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CopperString 2.0

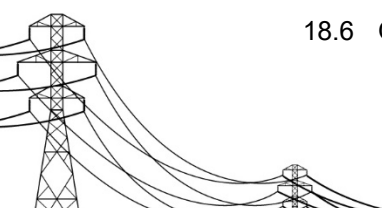
Matters of national environmental significance

Volume 2 Chapter 18



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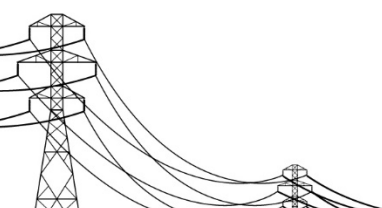


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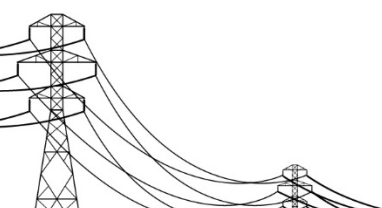


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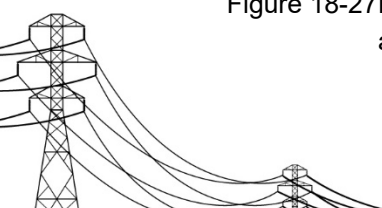
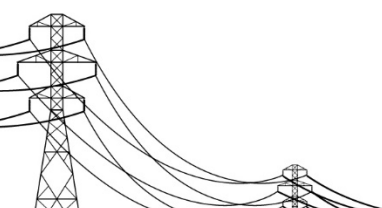


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18. Matters of national environmental significance

18.1 Introduction

18.1.1 Proposed action

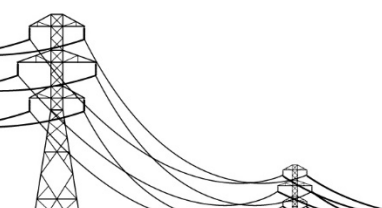
CuString Pty Ltd (CuString) proposes to construct and operate the CopperString 2.0 Project (the Project), which comprises approximately 1,060 km of extra high voltage overhead electricity transmission line and associated infrastructure. The Project would connect the North West Power System (NWPS), and foundation customers at isolated mine sites along the Project route, to the state electricity grid, allowing participation in the National Electricity Market (NEM).

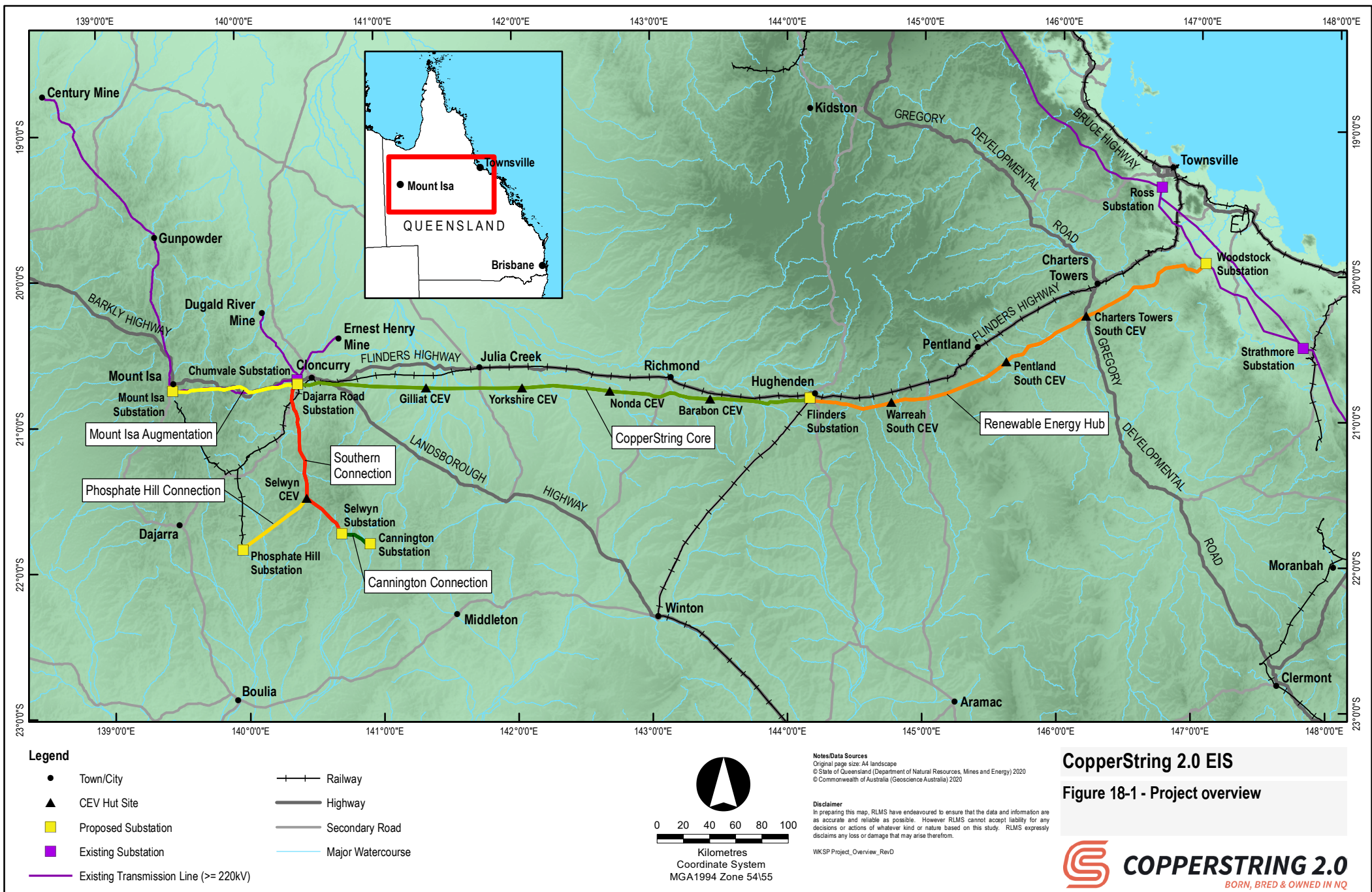
The Project would connect to the state electricity grid, via a new connection point near Woodstock, south of Townsville, and would extend west to Mount Isa, with a southern connection extending from Cloncurry to Phosphate Hill Mine and Cannington Mine. The Project involves construction of seven new substations near Woodstock, Hughenden, Dajarra Road (Cloncurry), Mount Isa, Selwyn, Cannington Mine and Phosphate Hill Mine, as shown in Figure 18-1.

The Project was declared to be a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 29 August 2010 (EPBC 2010/5581) with the decision requiring a bilateral assessment with the Queensland Government. Baseline data and an assessment of impacts was prepared for an Environmental Impact Statement (EIS) however the Project was suspended in 2011, with a declaration of a lapsed proposal of an action being made by the Commonwealth Department of Environment on 18 March 2015.

A new referral for the Project was prepared under the EPBC Act and submitted to the Commonwealth Department of the Environment and Energy on 1 April 2019. The Commonwealth Minister for the Environment issued a referral decision (EPBC 2019/8416), dated 14 May 2019, determining the Project to be a controlled action requiring assessment by EIS, under a bilateral agreement with the Queensland Government. The referral includes the following specific controlling provisions:

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (Sections 20 and 20A)





18.1.2 Purpose of chapter

The purpose of this chapter is to describe the assessment of Project impacts on the above controlling provisions, which are defined as matters of national environmental significance (MNES) under the EPBC Act. This chapter has been prepared as a stand-alone document and includes avoidance and mitigation measures of impacts to MNES and a description of proposed offset measures where significant residual impacts to MNES have been identified. This chapter has been prepared pursuant to the Bilateral Agreement to meet the impact assessment requirements under both Commonwealth and Queensland legislation. The Bilateral Agreement is an agreement made under section 45 of the EPBC Act between the Commonwealth and the State of Queensland. It provides accreditation of the Queensland environmental assessment processes and allows environmental assessment to be undertaken without duplication between governments, whilst strengthening intergovernmental cooperation and promoting a partnership approach to environmental protection and biodiversity conservation.

This chapter has been prepared in consultation of various legislation, guidelines and policies including, but not limited to, the following:

- Significant impact guidelines 1.1 – Matters of National Environmental Significance
- EPBC Act
- EPBC Act Environmental Offsets Policy
- Listing advices, recovery plans, conservation advices, threat abatement plans, draft referral guidelines and referral guidelines for applicable species
- Species Profile and Threats (SPRAT) Database.

Further information about legislative contexts and standards is provided in Section 18.1.8.

Section 18.1.9 includes a cross reference to relevant sections of the MNES chapter that address each of the matters in Division 5.2 of the *Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations).

18.1.3 Defined terms

Key terms used throughout this chapter are defined as follows:

- ‘Corridor selection’ – means the baseline investigation corridor being a nominal 1,060 km long corridor transmission line alignment, which includes the easements for the transmission line as described in Table 18-8.
- ‘Study area’ – means the 5 km wide corridor used to collect baseline data for assessment of impacts to MNES. The study area is further defined in Section 18.3.2
- ‘Project area’ – means the transmission line easement and associated infrastructure both on and off-easement (including laydown areas, substations, CEV huts, access tracks, brake and winch sites, and construction camps).

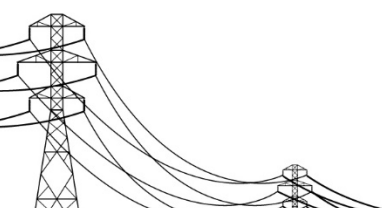
18.1.4 Project proponent

The proponent for the Project is CuString Pty Ltd.

Australian Business Number: 47137531054

Postal address: Level 14, 40 Creek Street, Brisbane City QLD 4000

CuString is a private company based in Townsville, Queensland, with a long history in the energy supply industry in North Queensland.



CuString (including its directors) has not been, and is not currently, the subject of any proceedings under a Commonwealth, state or territory law for the protection of the environment or the conservation and sustainable use of natural resources.

CuString is committed to seeking and complying with all required regulatory approvals for the Project and attaining a conservation objective of no significant residual impacts to any MNES values.

A Project Framework Environmental Management Plan (FEMP) has been developed in accordance with the Department of Agriculture, Water and Environments 'Environmental Management Plan Guidelines' (2014) and incorporates the outcomes of the assessment undertaken in the EIS. The Project FEMP is provided in Volume 3 Appendix Q Framework Environmental Management Plan.

A complete list of the experience and qualifications of consultants and sub-consultants engaged to undertake the EIS for the Project is included in Volume 3 Appendix B Study team.

18.1.5 Project rationale

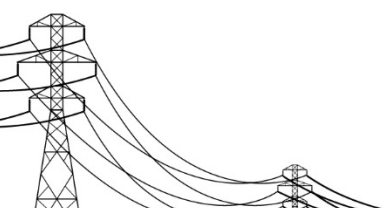
Currently, electricity consumers connected to the NWPS, which covers Mount Isa, Cloncurry, Gunpowder and Century Mine, do not have access to the NEM. Within the NWPS, electricity is supplied by bilateral agreements between generators and consumers.

The North West Minerals Province (NWMP) is the dominant source of base metals in Queensland and an extremely prospective, mineral rich area. The geographic remoteness of the region however has historically constrained its development. Although early projects in the region developed their own energy and transport infrastructure, some regional infrastructure has been developed. Current energy prices (electricity and gas) in the NWPS are high by national and international standards and supply options are limited. Access to competitively-priced electricity, through a transmission network with the capacity to both import and export electricity, will significantly contribute to the prolonged economic development of the region, with considerable social benefits for local communities. The Project will facilitate the participation of this economically important region in the NEM and will enable consumers in the NWPS to access the state electricity grid through connection to the Powerlink transmission network.

The corridor selection traverses an identified region of significant renewable energy resources that are currently constrained by the lack of access to the state electricity grid. Connection to the state electricity grid and participation in the NEM would improve the economic feasibility of these projects.

The Project is a private sector initiative that will deliver significant community benefits within the local, regional and national contexts. Based on the recommendations of various reviews of the NEM, the project will upgrade the electricity supply to the NWMP to foster the continued economic, social and community growth of the region. Furthermore, the Project will enable development of identified renewable resources in the region, providing these with an access to market that is currently a constraint on their development.

The Project addresses key priorities and goals of both the Australian and Queensland Governments by maximising the economic opportunities for mining and processing in the NWMP within acceptable social and environmental standards. Further economic opportunities will be maximised by encouraging development of alternative energy sources, encouraging the development of geographically challenged commercial operations and delivery of more competitively priced, secure and reliable energy. Government support of the Project is discussed below.



Commonwealth Government support

In 2009, the Commonwealth Government identified the extension of the national electricity grid to the NWMP as a national infrastructure priority, in the report National Infrastructure Priorities: Infrastructure for an economically, socially, and environmentally sustainable future (Infrastructure Australia, 2009).

The ongoing development of the NEM requires the establishment of new generation, including wind and solar based renewables.

The Australian Government published Our North, Our Future White Paper on Developing Northern Australia in 2015. The white paper identifies that:

- Infrastructure plays an integral role in unlocking economic opportunities.
- The correct infrastructure can be transformative for regions.
- Conversely, wrong infrastructure can waste resources and lock communities into poor outcomes.
- There are significant infrastructure gaps throughout the region.
- Outside of electricity networks, towns and cities run on stand-alone power systems (off grid).
- A commitment by the Commonwealth Government to ensure northern Australia has the appropriate infrastructure to support economic and population growth.
- Identification that public and private sector investment is required to deliver the stated goal of developing northern Australia.

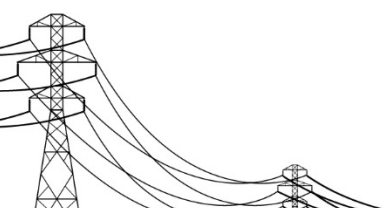
The Project is consistent with the White Paper. The development of the Project will support the following:

- Access to competitively priced energy, which will further diminish the risk of energy price instability from a single primary source.
- Increased resource exploration in north-west Queensland (NWQ) by providing competitive and reliable energy supply for the processing of products.
- Access to the state electricity grid by small mining operations that will decrease reliance on diesel power generation.
- Decreased risk of supply interruptions to industrial users and communities.

The economic development opportunities that will result from the Project will apply to all sectors of the economy including mining, agriculture, manufacturing and processing, and residential. The Project will support and stimulate both domestic and export opportunities.

The Project will provide direct employment opportunities during construction and operation. It is anticipated that 750 people will be employed during the construction of the Project and 30 people will be required to operate and maintain the infrastructure.

Indirect employment opportunities will occur as a result of the construction and commissioning of the Project by means of further regional development and an expansion to the exploration, mining, and resources processing of the region, due to the provision of competitive and reliable electricity. The paper, Re-powering the Townsville & North West Minerals Province Industrial Economy, estimates an average of 3,560 full-time equivalent (FTE) jobs for at least 25 years across the Townsville to NWMP corridor, as a result of increased production in the NWMP supported by providing access to the NEM via the Project (CuString, 2020).



The Council of Australian Government (COAG) Energy Council (superseded in May 2020 by the Energy National Cabinet Reform Committee) has recognised the challenge many renewable energy projects face in accessing the NEM and the importance of facilitating the efficient expansion of the electricity supply network to address this issue. At the COAG Energy Council meeting on 20 March 2020, ministers discussed renewable energy zone connections and requested that rule changes be developed to implement renewable energy zones (COAG Energy Council, 2020a). The COAG Energy Council recognised that the forecast of new utility scale renewable generation capacity is greater than the currently available hosting capacity in the relevant areas of the grid (COAG Energy Council, 2020b).

The Project provides an expansion of the state electricity grid consistent with the objective of the COAG Energy Council to connect recognised renewable energy resources in northern Queensland. The access advantages that will be provided to the clean energy corridor between Townsville and Mount Isa will assist projects that will contribute to the Queensland Government and the Australian Government's Renewable Energy Targets and meeting the needs of future national carbon emissions reduction obligations or schemes.

Queensland Government support

The Queensland Government has recognised the development potential of the NWMP. This region is a world class resources area and is the primary driver of regional employment and economic growth. The Queensland Government has recognised there are challenges that may prevent the ongoing economic development of the region. There is a long history of government initiatives associated with the development of the region, as shown in Table 18-1.

Table 18-1 Queensland Government support

Date	Development plan or publication
mid-to-late 1990s	Northwest Queensland Development Initiative
2007	Northern Economic Triangle Infrastructure Plan (NET Infrastructure Plan)
2007	NET Infrastructure Plan Progress Report (progressing priority actions)
2009	Review of North West Queensland Energy Delivery (the Sims Review)
2010-2013	North West Regional Plan
November 2015	North West Minerals Province Taskforce
June 2016	Advancing North Queensland: Investing in the future of the north
June 2017	Powering Queensland Plan: an integrated energy strategy for the state including the Powering North Queensland Plan
July 2017	Strategic Blueprint for Queensland's North West Minerals Province

In 2007, the Queensland Government developed the NET Infrastructure Plan, which included strategies to drive economic development in the geographic triangle linking Townsville, Mount Isa and Bowen, with a focus on mining, minerals processing, and industrial development over the next 50 years. Providing access to competitively priced and reliable energy in north

Queensland and NWQ, including the NWMP, was identified as a key action to achieve the strategic objectives of the NET Infrastructure Plan.

In 2009, the Queensland Government and Queensland Resources Council jointly commissioned an independent review of options capable of satisfying the long-term energy supply requirements of NWQ, known as the Sims Review. The Sims Review considered several options including:

- Redevelopment of the Mica Creek Power Station
- Self-supply by large regional customers
- Electricity transmission links to the state electricity grid
- Development of renewable energy generation projects

The identified 'clean energy corridor' contains several proposed major renewable energy projects that cannot proceed without a transmission line connecting them to the state electricity grid. Such a connection would allow them to export into the NEM when their variable output exceeds the relatively small potential energy demand in NWQ.

The Sims Review concluded that at the time there was insufficient information to determine the lowest cost option for the customers, recommending the Queensland Government facilitate a customer driven, competitive process to determine the optimum energy solution.

The 2010 North West Regional Plan put the NET Infrastructure Plan and the Sims Review into a broader regional context. It developed energy strategies and land use policies in recognition of a lack of price parity with regions connected to the NEM, the potential economic and community benefits that could be unlocked, and the infrastructure required to harness potential renewable energy resources in the region (DIP, 2010).

In 2015, the North West Minerals Province Taskforce identified that there is a general lack of enabling infrastructure in the region.

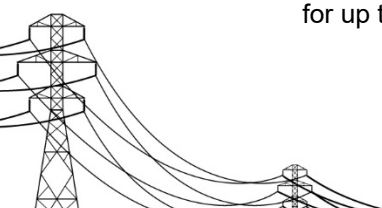
The 2016 Advancing North Queensland: Investing in the future of the north paper, identified the Queensland Government's commitment to grow the economy of the region, including initiatives to improve infrastructure and connectivity. The Project is ideally placed to assist with the delivery of the stated goals of this paper through providing a new and stable infrastructure connection to the state electricity grid.

The 2017 Powering Queensland Plan recognised the very significant and valuable contribution that the world class renewable resources west of Townsville can make to achieve the state objective of 50 percent renewables by 2030. The Powering North Queensland Plan identifies the importance of diversity in energy supply in northern Queensland. The Project supports these objectives by providing the infrastructure for connection of the large renewable resources available in the region as well as providing NEM access for the current isolated gas fired generation in Mount Isa. These renewables and the NWPS gas generation will be vital to achieving the state's low emissions target.

The 2017 Strategic Blueprint for Queensland's North West Minerals Province identified three strategic priorities including facilitating continued resources sector development and delivering integrated and appropriate services.

Regional government support

A BIS Shrapnel Report of March 2010, commissioned by the Mount Isa to Townsville Economic Development Zone Incorporated (MITEZ), concluded that renewable projects identified at the North Queensland Renewable Energy Roundtable Forum in November 2009 have the potential for up to 900 mega-watts (MW) of installed renewable energy capacity to be connected to the



state electricity grid, for participation in the NEM. This preliminary work was also supported by an analysis of the renewable energy potential of the region, including the report Growing Queensland's Renewable Energy Electricity Sector a parliamentary submission by the United North Queensland Regional Development Organisation.

18.1.6 Relationship to other projects

There is currently one other project in the region, the 15 Mile Irrigated Agricultural Development, that has been approved by the Queensland Coordinator General. The 15 Mile Irrigated Agricultural Development is a proposed master planned irrigated agricultural precinct on the banks of the Flinders River, approximately 12 km north-northwest of Hughenden. This project is not likely to be impacted by the Project.

The Kennedy Energy Park is a proposed hybrid wind, solar and storage project located approximately 80 km north of Hughenden. The Project would provide a benefit to the Kennedy Energy Park in providing a connection to the state electricity grid and allowing participation of the Kennedy Energy Park in the NEM.

A number of existing mining operations that are likely to benefit from the Project through a competitive and reliable electricity source are shown in Figure 18-2.

18.1.7 Assessment of alternatives

18.1.7.1 Alternatives to the Project

Currently, the only feasible alternative to the Project is to take no action. This would allow current arrangements to continue, where each energy user makes private agreements with existing suppliers or installs their own private energy generating plant for their site.

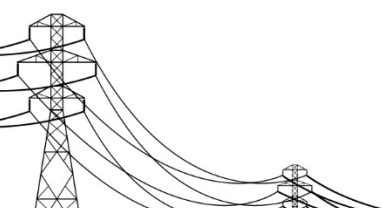
The alternative would not improve the competitiveness of energy supply in the region by allowing many buyers and sellers access to electricity loads and generation. As there are currently no developed options for generators in the NWPS to participate in the NEM, taking no action would mean that energy prices in the NWPS would remain high with limited supply options.

Similarly, taking no action will mean continued limitation of development of the NWMP and of renewable energy resources in north and north-west Queensland, such as Kennedy Energy Park.

The expected volume of renewable resources and the operation of the existing power stations in the NWMP will provide a surplus of generation capacity in the CopperString transmission network. This surplus energy will be transmitted through the NEM, increasing the supply of both renewable and firm generation capacity in North Queensland. This flow of energy will reduce loss factors in North Queensland and place downward pressure on energy pricing, improving the cost of minerals processing in Townsville. These economic benefits of reliable and competitively priced electricity will be lost if the Project does not progress.

18.1.7.2 Alternative route alignment

The corridor selection process followed the Powerlink engagement model for Corridor Development. The route selection for the CopperString 1.0 Project from 2010 was used as a starting point for determining the Project's corridor selection. The methodology for the 2010 Route Selection Report was re-visited to reconfirm key Project assumptions and selection criteria. The process also considered recent Queensland Government policy concerning power infrastructure and the locations of critical substations that define the Project network structure (and hence greatly influence the general corridor alignment).



CopperString 1.0 corridor selection process

An EIS was prepared for the CopperString 1.0 Project and the 2010 Route Selection Report formed a key component of the EIS. A seven-stage approach was used to identify the preferred transmission line corridor alignments:

- Establish start and end points for the transmission line
- Establish corridor selection criteria
- Undertake desktop studies to determine broad constraints
- Develop potential corridor route options
- Select a preferred corridor option
- Undertake limited field investigations
- Further refine the preferred corridor option

Selection criteria included minimising construction constraints (e.g. length, bends, terrain, soil stability, inundation, watercourse crossings), minimising disturbance to areas of known ecological and heritage values, minimising disturbance to landholders and existing land use, maximising ease of access, and minimising disturbance to and potential interference from existing third-party infrastructure.

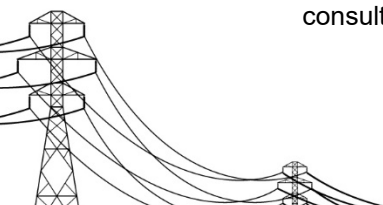
Analysis of the 2010 route confirmed that a corridor south of the Flinders Highway is the most appropriate alignment due the following major factors:

- An alignment through the Herveys Range (Eastern Study Corridor) is easier south of the Flinders Highway due to a natural narrowing of the range in this location and the availability of a less constrained corridor.
- Elevation is flatter west of the Herveys Range and to the south of the Flinders Highway. An alignment north of the Flinders Highway requires the crossing of multiple ranges and mountains including the Gasstree Ranges, Great Basalt Wall, Lolworth Range and Great Dividing Range.
- Several Protected Areas occur north of the Flinders Highway including White Mountain National Park. The review identified the registration of the Ballara Nature Refuge to the south of Cloncurry.
- Numerous river systems converge north of the Flinders Highway between Hughenden and Cloncurry creating expansive flood plains. An alignment to the south of the Flinders Highway avoids the worst of these flood plains.
- The landscape is relatively uniform within the study area between Mingella to Cloncurry. MSES occur sporadically throughout the area and the nominated 5 km study area provides significant opportunity for the final Project corridor to avoid, minimise and mitigate impacts to important ecological values and features.
- The desire for a direct route to reduce construction length and costs supports a southern route.

CopperString 2.0 corridor selection process

An initial 5 km wide study corridor was further refined to the current corridor selection (60 m or 120 m wide depending on section), following a multi-disciplinary review and extensive consultation.

The corridor refinement methodology incorporated a detailed desktop review and extensive consultation with various stakeholders including Government, landholders and business groups



regarding the alignment of the 120 m wide Project easement within the 5 km study area. The process reviewed the infrastructure requirements within the 5 km study area and used a hierarchical approach to refine the alignment and establish the 120 m wide Project easement.

1. **AVOID** - identify major amendments to the corridor to resolve issues such as changes in land use, newly identified environmental constraints or specific landholder requirements. The major amendments were considered first to ensure the Project network structure (including infrastructure requirements such as Controlled Environmental Vault huts and sub-stations) were practical.
2. **MINIMISE** – identify minor adjustments of the corridor to minimise impacts on environmental values or improve practicality / constructability within the 120 m wide Project easement. Examples include minor amendments to avoid property infrastructure (e.g. cattle yards) or environmental values such as areas of habitat or known locations for conservation significant species, wetlands and major watercourses.
3. **MITIGATE** – consider construction methods that will further reduce impacts. For example, the evaluation may identify areas where impacts cannot be avoided or adequately minimised through corridor amendments. At these locations, opportunities to reduce impacts via design and/or construction method are considered and noted. These mitigation procedures are outlined in the Project Field Development Plan.

The Projects infrastructure requirements define the CopperString 2.0 network structure. The networks and distribution requirements were modelled to identify the required locations for substations. Modelling identifies substations are required in the following general locations:

- Woodstock
- Flinders (Hughenden)
- Dajarra Road (Cloncurry)
- Mount Isa
- Selwyn
- Cannington
- Phosphate Hill

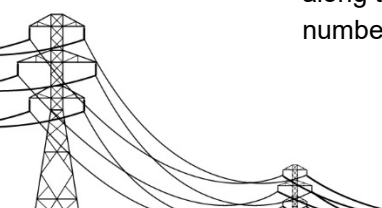
In addition, the analysis identified the requirements for Controlled Environmental Vault (CEV) Huts at no greater than 120 km apart along the alignment.

Most of the Project sits across a relatively uniform open rural landscape dominated by grazing activities and expansive areas of least concern vegetation communities. It is worth noting that when undertaking the process of refining the corridor, similar landscape features were encountered across large areas due to the vastness and linear nature of the study corridor.

The corridor selection process has considered the following:

- Changes to land use and updates to environmental constraint mapping layers that have occurred since 2010 as well as results of CopperString 1.0 investigations
- Consultation with landholders to identify constraints on land such as infrastructure, heli-mustering and visual amenity
- Technical constraints such as engineering limitations, crossing of existing lines and connections to substations

Extensive investigations and consultation resulted in requests to avoid or minimise impacts along the 120m proposed easement. Requests to move the corridor were assessed against a number of criteria including:



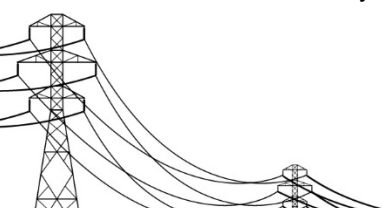
- Improved environmental outcome
- Reduced impact on landholders
- Improved cultural heritage outcome
- Technical feasibility

Once the change request had been assessed it was either approved or rejected based on the information available. Overall, 107 change requests based on environmental impacts, landholder requests, cultural heritage requests and technical feasibility were submitted as part of the corridor refinement process. Of these 107, 10 requests relate to the Ballara Nature Reserve.

Several major corridor amendments were required during this process to avoid environmental, social and economic impacts including:

- Burdekin River Crossing - The review of the 2010 crossing point in the Burdekin River was shifted to avoid MNES of *Eucalyptus raveretiana* as well as Of Concern regional ecosystem that was mapped along the river bed and bank. The purpose of the shift was to avoid direct impact to this species.
- An area west of the crossing point at the Burdekin River had been mined and the shift to the north would avoid interference with the mining operations. The corridor was further adjusted east of the river crossing to avoid a Mining Lease and mining operations being undertaken in the area.
- The corridor selection was realigned to avoid Kennedy Wind Farm in order to avoid sterilisation of the wind resources and potential impacts on the wind farm. The corridor selection was shifted outside of the “fall zone” to avoid impacts in the event of a wind turbine failure. This realignment also included relocation of the proposed Flinders Substation at Hughenden.
- The corridor selection was realigned to run south of the Tucker Range and north of the Rishton Scrub and Rochford Scrub, to avoid semi-evergreen vine thicket threatened ecological communities (TECs), the reserve areas (listed on the National Estate Heritage Register), and the associated values for conservation significant flora and fauna habitat within them.
- The corridor selection was shifted by 2 km to avoid impact on operations and a camping area near the historic mining township of Mary Kathleen.
- The corridor selection passing through the Ballara Nature Refuge was re-routed to the eastern side of Cloncurry Duchess Road, reducing the distance that the corridor selection will extend through the reserve. This alignment also avoids steep terrain. Additional ecology studies were conducted within the reserve between November 26th -31st 2020 to explore the feasibility of alternative alignments. Targeted survey effort was focussed on the potential for conservation significant fauna species, including the night parrot (*Pezoporus occidentalis*) and ghost bat (*Macroderma gigas*) as well as other features of value to be managed within the protected area. The refined alignment presented within this report is considered to be the alignment with the least ecologically impact.
- The corridor selection was revised to avoid the potential for high impact earthworks in mapped wetlands of High Ecological Significance.

In addition to the above, a number of other minor amendments were made to the corridor selection to avoid impacts to environmentally sensitive areas (e.g. Of Concern regional ecosystems, mapped essential habitat areas, known species locations, and culturally significant

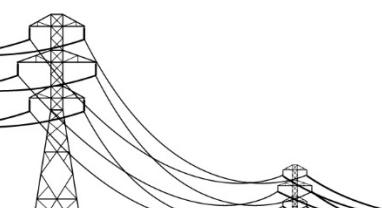


places) and in consideration of landholder comments and engineering considerations (e.g. locations near flood impacted areas and watercourses).

18.1.8 Legislative context and standards

The MNES baseline assessment has been undertaken with consideration to the following legislation:

- EPBC Act is Commonwealth legislation protecting MNES including TECs, threatened flora and fauna species, migratory species, world heritage properties, national heritage places, wetlands of international importance, the Great Barrier Reef Marine Park (GBRMP), Commonwealth Marine Areas and Commonwealth lands. Administered and enforced by the Commonwealth Department of Agriculture, Water and the Environment (DAWE).
- *Nature Conservation Act 1992* (NC Act) protects Queensland's ecological values including protected areas and protected native wildlife and wildlife habitats. The *Nature Conservation (Wildlife) Regulation 2006* (NC Regulation) is a piece of subordinate legislation to the NC Act. This protects breeding places for wildlife listed under the NC Act. The *Nature Conservation (Wildlife Management) Regulation 2006* (WM Regulation) regulates protected plants and associated high risk trigger areas under the NC Act. The Nature Conservation (Koala) Conservation Plan 2017 (Koala Plan) prescribes koala districts across Queensland and requires clearing of koala habitat to be undertaken in a certain manner. The NC Act and subordinate legislation are administered and enforced by the Department of Environment and Science (DES).
- *Vegetation Management Act 1999* (VM Act) regulates the clearing of native vegetation in Queensland in a way that conserves remnant vegetation i.e. regulated vegetation that is endangered, of concern or least concern regional ecosystem (RE), conserves vegetation in declared areas, ensures that vegetation clearing does not cause land degradation and prevents loss of biodiversity and maintains ecological processes. The VM Act is administered and enforced by DNRME.
- *Fisheries Act 1994* (Fisheries Act) provides for the use, conservation and enhancement of the Queensland community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of ecologically sustainable development and promote ecologically sustainable development. This seeks to protect and maintain commercial and recreational fisheries and coastal areas that provide important fish habitat and marine plants. The Fisheries Act is administered by the Queensland Department of Agriculture and Fisheries (DAF).
- *Biosecurity Act 2014* (Biosecurity Act) provides a framework for effective biosecurity in Queensland and to manage risks associated with emerging, endemic and exotic pests and diseases that impact on industries, the environment, domestic animals, and infrastructure. The Biosecurity Act is administered and enforced by DAF.
- *Planning Act 2016* (Planning Act) is a central piece of the Queensland planning legislation framework that manages the processes by which development occurs, and coordinates planning at local, regional and State levels.
- *Water Act 2000* (Water Act) provides for the sustainable management of Queensland's water resources. It aims to provide for ecologically sustainable development and to promote the efficient use and management of water resources. The Water Act defines what a watercourse is and regulates the taking of water, and development in and around watercourses. The Water Act is administered and enforced by the Department of Natural Resources, Mines and Energy (DNRME).



Consultation with DAWE has been undertaken both prior to field surveys and prior to preparing the MNES chapter of the EIS in order to confer on requirements for both surveys and Commonwealth assessment submissions.

Other approvals and conditions

A summary table of the relevant legislation and likely triggers for approvals and compliance requirements is provided in Table 18-2.

