directionally drilled under the creek or suspended over the creek. The direct disturbance of 0.2 ha of foraging habitat and 0.2 ha of spawning/foraging habitat is unlikely to lead to a long-term decrease in the size of a population as the species is likely to persist in the area in the remaining 269.7 ha of foraging habitat and 26.1 ha of spawning/foraging habitat within the Borumba PHES Survey area, and within the greater Mary River catchment. Upgrades to existing bed level crossings and the installation of temporary piped culvert crossings in accordance with the ADR or *Fisheries Act 1994* performance outcomes will not impede passage and will reduce ongoing maintenance requirements and the risk to aquatic fauna. The Bailey bridge design does not impede environmental flows and the placement of piers either do not meet the criteria for a waterway barrier or conform with performance outcomes required to maintain fish passage under the Queensland *Fisheries Act 1994*. After the Project the bridges will be decommissioned if the Main Works Project does not go ahead. Due to the temporary nature of the proposed action and the proposed management measures, any indirect impacts (e.g. temporary changes of water quality or light emissions) associated with the Project that may disturb the species are unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The area of occupancy for the species has not been defined. The direct disturbance of 0.2 ha of foraging habitat and 0.2 ha of spawning/foraging habitat across the four work areas is unlikely to result in any changes to the species AOO as there are extensive areas of suitable habitat present within the Borumba PHES Survey area and in the surrounding area. The direct disturbance of 0.2 ha of foraging habitat and 0.2 ha of spawning/foraging habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of a population.

Mary River cod (*Maccullochella mariensis*)	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** The population of Mary River cod occurring in Lake Borumba is already isolated by the existing impoundment (Borumba Dam). The Project does not involve the construction of any permanent barriers, including the use of Bailey bridges and pipeline directional drilling or overhead suspension, that will create a new barrier or further isolate populations. Therefore, it is considered highly unlikely the proposed action will fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely** Habitat critical to the survival of the species includes mapped foraging and spawning habitat, which meets the requirements stated in Table 94. Eight waterway crossings are proposed, including upgrades to seven existing crossing locations through a combination of bridge structures, temporary piped culverts, or bed level crossings. Four temporary piped-culvert crossings within Area 4 (Borgan) will be used until Bailey bridges are implemented, after which the crossings will be converted back to bed level crossings. The Bailey bridges were selected because they can be removed and have a smaller footprint than other bridges. The design of the bridges means they will not impede flow, disturbance from their construction will largely be on the high banks, and they conform with performance requirements under the Queensland *Fisheries Act 1994*. The bridges will be removed at the completion of the Project if the Main Works do not proceed, and the area rehabilitated (Appendix C). Furthermore, preliminary modelling for the bridges shows no notable change to the flow when the bridges are installed to cross Yabba and Sandy creeks. The bed level crossing at Area 1 (Borumba Dam) will be in place for the duration of the Project (~2 years). It is an area accessed for maintenance of Borumba dam and will be constructed by placing gravel or roughened concrete on the bed, which will minimise disturbance of fine sediments on the bed. Upgrades to the bed level crossings over Yabba Creek in Area 3 (Walkers Top) and Area 4 (Borgan) will also comprise either gravel or roughened concrete. The selection of material for the bed level crossings will be decided in line with anticipated traffic levels (i.e. gravel for low-traffic and concrete for high-traffic areas). While isolated sections of suitable habitat for the species will be temporarily disturbed (i.e. bed level crossing below the Borumba Dam wall, pier locations for the temporary bridges), it is not expected that the impacts of the proposed action will adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	**Unlikely** The Mary River cod Research and Recovery Plan states there have been no observations of spawning behaviour in wild habitats (Simpson & Jackson, 1996). Thus, the breeding cycle has only been studied in fish hatcheries. The Mary River cod form pairs and spawn annually in spring only after water temperature rises above 20°C. It is presumed that the species uses hollow logs as nests in the wild, and eggs take seven days to hatch. It is unknown if Mary River cod are breeding within Lake Borumba. Breeding and recruitment success among impoundment populations of other Australian percichthyid fish have been low or non-existent (Barlow, 1991). In 2017/18, 1,000 Mary River cod individuals were stocked into Lake Borumba, with an additional 5,000 individuals stocked in recent years.

Mary River cod (*Maccullochella mariensis*)	
Impact criteria	**Assessment**
	Approximately 0.2 ha of suitable spawning/foraging habitat is mapped within the Exploratory Works Project footprint. The direct disturbance of 0.2 ha of suitable spawning habitat is unlikely to lead to disrupt the breeding cycle of the species, as the species is likely to breed in the remaining 269.7 ha of foraging habitat and 26.1 ha of spawning/foraging habitat within the Borumba PHES Survey area, and within the greater Mary River catchment. The works does not involve the construction of any permanent barriers, including the use of Bailey bridges and pipeline directional drilling or overhead suspension. Indirect impacts resulting from the proposed works, including changes to water quality and dust, light, air, and noise emissions may temporarily disrupt the breeding cycle for the Mary River cod. To manage this, controls for erosion and sedimentation, leaks and spills of hazardous chemicals or waste, and the unintentional release of contaminated water will be implemented to ensure water quality downstream of site establishment works does not decrease from pre-construction levels. Also, the removal of habitat features for breeding (riparian and instream vegetation and debris) will be avoided (such as restricted areas) during site establishment works. With these reasons, the Exploratory Works Project is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The Exploratory Works Project will disturb 0.2 ha of foraging habitat and 0.1 ha of spawning/foraging habitat for the species. Seven bed level crossings, all of which are upgrades to existing crossings, and four temporary Bailey bridges are proposed. Four of these crossings will initially have temporary piped culverts installed to provide access during bridge construction at Yabba and Sandy Creek in Area 4 (Borgan) after which the crossings will be converted back to bed level crossings. The Bailey bridges were selected because they can be removed and have a smaller footprint than other bridges. The design of the bridges means they will not impede flow and disturbance from their construction will largely be on the high banks. The bridges will be removed at the completion of the Project if the Main Works do not proceed, and the area rehabilitated (Appendix C). Furthermore, preliminary modelling for the bridges shows no notable change to the flow when the bridges are installed to cross Yabba and Sandy creeks. The bed level crossing at Area 1 (Borumba Dam) will be in place for the duration of the Project (~ 2 years). It is an area accessed for maintenance of Borumba dam and will be constructed by placing gravel on the bed, which will minimise disturbance of fine sediments on the bed. Upgrades to the two bed level crossings over Yabba Creek (Area 3 (Walkers Top)) will be comprised of either gravel or roughened concrete and will not disturb any segment of waterway not already utilised and disturbed as a crossing. The temporary water pipeline crossings of Yabba Creek will be via directional drilling or suspended overhead, minimising the extent of disturbance. These structures will be removed following the completion of the works if the Main Works do not proceed. While isolated sections of suitable habitat for the species will be temporarily modified (i.e. bed level crossing below the current dam wall), it is not expected that the impacts of the proposed action will result in changes to the habitat of the species that will cause the species to decline.

Mary River cod (*Maccullochella mariensis*)	
Impact criteria	**Assessment**
	Indirect impacts resulting from the proposed works, including changes to water quality and dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** Invasive aquatic species have been identified as a medium priority threat to this species. The Exploratory Works Project is unlikely to introduce any invasive aquatic species or result in the movement of invasive aquatic species to other areas of the catchment. The Exploratory Works Project is considered unlikely to result in invasive species becoming established.
Introduce disease that may cause the species to decline	**Unlikely** Disease is not identified as a threatening process in the species recovery plan. The Exploratory Works Project is unlikely to introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** Conservation and management priorities as per the Conservation Advice (TSSC, 2016) that are relevant to the Exploratory Works Project include: • ensure that appropriately designed fishways are installed at barriers to Mary River cod movements • protect existing riparian vegetation and restore riparian vegetation by replanting known endemic riparian species that provide shade cover to pools along the stream channels • improve the management of stream flows, water quality and riparian environments throughout catchments which are known habitat for the Mary River cod by monitoring and mitigating erosion • avoid translocation of invasive fish species within the known and potential range of the Mary River cod. No significant works or infrastructure will be required in waterways and the required structures will not pose a permanent barrier to fish movement. Structures will be removed immediately following the completion of the works. Existing riparian vegetation and habitat features required by the species will be avoided (use of restricted areas) and water quality downstream of site establishment works will not decrease from pre-construction levels (use of controls for erosion and sedimentation, leaks and spills of hazardous chemicals or waste). There will also be an opportunity to improve or restore riparian vegetation as part of the rehabilitation works proposed for the Exploratory Works Project. The Exploratory Works Project is unlikely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.3.10 Mary River turtle (*Elusor macrurus*)

The Project has the potential to significantly impact the Mary River turtle (*Elusor macrurus*), which was listed as endangered under the EPBC Act at the time of the controlled action decision for the Project. This section provides the following:

- In Table 97, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 98, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 99, an assessment against the significant impact criteria for species listed as endangered under the EPBC Act.

The extent of suitable habitat (i.e. foraging and nesting habitat) within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and the Exploratory Works Footprint, and the locations of Mary River turtle are shown on Figure E-20, which is contained in Appendix E. It is noted that most of the works for the Project are on land and above the 1% AEP and as such are unlikely to have an impact on flood conditions or the health of the waterways. In addition, as noted in Section1.4.1 the design has avoided the construction of barriers through Kingaham Creek.

The significant impact assessment undertaken in Table 99 identified that the Project is **unlikely** to result in a significant impact Mary River turtle.

Table 97: Description of Mary River turtle (*Elusor macrurus*)

Mary River turtle (*Elusor macrurus*)	
Profile	**Conservation status**: Endangered **Habitat:** Like other turtles with cloacal respiration, the Mary River turtle occurs in flowing, well oxygenated sections of streams. Its habitat consists of riffles (particularly productive parts of a river that are shallow with fast-flowing, aerated water) and shallow stretches alternating with deeper, flowing pools. It may occur in waterholes with depths more than 6 m, but generally does not occur in impoundments (Flakus, 2002). **Distribution:** The Mary River turtle is endemic to the Mary River in south-eastern Queensland. **Previous records:** Prior to surveys in 2022 and 2023, there were no recent or historical records of the Mary River turtle within Lake Borumba or its tributaries. However, data uploaded to the Atlas of Living Australia (ALA) database in August 2024 showed one record of a male Mary River turtle within 2 km of Area 1 (Borumba Dam), as photographed and provided by TurtleSAT, a citizen science turtle survey and analysis tool. **Habitat Critical to the Survival of the Species:** Habitat critical to the survival of the Mary River turtle is the rivers and streams of the Mary River catchment, particularly (DCCEEW, 2024): • Reaches with alternating riffle zones and deep pools, which provide a well-oxygenated environment suitable for cloacal respiration. • Sandy banks which provide suitable nesting habitat. • In-stream large woody debris and undercut banks, which provide refugia for brumation (periods of inactivity) and safety from predators. • Basking sites such as in-stream emergent rocks or logs necessary for thermoregulation. • Foraging areas where food sources are available and concentrated such as riffle zones and macrophyte beds. The Mary River turtle is endemic to the Mary River in south-eastern Queensland.

Mary River turtle (*Elusor macrurus*)	
	Important Populations: The Mary River turtle is known from two populations in the Mary River drainage. Both of these populations are very important for the conservation of the species, as would be any newly discovered population. **Threats:** Conservation Advice (DCCEEW, 2024) for the species identifies the following threats: • predation of nests and adults by *Vulpes vulpes* (European red fox) • invasion of weeds into riparian habitat • increase in air temperatures and the frequency and intensity of drought • increase in the frequency and intensity of floods • fire regimes that cause biodiversity decline • dams and weirs • clearing of riparian vegetation • sand/gravel extraction • livestock trampling nesting banks • nest predation by native species • recreational activities.
In the Survey area	**Survey effort:** Targeted surveys, including habitat assessments, were undertaken between June 2022 and May 2024 in accordance with the Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC, 2011) advice from subject matter expert Dr. Col Limpus (Chief Scientist at DES), and the monitoring and sampling manual (DES, 2018), in areas of suitable habitat (Lake Borumba, Yabba Creek and tributaries which feed into Lake Borumba). Surveys involved visual observations of the Mary River turtle via kayaking, fyke netting, cathedral trapping, snorkelling, muddling, and boat-based electrofishing (Hydrobiology, 2023). **Species occurrence:** Six Mary River turtle individuals were recorded within the Borumba PHES Survey area, with five individuals observed within the Exploratory Works Survey area. Specifically, Mary River turtles were located downstream of the existing Borumba Dam, and upstream of Lake Borumba in Yabba and Sandy creeks (Hydrobiology, 2022; Hydrobiology, 2023). Two specimens were recorded immediately downstream of the dam wall. One individual was recorded upstream of Lake Borumba in Sandy Creek and one juvenile was recorded in Yabba Creek upstream of Lake Borumba. Historical records show the species is more common further downstream of Yabba Creek and into the Mary River. **Habitat:** Approximately 178.5 ha of foraging habitat and 5.9 ha of nesting habitat was confirmed in the Borumba PHES Survey area, of which 0.5 ha of foraging habitat and 0.1 ha of nesting habitat is present within the Exploratory Works Project footprint. Habitat within the Borumba PHES Survey area includes areas upstream of Borumba Dam in Yabba Creek, Kingaham Creek, and Sandy Creek, Lake Borumba, and Yabba Creek downstream of Borumba Dam. Foraging habitat includes permanent water within shallow or deep pools with evidence of riffles and undercut banks. Permanent pools can be deep, shallow or have riffles but must also have large woody debris and boulders, overhanging vegetation, and macrophytes (instream submerged and semi-emergent forms) (Hydrobiology, 2022; Hydrobiology, 2023). Nesting habitat for the Mary River turtle includes unconsolidated sediments, particularly alluvial sand banks, within 100m of pool habitat. There is evidence that recruitment occurs in Yabba Creek upstream of Lake Borumba (Hydrobiology, 2023). **Present threats on the species:** • changes to hydrology and streamflow due to dams and weirs. Lake Borumba, adjacent to the Project footprint, is an existing impoundment on Yabba Creek • invasive weeds including *Lantana camara*, passionflower, Noogoora burr, Crofton weed, and mistflower grow in riparian zones degrading habitat

Mary River turtle (*Elusor macrurus*)	
	• invasive pest fauna including feral cat, dingo, fox, European brown hare and rabbit, cattle, pig and rusa deer that may predate on the species or destroy nests • livestock trampling of nests, with suitable nesting habitat adjacent to areas used for cattle grazing • recreation, with Lake Borumba and Yabba Creek used for recreation boating activities • nest predation by native species.

Table 98: Assessment of potential impacts, and mitigation options for the Mary River turtle (*Elusor macrurus*)

Mary River turtle (*Elusor macrurus*)		
Potential Impact	**Assessment**	**Mitigation Options**
Instream earthworks causing habitat loss and fragmentation	Earthworks and installation of infrastructure (i.e. bridge piers) associated with waterway crossings have the potential to remove habitat for the species, including both in-stream habitat and riparian habitat. If extensive, the loss of habitat could lead to fragmentation and negatively impact the survival of the species. As such, the final design has considered these risks to the species and designed out the requirement for extensive instream works that would result in large amounts of habitat disturbance for the species. The Project involves the construction of four temporary bridges and upgrades to seven existing creek crossings over Yabba and Sandy creeks to support access and infrastructure development across Area 1 (Borumba Dam), Area 3 (Walkers Top) and Area 4 (Borgan). The four bridges are in Area 4 (Borgan), with three of these locations associated with an existing crossing. The bridge crossings will utilise prefabricated Bailey bridges and be removed following the completion of the works if the Main Works do not proceed. Four existing crossings, which are required to support bridge construction, will be upgraded to temporary piped culverts before being converted to concrete bed level crossings. The three other existing bed level crossings will also be upgraded to roughened concrete or compacted gravel to improve access	To mitigate impacts of earthworks associated with the construction of crossings, the following measures are proposed: • No bank or instream disturbance will be undertaken until a suitably qualified person has checked the banks for suitable breeding places. A minimum of 30 m upstream and downstream of the work area in creeks will be inspected. • Restricted areas will be established with riparian areas adjacent to the work areas marked to ensure no clearing or works in these areas. • Boundary maps and exclusion and buffer zones will be provided to contractors, with permitted personnel only allowed access on foot beyond the boundary of the restricted areas. • Works will be undertaken within existing cleared areas, wherever possible. • Micro-siting of work sites to avoid potential nesting sites. • Rehabilitation of disturbed areas once works are complete (Appendix C). To avoid extensive instream works and the creation of barriers, the following measures are proposed: • Bailey bridges will be installed across Yabba Creek and Sandy Creek, with design minimising the number of piers needed. As these are prefabricated bridges, the extent of

Mary River turtle (*Elusor macrurus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	around the Project site. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). All bed level crossings will be placed in line with the existing bed level crossings and be constructed in accordance with the Queensland *Fisheries Act 1994,* which requires a provision for aquatic passage, and the *Planning Act 2016* (including the ADR). The crossing upgrades will also reduce ongoing maintenance required for the existing crossings. No other waterways in the Project footprint are capable of supporting this species. While the overwhelming majority of suitable habitat for the species will be avoided and the existing tracks are not within suitable nesting habitat for this species, the existing crossings are mapped as foraging areas. As such, the crossings and installation of the Bailey bridges on Yabba Creek and Sandy Creek will result in the temporary loss of discrete parts of suitable habitat. However, given the isolated nature of the potential impacts, it is unlikely the habitat loss would lead to population fragmentation. The impact pathways include: • earthworks and installation of infrastructure associated with the construction of waterway crossings.	works needed to install the bridges is reduced and will mainly be confined to the high stream banks. • Upgrade of bed level crossings in accordance with the ADR. The design requirements prohibit the introduction of barriers to fish movement, including vertical drops between upstream and downstream reaches, so the works are not anticipated to result in any barriers to turtle passage being introduced that may lead to species fragmentation. The bed level crossings and temporary piped culverts required for use during bridge construction are located at existing crossings and the one downstream of the dam is in an area accessed for dam maintenance. • Directional drilling – the water pipeline crossings of Yabba Creek will be constructed using directional drilling or overhead suspension to minimise the extent of disturbance and prevent the introduction of structures into the waterway that could serve as a barrier to movement for the species.
Changes to habitat quality as a result of erosion and sedimentation	Habitat quality may decline as a result of erosion and sedimentation, due to inadequately managed construction areas on nearby land and instream for crossings. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required for the species to thrive. However, as all seven proposed crossing upgrades and three of the bridge sites are located at existing vehicle crossing points within the Project site, their upgrade will help reduce long-term erosion and sedimentation impacts associated with the existing design. The crossing upgrades will also reduce ongoing maintenance works, which ultimately will have a better	Erosion and sediment control measures, outlined in an Erosion and Sediment Control Plan, will be implemented to mitigate the impacts on habitat quality. Measures will include: • Undertaking clearing for the geotechnical investigation areas immediately prior to the investigation to limit the time bare ground is exposure to rain, leading to erosion. • Rehabilitating exposed areas as soon as possible to further reduce the likelihood of erosion and sedimentation causing turbid runoff entering waterways.