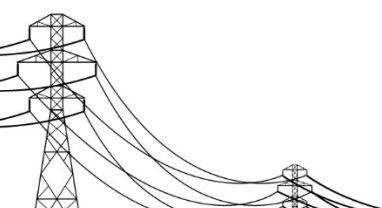
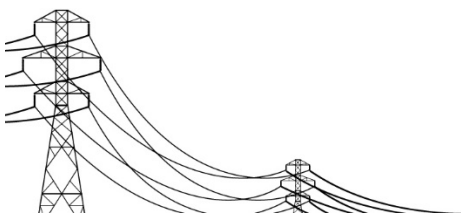
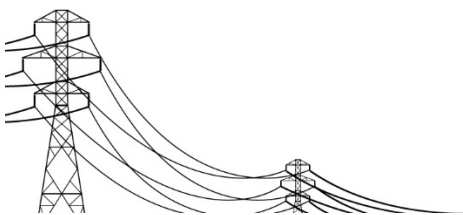


Table 18-2 Summary of approvals

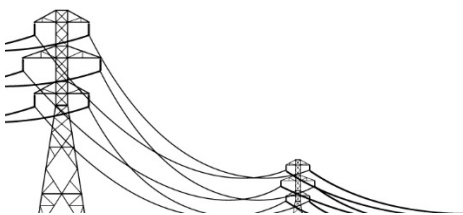
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Commonwealth				
Controlled action EIS assessment EPBC Act DAWE	Design Pre-construction	EPBC Act referral is required when a project may potentially significantly impact MNES protected under the EPBC Act.	Required The Project was referred to the DAWE in 2019 (EPBC Act Referral 2019/8416). The referral decision was that the Project is a controlled action. MNES will be addressed in the addressed in the CuString EIS and assessed under the Queensland bilateral assessment agreement. Public comment period/s applies.	Transmission line corridor
Indigenous Land Use Agreement or suppression of native title <i>Native Title Act 1993 (Commonwealth)</i> <i>National Native Title Tribunal (NNTT)</i> <i>Native Title (Queensland) Act 2003</i> <i>National Native Title Tribunal (NNTT)</i> Attorney-General's Department – Registered Native Title Party	Pre-construction	Indigenous Land Use Agreements will not be required for the project. Suppression of Native Title will be managed by the State of Queensland to allow access to land.	Not Required The State of Queensland will manage the notification process required for the Suppression of Native Title within State Land within the Project corridor.	Transmission line corridor Site preparation/ civil works Accommodation camps Laydown areas



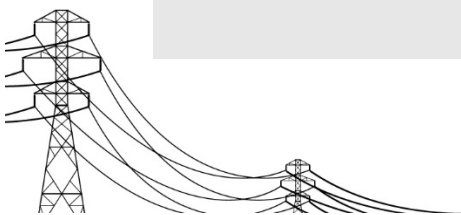
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
State – Development application				
Coordinated project EIS (Coordinated project declaration received on 26 April 2019) <i>State Development and Public Works Organisation Act 1971, section 36 (1)(a)</i> <i>Queensland Treasury</i>	Design Pre-construction	A coordinated project declaration is given to projects with complex approval requirements, significant environmental effects, strategic significance or significant infrastructure requirements.	Required The Project was declared a coordinated Project on 26 April 2019. The Terms of Reference for the EIS were approved on 4 September 2019.	Transmission line corridor Site preparation/ civil works
Prescribed Project Declaration <i>State Development and Public Works Organisation Act 1971, section 76 E (1)(d)</i> <i>Queensland Treasury</i>	Design Pre-construction	A prescribed project declaration is given after the EIS approval for projects with complex secondary approval requirements.	Required A letter request to the CG for a prescribed project declaration enables the CG, if necessary, to intervene in state and local government approval processes to ensure timely decision- making for the prescribed project. This will be relevant to ant tier two approvals if agencies are not cooperating.	Transmission line corridor Site preparation/ civil works



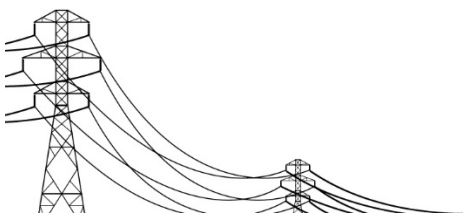
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Ministerial Infrastructure Designation Designation of premises For development of infrastructure (Electricity operating works) <i>Planning Act 2016, Part 5 / Planning Regulation 2017, Schedule 5, Part 2, Item 6</i> <i>Minister's Guidelines and Rules</i> <i>Queensland Treasury</i>	Pre-construction	Establishment of transmission corridor and development of infrastructure.	Required EIS to include sufficient information to address all aspects required by the Environmental Assessment Report (EAR) highlighting environmental values, potential impacts and mitigation measures. The EAR will be submitted after the CG has accepted the final EIS. The Planning Regulation 2017, Schedule 5, Part 2 (18) notes that the infrastructure designation can include storage and works depots and similar facilities, including administrative facilities relating to the provision or maintenance of infrastructure (i.e. laydown areas control centres can be included in the infrastructure designation..	Transmission line corridor
MCU development permit assessable under the local government planning scheme Planning Act	Pre-Construction	MCU is required for sub-stations, temporary construction camps and laydown areas where	Not Required No application required for the corridor selection, provided successful Infrastructure Designation. Assessment	



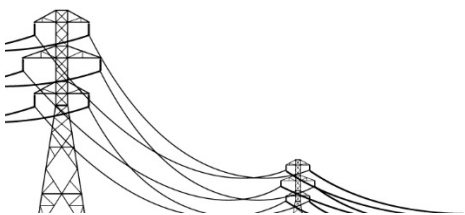
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Planning Schemes (Burdekin Shire Council, Charters Towers Regional Council, Flinders Shire Council, Richmond Shire Council, McKinlay Shire Council, Cloncurry Shire Council, Mount Isa City Council) Local government State assessment and referral agency		triggered by individual planning schemes	will be included in the EIS against the relevant planning schemes but the approval will be facilitated under the Infrastructure Designation process. Required Construction camp or laydown areas may trigger MCU, however location/details will not currently known and were not identified within the CopperString 1.0 Project EIS. Proposed that responsibility lies with the Contractor. Development Application for MCU will require proposed design and layout of construction camps and laydown areas, and assessment against the relevant planning scheme provisions. Consent from landowners will be required to lodge the planning application.	Accommodation camps Laydown areas
Owners Consent Planning Act <i>Land Act 1994</i> DNRME	Design and Approvals	Where the proponent is not landholder, owner's consent is required to be obtained and provided to supporting a development application. For State land and road reserves consent must be obtained from State Land agency	Not Required Owner's consent is not required for the EIS or infrastructure designation process. Required Owners consent may be required for secondary approvals, including approvals for temporary construction camp and clearing permits. Application to DNRME for owners consent for works within State Land (road reserve, watercourse, leasehold). Letter of consent from freehold landholders.	Site preparation/ civil works Accommodation camps Laydown areas



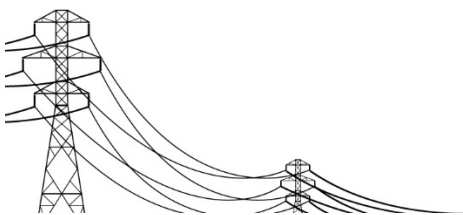
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
General Environmental Duty <i>Environmental Protection Act 1994</i> DES	Construction	General environmental duty outlines the duty of care responsibilities of all those undertaking work on the Project and the obligation to take all necessary measures to prevent environmental harm.	Required The Act requires all those working on the Project to abide by a General Environmental Duty. Record of compliance and measures taken to comply with General Environmental Duty e.g. construction environmental management plan (CEMP), inspection checklists.	Whole project
Operational works development permit assessable under the local government planning scheme Planning Act Planning Schemes (Burdekin Shire Council, Charters Towers Regional Council, Flinders Shire Council, Richmond Shire Council, McKinlay Shire Council, Cloncurry Shire Council, Mount Isa City Council) Local government	Pre-construction	If the designation process is undertaken, then transmission infrastructure does not constitute operational works. Construction camp or laydown areas may trigger operational works, however location / details may not be known for the EIS.	Required Operational works application for any bulk earthworks required for the construction of the temporary accommodation camps will require the application to be supported by design plans, statement of compliance with relevant codes and application forms and fees.	Transmission line corridor Site preparation/ civil works Accommodation camps Road crossings Laydown areas



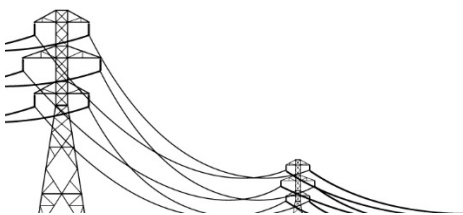
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Operational Work – Vegetation clearing Planning Act VM Act. <i>Electricity Act 1994</i> (Electricity Act) <i>State Assessment and Referral Agency (SARA)</i> DNRME (Advice)	Pre-construction	Clearing for construction areas and corridor. As a coordinated project, CopperString is considered to be a relevant purpose. Under sections 101 and 112A of the Electricity Act, clearing vegetation on freehold land is accepted development if the clearing is on premises the subject of an infrastructure designation that includes the operating works or is undertaken by a transmission entity for the operating works.	Not Required Vegetation clearing for the transmission corridor to be assessed as part of the EIS process and infrastructure designation will be exempt or accepted development. Required Additional clearing activities that are not included in the above (E.g. for accommodation camps may require Operational Works application for clearing of native vegetation or as included as part of an MCU application.	Transmission line corridor Accommodation camps Laydown areas



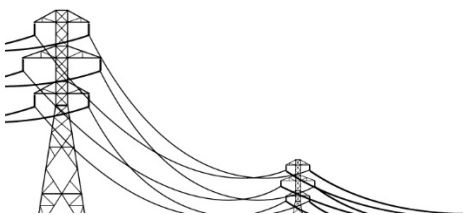
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Operational works for constructing waterway barrier works OR Compliance with Accepted development requirements for operational work that is constructing or raising waterway barrier works Planning Act Fisheries Act	Pre-construction	Will apply to specific locations during the construction phase where crossing waterways has the potential to create a barrier to fish passage.	Not Required Crossings of waterways during construction will utilise existing crossings, and crossings will not be of a type that constitute waterway barrier works. During the construction phase of the Project will utilise existing waterway crossings and where a temporary crossing is required it will be required to meet the Accepted development requirements for operational work that is constructing or raising waterway barrier works 2018.	Waterway crossings
Protected plant clearing permit or Exempt clearing notification NC Act DES	Pre-construction	When clearing areas identified as being within the high risk flora survey trigger areas for protected plants or where protected plants have been detected, a flora survey must be undertaken in accordance with the guideline and a clearing permit or exemption notice obtained.	Required Mapping indicates that Protected plant Flora surveys will be required as part of pre-clearance activities along the Woodstock to Dajarra Road corridor alignment. These surveys will indicate whether a clearing permit or exempt clearing notification is required.	Transmission line corridor Laydown areas



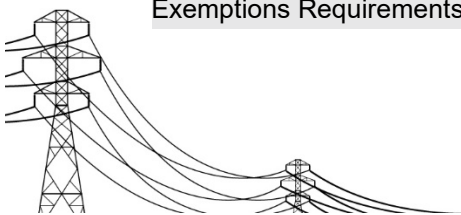
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Species management program (SMP) NC Act WM Regulation	Pre-construction	When undertaking activities which interfere with breeding places for species listed under the NC Act.	Required High risk SMPs Low risk SMP Species that are likely to require a high risk SMP include: - Southern black-throated finch - Southern squatter pigeon - Julia Creek dunnart Species with potential to require a high risk SMP are: - Night parrot - Red goshawk - Short-beaked echidna - Common death adder - Plains death adder - Colonial breeding bats - Special least concern (migratory) birds – where nests observed - Ornamental snake - Northern leaf-nosed bat - Vine-thicket fine lined slider - Australian painted snipe	Transmission line corridor Site preparation/ civil works Accommodation camps Laydown areas



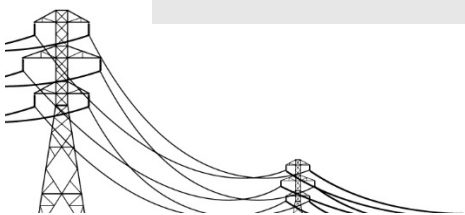
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Environmental offsets <i>Environment Offsets Act 2014</i> (EO Act) DES	Pre-construction	Environmental offsets are required where there are residual impacts following the removal of fauna, flora and habitat that cannot be avoided after applying mitigation and management measures.	Required Assessment of significant residual impacts in accordance with Queensland Environmental Offsets Policy Significant Residual Impact Guideline (either DES or Queensland Treasury). If offsets required, may be either proponent-driven (land-based) or financial settlement and in accordance with the Environmental Offsets Policy	Transmission line corridor Site preparation/ civil works Substations Accommodation camps Transmission towers Network control centre Waterway crossings Laydown areas
Transmission authority Electricity Act DNRME	Pre-construction	Applicable for obtaining transmission authority for the transmission line and works to construct transmission line	Required An application must be submitted in writing (there is no prescribed form) to The Regulator (Director-General, Department of Natural Resources, Mines and Energy) at the address given in this summary sheet, clearly stating proposed activity/grid (description). It must be accompanied by the fee prescribed under S188: Application for transmission authority of the Electricity Act and Schedule 7: Fees payable to regulator of the Electricity Regulation 2006.	Transmission line corridor
Transmission corridor easement <i>Land Title Act 1994</i> DNRME	Pre-construction	To establish an easement for the transmission corridor	Required Sealed easement plan	Transmission line corridor



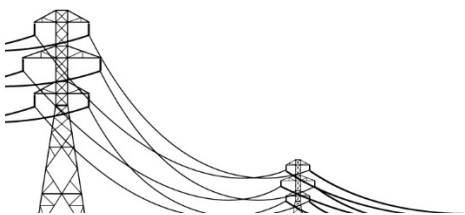
Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
Cultural Heritage Management Plan Duty of Care <i>Aboriginal Cultural Heritage Act 2003.</i> <i>Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP)</i>	Pre-construction	Avoid impacting significant Aboriginal and historic cultural heritage to minimise potential for harm. Cultural heritage management agreement being developed to meet ACA Duty of Care	Required Cultural Heritage Management Plan	Whole project
Work in a State Road Corridor <i>Impact Assessment Guidelines, infrastructure agreements- Transport Infrastructure Act 1994</i> <i>Department of Transport and Main Roads (DTMR)</i>	Pre-construction	For the use of state controlled roads during construction, and where new access point may be required.	Required Road Corridor Permit application form Traffic Control Permit, including traffic management plan Utility Installation Work approval (F5165 – Installation of utility assets in State Controlled Roads Application)	Site preparation/ civil works Road crossings
Work in a local road corridor <i>Impact Assessment Guidelines and Infrastructure agreements- local government policies- Local Government Act 1993</i> Local Government	Pre-construction	For the use of local governmental roads during construction	Required Road Opening Permit and Application for Road Excavation Road Closure Permit Carrying out works or interfering with a road approval	Road crossings
Riverine Protection Permit (RPP) <i>Water Act 2000</i> Riverine Protection Permit Exemptions Requirements	Pre-construction	A RPP is required to excavate, place fill or destroy vegetation in a watercourse, lake or spring unless such works are	Required The exemption requirements are considered likely to apply to any clearing of vegetation required to be undertaken within a watercourse, provided that clearing can	Waterway crossings



Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
WSS/2013/726 Version 2.01 dated 2019 (RPP exemption requirements)		otherwise authorised or exempt. CuString will be an electricity entity and thus an approved entity under the RPP exemption requirements The purpose of the RPP exemption requirements are to outline when it is permitted to excavate, place fill or destroy vegetation in a watercourse, lake or spring without the need for a riverine protection permit under the <i>Water Act 2000</i>. For the exemption to apply vegetation clearing must be: - carried out under an accepted development vegetation clearing code (other than category A), or - of an area that is less than 0.5 ha of a least concern RE in a category B area or - of an area that is less than 0.5 ha in a category C, R or X area.	meet the conditions of the exemption requirements. E.g. Where clearing is required for vehicular access tracks, the clearing must not exceed 10 m wide it can be carried out under the provisions of the Clearing for Infrastructure Accepted Development Code and therefore meets the exemption requirements. Clearing for other linear infrastructure under this code will be dependent on the area to be cleared and the vegetation category. Required Required, where a RPP is required, either for clearing of vegetation or excavating more than 500 m³ within a watercourse, the application to DNRME must include a plan denoting area of disturbance.	



Approval relevant legislation/ Approving authority	Project Phase	Trigger	Approval required	Project Element
General Biosecurity Obligation Biosecurity Act <i>Commonwealth pest and weed management strategies</i> Biosecurity Queensland DAF	Construction	Where undertaking activities which may contribute to the spread of invasive plant or animal species	Required Demonstration of taking all reasonable and practical steps to minimise the risks associated with invasive plants under their control e.g. CEMP, work method statements, inspection checklists.	Whole project
Local & Other Permits				
Plumbing and Drainage	Construction	Undertaking plumbing and drainage work	Required Self-assessable Certification of works. Contractor responsibility	Accommodation camps
Building Work <i>Building Act 1975</i>	Pre-construction	Development permit for building works associated with transmission towers, temporary construction camps and other construction activities.	Required Self-assessable. For construction plans approved by certifier. Contractor responsibility	Accommodation camps Transmission towers Laydown areas
Easement arrangements and land access <i>Land Act 1994</i> Land owners	Design and Pre- construction	Any works or access requirements on land not owned by the proponent.	Required Easement agreements Land access agreements Entry notifications.	Whole project

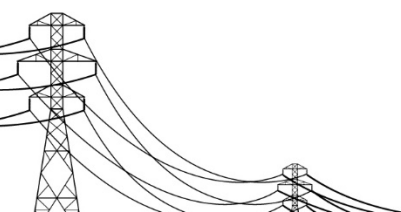


18.1.9 Cross-reference to Division 5.2 of EPBC Regulations

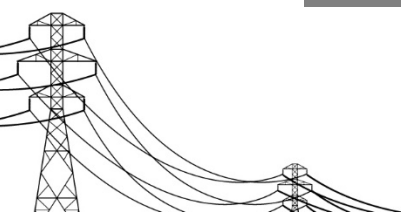
The MNES chapter must address each of the matters mentioned in Division 5.2 of the EPBC Regulations, which refers to Schedule 4 for a list of the relevant information to be included.

Table 18-3 Cross reference to Division 5.2 of EPBC Regulations

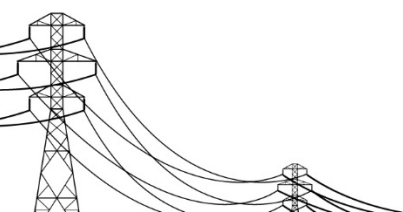
Matters to be addressed	Section of MNES chapter
1 General information	
1.01 The background of the action including:	
(a) the title of the action	Section 18.1.1
(b) the full name and postal address of the designated proponent	Section 18.1.4
(c) a clear outline of the objective of the action	Section 18.1.1
(d) the location of the action	Section 18.1.1
(e) the background to the development of the action	Section 18.1.1
(f) how the action relates to any other actions (of which the proponent should be reasonably aware) that have been, or are being, taken or that have been approved in the region affected by the action	Section 18.1.6
(g) the current status of the action	Section 18.1.1
(h) the consequences of not proceeding with the action	Section 18.1.7
2 Description	
2.01 A description of the action, including:	
(a) all the components of the action	Section 18.2.4
(b) the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts	Section 18.2.4
(c) how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts	Section 18.2.5
(d) relevant impacts of the action	Section 18.5
(e) proposed safeguards and mitigation measures to deal with relevant impacts of the action	Section 18.5
(f) any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action	Section 18.1.8
(g) to the extent reasonably practicable, any feasible alternatives to the action, including: – (i) if relevant, the alternative of taking no action – (ii) a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action – (iii) sufficient detail to make clear why any alternative is preferred to another	Section 18.1.7
(h) any consultation about the action, including: – (i) any consultation that has already taken place – (ii) proposed consultation about relevant impacts of the action – (iii) if there has been consultation about the proposed action - any documented response to, or result of, the consultation	Section 18.2.3.1
(i) identification of affected parties, including a statement mentioning any communities that may be affected and describing their views.	Section 18.2.3.1



Matters to be addressed	Section of MNES chapter
3 Relevant impacts	
3.01 Information given under paragraph 2.01(d) must include:	
(a) a description of the relevant impacts of the action	Section 18.5.2 and 18.5.3
(b) a detailed assessment of the nature and extent of the likely short term and long term relevant impacts	Section 18.5
(c) a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible	Section 18.5.4
(d) analysis of the significance of the relevant impacts	Section 18.5.4
(e) any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Section 18.3 and 18.4
4 Proposed safeguards and mitigation measures	
4.01 Information given under paragraph 2.01(e) must include:	
(a) a description, and an assessment of the expected or predicted effectiveness of, the mitigation measures	Section 18.5.2 and 18.5.3
(b) any statutory or policy basis for the mitigation measures	Section 18.5.2 and 18.5.3
(c) the cost of the mitigation measures	Section 18.2.2
(d) an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing	Section 18.5.8
(e) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program	Section 18.1.8
(f) a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action, including mitigation measures proposed to be taken by State governments, local governments or the proponent.	Section 18.5.7
5 Other approvals and conditions	
5.01 Information given under paragraph 2.01(f) must include:	
(a) details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including: – (i) what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy – (ii) how the scheme provides for the prevention, minimisation and management of any relevant impacts	Section 18.1.8
(b) a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action	Section 18.1.1
(c) a statement identifying any additional approval that is required	Section 18.1.8
(d) a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	TBA
6 Environmental record of person proposing to take the action	
6.01 Details of any 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; and	Section 18.1.4
(b) for an action for which a person has applied for a permit, the person making the application.	N/A
6.02 If the person proposing to take the action is a corporation—details of the corporation's environmental policy and planning framework.	Section 18.1.4 and 18.5.8
7 Information sources	



Matters to be addressed	Section of MNES chapter
7.01 For information given in a draft public environment report or environmental impact statement, the draft must state:	
(a) the source of the information; and	Section 18.8
(b) how recent the information is; and	Section 18.8
(c) how the reliability of the information was tested; and	Section 18.3
(d) what uncertainties (if any) are in the information.	Section 18.3 and 18.4



18.2 Project description

18.2.1 Overview

The CopperString transmission network is divided into the following eight sections as shown in Figure 18-3:

4. Woodstock Substation

The Woodstock Substation will connect the CopperString transmission network to the existing 275 kV Powerlink transmission network and will transform voltage between 275 kV and 330 kV.

5. Renewable Energy Hub

The first 342 km of the Project from the Woodstock Substation, consisting of a dual circuit 330 kV transmission line and the Flinders Substation (south-west of Hughenden) to which it connects, forms the Renewable Energy Hub.

6. CopperString Core

Moving further westward, the next 395 km of the Project, consisting of a dual circuit 330 kV transmission line and the Dajarra Road Substation (near Cloncurry) to which it connects, forms the CopperString Core. The CopperString Core connects the eastern-most bulk supply substation of the NWPS 220 kV network, at Cloncurry, to the Flinders Substation. The Dajarra Road Substation will transform the voltage between 330 kV and 220 kV (the NWPS transmission voltage) for connections to the Ergon Energy Chumvale Substation, Dugald River Mine, Ernest Henry Mine and the Southern Connection.

7. Mount Isa Augmentation

The Mount Isa Augmentation will upgrade and supplement the transfer capacity between the Chumvale Substation and the Mica Creek Complex at Mount Isa. The Mount Isa Augmentation will consist of a new substation south of Mount Isa, near the Mica Creek complex, with a dual circuit 220 kV transmission line connection to the Dajarra Road Substation.

8. Southern Connection

The Southern Connection will consist of a dual circuit 220 kV transmission line connection the Dajarra Road Substation the Selwyn Substation. The Southern Connection will enable connection of the southern mines, such as Cannington Mine, Mount Dore Mine and Phosphate Hill Mine that are presently not connected to the NWPS. The Selwyn Substation will include distribution equipment to connect the Mount Dore Mine.

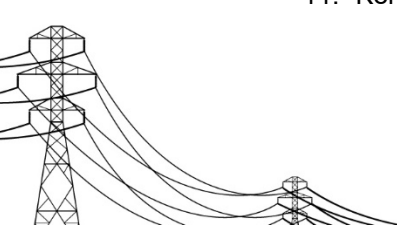
9. Cannington Connection

The Cannington Connection will consist of the Cannington Substation and a single circuit 220 kV transmission line connection from the Selwyn Substation. The Cannington Substation will include distribution equipment to connect the Cannington Mine.

10. Phosphate Hill Connection

The Phosphate Hill Connection will consist of the Phosphate Hill Substation and a single circuit 220 kV transmission line that connects to the Southern Connection at KP 90.33DS. The Phosphate Hill Substation will include distribution equipment to connect the Phosphate Hill Mine.

11. Kennedy Connection (option)

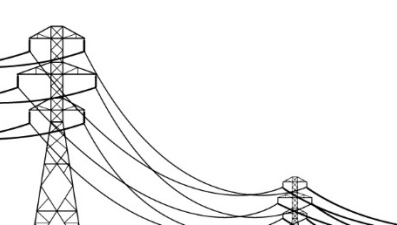


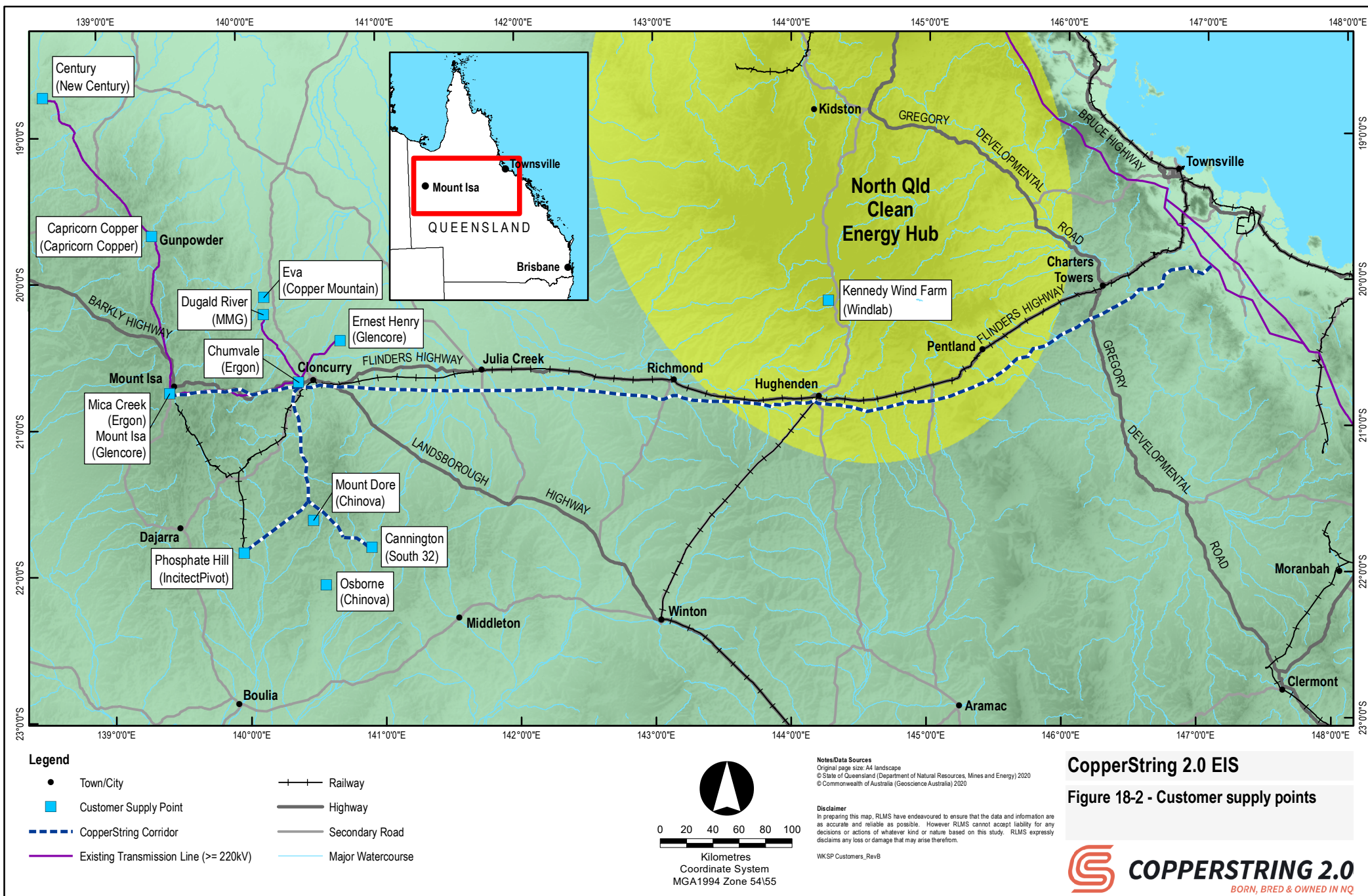
The Kennedy Connection option (not assessed in the EIS) will be a dual circuit 330 kV transmission line connection to the proposed Kennedy Wind Farm (Phase 2 of the Kennedy Energy Park), approximately 80 km north of Hughenden, to the Flinders Substation.

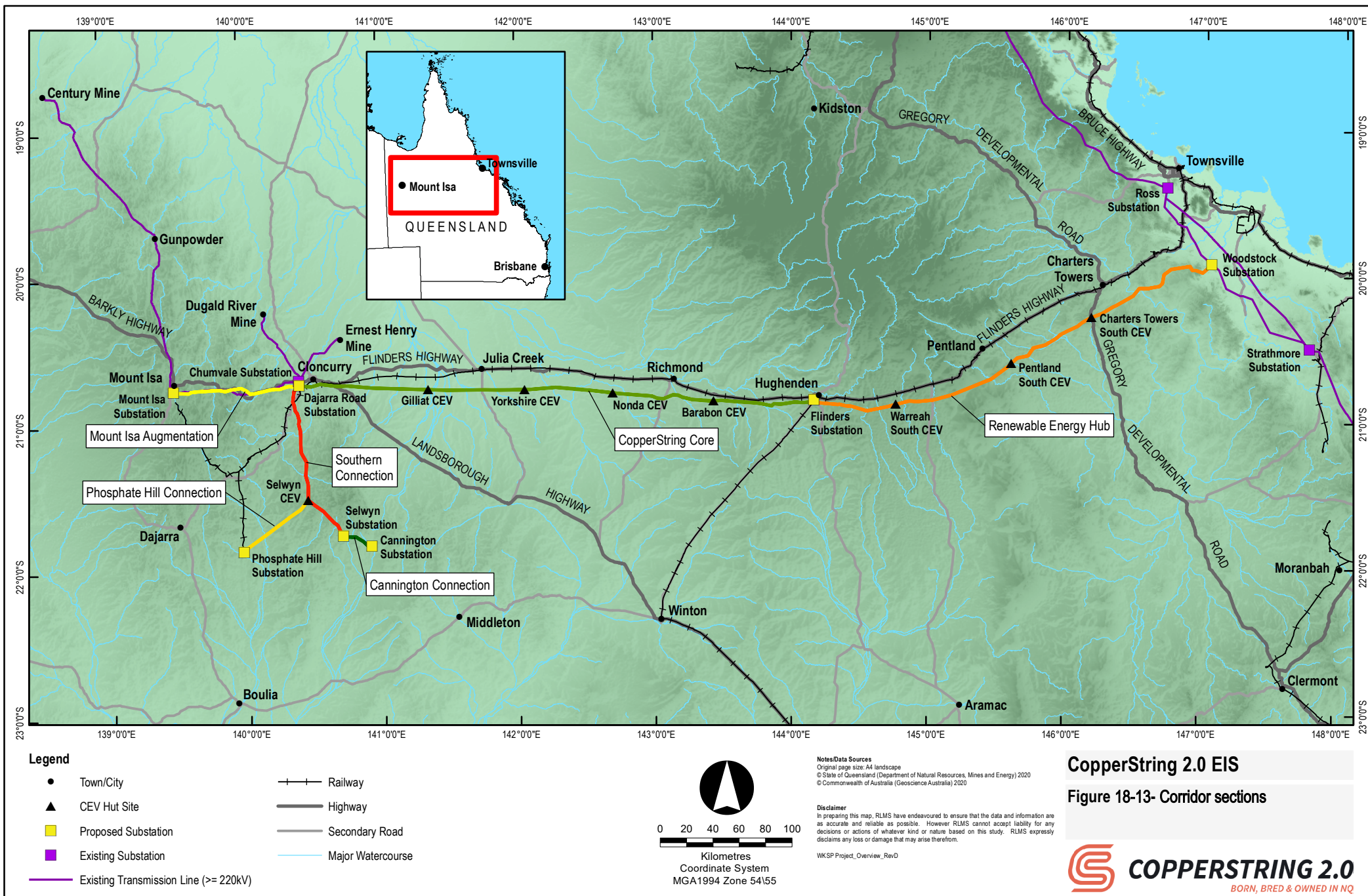
The Project transmission system will be designed to deliver 500 MW of electricity to the CopperString Core with a reliability equal to, or better than, that already experienced by electricity consumers connected to the NWPS. The Project will be capable of exporting power into the state electricity grid from generators on the existing islanded systems and future generators, such as the proposed Kennedy Wind Farm.

The Project includes the development of the transmission line, substations, laydown areas, construction camps, communication huts, access tracks, and vegetation management.

Figure 18-2 shows customer supply points for the Project.







18.2.2 Cost and timing

The Project is estimated to have a capital expenditure of approximately \$1.7 billion.

Following a four month period of pre-construction activities (Section 18.2.5), construction is expected to take approximately 31 months to complete. The proposed construction staging is outlined in Table 18-4. Specific costs of undertaken mitigation measures are unknown at this stage of the Project.

Table 18-4 Proposed construction staging

Project milestone	Completion Date
Preliminary design via early contractor involvement	Q1 2021
Completion of the EIS Process	Q1 2021
Detailed design	Q3 2021
Financial close/notice to proceed for construction phase	Q3 2021
Commissioning of connection to the Renewable Energy Hub and CopperString Core	Q1 2024
Commissioning of Mount Isa Augmentation and Southern Connections	Q2 2024

18.2.3 Social and economic considerations

18.2.3.1 Public consultation and stakeholder engagement

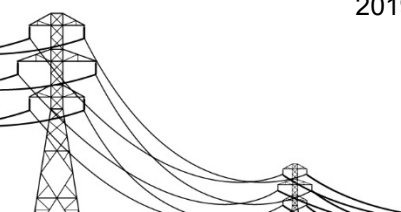
CuString has an ongoing stakeholder engagement program that aims to inform stakeholders and the community of the Project, and seek engagement and feedback from stakeholders and the community.

Relevant stakeholder groups that have been identified and engaged in consultation include the following:

- Commonwealth Government elected representatives and Commonwealth Government departments (including representatives from adjacent Commonwealth electorates)
- Commonwealth ministers in relevant portfolios, including the Prime Minister
- State Government elected representatives and State Government departments
- State Government ministers in relevant portfolios
- Government owned corporations such as Energy Queensland, Queensland Rail and Townsville Port Authority
- Local Government representatives
- Landowners
- Traditional owners and Indigenous groups
- Regional and local community groups
- Other key stakeholder groups including industry groups, mining groups, media, renewable energy providers, emergency and health services, businesses, service providers and potential customers.

Public consultation activities that have been undertaken include:

- Draft Terms of Reference released for public comment between 8 July 2019 and August 2019



- Various consultation, including meetings, briefings, workshops and written communications with relevant Commonwealth, Queensland and local Government departments/agencies
- Written communications with relevant Indigenous groups
- Meetings with the National Australia Infrastructure Facility (NAIF)
- Landholder consultation activities through written communication, phone calls, and face-to-face meetings
- Meetings and written communication with other key stakeholders such as community groups, emergency services, mining companies and electricity service providers and other potential customers

In addition to CuString's public consultation program, targeted consultation was undertaken in February 2020 to inform the preparation of the Social Impact Assessment, which included face to face meetings or telephone interviews with key stakeholders including local government representatives, social infrastructure services and emergency services, and landholders.

Feedback and concerns raised during the consultation process can be broadly categorised into the following themes:

- Land management impacts of corridor selection
- Construction impacts
- Social impacts on the local community
- Biosecurity
- Roads and transport
- Project support
- Economic impacts
- Climate change

These concerns have been addressed through Project design changes or mitigation and management measures, which are discussed in chapters of the EIS.

The feedback from consultation activities indicates there is generally support of the Project from all stakeholder groups, as the Project is seen as offering economic and social opportunities for local communities.

Landowner and overlaying tenure consultation

Landholder consultation activities were commenced once the ToR had been accepted and published. The process used was one of individual consultation with each impacted landholder along the proposed corridor selection. Following initial contact with landholders, follow-up activities have been undertaken to respond to landholder requests or to provide further information as the Project has progressed. To capture feedback from landholders, CuString has developed and maintained a database of contact. Consultation with landowners is described in Table 18-5.

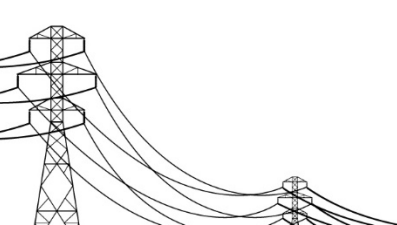


Table 18-5 Landowner and overlaying tenure holder consultation

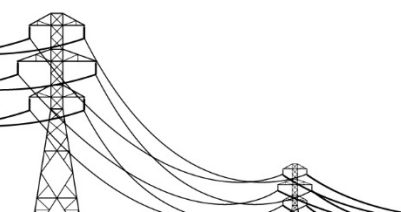
Date	Purpose	Format	Details of contact
18 April 2019	Project intent	Letter	Outline of project Statement that Project has an impact on the property
June – August 2019	Project Detail and potential impacts	Face-to-Face Phone Email	Briefing undertaken by Land agents Briefing pack - provides overview of Project, outline potential impacts, maps of property Seek feedback from property owner on constraints and opportunities and agreement on project
June 2019 onwards	Refine Corridor and Develop Land Agreements	Face-to-Face Phone Email	Ongoing consultation and communication with landholders on proposed transmission corridor and project changes as necessary Obtain landholder consent to entry for scientific and other studies
1 October 2019	Project update	Letter	Project update Easement acquisition Easement guide
February – March 2020	Project update	Phone	Discussions with respect to corridor changes and advising a hold on face to face meetings due to COVID – 19 travel restrictions.
July 2020	Project update	Phone	Recommencing discussions and preparing for face to face meetings in August 2020
July 2020	Project Update	Letter	Newsletter to landholders advising of the recent progress on the Project.
2 July 2020 – ongoing	Project intent and project impacts to overlaying tenure holders	Letter Email Phone	Overview of impacts of the Project and offering opportunity to communicate with Project on impacts
29 July 2020	Project update to landowners	Letter	Project update including further meetings with Land Agents to discuss Land Option Agreements
22 September 2020	Land Option Agreements to Landowners	Face-to-face Phone Email	Delivery of Land Option Agreements with impacted landholders Ongoing consultation with landholders on project and impacts

Indigenous groups and traditional landowner consultation

The briefings and activities in Table 18-6 have been undertaken with Indigenous groups and traditional landowners as part of the process of developing the EIS. The consultation process has worked towards developing Cultural Heritage Management Plans with Traditional Owners.

Table 18-6 Indigenous Groups and Traditional Landowners Consultation

Date	Purpose	Method	Agencies in attendance
15 August 2019	Project Intent and Information to Traditional Owner Groups	Letter	• Yulluna People • Birriah People • Mitakoodi People #5 • Kalkadoon People #5 • Wanamara People • Yirendali People
22 January 2020	Project briefing	Meeting	NAIF
29 July 2020 onwards	Project introduction	Meetings	• Yulluna People • Birriah People • Mitakoodi People #5 • Kalkadoon People #5 • Wanamara People • Yirendali People
18 August 2020 onwards	Formal meeting Traditional Owner Group Directors to begin Cultural Heritage Management Plan (CHMP) process	Meetings	• Yulluna People • Birriah People • Mitakoodi People #5 • Kalkadoon People #5 • Wanamara People • Yirendali People
10 September 2020 onwards	Development of CHMPs	Ongoing phone call and emails	• Yulluna People • Birriah People • Mitakoodi People #5 • Kalkadoon People #5 • Wanamara People • Yirendali People

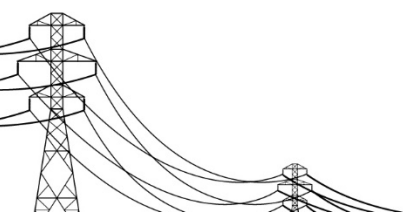


Ongoing public consultation

A wide range of stakeholders will be impacted by the Project and CuString has engaged with them to provide information and gain feedback on the impacts of the project and provide input to form the EIS. Public consultation will be an ongoing process throughout the EIS period and over the life of the Project. Table 18-7 outlines proposed ongoing public consultation activities. Further feedback from the EIS public consultation process will be key in providing further input to the Project in the detailed design phase.

Table 18-7 Ongoing proposed public consultation activities

Stakeholder group	Proposed consultation activities
Commonwealth Government departments and representatives	Ongoing consultation regarding: • Environmental offsets • MNES • NAIF
Queensland Government departments and representatives	Ongoing consultation regarding: • Environment/environmental offsets • Main roads and transport • Emergency services • Native title • Planning and approvals • Health and safety • Water resource management • Biosecurity
Local governments and representatives	Ongoing consultation regarding: • Local government planning regulations • Waste management • Water supply • Camp construction and management • Road Use Management Plans • Local business participation plan • Local workforce and Indigenous participation plan • Emergency management • Health and safety • CEMP
Landholders	• Continued engagement about corridor selection and impacts to properties • Consultation on proposed detailed design investigations on properties • Easement agreements • Transmission line construction • Emergency management



Stakeholder group	Proposed consultation activities
Traditional Owners and Indigenous groups	• Develop CHMP • Cultural heritage surveys and cultural heritage management strategies • Broader Indigenous public consultation outside of CHMPs • Indigenous employment participation plan • Indigenous Engagement Strategy (NAIF)
Government owned corporations and private enterprises	• Detailed project design including technical design • Tender process
Regional and local communities and businesses	• Community information sessions on Project • Local workforce and Indigenous participation plan • Local business participation plan

18.2.3.2 Social impact assessment

A Social Impact Assessment has been prepared for the Project. A summary of the main impacts and opportunities identified in the Social Impact Assessment is included below.