Mary River turtle (*Elusor macrurus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	outcome for the water quality within the creek system compared to the existing design. The impact pathways include: • erosion and sedimentation associated with earthworks, vegetation clearance, and poor rehabilitation measures has the potential to lead to turbid run off entering adjacent waterways, resulting in adverse changes to water quality.	• Installation of suitable site-specific controls, that may include earth basins, filters, rock check dams, sediment fences, and sediment traps.
Barriers to movement	In the absence of appropriate design and mitigation measures Project components constructed within waterways may form barriers to aquatic species movement. Barriers to movement may act to isolate species, hindering their ability to thrive. The four bridge crossings will utilise prefabricated Bailey bridges and have been designed to allow aquatic fauna passage. These structures will be removed following the completion of the works. The four existing crossings of Yabba and Sandy creeks that are required to support bridge construction will be upgraded to temporary piped culverts before being converted to concrete bed level crossings. Other existing crossings of Yabba Creek will be upgraded in accordance with the ADR, which will also reduce ongoing maintenance issues with the existing crossings. No other waterways in the Project footprint can support this species. All bed level crossings will be comprised of either roughened concrete or gravel placed and will be placed in line with the existing bed level crossings. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). While upgrades to the existing crossings may temporarily cause a barrier to species movement during their construction, this impact will be short-term and confined to the construction period only.	The installation of Bailey bridges to cross Yabba Creek and Sandy creek avoids the introduction of barriers to movement being introduced into the waterways. Should the Main Works not proceed, the bridges will be removed and the area rehabilitated. Upgrades to existing bed-level crossings will be designed and installed to ensure there are no barriers created within the waterway that will impede movement between upper and lower reaches (i.e. no vertical drops greater than 200 mm). For bed level crossings, the crossing entry and exit will be constructed with compact gravel or roughened concrete, which is not expected to pose a barrier to species movement (Dowling, 2024). Utilising a piped-culvert design during the construction of the Bailey bridges will help to maintain passage, while also lowering the risk of any vehicle interactions with fauna and minimising negative impacts on water quality and sedimentation. Riparian areas adjacent to the site where the works are proposed to occur will be marked as restricted areas to ensure equipment and machinery that may prevent overland movement of the species is not laid down in these areas. Furthermore, the water pipeline crossings of Yabba Creek will be via directional drilling or overhead suspension to minimise the extent of disturbance and prevent the introduction of structures into the waterway that could serve as a barrier to movement for the species.

Mary River turtle (*Elusor macrurus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • structures associated with the construction of waterway crossings (i.e. Bailey bridges and bed level crossings, sediment fences, bunds).	
Spread of weeds, pests and disease due to increased human activity	Activities undertaken within watercourses may act to spread aquatic weeds without the application of suitable mitigation and management measures. An increased incidence of weeds may cause reduced availability of suitable habitat and resources for the species. Use of construction machinery and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Pests may contribute directly to injury or mortality of aquatic species. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants • invasive animals preying on turtle eggs and hatchlings.	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on turtles. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures. Mary River turtle nests detected in the Project area will be protected from predators by fixing 70-100 cm plastic or wire mesh covers with 10 cm grid-size over nests, which will be kept in place with turf pegs, tent pegs or something suitably similar. The nest will be positioned in the centre of the mesh, preventing predators from burrowing and accessing the eggs, but allowing hatchlings to pass through.
Injury or mortality to individuals	The use of construction machinery within waterways has the potential to directly result in fauna injury or mortality. Aquatic species, including the Mary River turtle, are also at risk of injury or mortality from vehicle strike at the site of the proposed bed level crossings, if they are present. Nesting sites, which may occur within the Borumba PHES Survey area, are prone to disturbance from clearing activities and earthworks, leading to the injury or mortality of unhatched or juvenile turtles. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site, working within, or crossing, the waterway.	Vehicles will aim to traverse the bed level crossing when low flows permit. In such periods, it is expected that there will be visibility of the stream bed which will allow for a visual inspection of any species present. Should any species be present, vehicle movements across the stream will be halted until the species moves either upstream or downstream to avoid the risk of injury or mortality. Fauna exclusion fencing appropriate for turtles will be installed perpendicular to the water's edge along the banks between instream works areas and nesting reaches, and around works on banks. This will minimise safety risks to threatened turtle species by preventing turtles from accessing the construction areas.

Mary River turtle (*Elusor macrurus*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Should any species be observed to be injured at the site of the stream bed crossing, the injured individual will be transported to a vet, if possible. Instream activities and riparian works will be minimised during breeding seasons (October to January for the Mary River turtle). If it is not possible to undertake works outside breeding seasons, pre-clearance surveys upstream and downstream from the works area will identify, map and mark out turtle nesting sites. Any active turtle nests will be identified during pre-clearance surveys and will be mapped out and marked. A restricted area around the waterway crossing works will prevent personnel, vehicles and machinery from approaching active turtle nests. Daily inspections will be done of the fenced areas to inspect for adult and hatching turtles.
Reduced amenity through light emissions	Artificial light emissions may occur in several locations across the Project area for over 12 months. The use of artificial lighting to support the construction of the Project would particularly impact nocturnal species, affecting their ability to thrive in areas surrounding worksites requiring artificial lighting. For the Mary River turtle, the occurrence of artificial light could result in changes to nesting behaviours, and greater risk of predation of hatchlings or juveniles. The impact pathways include: • introduction of lighting necessary to illuminate work areas resulting in changes to animal behaviour, and increased risk of predation.	Construction activities will be limited to daytime hours as far as practicable, and only minimal lighting will be installed around buildings and work sites (e.g. at exploratory tunnelling supporting infrastructure) at night. Additionally, shades/shields to direct light downward will be installed, and bright white lights avoided in favour of orange or amber hue lighting where worker safety is not compromised.
Reduced amenity through dust emissions	Earthworks and vehicle movements, particularly on unsealed roads, and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and be deposited within waterways. In the absence of mitigation, this may hinder aquatic species, including the Mary River turtle, by altering water quality, which may compromise their ability to thrive or result in mortality.	Mitigation measures to be implemented to reduce the generation of dust emissions include regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e. low wind speed) only.

Mary River turtle (*Elusor macrurus*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • construction and use of access tracks used by vehicles and machinery within the Project area.	
Impacts to surface water quality and quantity, release of contaminated water from construction areas	Unauthorised or unintentional releases of contaminated water from construction areas may enter the surrounding environment including waterways. Depending on the nature of the contaminated water and the release quantity and duration, this could compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water that enters waterways or the water table, may direct (e.g. illness) or indirect (e.g. reduced suitability of habitat) impacts on species in areas surrounding or downstream of the initial contamination zone. The impact pathways include: • contaminated runoff or releases associated with site activities may runoff into adjacent waterways, impacting surface water and groundwater.	Potential impacts to water quality will be managed (such as controls for erosion and sedimentation, leaks and spills of hazardous materials and waste, weed and pest species) to mitigate risks associated with the unintended release of contaminated water. To minimise the risk of the accidental release of contaminated water from the Project, a range of water management infrastructure is proposed to capture and treat dirty water (see Section 2.7.3). This includes a water treatment plant capable of treating water to required environmental standards for the Yabba Creek catchment and basins to store dirty and clean water.
Contamination from hazardous materials	There is a risk of chemicals, required to support construction activities, spilling or leaking and contaminating suitable Mary River turtle habitat. The extent of the harm such contamination would cause the species is variable and contingent on the extent of the spill and nature of the spilt material. However, it is reasonable to assume that without suitable mitigation, the impacts of such contamination could result in significant mortality to the species. The impact pathways include: • hazardous materials associated with the use of vehicles, machinery, and Project activities may spill or leak onto the ground and run off into adjacent waterways.	The management of hazardous materials on site will be in strict accordance with the CEMP and waste management plan. This will include controls being put in place to limit the likelihood of hazardous materials spilling. Controls will include storage and handling requirements, spill kits, trained personnel handling hazardous materials, and the development of emergency response protocols to respond to, and contain, spills.

Table 99: Significant impact assessment for the endangered Mary River turtle (*Elusor macrurus*)

Mary River turtle (*Elusor macrurus*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The size of the Mary River turtle population in the Project footprint is unknown, and the population density of the Mary River turtle is lower than that of other turtles in the Mary River (DEWHA, 2008). The species constituted 14% of turtles captured during systematic population monitoring by Flakus (2002), and the species may be rare throughout its known range (Cann, 1998). The species has experienced a 95% reduction in the population of breeding female Mary River turtles between 1970 and 2000 (DEWHA, 2008). Eight waterway crossings are proposed, including upgrades to seven existing crossing locations, through a combination of bridge structures or bed level crossings. These areas are mapped as foraging habitat for the species, with suitable nesting habitat also present at a bridge crossing of Yabba Creek and near two bed level crossings as well as the waterway crossings for the temporary water infrastructure. The disturbance or temporary loss of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Project footprint is unlikely to reduce available breeding, foraging, or dispersal resources such that this loss would likely lead to a long-term decrease in the size of the population, as the species is likely to persist in the area, in the remaining 178.5 ha of foraging habitat and 5.9 ha of nesting habitat within the Borumba PHES Survey area, and within the greater Mary River catchment. Due to the temporary nature of the proposed action, any indirect impacts associated with the works that may disturb the species are unlikely to lead to a decrease in the size of a population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	**Unlikely** The AOO is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The Conservation Advice does not state the AOO for the Mary River turtle. However, from literature, it is known that the Mary River turtle occupies at least 200 km of the Mary River from Kenilworth to Tiaro (DEWHA, 2008). The direct loss of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Exploratory Works Project footprint is unlikely to result in any changes to the species AOO as it is a very small area compared to the greater 178.5 ha of foraging habitat and 5.9 ha within the Borumba PHES Survey area, and within the greater Mary River catchment. The temporary disturbance of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of the species.

Mary River turtle (*Elusor macrurus*)	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** The species occurs from Conondale to the Mary River Tidal Barrage at Tiaro, in major tributaries and the main channel of the Mary River including Obi Obi, Yabba, Wide Bay, Munna and Tinana creeks (DCCEEW, 2024). As there are no impoundments or barriers proposed as part of the action it is unlikely that the Project will fragment the population into two or more populations. One bed level crossing will be in place for the duration of the Project (~ 2 years) at Area 1 (Borumba Dam). The other four bed level crossings will be used while the Bailey bridges are installed and are at existing crossings. The crossings will be constructed by placing 10-20 m^3 of D50-100 mm rock or similar on the bed, in line with the existing bed level, which will minimise disturbing any fine sediments on the bed. After two years, if the Main Works Project does not go ahead, the bed level crossing in Area 1 (Borumba Dam) will be rehabilitated to pre-disturbance conditions. The bed level crossings and bridges will be constructed to allow the Mary River turtle to move through these areas. As such, it is considered highly unlikely that the existing population will become fragmented into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely** Habitat critical to the survival of the species includes mapped foraging and nesting habitat, which meet the requirements stated in Table 97. Eight waterway crossings are proposed, including upgrades to seven existing crossing locations, through a combination of bridge structures or bed level crossings. These areas are mapped as foraging habitat for the species, with suitable nesting habitat also present at a bridge crossing of Yabba Creek and near two bed level crossings as well as the waterway crossings for the temporary water infrastructure. Four temporary piped culvert crossings will be used until Bailey bridges are implemented in Area 4 (Borgan), after which the crossings will be converted back to bed level crossings. The Bailey bridges were selected because they can be removed and have a smaller footprint than other bridges. The design of the bridges means they will not impede flow and disturbance from their construction will largely be on the high banks. The bridges will be removed at the completion of the Project if the Main Works do not proceed, and the area rehabilitated (Appendix C). The bed level crossing at Area 1 (Borumba Dam) will be in place for the duration of the Project (~2 years). It is an area accessed for maintenance of Borumba Dam wall and will be constructed by removing existing large rocks and placing gravel on the bed, which will minimise disturbance of fine sediments on the bed. If the Main Works Project does not proceed, the bed level crossing will be rehabilitated to pre-disturbance conditions. Upgrades to the two bed level crossings over Yabba Creek (Area 3 (Walkers Top)) will be comprised of either gravel or roughened concrete and will not disturb any segment of waterway not already utilised and disturbed as a crossing. As such, it is unlikely that the Exploratory Works Project will adversely affect habitat critical to the survival of a species.

Mary River turtle (*Elusor macrurus*)	
Impact criteria	**Assessment**
Disrupt the breeding cycle of a population	**Unlikely** Historical records suggest that the Mary River turtle generally demonstrates nest-site fidelity and returns to the same nesting sites each year (DCCEEW, 2024). High density aggregated nesting appears to be concentrated on a small number of sand banks. However, low density nesting is widely distributed throughout the catchment (DCCEEW, 2024). Within the Borumba PHES Survey area, there is 5.9 ha of nesting habitat for the Mary River turtle, which is associated with unconsolidated sediments including areas with grasses within 100 m of pool habitat. There is 0.1 ha of nesting habitat in the Project footprint. In the Borumba PHES Survey area, nesting habitat is present upstream of Lake Borumba in Yabba Creek, and a small area is located downstream of Lake Borumba in Yabba Creek. Although no nests have been observed within the Borumba PHES Survey area and neither any breeding pairs, recruitment is evident in Yabba Creek upstream of Lake Borumba (Hydrobiology, 2023; Hydrobiology, 2022). Should the Mary River turtle nest within the Exploratory Works Survey area, the Exploratory Works could potentially disrupt the breeding cycle due to disturbance on creek banks and downstream impacts associated with decreased water quality, increased sedimentation and altered flow regimes. In light of this, the proposed action will aim to avoid construction on creek banks with dense overhanging riparian vegetation, where possible, to retain suitable breeding places. Furthermore, instream and riparian works will be minimised during the breeding season for the Mary River turtle which occurs from October to January. If this not achievable, pre-clearance surveys will identify, map, and mark out turtle nesting sites. No bank disturbance will be undertaken until a suitably qualified person has checked the banks (30 m upstream and downstream of the proposed works) for fauna and nesting sites. Any identified nests will then be protected using exclusion fencing or other protective measures. The proposed works will impact 0.1 ha of nesting habitat. With no current breeding places within the Exploratory Works Survey area, and relatively small size of direct loss of nesting habitat, the Exploratory Works Project is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While disturbance of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Project footprint is anticipated to result in a temporary decrease in the availability of habitat for the species, this is unlikely to result in a decline of the species, given the remaining 178.5 ha of foraging habitat and 5.9 ha of nesting habitat within the Borumba PHES Survey area. The impacts of constructing Bailey bridges and bed level crossings across Sandy and Yabba creeks may temporarily decrease the quality of habitat for the species. The impacts include dust, light, air and noise emissions, and downstream impacts involving decreased water quality, increased sedimentation, and altered flow regimes. However, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	**Unlikely** Invasive aquatic and terrestrial species have been identified as a low priority threat to this species. Foxes are also recognised as nest predators. The Project is not anticipated to elevate the risk of aquatic weed or fox occurrences beyond the current scenario. The Exploratory Works Project will unlikely result in the establishment of invasive species.

Mary River turtle (*Elusor macrurus*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** As no diseases are known to adversely impact the species, it is not expected that the Project will introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** The Project will not impact important breeding sites for this species and although the proposed works will impact habitat critical to the survival of the species, the temporary disturbance of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Project footprint is unlikely to interfere with the recovery of the species, as it is a very small area compared to the greater 178.5 ha of foraging habitat and 5.9 ha of nesting habitat within the Borumba PHES Survey area. There is no endorsed recovery plan for this species, but it is not expected that the action will exacerbate the primary threats to the species, including predation and disturbance to nest sites, or impede the recovery actions identified in the Conservation Advice.
Recommendation:	Significant impact is **Unlikely**

7.3.11 White-throated snapping turtle (*Elseya albagula*)

The Project has the potential to significantly impact the white-throated snapping turtle (*Elusor macrurus*), which is listed as critically endangered under the EPBC Act. This section provides the following:

- In Table 100, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 101, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 102, an assessment against the significant impact criteria for species listed as critically endangered under the EPBC Act.

The extent of suitable habitat (i.e. foraging and nesting) within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and Exploratory Works Footprint, and the location of white-throated snapping turtle records are shown on Figure E-21, which is contained in Appendix E.

A few records of white-throated snapping turtle occur outside of areas mapped as suitable habitat. White-throated snapping turtle are known to migrate between suitable habitats. The record within Lake Borumba may represent an individual moving between areas of suitable habitat. However the individual was also recorded during boat-based electrofishing, which has a 1 km buffer around survey records due to the area covered, and the record is less than 1 km from suitable habitat in the lake. The historical record (from 2017) that is located on land south of the existing Borumba Dam wall may have been observed on land but could also have been recorded in the pool below the dam wall. It is noted that land in this area is heavily disturbed due to proximity to the dam wall.

It is noted that most of the works for the Project are on land and above the 1% AEP and as such as unlikely to have an impact on flood conditions or the health of the waterways. In addition, as noted in Section 1.4.1 the design has avoided the construction of barriers through Kingaham Creek.

The significant impact assessment undertaken in Table 102 identified that the Project is **unlikely** to result in a significantly impact white-throated snapping turtle.

Table 100: Description of white-throated snapping turtle (*Elseya albagula*)

White-throated snapping turtle (*Elseya albagula*)	
Profile	**Conservation status:** Critically Endangered **Habitat:** The White-throated snapping turtle is recognised as a habitat specialist, preferring clear, flowing, well-oxygenated waters. This preference appears to be associated with their physiological adaptation to extract oxygen from water via cloacal respiration. They require riffle zones, submerged logs and log jams, undercut/overhanging banks and riparian vegetation, and macrophyte beds (DAWE, 2020). **Distribution:** This species is only found in Queensland in the Fitzroy, Mary, and Burnett Rivers and associated smaller drainages in South East Queensland. Impoundments are also known to provide habitat, and individuals can be abundant in and successfully breed from impoundment areas (DAWE, 2020). It has been recorded in many impoundments throughout its distribution, including: • Fitzroy catchment: Fitzroy River Barrage, Glebe Weir, Eden Bann Weir and Emerald Town Weir • Burnett catchment: Bingera Weir, Wuruma Dam, Kolan Barrage, Ben Anderson Barrage and Ned Churchward Weir • Mary catchment: Mary River Barrage, Imbil Weir, Borumba Dam and Tallegalla Weir.