Economy

The Project will generate direct and indirect employment opportunities through construction workforce opportunities and supply of goods and services. It is expected there will be a construction workforce peak of 750 full time employees. CuString will employ locally and regionally where possible and competitive; however, some specialist roles may be sourced from elsewhere in Queensland, Australia, or from overseas. Likewise, local businesses and service providers will have an opportunity to provide goods and services for the Project, where appropriate and competitive.

CuString will work with councils, education and training providers, and local employment agencies to develop a local and Indigenous workforce participation plan. Employment opportunities provided by the Project were viewed by stakeholders as a positive benefit for the regional study area.

Network control and maintenance personnel required for operation of the Project is estimated to require a small workforce of up to 30 personnel. Maintenance roles would be subcontracted and most likely located in either Mount Isa or Townsville who are expected to stay in local accommodation during maintenance periods. The network control workforce will be permanently located in Townsville.

The Project will also generate significant medium term employment in the Queensland economy through the additional resources stimulated through connection to the state electricity grid, and participation in the NEM. In addition to direct jobs generated on site, the construction, installation, and production phases of new projects will require significant quantities of Queensland sourced goods and services, including mining, engineering, management services, machinery, cement, manufacturing and various other business services. These inputs will further increase the demand for labour across the Queensland economy.

The Economic impact assessment in Volume 3 Appendix AB estimates a projected increase in employment in North-West Queensland by 1,849 employee years from 2020 to 2024, with a peak net employment of an additional 950 full time equivalent jobs in 2024, as a result of

construction of the Project. With the connection to the NEM, employment in North-West Queensland is projected to remain largely steady at around 12,000 FTE jobs through to 2040, compared to experiencing a gradual decline to approximately 6,400 FTE jobs under the 'business as usual' case.

Community health, safety and connectivity

Impacts to community health, safety and connectivity are related to the increase in traffic on roads during construction of the Project, particularly heavy vehicles including road trains. The Project's construction traffic related impacts will be managed by a Road Use Management Plan, which will be developed in consultation with government agencies including the Department of Transport and Main Roads and Queensland Police Service. The plan will include measures to manage the efficiency of the road network and to promote safety and awareness in local communities about construction traffic and safe behaviour.

The presence of a temporary construction workforce in regional towns was identified as a cause of potential concern in the Social Impact Assessment. These concerns included the social integration of the non-resident workforce and concern about maintaining the feeling of safety and trust experienced in small communities. While the potential for the construction workforce to negatively impact community safety and values is limited, CuString will develop a workforce management plan including a code of conduct, which will address:

- Code of conduct and behaviour management
- Fitness for work policy including drug and alcohol testing
- Expectations and standards when dealing with external parties and the broader community
- Promoting participation of workforce in local clubs and events.

Impacts on health and emergency services and other community infrastructure

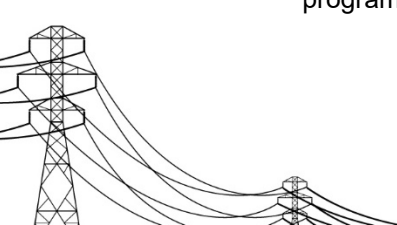
The Social Impact Assessment found that the majority of communities had access to a general practitioner and emergency services with the capacity to respond to any incidents from the Project.

Workforce wellbeing was identified as a potential impact of the Project and will be addressed in the workforce management plan. The workforce management plan will include measures such as provision of amenities and recreational activities in construction camps, access to telecommunication infrastructure, opportunities to participate in local community clubs and events, and access to local businesses and facilities, and mental health support.

Cumulative impacts

The Social Impact Assessment found that there is a skills shortage across the regional study area and there is unlikely to be the specialist skills required for the Project in the existing workforce. Project-related employment may draw workers away from existing employment and future local employers.

There are a number of other projects expected to be developed in the regional study area, which may overlap with the Project in terms of skill sets required. These projects include the 15 Mile Irrigated Agricultural Development, along with projects in Townsville (North Queensland Country Club Resort and Equestrian Centre). In addition, during consultation stakeholders indicated that other projects may also coincide with the Project's timeline, including Big Rocks Weir, Singapore Military Training Initiative, and a number of local government works programmes.



Should all projects be developed, there is potential that there may be competition for labour in the regional study area, drawing workers from existing jobs and creating shortfalls. However, it is expected that the Project's workforce would be sourced from a combination of local and other parts of Queensland and Australia, along with opportunities for training local workforce.

To minimise draw of workforce from existing jobs, the following mitigation measures would be implemented:

- Maximise Indigenous employment, through investment in work-ready programs in the region
- Identify opportunities for the employment of apprentices and trainees
- Work with local training providers to provide training for regional Indigenous and non-Indigenous workers to gain the required qualification to be employed on the project.

18.2.3.3 Economic impact assessment

The Economic impact assessment for the Project (Volume 3 Appendix AB) identified an increase to real economic output over the period to 2050 as a result of the Project as follows:

- North-West Queensland by a cumulative total of \$142.6 billion (with a net present value of \$81.0 billion, using a 3% real discount rate)
- Queensland by a cumulative total of \$139.5 billion (with a net present value of \$79.3 billion, using a 3% cent real discount rate)
- Australia by a cumulative total of \$131.8 billion (with a net present value of \$75.0 billion, using a 3% real discount rate).

18.2.4 Key components of the Project

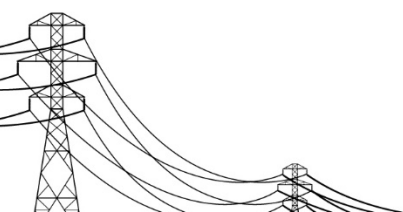
18.2.4.1 Corridor selection process

A Corridor selection report was prepared, identifying the corridor from Woodstock to Mount Isa and from Cloncurry south to the Selwyn Substation and connection points to Mount Dore Mine, Phosphate Hill Mine and Cannington Mine.

The corridor selection process followed the Powerlink Corridor Development Process engagement model for corridor selection and was based on the CopperString 2010 Route Selection Report (RLMS 2010). The process also considered recent Queensland Government policy concerning power infrastructure and the locations of critical substations that define the Project network structure.

The corridor selection was considered best for the Project for the following reasons:

- An alignment through the Herveys Range (Eastern Study Corridor) is easier south of the Flinders Highway due to a natural narrowing of the range in this location and the availability of a less constrained corridor.
- Elevation is flatter west of the Herveys Range and to the south of the Flinders Highway. An alignment north of the Flinders Highway requires the crossing of multiple ranges and mountains including the Gasstree Ranges, Great Basalt Wall, Lolworth Range and Great Dividing Range.
- Several Protected Areas occur north of the Flinders Highway including White Mountain National Park. The review identified the registration of the Ballara Nature Refuge to the south of Cloncurry.



- Numerous river systems converge north of the Flinders Highway between Hughenden and Cloncurry creating expansive flood plains. An alignment to the south of the Flinders Highway avoids the worst of these flood plains.
- The landscape is relatively uniform within the study area between Mingella to Cloncurry. MSES occur sporadically throughout the area and the nominated 5 km Study area provides significant opportunity for the final 120 m wide project corridor to avoid, minimise and mitigate impacts to important ecological values and features.

Several amendments were made to the corridor selection to avoid environmental, social and economic impacts including:

- **Burdekin River Crossing** - The review of the 2010 crossing point in the Burdekin River was shifted to avoid *Eucalyptus ravertiana* that was mapped on the riverbank. This species is a Commonwealth listed MNES and the purpose of the shift was to avoid impact on this species.

In addition, it was noted that west of the crossing point at the Burdekin River had been mined and this shift would avoid interference with the mining operations. The corridor was further adjusted east of the river crossing to avoid a Mining Lease and impact on the mining operations.

Kennedy Wind Farm - This development is a 43 MW wind farm under construction by Windlabs Limited. A major realignment was undertaken to avoid sterilisation of the wind resource and potential impact on the wind farm. In addition, the corridor was shifted outside of the “fall zone” should a wind turbine fail. The shift of the corridor is north towards the Flinders Highway and includes a substation south-west of Hughenden.

- **Mary Kathleen historic township** - Land owners requested a shift of the corridor by two kilometres to avoid impact on their operations and a camping area near the historic mining township of Mary Kathleen.

This alignment requires two additional crossings of the Barkly Highway and an Ergon extra high voltage line in the area. The alignment was assessed and approved by Project engineering team.

- **Ballara Conservation Reserve** - The alignment through the Ballara Nature Refuge was re-examined. The preferred corridor is proposed on the eastern side of Cloncurry Dajarra Road, reducing the distance the corridor extends through the reserve. This alignment also avoids steep land and rugged terrain located on the eastern side of Cloncurry Dajarra Road and the Mount Isa Rail Line.

Thirty-eight other minor amendmens were made to the corridor selection to avoid impacts to environmentally sensitive areas, cultural heritage sensitive areas, consideration of landholder requests and engineering considerations (eg. Locations near flood impacted areas and watercourses).

A concept design and Field Development Plan have also been developed for the Project which provide a process for the detailed design and construction to further refine the corridor selection to minimise and mitigaete impacts.

The individual section of the corridor selection are summarised in Table 18-8.

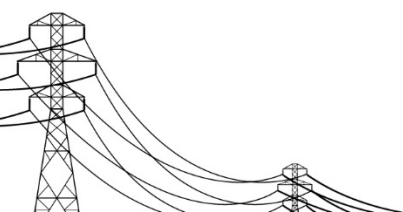


Table 18-8 Description of transmission line easement

Transmission Line Section	Approximate Distance (km)	Voltage (kV)	Easement width (m)	Corresponding kilometre points (KP)
Renewable Energy Hub	342	330	120	0 - 341.74WD
CopperString Core	395	330	120	341.74 - 736.289WD
Dajarra Road Connection for Ernest Henry and Chumvale Substation	4	220	60	0 - 3.671EE
Dajarra Road Connection for Dugald River	3	220	80	0 - 2.68MMG
Mount Isa Augmentation	99	220	60	0 - 98.599DM
Southern Connection	129	220	60	0 - 129.247DS
Cannington Connection	24	220	60	0 - 24.304SC
Phosphate Hill Connection	63	220	60	90.33DS - 63.145SP

The 120 m wide easement from Woodstock Substation to Dajarra Road Substation (Renewable Energy Hub and CopperString Core) accounts for a potential future duplication of these sections of the transmission line. Construction will only occur on the southern side of the easement, leaving the northern side for an expansion if necessary in the future.

Connection to the existing NWPS near Chumvale Substation will be achieved by cutting in to the existing 220 kV transmission lines connecting Chumvale Substation to the Ernest Henry Mine and Dugald River Mine. These cut-ins will connect the Dajarra Road Substation to the Chumvale Substation and transfer connection of the two mines' 220 kV transmission lines to the Dajarra Road Substation. A 60 m wide easement is required for the dual circuit line connecting to the Chumvale Substation and the Ernest Henry connection (one line for each connection) and an 80 m wide easement is required for the Dugald River connection.

The remaining sections (Mount Isa Augmentation, Southern Connection, Cannington Connection, and Phosphate Hill Connection) will have 60 m wide easements, with the transmission line being constructed in the centre of the easements.

18.2.4.2 Transmission towers

Although the conceptual design is based on steel lattice transmission towers, alternative structures such as monopoles may be considered, where appropriate.

The Renewable Energy Hub and CopperString Core will be double circuit 330 kV transmission lines. Typical structures are shown in Plate 18-1. Each transmission tower will support a single circuit on each side of the tower.

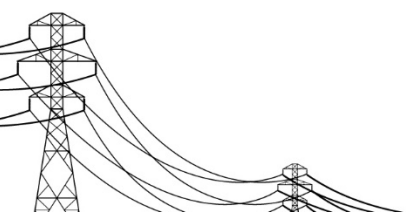




Plate 18-1 Typical 330 kV double circuit steel lattice transmission tower (left) and 330 kV double circuit monopole (right)

The Mount Isa Augmentation and the Selwyn Connection will each be a double circuit 220 kV transmission line. Each transmission structure will support a single circuit on each side of the tower.

The Phosphate Hill Connection and the Cannington Connection will each have a single circuit 220 kV transmission line. Typical single circuit structures, with a single overhead earth wire, are shown in Plate 18-2.

Each transmission line circuit consists of three phase conductors (or possibly groups of sub-conductors) and an optical ground wire (OPGW). Each individual phase corridor is attached to the transmission tower with an insulator and a cross arm. The OPGW consists of a fibre optic cable shielded by a conductor and is used for both lightning protection and communications media.

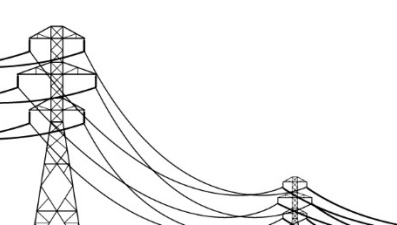




Plate 18-2 Typical 220 kV single circuit lattice transmission tower (left) and 220 kV single circuit monopole (right)

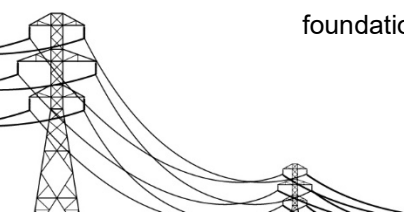
Transmission towers will be designed to maintain a mid-span clearance of the transmission line above local terrain in compliance with Queensland legislation. Nominal transmission tower heights and distances between transmission towers are described in Table 18-9. Transmission tower heights will vary from location to location depending on topography of each specific location.

Table 18-9 Physical description of transmission towers

Corridor section	Minimum height (m)	Maximum height (m)	Typical spacing (m)
Renewable Energy Hub	60	81	450-500
CopperString Core	60	81	450-500
Mount Isa Augmentation	55	76	400-450
Southern Connection	55	76	400-450
Cannington Connection	49	70	400-450
Phosphate Hill Connection	49	70	400-450

The distance between transmission towers will typically be in the range of 400–500 m. This may vary depending on the topography and conductor clearance required in particular areas of the easement. Drawings showing indicative placement of transmission towers are included in Volume 3 Appendix H Tower siting plans.

The concept transmission tower sites have been selected after careful consideration of all physical constraints such as sensitive environmental areas, rock/soil types, significant waterways, watercourse or infrastructure crossings, existing land use, and amenity. The transmission towers will be sited to make the best use of available terrain providing both sound foundations whilst minimising impacts to the environment and adjacent land uses.



Transmission towers and associated construction materials will be located outside of active watercourses and wetlands. Where the corridor selection crosses large braided ephemeral systems, some of which are more than 1 km wide, tower sites have been individually selected to avoid existing channels and the tower design will be sufficient to withstand seasonal flows or larger flooding events.

18.2.4.3 Transmission tower foundations

The type of foundation for the transmission towers is largely dependent on the site and soil condition. The transmission tower foundations will be comprised of reinforced concrete. Transmission tower sites that may be subject to inundation from flooding and large rainfall events will utilise concrete sleeves over the base of the footings and foundations to armour the structure and site from erosion or degradation.

Detailed geotechnical studies will be conducted during the detailed design phase of the Project to finalise foundation types and will likely constitute a range of footing types and designs that will vary for each location. Transmission tower foundations will be mostly bored concrete piers. Depending on ground conditions, alternative foundation design, such as rock anchors or concrete raft foundations, may be required. Further site testing will be conducted during construction to enable selection of a standard design for each site.

Where monopoles are used there will be a single foundation, rather than four separate footings. In certain installation conditions, monopoles may require the fitment of guy wires, which will have additional anchoring foundations.

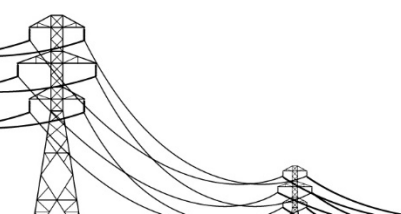
18.2.4.4 Watercourse and other infrastructure crossings

The transmission lines will cross the infrastructure highlighted in Table 18-10.

Table 18-10 Watercourses and other infrastructure crossings

Infrastructure	Number of crossings
Road crossings	
State-controlled roads	14
Local government roads	35
Railway crossings	
Railway crossings	3
Transmission line crossings	
220 kV	4
66 kV	8
33 kV	2
19.1 kV	29
11 kV	2
Pipeline crossings	
Gas pipeline crossings	2
Watercourse crossing*	
Total watercourse crossings	62
Major watercourse crossings	29

*table denotes number of times watercourses are crossed, some watercourses are crossed multiple times



The watercourses in Table 18-10 are named watercourses identified on Geosciences Australia (2006) 1:250,000 Topographic data. Of these, 53 are identified as watercourses and five are identified as drainage features on Queensland Government Watercourse identification mapping. Major watercourse crossings are defined as crossings where the corridor selection traverses significant floodplain extents greater than 0.5 km in width, which accounts for more than 90 percent of the floodplain crossing extents. A summary of watercourse crossings is included in Table 18-11.

Table 18-11 Named water features traversed by the corridor selection

Watercourse	Approximate Location (KP)	Drainage Basin
Blackmore Creek	0.9WD	Haughton
Spring Creek	63.6WD	Burdekin
Stony Creek	66.7WD	
Vine Creek	69.1WD	
Boatswain Creek	71.8-76.4WD	
Cornishman Creek	78.8WD	
Lighthouse Creek	83.8WD	
Horse Creek	104.8WD	
Eight Mile Creek	108.9WD	
Oaky Creek	123.9WD	
Campaspe River	141.5-161.6WD	
Manoa Creek	174.9WD	
Five Mile Creek	189.7WD	
Sandy Creek	200.8WD	
Moocha Creek	212.3WD	
Torrens Creek	247.9WD	Cooper Creek
Bullock Creek	272.2WD	
Prairie Creek	290.4WD	
Skeleton Creek	299.3WD	
Smiths Creek	355.7-365.2WD	Flinders
Cannonball Creek	368.2WD	
Stony Creek	376.4WD	
Walker Creek	379.1-382.6WD	
Warianna Creek	382.7WD	
Eastern Creek	400.7WD	
Sloane Creek	401.9-402.3WD	
Mile Creek	417.1WD	
O'Connell Creek	447.8WD	
Alick Creek	486-545.7WD	
Julia Creek	586.3-587.1WD	
Eastern Creek	599.3-602WD	
Sadowa Creek	608.9-609.7WD	
Gilliat River	624.7-626.6WD	
Gidya Creek	630.8-635WD	
Holy Joe Creek	640-640.2WD	
Box Creek	650.7WD	
Fullarton River	661.4WD	
Scrubby Creek	674.5-674.9WD	
Williams River	682.5WD	
Elder Creek	686.7WD	

Watercourse	Approximate Location (KP)	Drainage Basin
Turpentine Creek	695.8WD	
Coppermine Creek	725WD	
Cloncurry River	726.9WD	
Chinaman Creek	732.9WD	
Corella River	30.9DM	
Lunch Creek	33.2DM	
Cameron Creek	45.2-45.8DM	
Charley Creek	55.1DM	Leichhardt
Leichhardt River (East Branch)	65.4DM	
Gorge Creek	80.5DM	
Lagoon Creek	93.6DM	
Leichhardt River	97.2DM	
Mica Creek	97.6DM	
Slaty Creek	16.5DS	Flinders
Cloncurry River	39.4-39.7DS	
Florence Creek	49.6DS	
Gorge Creek	68.6DS	
Cloncurry River	71.1-71.4DS	
Victory Creek	82.1DS	
Sandy Creek	118.9-119DS	Georgina
Lightning Creek	4.0SC	
Burke River	44.0SP	

Consultation with the relevant government agencies, such as Queensland DTMR and Queensland Rail will be required in order to develop specific management plans for possible impacts to existing infrastructure.

No new rail crossings are proposed for the access tracks. Where access tracks are required to cross a railway line, existing operational crossings will be utilised.

Major roads are an important means of access to the transmission line easement for construction and maintenance. They are also a constraint to cross when constructing a transmission line because of the need to maintain the use of the road and to protect the users of the road during construction.

Water features may be defined as waterways for waterway barrier works, under the Queensland Fisheries Act. Most waterways along the proposed route flow intermittently or are ephemeral and as works in these areas are generally programmed for the dry season, it is expected most waterways will be dry when crossed. Where this is not the case, and for larger waterway crossings, the access to transmission tower sites will use only existing crossings and no new waterway crossings will be constructed, unless for safety reasons. If new waterway crossings are required, they will be designed within the Queensland Department of Agriculture and Fisheries' Accepted development requirements for operational work that is constructing or raising waterway barrier works. Table 18-12 shows locations where the corridor selection traverses mapped waterways for waterway barrier works that are considered high risk (red) or major risk (purple) of impacts to fish passage and habitat under the Queensland Fisheries Act.

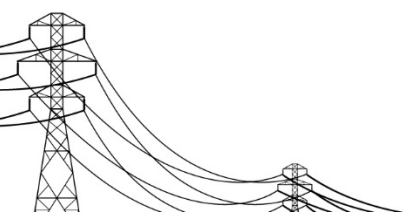
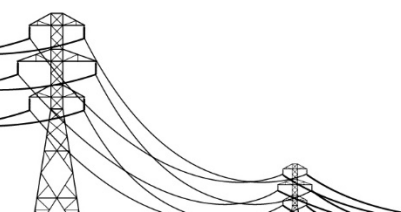


Table 18-12 Waterways for waterway barrier works crossings

WWBW Code	Approx. Location (KP)
High	0.9WD
Major	23.4WD
Major	24.4WD
High	35.3WD
Major	48.6WD
Major	55.4WD
Major	69.1WD
Major	71.2WD
High	78.8WD
High	83.8WD
Major	85.8WD
High	104.8WD
High	107.2WD
Major	123.9WD
High	124.8WD
Major	138.2WD
Major	161.3WD
High	174.9WD
Major	180.5WD
Major	181.4WD
Major	200.8WD
Major	201.3WD
Major	206.7WD
Major	212.3WD
High	222.5WD
Major	248.0WD
High	272.2WD
Major	379.3WD
Major	380.2WD
Major	382.5WD
Major	382.6WD
Major	383.2WD
Major	383.5WD
High	400.7WD
High	401.9WD
High	445.8WD
High	447.8WD
Major	486.1WD
Major	486.7WD
Major	487.0WD
Major	525.2WD
Major	525.5WD
Major	526.2WD
Major	543.3WD
Major	544.2WD
Major	544.6WD
Major	545.2WD

WWBW Code	Approx. Location (KP)
Major	545.7WD
High	586.4WD
High	586.8WD
High	587.2WD
Major	599.3WD
Major	601.7WD
High	608.9WD
High	609.5WD
High	609.7WD
Major	624.7WD
Major	625.0WD
Major	625.1WD
Major	625.4WD
Major	625.5WD
Major	625.6WD
Major	625.9WD
Major	626.0WD
Major	626.1WD
Major	626.6WD
Major	631.7WD
Major	632.2WD
Major	632.7WD
Major	632.9WD
Major	633.4WD
Major	633.6WD
Major	634.0WD
Major	634.3WD
Major	634.5WD
Major	634.8WD
Major	635.1WD
High	661.4WD
High	674.4WD
High	682.5WD
High	686.7WD
Major	726.8WD
High	31DM
High	65.5DM
High	97.2DM
High	5.9SC
Major	39.4DS
Major	39.4DS
Major	39.6DS
High	49.6DS
Major	71.2DS
Major	71.3DS
Major	71.4DS
Major	43.9SP



Where riparian zones contain vegetation that is at risk of significant disturbance from manual line stringing, the conductor draw lines and OPGW stringing activities across the watercourse will be performed by helicopter.

The river crossings are:

- Burdekin River
- Campaspe River
- Cape River
- Gilliat River
- Fullarton River
- Williams River
- Cloncurry River
- Corella River
- Leichhardt River
- Burke River

18.2.4.5 Substation locations

New substations will be required at Woodstock, Hughenden, Dajarra Road (Cloncurry), Mount Isa, Selwyn, Cannington and Phosphate Hill (refer to Figure 18-1).

Substations are required to perform switching, transform voltage, control stability through reactive and system strength support, and to connect to the customer or Powerlink systems.

Indicative plans of the substation locations are included in Volume 3 Appendix I Indicative infrastructure layout and cross-section drawings.

Woodstock

The Woodstock Substation will connect the CopperString transmission network to the Powerlink 275 kV transmission network, on the Strathmore to Ross transmission line. The Woodstock Substation will be the interface for conductors, communications, and protection between the Powerlink and CopperString transmission networks.

The Woodstock Substation will be located approximately 43 km south-east of the township of Woodstock adjacent to the Ayr Ravenswood Road.

The Woodstock Substation will transform voltage between the 275 kV and 330 kV networks. Reactive plant such as line reactors, synchronous condensers, static VAR compensators (SVCs) or capacitor banks may be required.

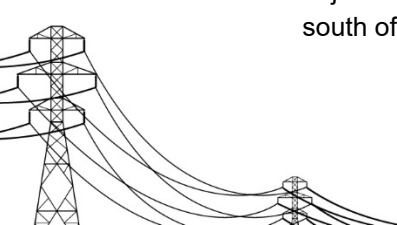
Hughenden

The Flinders Substation located approximately 5 km south-west of Hughenden, will form part of the Renewable Energy Hub.

Reactive plant such as line reactors, synchronous condensers, SVCs or capacitor banks may be required.

Dajarra Road

The Dajarra Road Substation will be located approximately 9.5 km south-west of Cloncurry, adjacent to the Cloncurry Duchess Road. The Dajarra Road Substation is approximately 3 km south of the existing Chumvale substation. The Dajarra Road Substation will transform voltage



between the 330 kV and 220 kV networks, interconnect with the NWPS 220 kV network at Chumvale, and connect to transmission lines radiating out to 220 kV customers.

Reactive plant such as line reactors, synchronous condensers, SVCs or capacitor banks may be required.

The existing 220 kV transmission line connecting Chumvale Substation to Dugald River Mine will be cut at a location near the Chumvale Substation. The section of the transmission line connected to Dugald River Mine will be joined to a short section of transmission line connecting it to the Dajarra Road Substation. The remaining section of the Dugald River Mine transmission line will be disconnected from the Chumvale Substation.

The existing 220 kV transmission line connecting Chumvale Substation to Ernest Henry Mine will be cut at a location near the Chumvale Substation. The remaining section of the Ernest Henry Mine transmission line will be joined to a short section of transmission line to connect it to the Dajarra Road Substation. The remaining section of Ernest Henry Mine transmission line connected to the Chumvale Substation will similarly be joined to a short section of the transmission line connecting it to Dajarra Road Substation. In this way, brownfield work on the primary systems at the Chumvale Substation can be minimised.

Chumvale

The Chumvale Substation is an existing substation owned by Ergon Energy. As detailed above, it is possible to affect a cut-in on the Dugald River 220 kV transmission line without the need for brownfield work on the primary systems at the Chumvale Substation.

It will be necessary to integrate protection and communication systems at the Chumvale Substation.

Mount Isa

The Mount Isa Substation will be located north of the existing Mica Creek power station at Mount Isa. The Mount Isa Substation will transform voltage between the 220 kV and 132 kV networks, interconnect with the Mica Creek D Substation, and connect to transmission lines radiating out to 220 kV and 132 kV customers.

Reactive plant such as line reactors, synchronous condensers, SVCs or capacitor banks may be required.

Selwyn

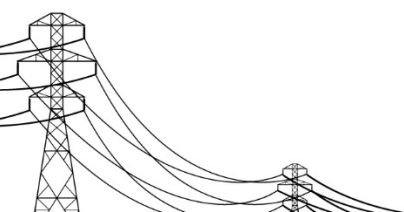
The Selwyn Substation will be located approximately 35.5 km south-east of the township of Selwyn and 23 km north-west of Cannington Mine. Selwyn Substation will provide switched connections between the incoming 220 kV transmission line circuits from the Dajarra Road Substation and the Cannington Mine Substation. The Selwyn Substation will also include two 220/132 kV transformers and a 132 kV bus supplying the Mount Dore Mine connection.

Cannington

The Cannington Substation is located at the Cannington Mine and will comprise a single 220/11 kV transformer and single 11 kV circuit breaker.

Phosphate Hill

The Phosphate Hill Substation is located at the Phosphate Hill Mine and will comprise a single 220/11 kV transformer and single 11 kV circuit breaker.



18.2.4.6 Substation equipment

Fencing, roads and drainage

Security fences with locked gates will be installed around the substation sites to restrict unauthorised access to the site in accordance with regulatory standards. The site will be unattended unless maintenance of the substation is being carried out.

Internal roads within the substation will be bitumen finished and external access roads gravel finished. Access roads will be approximately 5 m wide and the substation sites will provide enough space for maintenance and emergency vehicles that may need to access the site.

Substation platform surface runoff will filter through the crushed rock surface layer and be collected by open drains around the platform perimeter to suitably sized secondary containment ponds. The collected surface water will run into drainage pits, piped to the edges of the platform and discharged through headwalls with aprons to dissipate the energy of the water. Oil and water separators will be installed as part of drainage. A first flush diversion system will be installed to mitigate the risk of releasing sediments and contaminants from the area. Automated oil detection and separation systems may be used.

Major electrical equipment, switchgear and fire protection

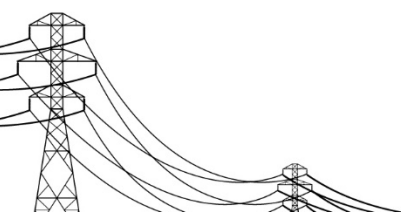
Specific design parameters of each of the substations are outlined in Table 18-13. The main power transformers to be installed will be large oil filled static units, with a delivery weight, without oil, in the order of 65 to 200 t, with oil volumes up to 150 kL for the larger transformers. Transformer installations are designed with oil containment bunds and oil interception systems to minimise the risk of an oil spill escaping into the environment. Biodegradable oils may be used where technically feasible in order to mitigate significant environmental risks.

Table 18-13 Technical description of substation sites

Substation	Technical description of major electrical equipment
Woodstock	• 2 x 275/330 kV transformers • 2 x 330 kV line shunt reactors
Flinders	• 2 x 330 kV SVCs including transformers • 3 x 330 kV shunt reactors • 2 x 330 kV line reactors
Dajarra Road	• 2 x 330/220 kV transformers • 2 x 330 kV SVCs including transformers • 2 x 330 kV line reactors • 2 x 220 kV shunt capacitors
Mount Isa	• 2 x 220/132 kV transformers • 2 x 132 kV shunt capacitors
Cannington Mine	• 1 x 220/132 kV transformers
Phosphate Hill Mine	• 1 x 220/132 kV transformers
Selwyn	• 2 x 220/132 kV transformers

Fire protection in equipment rooms will mainly be passive protection methods, such as fire retardant cabling, dispersal of equipment, and fireproof cabinets.

The installation of transformers and other equipment will be designed where possible to eliminate the requirement for fire water deluge systems. Where technically feasible, fire resistant transformer oil will be used to prevent the escalation of transformer faults into fire.



Gaseous fire suppression will be considered during the safety in design risk assessment processes and only installed if warranted.

Other Facilities

Substation sites will have an allowance for a small maintenance facility that will consist of a dust-free building with an internal cubicle that includes amenities, an office and a hardstand for the loading and unloading of storage.

All substation sites, with the exception of the Cannington and Phosphate Hill Substations, will incorporate an unsealed helicopter landing area.

Additional areas may be required for hazardous substance enclosures or fuel storage areas or tanks.

Any storage shed will typically be a 'slab on ground' portal frame design with Colorbond® type walls.

18.2.4.7 Protection, control and communications systems

Control systems

The transmission system, including the necessary power quality control and protection schemes, will meet the requirements of the National Electricity Rules (NER).

The substations will house the supervisory control and data acquisition (SCADA) system in a separate control and communications building at each substation site. The SCADA system will communicate with the control centre for interface with a human operator. This automated system ensures real-time 24-hour monitoring of the network.

The control and communications buildings will be of a transportable prefabricated building design with fire resilient Colorbond® walls and roofing. They will be delivered complete to site and installed on their foundations using a mobile crane.

Voltage and reactive power control

The transmission system will maintain voltage at the relevant connection points within the requirements of the NER. The system will effectively and efficiently control voltage and reactive power to achieve efficient, stable and safe power transfer.

Islanding capability

The transmission system will include an emergency frequency control scheme meeting the requirements of the NER. The scheme will include appropriate controls for scenarios such as separation from the state grid and separation of portions of the network.

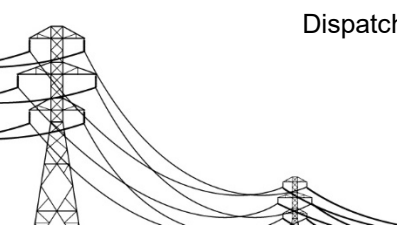
Protection and load shedding

The control system will include necessary plant self-protection systems and load shedding regimes consistent with the NER.

The existing NWPS currently incorporates local load shedding regimes, which may be incorporated into the CopperString transmission network system following a review of the compliance of these regimes with the NER.

Dynamic rating

The transmission system will be capable of calculating the dynamic rating of critical sections of the transmission line in real time and communicating this to the National Electricity Market Dispatch Engine (NEMDE) for use in constraint equations.



Local generation

As the Project will be connecting the NWPS to the state electricity grid, to enable participation in the NEM, all existing local generators connected to the NWPS, and generators connecting directly to the Project, will need to register under the appropriate categories to participate in the NEM. The system will connect each scheduled and semi-scheduled generator to the NEMDE. The NEMDE will manage constraints and dispatch local generation.

Communications system

Fibre optic cables incorporated into the OPGW will provide communication links across the system.

Communications will be by dual OPGW for the dual and single circuit transmission lines.

Spare capacity in the OPGW system will be offered to telecommunications carriers willing to pass the benefit of this spare capacity on to communities along the Project corridor selection.

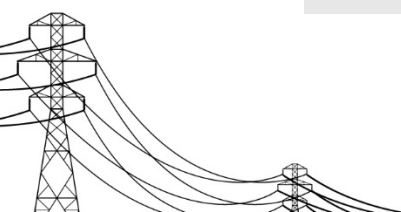
OPGW repeater stations

In addition to the communication infrastructure at each substation, OPGW repeater stations will be required at sites along the transmission network to boost the optical signal. Repeater stations will be located at a spacing of 80 to 120 km, close to the transmission line. The locations will be finalised during the detailed design of the Project.

The main component of the repeater stations will be a hut housing the CEV. The CEV huts will be unmanned. Equipment within the CEV huts will be battery powered, charged by mains electricity, where available, or solar power. Proposed locations of CEV huts are outlined in Table 18-14 and indicative locations and site plans are included in Volume 3 Appendix I Indicative infrastructure layout and cross-section drawings.

Table 18-14 Proposed CEV hut locations

CEV hut	Chainage	Location
Charters Towers South CEV	Between KP 110WD and KP 111WD	Approximately 23 km south-west of Charters Towers, adjacent to the Gregory Developmental Road
Pentland South CEV	Between KP 181WD and KP 182WD	Approximately 24 km south-east of Pentland, adjacent to Longton Road
Warreah South CEV	Between KP 277WD and KP 278WD	Approximately 9.8 km south-west of Warreah railway station, adjacent to Cottonvale Penrice Road
Barabon CEV	Between KP 419WD and KP 420WD	Approximately 4.5 km south of the Barabon railway station, adjacent to Barabon Terranburby Road
Nonda CEV	Between KP 497WD and KP 498WD	Approximately 12 km south of the Maxwellton railway station, adjacent to Maxwellton Kynuna Road
Yorkshire CEV	Between KP 564WD and KP 565WD	Approximately 17.5 km south-east of Quarrells railway station, adjacent to Yorkshire Nelia Road



CEV hut	Chainage	Location
Gilliat CEV	Between KP 637WD and KP 638WD	Approximately 10.5 km south-east of Tibarri railway station, adjacent to Wellen Road
Selwyn CEV	Between KP 90DS and KP 91DS	Approximately 4.5 km west of the township of Selwyn

Site works will comprise installation of an earth grid, conduits for power, control and communications cables, security fence, weed mats and a gravel surface. Where grid connected power supply is not available, solar array frames will supply power requirements. These solar array frames will be mounted on strip footings and will be rated for local wind or cyclone conditions. An example of a typical CEV hut (non-solar) is provided in Plate 18-3.

The CEV huts will be prefabricated and mounted on concrete piers inside a fenced area, that will also contain the ground mounted solar panels, where required. The CEV huts will be on the northern side of the corridor, outside but abutting the easement. An area of approximately between 15 x 16 m and 20 x 30 m will be fenced, however to ensure that vegetation management is maintained an area of approximately 60 x 65 m is required to maintain fire security.



Plate 18-3 Typical CEV hut

Network control centre

The transmission system will require a control centre. The system will be operated by a third party network service provider from their relevant existing operations centre. CuString is currently engaged in discussions with Powerlink regarding the scope of these services. If a dedicated control room is required, it will be established in the region.

If required, a dedicated, stand-alone backup control centre will be located at the Dajarra Road substation. This system will include sufficient human-machine interfaces and operator facilities, including parking and service vehicles to allow operation of the system from the Dajarra Road control centre. The Dajarra Road control centre will be capable of operation of the entire system in isolation from the main control centre for sustained periods of time.

18.2.4.8 Access tracks

Access to the transmission line will be required for both the construction and ongoing maintenance of the transmission line. Access will also be required to each transmission tower site.

Access tracks will generally be contained within the transmission line easement however where terrain, environmentally or culturally sensitive areas and water crossings do not permit this, the access track may be located outside of the easement, with spur tracks linking the main access track to each transmission tower site.

In vegetated areas, existing cleared paths will be utilised where possible so that clearing by the Project is kept to a minimum.

It is intended to utilise the existing road network and private access tracks, though some new tracks will be required to provide access for construction and maintenance teams.