White-throated snapping turtle (*Elseya albagula*)	
	Previous records: The white-throated snapping turtle has been observed within Borumba Dam and its tributaries (Limpus, 2008). **Habitat Critical to the Survival of the Species:** The National Recovery Plan for the white-throated snapping turtle defines habitat critical to the survival of the species as: • parts of riverine systems with permanent water, including pools, within the species' distribution that contain shelter and refuges (e.g. bank overhangs, overhanging riparian vegetation, macrophyte beds, moderate to high densities of submerged boulders and/or log jams) • all currently known and new aggregated nesting sites (all nesting sites should be considered to be part of an aggregation unless it can be demonstrated otherwise). **Important Populations:** There are numerous areas within each catchment where the species is abundant. All areas with high abundance/densities represent important populations, as threats impacting them could result in high losses. **Threats:** Conservation Advice (DOE, 2014) for the species identifies the following threats driving low recruitment to the adult population: • excessive (near total) loss of eggs and hatchlings at the aggregated nesting areas in the Fitzroy, Burnett and Mary catchments • predation by feral (fox, dog, pig, cat) and native (varanid, water rat) animals • trampling of nests by cattle • construction of dams and weirs is an additional threat (DOE, 2014), acting via: – fragmentation of preferred habitat by dam infrastructures and associated deep water reaches of impoundments that are largely anoxic and detrimental to cloacal ventilating species – obstruction of migration within rivers – injury and death during over-topping and water releases, drowning of turtles in filter screens – inappropriate water allocation leading to low flow, or cessation of flow, which may reduce oxygenation of the water and impede cloacal respiration – flooding of traditional nesting areas • loss of riparian vegetation overhanging riverine habitat, leading to reduction in fruit as food for adult turtles • stocking of fish (top end predators) into dam impoundments for recreational fishing increases predatory pressure on juvenile turtles • recreational fishing – caught turtles may acquire hook injuries or die when they are cut loose or break away with ingested hook • dense aquatic weeds in the river and weeds on river banks can alienate nesting habitat • extended drought periods, exacerbated by water extraction causing reduction in water quality and breeding rates, and presumed increase in mortality.
In the Survey area	**Survey effort:** Targeted surveys, including habitat assessments were undertaken between June 2022 and May 2024 in accordance with the Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC, 2011), advice from subject matter expert Dr. Col Limpus (Chief Scientist at DES), and the monitoring and sampling manual (DES, 2018), in areas of identified suitable habitat to be impacted by the Exploratory Works Project. Surveys involved visual observations of the white-throated snapping turtle via kayaking, fyke netting, cathedral trapping, snorkelling, muddling, and boat-based electrofishing (Hydrobiology, 2023). **Species occurrence:** Seven individuals of the white-throated snapping turtle were recorded within the Borumba PHES Survey area, with no individuals recorded within the Exploratory Works Survey area. Specifically, the species was recorded in both Lake Borumba and downstream of the dam in Yabba Creek, which reflects historical records. **Habitat:** Approximately 184.2 ha of foraging habitat and 6 ha of nesting habitat was confirmed in the Borumba PHES Survey area, of which 0.5 ha of foraging habitat and 0.1 ha of nesting habitat is present within the Project footprint. Habitat within the Borumba PHES Survey area includes

White-throated snapping turtle (*Elseya albagula*)	
	upstream of Borumba Dam in Yabba Creek, Kingaham Creek, and Sandy Creek, Lake Borumba, and downstream of Borumba Dam in Yabba Creek. Foraging habitat includes permanent water within shallow or deep pools with runs, riffles, undercut banks, and large woody debris. Permanent pools can be deep, shallow, or have riffles but most have boulders, overhanging vegetation and macrophytes (instream submerged and semi-emergent forms) (Hydrobiology, 2022; Hydrobiology, 2023). Nesting habitat for the white-throated snapping turtle includes unconsolidated sediments, particularly alluvial sand banks, within 100 m of pool habitat. There is no evidence of recruitment with the Exploratory Works Survey area, with no juvenile individuals detected (Hydrobiology, 2023). **Present threats on the species:** • predators including feral fox, dog, pig and cat may predate on eggs and hatchlings • grazing cattle may trample on nests • Lake Borumba, adjacent to the Project footprint, is an existing impoundment on Yabba Creek • recreational fishers catching turtles • aquatic weeds including water hyacinth, hymenachne and salvinia.

Table 101: Assessment of potential impacts, and mitigation options for the white-throated snapping turtle (*Elseya albagula*)

White-throated snapping turtle (*Elseya albagula*)		
Potential Impact	**Assessment**	**Mitigation Options**
Instream earthworks causing habitat loss and fragmentation	Earthworks and installation of infrastructure (i.e. piers) associated with waterway crossings have the potential to remove habitat for the species, including both in-stream habitat and riparian habitat. If extensive, the loss of habitat could lead to fragmentation and negatively impact the survival of the species. As such, the final design has considered these risks to the species and designed out the requirement for extensive instream works resulting in the disturbance of approximately 0.5 ha of foraging and 0.1 ha of nesting habitat. The Project involves the construction of four temporary bridges and upgrades to seven existing creek crossings over Yabba and Sandy creeks to support access and infrastructure development across Area 1 (Borumba Dam), Area 3 (Walkers Top) and Area 4 (Borgan). The four bridges are in Area 4 (Borgan), with three of these locations associated with an existing crossing. The bridge crossings will utilise prefabricated Bailey bridges and be	To mitigate impacts of earthworks associated with the construction of crossings, the following measures are proposed: • No bank or instream disturbance will be undertaken until a suitably qualified person has checked the banks for suitable breeding places. A minimum of 30 m upstream and downstream of the work area in creeks will be inspected. • Exclusion zones will be established with riparian areas adjacent to the work areas marked as restricted areas to ensure no clearing or works in these areas. • Rehabilitation of disturbed areas once works are complete (Appendix C). To avoid extensive instream works and the creation of barriers, the following measures are proposed: • Bailey bridges will be installed across Yabba Creek and Sandy Creek, with design minimising the number of piers needed. As these are prefabricated bridges, the extent of works needed to

White-throated snapping turtle (*Elseya albagula*)		
Potential Impact	**Assessment**	**Mitigation Options**
	removed following the completion of the works (if the Main Works do not proceed). Four existing crossings, which are required to support bridge construction, will be upgraded to temporary piped culverts before being converted to concrete bed level crossings. The three other existing bed level crossings will also be upgraded to roughened concrete or compacted gravel improve access around the Project site. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). All bed level crossings will be placed in line with the existing bed level crossings and be undertaken in accordance with the Queensland *Fisheries Act 1994,* which requires a provision for aquatic passage*,* and the *Planning Act 2016* (including the ADR). The crossing upgrades will also reduce ongoing maintenance issues with the existing crossings. No other waterways in the Project footprint are capable of supporting this species. While the overwhelming majority of suitable habitat for the species will be avoided and the existing tracks are not within any nesting habitat for this species, the existing crossings are mapped as foraging areas. As such, the crossings and installation of the Bailey bridges on Yabba Creek and Sandy Creek will result in the temporary loss of discrete parts of suitable habitat. However, given the isolated nature of the potential impacts, it is unlikely the habitat loss would lead to population fragmentation. The impact pathways include: • earthworks and installation of infrastructure associated with the construction of waterway crossings.	install the bridges is reduced and will mainly be confined to the high stream banks. • Upgrades of existing bed level crossings will be in accordance with the ADR. The design requirements prohibit the introduction of barriers to fish movement, including vertical drops between upstream and downstream reaches, so the works are not anticipated to result in any barriers to turtle passage being introduced that may lead to species fragmentation. The bed level crossings and temporary piped culverts required for use during bridge construction are located at existing crossings and the one downstream of the dam is in an area accessed for dam maintenance. • Directional drilling – the water pipeline crossings of Yabba Creek will be constructed using directional drilling or overhead suspension to minimise the extent of disturbance and prevent the introduction of structures into the waterway that could serve as a barrier to movement for the species.

White-throated snapping turtle (*Elseya albagula*)		
Potential Impact	**Assessment**	**Mitigation Options**
Changes to habitat quality as a result of erosion and sedimentation	Habitat quality may decline as a result of erosion and sedimentation from inadequately managed construction areas. Erosion and sedimentation may reduce the availability of nutrients and other essential resources required for the species to thrive. However, as the seven proposed crossing upgrades are located at existing vehicle crossing points within the Project site, their upgrade will help reduce long-term erosion and sedimentation impacts associated with the current design, along with reducing ongoing maintenance works, which ultimately will have a better outcome to the water quality within the creek system compared to the existing design. The impact pathways include: • erosion and sedimentation associated with earthworks, vegetation clearance, construction of waterway crossings, and poor rehabilitation measures has the potential to lead to turbid run off entering waterways, resulting in adverse changes to water quality.	Erosion and sediment control measures, outlined in an Erosion and Sediment Control Plan, will be implemented to mitigate the impacts on habitat quality. Measures will include: • Undertaking clearing for the geotechnical investigation areas immediately prior to the investigation to limit the time bare ground is exposure to rain, leading to erosion. • Rehabilitating exposed areas as soon as possible to further reduce the likelihood of erosion and sedimentation causing turbid runoff entering waterways. • Installing suitable site-specific controls, that may include earth basins, filters, rock check dams, sediment fences, and sediment traps.
Barriers to movement	In the absence of appropriate design and mitigation measures Project components constructed within waterways may form barriers to aquatic species movement. Barriers to movement may act to isolate species, hindering their ability to thrive. The four bridge crossings will utilise prefabricated Bailey bridges and have been designed to allow aquatic fauna passage. These structures will be removed following the completion of the works. The four existing crossings of Yabba and Sandy creeks that are required to support bridge construction will be upgraded to temporary piped culverts before being converted to concrete bed level crossings. Other existing crossings of Yabba Creek will be upgraded in accordance with the ADR, which will also reduce ongoing maintenance issues with the existing crossings. No other waterways in the Project footprint can support this species. All bed level crossings will be comprised of either roughened concrete or gravel placed and will be placed in line with the	The installation of Bailey bridges to cross Yabba Creek and Sandy creek avoids the introduction of barriers to movement being introduced into the waterways. Should the Main Works not proceed, the bridges will be removed and the area rehabilitated. Upgrades to existing bed-level crossings will be designed and installed to ensure there are no barriers created within the waterway that will impede movement between upper and lower reaches (i.e. no vertical drops greater than 200 mm). For bed level crossings, the crossing entry and exit will be constructed with compact gravel or roughened concrete, which is not expected to pose a barrier to species movement (Dowling, 2024). Utilising a piped-culvert design during the construction of the Bailey bridges will also help to maintain aquatic passage, while also lowering the risk of any interactions with vehicles and minimising negative impacts on water quality and sedimentation. Riparian areas adjacent to the site where the works are proposed to occur will be marked as restricted areas to ensure equipment

White-throated snapping turtle (*Elseya albagula*)		
Potential Impact	**Assessment**	**Mitigation Options**
	existing bed level crossings. The material installed at each respective crossing will be determined by the anticipated volume of traffic (i.e. D50-100 mm rock or similar for low-traffic areas and roughened concrete for high-traffic areas). While upgrades to the existing crossings may temporarily cause a barrier to species movement, this impact will be short-term and confined to the construction period only. The impact pathways include: • structures associated with the construction of waterway crossings (i.e. Bailey bridges, temporary piped culverts, and bed level crossings, sediment fences, bunds).	and machinery that may prevent overland movement of the species is not laid down in these areas. Furthermore, the water pipeline crossings of Yabba Creek will be via directional drilling or overhead suspension to minimise the extent of disturbance and prevent the introduction of structures into the waterway that could serve as a barrier to movement for the species.
Spread of weeds, pests and disease due to increased human activity	Activities undertaken within watercourses may act to spread aquatic weeds without the application of suitable mitigation and management measures. An increased incidence of weeds may cause reduced availability of suitable habitat and resources for the species. Use of construction machinery and movement of construction personnel may spread weeds and pests through the Project area, particularly in areas not previously subject to development/disturbance. Pests may contribute directly to injury or mortality of aquatic species. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area. • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants • invasive animals preying on turtle eggs and hatchlings.	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on turtles. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures. White-throated snapping turtle nests detected in the Project area will be protected from predators by fixing 70-100 cm plastic or wire mesh covers with 10 cm grid-size over nests, which will be kept in place with turf pegs, tent pegs or something suitably similar. The nest will be positioned in the centre of the mesh, preventing predators from burrowing and accessing the eggs, but allowing hatchlings to pass through.
Injury or mortality to individuals	The use of construction machinery within waterways has the potential to directly result in fauna injury or mortality. Aquatic species, including the white-throated snapping turtle, are also at risk of injury or mortality from vehicle strike at the site of the proposed bed level crossings, if they are present. Nesting sites, which may occur within the Borumba PHES Survey area, are prone to disturbance from clearing activities and	Vehicles will aim to traverse the bed level crossing when low flows permit. In such periods, it is expected that there will be visibility of the stream bed which will allow for a visual inspection of any species present. Should any species be present, vehicle movements across the stream will be halted until the species moves either upstream or downstream to avoid the risk of injury or mortality.

White-throated snapping turtle (*Elseya albagula*)		
Potential Impact	**Assessment**	**Mitigation Options**
	earthworks, leading to the injury or mortality of unhatched or juvenile turtles. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site, working within, or crossing, the waterway.	Fauna exclusion fencing appropriate for turtles will be installed perpendicular to the water's edge along the banks between instream works areas and nesting reaches, and around works on banks. This will minimise safety risks to threatened turtle species by preventing turtles from accessing the construction areas. Should any species be observed to be injured at the site of the stream bed crossing, the injured individual will be transported to a vet, if possible. Instream activities and riparian works will be minimised during breeding seasons (March to August for the white-throated snapping turtle). If it is not possible to undertake works outside breeding seasons, pre-clearance surveys upstream and downstream from the works area will identify, map and mark out turtle nesting sites. Any active turtle nests will be identified during pre-clearance surveys and will be mapped out and marked. A restricted area around the waterway crossing works will prevent personnel, vehicles and machinery from approaching active turtle nests. Daily inspections will be done of the fenced areas to inspect for adult and hatching turtles.
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in a temporary increase in noise, vibration, and air emissions, which could potentially impact this species. However, as the Project is largely outside the creeks, with setbacks to work areas, and suitable mitigation controls will be implemented, it is not anticipated that unwanted emissions will impact the species. Artificial light emissions may occur in several locations across the Project area for over 12 months. The use of artificial lighting to support the construction of the Project would particularly impact nocturnal species, affecting their ability to thrive in areas surrounding worksites requiring artificial lighting. For the white-throated snapping turtle, the occurrence of artificial light could result in changes to nesting behaviours, and greater risk of predation of hatchlings or juveniles.	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions include: • Light: instream construction activities will be limited to daytime hours as far as practicable, and only minimal lighting will be installed around buildings at night (which will be on motion sensor to further reduce light emissions). Additionally, shades/shields to direct light downward will be installed, and bright white lights avoided in favour of orange or amber hue lighting where worker safety is not compromised. • Noise: dampening fences will be installed at significant noise sources (e.g. drilling sites/tunnelling sites). Tunnelling activities near the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species).

White-throated snapping turtle (*Elseya albagula*)		
Potential Impact	**Assessment**	**Mitigation Options**
	The impact pathways include: • introduction of lighting necessary to illuminate work areas resulting in changes to animal behaviour, and increased risk of predation • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions • vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	• Air: regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e. low wind speed) only.
Reduced amenity through dust emissions	Earthworks and vehicle movements, particularly on unsealed roads and without the application of appropriate mitigation, are likely to generate dust. Dust may disperse away from construction areas and be deposited within Lake Borumba and associated waterways. In the absence of mitigation this may hinder the white-throated snapping turtle through altering water quality, which may compromise its ability to thrive or result in mortality. The impact pathways include: • construction and use of access tracks used by vehicles and machinery within the Project area.	Mitigation measures to be implemented to reduce the generation of dust emissions include: • regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable • lowering of speed limits across the disturbance area to minimise dust generation • regular cleaning of machinery and vehicle tyres to reduce dust emissions • limiting spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.
Impacts to surface water quality and quantity, release of contaminated water from construction areas	Unauthorised or unintentional releases of contaminated water from construction areas may enter the surrounding environment including waterways. Depending on the nature of the contaminated water and the release quantity and duration, this could compromise the growth and survival of vegetation (both terrestrial and aquatic) nearby. Unauthorised contaminated water that enters waterways or the water table, may direct (e.g. illness) or indirect (e.g. reduced suitability of habitat) impacts on species in areas surrounding or downstream of the initial contamination zone. The impact pathways include: • contaminated runoff or releases associated with site activities may runoff into adjacent waterways, impacting surface water and groundwater.	Potential impacts to water quality will be managed (such as controls for erosion and sedimentation, leaks and spills of hazardous materials and waste, weed and pest species) to mitigate risks associated with the unintended release of contaminated water. To minimise the risk of the accidental release of contaminated water from the Project, a range of water management infrastructure is proposed to capture and treat dirty water (see Section 2.7.3). This includes a water treatment plant capable of treating water to required environmental standards for the Yabba Creek catchment and basins to store dirty and clean water.

White-throated snapping turtle (*Elseya albagula*)		
Potential Impact	**Assessment**	**Mitigation Options**
Contamination from hazardous materials	There is a risk of chemicals, required to support construction activities, spilling or leaking and contaminating suitable White-throated snapping turtle habitat. The extent of the harm such contamination would cause the species is variable and contingent on the extent of the spill and nature of the spilt material. However, it is reasonable to assume that without suitable mitigation, the impacts of such contamination could result in significant mortality to the species. The impact pathways include: • hazardous materials associated with the use of vehicles, machinery, and Project activities may spill or leak onto the ground and run off into adjacent waterways.	The management of hazardous materials on site will be in strict accordance with the CEMP and waste management plan. This will include controls being put in place to limit the likelihood of hazardous materials spilling. Controls will include storage and handling requirements, spill kits, trained personnel handling hazardous materials, and the development of emergency response protocols to respond to, and contain, spills.

Table 102: Significant impact assessment for the critically endangered white-throated snapping turtle (*Elseya albagula*)

White-throated snapping turtle (*Elseya albagula*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of a population	**Unlikely** The number of individuals in the Mary River catchment is unknown, however studies have shown that the population of White-throated snapping turtles has been declining due to data inferred from the paucity in juvenile and immature individuals. Studies in the Mary River catchment showed immature turtles comprising just 18% of the 456 turtles, with excessive egg loss operating on these populations for the last 20 years (Limpus, 2008). The same trends were observed within the Borumba PHES Survey area, with limited recruitment in the area, and no juveniles detected (Hydrobiology, 2023). Eight waterway crossings are proposed, including upgrades to seven existing crossing locations through a combination of bridge structures, temporary piped culverts, or bed level crossings. These areas are mapped as foraging habitat for the species, with suitable nesting habitat also present at a bridge crossing of Yabba Creek and near two bed level crossings as well as the waterway crossings for the temporary water infrastructure. The temporary water pipeline crossings of Yabba Creek will be via directional drilling or suspended overhead, minimising the extent of disturbance.

White-throated snapping turtle (*Elseya albagula*)	
Impact criteria	**Assessment**
	The disturbance or temporary loss of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Project footprint is unlikely to reduce available breeding, foraging, or dispersal resources such that this loss would likely lead to a long-term decrease in the size of the population, as the species is likely to persist in the area, in the remaining 184.2 ha of foraging habitat and 6 ha of nesting habitat within the Borumba PHES Survey area, and within the greater Mary River catchment. Due to the temporary nature of the proposed action, any indirect impacts associated with the works that may disturb the species are unlikely to lead to a decrease in the size of a population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	**Unlikely** The AOO is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The Conservation Advice states that the AOO is estimated to be <500 km^2 (DOE, 2014). Eight waterway crossings are proposed, including upgrades to seven existing crossing locations through a combination of bridge structures or bed level crossings. These areas are mapped as foraging habitat for the species, with suitable nesting habitat also present at a bridge crossing of Yabba Creek and near two bed level crossings as well as the waterway crossings for the temporary water infrastructure. The temporary water pipeline crossings of Yabba Creek will be via directional drilling or suspended overhead, minimising the extent of disturbance. The disturbance or temporary loss of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Exploratory Works Project footprint is unlikely to result in any changes to the species AOO as it is a very small area compared to the greater 184.2 ha of foraging habitat and 6 ha of nesting habitat within the Borumba PHES Survey area, and within the greater Mary River catchment. The temporary disturbance of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of the species.
Fragment an existing population into two or more populations	**Unlikely** The population is found in three different catchments including the Fitzroy, Mary and Burnett catchments. It has been shown that populations of the white-throated snapping turtle in the Fitzroy catchment have been separated from the Mary and Burnett catchments for an extended period, producing two lineages, which can be considered to be Evolutionarily Significant Units (Todd, et al., 2013). Current barriers such as dams and weirs within the catchments have fragmented the population, but individuals have been seen to move over or around such infrastructure (DOE, 2014). As a result, “the Committee does not regard fragmentation as severe”.

White-throated snapping turtle (*Elseya albagula*)	
Impact criteria	**Assessment**
	The proposed activities for the Project do not create new dams or weirs or establish other instream barriers. Therefore, it is considered unlikely that the Exploratory Works Project will fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely** Habitat critical to the survival of the species includes mapped foraging and nesting habitat which meet the requirements stated in Table 100. The Exploratory Works Project will not impact known aggregated nesting sites but may impact parts of the river system that support habitat critical to the survival of the species. Eight waterway crossings are proposed, including upgrades to seven existing crossing locations through a combination of bridge structures, temporary piped culverts, or bed level crossings. These areas are mapped as foraging habitat for the species, with suitable nesting habitat also present at a bridge crossing of Yabba Creek and near two bed level crossings as well as the waterway crossings for the temporary water infrastructure. Four temporary piped-culvert crossings within Area 4 (Borgan) will be used until Bailey bridges are implemented, after which the crossings will be converted back to bed level crossings. The Bailey bridges were selected because they can be removed and have a smaller footprint than other bridges. The design of the bridges means they will not impede flow and disturbance from their construction will largely be on the high banks. The bridges will be removed at the completion of the Project if the Main Works do not proceed, and the area rehabilitated (Appendix C). Furthermore, preliminary modelling for the bridges shows no notable change to the flow when the bridges are installed to cross Yabba and Sandy creeks. The bed level crossing at Area 1 (Borumba Dam) will be in place for the duration of the Project (~2 years). It is an area accessed for maintenance of Borumba Dam and will be constructed by placing gravel on the bed, which will minimise disturbance of fine sediments on the bed. Upgrades to the bed level crossings over Yabba Creek in Area 3 (Walkers Top) will comprise either gravel or roughened concrete and will not disturb any segment of waterway not already utilised and disturbed as a crossing. The temporary water pipeline crossings of Yabba Creek will be via directional drilling or suspended overhead, minimising the extent of disturbance. If the Main Works Project does not proceed, these areas will be rehabilitated to pre-disturbance conditions. As such, it is considered unlikely that the proposed action will adversely affect habitat considered critical to the survival of the species.
Disrupt the breeding cycle of a population	**Unlikely** The home range of white-throated snapping turtles are relatively small, utilising stream lengths of less than 1 km (DAWE, 2020).The white-throated snapping turtle does not appear to migrate to nest either, with females nesting on alluvial sand-loam banks near Tiaro, and between Traveston and Kenilworth within the Mary River catchment. This is located outside the Borumba PHES Survey area. Within the Borumba PHES Survey area, there is 6 ha of nesting habitat for the white-throated snapping turtle. Most of the nesting habitat is upstream of Lake Borumba in Yabba Creek although no nests have been observed within the

White-throated snapping turtle (*Elseya albagula*)	
Impact criteria	**Assessment**
	Borumba PHES Survey area and neither have any juveniles nor breeding pairs (Hydrobiology, 2023; Hydrobiology, 2022). Should the white-throated snapping turtle nest within the Exploratory Works Survey area, the Exploratory Works could potentially disrupt the breeding cycle due to downstream impacts associated with decreased water quality, increased sedimentation and altered flow regimes. In light of this, the proposed action will aim to avoid construction on creek banks with dense overhanging riparian vegetation, where possible, to retain suitable breeding places. Furthermore, instream and riparian works will be minimised during the breeding season for the white-throated snapping turtle which occurs from October to January. If this not achievable, pre-clearance surveys will identify, map, and mark out turtle nesting sites. No bank disturbance will be undertaken until a suitably qualified person has checked the banks (30 m upstream and downstream of the proposed works) for fauna and nesting sites. Any identified nests will then be protected using exclusion fencing or other protective measures. The proposed works will impact 0.1 ha of nesting habitat. With no current breeding places within the Exploratory Works Survey area, and relatively small size of direct loss of nesting habitat, the Exploratory Works Project is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While disturbance of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Project footprint is anticipated to result in a temporary decrease in the availability of habitat for the species, this is unlikely to result in a decline of the species, given the remaining 184.2 ha of foraging habitat and 6 ha of nesting habitat within the Borumba PHES Survey area. The impacts of constructing Bailey bridges and bed level crossings across Sandy and Yabba creeks may temporarily decrease the quality of habitat for the species. The impacts include dust, light, air and noise emissions, and downstream impacts involving decreased water quality, increased sedimentation, and altered flow regimes. However, it is considered unlikely, due to the temporary nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	**Unlikely** Invasive aquatic and terrestrial species have been identified as a low priority threat to this species. The Exploratory Works Project is not anticipated to elevate the risk of aquatic weed occurrences beyond the current scenario. Relevant to invasive and exotic fish the impacts are considered consistent with the current scenario. In addition, no significant works or infrastructure will be required in waterways. The works does not involve the construction of any permanent barriers including the use of Bailey bridges and pipeline directional drilling or overhead suspension. These crossings will be temporary (<2 years) to allow access to the sites. Nevertheless, management actions provided in the CEMP (Appendix F) will be implemented to ensure the introduction of invasive species is avoided, water quality and habitat does not decrease from pre-construction levels and become conducive to invasive aquatic species. The Exploratory Works Project will unlikely result in the establishment of invasive species.

White-throated snapping turtle (*Elseya albagula*)	
Impact criteria	**Assessment**
Introduce disease that may cause the species to decline	**Unlikely** As no diseases are known to adversely impact the species, it is not expected that the Exploratory Works Project will introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** The Project will not exacerbate the highest priority threat to this species, which is predation at nesting sites, and trampling and crushing at aggregated nesting sites. No in-stream barriers are planned as part of the Exploratory Works therefore fragmentation is not a significant risk to the species either. It is known that the species utilises the Borumba PHES Survey area for foraging, however no active nesting sites have been observed. Therefore, the Project will not be directly impacting the breeding cycle of a population. The action however may contribute to the following threats recognised in the draft Recovery Plan: • loss/degradation of riparian and in-stream habitat • water flow management • potentially vehicles crossing rivers impacting individuals. Management actions will be implemented to avoid significant impacts to species foraging and nesting habitat. To minimise the loss and degradation of riparian and in-stream habitat, the proposed action will avoid construction on creek banks with dense overhanging riparian vegetation, where possible, to retain suitable breeding places. Preliminary flow modelling for the bridges shows no notable change to the flow when the bridges are installed to cross Yabba and Sandy creeks. No bank disturbance will be undertaken until a suitably qualified person has checked the banks (30 m upstream and downstream) for fauna and nesting sites. To avoid collisions, daily inspections of fenced areas will be inspected for adult and hatching turtles. The proposed works will impact habitat critical to the survival of the species, the direct loss of 0.5 ha of foraging habitat and 0.1 ha of nesting habitat within the Exploratory Works Project footprint is unlikely to interfere with the recovery of the species, as it is a very small area compared to the greater 184.2 ha of foraging habitat and 6 ha of nesting habitat within the Borumba PHES Survey area. It is not expected that the action will exacerbate the primary threats to the species, including predation and disturbance to nest sites. Therefore, the action is not likely to interfere with the recovery of the species.
Recommendation:	Significant impact is **Unlikely**

7.3.12 Yellow-bellied glider (*Petaurus australis australis*)

The Project has the potential to significantly impact the yellow-bellied glider (*Petaurus australis australis)*, which is listed as vulnerable under the EPBC Act. This section provides the following:

- In Table 103, information on the species, including a habitat description, current known distribution, previous desktop records, a definition of habitat critical to the survival of the species, important populations, and threats.
- In Table 104, an assessment of the potential impacts and the suite of mitigation measures developed for the Project.
- In Table 105, an assessment against the significant impact criteria for species listed as vulnerable under the EPBC Act.

The extent of suitable habitat (i.e. denning and foraging) within the Borumba PHES Survey area, the Exploratory Works Survey area, the Project area, and Exploratory Works Footprint, and the locations of yellow-bellied glider are shown on Figure E-12, which is contained in Appendix E. It should be noted there is a single record of a yellow-bellied glider outside the mapped extent of suitable habitat for the species. This is likely to be an errant individual temporarily venturing outside the species' suitable habitat, rather than indicative of an individual permanently residing in areas of unsuitable habitat.

The significant impact assessment undertaken in Table 105 identified that the Project is **likely** to result in a significant impact on yellow-bellied gliders.

Table 103: Description of the yellow-bellied glider (*Petaurus australis australis*)

Yellow-bellied glider (*Petaurus australis australis*)	
Profile	**Conservation status:** Vulnerable **Habitat:** The Conservation Advice for the species states the yellow-bellied glider occurs in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests, with a preference for large patches of mature old growth forest that provide suitable trees for foraging and shelter (DCCEEW, 2022). The species has a specialised diet that consists primarily of sap from eucalypts but also includes components of eucalypt nectar and arboreal invertebrates. The reliance on a particular food resource (e.g., nectar) varies according to seasonal availability and the species is therefore reliant on diverse forests for habitat (DAWE, 2022). The species requires large, preferably living, hollow-bearing trees to facilitate breeding and sheltering. Preferences are typically shown for large (>50 cm DBH), smooth-barked eucalypt species. **Distribution:** The Conservation Advice for the species states the yellow-bellied glider is found at altitudes ranging from sea level to 1,400 m above sea level and has a widespread but patchy distribution from south-eastern Queensland to far south-eastern South Australia, near the Victoria-South Australia border (DAWE 2022). Most of the Queensland distribution is coastal, extending southward along the eastern seaboard from north of Mackay and continuing through the NSW-Qld border. However, isolated subpopulations are found inland in the Blackdown and Carnarvon Ranges of central Queensland (DAWE 2022). **Previous records:** ALA records show the species has been previously recorded within 10 km of the Project footprint (ALA, 2023). • **Habitat Critical to the Survival of the Species:** The Conservation Advice defines habitat critical to the survival of yellow-bellied gliders as any of the following (DAWE, 2022): – large contiguous areas of floristically diverse eucalypt forest, which are dominated by winter-flowering and smooth-barked eucalypts, including mature living hollow-bearing trees and sap trees – areas identified as refuges under future climate change scenarios

Yellow-bellied glider (*Petaurus australis australis*)	
	– short or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas – habitat corridors required to facilitate dispersal of the subspecies between fragmented habitat patches and/or that enable recolonisation or movement away from threats – areas in which some trees have evidence of use for sap extraction by yellow-bellied glider (south-eastern). In light of these criteria, the Borumba PHES Survey area is considered to support habitat critical to the survival of the species as it comprises large contiguous areas of floristically diverse eucalypt forest, dominated by winter-flowering and smooth-barked eucalyptus, including mature living hollow-bearing trees and sap trees. **Important Populations:** The Conservation Advice for the species (DAWE, 2022) does not specifically identify the local population as an 'important population', however advice recommends that all known populations for which genetic and breeding information is not available should be considered 'important populations'. As there is no genetic or breeding information available for the local population, it is considered an 'important population'. **Threats:** The Conservation Advice for the species identifies the following threats to the yellow-bellied glider: • climate change • altered fire regimes • habitat clearing • predation by invasive species • mortality by barbed wire fencing • habitat fragmentation • timber harvesting.
In the Survey area	**Survey effort:** Surveys, including habitat assessments were undertaken between May 2022 and July 2024 in accordance with the Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011). Thermal drone surveys have also been undertaken targeting this species and other arboreal mammals. Surveys were undertaken within the Borumba PHES Survey area, which includes the Exploratory Works Survey area and an area extending beyond the Exploratory Works Survey area boundary. Figure E-12 presents the Exploratory Works Survey area and the Borumba PHES Survey area. Further information on the survey effort is provided in Appendix M**.** **Species occurrence:** While 21 records of yellow-bellied glider were detected within the Borumba PHES Survey area, 19 species observations were recorded in the Exploratory Works Survey area. The species observations were concentrated in habitat associated with Area 4 (Borgan). It is noted that one record occurs outside mapped habitat. This is likely to be an errant individual temporarily venturing outside the species' suitable habitat, rather than indicative of an individual permanently residing in areas of unsuitable habitat. Figure E-12 presents the observations within the respective work areas. **Habitat**: 2,959 ha of denning habitat and 94.4 ha of foraging habitat occurs within the Borumba PHES Survey area, of which 676.3 ha of denning habitat and 0.2 ha of foraging habitat occurs in the Exploratory Works Survey area. A conservative approach was taken in mapping habitat for the species. Denning habitat is mapped as any areas of remnant vegetation greater than 50 ha in area with at least one large tree as a surrogate for a hollow-bearing tree, which are typically more than 50 cm DBH. Foraging habitat is mapped as any remnant and regrowth areas either connected to or within 50 m of denning habitat that includes vegetation with a high diversity of known foraging tree species including *Angophora leiocarpa, Corymbia intermedia, Eucalyptus tereticornis, E. propinqua,* and *E. grandis.*

Yellow-bellied glider (*Petaurus australis australis*)	
	Present threats on the species: • invasive fauna including feral foxes and cats may predate on the species, and feral deer may degrade habitat by rubbing, trampling and grazing on saplings of habitat trees. • barbed-wire is present and associated with Borumba Dam and associated infrastructure. • disturbance from fire, grazing and logging were observed throughout RE 12.11.10 but at low severity.

Table 104: Assessment of potential impacts and mitigation options for the yellow-bellied glider (*Petaurus australis australis*)

Yellow-bellied glider (*Petaurus australis australis*)		
Potential Impact	**Assessment**	**Mitigation Options**
Vegetation clearing and habitat degradation	The Project is anticipated to result in the clearing of 35.3 ha of denning habitat for the yellow-bellied glider habitat. No foraging habitat for the species will be cleared. The removal of denning habitat for the species has the potential to adversely impact the species as the area available for denning will be reduced, potentially putting pressure on the remaining available habitat able to be utilised by individuals. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks, geotechnical investigation sites, and spoil areas.	The proposed Project footprint has been redesigned to avoid as much habitat for species, including the yellow-bellied glider (southern and central), as possible. Where vegetation clearing is unavoidable, to mitigate the impact of direct habitat loss, the following measures are proposed to minimise the clearing of vegetation, with further information provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Pre-clearance surveys Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim to identify, map, and mark out restricted areas, and potential habitat trees (i.e. sap trees and hollows-bearing trees) to inform the approach to vegetation clearing. • Works micro-siting Working with the construction contractor to relocate infrastructure or optimise clearing (including micro-siting) extents to avoid or minimise habitat loss and fragmentation. Works will aim to avoid the clearing of sap trees and hollow-bearing trees (>1 m DBH) in accordance with the Conservation Advice for this species. Sap trees and hollow-bearing trees will be clearly marked, and GPS locations recorded and all effort will be made to avoid these

Yellow-bellied glider (*Petaurus australis australis*)		
Potential Impact	**Assessment**	**Mitigation Options**
		trees, with a preference given to clearing smaller (non-hollow bearing trees) over mature hollow bearing trees. • Restricted areas Prior to the commencement of vegetation clearing, flagging tape, barricade fencing, fluorescent markers, signage, or a combination of these measures will be installed to clearly delineate restricted areas and clearing boundaries. This will avoid unnecessary clearing and ensure personnel and vehicle(s) stay within the approved Exploratory Works Project footprint, avoiding contravention of disturbance limits. • Hollow salvaging Where hollow-bearing tree removal cannot be avoided, the hollow to be impacted will be assessed prior to clearing to determine if they meet the minimum requirements for a yellow-bellied glider. Where possible, suitable hollows will be salvaged and installed on a nearby tree in suitable habitat. Nest boxes and/or carved hollows will also be installed on a 1:1 basis at a minimum to replace cleared hollows as per the hollow replacement strategy described in the FFMP (Appendix J of CEMP (Appendix F). It is noted the replacement of hollows is an added measure and does not contribute to the impact assessment on the species. Monitoring of both natural and artificial hollows will be undertaken, drawing on established frameworks such as those outlined in the Habitat Survey for Bushfire Recovery for Wildlife and Habitat Community Grants Program (Croft, 2020) to guide effective placement and maintenance.
Habitat fragmentation	The Project would result in the clearing of 34.1 ha of habitat for the yellow-bellied glider. Habitat clearing has the potential to result in habitat fragmentation for species, if patches of suitable habitat become isolated from other areas of suitable habitat. However, as the proposed works will retain large tracts of contiguous suitable habitat that provides connectivity to adjacent suitable habitat and the majority of the works comprise narrow tracks (<6 m wide) with only a few areas where clearing is >6 m,	Clearing in yellow-bellied glider habitat will primarily consist of creating narrow, linear tracks (no more 6 m width) in vegetation. Based on an average glider ratio of 2.0 these linear gaps will not impede movement noting that the crown cover will likely also extend over parts of the tracks and the drill sites in all locations. Where larger tracts of yellow-bellied glider habitat are proposed to be removed (i.e., lower dam wall), contiguous sections of suitable

Yellow-bellied glider (*Petaurus australis australis*)		
Potential Impact	**Assessment**	**Mitigation Options**
	it is unlikely fragmentation of yellow-bellied glider habitat will occur. As per the Conservation Advice for this species, the subspecies has very low dispersal capabilities over spaces larger than its gliding distance. The maximum gliding distance may be up to 120 m, though management should be informed by average gliding performance which is suggested to be a glide ratio (horizontal distance/height dropped) of 2.0. The impact pathways include: • vegetation clearing of suitable habitat to establish access tracks and geotechnical investigation sites.	habitat will be retained around the proposed works to allow continued species movement and negate potential isolation. In this regard, the Project is unlikely to cause habitat fragmentation such that the species is likely to avoid areas of previously suitable habitat. Despite this, measures are outlined in the CEMP which will facilitate movement including micro-siting of works to avoid and/or minimise clearing.
Injury or mortality to individuals	During vegetation clearing, there is potential for direct mortality if yellow-bellied gliders are present (i.e., denning in hollow-bearing trees to be cleared). The risk of vehicle strike or machinery strike is considered negligible. The impact pathways include: • injury or death from vehicles and/or machinery necessary for Project activities including earthworks, vegetation clearing, geotechnical investigations, tunnel works, internal transport of materials around site • injury or death during tree felling procedures, necessary for clearing works.	To mitigate the risk of injury or death to yellow-bellied gliders that may be present in or near the Project footprint during vegetation clearing, the following mitigation measures are proposed with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • General Minimise works in glider habitat during the breeding period (spring – summer). Works will aim to avoid the clearing of sap trees and hollow-bearing trees (>1 m DBH) in accordance with the Conservation Advice for this species. Avoid clearing large trees (>30 cm DBH). Wherever possible, the use of barbed wire fencing will be avoided across the Exploratory Works. Off-track driving will not be permitted and reduced speed limits will be enforced near suitable habitat, with appropriate signage on site. Undertake a prestart toolbox at commencement this action of works to inform the work party of potential and/or confirmed presence of gliders and key habitat features in the area and planned procedure to manage these values. • Pre-clearance surveys

Yellow-bellied glider (*Petaurus australis australis*)		
Potential Impact	**Assessment**	**Mitigation Options**
		Pre-clearance surveys will be undertaken by a qualified ecologist and/or FSC with the aim of identifying, mapping, and marking out restricted areas, and potential habitat trees (i.e. sap trees and hollows- bearing trees) to inform the approach to vegetation clearing. • Micro-siting Works will minimise clearing suitable hollow-bearing trees through micro-siting infrastructure. Hollow-bearing trees will be clearly marked, and GPS locations recorded. • Clearing Where not in use hollows that meet the species' requirements will be 'blocked' to prevent breeding during Exploratory Works activities. When Exploratory Works activities are completed in the area, blocked hollows will be reopened as part of site reinstatement / rehabilitation activities. All hollows will be checked by an ecologist and/or FSC prior to the trees being felled. With the FSC to oversee the clearing works. Queensland Hydro will also look at the use of drones to minimise the risk of clearing trees with arboreal species residing in them. If a glider is sighted within 50 m of the activity: – Stop works until a suitably qualified FSC is consulted and advises on the next steps. – Gliders to be left to self-disperse or otherwise directed by FSC. – Works to commence following the approval from the FSC or the environmental officer. Suitable yellow-bellied glider hollows will be replaced on a 1:1 basis with suitable nest boxes for the species based on current best practice, or salvaged hollows from the cleared area. Capture and release those healthy individuals. Any injured animals will be taken to a wildlife carer and/or a vet for treatment. • Other works If a glider is sighted within 50 m of the activity:

Yellow-bellied glider (*Petaurus australis australis*)		
Potential Impact	**Assessment**	**Mitigation Options**
		– Notification is to be provided to the environmental officer immediately. Notification shall include, GPS / general location, adjacent work operations and any movement observations (is it stagnant, moving direction etc). Visual monitoring of the gliders shall occur until advised by environmental officer. – Based on ongoing risk from proposed works and glider behaviour, environmental officer may request works to stop. Works shall recommence following advice from a suitability qualified FSC. • Active breeding location discovery If any active breeding locations are identified, a restricted area will be established, and works will be halted until the animals have moved on or can be safely relocated. This may include clearing around the habitat tree and leaving for a period of 24-48 hours to allow the animals to move on. Trees within confirmed breeding activities will be recorded in the Animal Breeding Place Register and discussed in the Exploratory Works SMP and reported to DETSI/DCCEEW as required.
Spreading pests and weeds	The spread of pests and weeds, particularly cats and foxes, and species that compete for tree hollows, is a known threat to the species. Project activities have the potential to facilitate the spread of weeds and attract pest fauna from areas adjacent to the Project area. However, the strict implementation of appropriate biosecurity measures on machinery, vehicles and material movement is expected to reduce these risks. The impact pathways include: • transport of plant reproductive material or specimens on vehicles, machinery, equipment or material being moved into and between sites within the Project area • facilitation of pest concentration through habitat alteration (vegetation clearing) and potential attractants.	The Project area is already subject to widespread weed and pest occurrence. Queensland Hydro has general obligation under the Queensland *Biosecurity Act 2014* and has developed a Biosecurity Management Plan which aims to manage biosecurity matters on Queensland Hydro land and during construction activities, including the management of pest species known to predate on gliders. Queensland Hydro is also committed to working with adjacent landholders and other asset managers to implement these measures.