Access tracks will be constructed to a standard suitable for dry weather use for four wheel drive vehicles at low speed. Typically, where formed access tracks are constructed, they will be 7 m wide tracks to allow the safe movement of construction and maintenance equipment and vehicles. The road bed itself will be 5 m wide with 1 m wing ditches on each side of the track, to direct surface run-off from both sides of the track away and into undisturbed areas.

18.2.5 Pre-construction and construction activities

18.2.5.1 Pre-construction activities

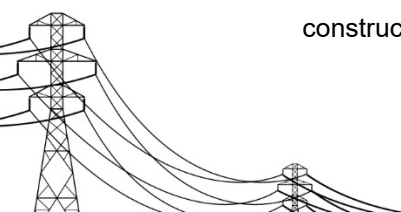
A four month period of pre-construction activities will include:

- Finalisation of the detailed design of the Project
- Geotechnical, property and other surveys for the easement, transmission tower and substation foundations and earthing systems
- Establishment of Townsville logistics yard
- Land acquisition for the easement, CEV huts and substations including re-subdivision of the lots as necessary
- Acquiring development approvals, licences, permits and native title/cultural heritage clearances
- Commissioning of the temporary construction camps and site offices
- Workforce sourcing and induction
- Construction team mobilisation
- Control set out and survey of substation and transmission line land
- Procurement of construction materials that require a long lead-time)
- Transportation of materials.

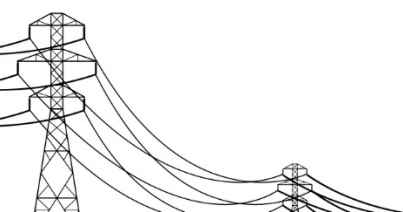
18.2.5.2 Construction schedule and construction zones (work fronts)

The proposed construction schedule in Table 18-4 has been developed with reference to the seasonal rainfall anticipated during the summer months. Areas at high risk of flooding and erosion will be targeted for construction during the dry months. For example construction activities in the Mitchell Grass Downs areas stretching from east of Hughenden to west of Julia Creek will be limited during December-March.

Due to the linear nature of the infrastructure, the Project will be segmented into eight or more construction zones (refer to Figure 18-4 and Figure 18-5).



It is envisaged that transmission line construction will be undertaken using up to four work fronts, moving from one construction zone to another upon completion of the required works. Figure 18-4 gives an overview of the movement of each work front. Each work front will consist of several small teams, each focusing on a specific activity – clearing and access, foundations, steelwork, stringing or rehabilitation. For example, once the clearing and access teams of a particular work front have completed a construction zone, they will move onto the next construction zone, while other teams, such as foundation teams continue their activities. This accounts for the overlap of activities occurring within individual construction zones. Depending on the activity one team could be up to 30 to 70 km in front of the following team. Each team may comprise a number of crews working across one or more transmission tower sites.



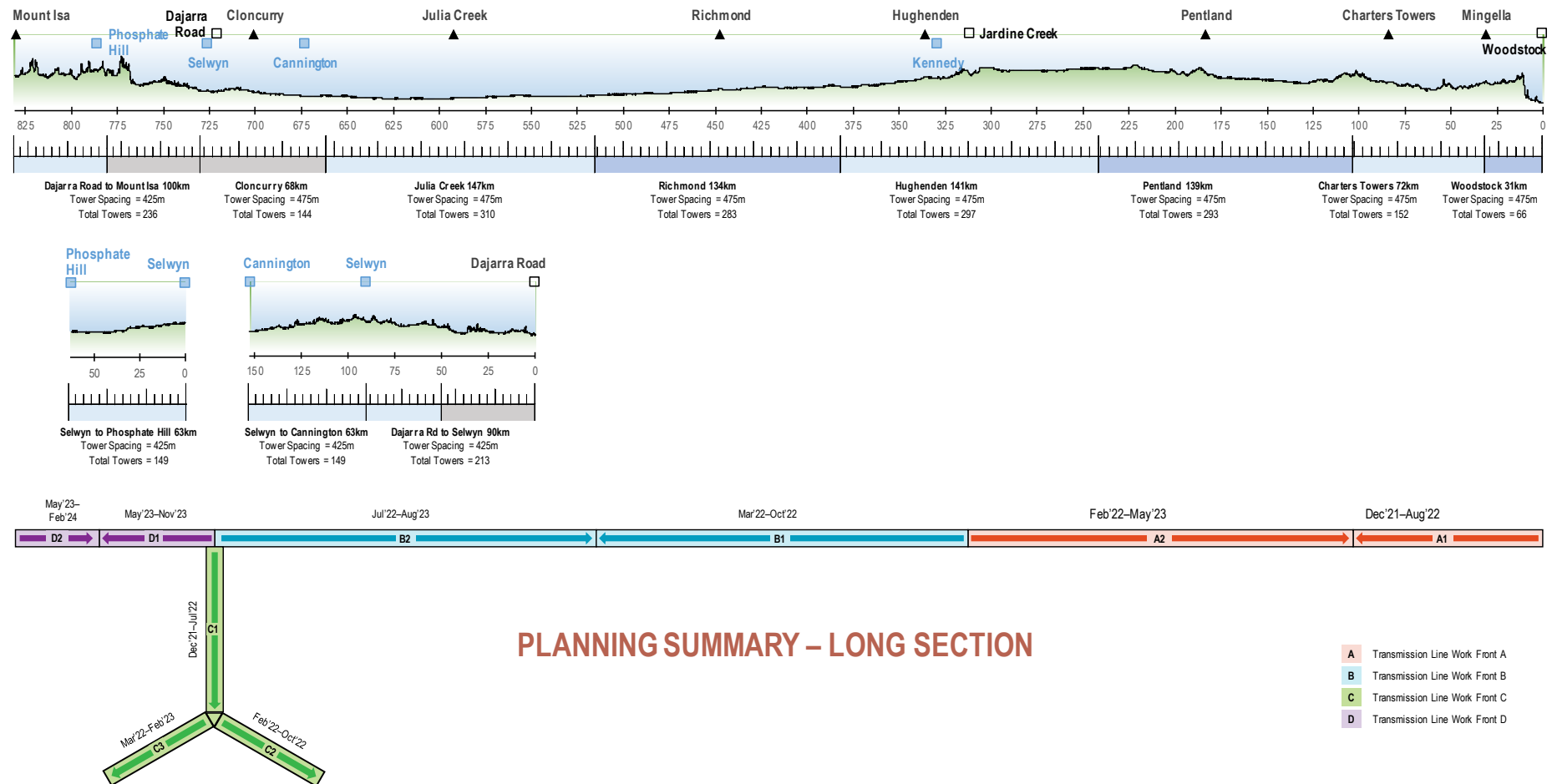
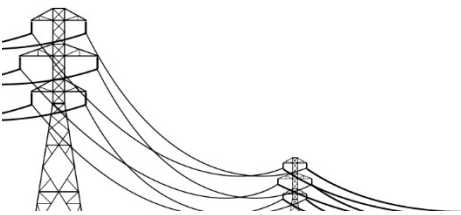


Figure 18-4 Indicative transmission line construction zone staging



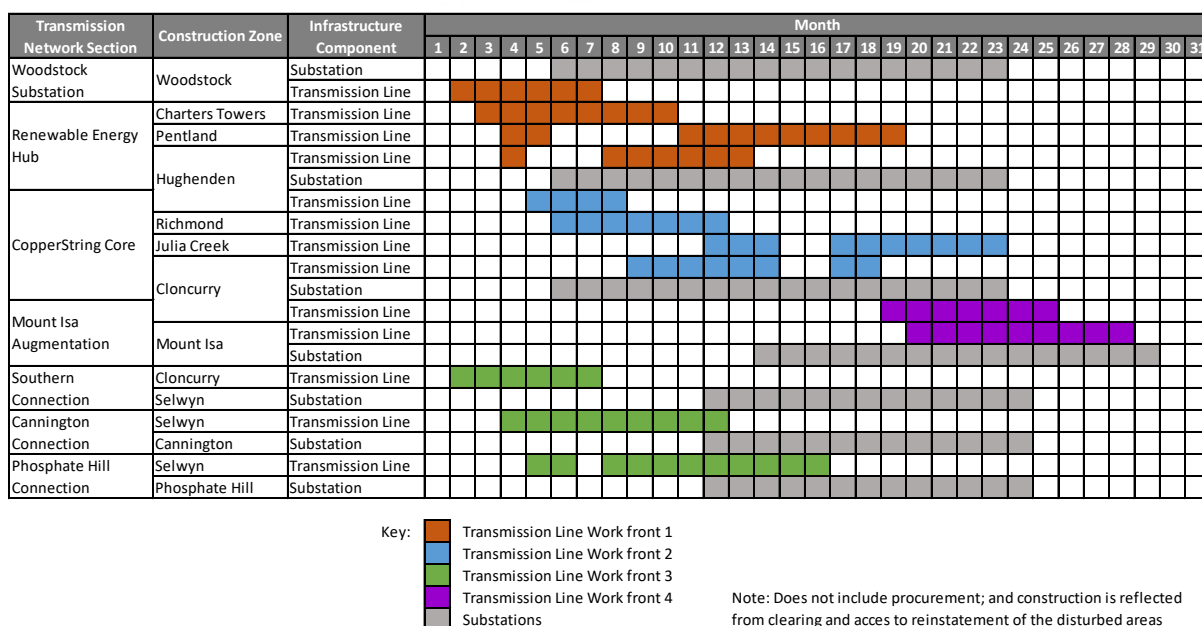


Figure 18-5 Indicative Project construction zone staging

18.2.5.3 Hours of operation

Construction work hours will be determined with consideration of the following:

- Proximity to sensitive receptors
- Climate (e.g. during hotter months, the working day may be staggered to commence earlier in the morning to avoid the heat of the afternoon).
- Deliveries at laydown/delivery areas will ensure no noise is heard by sensitive receptors outside the hours of 6.30 am to 6.30 pm Monday to Saturday.
- Some activities, such as vehicle refuelling and maintenance, will occur outside of designated construction work hours.
- Head office and administrative staff will work normal business hours, from Monday to Friday.

The roster for the direct workforce will be selected by the contractors; it is anticipated that a roster of three weeks on and one week off, will be selected. This is based on the following factors:

- The “current” industry practice for the transmission line industry (information sourced from industry)
- Minimisation of indirect costs such as travel and removal of the Sunday double time penalties.

18.2.5.4 Construction workforce

It is anticipated that 750 people will be employed during construction of the Project. An estimate of the peak occupational groupings for each transmission line construction zone is included in Table 18-15.

Table 18-15 Indicative peak occupational groupings for each construction zone

Role	Estimated peak personnel requirements
Construction Manager	2
Area Manager – Civil	4
Area Manager – Structural	4
Commissioning Engineers	4
Area Engineers	8
Compliance Officers	8
Administration, Human Relations and Community Relations staff	10
Surveyors	6
CH Monitors	4
Logistics	6
Planners, contractors, finance, procurement	10
Camp staff	10
Sub-total	76
Riggers	150
Plant Operators	40
Fitters	6
Labourers	50
Sub-total	246
Total	322 (~350)

18.2.5.5 Construction camps

Location of construction camps

CuString acknowledges the potential impact of a large workforce on local infrastructure and services of areas with small existing populations and housing availability. For this reason, it is planned that temporary construction camps will house most of the construction workforce.

Preliminary construction camp locations have been identified for the following locations:

- Within one hour of Woodstock Substation
- Charters Towers
- Pentland
- Hughenden
- Richmond
- Julia Creek
- Cloncurry
- Mount Isa
- Selwyn Substation

It is envisaged that the Project will operate a combination of fly-in-fly-out (FIFO) and bus-in-bus-out (BIBO) deployment of workforce. Townsville will be the FIFO/BIBO hub servicing the camps

at Woodstock, Charters Towers and Pentland, via chartered buses, and the camps at Hughenden, Richmond, Julia Creek, Cloncurry, Mount Isa and Selwyn Substation via chartered flights.

Once accommodated at a construction camp, the workforces will be transported to and from work sites by four-wheel drive or bus.

Construction camps will consist of demountable buildings that will be decommissioned at the end of the construction program. Local suppliers will be used for food and other consumables where practicable.

Services

Sewage and wastewater disposal systems will be required at all construction camp sites unless town sewage treatment plants are used. Camps located within town areas may be able to access the local council reticulated sewage system. Where this is not possible, construction camps will require a sewage treatment plant to adequately meet the loading for each camp and will be developed to comply with requirements of Queensland Health, DES and local councils.

Removable toilet facilities (e.g. porta-loos) will be utilised by each work crew for intra-day ablutions on the construction sites. Licensed waste contractors will be engaged to service and transport this waste.

Construction camp water requirements are discussed in Section 18.2.5.6.

A number of the proposed construction camp sites already have access to the local electricity network and will not require further system upgrade to the planned construction camp site. The preference is to access the existing local electricity supply network where possible or where not possible, to use a standalone diesel generator to provide the required electricity supply.

All temporary construction camps will have back-up diesel generators to meet the power demand for each camp's capacity in the event of a power blackout from the local electricity supply or in an emergency. These generators will make use of acoustic enclosures to minimise the noise levels that result from their operation.

An adequate communications system will be established at each construction camp to ensure that the site and camp offices can effectively control the activities of staff in the field and comply with the emergency planning and response procedures developed for the Project.

Some additional infrastructure may be required to facilitate connection to existing services. These requirements will be subject to ongoing discussions with landholders and local councils.

18.2.5.6 Construction water

Water requirements for the Project include water for construction activities such as concrete batching, dust suppression and cleaning of insulators, and potable water for construction camps and site offices at laydown/delivery areas.

The total water requirements estimated for the Project are summarised in Table 18-16.

Table 18-16 Estimated construction phase water usage

Activity	Estimated water usage (kL)	Assumptions
Concrete batching plants	23,500	220 L/m ³ of water for concrete
Dust suppression during construction	138,600	Average 13 month construction duration over seven construction zones (operational at one time) at five water dumps per day (10,000 L)

Activity	Estimated water usage (kL)	Assumptions
Construction camp utilisation	46,000	70 L/man/day over the life of the construction camps and proportion for fire-fighting requirements
Site offices	6,500	10 L/man/day over the life of the site offices
Cleaning of insulators	500	Requirement of approximately 200 L/tower
Contingency	21,510	10% contingency
Total	236,610	-

Water required for concrete batching will be sourced from appropriate water sources and quantities will be finalised during the detailed design of the Project. The preference is to utilise existing concrete batching plants and therefore the water supply of these facilities. Where new or temporary mobile batching plants are proposed, the water source will be determined in consultation with local councils and the DNRME.

Dust suppression will occur by the watering of access tracks to limit the risk of dust and air emissions related to vehicle movement. It is anticipated that watering of access roads near homesteads or sensitive receptors will be sufficient to mitigate the anticipated air quality impacts to the human environment during construction.

As part of the commissioning program individual transmission tower sites will be inspected and cleaned to ensure the optimal function and efficiency of the installed equipment. The insulators will be washed, prior to energisation of the transmission line, to remove pollutants, such as particulates and dust that may impact on the lightning and over-voltage withstand capacity of the insulators.

The preferred hierarchy for proposed water sources for use in construction camps is as follows:

- Use the town water supplies from existing local council water reticulation networks through the construction of water supply pipelines
- Use groundwater through new unallocated groundwater reserves or existing bores
- Access existing town water supplies and transport water by trucks to the temporary camp sites, where it will be stored in tanks at the facility site.

Water will require treatment to a potable standard where existing town water supplies are not proposed to be used. This will be achieved through the use of water treatment plants at the temporary construction camps.

Where feasible, recycling of water will be implemented to reduce the total load of the water requirements, though the quantity of this water supply will be subject to further negotiations with the engaged contractor.

18.2.5.7 Plant and equipment

Table 18-17 indicates the types and quantities of plant and equipment required for each work front. Up to three work fronts may be in operation at a time.

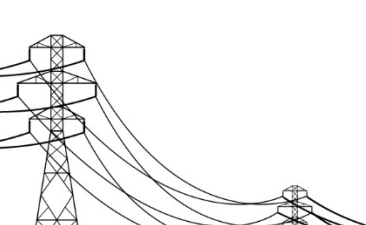
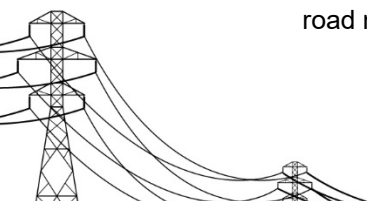


Table 18-17 Typical plant and equipment required for each work front

Activity	Quantity	Materials and Equipment
Clear and Grub	2	D10 Dozer
	2	Grader 16GRP
	2	D7 Dozer – with stick rake
	2	Tub Grinder
	2	30 t excavator (and grab in sensitive areas)
Construction of access tracks	2	Graders 16GRP
	2	30 t excavator (and grab in sensitive areas)
	2	Front End Loader
	2	20 t Articulated Truck
	2	Water Truck
	2	Backhoe
Foundation Excavation	8	Excavator mounted auger
	2	30 t Excavator
	2	Airtrack
Stub Set and Form	4	8x8 with 2 t Hiab (truck)
	8	Foundation Jigs
	4	20 t Franna (crane)
Batch Plant	2	Front End Loader
	16	Cement Truck
Transmission tower Assembly and Erection	4	8x8 with 2 t Hiab (truck)
	4	Manitou (forklift)
	4	20t Franna (Crane)
	4	Mobile Crib Room
	4	25 t Franna (crane)
	4	120 t Crane (with long boom)
	4	70 m Elevated work platform
Stringing	1	Helicopter
	1	Helicopter Support Vehicle
	4	15 t Brake and Winch
	4	9 t Brake and Winch
	4	8x8 with 2 t Hiab (truck)
	2	25 t Franna (crane)
	12	70 m Elevated work platform
	4	Winch Trucks
	2	30 t Excavator
	2	Earthing Backhoe
	2	Earthing Airtrack
	500	Triple Stringing Blocks
	4	Mobile Crib Room
Laydown area	2	Water Truck
	2	Grader 140G
	2	Front End Loader
	2	Fuel Truck
	2	20 t Franna (crane)
	2	Welding Plant
	2	5 t Forklift
Rehabilitation	2	Backhoe
	2	Bobcat
	2	30 t Excavator
	2	20 t Articulated Truck
	2	Front End Loader

18.2.5.8 Construction traffic

Construction of the Project will generate additional heavy and light vehicle traffic on the public road network. The major state-controlled roads servicing the Project are the Flinders Highway

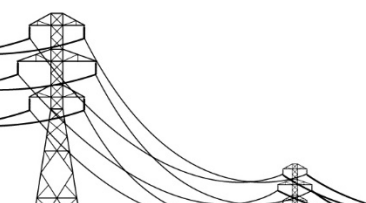


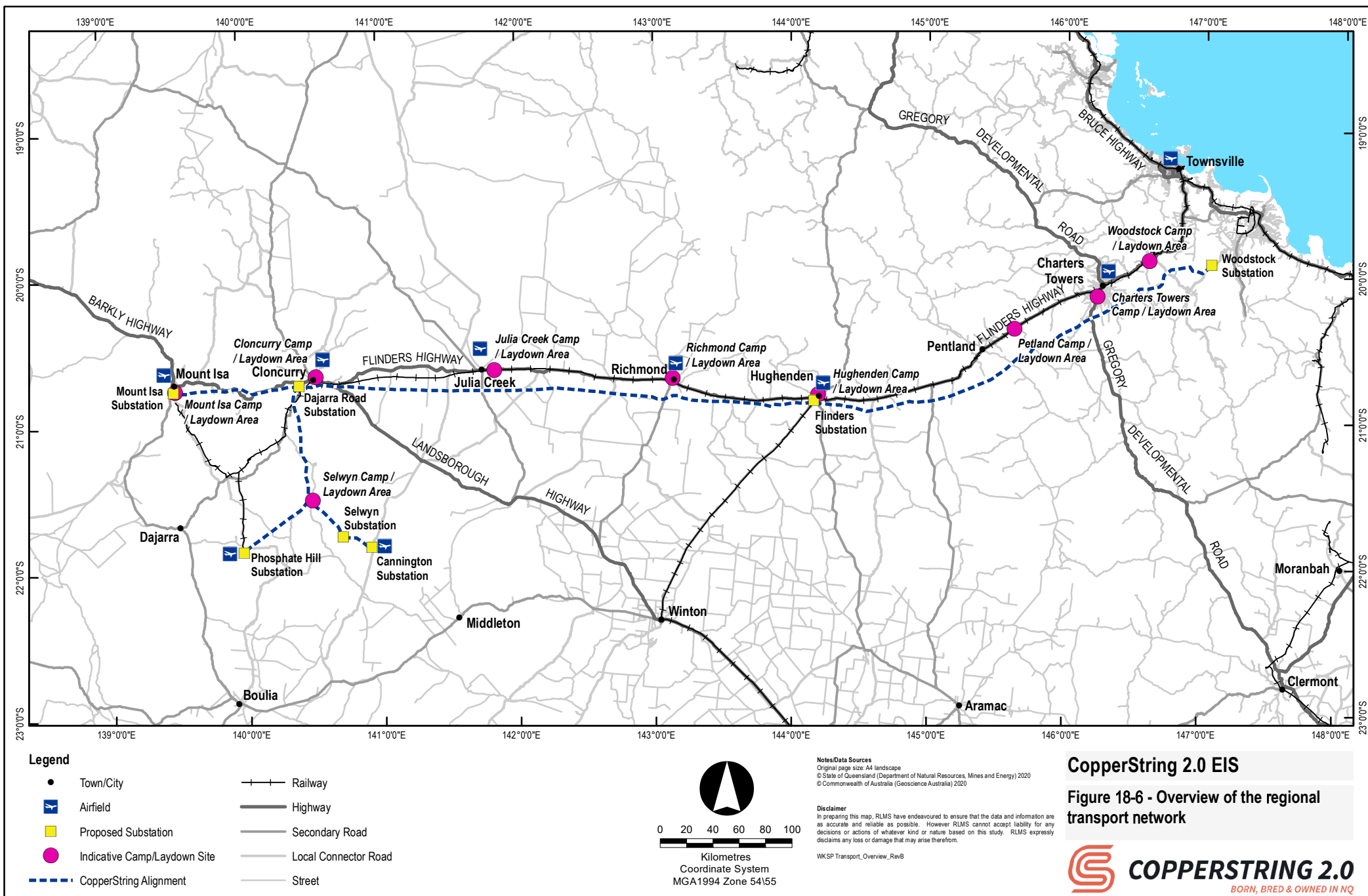
and Barkly Highway. Other state-controlled roads that may be impacted by an increase of traffic during construction of the Project include:

- Townsville Port Road
- Gregory Developmental Road
- Kennedy Developmental Road
- Landsborough Highway
- Burke Developmental Road
- Torrens Creek Aramac Road
- Hughenden Muttaborra Road
- Richmond Winton Road
- Julia Creek Kynuna Road
- Cloncurry Dajarra Road
- Burdekin Falls Dam Road
- Diamantina Developmental Road
- Mount Isa Duchess Road

Volume 3 Appendix X Transport impact assessment includes a detailed assessment of impacts to these roads in addition to local government roads.

Figure 18-6 shows an overview of the regional transport network.





18.2.5.9 Construction materials

General

Construction materials will be sourced from a variety of locations. Material that can be supplied by fabricators and suppliers in Townsville will be reviewed as part of pre-construction. Project activities.

Materials such as foundation reinforcing steel, transmission tower steelwork, drums of conductor and all equipment and materials will be delivered by truck and stored in laydown/delivery areas. It is anticipated that procurement of transmission tower steel may occur in advance of construction requirements and will be stored in Townsville or the regional laydown/delivery areas until construction commences in that zone.

Reinforcing and transmission tower steel bundles will then, where practicable, be partially pre-assembled then organised into transmission tower lots for delivery to the construction zone. The specific means of transporting transmission tower steelwork will depend upon the specific transmission tower location and related access constraints.

Store facilities will also be provided at laydown areas to house smaller and more vulnerable components such as spacers and insulators. Stores will also likely house construction hand tools, small construction equipment, fixing and assembly materials including containers of touch-up paint or other protective coatings.

Concrete batching plants and quarry materials

Concrete batching plants will be required for the supply of concrete for foundations during the preparation and construction phases of the Project. Where possible, existing operational batching plants will be used. If existing batching plants are unavailable, new batching plants will be construction in the vicinity of existing batching plants in major localities or adjacent to the regional construction zone areas.

Where mobile concrete batching plants are proposed, the batching plants will be managed by operators under the appropriate licence. Once construction in a construction zone is complete the plant will be removed.

Cement will likely be sourced from Townsville, where well established large-scale operations already supply materials to the NWMP. The aggregate required for the concrete batching plants is likely to be supplied from the region and the final source of these materials will be subject to further discussions with key stakeholders including local councils.

Townsville logistics yards

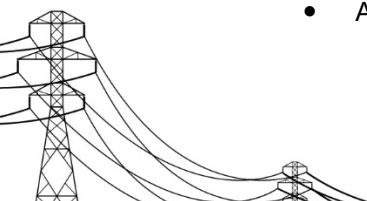
The majority of plant will be imported as pre-assembled modules (as far as is practicable) through the Port of Townsville. A logistics yard near the Port of Townsville intermodal terminal may be used to marshal deliveries prior to dispatch by road or rail to the project site.

This logistics yard will be operational for the duration of the Project's construction.

18.2.5.10 Construction of transmission towers (structure erection)

Transmission tower construction for each construction zone will be undertaken as follows:

- Materials will be removed from containers or vehicles at each transmission tower site and arranged in a logical way to assist rapid assembly of the structure.
- Assembly crews will use smaller cranes to piece together sections of the structure and attach relevant transmission line hardware at ground level.
- A larger crane will lift and secure together the sections in place from the ground up.



- Finishing elements will be installed.

Where monopoles are utilised, the erection timeframes will be shorter.

18.2.5.11 Stringing

Stringing of the conductors and earth wires is the process of installing the conductors and earth wires to the transmission towers.

Temporary clearance structures (or hurdles), typically consisting of vertical wood poles with cross arms, will need to be installed at road and rail crossings and at crossings of energized existing overhead electric lines to prevent conductors or draw lines from sagging onto existing infrastructure during the stringing operation. Once the conductors have been fixed to the transmission towers the hurdles will be removed.

At no point does the CopperString transmission line cross existing electricity distribution infrastructure with a higher voltage than the proposed transmission lines. At any such intersections, lines of higher voltage will cross above the line of lower voltage.

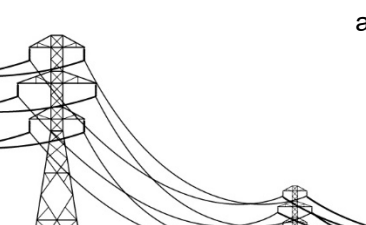
Some electricity infrastructure that the Project crosses may be required to be de-energised for a short period of time to allow for the safe construction of the Project transmission infrastructure. Consultation will be required with the owners of any other electricity infrastructure that the Project may interfere with to arrange any planned outages and to detail the transmission line crossing, once the detailed design and staging of the Project is finalised.

Brake and winch sites for tensioning the transmission lines will be required approximately every 5 to 10 km along the transmission line. To the greatest extent practical, brake and winch sites will be located within the transmission line easement. However, some brake and winch sites may occur outside the easement. Each brake and winch site requires an area of approximately 60 m x 250 m (1.5 ha). The sites are needed to set up the winches and brakes with the conductor drums. Depending on topography, some incidental grading may be required at pulling and tensioning sites to create level pads for equipment.

Helicopters will be employed as the primary means of installing insulator strings, conductor draw lines and overhead earth wires.

Stringing between pulling and tensioning sites will be undertaken as follows:

- For the section to be strung a helicopter or elevated work platform will be used to fit the insulator strings and sheaves to the transmission tower structure to ensure when the lines are being strung that there is no damage to the conductor and earth wires.
- For each stringing section a helicopter will thread the draw line that will be used to pull the conductor.
- The draw line will be pulled by the helicopter and tensioned using a braking device to ensure the transmission line does not come into contact with obstructions or the ground. A smaller ground crew will conduct visual inspections during stringing to monitor the work and ensure the draw line does not become obstructed.
- The draw line is then detached from the helicopter and attached to the conductor to be strung. When pulling twin conductor circuits, a headboard is used to connect the conductors, and the headboard is connected to the draw line. The conductor(s) are then drawn into place.
- A large work crew will follow the stringing operations and detach the conductor from the sheave blocks and attach it to the transmission tower ensuring the correct amount of sag in accordance with the transmission line design. Where spacers and dampers are required along the transmission line, they will be installed at this stage of the stringing operation.



- After stringing of the conductors a similar process will be conducted for the OPGW, where a helicopter will be utilised to pull the OPGW. An optical fibre jointing crew will follow and complete the jointing from the ground. This last activity in the line stringing will occur at a rate of approximately 10 km per day.
- The stringing crew will consist of a total of 50 people, completing from 3 km/week over rough terrain, to 7 km/week on flat terrain, with an average of 5 km/week over variable terrain. Helicopter stringing activities will be undertaken essentially within the easement, which is, as discussed previously, well separated from buildings and other sensitive receptors.

18.2.5.12 Transmission tower completion

After stringing, a completion crew will attend to each structure site to conclude the construction program by completing the following:

- Installation of warning and informational signage
- Construction of wildlife-friendly anti-climbing devices.

A separate crew will conduct any required final rehabilitation of temporary disturbance at tower sites. At the conclusion of construction, the easement will also be cleaned of packing crates, hardware and all construction debris.

Rehabilitation of construction sites will occur progressively as the construction process advances. Disturbed areas not required for access roads and maintenance areas around structures will be restored in accordance with safety constraints. These sites may be heavily trafficked, with ground disturbance in construction material laydown areas, footing drill pads, crane pads, mobile crib room pads, and truck turning areas. The sites will be ripped to break up any compacted soil.

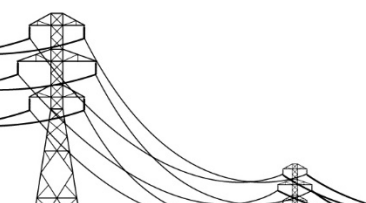
18.2.5.13 Construction of substations

Overview

Construction of substations occurs over a relatively short period and is dependent on the procurement of the major substation equipment, such as transformers and static VAR compensators. On average construction of an individual substation will require approximately 12 to 18 months.

Construction of the substations, and other infrastructure such as the communications CEV huts, broadly involves the following series of activities:

- Site preparation
- Vegetation clearing
- Site fencing
- Civil works
- Earth grid installation
- Drainage
- Foundations
- Equipment installation
- Rehabilitation.



Site preparation

Appropriate measures will be taken to minimise disturbance and loss of topsoil from the site and to rehabilitate disturbed areas in the substation vicinity as a result of the construction works. Excess material onsite will be disposed of in an appropriate manner.

Vegetation clearing

Substation sites have generally been selected in pre-disturbed areas where minimal vegetation clearing is required. Where vegetation clearing is required, bulldozers and broad acre mulchers will generally be used, with more refined hand or mechanical clearing methods employed for smaller operations in environmentally sensitive areas and riparian zones. A Vegetation Management Plan will be developed to ensure appropriate measures for clearing are used, such as the presence of a qualified faun spotter/catcher during clearing to allow the safe movement of fauna.

Site fencing

Security fences with locked gates will be installed around the substation sites to restrict unauthorised access to the site. The site will be unattended unless maintenance of the substation is being carried out.

A boundary fence will define the overall boundary of the substation site and the balance of the land acquired will provide a buffer zone.

Due precautions will be taken to minimise potential for loss or injury to persons or livestock during the construction phase.

Civil works

Foundations for the substation equipment will be excavated and an earth grid will be installed under the substation site.

Drainage

Drainage work consists of the installation of all drains, pits and culverts necessary to control the flow of stormwater from the substation footprint.

Foundations

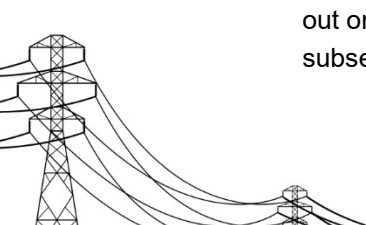
It is expected that structure foundations within the substation will be one of two main types, broadly described as excavated and bored. Bored concrete foundations will be used if the site conditions are favourable for drilling. Excavated or rock anchor foundations will be used when the ground conditions are not suitable for the bored type (e.g. in hard rock). Isolated concrete plinths and foundations will then be constructed to support the site infrastructure.

Formwork will be removed after an appropriate curing time. Other foundation requirements such as those for the control and communications buildings are normally completed at this time. Concrete for the foundations, transformer bund walls and cable trenches will be transported from concrete batching plants.

Major electrical equipment and switchgear

Equipment will be mounted on individual steel support structures in distinct bays for each separate circuit, such as incoming and outgoing transmission lines.

The steel for the lattice and tubular structures will be fabricated, galvanised, sorted and bundled ready for delivery at a factory or workshop off-site. Pre-assembly of the structures will be carried out on site and will involve assembly of the individual member into a number of sections and subsequent erection by a mobile crane.



Once all gantry and support structures have been erected, the busbars and high voltage electrical equipment (disconnectors, earth switches, instrument transformers, circuit breakers, reactors, capacitors, power transformers etc.) will be installed and electrical connections made. Cables that carry the control and protection signals from equipment in the yard to the control equipment building/s will be laid and all connections made.

Purpose built equipment such as large power transformers will undergo project specific testing and functional systems will be subject to detailed acceptance tests during the commissioning of the Project.

Rehabilitation

Rehabilitation at the substation site will include clean up and final trim of exposed soils, removal of construction waste, landscaping and commissioning of environmental management equipment such as oil/water monitoring systems, and first flush diversion valves. Planting of native species and other landscaping measures will supplement the screening of the site from public viewpoints.

18.2.6 Operation of the Project

18.2.6.1 General

Ongoing maintenance will be required throughout the operation of the transmission network. The operational period of the Project will require approximately 15 FTE employees to operate the transmission network plus an additional 15 part-time maintenance employees as required.

Broadly the operation and maintenance of the Project will necessitate:

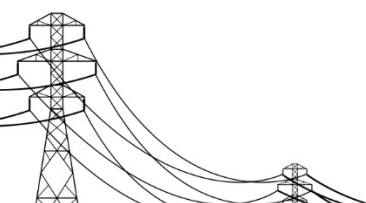
- Maintenance – field based planned and reactive maintenance, asset management systems and associated supportive staff
- Network control (operations) – continuous operation of a control centre capable of monitoring the network and dispatching field teams for routine and defect maintenance
- Life cycle replacement requirements
- Administrative management of the system.

18.2.6.2 Maintenance

Routine maintenance activities are expected to occur on a regular basis according to the maintenance contractor's maintenance plan. The frequency of maintenance will vary for different components of the transmission network and is dependent on aspects such as their immediate operating environment, seasonal constraints, risks associated with their failure and regulatory requirements.

Visual inspection of the transmission line, easement and access tracks will be conducted via four wheel drive vehicles, helicopter or aerial remote sensing, such as lidar technology. The visual inspections will examine network components for signs of degradation or failure. The inspection will confirm that no unauthorised activities are taking place within the easement that may affect the safe operation of the transmission network. Unauthorised activities include anything outside of operational and maintenance activities and what is agreed upon with the landholder in the easement agreement.

The visual/lidar inspection will inform vegetation management control. The frequency of vegetation control will be dependent on the type of vegetation cover and the risk it poses to the transmission network, and will be conducted as necessary. Environmentally sensitive areas may be cleared by hand to limit disturbance to the surrounding environment.



During operation of the transmission network, access will be required to each tower. This will necessitate the continuing management of access tracks, which will also be assessed as part of the regular maintenance inspections.

Routine inspection and maintenance activities will also be required in the remainder of the transmission network infrastructure such as equipment in the substations and CEV huts.

In addition to these routine inspection and maintenance activities, network components will require access for unplanned events and failures.

The transmission lines traverse regions of severe storm, lightning and bushfire activity and although these risks are considered in the design, selection and installation of transmission network components, such activity may lead to protection elements tripping a line section. Unplanned events, such as lines tripping, may require visual inspection to ensure the network is safe to re-energise.

The transmission network will be remotely monitored. Maloperation or failure of components and systems in the substations and CEV huts will be alarmed. Such alarms may require on-site investigation together with any repairs identified as being required.

Reliability and availability of energy supply from the network will form part of operational agreements with the Australian Energy Regulator and individual bulk customers. The impacts from frequency, duration and severity of outages, load-shedding and curtailment will vary across the customer base. These factors will drive decisions on responses to events. Depending on location within the network and impacts on travel time from seasonal access aspects this response may be by vehicle or helicopter.

The replacement of any defective components can usually be completed without the need to de-energise the transmission line.

Where on the ground maintenance and repair is performed, the spread of weeds will be limited by conforming to the Concept biosecurity plan developed for the Project, included in Volume 3 Appendix U Concept biosecurity plan.

Maintenance of the transmission network is likely to be contracted to existing transmission line maintenance service providers in the region. Specialist crews will be required to inspect and maintain the substation infrastructure.

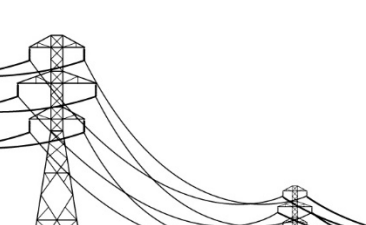
18.2.6.3 Network control

The transmission network will likely be operated by an existing network service provider from an existing operating centre. The network control centre will be responsible for monitoring and emergency response of the transmission infrastructure and ensuring the network performance and reliability targets set by CuString and the associated regulatory bodies are met. The operational and asset management strategies will be consistent with existing industry best practice and make certain the control systems interface with the regulators, network providers and electricity users and generators.

If a dedicated network control room is required it will be established in the region.