Yellow-bellied glider (*Petaurus australis australis*)		
Potential Impact	**Assessment**	**Mitigation Options**
Changes to the local bushfire regime	Inappropriate fire regimes are an identified threat to the yellow-bellied glider. The Project is unlikely to directly result in any alterations to the prevalence of, or alterations to, bushfire regimes. However, the works may pose a temporary elevated risk of generating bushfires as a result of sparks generated from the use of machinery onsite and inappropriate handling or storage of flammable materials and cleared vegetation. Given that the Project area is heavily vegetated, bushfire has the potential to rapidly spread and alter habitat and associated resources. Bushfires are a frequent event in the area with the most recent event in 2021.	Increased bushfire risk will be managed by a range of measures including not parking or idling vehicles in areas of long grass, no smoking on site unless in designated areas, and the completion of risk assessments for “hot work” activities, and daily assessments of the fire danger risk. A bushfire management plan is being developed for all the land Queensland Hydro manages, which will have relevance to the Project. In addition, an incident management plan will be developed by the explosive handler which will include measures around bushfire management. Queensland Hydro will also work with the asset manager and the leaseholder regarding bushfire management within known records associated with Imbil State Forest and potential habitat in the footprint mainly associated with the Conondale Resources Reserve.
Habitat degradation through air, noise, vibration, and light emissions	Project activities are likely to result in elevated noise, vibration, air, and light emissions, which each have the potential to impact the yellow-bellied glider with the species sensitive to disturbance. The introduction of these emission sources may impact the natural behaviour of the species, including their movement, foraging, and breeding habits, or reduce habitat suitability. Most of the emissions sources are associated with the tunnelling works down in the Sandy Creek and Yabba Creek floodplain where this species has not been previously recorded, though habitat is mapped as being present. Further, tunnelling activities in proximity to the ground surface will be temporary and limited to only one month (after which the depth of the tunnelling is not expected to result in vibration emissions at the surface that will impact the species). While high intensity vibratory works are not currently anticipated onsite. The impact pathways include: • the introduction of artificial lighting to illuminate night work (e.g. drilling the deep boreholes and tunnelling works) • tunnelling, blasting, and drilling for the geotechnical investigations and tunnel construction is likely to introduce vibration, noise, and air emissions	While these impacts will be limited to discrete areas throughout the Project area, and temporary in nature, measures to be implemented to mitigate these emissions, including but not limited to below with further details provided in the FFMP, located in Appendix J of the CEMP (Appendix F): • Light Construction activities will be limited to daytime hours as far as practicable however some works will be 24/7 and lighting will be required. In these areas lighting will be designed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023) and with consideration to worker safety. This includes directional lighting (shielding where possible), limiting blue, violet or ultraviolet lights, limiting intensity and managing timing where possible. Lighting impacts will be isolated to the portal pad, staging pad, and civil construction compound and in the vicinity of deep geotechnical boreholes that will be drilled through the night. • Noise/Vibration Works will be undertaken outside of breeding periods, where possible.

Yellow-bellied glider (*Petaurus australis australis*)		
Potential Impact	**Assessment**	**Mitigation Options**
	• vegetation clearing, and vehicle and machinery movement around the site may result in increased air, noise, and light emissions.	Prior to blasting or other high intensity vibratory works commencing, pre-clearance surveys will be undertaken to determine whether breeding is occurring within 200 m of the works. No blasting or other high intensity vibratory works will be undertaken within 200 m of known active breeding sites during breeding seasons unless otherwise approved by a noise/vibration specialist and experienced ecologist. • Air Regular wetting down or covering of areas with the potential to generate airborne dust wherever practicable, lowering of speed limits across the disturbance area to minimise dust generation, regular cleaning of machinery and vehicle tyres to reduce dust emissions, and limitation of the spraying of herbicides, aerosols and other chemicals to suitable weather conditions (i.e., low wind speed) only.

Table 105: Significant impact assessment for the vulnerable yellow-bellied glider (*Petaurus australis australis*)

Yellow-bellied glider (*Petaurus australis australis*)	
Impact criteria	**Assessment**
Lead to a long-term decrease in the size of an important population	**Unlikely** The Project is anticipated to clear 35.3 ha of suitable denning habitat across four separate work areas. The direct loss of 35.3 ha of suitable habitat is unlikely to lead to a long-term decrease in the size of an important population as the species is likely to persist in the area in the remaining suitable habitat. The Project also proposes to clear a number of hollow-bearing trees which has the potential to adversely impact the local population(s). The number of hollows to be cleared however is not likely to lead to the decline in the species with hollows present in adjacent areas in high abundance, while there is an opportunity to micro-site the works to avoid the clearing of canopy trees and hollows given the open nature of the vegetation communities in some areas. Further Queensland Hydro will look to replace any lost hollows as per the hollow strategy outlined in Appendix F. Due to the temporary and in some case localised nature of the Project, any indirect impacts associated with the works that may disturb the species are unlikely to lead to a long-term decrease in the size of an important population. As such, the proposed action is unlikely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	**Unlikely** The area of occupancy (AOO) is defined as the area occupied by a species and is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. The area of occupancy for the yellow-bellied glider is estimated to be 12,724 km^2 (1.3 million ha) (DAWE, 2022). The clearing of 35.3 ha of suitable habitat within which the species has been recorded is unlikely to result in any changes to the species AOO as there are extensive areas of suitable habitat present within the Borumba PHES Survey area and in the surrounding area. The removal of 35.3 ha of suitable habitat is unlikely to remove the species occurrence records in this area and, using an AOO methodology consistent with the IUCN Red List calculation of AOO, the species occurrence within a 2 km x 2 km grid is unlikely to change. In this regard, the works are unlikely to reduce the AOO of an important population.

Yellow-bellied glider (*Petaurus australis australis*)	
Impact criteria	**Assessment**
Fragment an existing population into two or more populations	**Unlikely** As per the Conservation Advice for the yellow-bellied glider, this species is particularly vulnerable to the impacts of clearing and fragmentation due to its large, exclusive home ranges, requirement for large areas of forest, and inability to cross even small areas of cleared land. This is likely evident onsite with the species only recorded from habitat in the proposed upper reservoirs rather than the Sandy Creek and Yabba Creek floodplains despite the riparian zones of these creeks and areas of previously cleared vegetation being mapped as denning habitat. Although approximately 35.3 ha of habitat will be cleared for the Exploratory Works Project, clearing will occur in limited, scattered and isolated areas within extensive contiguous habitat. Cleared areas will generally only create narrow gaps (<6 m) in vegetation and are not expected to interfere with species movement. Where larger tracts of yellow-bellied glider habitat are proposed to be removed (i.e., Area 1 (Borumba Dam) and Area 4 (Walkers Top)), contiguous sections of suitable habitat will be retained around the proposed works that will support species movement. Further, the glide distance of yellow-bellied glider can reach 100 m, though has been documented to average 25.2 m in low-canopy forests (Goldingay, 2014), yellow-bellied glider are likely to be capable of gliding across most gaps created by Exploratory Works within suitable habitat areas noting that for most of the linear infrastructure canopy cover will still persist over most of the cleared areas. Therefore, the removal of vegetation for the Exploratory Works Project will not create a habitat gap or other barrier that would result in fragmentation of the population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** The Exploratory Works Survey area supports habitat critical to the survival of the species as it comprises large, hollow-bearing trees and several winter-flowering and smooth-barked eucalypt species. As the Project is anticipated to result in the direct loss of 35.3 ha of yellow-bellied glider habitat, the proposed action is likely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Likely** This species reproduces seasonally, with a litter size of one and individuals reaching maturity around two years of age. The yellow-bellied glider is social and lives in family groups of two to six individuals occupying an exclusive home range of 50-65 ha shelter (DCCEEW, 2022). Although there are no records of breeding pairs or juvenile yellow-bellied gliders near the Project footprint, as the species is known to occupy habitat near the Project footprint, it is possible that clearing any hollow-bearing trees for the Exploratory Works Project could disrupt a breeding cycle of a population.

Yellow-bellied glider (*Petaurus australis australis*)	
Impact criteria	**Assessment**
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** While clearing approximately 35.3 ha of suitable habitat for the species is anticipated to result in a decrease in the availability of habitat for the species, this clearing is unlikely to result in a decline in the species, given the spatial extent of the clearing and the large areas of suitable habitat that will remain in the landscape. The Project also proposes to clear a number of hollow-bearing trees which has the potential to adversely impact the local population(s). The number of hollows to be cleared however is not likely to lead to the decline in the species with hollows present in adjacent areas in high abundance, while there is an opportunity to micro-site the works to avoid the clearing of canopy trees and hollows given the open nature of the vegetation communities in some areas. Further Queensland Hydro will look to replace any lost hollows as per the hollow strategy outlined in Appendix J in the CEMP (Appendix F). Indirect impacts resulting from the proposed works, including dust, light, air, and noise emissions may temporarily decrease the quality of habitat for the species, however, it is considered unlikely, due to the temporary and localised nature of these disturbances, that it would cause the species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** A broad range of introduced pest animal and plant species are already established in the Borumba PHES Survey area and surrounds with little apparent impact on the yellow-bellied glider population. The Exploratory Works Project is not expected to exacerbate any existing threats or lead to any new invasive species becoming established in the species' habitat.
Introduce disease that may cause the species to decline	**Unlikely** The Conservation Advice does not identify any specific diseases that impact this species. The action is unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely** Despite no recovery plan being adopted for the species yet, a conservative approach suggests the clearing of habitat considered critical for the survival of the species could interfere with the recovery of that species. However, given the relatively minor amount of yellow-bellied glider habitat clearing proposed as part of the Exploratory Works Project, it is considered unlikely the proposed action would *substantially* interfere with the recovery of the species.
Recommendation:	Significant impact is **Likely**

8. Proposed offsets – RFI item 6.1

MNES species and communities found to have a significant, residual impact because of Exploratory Works Project are proposed to be offset under the EPBC Act Environmental Offsets Policy (DSEWPC 2012) (EPBC Act Offsets Policy). The full significant impact assessment and identified SRIs are provided in Section 7 of this report.

Table 106 summarises the MNES required to be offset, relevant impact areas, and the proposed offset delivery approach.

Table 106: Summary of species with a significant residual impact and proposed offset approach

Common name	Scientific name	EPBC Act status	Extent of habitat to be cleared (ha)	Delivery approach
Threatened ecological community				
Lowland Rainforest of Subtropical Australia	N/A	Critically endangered	2.5	Land-based
Threatened flora				
Brush sophora	*Sophora fraseri*	Vulnerable	0.3	Land-based
Scrub turpentine	*Rhodamnia rubescens*	Critically endangered	0.7	Compensatory measures
Threatened fauna				
Black-breasted button-quail	*Turnix melanogaster*	Vulnerable	0.2	Land-based
Glossy black-cockatoo (south-eastern)	*Calyptorhynchus lathami lathami*	Vulnerable	27.9	Land-based
Greater glider (southern and central)	*Petauroides volans*	Endangered	35.2	Land-based
Koala (Combined pop. of QLD, NSW, ACT)	*Phascolarctos cinereus*	Endangered	35.3 (foraging/breeding) and 52.3 (dispersal/refuge)	Land-based
Long-nosed potoroo (northern)	*Potorous tridactylus tridactylus*	Vulnerable	38.0	Land-based
Yellow-bellied glider (southern Subspecies)	*Petaurus australis australis*	Vulnerable	35.3	Land-based

Queensland Hydro propose that environmental offsets for the Exploratory Works Project will primarily be delivered through land-based offsets that meet 100% of MNES offset requirements applying the Offsets Assessment Guide (DSEWPC, 2012). For one threatened flora species, the scrub turpentine, it is proposed 100% of the offset requirement will be delivered through compensatory measures due to significant threats posed by myrtle rust on the species' population. Further details and justification for the compensatory measures are provided in the Exploratory Works Offset Area Management Plan (OAMP) (Appendix I).

The proposed land-based offset areas will support the impacted MNES and associated habitat functions impacted by Exploratory Works such as breeding and foraging habitat. The proposed offsets will deliver habitat quality gains for each MNES, reduce threatening processes and improve connectivity and dispersal. This approach is consistent with the EPBC Offsets Policy.

Further details and justification for the proposed offsets are outlined in the OAMP.

8.1 Offset Area Management Plan – RFI item 6.2

The OAMP outlines how the Exploratory Works Project will meet the requirements of the EPBC Act Offsets Policy. It includes:

- a summary of the significant residual impacts to MNES and identification of the Exploratory Works Project's environmental offset requirements, including a description of the proposed offset site that is supported by mapping (RFI Item 6.2(a))
- how the proposed offset sites provides connectivity within the surrounding landscape (RFI Item 6.2(b))
- information on the contribution of proposed offset sites to relevant State and/or regional plans or initiatives for the conservation of protected matters (6.2(c))
- information on the presence of, and usage by, relevant MNES on and adjacent to the proposed offset sites, and the presence and quality of habitat for MNES in the proposed offset sites (RFI Item 6.2(d))
- an assessment of how the offset and impact sites are like-for-like (RFI Item 6.2(e)), including habitat quality scoring of:
  - impacted areas for each MNES value to be offset
  - offset areas for each MNES including starting and future scores to demonstrate habitat gains over time
  - description of the methodology used to inform the inputs of the Offsets Assessment Guide in relation to the offset site for each relevant MNES (RFI Item 6.2(f))
  - the proposed offset delivery approach and management strategy, including:
    - timeframes for future stages in the offset program
    - final performance outcomes
    - five yearly milestones and associated monitoring to track progress
    - how the strategy addresses and meets all the EPBC Environmental Offset policy principles (RFI Item 6.2(h))
    - details on how the offset areas will be legally secured to provide protection, including timeframes (RFI Item 6.2(g)).

8.2 Offsets for matters of state environmental significance – RFI item 6.2(c)

Most matters of state environmental significance (MSES) likely to trigger an offset requirement associated with the Exploratory Works are also listed as MNES. As such, offset requirements for these matters will be covered by the offsetting arrangements proposed in the OAMP.

There may, however, be a small number of MSES that will require offsetting arrangements in accordance with the Queensland Environmental Offsets Act and Regulation (2014) and the Queensland Environmental Offsets Policy V.1.15 (2023). These are likely to include watercourse vegetation and tusked frog (*Adelotus brevis*). MSES offsets will be outlined in an Offset Delivery Plan and approved by the DETSI. Offset delivery options for MSES include land-based offsets that may be co-located with MNES offsets, or a financial payment to DETSI.

As part of the s34 authority for works within the Conondale Resources Reserve, Queensland Hydro has proposed a financial settlement offset for the clearing required within Conondale Resources Reserve. The offset assessment considered only MSES, noting that the areas do support some MNES including Lowland Rainforest of Subtropical Australia TEC and habitat for koalas and gliders, which are the subject of this Preliminary Documentation and OAMP.

9. Habitat quality assessment – RFI item 7

Habitat quality assessments were undertaken within the impact areas and the proposed offset areas in accordance with Guide to determining terrestrial habitat quality – Methods for assessing habitat quality under the Queensland Environmental Offsets Policy Version 1.2 and the modified habitat quality assessment (MHQA) developed by DCCEEW.

The method is a best-practice approach to derive Habitat Quality Scores (HQS) that can be used to calculate offset obligation for SRI to MNES. The method is intended to generate a HQS that represents:

- key habitat values provided by a site (Site Condition)
- values of its surrounding landscape (Site Context).

When applied to threatened species, HQS also quantifies:

- the value of both the site and the species population (Species Stocking Rate) (flora and fauna)
- the value of species-specific habitat attributes (Species Habitat Index) (fauna only).

HQS are derived by assessing a range of habitat attributes and species-specific indicators based on data collected in the field and through GIS interrogation. In addition to methods outlined in the Guide, the MHQA also incorporates methodology outlined in the Queensland BioCondition Assessment Manual Version 2.2 (BioCondition Manual) (Eyre et al. 2015).

9.1 Description of Assessment Units

Applying the BioCondition Manual methodology, the impact footprint and offset areas have been stratified into 19 and 22 Assessment Units (AUs), respectively. A total of 42 BioCondition and habitat quality scoring sites were established across these AUs in the impact area, and 87 BioCondition and habitat quality scoring sites were established across the AUs in two offset areas.

A comprehensive summary of the methodology for habitat quality assessment, scoring and species-specific habitat attributes for each MNES being offset is provided in the OAMP (Appendix I). A summary of the area, regional ecosystem and condition of each AU in the impact area is presented in Table 107.

With respect to the locations selected for the BioCondition and habitat quality scoring sites within the impact footprint it is noted that some sites are not within the impact footprint. This is because much of the impact footprint is narrow and linear in nature, with many areas also located along and near existing tracks and disturbance. Conducting the assessments in these locations is likely to have resulted in a non-representative score of the broader supporting vegetation community (i.e., would have over-represented the level of disturbance within the impact footprint). As such, in line with the BioCondition Manual, sites were relocated so that they were within areas considered to more accurately represent the vegetation community being assessed.

The MHQA scores are used as the starting habitat quality score out of 10 on the impact site and offset area.

A summary of the MNES proposed to be offset, the respective impact areas, and habitat quality scores on the impact site, based on application of MHQA, are presented in Table 108.

Full calculator scoring sheets have been provided in the OAMP (Appendix I).

Table 107: Assessment units within the impact area

Assessment unit	RE	Condition*	Impact area (ha)^	No. sites	Site reference
1	12.11.10	Non-remnant	1.05	1	HQA318
2	12.11.10	Remnant	2.51	3	HQA68, HQA319, EXI009
3	12.11.14	Non-remnant	37.81	2	HQA107, HQA108
4	12.11.14	Regrowth	7.33	3	HQA218, HQA64, HQA59
5	12.11.14	Remnant	9.21	7	HQA7, HQA83, HQA317, HQA8, EXI004, EXI005, EXI006,
6	12.11.15	Non-remnant	6.88	1	EXI001
9	12.11.3	Remnant	9.09	9	HQA20, HQA208, HQA210, HQA71, HQA86, HQA93, HQA94, EXI008, EXI010
10	12.11.9	Remnant	0.65	2	EXI002, EXI003
11	12.12.12	Non-remnant	5.81	2	HQA226, HQA227
12	12.12.12	Remnant	1.31	1	HQA315
14	12.12.15	Remnant	4.57	4	HQA29, HQA74, HQA78, HQA82
15	12.12.16	Remnant	0.21	2	HQA76, EXI007
16	12.12.23	Non-remnant	0.05	1	HQA101
17	12.12.23	Remnant	1.13	1	HQA316
19	12.3.7	Remnant	2.53	3	HQA40a, HQA41, HQA72

* Non-remnant REs are based on Queensland pre-clear mapping and/or regrowth vegetation observed during field surveys.
^ The total impact area in this table does not include water or plantation areas that are part of the total disturbance footprint

Table 108: Habitat quality scores – impact area

MNES	Habitat quality score	
	Impact area (ha)	Current habitat quality
Lowland Rainforest of Subtropical Australia	2.5	7
Threatened Flora		
Brush sophora	0.3	7
Scrub turpentine	0.7	*Being delivered as compensatory measures. Refer Section 8*
Threatened Fauna		
Black-breasted button-quail	0.2	6
Glossy black-cockatoo	27.9	8
Greater glider	35.2	7
Koala (foraging and breeding)	35.3	8
Koala (dispersal and refuge)	52.3	4
Long-nosed potoroo	38.0	7
Yellow-bellied glider	35.3	7

10. Economic and social matters

The Borumba PHES Project construction is anticipated to deliver social value for stakeholder groups including local and regional communities, local businesses and commerce groups, and Traditional Owner Groups and Indigenous community.

Social and economic benefits from the Exploratory Works Project may include:

- improvements to road access
- patronage of local businesses
- provision of environmental data that may not otherwise be collected to regulatory agencies
- works associated with the delivery of offsets
- assisting in determining the viability of the Main Works, and thus the potential benefits associated with the Borumba PHES Project
- progression of exploratory works phase community benefits initiatives focused on Imbil and Kilcoy streetscape enhancements and related projects, community grants and sponsorships and support for the operation of the Imbil Medical Centre.

Key positive impacts of the construction of the Main Works primarily relate to the provision of economic opportunities and the stimulation of the economy including:

- increase in employment opportunities for residents in the Borumba PHES Project area, nearby population centres, and Gympie Region
- increase in employment and business supply for Indigenous communities and businesses
- increase in business and economic prosperity for local businesses due to increased workforce associated patronage and Project supply opportunities
- increase in business and economic prosperity due to ad hoc increases in demand for local short-term accommodation by Project consultants or short-term contractors
- delivery of priority projects under the Community Benefits Program
- delivery of enabling community infrastructure (such as roads, energy and telecommunications) for the mutual benefit of the project and region.

Once operational, the Borumba PHES Project has the potential to deliver social value for a range of stakeholder groups including:

- increase in employment opportunities for residents of local and regional communities
- alignment with State renewable energy transition objectives and targets
- positive contributions towards wellbeing outcomes for residents and visitors due to restoration of recreation opportunities
- enhance economic diversification in Gympie Region through generation of recreation, tourism, and renewable energy related opportunities associated with the Borumba PHES Project.

Some of the social and economic benefits associated with the Exploratory Works Project are discussed below.

10.1 Social and economic costs and/or benefits – RFI item 8.1

The Exploratory Works Project is a major infrastructure investment requiring significant capital and labour resources to deliver. Substantial expenditure on direct costs, including but not limited to geotechnical investigations, environmental management, temporary infrastructure, civil works, tunnelling investigations, and offsets, is anticipated between 2024 and 2027.

The size and composition of the workforce during the Exploratory Works will vary depending on the activities being undertaken. There are two relatively distinct workforces proposed for the Exploratory Works program, based on the specific skills set required for the tunnelling works compared to the broader geotechnical program. To mitigate potential impacts to housing and accommodation, Queensland Hydro has state approval to construct two TWACs to support the Project, one in Gympie Regional Council LGA and one in the Somerset Regional Council LGA.

These TWACs are not part of the Exploratory Works referred action. Access to the camps will be via the existing road network via Imbil and Kilcoy respectively. The use of the TWACs will reduce the amount of Project traffic manoeuvring across the site and across the two road networks, with dedicated buses to transport workers to site, and limit potential impacts to short and medium term accommodation in the region.

10.1.1 Social assessment

A social assessment, in the form of a Social Assessment and Management Plan (SAMP) is being prepared for the Exploratory Works. The SAMP will:

- identify and assess the social impacts which may occur in local and regional communities during Exploratory Works
- detail the social impact mitigation and benefit enhancement measures (collectively referred to as “management measures”) required to manage significant potential social impacts identified
- provide a framework for Queensland Hydro and its stakeholders to mitigate, monitor, and assess the effectiveness of measures into the future.

The SAMP is part of the Queensland Government’s requirements under the Borumba Pumped Hydro Energy Storage Project Exploratory Works – Geotechnical and Investigations Works Project Report for the Works Regulation established under the *State Development and Public Works Organisation Act 1971 and* is subject to approval by the Queensland Office of the Coordinator-General. The SAMP addresses key matters within the Coordinator-General’s Social Impact Assessment Guideline (DSDILGP, 2018) and will be published on the Queensland Hydro website.

The SAMP has been developed in consultation with stakeholders including the Office of the Coordinator General, and DSDIP, Queensland Hydro’s Stakeholder Reference Group, and Gympie Regional Council, and with future engagement of Somerset, Fraser Coast and Sunshine Coast Councils, Traditional Owner representatives and local Chambers of Commerce.

10.1.1.1 Social study area

The social study area of Queensland Hydro's Exploratory Works activities is determined by:

- the scale and nature of Exploratory Works activities
- the regional and local development context
- key community characteristics that may be affected by Exploratory Works, whether positively or negatively
- how social impacts, whether positive or negative, may be reasonably perceived or experienced by different stakeholders.

Distinct localities within this social study area were defined using the Australian Statistical Geography Standard (ASGS), a hierarchy of social geography developed to reflect the location of people and communities and is used for the publication and analysis of official statistics and other data, including the ABS Census of Population and Housing (ABS, 2023). Analysis of baseline characteristics was undertaken for each of the social study areas within the broader Mary River Catchment to provide context to understanding community identity and values within the social study area.

10.1.1.2 Social and economic matters

Assessment of the social environment, and potential social impacts and/or benefits associated with the Exploratory Works Project are summarised below. Stakeholder and community engagement, which is a core component of the social impact assessment is discussed in Section 10.3.

Workforce development and management

Key workforce and labour market characteristics across the area around the Project include:

- Relative to Queensland, the Gympie and Somerset LGAs are characterised by low rates of labour force participation. This accords with the older age profile of the two LGAs.
- High rates of unemployment in the Gympie and Somerset LGAs relative to Queensland. The estimated unemployment rate in both Gympie and Somerset LGAs has consistently been higher than that for Queensland over the last ten years.

- Youth and indigenous unemployment contributed to a high proportion of total unemployment recorded for the Gympie and Somerset LGAs in 2021. Overall, the number of unemployed persons across both groups have declined in both LGAs compared to five years prior, with youth unemployment recording the greatest decrease.
- In 2022/23, health care and social assistance was the largest industry by employment in the Gympie LGA, followed by construction and retail trade (economy.id, 2024). In the Somerset LGA, manufacturing was the largest industry of employment followed by agriculture, forestry and fishing, and health care and social assistance (economy.id, 2024).
- Engineering and related technologies are the most common skills base in the Gympie and Somerset LGAs. Other prevalent skillsets across Gympie and Somerset include management and commerce and society and culture (QGSO, 2024). Aligning with the skills base of the two LGAs, the common occupations of employment include technicians and trades workers, labourers, community and personal service workers, and managers.

There could be cumulative demand for construction workers over the anticipated construction timeframe of the Exploratory Works, with at least four major road construction projects proposed within the Gympie LGA based on publicly available information. The anticipated construction workforce requirements for these proposed road projects are not known.

Consultation undertaken by Queensland Hydro about the Exploratory Works scope, together with consultation to develop the SAMP, indicate mixed views about the level of workforce visibility and interaction in nearby townships such as Imbil. While the indirect economic stimulus and strong interest in Project updates have generally been viewed positively, stakeholders have also expressed concern about the potential for activities associated with Exploratory Works to affect local business service capacity from labour draw, or to affect existing housing and accommodation, or change local character and values.

The area around the Project is anticipated to have some capacity to supply workers with relevant skills for the Exploratory Works, with greater capacity expected from the regional area. The delivery of the Exploratory Works relies on the procurement of specific work packages. These are promoted on the ICN Gateway portal and expected to achieve varying rates of participation and employment benefit for residents in the area.

The Exploratory Works is expected to generate both positive and negative impacts relating to workforce management measures. While employment opportunities would be generated through the Exploratory Works, the increased demand for unskilled and skilled labour may also increase the potential competition for labour with other businesses and industries in the area.

Housing and accommodation

Townships adjacent to the Project, including Imbil, Kandanga, Brooloo, Amamoor and Dagun fall within the 4570 postcode (Gympie and surrounds), which is used to identify housing statistics (SQM, 2024). Key characteristics of housing and accommodation in the key communities and broader region include the following:

- The regional area had 200,967 dwellings (mostly separate houses) with 10.8% unoccupied. People in this area had higher instances of property ownership and conversely lower instances of renting. Of those who rent, the percentage of public housing was also lower than the state average.
- This region has a labour force of approximately 225,559 people, with a labour force participation rate of 57%. There is an unemployment rate of 4.6%, which is lower than the state average (5.4%), but this low was not experienced in Gympie, where it was 5.9%. Women and youth had a higher incidence of unemployment. Low employment can be reflective of social disadvantage, which can affect access to housing and create vulnerabilities to housing, rental and short-term accommodation prices.
- Trends in residential vacancy rates indicate there is a tight rental market in Gympie and surrounds (represented by postcode 4750) since June 2018. The rental market in Kilcoy and surrounds (postcode 4515) is even more constrained. The adjacent postcodes of 4574 (which includes the suburb of Kenilworth) and 4515 (which includes Kingaham and Jimna) reported consistently lower vacancy rates. The vacancy rates for January 2024, indicate an extremely tight rental market across the Project's postcode study areas (Real Estate Institute of Queensland, 2018).
- The low rental vacancy rates have been accompanied by increased rental costs. Based on median weekly rent data, rental prices have more than doubled in the last three years. It is possible that any changes to local rental capacity may affect vulnerable low-income households significantly due to the related potential for price hikes.

- At the 2021 Census, both Gympie and Somerset LGAs comprised a higher proportion of low-income households compared to Queensland. The average individual and household incomes recorded in both LGAs have also been consistently lower than that Queensland average since 2016 (ABS, 2022).
- Affordable housing is a key dimension of economic wellbeing. Housing stress is considered to occur when households in the lower 40.0% of income distribution spend more than 30.0% of their income in housing costs (rents or mortgage repayments) (AHURI, 2019). The Queensland Government Statisticians Office (QGSO, 2024) indicates an estimated 359 people in the Gympie LGA and 52 people in the Somerset LGA experienced homelessness during the 2021 ABS Census.

Key themes from stakeholder engagement for this assessment, together with results of Queensland Hydro's engagement for the Exploratory Works and Main Works, note concern regarding increased pressure on low-income households, essential workers and other workforce sectors, rental capacity and affordability, and short-term accommodation options. Some stakeholders noted a need to balance camps with provision of future residential structures and identified the opportunity (largely associated with Main Works) to contribute to legacy assets and enhanced local accommodation options.

Consultation with short-term accommodation providers within 1.5 hours drive to the Exploratory Works sites highlights greater fluctuation in demand for businesses in the Walkers Top area, with greater consistency in demand for accommodation around Lake Borumba. Most providers that were consulted highlighted vacancies and the availability of accommodation during the business week while preserving availability for their weekend, long weekend and school holiday visitor trade. Some accommodation providers, therefore, expressed their support of Queensland Hydro's strategy of weekday accommodation bookings to avoid impacts to weekend trade or exclusive bookings.

To support the Exploratory Works two TWACs are proposed. For non-permanent workers such as consultants or short-term contractors, short-term accommodation may also be required. This would temporarily increase the demand for short-term accommodation in the region. The use of TWACs will mitigate potential issues regarding local housing availability.

There is a range of short-term accommodation providers in Imbil and local townships, which include hotels, caravan parks and campgrounds. To some degree, these providers may benefit from the additional demand generated from the Project, and they may opt to increase their rates accordingly, impacting (to a modest degree) tourism activity and expenditure within the region.

The introduction of TWACs may result in increased pressure on local infrastructure and services and perceived declines in social cohesion and community safety. This may generate a general dissatisfaction from local residents, through complaints and the spreading of negative stigma about the Project within the community. The presence of additional, though temporary, population within the catchment may impact on demand for services and goods within the catchment (particularly for any services that may be already underprovided within the region). However, due to the small size of the workforce this impact is likely to be minimal. The use of TWACs, along with appropriate traffic management strategies also mitigates some of the issues associated with the increase in traffic along the local road networks (e.g. damage and congestion to local road networks).

The SAMP identifies that the potential for significant adverse impacts on the capacity and affordability of local accommodation will be appropriately mitigated. However, the short-term demand remains a risk to the potential displacement of low-income, vulnerable, and regular visitor tourism to the local area.

The impacts are mitigated through Queensland Hydro's proposed workforce accommodation solutions (including two TWACs, and a principle-led, combined options approach to interim accommodation use). Queensland Hydro is preparing a Workforce Accommodation and Housing Strategy that will identify priorities for housing aligned with reducing risks to the community and increasing liveability for workers. The Strategy will be aligned with housing management frameworks set out by the Queensland Government, including the *Workers' Accommodation Act 1952* (Qld).

Well-planned arrangements for short-term accommodation use, may also have a positive and stabilising effect on income for tourism accommodation suppliers. Based on business owners' advice to Queensland Hydro, retaining a certain number of existing accommodations for weekend tourism (i.e. accommodation not for use for the Project on weekends) use is an effective strategy for avoidance of impacts to existing tourism markets.

Health and community wellbeing

Key characteristics of health and wellbeing in the key communities and broader region include the following:

- The estimated resident populations (ERP) for both Gympie and Somerset LGA have steadily increased over the ten-year period to 2023, with higher population growth observed in the Gympie LGA (QGSO, 2024). Overall, the ERP across the key communities have remained relatively stable up to 2016, with gradual increases in the population subsequently observed. The population for Imbil peaked in 2023 with 539 residents (QGSO, 2024).
- Between the two LGAs, Somerset is projected to experience the fastest population growth over the 25-year period from 2021 (QGSO, 2024). The anticipated average growth rate for the Gympie LGA is comparatively lower, however the projected population remains larger than that of Somerset LGA.
- Relative to Queensland, both Gympie and Somerset LGA comprise a higher proportion of residents aged 65 years or older and family households with no children. This age profile reflects an ageing population that is likely to become less economically active, require greater access to age-appropriate health and support services, and likely more susceptible to major changes/disruptions in their living environment and community.
- Both Gympie and Somerset LGAs recorded lower average individual and household incomes compared to Queensland. The average individual and household income recorded in both LGAs have also been consistently lower than that Queensland average since 2016 (ABS, 2022).
- Residents surrounding Lake Borumba and Imbil highlight the area as a close-knit community that exhibits strong social cohesion. Imbil township is revitalising and growing with the in-migration of new residents from coastal cities attracted to the lifestyle and surrounding natural environment. Residents have expressed the importance of tourism to the Mary Valley area, both from an economic generation and community perspective. At the regional level, residents of the Gympie LGA value the scenic environment, strong sense of community, friendly people, strong economy, and the level of services and facilities available (Gympie Regional Council, 2023).
- Imbil hosts a small number of social infrastructure and services including a primary/secondary school, outdoor education centre, day care centre, and limited capacity emergency service. Health/medical services are currently limited in Imbil with the nearest service located in Kenilworth (general practice) and Gympie (hospital as well as health and medical centres). As the main population and service centre of the Gympie LGA, a wide range of social infrastructure and services can be accessed in Gympie (city) including local and state government services as well as community support services. Kilcoy is the closest population and service centre to the Walkers Top area, with a hospital, emergency services, schools, and community support services available.
- Yabba Creek Road is the main road though Imbil town centre and is the main access route connecting Lake Borumba to Imbil and other key communities in the Gympie LGA. Yabba Creek Road reduces from two lanes to a single lane at a number of crossings across Yabba Creek and can be susceptible to flooding. Bella Creek Road is accessed from Yabba Creek Road and traverses the northern part of Borumba Dam. The road is a rural gravel road that is susceptible to frequent flooding. Stakeholders have raised flood islands as a critical issue with lived experience of being cut off from Imbil during flood events due to inaccessible roads.

The Exploratory Works will generate both positive and negative impacts relating to health and community wellbeing. Construction activities are anticipated to result in some pronounced traffic and amenity impacts while the overall positive effect on health and wellbeing is expected to be generated through increased community benefits and investment opportunities.

10.1.2 Economic costs

The economic assessment of the Borumba PHES Project comprised two key components:

- Economic impact analysis using Ernst & Young's CGE modelling to assess the direct market-related impacts of the Borumba PHES Project.
- Qualitative analysis of the Borumba PHES Project's broader economic implications, including social and environmental impacts, and the Borumba PHES Project's role in providing complementary electricity market services.

As a major project in a regional area, the Exploratory Works have the potential to temporarily impact the businesses, labour and amenity in the immediate vicinity. Potential adverse impacts during the Project include pressure on the local labour market, reduced tourism activity, and impacts on road use, the environment, residents' health, cultural concerns, and short-term accommodation. Potential benefits from the Exploratory Works include

use of short-term accommodation in periods where there may otherwise be low vacancy (e.g. weekdays), and patronage of local businesses.