18.2.6.4 Equipment design life

The design life of the transmission network is expected to be 45 years. It is anticipated during the operation of the Project some components will require to be replaced, which is likely to extend the life of the network and maintain the reliability of supply. Components will be operated in accordance with the manufacturers' recommendations. Items that have a design life of less than 45 years and are likely to require replacement during the life of the Project include:



- Electronic equipment and systems (including building auxiliary systems such as control and protection systems, fire alarms, security systems, batteries and extinguishers) – design life of 15 years
- Transformer oil refurbishment/replacement – design life of 10-20 years.

18.2.6.5 Operational standard and potential upgrades

The design of the transmission infrastructure is based on providing 500 MW, limited by transformer and line losses, to the Dajarra Road Substation and performance standards complying with the NER, including the N-1 level of security.

A number of foundation network users underpin the commercial feasibility of the Project's construction. While no future staged development of the Project is planned, it is acknowledged that the Project will provide opportunities for new and existing large energy users, generators and network service providers within the region to participate in the NEM, through future connections to the CopperString transmission network.

To achieve any capacity expansion beyond that of the foundation network user requirements, further investment may be required to ensure the capacity and reliability of the network. Potential upgrades to the transmission network will be subject to further development and regulatory approvals if an upgrade is determined to be required at a future date. The easement widths for the Renewable Energy Hub and CopperString Core include allowance for an additional transmission line.

18.2.7 Decommissioning and rehabilitation

The decommissioning process would essentially necessitate the reverse of the construction process, where, following electrical isolation the conductors and earth wires would be lowered, wound onto drums and transported for recycling. Towers would be removed and the steel transported for recycling.

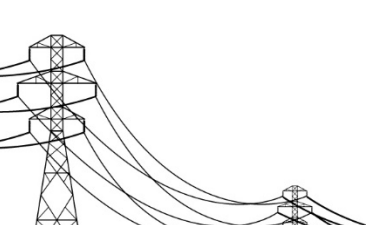
Footings that occur in agricultural land and other places where they would cause a nuisance would be cut off typically about 1 m below ground level with the lower end of the footing remaining in place. In areas of grazing quality, or not used for agricultural purposes, the footings will be cut off at approximately 300 mm deep. Rubble from the removed section of the footing would be removed from site and disposed of via a licenced waste disposal facility.

Decommissioning activities will also be addressed with regard to the same impacts as the construction phase. If no further transmission lines were planned for the easement, then the easement would be surrendered and returned in an acceptable condition with regard to the existing land use in the area.

18.3 Method

18.3.1 Overview of approach

The Project was subject to extensive ecological investigations as part of the original 2010 EIS and 2011 SEIS assessments and reporting undertaken between 2010 and 2011 (collectively referred to herein as CopperString 1.0 EIS). To maximise efficiencies and build upon the information obtained through those previous surveys and assessments, the current investigation has used an integrated approach. This combined a comprehensive review / gap analysis of previous studies with corridor realignment to avoid areas of ecological significance where possible, with renewed desktop assessments and targeted field surveys to ground-truth current conditions.



The following steps were used in the ecological assessment with the aim of integrating data, identifying gaps and streamlining the approach for targeted surveys of high value areas:

- A comprehensive review of the CopperString 1.0 EIS reports and mapping data was undertaken to identify key findings, ecological constraints and potential gaps imposed by logistical and land access constraints.
- A revised desktop assessment of government databases and mapping layers was undertaken to provide current information on conservation significant species, vegetation communities, aquatic and terrestrial habitats, and other ecological constraints.
- Preliminary constraints mapping was undertaken to identify and map the distribution of key ecological constraints including EPBC Act TECs, endangered or of concern REs mapped and regulated under the VM Act, essential habitat for species listed under the NC Act, Wetland Protection Areas, predicted habitat for conservation significant species confirmed present or considered likely to occur. A preliminary corridor selection workshop was undertaken to identify area of high ecological value and protection that could be avoided by the Project through a process of realignment of localised sections of the transmission line and corridor selection. The constraints mapping was also used to inform the site selection for targeted field survey efforts.
- Targeted field surveys were undertaken in 2010 and 2011 across the study area over five survey events. These provided representative ecological information under pre-wet and post-wet season weather conditions. Current surveys undertaken by GHD in 2019 targeted areas not assessed in the CopperString 1.0 EIS, areas of high potential ecological value, and areas representative of the local environment in different geographic sections of the study area (able to be accessed at the time).
- A likelihood of occurrence assessment was undertaken for all conservation significant species identified in desktop searches, with their likelihood of occurrence determined based on the results of the field surveys and desktop assessments.
- Revised ecological constraints mapping was undertaken to provide updated predictive habitat mapping for species of conservation significance and mapping of key constraints to inform the impact assessment process.
- Assessment of the proposed activities during construction and operation of the Project has been undertaken to identify potential impacts on the ecological values of the receiving environments. Recommended avoidance and mitigation measures have been proposed and significance of impact assessments conducted for conservation significant species.

18.3.2 Study area

The study area refers to the 5 km corridor which was subject to the field and desktop assessments (up to 2.5 km either side of the corridor selection). This study area width was employed to allow for a greater assessment of the surrounding areas and to allow for identification of regional values, connected values, and potential constraints or realignment opportunities.

The study area is described using six corridor sections (refer to Section 18.2) that relate to a section of the Project area (shown in Figure 18-2) and are further detailed in Table 18-18 in terms of bioregion, catchment, and location-specific references of kilometre posts (KPs).

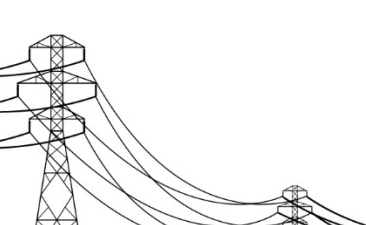


Table 18-18 Descriptions of Project corridor sections

Corridor Section	Linked Substations	Approx. Distance (km)	KPs (km)	Bioregions	Catchment
Woodstock Substation and Renewable Energy Hub	Woodstock Substation to Flinders Substation	342	0 to 341.74 WD	Brigalow Belt Einiasleigh Uplands Desert Uplands Mitchell Grass Downs	Haughton Burdekin River Coopers Creek Flinders River
CopperString Core	Flinders Substation to Dajarra Road Substation Includes connections for Ernest Henry, Dugald River and Chumvale Substation	402	341.74 to 736.289 WD 0 to 3.671 EE 0 to 2.68 MMG	Mitchell Grass Downs Desert Uplands Gulf Plains Northwest Highlands	Flinders River
Mount Isa Augmentation	Dajarra Road Substation to Mount Isa Substation	99	0 to 98.599 DM	Northwest Highlands	Leichhardt River Flinders River
Southern Connection	Dajarra Road Substation to Selwyn Substation	129	0 to 129.247 DS	Northwest Highlands	Georgina River Flinders River
Cannington Connection	Selwyn Substation to Cannington Substation	24	0 to 24.304 SC	Northwest Highlands Mitchell Grass Downs	Georgina River
Phosphate Hill Connection	Common South Point to Phosphate Hill Substation	63	90.33D S to 63.14 SP	Northwest Highlands Mitchell Grass Downs	Georgina River

18.3.3 Review of CopperString 1.0 EIS

Extensive desktop assessment and ecological surveys were previously undertaken as part of the CopperString 1.0 EIS assessments. In order to capture the relevant ecological information from previous studies, the following documents were reviewed:

- **CopperString Project EIS** – specifically the Terrestrial Ecology and Impact Assessment Report (BAAM, 2010) and the Aquatic Ecology (frc environmental, 2010), prepared for BAAM Pty Ltd, was viewed to ascertain the existing environmental values and legislative triggers identified during the initial assessment of the Project.
- **CopperString Project SEIS** - specifically the Terrestrial Ecology and Impact Assessment Report (BAAM, 2011) was viewed to ascertain additional information with regards to the existing environmental values, protected species and Project impacts updated as a supplementary submission following the initial EIS assessment.

A total of six ecological field surveys were undertaken for the CopperString 1.0 EIS investigations (refer to Table 18-19). The study area for the previous desktop assessments was a 5 km wide corridor along the centreline, with a 200 m wide corridor for field assessment purposes.

Table 18-19 Summary of previous ecological surveys relevant to the Project

Survey dates	Ecologists	Duration	Method and survey effort
Aquatic ecology surveys – frc environmental			
July 2010 / August – September 2010	Not specified	5 days / 10 days	Aquatic habitat assessments – 31 sites Water quality – 13 sites Aquatic flora assessment – 17 sites Macroinvertebrate sampling – 12 sites Electrofishing and trapping – 10 sites Turtle surveys and trapping – 4 sites
Targeted field surveys for MNES flora – BAAM			
July and August 2010	Not specified	Not specified	Quaternary vegetation assessments TEC verifications
Targeted field surveys for MNES reptiles - BAAM			
March-April 2011	4 fauna ecologists	10 days	Habitat suitability assessments Active searches
SEIS Terrestrial ecology surveys – BAAM, 3D Environmental			
April 2011	1 landscape ecologist 1 flora ecologist	12 days	Quaternary vegetation assessments Fauna habitat/rapid survey Trap and release surveys Regional ecosystem mapping
Targeted trapping survey for <i>Carpentarian Pseudantechinus</i> - BAAM			
May 2011	Not specified	4 x 5 days	Targeted trapping surveys Habitat suitability assessments
Targeted trapping surveys for Julia Creek Dunnart - BAAM			
May 2011	Not specified	2 x 5 days	Targeted trapping surveys Habitat suitability assessments
Targeted field surveys for MNES fauna – BAAM			
May / June 2011	4 fauna ecologists	10 days	Habitat suitability assessments Active searches

The distribution of survey sites was reviewed to identify areas that were not subject to surveying due to logistic or land access constraints. Additionally, key findings were reviewed to identify areas where conservation significant species were confirmed present or likely to occur, as well as other areas of ecological value. These were included in the assessment of constraints and impact assessment and identified knowledge gaps were a priority of the 2019 field surveys.

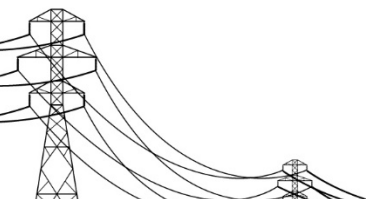
18.3.4 Desktop assessment

In order to provide current information on the existing environment, a comprehensive desktop assessment was undertaken reviewing the following government databases and mapping layers:

- **Protected Matters Search Tool (PMST)** - the DAWE PMST was used to identify MNES protected under the EPBC Act that have the potential to occur within the vicinity of the

study area. The search extent encompassed the study area together with a 5 km buffer. These search results are provided in Appendix A of the Ecology Technical Report.

- **Wildlife Online database** - the DES Wildlife Online (WO) database was used to retrieve historical records of flora and fauna species previously recorded within the vicinity of the study area. The search extent encompassed the study area as point coordinates along the corridor selection (at 30 km intervals with a 30 km buffer to each point).
- **Atlas of Living Australia database** - the Atlas of Living Australia (ALA) database was searched to retrieve historical records of conservation significant flora and fauna species assessed as likely to occur within the study area.
- **Biomaps (Wildnet)** - this mapping tool was used to review specific locations, collection dates, confirmation attributes and details of species of conservation significance assessed as likely to occur within the study area.
- **Flora Survey Trigger Mapping** – the DES protected plants flora survey trigger mapping was viewed to determine if any high risk trigger areas for protected plants listed under the NC Act occur within the study area.
- **Regulated Vegetation Management Mapping** – the DNRME Regulated Vegetation Management Map (version 3.07) and Vegetation Management Regional Ecosystem and Remnant Map spatial layer (version 11) was viewed to determine the extent and type of regulated vegetation categories and REs mapped within the study area.
- **Regional Ecosystem Description Database (REDD)** – the REDD was viewed to obtain a description of REs within the study area including the Queensland VM Act status, biodiversity status and wetland classification (Queensland Herbarium 2019).
- **Broad Vegetation Group (BVG) mapping** – mapping undertaken by the Queensland Herbarium (version 4.0) that amalgamates regional ecosystems into broad vegetation communities of similar species, structure and/or landform was reviewed for habitat types and general landscape types for impact assessment purposes.
- **Essential Habitat Mapping** - the DES Essential Habitat Map spatial layer (version 7.2) was viewed to determine if vegetation within the study area has been identified as essential habitat for a conservation significant species of wildlife listed under provisions of the NC Act.
- **Directory of Important Wetlands in Australia** – this database was searched to determine if any nationally protected wetlands were present within the study area.
- **Queensland Wetlands Mapping** – the DES wetlands mapping data (version 5.0) was viewed to identify lacustrine (lake), riverine and palustrine (swamp) water bodies or REs through point features (e.g. rock holes too small to be depicted as areas), major and minor watercourses lines, and polygons of wetland waterbodies and wetland REs at 1:100,000 scale as at 2017 extent.
- **Queensland Groundwater Dependent Ecosystem (GDE) Mapping** – the DES mapping layer was viewed to identify different types of GDEs (surface expression, terrestrial, subterranean), and the Queensland Springs Dataset of active (permanent and intermittent) and inactive springs.
- **DNRME Watercourse mapping** – this mapping layer was viewed to identify watercourses (including rivers, creeks, streams and drainage features) that are defined under the Water Act 2000, and their hierarchy, hydrological regime and names where available.
- Available aerial imagery.



18.3.5 Preliminary constraints mapping and risk avoidance

On 6 June 2019, members of CopperString, RLMS and GHD held a preliminary corridor selection workshop to identify key areas of ecological value that should be avoided through local route-realignments. Preliminary constraints mapping was undertaken to identify key constraints along the study area. The following key ecological constraints were mapped:

- Predicted habitat for conservation significant species considered known or likely to occur based on habitats confirmed in CopperString 1.0 EIS surveys and essential habitat factors listed for each species
- Known locations of conservation significant flora and fauna species
- Essential habitat for conservation significant species listed under the NC Act
- Flora trigger mapping for flora species listed under the NC Act
- Confirmed TECs mapped in the CopperString 1.0 EIS surveys
- Wetland Protection Areas

The preliminary corridor selection workshop was undertaken to identify area of high ecological value and protection that could be avoided by the Project through a process of realignment of localised sections of the transmission line and corridor selection, resulting in a number of mapped ecological constraints being avoided entirely.

The preliminary constraints mapping was used to inform the selection of field survey sites, targeting areas of high ecological value that had not been surveyed in the CopperString 1.0 EIS surveys and areas requiring re-assessment to validate current conditions.

18.3.6 Field surveys

Three ecological surveys were undertaken for the Project between September 2019 and November 2020. This comprised two pre-wet season surveys conducted as three separate field events:

- The first field survey assessed the western extent of the proposed corridor selection, from Mount Isa to east of Cloncurry in the Mount Isa Augmentation and the south-western sites of the Phosphate Hill and Cannington Connections.
- The second field survey assessed the remaining sections of the corridor selection, from east of Cloncurry in the west to Woodstock in the east.
- The third field survey assessed the Ballara Nature Refuge and the new alignment near Ravenswood. Additional targeted surveys for the koala, ornamental snake and black-throated finch were also conducted around Priare and Pentland.

During all survey event, rapid ecological assessments were undertaken at selected sites across the proposed alignment. The field teams for all surveys consisted of three fauna ecologists and two flora ecologists. The surveys targeted areas of high ecological value and areas that were not assessed in the original Copperstring 1.0 surveys due to land access or logistical constraints. This provided for greater investigation of areas of high ecological value and on-ground validation of current conditions at sites previously assessed in the Copperstring 1.0 project.

A summary of the 2019 field survey program is presented in Table 18-20. A description of the terrestrial flora and fauna and aquatic ecology survey techniques utilised during field surveys is presented in the following sections.

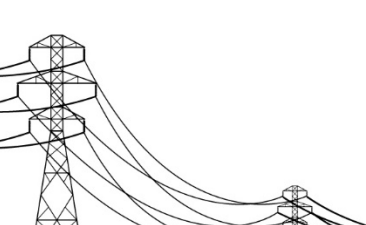


Table 18-20 Summary of field surveys

Survey dates	Field team	Duration	Survey area	Methodology and survey effort	Survey effort
Pre-wet season survey 1					
September 2019	3 fauna ecologists 2 flora ecologists	7 days	Mount Isa, Cloncurry, Dajarra, Phosphate Hill and Julia Creek.	Habitat suitability assessments Active searches Quaternary assessments SAT searches Targeted searches for conservation significant species Aquatic assessments	110 flora survey sites 82 fauna survey sites 6 aquatic survey sites
Pre-wet season survey 2					
December 2019	3 fauna ecologists 2 flora ecologists	7 days	Woodstock to Julia Creek	Habitat suitability assessments Active searches Quaternary assessments SAT searches Targeted searches for conservation significant species Aquatic assessments	123 flora survey sites 109 fauna survey sites 7 aquatic survey sites
Pre-wet season survey 3					
October / November 2020	2 fauna ecologists 2 flora ecologists	14 days	Ballara Nature Refuge, Pentland and Ravenswood.	Habitat suitability assessments Active searches Quaternary assessments SAT searches Targeted searches for conservation significant flora species Aquatic assessments	102 fauna survey sites 284 flora survey sites

Terrestrial flora surveys

Flora surveys involved a combination of vegetation community assessments and targeted surveys for conservation significant flora species. At each site, one or more of the following survey methods were applied:

Threatened Ecological Community assessments – the structural and compositional characteristics of vegetation communities were compared with DAWE’s descriptions of TECs to determine whether any vegetation communities met the thresholds necessary to constitute a TEC. This was undertaken where vegetation communities were mapped as equivalent REs to a listed TEC or displayed characteristics of a listed TEC.

Regional Ecosystem verification – verification of mapped remnant and high value regrowth RE communities was undertaken at 517 representative locations along the corridor selection. These Quaternary level assessments were undertaken at each location in accordance with the survey method detailed in Neldner *et al.* (2019). Data collected includes species and structural composition along with geology and landscape attributes. The characteristics of each assessed vegetation community type were compared to descriptions provided by the REDD (version 11.1) (Queensland Herbarium, 2019) so as to assign an RE identity.

Targeted searches for conservation significant flora – targeted searches for conservation significant flora species were undertaken in areas where previous records were documented or

suitable habitat for a conservation significant flora species was identified. Species identified as being most likely to be recorded included *Eucalyptus raveretiana*, *E. nudicaulis*, *Acacia armitii* and *Livistona lanuginosa*.

Recording of invasive species – prohibited or restricted invasive species as defined under the Biosecurity Act and listed as Weeds of National Significance were recorded and descriptions of densities and extent were documented. Invasive and pest flora species were noted during Quaternary level assessments (described above) and opportunistically during field surveys. These included areas accessible at the time of the survey events that were targeted due to the presence of conservation significant species and ecological communities.

The locations of terrestrial flora assessment sites are displayed in Figure 18-7.

Terrestrial fauna surveys

Fauna surveys involved a combination of habitat assessments, diurnal and nocturnal active searches, deployment of remote devices and targeted searches for conservation significant species. Terrestrial fauna surveys were undertaken at 293 sites within the study area, as shown in Figure 18-7. At each survey site, a combination of the following survey techniques were employed.

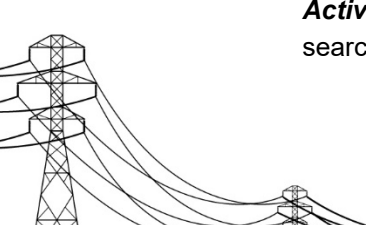
Habitat assessment surveys

At each of the 293 fauna survey sites, habitat assessments were undertaken to document the value of habitats for birds, reptiles, mammals and amphibians. This was based on the presence of key resources and habitat features including:

- Structural complexity of vegetation at canopy, shrub and ground layers
- Substrate type and the structural complexity of ground level microhabitats
- Presence of refuges and resources including fallen timber, leaf litter, hollow-bearing trees and stags, rocks/boulder piles and outcrops, caves and overhangs, mistletoes, nests, termite mounds and waterbodies
- Habitat condition based on existing land use and associated disturbance due to vegetation clearing, fragmentation, grazing, fire, weed and pest infestation
- Presence and condition of key resources for targeted conservation significant species including:
 - Breeding habitat for the Julia Creek dunnart (i.e. areas of Mitchell grass plains with a local abundance of cracking clays)
 - Foraging habitat for the koala (i.e. areas with a high abundance and diversity of koala food trees)
 - Breeding habitat for the squatter pigeon (i.e. sandy and stony soils with tussocky grasses within close proximity to permanent waterbodies)
 - Breeding habitat for the black-throated finch (southern) (i.e. woodland areas with a high abundance and diversity of native grasses within close proximity to permanent waterbodies).

Bird census – at each fauna survey site, area-based bird surveys were undertaken in accordance with the Birds Australia census technique (i.e. recording all birds seen or heard in a 2 ha area within a 20-minute period). This survey technique targeted a number of conservation significant bird species that have the potential to occur including squatter pigeon, red goshawk, black-throated finch and Australian painted snipe.

Active searches for reptiles and frogs – at each of the fauna survey sites, a 20-minute active search was undertaken to detect reptile and amphibian species by actively searching beneath



rocks, logs, bark, leaf litter and other microhabitats. Species targeted included the plains death adder and ornamental snake.

Driving / flushing surveys – driving / flushing surveys were undertaken to detect the squatter pigeon (southern) and other small ground-dwelling birds within suitable habitat. A total of over 775 km was driven over the course of the surveys.

Opportunist searches for wildlife and traces – all incidental observations of fauna during surveys were recorded. All secondary fauna traces were recorded including bones, feathers, skulls, sloughed skins, faecal pellets, tracks, burrows and scratches.

Deployment of remote surveillance cameras – remote surveillance cameras were baited and set at 13 locations (shown in Figure 18-7 and Plate 18-4). The remote cameras were deployed in representative vegetation types to target conservation significant species such as the koala, Julia Creek dunnart, and black-throated finch. Each camera was left in situ for three days and nights.

Microbat utilisation surveys – Anabats were set at 13 sites throughout the study area to record the echolocations of microbat species (as shown in Figure 18-7 and Plate 18-4). Anabat detectors were set 1 – 2 m above the ground in suitable flyways in areas of optimal bat habitat, with a local abundance of roosting sites (i.e. hollow trees and foraging habitat such as watercourses, waterbodies and vegetated areas). Each anabat was left in situ overnight. Recorded calls were analysed by specialist subconsultant Greg Ford.



Plate 18-4 Remote camera (left) and anabat (right) deployed in the field

Targeted searches for traces of conservation significant species

Within suitable habitat, the following methods, based on Commonwealth and State survey guidelines were used to target conservation significant fauna species:

- Koala – Targeted searches for koala faecal pellets were undertaken at 140 sites using the Spot Assessment Technique (SAT) (Phillips and Callaghan 2011). Spotlighting was undertaken within suitable habitat.
- Black-throated finch – Waterbody watches and area searches for birds were undertaken within 600 m of permanent waterbodies at 74 sites.
- Julia Creek dunnart – Deployment of remote cameras and collection of predator scats for content analysis were undertaken at 28 sites.
- Night parrot – Opportunistic surveys were undertaken at 84 sites. Targeted habitat assessments conducted at 27 sites.
- Squatter pigeon – Driving / flushing surveys and area searches at permanent waterbodies, including in the vicinity of dams and cattle troughs, were undertaken at 74 sites.

- Plains death adder – Nocturnal driving transects and active searches were undertaken at 104 sites.

A summary of the survey effort directed towards conservation significant species is presented in Table 18-21.

Aquatic flora and fauna assessment

Rapid aquatic assessments were conducted at key locations where the proposed corridor selection intersects waterways, waterbodies and riparian corridors as shown in Figure 18-7. The location of aquatic ecology assessments is presented in Figure 18-7. Surveys targeted previously unassessed aquatic features, where they were accessible. As the majority of aquatic features were dry at the time of assessment, surveys were limited to visual assessments and habitat characterisations, including documenting the following:

- Morphology of stream bed and banks
- Diversity and abundance of instream macrophytes
- Diversity and abundance of fringing riparian vegetation
- Instream habitat complexity and resource availability for aquatic fauna
- Likely flow regime based on characteristics observed.

Animal ethics and scientific permits

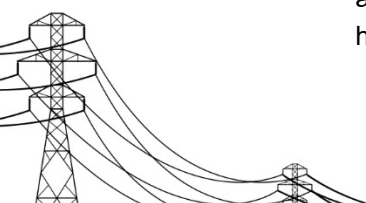
GHD field surveys were conducted in accordance with the following permits and approvals:

- Department of Employment, Economic Development and Innovation Scientific Users Registration Certificate (Registration Number 132)
- DES Scientific Purposes Permit (permit number WISP15723315)
- Animal Research Authority issued by the accredited GHD Animal Ethics Committee

Survey limitations

Limitations of the field survey assessments undertaken for the study area include:

- Pre-wet season field survey events only were undertaken, with consideration of results from previous field surveys undertaken in post-wet events. The conditions at the time of survey in September and December 2019 were dry with limited aquatic habitat conditions present and limited flowering of grasses that are used to indicate habitat for some species of conservation significance, such as black-throated finch and Julia Creek dunnart, as well as flora species of conservation significance such as *Dichanthium setosum*.
- The field survey team was not permitted to access a number of private properties at the time of survey. Where possible, survey sites were undertaken in equivalent ecosystems or along waterways that connected through those properties to obtain a representative condition of ecological values on that property. However some localised values may have been misrepresented or not identified using this method.
- Surveys were undertaken by GHD in the late dry season. Some migratory species, notably the painted honeyeater, are unlikely to be present in the region at that time of year. Nevertheless, sufficient information was available from historical records to assess the species likelihood of occurrence and identify and map areas of predicted habitat.
- Dry conditions at the time of survey limited the potential to identify the extent of potential nesting habitat for the southern black-throated finch. Targeted surveys are recommended as part of tier-two environmental approvals to identify and avoid key areas of nesting habitat for the southern black-throated finch.



- Surveys did not include flora surveys in compliance with the DES Flora Survey Guidelines – Protected Plants (Version 2.01, May 2019), or habitat quality assessments in accordance with the DES Guide to determining terrestrial habitat quality (Version 1.3, February 2020). These surveys will be undertaken once impact areas are defined, if triggered by relevant legislative requirements.
- A number of conservation significant species assessed within this report are listed as ‘confidential species’ by the DES. Previous records of the species may be generalised locations with or without dates provided, therefore the exact location of historical records may not be available. For such species, GHD has adopted a conservative approach and assessed these species with the highest appropriate level of likelihood.

18.3.7 Likelihood of occurrence assessment

An assessment was conducted to attribute a ‘likelihood of occurrence’ to conservation significant species (i.e. species listed under the EPBC Act) that have been previously recorded or were predicted to occur from the desktop searches. The assessment is provided in Section 18.4.12.

The likelihood of occurrence assessment was based on a review of species distributions and habitat requirements, historical records for the region, and the results of habitat assessments and field surveys conducted within the study area. The likelihood of occurrence ranking was based on the following framework:

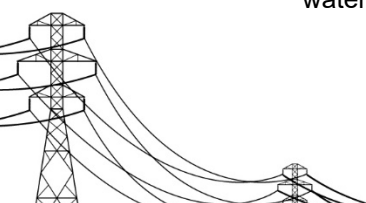
- Confirmed present: Species recorded during the field survey (GHD 2019 and BAAM 2010/2011).
- Likely to occur: Species has been recorded in the desktop search extent and suitable habitat is present in the study area.
- May occur: Species distribution incorporates the study area but only marginal habitat is present or the species has not been recorded in the desktop extent.
- Unlikely to occur: Species has not been previously recorded in the desktop search extent and/or current known distribution does not encompass study area and/or suitable habitat is generally lacking from the study area.

18.3.8 Habitat mapping for threatened species

Prior to undertaking field surveys, predictive habitat mapping was produced for all conservation significant species confirmed present or considered likely to occur in the Copperstring 1.0 EIS. Predictive mapping was based on essential habitat factors nominated for each species by DES, updated records and RE data, as well as the known, likely and/or potential habitat mapping produced for the Copperstring 1.0 project. Predictive mapping informed the targeted selection of survey sites, as well as localised route selection changes to avoid areas of ecological significance.

Following field surveys, predictive habitat mapping was refined based on information on habitat condition obtained from field surveys and additional species observations (or lack of observations for some flora species). The refined predictive habitat mapping was used to inform the impact assessment.

Suitable habitat has been mapped in the predictive mapping, which is broadly defined as areas that meet the Queensland State government essential habitat factors (where relevant and able to be mapped), the mapped distribution for the species, and/or other key habitat characteristics from the DAWE Species Profile and Threats Database that are able to be mapped (such as watercourse stream order or waterbody type).



Predictive habitat maps also show previous records from field surveys and available databases. Previous records are derived from the following sources (as relevant to the species):

- Copperstring 1.0 EIS field survey records (BAAM, 2010 and BAAM, 2011)
- GHD 2019 field survey records
- Wildlife Online database records (Wildnet data)
- Queensland Museum database records
- ALA records (if additional to the records shown on Wildnet or Qld Museum) and/or
- Birdlife Australia database records

For EPBC Act listed species, the potential habitat mapping has been limited spatially to the indicative distribution of the species shown on the DAWE Species Profile and Threats Database (derived from point locations, bioclimatic distribution models and/or expert knowledge), as relevant to the suitable habitat characteristics present.

The suitable habitat mapping has been considered for assessing potential impacts to each species, as relevant to their habitat requirements (e.g. non-breeding, breeding or foraging habitat), movements and lifecycle, and in relation to remaining suitable habitat available at the local and regional scales. Where this suitable habitat represents habitat critical to the survival of the species, or important habitat for a species, this has been specified in the impact assessment.

Habitat mapping criteria for each species is provided in Table 18-22, with further detail on specific criteria for koala habitat mapping provided in Table 18-23.

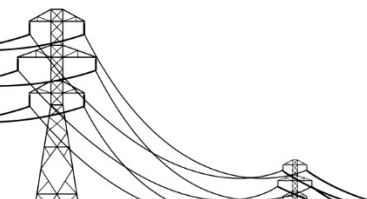
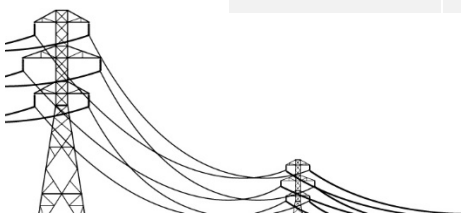
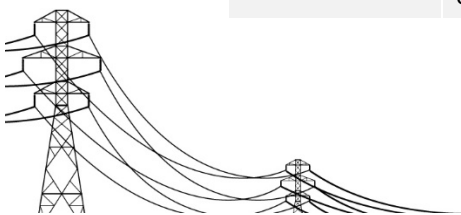


Table 18-21 Summary of survey effort for conservation significant species

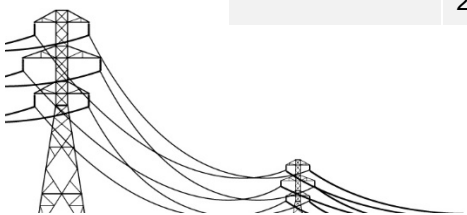
Species	Survey guidelines	Best practice methods	Survey effort 2010/2011	Survey effort in 2019	Survey effort in 2020
Flora					
<i>Acacia cromptiei</i> , <i>Eucalyptus raveretiana</i> , <i>Livistona lanuginosa</i>	AUS: Nil QLD: Flora survey guidelines – protected plants (DES 2020)	Random meander technique Targeted searches in suitable habitats	Targeted searches were undertaken by BAAM in 2010/11 for 12 days (2010) and at 408 sites (2011).	Active searches within the species distribution and targeted searches within suitable / predicted habitat for the species were undertaken at 233 sites. Random meanders through all vegetation communities surveyed.	Active searches within the species distribution and targeted searches within suitable / predicted habitat for the species were undertaken at 284 sites. Random meanders through all vegetation communities surveyed.
Birds					
Squatter pigeon	Survey guidelines for Australia's threatened birds (DEWHA, 2010). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018).	Active searches at permanent waterbodies, dams and cattle troughs. Driving / flushing surveys.	Targeted searches at 41 sites.	Driving surveys over 750 km. Active searches undertaken at 74 sites.	Driving surveys over 21 km Active searches undertaken at 16 sites.
Red goshawk	Survey guidelines for Australia's threatened birds (DEWHA, 2010).	Active searches in tall woodland habitats and riparian corridors. Driving through tropical woodland tracks and scanning groups of tall trees for nests	Active searches completed at 18 sites	Active searches undertaken at 28 sites. Targeted surveys completed at 23 sites	Active searches undertaken at 21 sites.
Black throated finch	Survey guidelines for Australia's threatened birds (DEWHA, 2010).	Bird census survey – 2 ha area for 20 minutes within savanna woodlands. Conduct waterbody watches late in the dry season.	Targeted surveys completed at 35 sites	Targeted surveys completed at 48 sites. Active searches undertaken at 30 sites.	Targeted surveys completed at 26 sites. Targeted habitat assessments at 3 sites Active searches undertaken at 40 sites.



Species	Survey guidelines	Best practice methods	Survey effort 2010/2011	Survey effort in 2019	Survey effort in 2020
Night parrot	Survey guidelines for Australia's threatened birds (DEWHA, 2010). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018). Survey advice from the Night Parrot Recovery Team.	Targeted searches at isolated waterbodies and subsequent evening watches. Songmeters deployed in predicted habitat.	Targeted surveys completed at 11 sites	Active searches undertaken at 10 sites.	Targeted surveys completed at 27 sites. Song meters deployed at 3 locations. Remote cameras deployed at two locations
Grey falcon	Survey guidelines for Australia's threatened birds (DEWHA, 2010). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018).	No specific methodology available. This species has only recently been listed as vulnerable under Commonwealth legislation.	Species not targeted during Copperstring 1.0 surveys. Opportunistic observations at	Active searches undertaken at 293 sites.	Active searches undertaken at 293 sites.
Painted honeyeater	Survey guidelines for Australia's threatened birds (DEWHA, 2010). Targeted species survey guidelines: painted honeyeater (Rowland 2012). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018).	Active searches within suitable habitat.	Targeted surveys at four sites.	Active searches undertaken at 17 sites.	Active searches undertaken at four sites.



Species	Survey guidelines	Best practice methods	Survey effort 2010/2011	Survey effort in 2019	Survey effort in 2020
Australian painted snipe	Survey guidelines for Australia's threatened birds (DEWHA, 2010). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018).	Targeted stationary observations Areas searches and line transects	Active searches at one site. Opportunistic searches at water sources.	Targeted stationary observations at 31 sites	Targeted stationary observations at 26 sites
Mammals					
Julia creek dunnart	Survey guidelines for Australia's threatened mammals (DEWHA, 2011). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018).	Active searches for signs of the species' presence (e.g. tracks, nests, burrows or scats). Daytime searches for the presence of suitable habitat. Elliot A trapping surveys. Pitfall trap surveys.	6 trapping surveys across 29 sites. Between 20 – 50 Elliot traps per site, 4 nights per site.	Active searches undertaken at 46 sites Targeted habitat assessments conducted as 17 sites	Active searches undertaken at 16 sites.
Koala	Survey guidelines for Australia's threatened mammals (DEWHA, 2011). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018). Spot Assessment Technique (Phillips and Callaghan 2011)	Scat surveys in accordance with the Spot Assessment Technique. Active searches of scratches.	Not targeted during the 2010/2011 surveys.	SAT searches conducted at 92 sites. Habitat assessments conducted as 92 sites	SAT searches conducted at 48 sites Targeted habitat assessments conducted as 42 sites.



Species	Survey guidelines	Best practice methods	Survey effort 2010/2011	Survey effort in 2019	Survey effort in 2020
Microbats	Survey guidelines for Australia's threatened bats (DEWHA, 2010). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018).	Deploy echolocation call detection devices (anabats) in flyways Harp trapping or mist netting Roost searches within suitable habitat.	Targeted searches at 10 locations within potential habitat.	Anabats deployed at 6 locations. Active searches undertaken at 74 sites.	Anabats deployed at 6 locations. Active searches undertaken at 19 sites.
Reptiles					
Plains death adder	Survey guidelines for Australia's threatened reptiles (DEWHA, 2011). Targeted species survey guidelines: common death adder (Rowland 2012).	Nocturnal vehicle transects Pitfall and funnel trapping	Not targeted during the Copperstring 1.0 field surveys.	Active searches undertaken at 104sites. Driving transects conducted on 25 evenings.	Species distribution not included in study scope.
Ornamental snake	Survey guidelines for Australia's threatened reptiles (DEWHA, 2011). Terrestrial vertebrate fauna survey guidelines for Queensland Version 3 (Eyre et al 2018).	Active searches in suitable habitat Nocturnal driving transects. Nocturnal active searches	Not targeted during the Copperstring 1.0 field surveys.	Active searches undertaken at 12 sites. Targeted surveys conducted as 15 sites.	Active searches undertaken at 13 sites. Targeted surveys conducted as 21 sites.