The Borumba PHES Project is expected to generate significant benefits at the regional and state level and is likely to involve some reallocation of labour and capital to support the Project. Initial analysis found the Borumba PHES Project is anticipated to support significant growth in gross regional product by just over $5 billion to 2050 (net present value (NPV)) to the Southern Queensland Renewable Energy Zone, highlighting tangible benefits from the infrastructure investment and ongoing operations.

10.2 Economic benefits and employment opportunities – RFI item 8.2

10.2.1 Business and industry

The construction industry is the key industry within the Gympie LGA, accounting for 21.0% of total economic output generated by the Gympie economy in 2022/23. Within the Somerset LGA, manufacturing is the key industry, accounting for 34.0% of total economic output generated by the Somerset economy during the same period. Other key characteristics of local business and industry within the LGAs include:

- As of June 2023, over 60% of registered businesses in both LGAs were non-employing businesses, such as sole traders, followed by almost a quarter with one to four employees (ABS, 2023). Of the registered businesses, the largest proportion comprised of agriculture, forestry and fishing businesses. Construction businesses accounted for the second highest proportion of total businesses.
- Imbil is the closest town to Lake Borumba and offers a range of small businesses including a pharmacy, butcher, post office, hardware store, grocer, bakery, food outlets, and short-term accommodation. Outside of Imbil, similar small businesses can also be found in the communities of Kandanga and Amamoor, while a greater range of small businesses is available in Kenilworth. Stakeholders have expressed concerns around how existing businesses in the region may be affected by the labour demand of the Exploratory Works particularly labour drain from existing employers and the availability of workers needed to support business operations.
- Value add by industry is an indicator of business productivity and can provide insight to the structure of an LGA's economy. In 2022/23, construction was the most productive industry in the Gympie LGA, while manufacturing was the most productive industry in the Somerset LGA. Agriculture, forestry and fishing was the second most productive industry across both LGAs (economy.id, 2024).
- Agriculture is an important industry and contributor to the economies of Gympie and Somerset LGA, with livestock slaughtering being the largest commodity produced across both LGAs. Other key agricultural commodities produced include vegetable and crops for hay in Somerset LGA and dairy and citrus fruit in Gympie LGA (economy.id, 2024).
- Tourism is also an important industry to both the Gympie and Somerset LGAs economies. In 2021/22, domestic tourists contributed around $180.2 million towards Gympie's economy, while in the Somerset LGA domestic contributed around $52.7 million to Somerset's economy (economy.id, 2024).
- A search of the Black Business Finder and Indigenous Business Direct (Supply Nation) in May 2024 identified eight Aboriginal and/or Torres Strait Islander owned businesses registered in the Gympie LGA and two in the Somerset LGA (Black Business Finder, 2024). Services provided by these registered businesses include building and civil construction, equipment hire solutions, earthmoving and excavations, labour hire, workforce training, electrical trades, specialist First Nations consultancy services, and digital marketing.

The Exploratory Works will generate both positive and negative impacts relating to local business and industry procurement. While the Exploratory Works is anticipated to generate a range of supply and procurement opportunities, some existing businesses may potentially experience diminished capacity due to increase in competition for labour and subsequent labour draw.

10.2.1.1 Employment opportunities

The Queensland Government is committed to 'buy local' to provide local businesses with access to the government market and stimulate regional economies. This commitment for a portion of workers to be sourced locally provides an opportunity to reduce the region's unemployment rate and for particular population groups where unemployment rates are high (such as Indigenous people and young people).

In December 2023, the unemployment rate was 5.5% for the Gympie LGA and 4.9% for the Somerset LGA. This reflects both a lack of job opportunities and an availability of labour supply in the Gympie region, which could benefit from the additional jobs provided by the Exploratory Works Project.

There is potential for some degree of unskilled labour to be employed by the Exploratory Works Project, providing opportunities for employment for a small number of residents within the local area. The volume of local residents benefiting from additional employment is likely to be small, however the value of employment to each of these residents may be significant, including through access to incomes, improved self-esteem, improved sense of identity, improved opportunities for social interaction and personal development (AIHW, 2023). Workers may also benefit from the development of new skills which would not otherwise have been gained, posing long-term benefits to the region through skills development.

10.2.1.2 Local business opportunities

Queensland Hydro is required to align with the Queensland Procurement Policy 2023, that values the participation of local, regional, social and Indigenous businesses in procurement opportunities. Queensland Hydro is also committed to 'buy local' to provide local businesses with access to the government market and stimulate regional economies.

During the Exploratory Works, local businesses may experience an increase in business opportunities and enhanced revenues from supply and procurement opportunities as well as induced expenditure by workers. Local retail businesses (such as retail outlets, food and beverage providers and other retail offerings) may benefit from modest incidental expenditure as a result of the workforce located in the region.

There is potential for some local businesses to benefit from local procurement in support of the Exploratory Works. Where local business skills are appropriately matched to those of the Project and available to meet the demand, these businesses may benefit from the Exploratory Works Project.

Where local businesses are engaged as part the Exploratory Works, it is possible other local Projects may be delayed or curtailed due to some crowding out pressures in the market and constrained access to skills in peak construction periods. This risk may be managed through consultation and engagement with businesses and local government.

10.2.1.3 Pressure on the local labour market

The Project workers are likely to be sourced locally and be drive-in drive-out from the region, where possible.

Depending on local economic conditions, a prominent local labour force could have ramifications for the broader labour market, resulting in competition for labour with local businesses which might result in higher wages, impacting on local businesses' access to workers.

10.2.1.4 Summary of Impacts

Queensland Hydro is committed to developing and implementing a Local Content Policy to maximise opportunities to local and regional business to supply to the Borumba PHES Project (Exploratory and Main Works) where feasible.

Underpinning the development of the Local Content Policy will be the principles and processes captured in the Queensland Procurement Policy 2023, which values the participation of local, regional, social, and indigenous businesses in procurement opportunities.

Queensland Hydro will endeavour to promote and participate in a range of supplier development workshops and educational sessions (including Capability Statement and Tendering for Business workshops and sessions on supplying to major projects) facilitated by DSDIP. Queensland Hydro's involvement in these sessions is focused on communicating information about the Borumba PHES Project, and what businesses need to do to get involved.

10.2.2 Tourism

Lake Borumba's primary function is providing water resources to the Mary Valley agricultural area. However, the lake is also utilised for tourism and recreational purposes, including fishing and boating, powered water sports (water skiing, jet skiing and tubing), non-powered water sports (rowing, canoeing, kayaking), dirt biking, horse riding, birdwatching, picnicking, sightseeing, and camping. Based on results from a community survey, the most popular activity to Lake Borumba visitors is camping, followed by fishing, boating, and picnicking/sightseeing.

The Exploratory Works are not expected to restrict public access to the lake, the lake day use area, boat ramp parking and general parking. The Lake Borumba Caravan and Campground will also remain operational. However, some public amenity impacts may result, specifically noise impacts, from the geotechnical program proposed downstream of the dam and near the Lake Borumba Caravan and Campground.

The majority of the Exploratory Works will occur within Queensland Hydro landholding where there is currently no public access or existing recreational use. Similarly, where the works occurs within the Conondale Resources Reserve there are no public facilities, including hiking trails.

10.3 Public stakeholder consultation – RFI item 8.3

10.3.1 Consultation to September 2024

This section summarises stakeholder engagement activities carried out for the Borumba PHES Project and feedback received during Powerlink Queensland (Powerlink) engagement from quarter four 2021 to quarter three 2022 (when Powerlink was responsible for developing the Borumba PHES Project), and during Queensland Hydro engagement from quarter four 2022 to present, including specific engagement on Exploratory Works.

10.3.1.1 Powerlink engagement

From quarter 4 2021 to quarter 3 2022, Powerlink provided opportunities for stakeholders to provide feedback on the Borumba PHES Project Exploratory and Main Works through phone, email, meetings, a workshop, and community information sessions. Activities were carried out in line with the Borumba PHES Project stakeholder engagement plan. Engagement activities included:

- holding stakeholder engagement events in Kandanga, Imbil, and Gympie
- launching the Borumba PHES Stakeholder Reference Group and holding two Stakeholder Reference Group meetings
- maintaining the Borumba PHES Project email address and general enquiries number to enable Powerlink to hear from stakeholders
- maintaining the interactive Project map to enable stakeholders and community members to ask questions about the Borumba PHES Project
- sharing fact sheets via the Borumba PHES Project website and stakeholder emails.

Under Powerlink's custodianship, major stakeholder engagement events undertaken included:

- stakeholder information sessions in Imbil (1 December 2021, 20 April 2022, 13 July 2022, and 23 November 2022) and Gympie (2 December 2021, 21 April 2022, 14 July 2022, 24 November 2022)
- stakeholder workshop to introduce the Borumba PHES Project to stakeholders (2 December 2021)
- stakeholder meeting with traffic and transport stakeholders in Kandanga (11 October 2022)
- environmental stakeholder groups meeting in Kandanga to discuss study scope for the water quality and terrestrial and aquatic ecology studies (30 March 2022)
- Stakeholder Reference Group meetings in Gympie (21 April 2022 and 24 November 2022) and Kandanga (13 July 2022)
- Stakeholder Reference Group visit to Wivenhoe Dam Pumped Hydro Project (19 May 2022).

Following the launch of Queensland Hydro in September 2022, Queensland Hydro absorbed responsibility for all community and stakeholder engagement activities.

10.3.1.2 Queensland Hydro Project engagement

From quarter four 2022 to present, Queensland Hydro provided opportunities for stakeholders to provide Borumba PHES Project feedback through phone, email, meetings, briefings, workshops, events, newsletters and community information sessions.

Engagement activities included:

- Holding government briefings and working group meetings with local government, state and federal government agency representatives and other key stakeholders.

- Issuing eight email campaigns to distribute Project newsletters and Project updates.
- Hosting community information sessions:
  - Gympie (17 July 2023) with 20 attendees
  - Imbil (18 July 2023) with 55 attendees
  - Kilcoy (19 July 2023) with 30 attendees
  - Nanango (20 July 2023) with 20 attendees
  - Nambour (24 July 2023) with 12 attendees
  - Cooroy (25 July 2023) with 21 attendees
  - Jimna (13 March 2024) with 23 attendees
  - Kilcoy (18 June 2024) with 11 attendees
  - Gympie (19 June 2024) with 13 attendees
  - Imbil (21 August 2024) with 45 attendees.
- Hosting community stalls and events including:
  - a stall at the Friends of Amamoor Cheers and Beers event on 9 December 2022
  - a stall at the QEJP Fair in Brisbane on 27 April 2023
  - a stall at GourMay Festival on 6 May 2023 & 25 May 2024
  - a stall at the Fraser Coast Industry and Careers Showcase on 5 and 18 June 2024
  - a stall at the Fraser Sustainable Futures Festival on 23 June 2024
  - a community BBQ at Lake Borumba on 24 June 2023
  - a stall at the Gympie Rotary Heritage Maker's Fair on 1 and 2 July 2023
  - a stall at the Gympie District Show from 17 – 19 May 2024
  - a stall at the Sunshine Coast Agricultural Show from 14 – 16 June 2024
  - a stall at the Kilcoy Show on 26 July 2024
  - a school BBQ at Mary Valley State College on 30 July and 1 August 2024.
- Hosting 11 Community Connect events at local businesses in the Mary Valley region to provide general Project information, including:
  - Imbil (22 May 2024) with nine attendees
  - Amamoor (23 May 2024) with five attendees
  - Kilcoy (28 May 2024) with four attendees
  - Imbil (29 May 2024) with seven attendees
  - Kenilworth (30 May 2024) with four attendees
  - Imbil (5 June 2024) with 35 attendees
  - Imbil (12 June 2024) with seven attendees
  - Woodford (18 June 2024) with five attendees
  - Imbil (19 June 2024) with 10 attendees
  - Imbil (26 June 2024) with five attendees
  - Kandanga (25 June 2024) with four attendees.
- Continuing Borumba PHES Stakeholder Reference Group (meetings held on 24 November 2022, 22 June 2023, 25 August 2023, 7 September 2023, 31 October 2023, 8 November 2023, 28 November 2023, 27 February 2024, 23 April 2024, 9 May 2024 and 21 June 2024). Note: In late June 2024 Queensland Hydro started the process to reform the Stakeholder Reference Group and introduce a series of specific Focus Groups through an open Expression of Interest process. It is anticipated the reformed SRG and new Focus Groups including a Community Benefits Panel will commence in early October 2024.
- Stakeholder Reference Group site tour held on 2 May 2024.
- Targeted meetings with environmental groups on 22 November 2023 and 30 November 2023, 14 June 2024 and 8 July 2024.
- Hosting an introductory traffic and transport workshop for key stakeholders on 11 October 2022.

- Newsletter distribution to 9,550 letterboxes in the area shown in Figure 41 on Wednesday 12 July 2023 (Figure 51).
- Three Industry Briefings were held in Brisbane (5 July 2023), Caloundra (6 July 2023) and Gympie (7 July 2023) to introduce Queensland Hydro's two pumped hydro Projects, outline the approach to engagement and partnering with industries throughout the Borumba PHES Project, and presenting the first tender packages.
- Maintaining the Borumba PHES Project email address to enable Queensland Hydro to hear from and respond to stakeholders, with over 800 incoming and outgoing emails recorded.
- Maintaining the Borumba PHES Project general enquiries number to enable Queensland Hydro to hear from and respond to stakeholders, with over 210 incoming and outgoing phone calls recorded.
- Maintaining the interactive Borumba PHES Project map to enable stakeholders and community members to ask questions about the Borumba PHES Project.
- Continuing meetings and discussions with landowners, leaseholders and agistees.
- Sharing Borumba PHES Project fact sheets via the Borumba PHES Project website[2] and stakeholder emails.

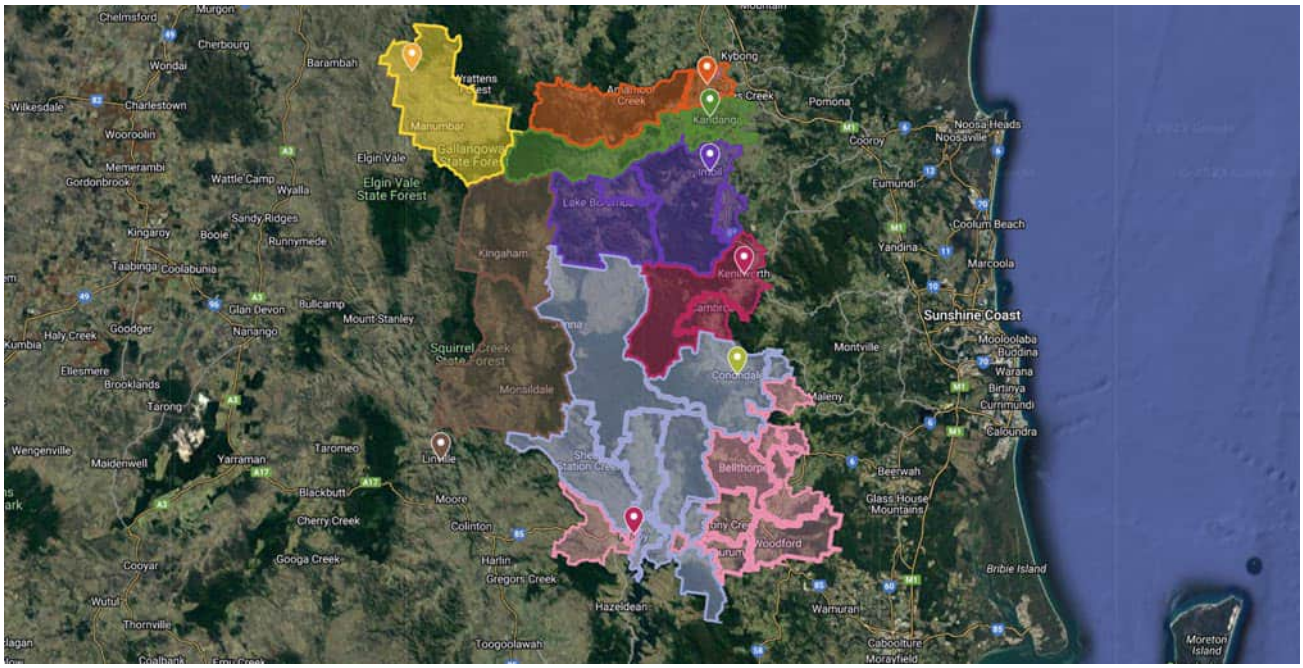


Figure 51: Indicative locations of newsletter letterbox drop

10.3.2 Queensland Hydro Exploratory Works engagement

Queensland Hydro has been engaging with stakeholders and the community on Exploratory Works impacts, as part of the overall Project engagement program. Exploratory Works impacts have been communicated to stakeholders and the community via:

- State and local government briefings
- drop-in community information sessions
- Stakeholder Reference Group meetings
- community connect events and stalls
- landholder meetings
- traditional owner meetings
- newsletters
- email notifications
- community enquiries.

[2] http://qldhydro.com.au/Projects/borumba

10.3.3 Consultation with Indigenous stakeholders

Kabi Kabi Peoples are the holders of important rights and interests in the area where the Project is proposed. Queensland Hydro recognises Kabi Kabi Peoples' enduring culture and connection to Country.

Kabi Kabi First Nation Traditional Owners Native Title Claim Group (Kabi Kabi) are both the Registered Native Title Holder for the Project area and the Cultural Heritage Party as defined under section 35 of the ACH Act.

Queensland Hydro first initiated consultation with Kabi Kabi regarding the Project in late 2021. The initial focus of engagement was the dissemination of study information in a separate and culturally appropriate forum to allow Kabi Kabi to consider Project information and provide feedback.

Since 2021, Queensland Hydro and Kabi Kabi have engaged extensively on matters including:

- Information sharing with regular briefings on Project elements, studies and timelines.
- Implementation of a Kabi Kabi Indigenous Impact Assessment (IIA):
  - Kabi Kabi is undertaking the IIA which broadly includes establishing a baseline of demographic data, consulting with the Kabi Kabi community, assessing the potential impacts and benefits on the Kabi Kabi community, making recommendations to avoid or mitigate impacts and to enhance benefits, and preparing a report to be appended to the main works EIS.
  - Queensland Hydro is providing information, which Queensland Hydro acknowledges is being provided later than originally planned due to changes to the schedule for the exploratory works Project and the proposed main works.
  - Kabi Kabi has planned and started to implement an engagement program including community meetings (and Queensland Hydro was invited to attend the first round of community meetings), noting that further engagement and community meetings will progress when the EIS is further progressed.
- Commissioning of a detailed Cultural Heritage Survey in mid-2022 and subsequent surveys and early works inspections to enable identification of cultural heritage and places of significance within the proposed Project footprint.
- Agreeing management measures in relation to cultural heritage and discussing the avoidance/ minimisation of impact on particular areas of significance.
- The manner in which Kabi Kabi will participate in the EIS, which has also included engagement with the Office of the Coordinator General.

Queensland Hydro and Kabi Kabi have entered into an ILUA for the Exploratory Works and an Early Works Agreement in relation to cultural heritage management. The ILUA was registered by the National Native Title Tribunal on 26 June 2024.

Through consultation, the following sentiments have been highlighted as being of concern to Kabi Kabi:

- the Project forms one aspect within a wider cultural landscape
- artefactual material has consistently been identified by Kabi Kabi as being significant, due to it being direct physical evidence of the visitation and utilisation of the area by Kabi Kabi
- the Mary River is a significant Kabi Kabi storyline and Kabi Kabi remain concerned with secondary impacts on the waterway and associated marine plants and animals
- the Kabi Kabi obligation to 'Care for Country' extends to the environmental landscape.