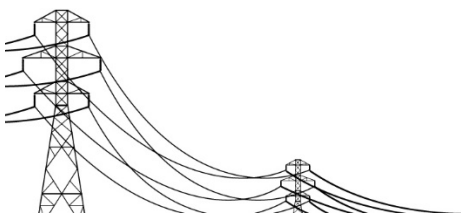
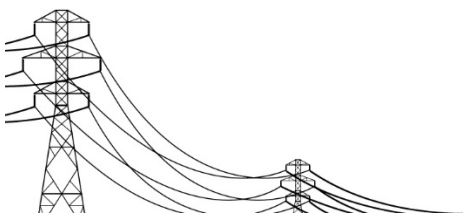


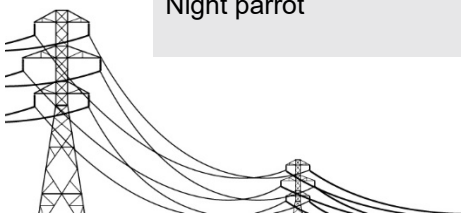
Table 18-22 Predictive habitat mapping criteria for conservation significant species

Species	Habitat type	Mapping criteria
Flora		
<i>Acacia cromptiei</i>	Suitable habitat	Distribution clipped to Richmond in the west to just east of KP 300. Mapped as any remnant RE located between KP 300WD and KP450WD containing: 4.3.3, 4.3.4, 4.3.8, 4.3.14, 4.3.19, 4.3.20, 4.3.23, 4.8.7, 4.9.1, 4.9.7, 4.9.8, 4.9.11, 9.8.5, 9.8.6, 9.10.4, 9.12.18, 10.3.15, 10.4.5
<i>Eucalyptus raveretiana</i>	Suitable habitat	Mapped using remnant RE polygons that contain REs 9.3.1, 8.3.3, 11.3.25 and 11.3.25b (mixed or single RE polygons) between KP 0WD and 110WD. Only along watercourses that are stream order 4 or higher.
<i>Livingstonia lanuginosa</i>	Suitable habitat	Restrict mapping to Burdekin Catchment area only (around KP 100WP to 225WD), show watercourse lines buffered 100 m within remnant RE polygons that contain REs 9.3.1, 10.3.6, 10.3.13, 10.3.14, 10.3.31, 11.3.4, 11.3.25 (mixed or single RE polygons) between KP 0WD and 225WD.
Fauna		
Australian painted snipe	Suitable habitat	Mapped using the following remnant (Category B) and regrowth (HVR - Category C and R) REs from all corridor sections: 1.3.6x1, 1.3.7, 1.3.7a, 1.3.7b, 1.3.7x1, 2.3.11, 2.3.17, 2.3.25, 2.3.3b, 2.3.7b, 2.3.7c, 4.3.1, 4.3.3, 4.3.4, 4.3.8, 9.3.1, 9.3.4, 9.3.6, 9.3.6a, 9.3.12, 9.3.12a, 9.3.12b, 9.3.13, 10.3.4, 10.3.4a, 10.3.4c, 10.3.13a, 10.3.13b, 10.3.14, 10.3.14a, 10.3.14b, 10.3.14c, 10.3.14d, 10.3.14f, 10.3.14h, 10.3.15, 10.3.15g, 10.3.16d, 10.3.28a, 10.3.28b, 10.4.5, 10.4.5x1, 10.4.7, 11.3.12, 11.3.25, 11.3.25b, 11.3.35, 11.3.35a, 10.3.13, 10.3.16, 2.3.3, 2.3.7, 2.3.17, 1.3.6.
Black-throated finch	Suitable habitat	Mapped using the following remnant REs between KP 0WD and 429WD: 9.3.1, 9.3.2, 9.3.3, 9.3.4, 9.3.5, 9.3.6, 9.3.7, 9.3.8, 9.3.9, 9.3.10, 9.3.11, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.18, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.23, 9.4.1, 9.4.2, 9.4.3, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.14, 9.5.16, 9.7.1, 9.7.2, 9.7.3, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.6, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.6, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.11, 9.11.12, 9.11.13, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.23, 9.11.24, 9.11.26, 9.11.28, 9.11.29, 9.11.31, 9.11.32, 9.12.1, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.33, 9.12.35, 9.12.37, 9.12.39, 10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3,

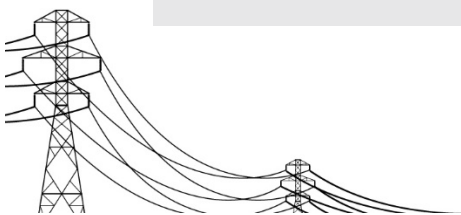
Species	Habitat type	Mapping criteria
		10.4.4, 10.4.5, 10.4.6, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20
White-throated needletail	Potential aerial distribution	Mapped as all remnant vegetation (excluding grassland broad vegetation groups DBVG1M: 30a, 30b, 31a, 31b, 33b and all non-remnant areas) east of Charters Towers only
Grey falcon	Suitable habitat	Mapped using the following remnant REs across all corridor sections: 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.11, 4.5.9, 4.7.4, 4.9.6, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.3.6, 5.3.20, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.3.8, 6.3.9, 6.3.16, 6.3.17, 6.3.18, 6.3.24, 6.3.25, 6.4.3, 6.5.1, 6.5.2, 6.5.3, 6.5.5, 6.5.17, 6.5.19, 6.7.5, 6.7.6, 9.4.3, 10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.19, 10.3.20, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.3, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.2, 10.7.3, 10.7.5, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.10.1, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20



Species	Habitat type	Mapping criteria
Julia Creek dunnart	Suitable habitat	No habitat mapped south or west of Cloncurry. Mapped using the following remnant REs between KP 260WD and ODM: 4.3.14, 4.3.15, 4.3.19, 4.3.20, 4.9.1, 4.9.5, 4.9.7, 4.9.8, 2.3.3, 2.9.1.
Koala	High, Moderate and Low value habitat = Habitat critical to the survival of the species Very Low value habitat = Not habitat critical to the survival of the species	Criteria detailed in separate table below – differentiating between coastal, inland and western inland habitat definitions consistent with Commonwealth definition and based on the following REs nominated as essential habitat factors for the koala by DNRME: 4.3.1, 4.3.2, 4.3.3, 4.3.5, 4.3.6, 4.3.7, 4.3.8, 4.3.10, 4.3.11, 4.7.1, 4.7.7, 4.7.8, 4.9.6, 4.9.12, 9.3.1, 9.3.2, 9.3.3, 9.3.4, 9.3.5, 9.3.6, 9.3.7, 9.3.8, 9.3.10, 9.3.11, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.27, 9.4.1, 9.4.2, 9.4.3, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.15, 9.5.16, 9.5.17, 9.7.1, 9.7.2, 9.7.3, 9.7.4, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.3, 9.8.4, 9.8.5, 9.8.9, 9.8.10, 9.8.11, 9.8.13, 9.10.1, 9.10.3, 9.10.4, 9.10.5, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.12, 9.11.13, 9.11.14, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.21, 9.11.22, 9.11.23, 9.11.24, 9.11.25, 9.11.26, 9.11.28, 9.11.29, 9.11.30, 9.11.31, 9.11.32, 9.12.1, 9.12.2, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.14, 9.12.15, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.25, 9.12.26, 9.12.27, 9.12.28, 9.12.29, 9.12.30, 9.12.31, 9.12.32, 9.12.33, 9.12.35, 9.12.36, 9.12.37, 9.12.38, 9.12.39, 9.12.44, 10.3.2, 10.3.3, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.17, 10.3.20, 10.3.27, 10.3.28, 10.4.3, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.2, 10.9.3, 10.9.5, 10.10.1, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.21, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.11, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20
Night parrot	Suitable nesting habitat	West from around KP 680 along the Woodstock to Dajarra corridor, plus all other corridors to west and south of Cloncurry using the following REs:



Species	Habitat type	Mapping criteria
		1.11.11, 1.5.12, 1.7.4, 4.5.5c, 4.5.5x1, 4.5.8, 4.5.8x1, 4.7.2, 4.7.2x1a, 4.7.2x1b, 4.9.13a, 4.9.13x1
	Suitable feeding habitat	West from around KP 680 along the Woodstock to Dajarra corridor, plus all other corridors to west and south of Cloncurry using the following REs: 1.5.15, 1.5.6c, 1.11.13, 4.3.14, 4.3.17b, 4.3.18, 4.3.20x1, 4.4.1, 4.4.1d, 4.4.1x6, 4.5.3x1b, 4.5.3x2, 4.5.3x70, 4.9.1c, 4.9.4x1c, 2.3.69b, 2.4.2a, 2.4.2b, 2.9.1, 2.3.3
Painted honeyeater	Suitable habitat	All remnant RE vegetation west of Charters Towers
Plains death adder	Suitable habitat	Mapped as remnant areas of Northwest Highlands Bioregion and RE polygons between KP 0WD and 99.15DM and all of Southern, Cannington and Phosphate Hill Connection corridor sections that are or contain REs: 4.3.14, 4.3.15, 4.3.19, 4.3.20, 4.9.1, 4.9.5, 4.9.7, 4.9.8, 2.3.3, 2.9.1
Red goshawk	Suitable habitat	Mapped using the BAAM (2011) mapped 'potential' habitat, with added records buffered 5 km within potential habitat areas that are (or contain) the following remnant REs all corridor sections (excluding between KP 546WD and 670WD: 11.3.7, 11.3.25, 11.3.30, 11.3.35, 11.5.12, 11.11.15, 11.12.9, 9.3.1, 9.3.3, 9.3.6, 9.3.12, 9.3.19, 9.5.4, 9.11.1, 9.11.2, 9.11.5, 9.12.22, 9.12.32, 10.3.11, 10.3.13, 10.4.5, 10.4.7, 10.7.3, 10.7.4, 10.7.5, 10.7.7, 10.7.10, 10.7.12, 10.10.1, 10.10.4, 10.10.5
Ornamental snake	Suitable habitat	Restricted to within 40 km of known records. Mapped using the following remnant REs between KP 100WD and 250WD: 10.3.2, 10.3.3, 10.3.4, 10.3.7, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.27, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.8, 10.5.5, 10.9.1, 10.9.6, 10.9.7, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.9, 11.3.10, 11.3.12, 11.3.15, 11.3.21, 11.3.23, 11.3.24, 11.3.25, 11.3.27, 11.3.28, 11.3.31, 11.3.34, 11.3.37, 11.3.38, 11.3.40, 11.4.2, 11.4.3, 11.4.4, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.11, 11.5.2, 11.5.3, 11.5.16, 11.8.11, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.7, 11.9.11, 11.9.12, 11.9.14, 11.11.15, 11.12.6, 11.3.7, 11.3.30, 11.3.32, 11.3.35.
Squatter pigeon (southern)	Breeding habitat	Records buffered 5 km and mapped using the following remnant REs between KP 0WD and 333WD 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.16, 9.7.1, 9.7.2, 9.7.3, 9.7.5, 9.7.6, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.2, 10.7.3, 10.7.5, 10.7.11, 10.7.12, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.4, 11.7.6
	Suitable habitat	Records buffered 5 km and mapped using the following remnant REs between KP 0WD and 333WD 9.3.1, 9.3.2, 9.3.3, 9.3.4, 9.3.5, 9.3.6, 9.3.7, 9.3.8, 9.3.9, 9.3.11, 9.3.13, 9.3.14, 9.3.15, 9.3.16, 9.3.17, 9.3.18,



Species	Habitat type	Mapping criteria
		9.3.19, 9.3.20, 9.3.21, 9.3.22, 9.3.23, 9.4.1, 9.4.2, 9.4.3, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8, 9.5.9, 9.5.10, 9.5.11, 9.5.12, 9.5.16, 9.7.1, 9.7.2, 9.7.3, 9.7.5, 9.7.6, 9.8.1, 9.8.2, 9.8.4, 9.8.5, 9.8.6, 9.8.9, 9.8.10, 9.8.11, 9.10.1, 9.10.3, 9.10.6, 9.10.7, 9.10.8, 9.11.1, 9.11.2, 9.11.3, 9.11.4, 9.11.5, 9.11.7, 9.11.10, 9.11.11, 9.11.12, 9.11.13, 9.11.15, 9.11.16, 9.11.17, 9.11.18, 9.11.19, 9.11.23, 9.11.26, 9.11.28, 9.11.29, 9.11.31, 9.11.32, 9.12.1, 9.12.3, 9.12.4, 9.12.5, 9.12.6, 9.12.7, 9.12.10, 9.12.11, 9.12.12, 9.12.13, 9.12.16, 9.12.17, 9.12.18, 9.12.19, 9.12.20, 9.12.21, 9.12.22, 9.12.23, 9.12.24, 9.12.26, 9.12.28, 9.12.30, 9.12.31, 9.12.33, 9.12.35, 9.12.37, 9.12.39, 10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.19, 10.3.20, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.3, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.2, 10.7.3, 10.7.5, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.10.1, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20.
Migratory species	Non-breeding habitat	Wetlands and waterboddies represent non-breeding habitat for: Latham's snipe (<i>Gallinago hardwickii</i>), oriental pratincole (<i>Glareola maldivarum</i>), Marsh sandpiper (<i>Tringa stagnatilis</i>), Wood sandpiper (<i>Tringa glareola</i>) Fork-tailed swift (<i>Apus pacificus</i>) – Aerial species so just a dot for the record
Migratory species	Breeding habtiat	Wetlands and waterboddies represent breeding habitat for: Gull-billed tern (<i>Gelochelidon nilotica</i>), Glossy ibis (<i>Plegadis falcinellus</i>) Caspian tern (<i>Hydroprogne caspia</i>) - breeding habitat at Lake Moondarra (large lake north of Mt Isa). Dispersal and foraging habitat along watercourses, wetlands, lakes and dams.

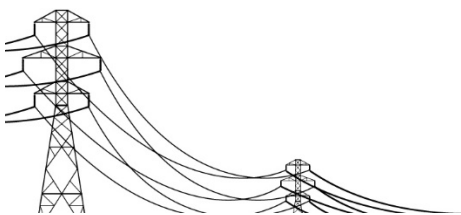
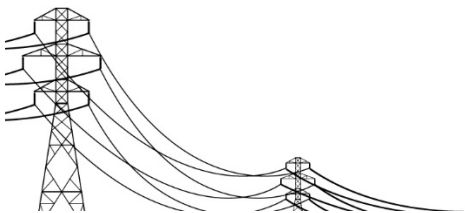
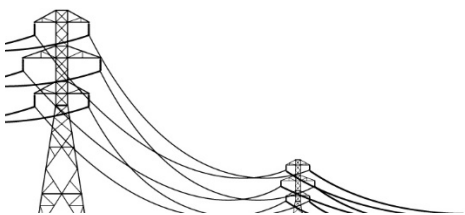


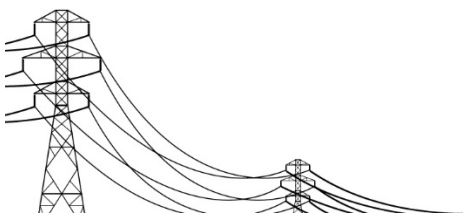
Table 18-23 Predictive habitat mapping criteria for koala



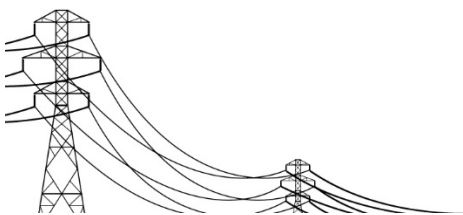
DAWE Criteria	Criteria used for mapping koala habitat	Representative photo	Scoring in EPBC habitat assessment toolkit
Coastal koala habitat: large, connected areas of native vegetation, including in forests and woodlands where logging has altered tree species composition; these areas may be remnant, regrowth or plantation vegetation small, isolated patches of native vegetation in rural, urban or peri-urban areas windbreaks and narrow areas of native vegetation along riparian areas or linear infrastructure isolated food and/or shelter trees (i.e. on farm lands, in suburban streetscapes, parks and yards).	Apply to Brigalow belt REs (11) – Include all High, Moderate and Low value habitat based on the descriptions below. High = Remnant REs recognised as essential habitat factors for the koala in DNRME mapping that contain primary or secondary food trees named for the local shire council regions in the National Koala Tree Planting List (i.e. <i>Eucalyptus camaldulensis</i> , <i>E. tereticornis</i> , <i>E. coolabah</i> , <i>E. brownii</i> , <i>E. cambageana</i> , <i>E. exserta</i> , <i>E. ochrophloia</i> , <i>E. orgadophila</i> , <i>E. moluccana</i>)		Koala occurrence: 2 Vegetation composition: 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 - 2 Total: 8 - 9
	High = Remnant REs recognised as essential habitat factors for the koala in DNRME mapping that are on alluvial (land zone 3) and within 300 m of watercourses of stream order 2 and higher		Koala occurrence: 2 Vegetation composition: 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 - 2 Total: 8 - 9



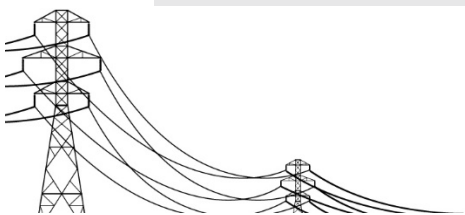
	Moderate = Remnant Forest and woodland REs that have moderately fertile soils (i.e. land zone 3 (alluvial) and 12 (hills and lowlands on granitic rocks)), with sparse to moderate tree densities including known koala food trees NOT listed as primary or secondary food trees)		Koala occurrence: 2 Vegetation composition: 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 Total: 8
	Low = All remaining REs recognised as essential habitat factors in DNRME mapping that are on skeletal, low nutrient soils and have very sparse tree densities	None present in study area	N/A
	Low = REs recognised as essential habitat factors in DNRME mapping that are Acacia dominated woodland or shrubland with occasional emergent koala food trees	None present in study area	N/A
	Low = All patches of regrowth and isolated trees containing koala food trees. These areas were digitised based on high resolution aerial imagery		Koala occurrence: 0 - 1 Vegetation composition: 1 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 Total: 5 - 6



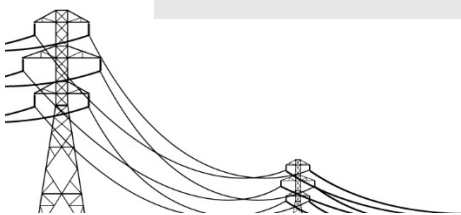
Inland koala habitat: Eucalypt forests and woodlands, as well as Acacia woodlands (with emergent food trees) <i>in both riparian and non-riparian</i> environments – woodlands and forests (where koala food trees have reliable access to soil moisture) – box gum or red gum woodlands on heavier soils in remnant or regrowth vegetation patches particularly riparian zones – small, patchy and sparsely distributed woodlands, shrublands and forest in highly modified, agricultural-grazing landscapes or in and around rural towns (although there are some	Apply to Einasleigh Uplands REs (9) (i.e. Inland areas immediately west of the GDR) – Include all High and Moderate value habitat and all Low value habitat (excluding regrowth and isolated trees) occurring within 5km of drought refuge (i.e. high value habitat)		
	High = Remnant REs recognised as essential habitat factors for the koala in DNRME mapping that contain primary or secondary food trees named for the local shire council regions in the National Koala Tree Planting List (i.e. <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i>, <i>E. coolabah</i>, <i>E. brownii</i>, <i>E. cambageana</i>, <i>E. exserta</i>, <i>E. ochrophloia</i>, <i>E. orgadophila</i>, <i>E. moluccana</i>)		Koala occurrence: 2 Vegetation composition: 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 - 2 Total: 8 - 9
	High = Remnant REs recognised as essential habitat factors for the koala in DNRME mapping that are on alluvial (land zone 3) and within 300 m of watercourses of stream order 2 and higher		Koala occurrence: 2 Vegetation composition: 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 - 2 Total: 8 - 9



large, connected areas of habitat also).	Moderate = Remnant Forest and woodland REs that have moderately fertile soils (i.e. land zone 3 (alluvial) and 12 (hills and lowlands on granitic rocks)), with sparse to moderate tree densities including known koala food trees NOT listed as primary or secondary food trees in the National Koala Tree Planting list)		Koala occurrence: 1 - 2 Vegetation composition: 1 - 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 Total: 6 - 8
	Low = All remaining REs recognised as essential habitat factors in DNRME mapping that are on skeletal, low nutrient soils and have very sparse tree densities where these occur within 5 km of drought refuge (i.e. high value habitat)		Koala occurrence: 0 Vegetation composition: 1 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 Total: 5
	Low = REs recognised as essential habitat factors in DNRME mapping that are Acacia dominated woodland or shrubland with occasional emergent koala food trees where these occur within 5km of drought refuge (i.e. high value habitat)		Koala occurrence: 0 Vegetation composition: 1 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 Total: 5



	Very Low = Low value habitat detailed above that is more than 5 km from drought refuge	As above but > 5 km from drought refuge	Koala occurrence: 0 Vegetation composition: 1 Habitat connectivity: 1 Key existing threats: 0 - 1 Recovery value: 0 - 1 Total: 2 – 4 Not habitat critical to the survival of the species
Semi-arid inland koala habitat: Eucalypt (and related genera) forests and woodlands (<i>particularly in the vicinity of riparian environments</i> and Acacia-dominated forest, woodland and shrubland (with emergent food trees) – woodlands and forests (where koala food trees have reliable access to soil moisture) – box gum or red gum woodlands on heavier soils in remnant or regrowth vegetation patches particularly riparian zones – small, patchy and sparsely distributed woodlands, shrublands and forest in highly modified, agricultural-grazing landscapes or in and around rural towns	Apply to Desert Uplands and Mitchell Grass Plains REs (10 and 4) (i.e. western inland areas) – Include all High and Moderate value habitat and Low value habitat (excluding regrowth and isolated trees) occurring within 1km of drought refuge (i.e. high value habitat)		
	High = Remnant REs recognised as essential habitat factors for the koala in DNRME mapping that contain primary or secondary food trees named for the local shire council regions in the National Koala Tree Planting List (i.e. <i>Eucalyptus camaldulensis</i>, <i>E. tereticornis</i>, <i>E. coolabah</i>, <i>E. brownii</i>, <i>E. cambageana</i>, <i>E. exserta</i>, <i>E. ochrophloia</i>, <i>E. orgadophila</i>, <i>E. moluccana</i>)		Koala occurrence: 2 Vegetation composition: 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 - 2 Total: 8 - 9
	High = Remnant REs recognised as essential habitat factors for the koala in DNRME mapping that are on alluvial (land zone 3) and within 300 m of watercourses of stream order 2 and higher		Koala occurrence: 2 Vegetation composition: 2 Habitat connectivity: 2 Key existing threats: 1 Recovery value: 1 - 2 Total: 8 - 9



(although there are some large, connected areas of habitat also).

Moderate = Remnant Forest and woodland REs that have moderately fertile soils (i.e. land zone 3 (alluvial) and 12 (hills and lowlands on granitic rocks)), with sparse to moderate tree densities including known koala food trees NOT listed as primary or secondary food trees)



Koala occurrence: 1 - 2
Vegetation composition: 1 - 2
Habitat connectivity: 2
Key existing threats: 1
Recovery value: 1
Total: 6 - 8

Low = All remaining REs recognised as essential habitat factors in DNRME mapping that are on skeletal, low nutrient soils with very sparse tree densities where these occur within close proximity (i.e. within 1km) of drought refuge (i.e. high value habitat)

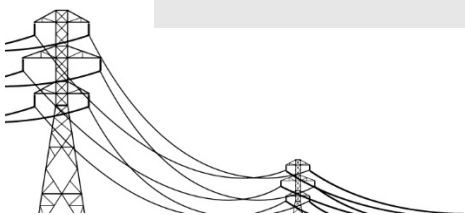


Koala occurrence: 0 - 1
Vegetation composition: 1
Habitat connectivity: 1
Key existing threats: 0 - 1
Recovery value: 1
Total: 3 - 5

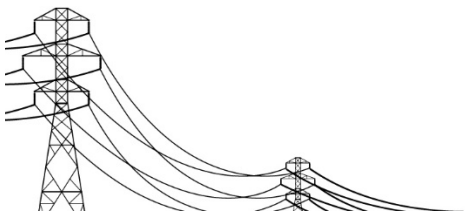
Low = REs recognised as essential habitat factors in DNRME mapping that are Acacia dominated woodland or shrubland with occasional emergent koala food trees where these occur within close proximity (i.e. within 1km) of drought refuge (i.e. high value habitat)



Koala occurrence: 0 - 1
Vegetation composition: 1
Habitat connectivity: 1
Key existing threats: 0 - 1
Recovery value: 1
Total: 3 - 5



	Very Low = Low value habitat detailed above that is more than 1 km from drought refuge	As above but > 1 km from drought refuge	Koala occurrence: 0 Vegetation composition: 1 Habitat connectivity: 1 Key existing threats: 0 - 1 Recovery value: 0 - 1 Total: 2 – 4 Not habitat critical to the survival of the species
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18.3.9 Assessment of potential impacts

An assessment of the proposed activities during construction and operation of the Project has been undertaken to identify potential impacts on the ecological values of the receiving environments. General impacts to existing ecological values have been described, as well as impacts specific to locations and/or species or faunal-groups, as relevant. Avoidance, mitigation and minimisation measures have been proposed to reduce the potential for impacts to species, their habitat and other ecological values. An assessment of the likelihood and duration of impacts has been included for key significant communities or species assessed.

Predicted effectiveness ratings are defined as follows:

- Very high effectiveness: complete avoidance of known occurrences and/or habitats
- High effectiveness: substantial avoidance of known occurrences and/or habitats
- Moderate effectiveness: areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.
- Low effectiveness: mitigation of impacts only through implementation of EMP, spotter-catchers, pest fauna and weed control.
- Very low effectiveness: No mitigation strategies proposed.

An predicted reliability of assessments has been included, with species reliability index ratings provided as follows:

- 3 = species life history and distribution within Study Area well known
- 2a = species life history poorly known, distribution within Study Area well known
- 2b = species life history well known, distribution within Study Area poorly known
- 1 = species life history and distribution within Study Area poorly known

Disturbance areas

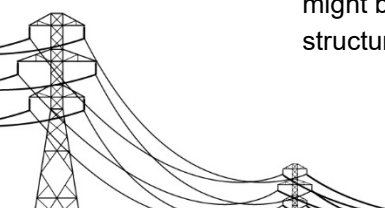
For determining the impacts of the Project on ecological values, a process of mapping and data analysis has been undertaken as follows:

- Mapping landscape types across the Project area
- Analysing canopy height data from Lidar modelling to derive the percentage of the landscape types canopy cover that have vegetation > 5 m height that would require clearing or trimming, therefore a percentage of the Project area likely to be disturbed
- Assumptions for Project infrastructure footprints and construction areas (e.g. transmission line corridor, access tracks, tower footprints etc)
- Application of percentage disturbances per landscape type to mapped species habitat or other ecological value to estimate the impact area

These steps are further detailed below.

Landscape types

The landscape types have been identified for the purposes of discerning impacting activities along the Project area. The Project area has been classified into six general landscape types that occur, based on regional ecosystem mapping classified by broad vegetation groups (BVGs), and other features such as watercourses. The BVGs are classified by the Queensland Herbarium by amalgamating vegetation communities on an Environmental basis. The BVGs might be grouped according to a single dominant species or suite of species, or by a distinct structural formation (e.g. grasslands) or a combination of structural formation and habitat (e.g.



low woodlands on plains). The landscape types have used the dominant BVG type (where a mixed regional ecosystem polygon occurs) at the 1:1 million scale (i.e. for regional use, rather than state or national comparisons).

The resulting landscape types include:

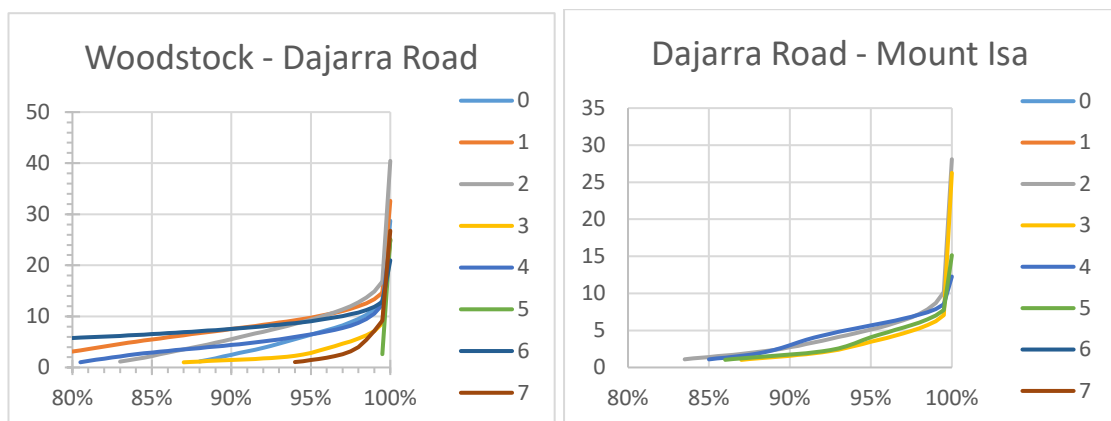
- Open forest to open woodland (eucalypt/melaleuca/belah dominated) on flat to undulating plains (1)
- Riparian zone and fringing vegetation along ephemeral channels, watercourses and channelised floodplains (2)
- Low open woodland to wooded spinifex grassland (eucalypt/acacia dominated) on slopes, crests and scarps (3)
- Mixed low woodland with spinifex (gidgee/mulga/eucalypt dominated) on plains (4)
- Tussock/hummock grassland (5)
- Cleared grazing land with scattered trees (7)

The landscape types are further described in the Volume 1 Chapter 3 Site Description.

Canopy height data

Within each segment of the corridor selection, an analysis of available canopy height data extracted from the 2010 Lidar (light detection and ranging remote sensing survey flown along the project as part of the CopperString 1.0 EIS that measures the distance/range to the surface) was undertaken. In 2010 the lidar was processed to derive a Canopy Height Model (CHM) that was approximately 1.5 km wide. The CHM is available as 2.5 km x 2.5 km tiles with 1 m² pixels. The tiles were merged for each line section (the Woodstock to Dajarra Road section was processed as 6 fragments). Pixels with the tallest canopy heights were individually inspected and where found to be aberrant were set to a representative height from the surrounding canopy. This data cleansing was done until the pixel heights became an obvious component in the canopy structure. There would have been less than 200 such points. In some areas the excessive heights were associated with man made structures. These areas were bounded and excluded from the zonal statistics. The current corridor selection in discrete parts deviates outside the boundary of 2010 lidar data; however, the canopy height data covers a 1.5 km width along the 2010 CopperString 1.0 project corridor and provides substantial coverage of the representative landscape types.

The modelled canopy heights are shown on the charts in Plate 18-5 for the different corridors and landscape types (x axis showing the percentage coverage of each landscape type area, and y axis showing the tree height in metres). These charts show that the majority of the vegetation for each landscape type in each region is below 5-10 m in height. The numbers for the coloured lines correlate to the landscape type numbers provided above.



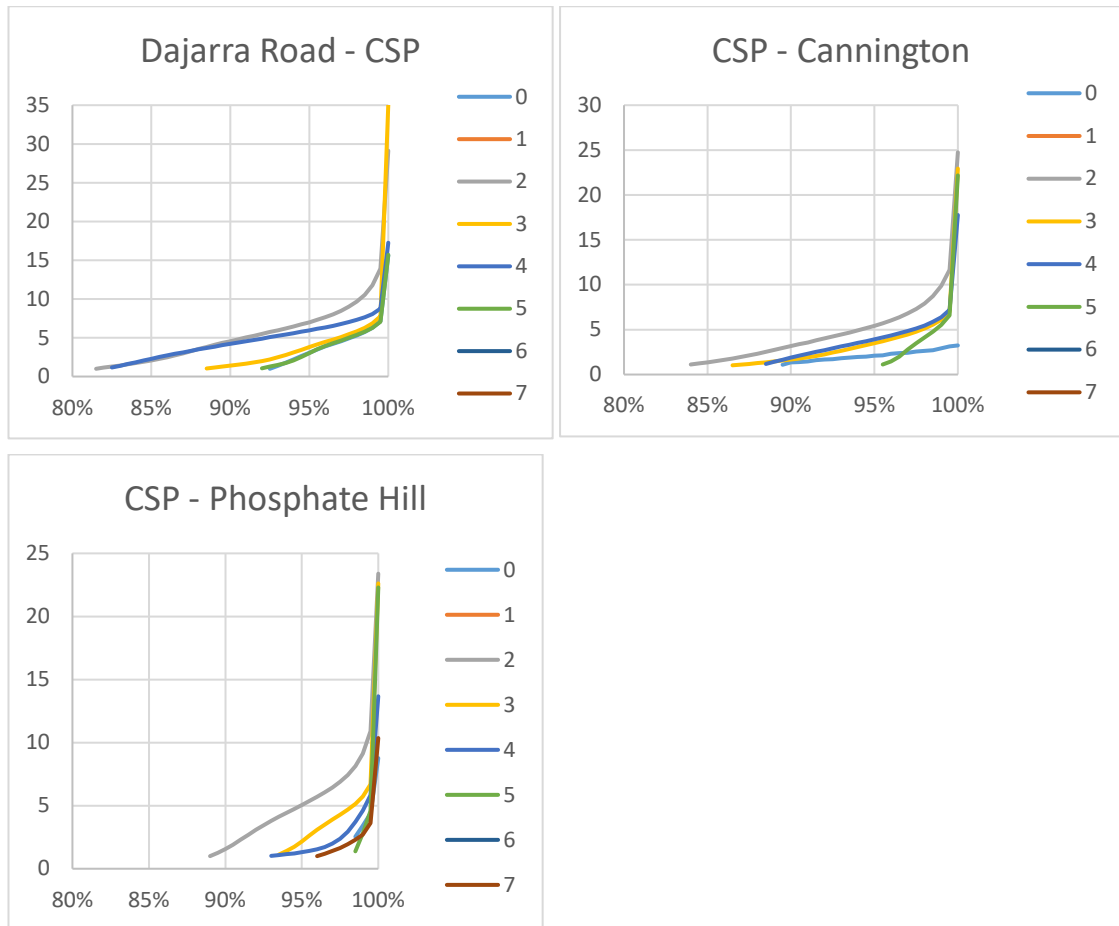


Plate 18-5 Canopy tree height data across Project sections (x axis = % of landscape type; y axis = height in metres)

The approximate percentages of the landscape types within each corridor section that are likely to contain vegetation greater than 5 m in height (derived from the CHM and provided in Table 18-24) have been used as the approximate disturbance areas for the Project footprint areas. These percentages differ slightly for different corridor sections due to different vegetation, landforms, geology and soils, and subsequently different vegetation structure.

Table 18-24 Disturbance area percentage per landscape type

Corridor section	1+ Open forest to woodland	2* Riparian	3 Low woodland	4 Mixed woodland	5 Grassland	7 Cleared
Woodstock-Dajarra Rd	12.6%	3.2%	0.2%	0.3%	0.1%	0.1%
Dajarra Rd-Mount Isa	-	3.5%	2.2%	0.0%	0.2%	-
Dajarra Rd-CSP	-	2.8%	3.9%	0.2%	0.0%	-
CSP-Cannington	-	1.6%	1.8%	0.3%	0.4%	-

Corridor section	1+ Open forest to woodland	2* Riparian	3 Low woodland	4 Mixed woodland	5 Grassland	7 Cleared
CSP-Phosphate Hill	-	1.2%	0.8%	0.1%	0.2%	0.0%

Source: LIDAR canopy height model per landscape type (based on broad vegetation groups)

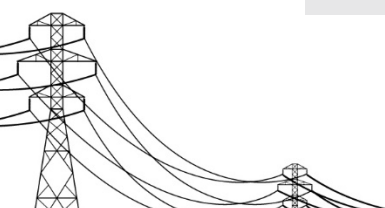
* Riparian landscape types will be 0% disturbance for the transmission line due to tower placements outside of riparian corridors and spanning across watercourses, and 0.25x the percentage disturbance for the access tracks based on the assumption that 25% of the total riparian areas will require a new access track (i.e. where there is no existing or cleared crossing)

Project infrastructure footprints

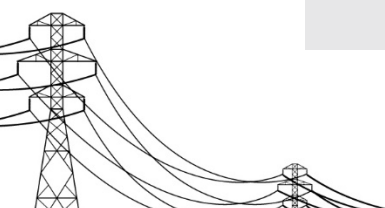
Table 18-25 outlines the estimated disturbance assumptions for infrastructure required for the construction and operation of the Project. These assumptions have been used to calculate the total disturbance requirements of the Project across defined landscape types. The resulting disturbance areas for the specific infrastructure is presented in Volume 1 Chapter 2 Project Description.

Table 18-25 Infrastructure disturbance assumptions

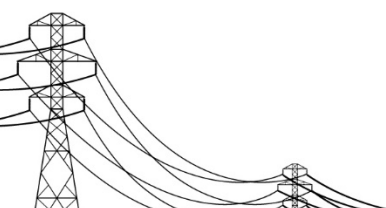
Section	Assumed measure	Assumption
Access tracks	7 m wide	- Area of access tracks = 0.007 km*length of section - Clearing for access tracks assumed to be required 25% of the time in open forest and riparian landscapes only - Assumed 163 ha of access tracks through open forest landscape type. Clearing required = 163 ha*25%=41 ha - Assumed 140 ha of access tracks through riparian landscape. Clearing required = 140 ha * 25%=35 ha
Brake and winch	15,000 m ² (1.5 ha – 250 m x 60 in the straight) 125 x 60 m each location at bend.	Assumed 1 per 7 km Number of calculated per Corridor section as below: - Renewable Energy Hub (112 bends) – 50 - CopperString Core (92 bends) - 55 - Dajarra Rd Connection Dugald River (6 bends) - 2 - Chumvale Connection (14 bends) - 3 - Mt Isa Augmentation (70 bends) - 15 - Southern Connection Dajarra Rd to Selwyn (54 bends) - 20



Section	Assumed measure	Assumption
		- Cannington Connection (14 bends) - 4 - Phosphate Hill Connection – (12 bends) - 10
Towers	144 m ² (12 m*12 m)	Calculated per Corridor section: - Renewable Energy Hub. (341.67 km - 728 towers) - CopperString Core (395.53 km - 837 towers) - Dajarra Rd Connection Dugald River (2.71 km – 9 towers) - Chumvale Connection (3.7 km – 13 towers) - Mt Isa Augmentation (99.36 km – 243 towers) - Southern Connection Dajarra Rd to Selwyn (129.84 km – 314 towers) - Cannington Connection (24.42 km - 73 towers) - Phosphate Hill Connection – (63.62 km – 148 towers)
Tower construction area	960 m ² (80 m*12 m)	Assumed one per tower Calculated per Corridor section
Transmission line	60 m wide easement	448 ha of Open Forest to open woodland landscape type disturbed - No Riparian type disturbed 52.28 ha of Low open woodland landscape type disturbed 14.05 ha of Mixed low woodland landscape type disturbed 5.88 ha of Tussock/hummock grassland landscape type disturbed 3.49 ha of previously cleared landscape type disturbed
Fly yard	100 m*100 m (1 every 20 towers – approx. 1 per 10 km.	- Assumed to occur in cleared areas where possible or substation/CEV areas. - Additional clearing of 1 ha approximately every 10 km will occur along Mount Isa Augmentation, Southern Connection, Phosphate Connection and Cannington Connection - No clearing for fly yards will occur in riparian areas
CEV	GIS	- Barabon CEV – 0.32 ha - Charters Towers South CEV – 0.32 ha



Section	Assumed measure	Assumption
		- Gilliat CEV – 0.3 ha - Nonda CEV – 0.35 ha - Pentland South CEV – 0.3 ha - Selwyn CEV – 0.3 ha - Warreah South CEV – 0.36 ha - Yorkshire CEV – 0.3 ha
CEV access	GIS	- Barabon CEV– 0.11 ha - Charters Towers South CEV– 0.13 ha - Gilliat CEV – 0.11 ha - Nonda CEV – 0.15 ha - Pentland South CEV – 0.3 ha - Selwyn CEV – 6 ha - Warreah South CEV – 17 ha - Yorkshire CEV – 0.1 ha
Substation	GIS	- Cannington Substation – 1 ha - Dajarra Road Substation – 32 ha (site area 83.85 ha) (also used as laydown) - Flinders Substation – 32 ha (site area 86.63 ha) (also used as laydown) - Mount Isa Substation – 7 ha - Phosphate Hill Substation – 1 ha - Selwyn Substation – 25 ha (site area 36 ha) - Woodstock Substation – 39 ha (site area 39 ha) (also used as laydown)
Camps/laydowns	Camp 8 ha Laydown is 4 ha	- Charters Towers Camp 12 ha (site area 40.07 ha) - Cloncurry camp 24 ha - Hughenden camp 12 ha - Julia Creek Camp 12 ha - Mount Isa laydown 12 ha - Pentland laydown 12 ha - Richmond camp / laydown 12 ha - Selwyn camp 12 ha - Woodstock laydown areas 12 ha



Disturbance areas for ecological values

The areas of permanent loss per corridor section derived using the above assumptions were applied to intersected mapped species habitat or other ecological areas mapped within the Project area in order to estimate the Project activity area to use for assessment of potential impacts.