The assessment reflected in the Preliminary Documentation has addressed potential impacts to MNES, being matters regulated by the EPBC Act, in accordance with the requirements of the Act. Queensland Hydro acknowledges that Kabi Kabi Peoples adopt a more holistic approach that does not separate matters such as environment, people, culture and cultural heritage. Additionally, Queensland Hydro is engaging with the Kabi Kabi Peoples' Aboriginal Corporation Board (the KKPAC Board) about exploratory works offsets.

Looking forward, the KKPAC Board and Queensland Hydro have agreed on an approach to Kabi Kabi Peoples' participation in the main works EIS which considers a range of matters beyond those requiring assessment under the EPBC Act. Queensland Hydro considers that, drawing on thousands of years of knowledge and experience, Kabi Kabi can make a valuable contribution to the EIS. The KKPAC Board has clearly communicated to Queensland Hydro that it seeks to protect and advance the interests of the Kabi Kabi Peoples and Kabi Kabi Country. The KKPAC Board is committed to a thorough due diligence process so that they can be appropriately

informed, and ensure that the broader Kabi Kabi community is informed and able to provide feedback, before they will make any decision to consent or otherwise in relation to the main works.

Downstream of the project, the Butchulla Peoples received acknowledgement of their native title rights in October 2014 and December 2019. The determinations recognised rights of possession, occupation use and enjoyment over land and sea country, including K'gari. Queensland Hydro acknowledges that consulting with, and learning from, the Butchulla Peoples is important. Through initial engagement with the Butchulla Native Title Aboriginal Corporation (BNTAC), Queensland Hydro understands that Butchulla Peoples may have concerns associated with potential impacts on water associated with the main works. Queensland Hydro will further engage with BNTAC and the Butchulla Aboriginal Corporation (BAC) throughout the development of the main works EIS.

10.3.4 Key stakeholder issues

10.3.4.1 Issues raised during Powerlink engagement

A range of stakeholder feedback was received during Powerlink's engagement between late 2021 and September 2022, with the top themes being:

- hydrological modelling for the dam
- flora and fauna
- traffic and transport
- water quality.

Other feedback themes included:

- housing and accommodation
- upper reservoir design
- water availability/demand/allocation
- lower reservoir design
- recreational facilities and use
- economic opportunities
- water plan revision
- jobs and training, offsets
- stakeholder engagement
- amenity and lifestyle
- indigenous cultural heritage
- inundation area
- management of lower reservoir
- non-indigenous cultural heritage
- national park inundation
- dam safety
- energy transformation
- geomorphology
- aquatic fauna movement
- existing water use
- flooding
- hydrogeology.

10.3.4.2 Issues raised during Queensland Hydro Exploratory Works engagement

A range of stakeholder feedback was received on the Exploratory Works during Queensland Hydro's engagement from quarter four 2022 to present. For this period of engagement, the stakeholder groups and their feedback themes and interest areas are included in Table 109.

Table 109: Key stakeholder feedback themes

Stakeholder Group	Engagement themes	Key issues
State Government (name at time of consultation - Department of Resources, Seqwater, Department of Energy and Climate, Department of Premier and Cabinet, Department of Regional Development, Manufacturing and Water, Department of Agriculture and Fisheries, Department	• Environment – approvals process • Environmental and Planning Approvals – offsets and rehabilitation and social assessments • Project design and scope, auxiliary facilities, general project, roads, underground infrastructure, hydrology and flooding • Workforce – camps • Land and property access and leases	• Borgan Road closure • Discussion about locations for track mapping, Exploratory Works and frequency and regularity for access • Housing and affordability • Downstream impacts, (Butchulla) • Dam failure – health/safety and social • Potential compensation for key stakeholders using facilities • Traffic and school bus route impacts

Stakeholder Group	Engagement themes	Key issues
of Environment, Science and Innovation, Queensland Parks and Wildlife Service, Office of the Coordinator General, Department of Transport and Main Roads)	• Design and engineering • Engagement • Traffic and transport • Community safety • Land and property – access, works and changes • Environment – biosecurity, fauna – terrestrial, visual amenity, water allocation and availability, water quality	• Traditional Owner engagement • Coordination between Powerlink and Queensland Hydro engagement • Works/access notifications for fieldwork and environmental studies • Licence agreements for Kingaham Creek bypass and temporary workers accommodation camps • Investigating potential for stockpile site • Yabba Creek Road upgrade • Exploratory Works traffic impact assessment • TMR road network flood immunity • Bella Creek Road widening works
Local government (Gympie Regional Council (GRC))	• Project design and scope – roads • Social – housing and accommodation • Engagement • Water • Waste • Traffic and transport	• Bella Creek Road widening works • GRC flood recovery works program • Cultural heritage requirements for widening works • Kingaham Creek bypass design • Vehicle movement complaints • Borgan Road closure • Local content, industry engagement and procurement opportunities • Accommodation ROI, community infrastructure • Temporary workforce accommodation camps • Impacts to rental housing availability • Local events • Imbil town planning and Community Benefits Framework • Roads and fauna safety (e.g. koala fencing) • Enabling infrastructure opportunities (including water, power, waste management, roads) • Waste management
Local government (Somerset Regional Council)	Project design and scope - roads engagement	• Flood recovery works to Yielo Road • Pavement repairs, curve widening, grid maintenance, call point signage • Stakeholder engagement • Local election caretaker mode • Local content • Enabling infrastructure opportunities
Stakeholder Reference Group	• Environment – biosecurity, cultural heritage, fauna – aquatic, fauna – terrestrial, flora and vegetation, groundwater, noise and vibration, water allocation and availability, water quality • Opportunities for engagement • Workforce – camps • Environmental and planning approvals – investigations and studies, offsets and rehabilitation • Project design and scope – general, hydrology and flooding, geology,	• Environmental monitoring during track upgrades • Temporary workers accommodation camps and surface civil works packages • Exploratory Works timing • Size of equipment • Bella Creek Road upgrades and approvals • Bella Creek Road works and management • Biosecurity planning • Kingaham Creek bypass

Stakeholder Group	Engagement themes	Key issues
	roads, underground infrastructure, dam safety/failure risks • Social – recreation and tourism • Traffic and roads management • Local content • Legacy, benefits and development	• Waste management • Maximising local content opportunities • Regional development priorities • Community benefits initiatives • Community traffic awareness
Landholders	• Environmental and planning approvals • Engagement • Land and property – access, property works/changes/leases, gates • Environment – biosecurity, water quality • Traffic and transport – haulage, construction traffic, traffic management, driver behaviour • Community safety • Social – community investment and benefits, housing and accommodation	• Yielo Road notifications • Survey access for environmental studies • Property negotiation timing • Access agreements • Kingaham Creek bypass and worker accommodation tendering opportunities • Cattle grid addition and removal • Bore water usage • Truck movements and road usage • Fire management • Bella Creek Road works and road condition • Stock movements, access to water, fencing and land use • Boat ramp and facility access during Exploratory Works
Traditional Owners	• Project information sharing and status updates • Quality of engagement • Cultural heritage • Environmental impacts • Other impacts • Biodiversity offsets • Management of offset land • Management of other land • Project benefits • Queensland Procurement Policy, including indigenous procurement • Planning and environment approvals	• Timely and accurate information sharing • Project rationale, including location selection • Quality of engagement • Need for consultation with the wider Kabi Kabi community • Impacts on cultural heritage • Environmental impacts • Participation in the EIS • Free Prior and Informed Consent • Management of offset and other land • Potential benefits, including supply chain opportunities
Community and Environment Groups	• Employment and procurement opportunities, skills and training • Environmental and planning approvals, offsets and rehabilitation • Social – health and wellbeing • Regional development – community infrastructure and services • Engagement • Traffic and transport	• Supply opportunities • Local skills • Engagement for Exploratory Works environmental approvals • Traffic impacts

Stakeholder Group	Engagement themes	Key issues
General public	• Traffic and transport • Environmental and planning approvals • Project design and scope – general and roads • Project design • Engagement • Employment and procurement	• Fire management • Haulage routes • Project timeframes • Overview of works • Traffic impacts • Accommodation for workers and temporary camps • Road upgrades • Supporting works • Employment opportunities • Skills required for Project

10.3.4.3 Community information sessions

During the Borumba PHES Project's in-field stakeholder engagement from July 2023 to August 2024, ten community information sessions were held in Gympie (2), Imbil (2), Jimna (1), Kilcoy (2), Nanango (1), Nambour (1) and Cooroy (1). During these sessions 250 members of the community were engaged.

During community information sessions, stakeholders engaged in one-on-one conversations with Queensland Hydro team members. Following each session, Queensland Hydro team members analysed the most popular stakeholder feedback themes. Further information is discussed in accordance with location in Table 110.

This summary is a snapshot only. Engagement is ongoing and will continue throughout the Borumba PHES Project development.

Table 110: Summary of community information sessions

Location	Date	Attendance	Email subscribers	Key themes	Notes
Gympie	17 July 2023	20	17	• Supplier information • Ecology and biodiversity • Inundation impacts • Community benefits • Water quality • Downstream impacts	
	19 June 2024	13		• Employment opportunities and procurement • Environmental planning approvals • Renewable energy • Traffic routes • Project design • Road upgrades	
Imbil	18 July 2023	55		• Community benefits • Downstream impacts • Supplier information • Traffic and transport (access to site) • Water quality • Timing and funding • Renewable energy technology • Workforce accommodation	• Pumped hydro as tourism – possibility for an experience centre and themed accommodation • Possibility for precast factory in Gympie (similar to the Snowy 2.0 factory in Cooma) • Team members from Brisbane Girls Grammar also attended the

Location	Date	Attendance	Email subscribers	Key themes	Notes
				• Bella Creek Road upgrades • Recreational facilities	meeting and spoke to the Queensland Hydro team members about managing safety during their school camps. This is part of ongoing engagement with the school and their outdoors program.
	21 August 2024	45	21	• Project design and scope • Environmental planning and approvals • Cultural heritage • Aquatic fauna • Flora and vegetation • Water allocation and availability • Water quality • Employment opportunities and skills and training • Community investment and benefits • Recreation and tourism • Workforce camps • Regional development • Social assessments	
Kilcoy	19 July 2023	30	10	• Supplier information • Traffic and transport (haulage routes) • Hydrology (operations during drought conditions) • Ecology and biodiversity • Inundation impacts	• Key stakeholders in attendance were the President of the Kilcoy Chamber of Commerce and Somerset Regional Council Mayor, Deputy Mayor and two local Councillors. • A representative of the Jimna Forest Action Group Incorporated attended this session. The group presented the Stakeholder Engagement team with a prepared letter of invitation to visit the Jimna Information Centre to discuss and visit local habitat.
	18 June 2024	11		• Project design and scope • Environmental and planning assessments and approvals • Employment and supplier opportunities • Skills and training	

Location	Date	Attendance	Email subscribers	Key themes	Notes
Nanango	20 July 2023	20	7	• Community benefits • Geotechnical information • Ecology and biodiversity	• Stakeholder feedback noted legacy issues from Traveston and Toowoomba Bypass Projects. Stakeholders asked about the ownership and leadership of Queensland Hydro and stated a distrust of the State Government following legacy issues from historical Projects.
Nambour	24 July 2023	12	6	• General Project update • Supplier information • Scheme operations.	
Cooroy	25 July 2023	21	8	• Supplier information • Scheme operations • Ecology	
Jimna	13 March 2024	23	7	• Project design and scope • Environmental planning approvals • Noise • Opportunities for engagement • Employment opportunities and procurement • Land and property value • Community investment and benefits • Housing and accommodation • Construction traffic and management	

11. Ecologically sustainable development– RFI item 9.1

11.1 Principles of Ecologically Sustainable Development

Sustainable development is an ideal that has been incorporated into legislation, strategies, policies, plans and initiatives in all Australian jurisdictions. The EPBC Act provides for the protection of the environment and the promotion of Ecologically Sustainable Development (ESD) at a Commonwealth Level. Although ESD lacks a universally accepted definition, the National Strategy for Ecologically Sustainable Development summarises ESD as 'development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations' (ESDSC, 1992). There are five guiding principles of ESD detailed in Section 3A of the EPBC Act, as reproduced below:

1. decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (Principle of Integration)
2. if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (Precautionary Principle)
3. the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (Inter and Intra-generational Equity)
4. the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making (Conservation of biological diversity and ecological integrity)
5. improved valuation, pricing and incentive mechanisms should be promoted (Improved valuation, pricing and incentive mechanisms).

The sections below describe how the Exploratory Works comply with each of the key principles.

11.1.1 Principle of integration

The principle of integration involves the integration of short-term and long-term, economic, environmental, social and equitable considerations in decision making. Developing the location and design of the Exploratory Works involved consideration of the potential benefits and adverse impacts on the following factors in both the present and future:

- ecosystems
- economic aspects
- cultural heritage and native title
- sustainability
- social aspects
- natural resources
- landscape qualities and characteristics
- engineering and design.

The potential impacts of the Exploratory Works Project on these factors were considered and continue to be assessed by technical specialists representing Queensland Hydro who offer diverse understanding and experience. Examples of when the Principle of Integration was applied during the development of the Exploratory Works, is evidenced by:

- avoidance of known areas of TEC and threatened species and species habitat
- locating components in areas subject to previous disturbance
- minimisation of the Project footprint by co-location with existing infrastructure in areas as that share a common footprint with the Borumba PHES Project
- negotiation of an early works agreement and ILUA with the Kabi Kabi People
- monitoring and cultural heritage clearance provided by the Kabi Kabi People

- consultation with landholders, leaseholders, agistees, community services, businesses, recreational users and representatives of the Stakeholder Reference Group
- consultation with regulatory authorities and State-Owned Corporation such as Seqwater and Powerlink
- preliminary investigation of areas with possible offset potential.

Mitigation and management measures have been developed and included within the various management plans to avoid and minimise significant adverse impacts to environmental, social, cultural and economic factors.

11.1.2 Precautionary principle

The precautionary principle describes the approach in environmental assessment where uncertainty and risk are incorporated into decision making and the assessment of possible outcomes of a development of the environment. The Exploratory Works are conservative in nature as they endeavour to better understand complex and poorly understood systems (i.e. geological and hydrogeological). The precautionary principle was applied during planning and design phase of the Exploratory Works to ensure effective management of the risk of adverse impacts to environmental, social and cultural heritage values by:

- proactively investigating alternatives to potentially harmful actions and design scenarios
- seeking technical specialist and traditional owner supervision during ground disturbing works
- taking preventative action in situations where there is a lack of scientific certainty (e.g. taking a conservative approach to habitat mapping as described in Section 4.1.1.5 and completing a significant impact assessment for species with a possible likelihood of occurrence as provided in Appendix J)
- implementing mitigation measures in accordance with the avoid, mitigate manage hierarchy (refer to Section 6)
- seeking stakeholder, technical specialist (in the form of subconsultants and technical review panel) and regulatory authority participation in decision making.

The Exploratory Works represent a clear commitment to improving scientific understanding of the Exploratory Works Survey area prior to construction commencing.

11.1.3 Inter- and intra-generational equity

Inter-generational equity requires the present generation to ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. Intra-generational equity is concerned with equity between people of the same generation and aim to assure justice among human within the present generation.

The concept of inter- and intra-generational equity has been addressed through:

- considering social impacts and benefits of the Exploratory Works
- responding to community concerns through stakeholder consultation
- engaging specialists to undertake technical field studies to inform design and minimise potential construction, operation and decommissioning impacts from the Exploratory Works on environmental, cultural and social factors
- consulting with the Kabi Kabi regarding an EWA and future ILUA
- implementing the following management plans to promote safety, mitigate the risks of environmental impact on natural resources and ensure land is suitable for intended future use (should the Borumba PHES Project not proceed):
  - construction environmental management plan
  - flora and fauna management plan
  - erosion and sediment control plan
  - biosecurity management plan
  - spoil management plan
  - stakeholder engagement plan.

The concept of inter-generational equity indirectly unpins the Exploratory Works Project given that the activities proposed are necessary to investigate the suitability and feasibility of the Borumba PHES Project as a whole. The Borumba PHES Project represents a long-term investment in Queensland's electricity infrastructure. As identified in

the Queensland Energy and Jobs Plan (State of Queensland, 2022), the Borumba PHES Project ultimately supports the decarbonisation of Queensland's energy system to ensure that the health, diversity and productivity of the environment are maintained or enhanced for future generations.

Likely benefits to current and future generations as a result of the Exploratory Works and Borumba PHES Project, include:

- support for State and Commonwealth transition to renewable energy and delivery of secure, reliable and clean energy to consumers
- minimising the design, cost, resources and environmental risks and uncertainties surrounding the Borumba PHES Project through geotechnical and exploratory drilling
- creating social, economic and employment benefits to the region, including:
  - investment to road improvements
  - creation of jobs
  - local procurement
  - indirect economic benefits for the service industries.

11.1.4 Conservation of biological diversity and ecological integrity

Biodiversity or 'biological diversity' describes the variability among living organisms on the earth, including the diversity within and between species and ecosystems. Ecological integrity describes the quality of ecosystems and their capacity to adapt to change and provide for the needs of the future (OEH, 2019).

The location and design of the Exploratory Works was developed taking into consideration conservation of sensitive environmental areas through avoidance and minimisation of impacts on known and potential threatened species and communities. Detailed ecological assessments (aquatic and terrestrial) have been undertaken within the Project footprint and broader surrounds to identify and manage potential impacts on biodiversity and ecological processes. Other technical assessments also informed the conservation of these factors including but not limited to groundwater assessment, surface water assessments and noise and air quality assessments.

Modifications, to the design and location of the Exploratory Works will continue to be made where necessary to avoid or minimise its effect on threatened species and communities.

11.1.5 Principle of improved valuation, pricing and incentive mechanisms

The principle of improved valuation, pricing and incentive mechanisms requires that environmental factors be included in the valuation of assets and services. The principle represents the need for the true value of natural resources to be incorporated into the cost of using those resources. By doing so helps ensure that resources are adequately managed and used in a sustainable manner.

Given it is challenging to assign a monetary value to the environmental impacts that may be caused by the Exploratory Works, the value of environmental resources within and surrounding the Exploratory Works is demonstrated indirectly through:

- the extent of technical assessments (including environmental investigations) undertaken to inform design and mitigation measures
- the optioneering undertaken to investigate design scenarios to ensure sensitive environmental areas are avoided
- implementation of mitigation measures to protect environmental values and ensure resources are utilised in a sustainable manner.

The costs associated with environmental design and mitigation measures have been incorporated into the Project cost and have helped inform estimates for the Borumba PHES Project. Related expenses for the Exploratory Works include the estimated value for further environmental investigations and site supervision, possible offset values, estimated waste, water and spoil management costs.

12. Environmental record of the person proposing to take the action

Queensland Hydro is the proponent proposing to take the action. Neither Queensland Hydro nor its parent company have committed offences under Commonwealth and/or State law for the protection of the environment or the conservation and sustainable use of natural resources. Similarly, no member of the Queensland Hydro Board or Executive Leadership Team has, committed an environmental offence.

13. Ecological data provision

Occurrence records (both sightings and evidence of presence) for all listed threatened and migratory species identified during field surveys for the Exploratory Works Project and Borumba PHES Project will be provided as part of the Preliminary Documentation.

The species occurrence records have been provided in accordance with the DCCEEW's Guidelines for biological survey and mapped data (2018) using the species observation data template provided with the request for additional information.

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