Significant impact assessments

A significance of impact assessment has been undertaken for conservation significant communities and species that have been confirmed present or considered likely to occur within the study area in accordance with the relevant guidelines at the Commonwealth and State government levels. For MNES, an assessment has been made against the EPBC Significant Impact Guidelines 1.1 (DoE 2013). Where a species-specific guideline has been published by the DAWE, this has been referred to in the significance of impact assessment.

Cumulative impacts

The scope of the cumulative impacts assessment is defined by the following:

- Identification of proposed projects within the public realm
- Review of project descriptions of proposed projects
- Review of environmental assessments of proposed projects
- Review of residual impacts of the Project on MNES
- Screening of residual impacts for their potential to interact with other impacts
- Prediction of the scale and magnitude of cumulative impacts on MNES

The cumulative impact assessment study area included the following seven local government areas (LGAs) through which the corridor selection traverses:

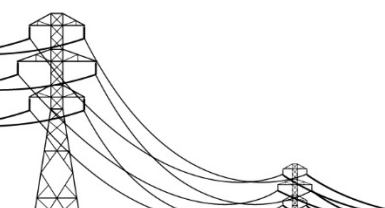
- Burdekin Shire Council
- Charters Towers Regional Council
- Flinders Shire Council
- Richmond Shire Council
- McKinlay Shire Council
- Cloncurry Shire Council
- Mount Isa City Council

Townsville City Council was also included as major deliveries and staging will occur through that LGA.

Data sources

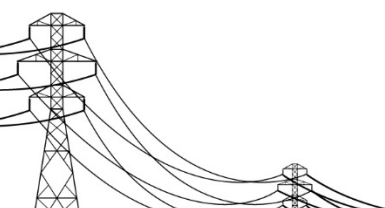
The cumulative impact assessment relied on the following data sources:

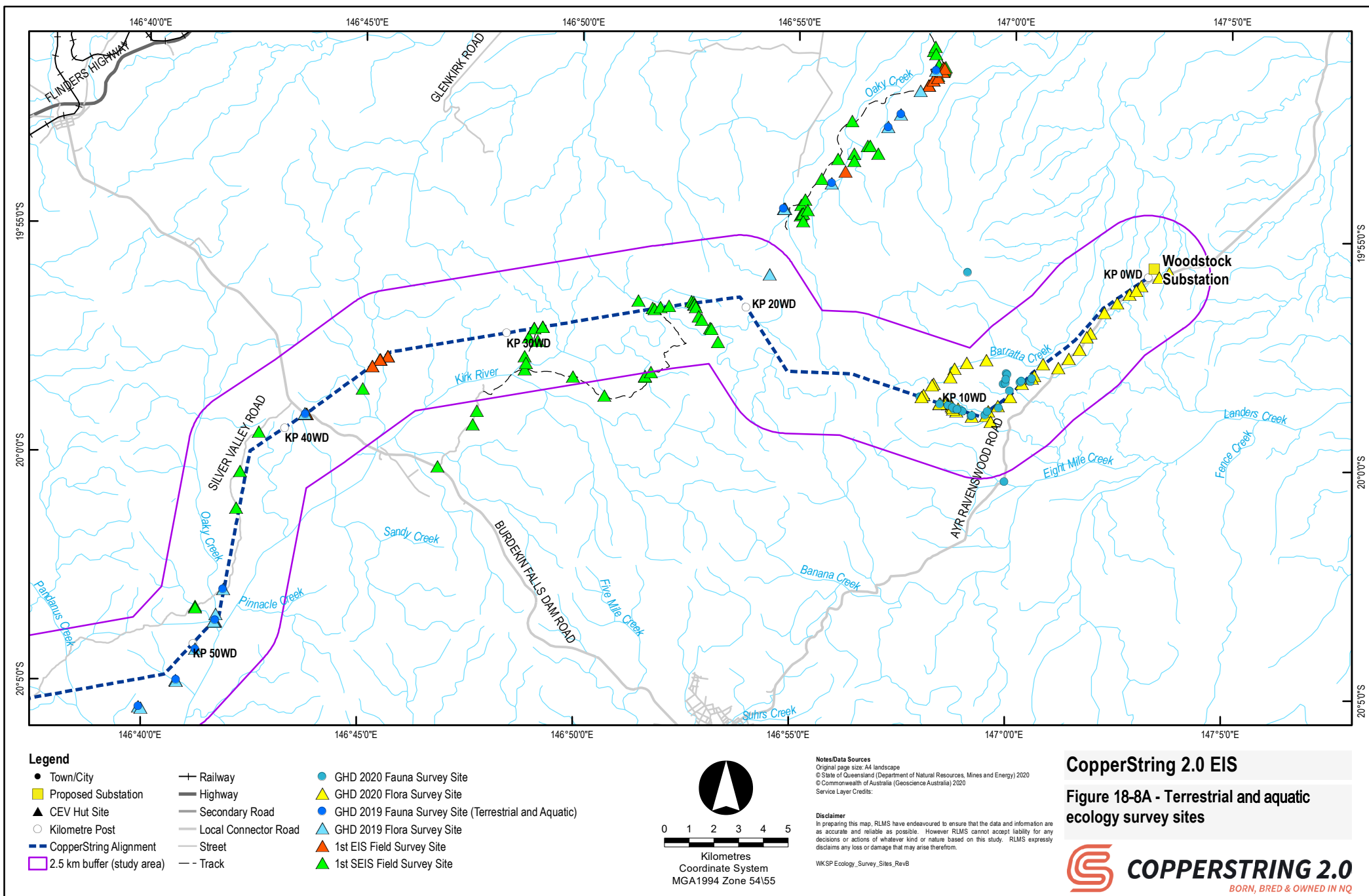
- Coordinated projects map (Queensland Department of State Development, Tourism and Innovation, 2020)
- Publicly available information regarding proposed projects, such as EISs and project websites
- Queensland's major mineral, coal and petroleum operations and resources map (State of Queensland, 2019)

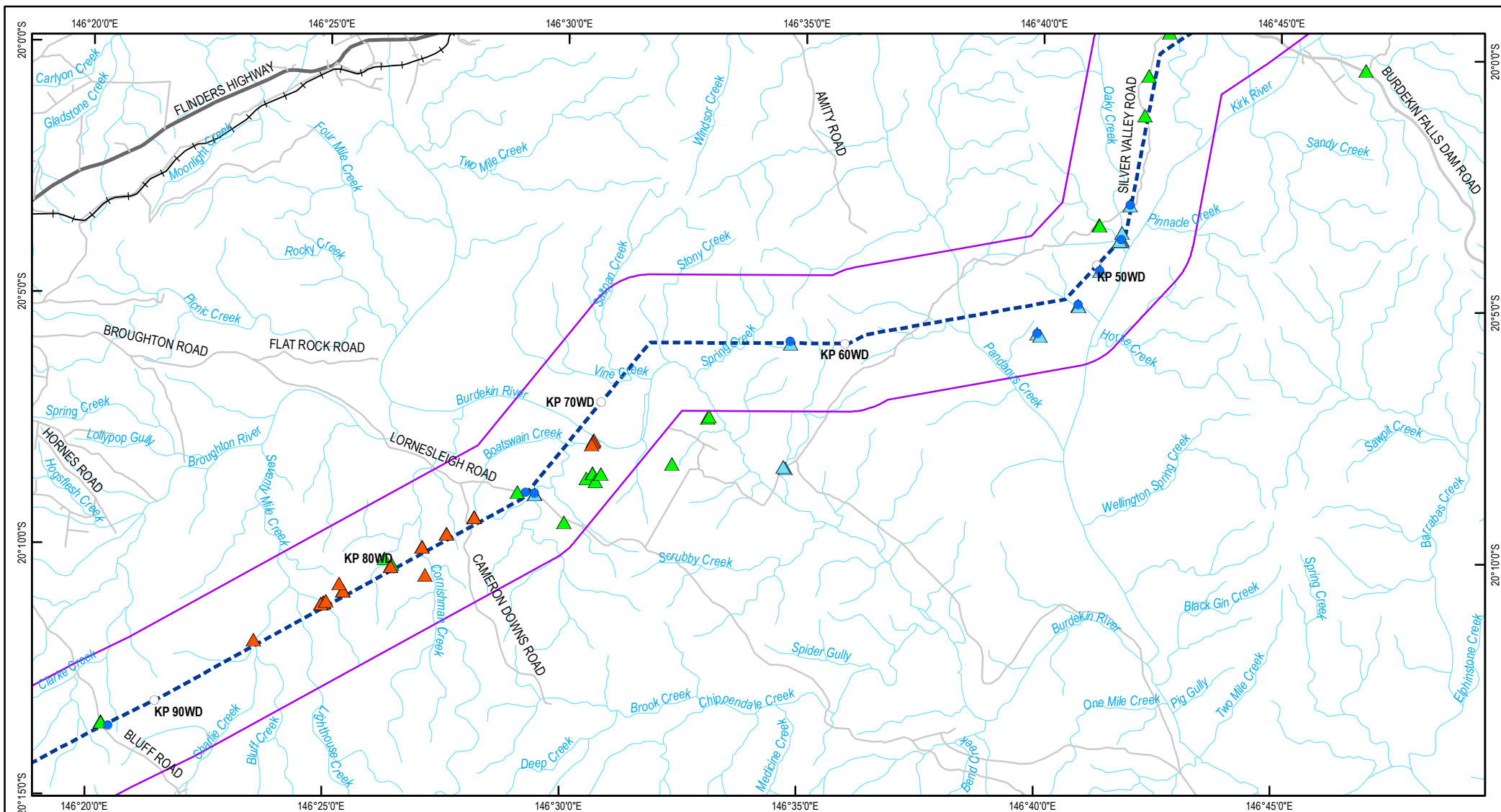


The cumulative impacts assessment also draws on the findings of other assessments conducted as part of the EIS, including:

- Volume 2 Chapter 5 Land
- Volume 2 Chapter 6 Geology and soils
- Volume 2 Chapter 7 Flora and fauna
- Volume 2 Chapter 8 Biosecurity
- Volume 2 Chapter 9 Water resources and water quality
- Volume 2 Chapter 10 Air and greenhouse gas
- Volume 2 Chapter 11 Noise and vibration
- Volume 2 Chapter 12 Waste management
- Volume 2 Chapter 13 Transport
- Volume 2 Chapter 14 Social
- Volume 2 Chapter 15 Cultural heritage
- Volume 2 Chapter 16 Economic
- Volume 2 Chapter 17 Hazards, health and safety
- Volume 2 Chapter 18 Matters of national environmental significance
- Volume 3 Appendix O Visual amenity

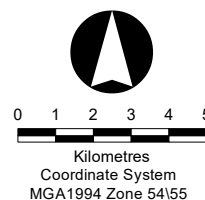






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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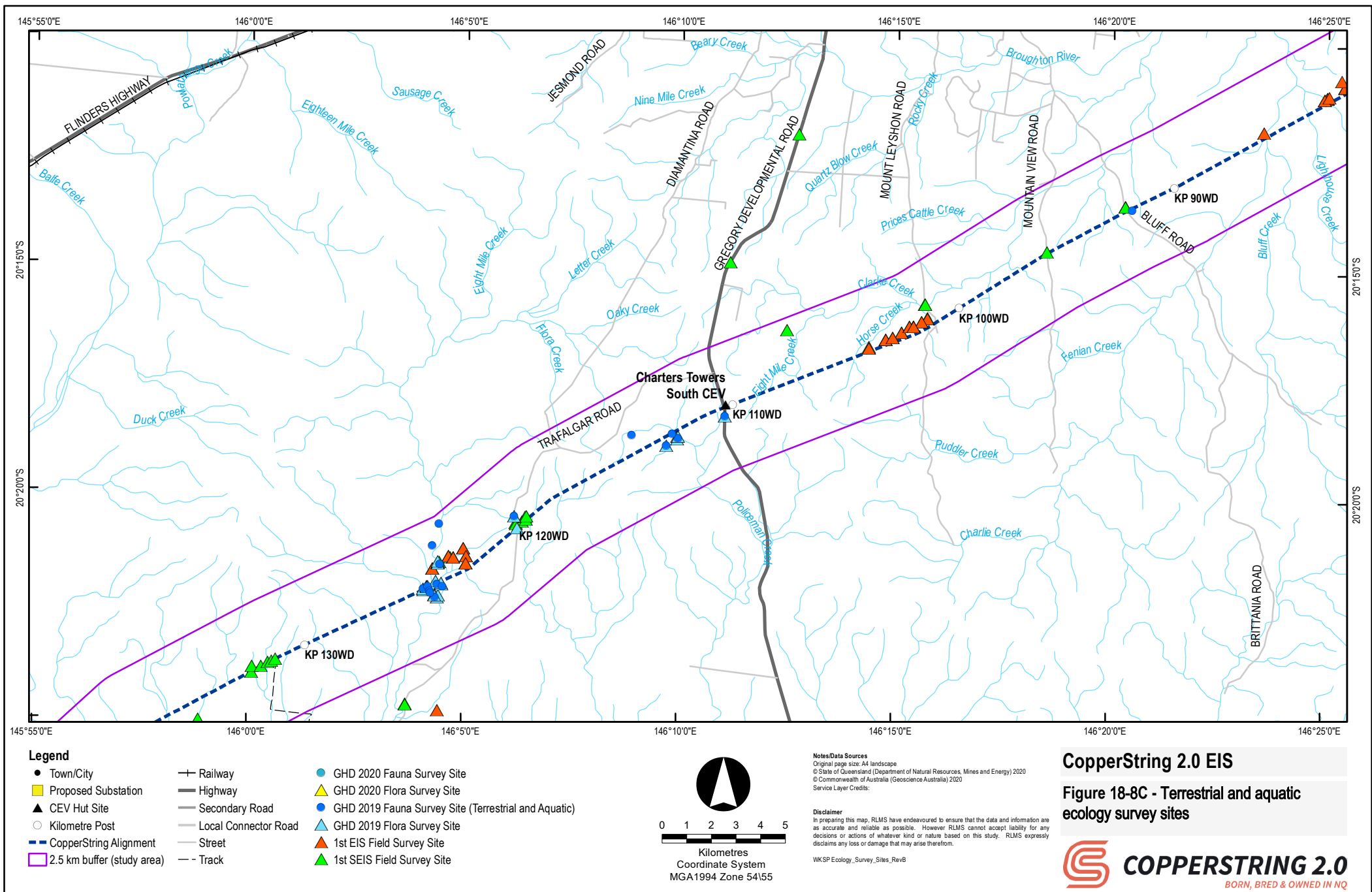
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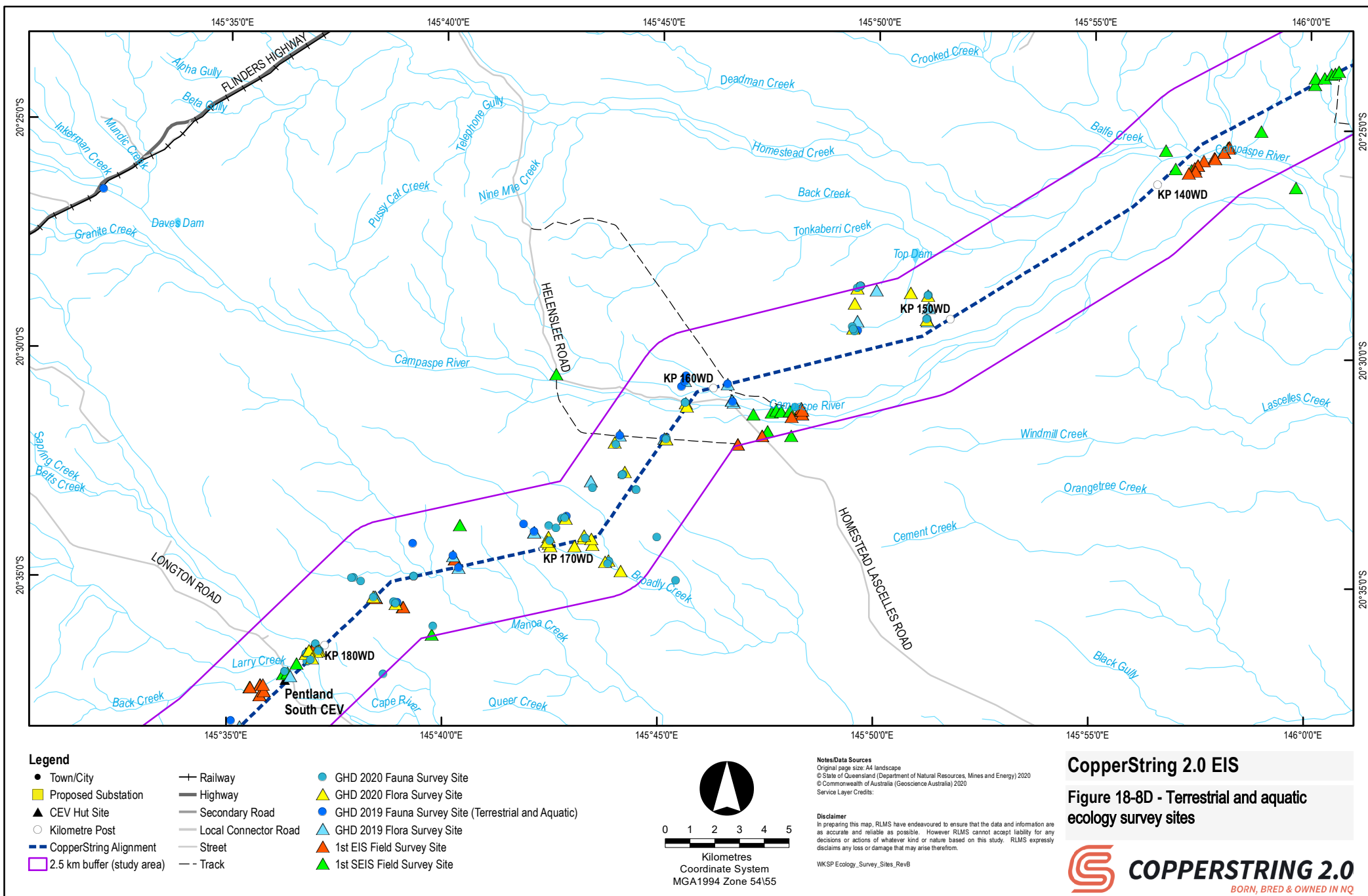
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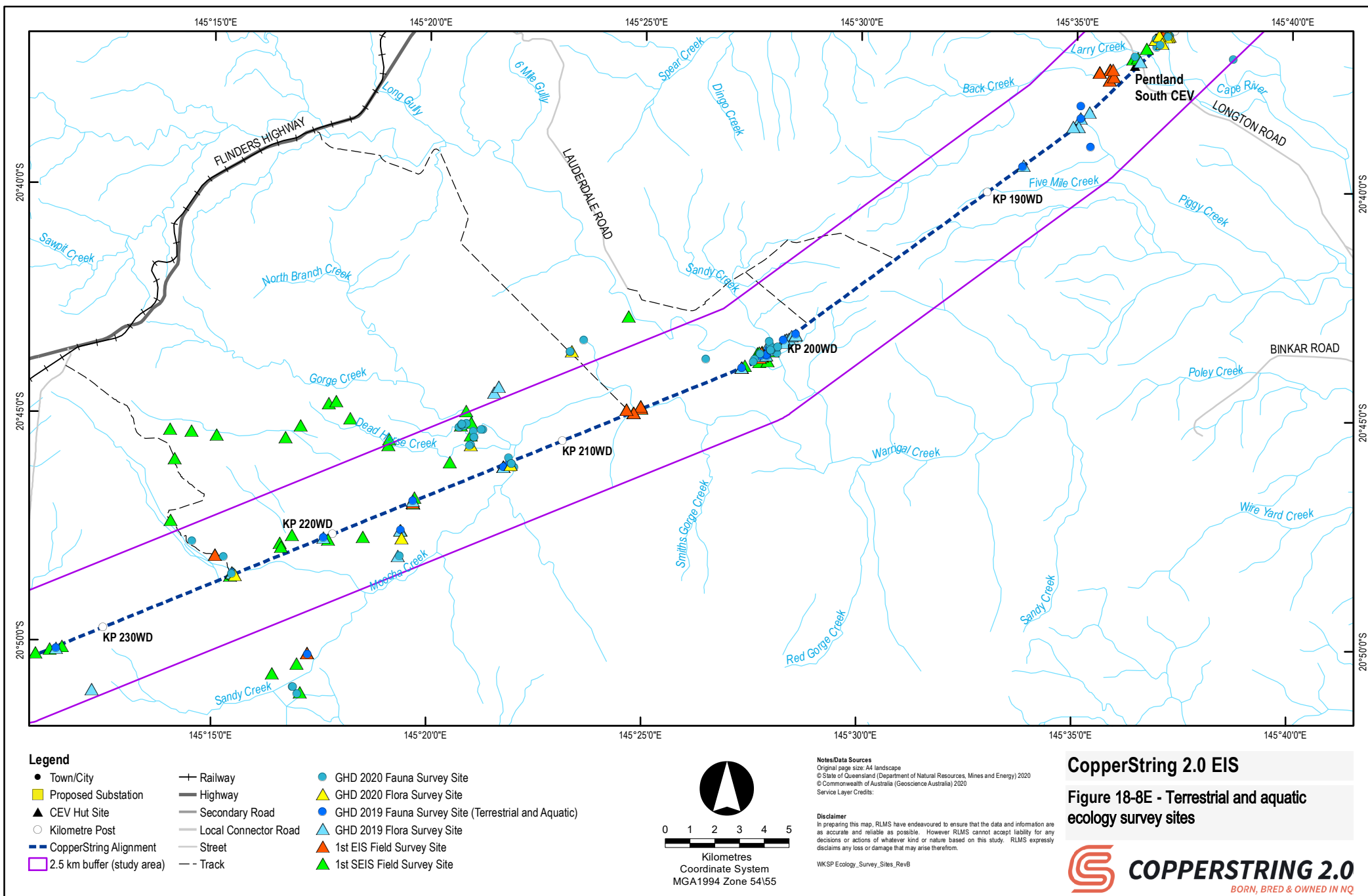
CopperString 2.0 EIS

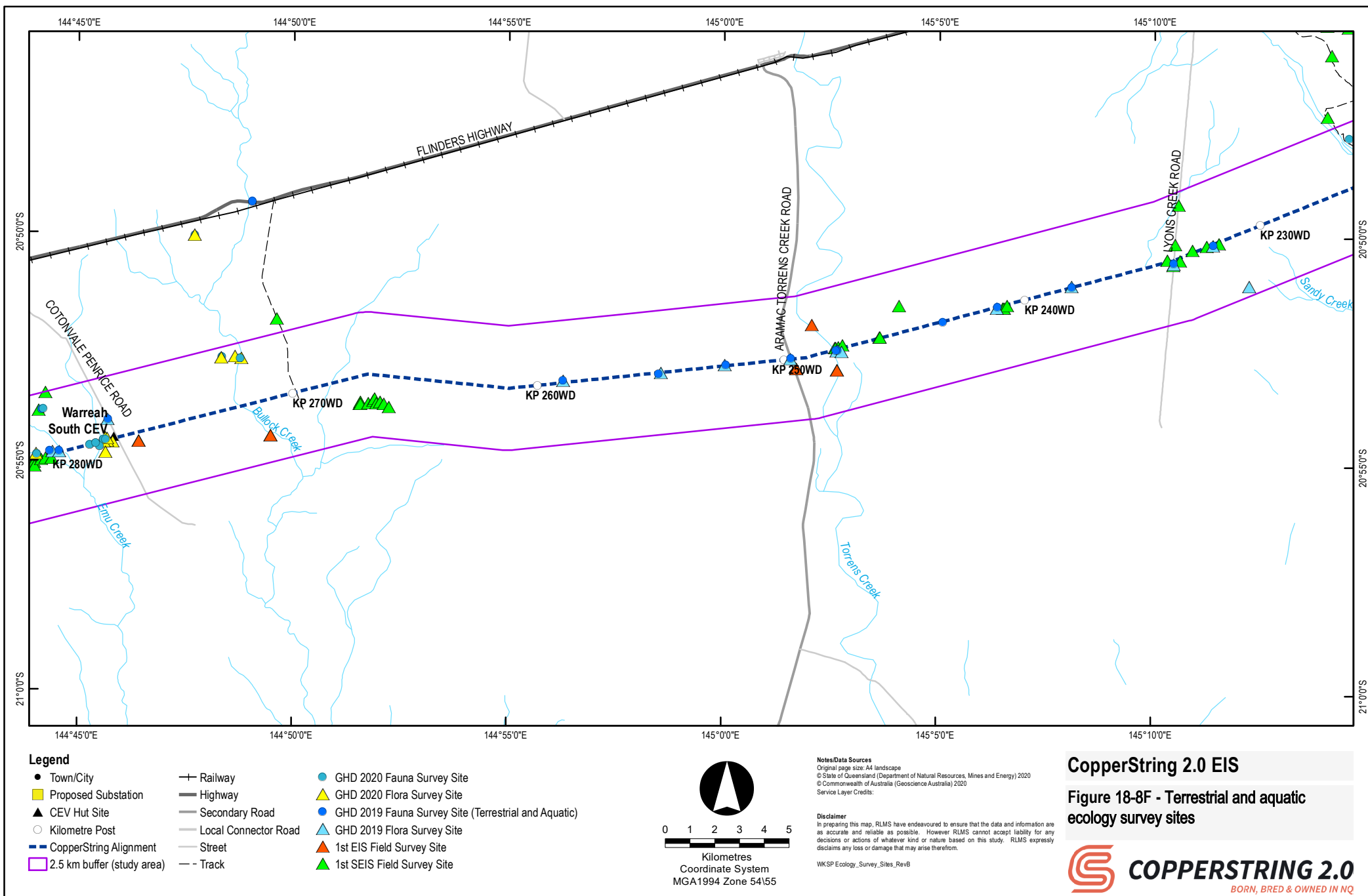
Figure 18-8B - Terrestrial and aquatic ecology survey sites

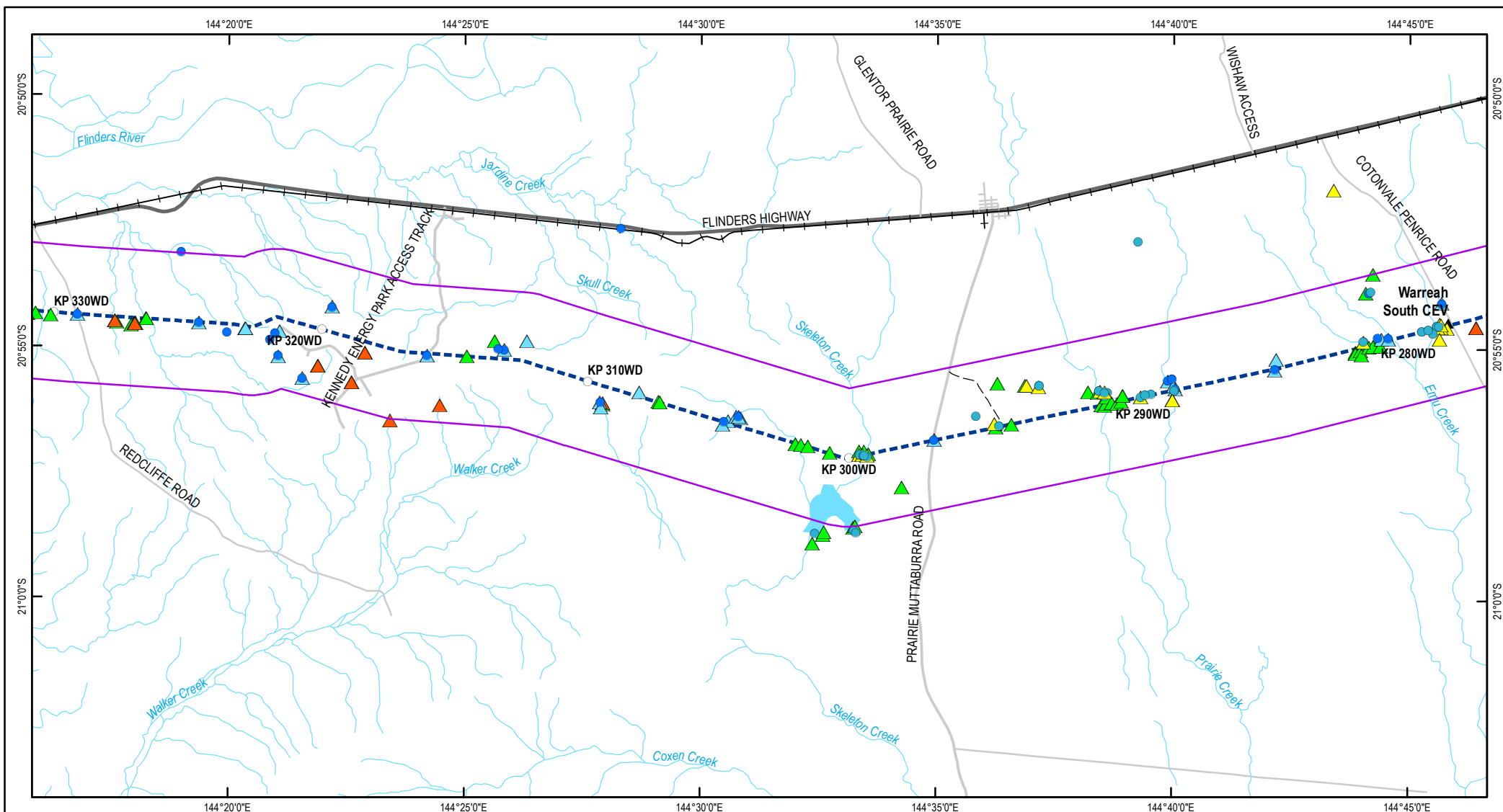






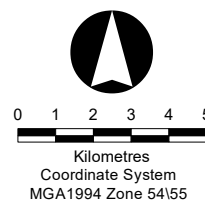






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



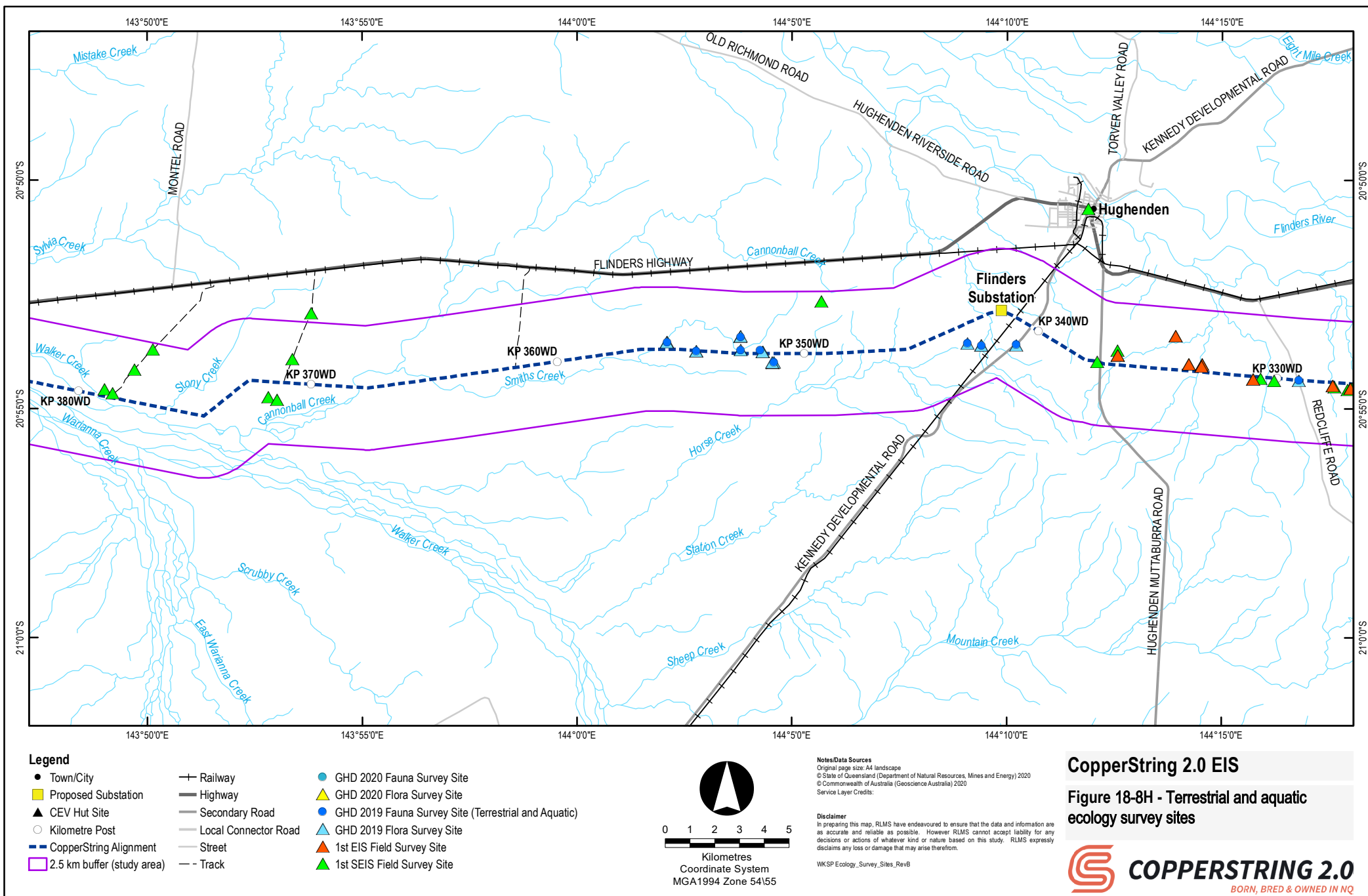
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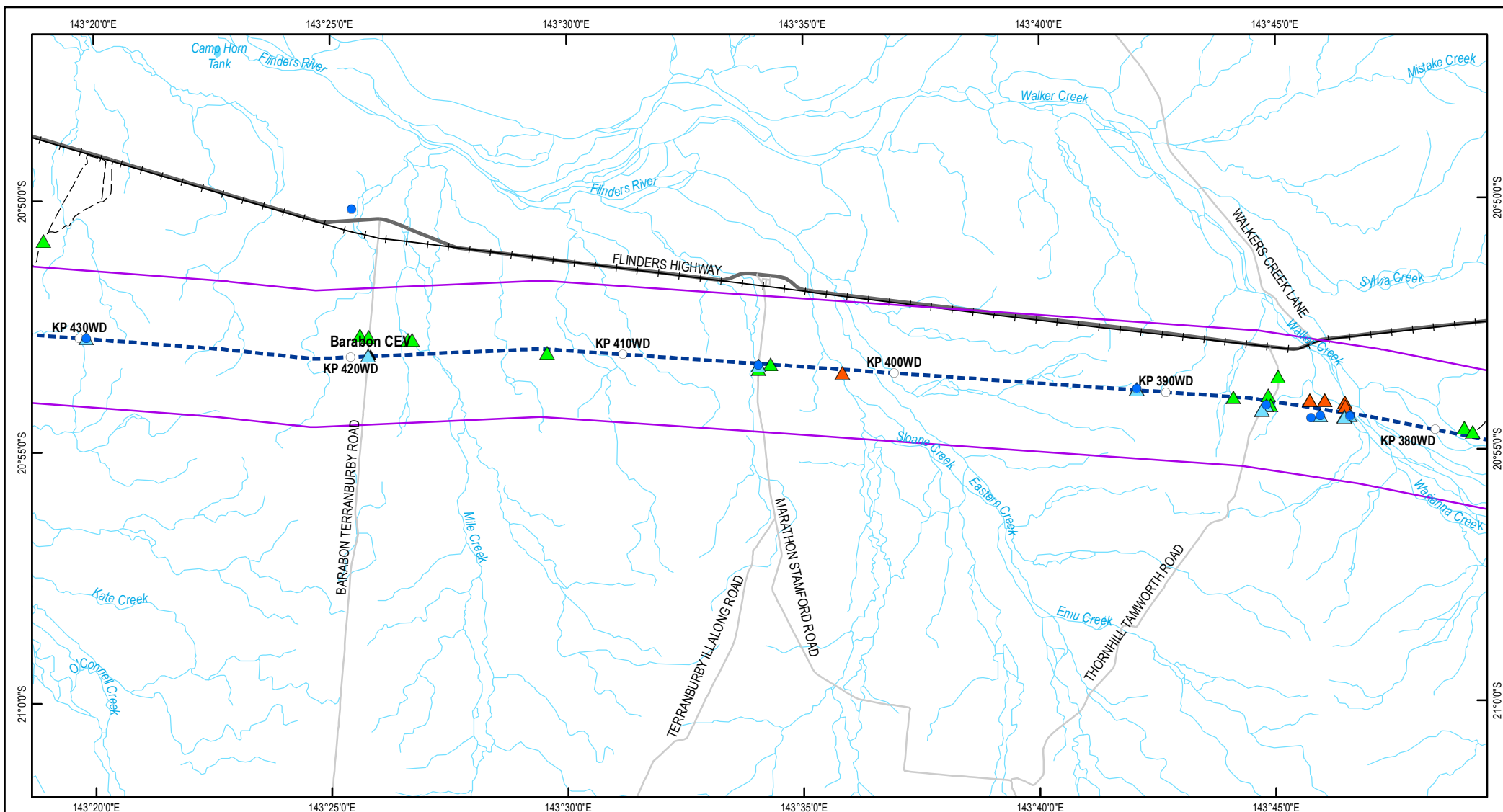
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CopperString 2.0 EIS

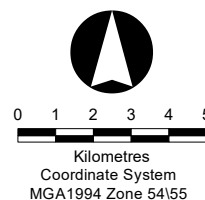
Figure 18-8G - Terrestrial and aquatic ecology survey sites





Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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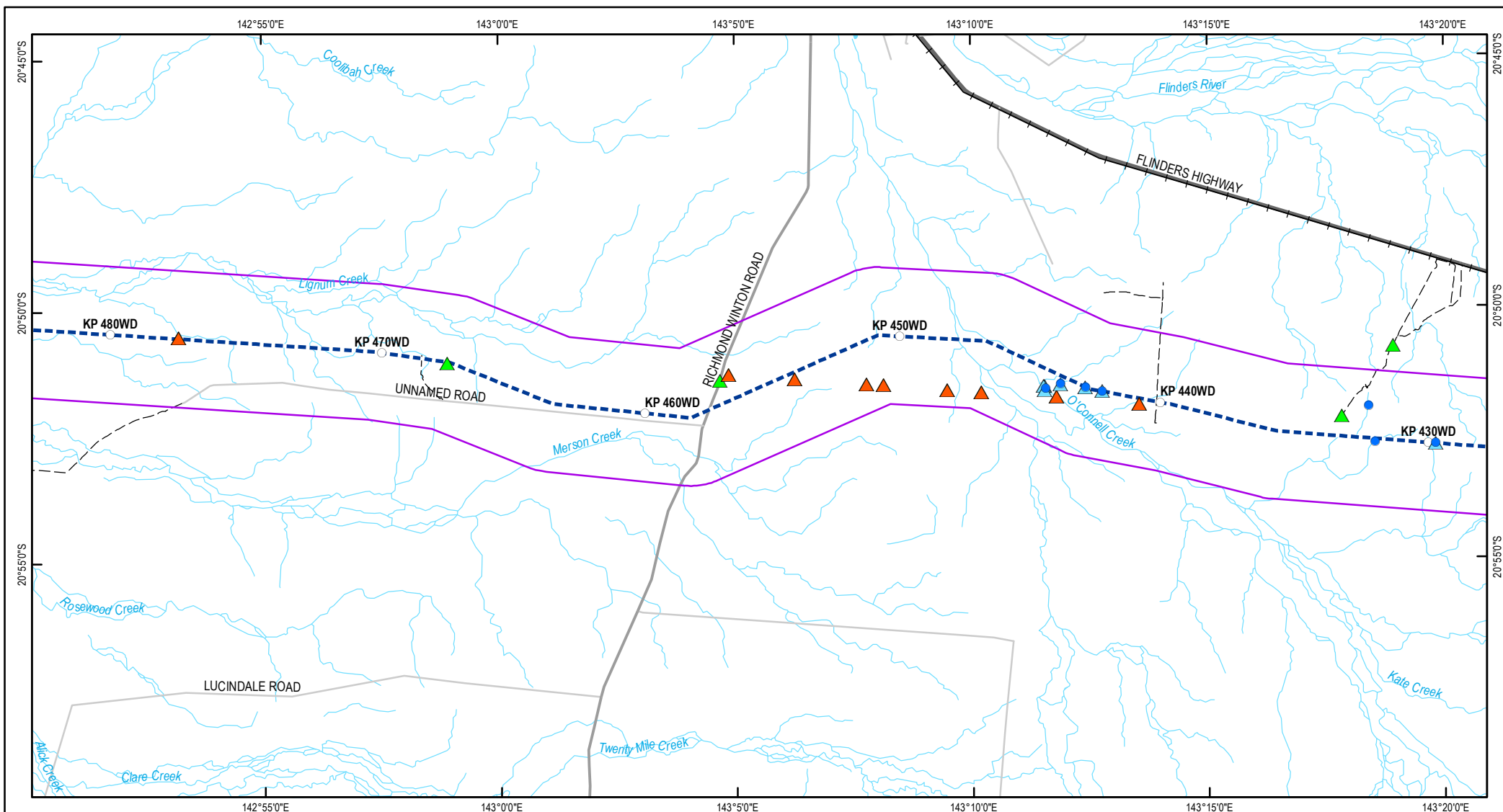
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WKSP Ecology_Survey_Sites_RevB

CopperString 2.0 EIS

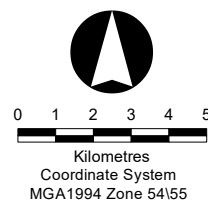
Figure 18-8I - Terrestrial and aquatic ecology survey sites





Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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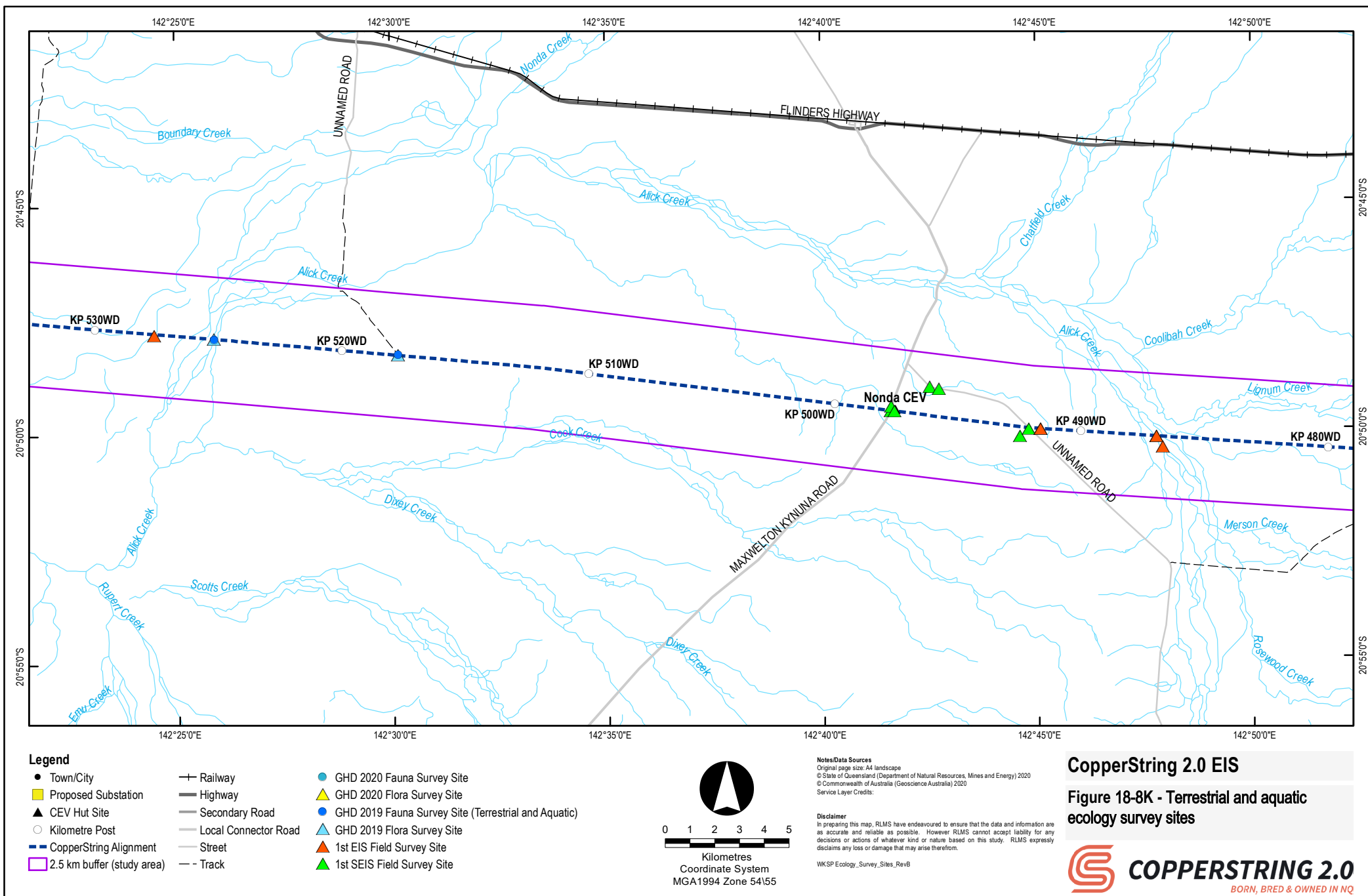
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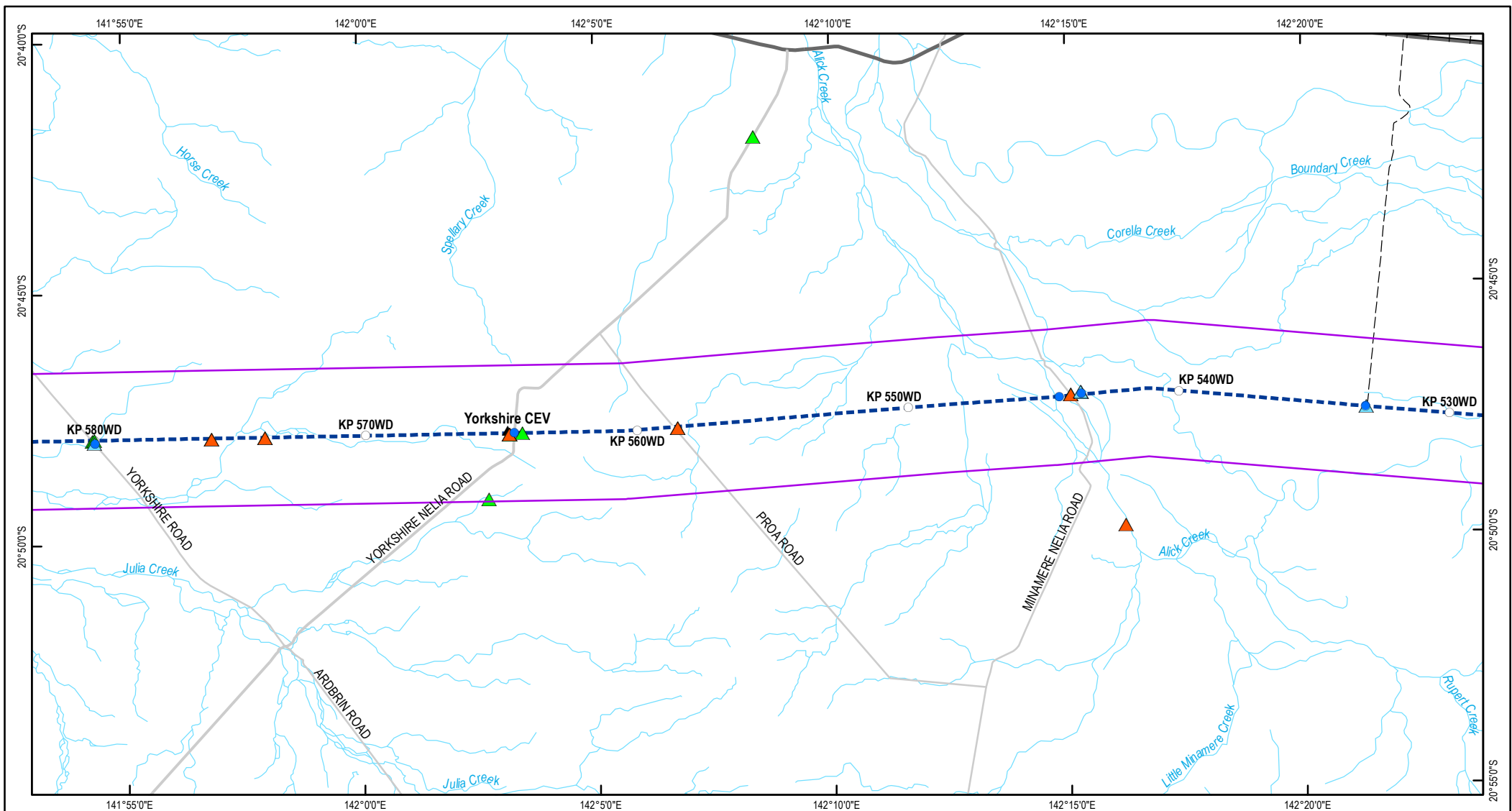
WKSP Ecology_Survey_Sites_RevB

CopperString 2.0 EIS

Figure 18-8J - Terrestrial and aquatic ecology survey sites

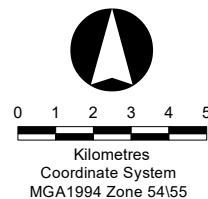






Legend

- | | | |
|------------------------------|------------------------|--|
| ● Town/City | ✚ Railway | ● GHD 2020 Fauna Survey Site |
| ■ Proposed Substation | — Highway | ▲ GHD 2020 Flora Survey Site |
| ▲ CEV Hut Site | — Secondary Road | ● GHD 2019 Fauna Survey Site (Terrestrial and Aquatic) |
| ○ Kilometre Post | — Local Connector Road | ▲ GHD 2019 Flora Survey Site |
| — CopperString Alignment | — Street | ▲ 1st EIS Field Survey Site |
| ■ 2.5 km buffer (study area) | — Track | ▲ 1st SEIS Field Survey Site |



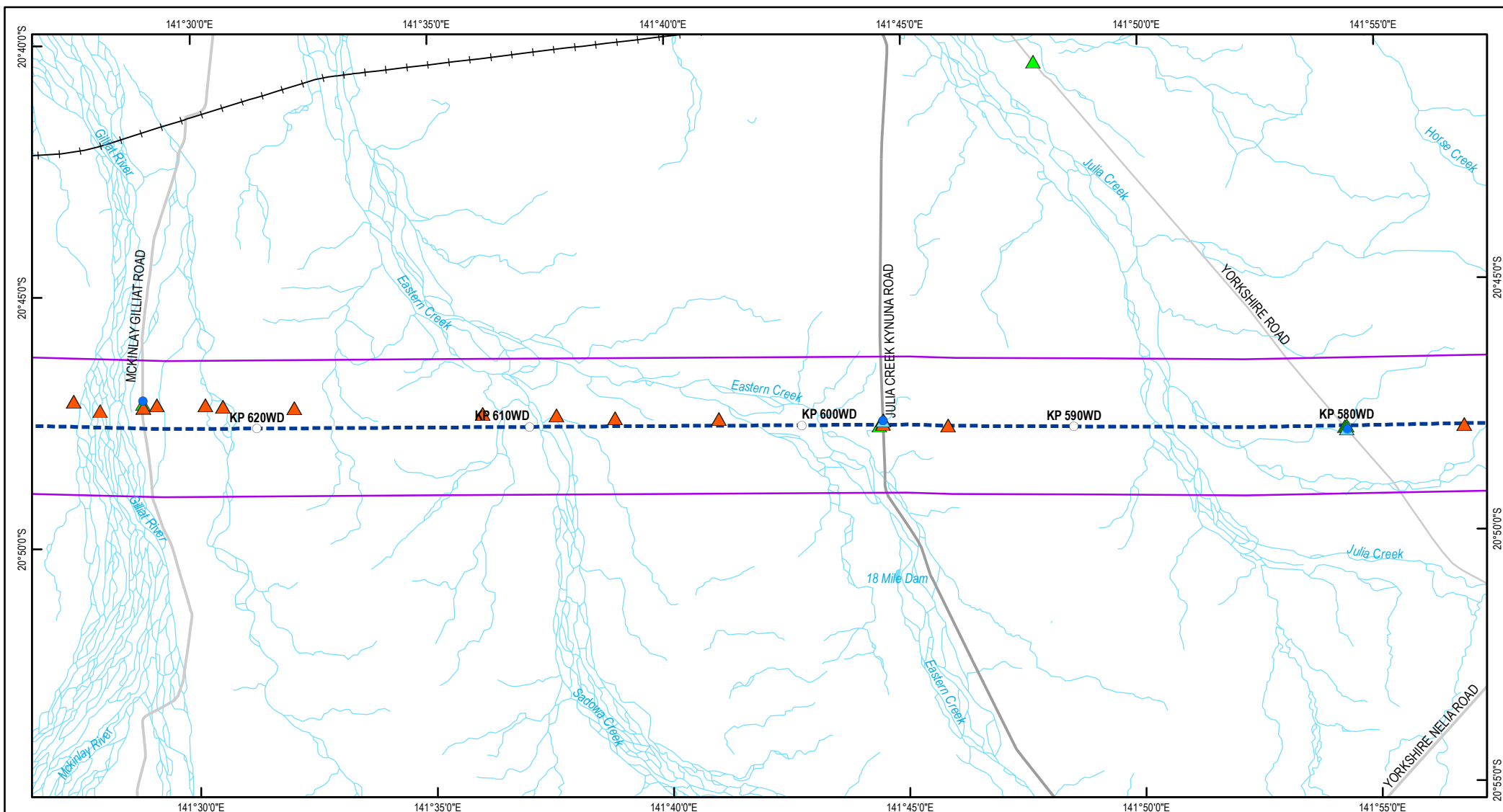
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WKSP Ecology_Survey_Sites_RevB

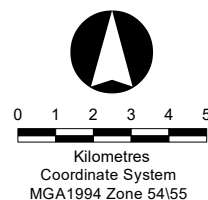
CopperString 2.0 EIS

Figure 18-8L - Terrestrial and aquatic ecology survey sites



Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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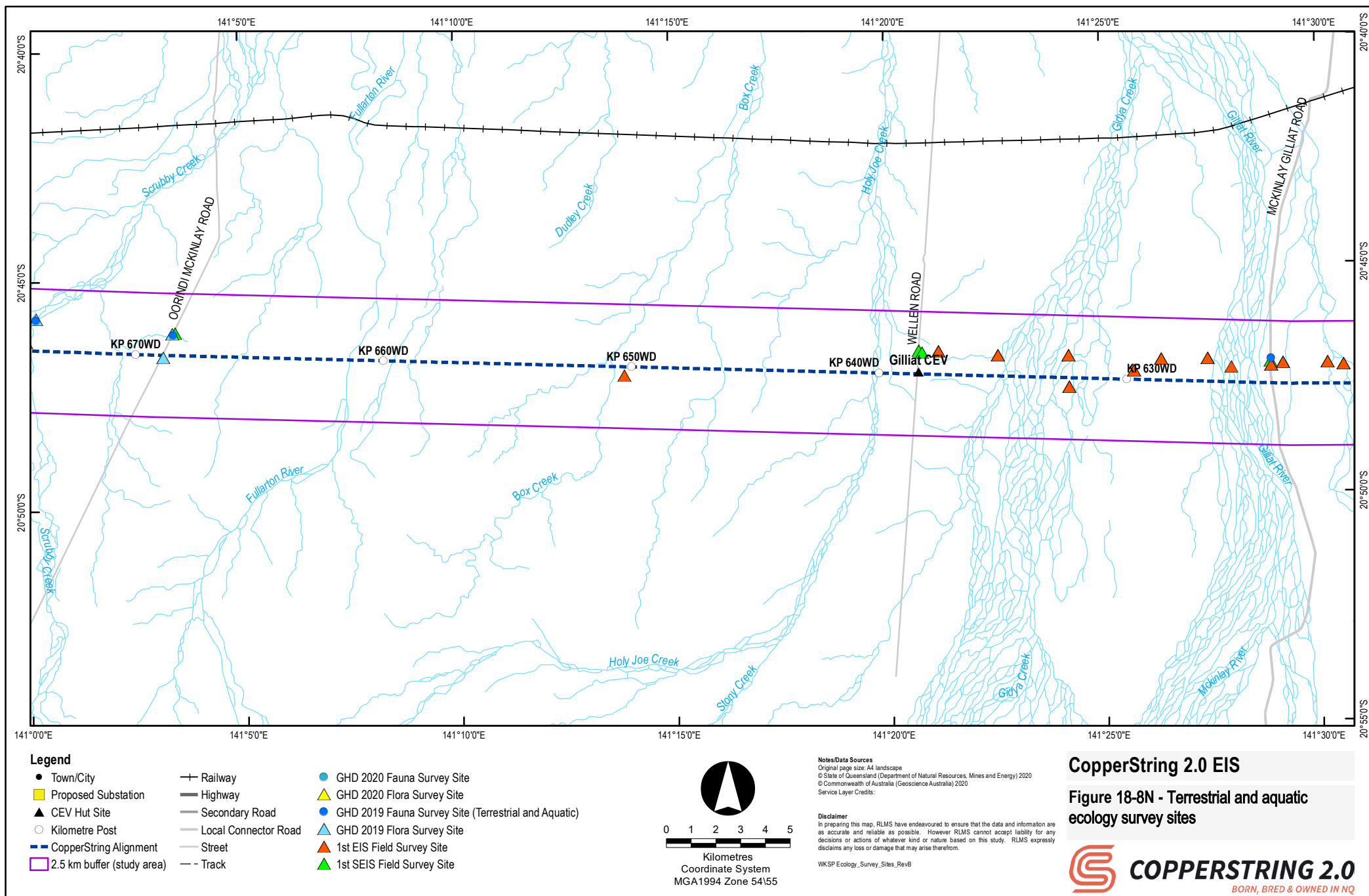
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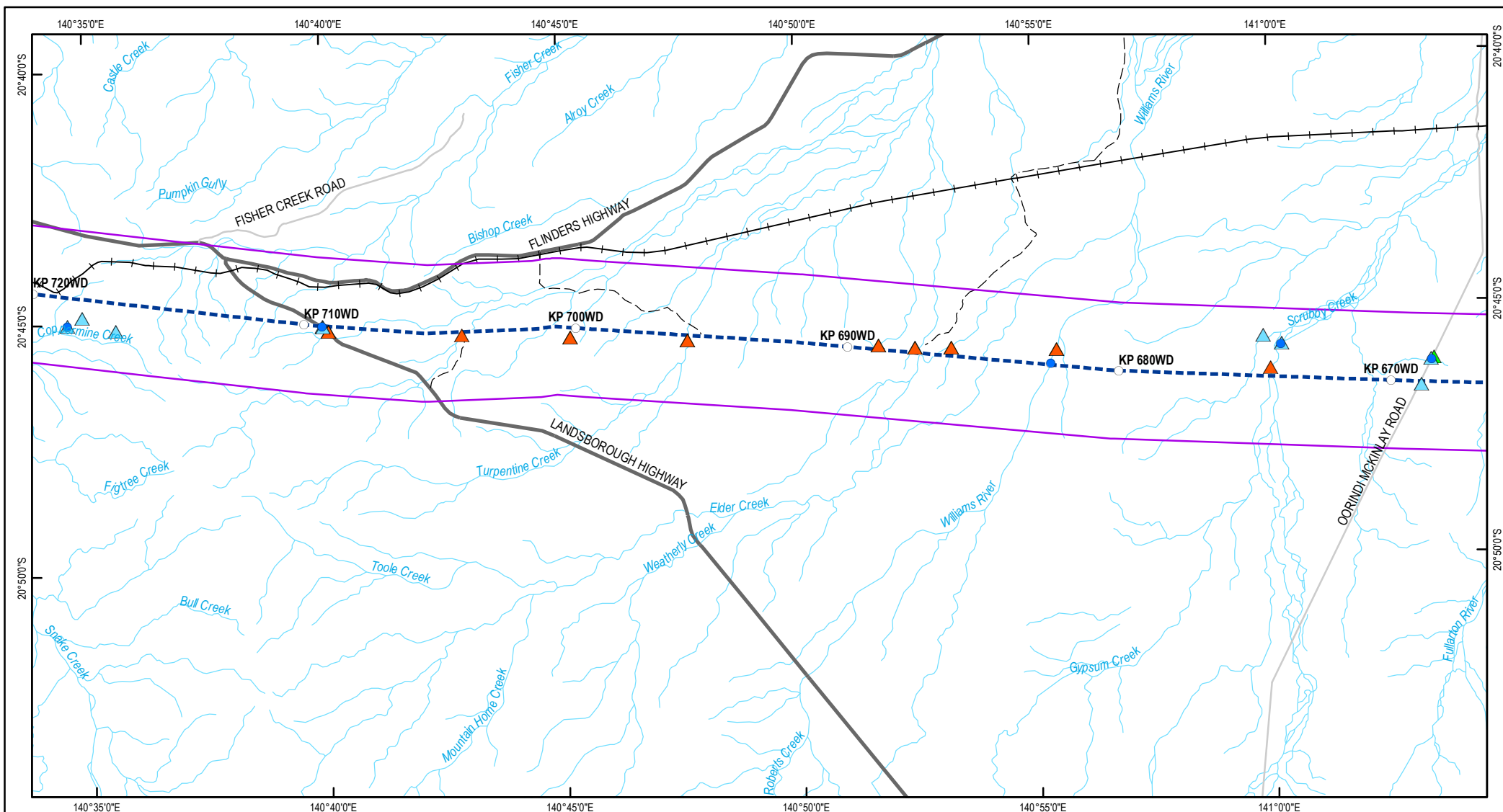
WKSP Ecology_Survey_Sites_RevB

CopperString 2.0 EIS

Figure 18-8M - Terrestrial and aquatic ecology survey sites

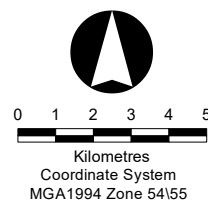






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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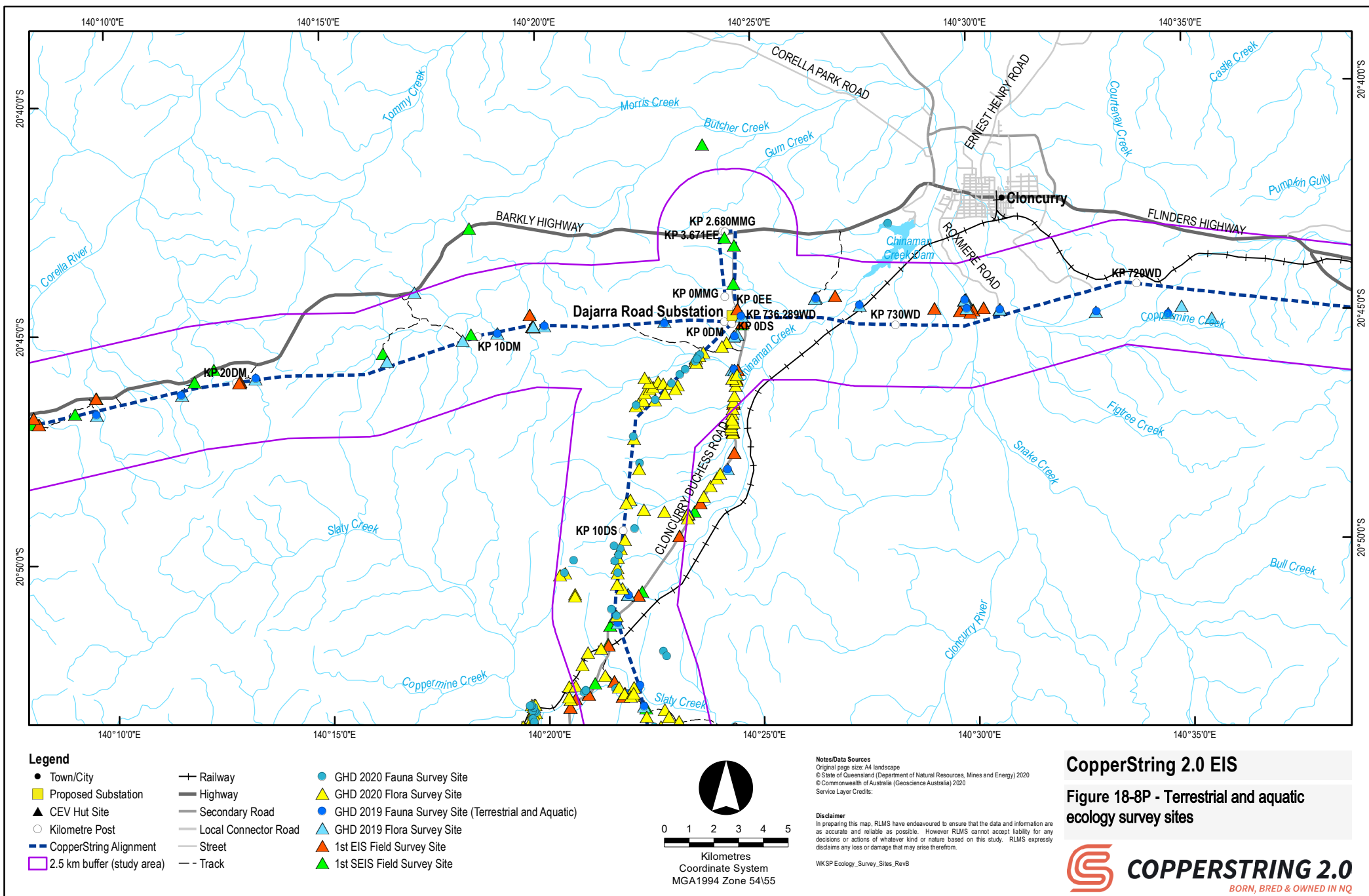
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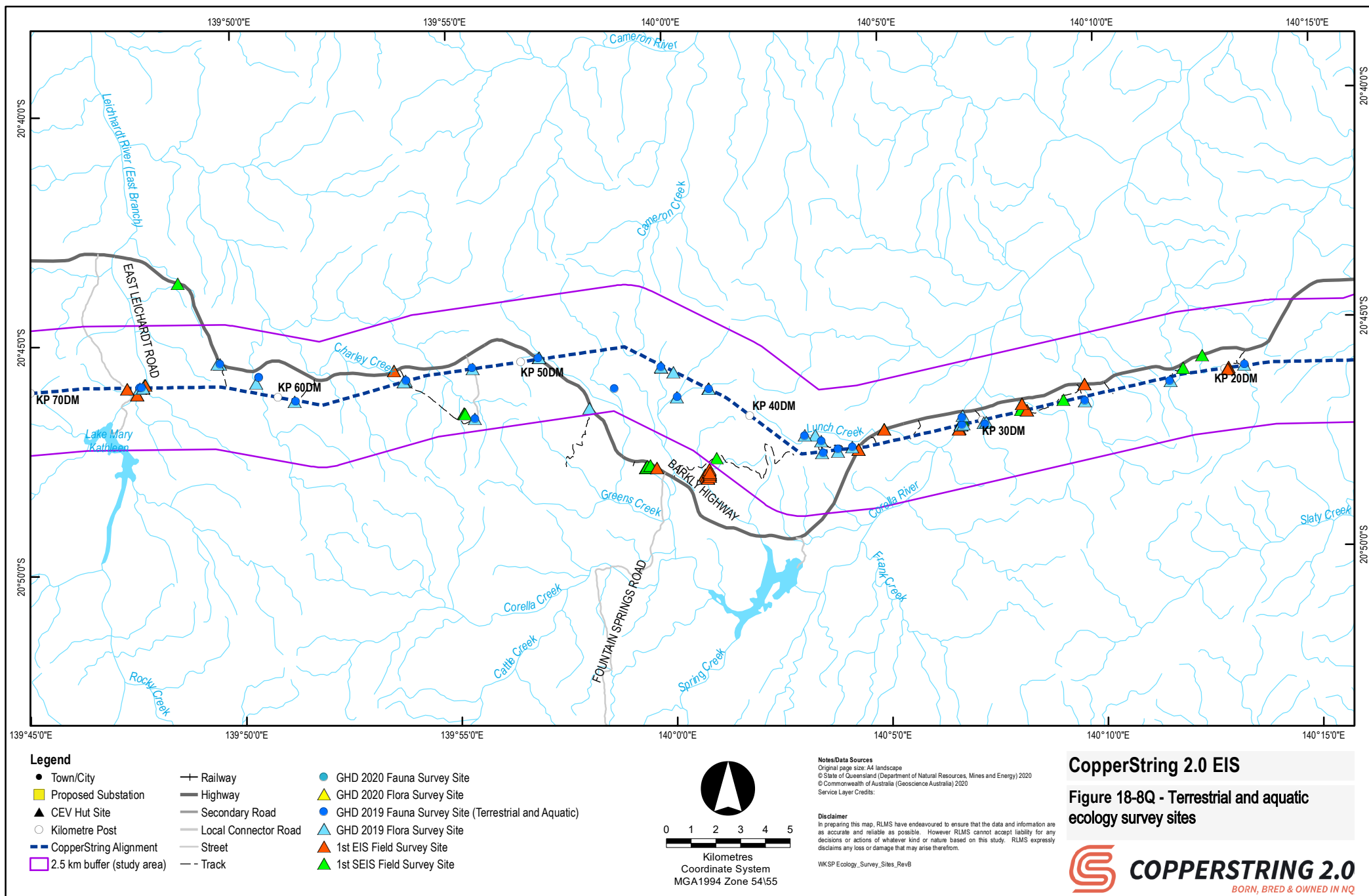
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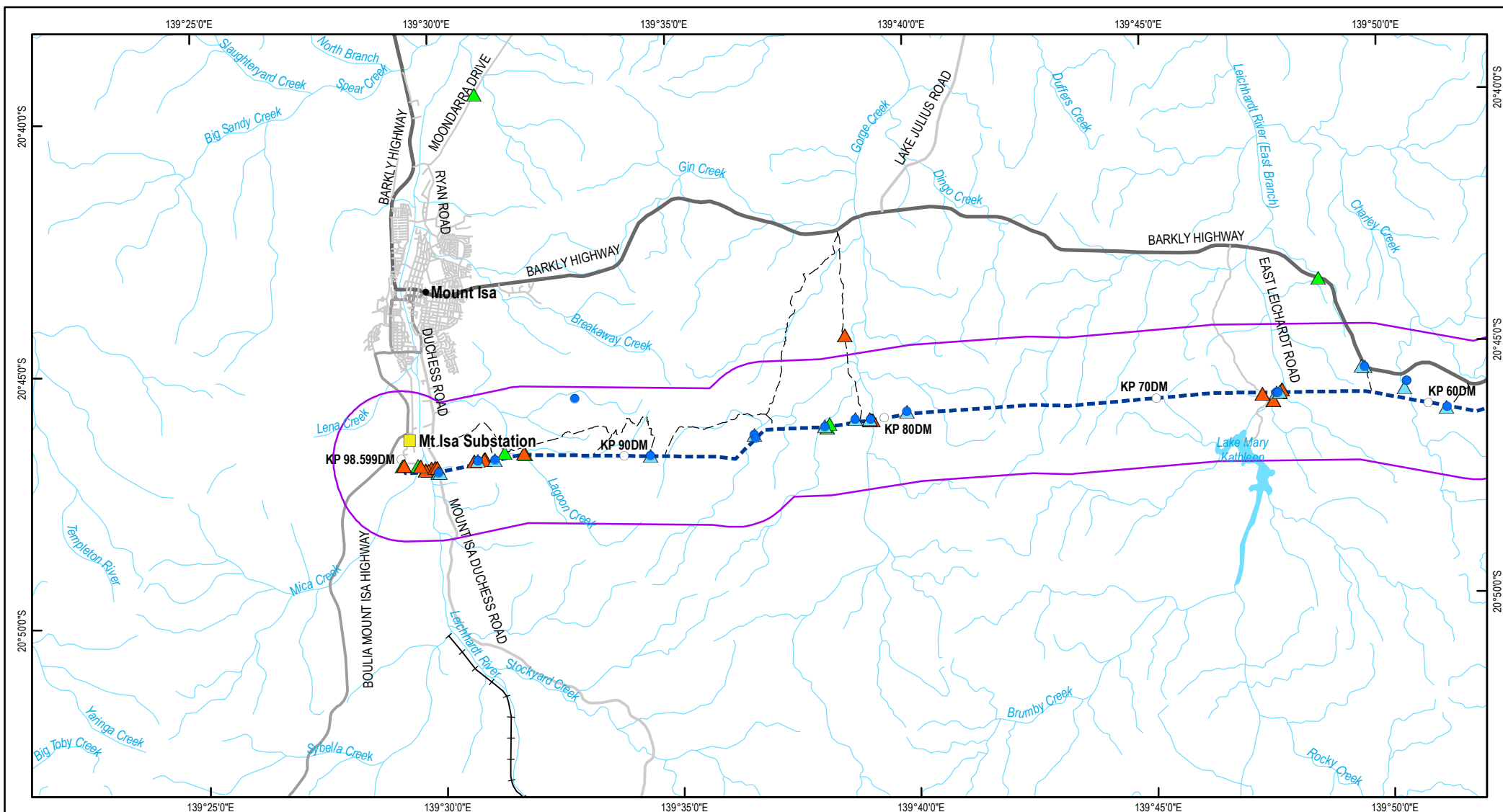
CopperString 2.0 EIS

Figure 18-80 - Terrestrial and aquatic ecology survey sites



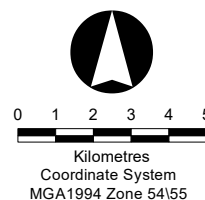






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- +— Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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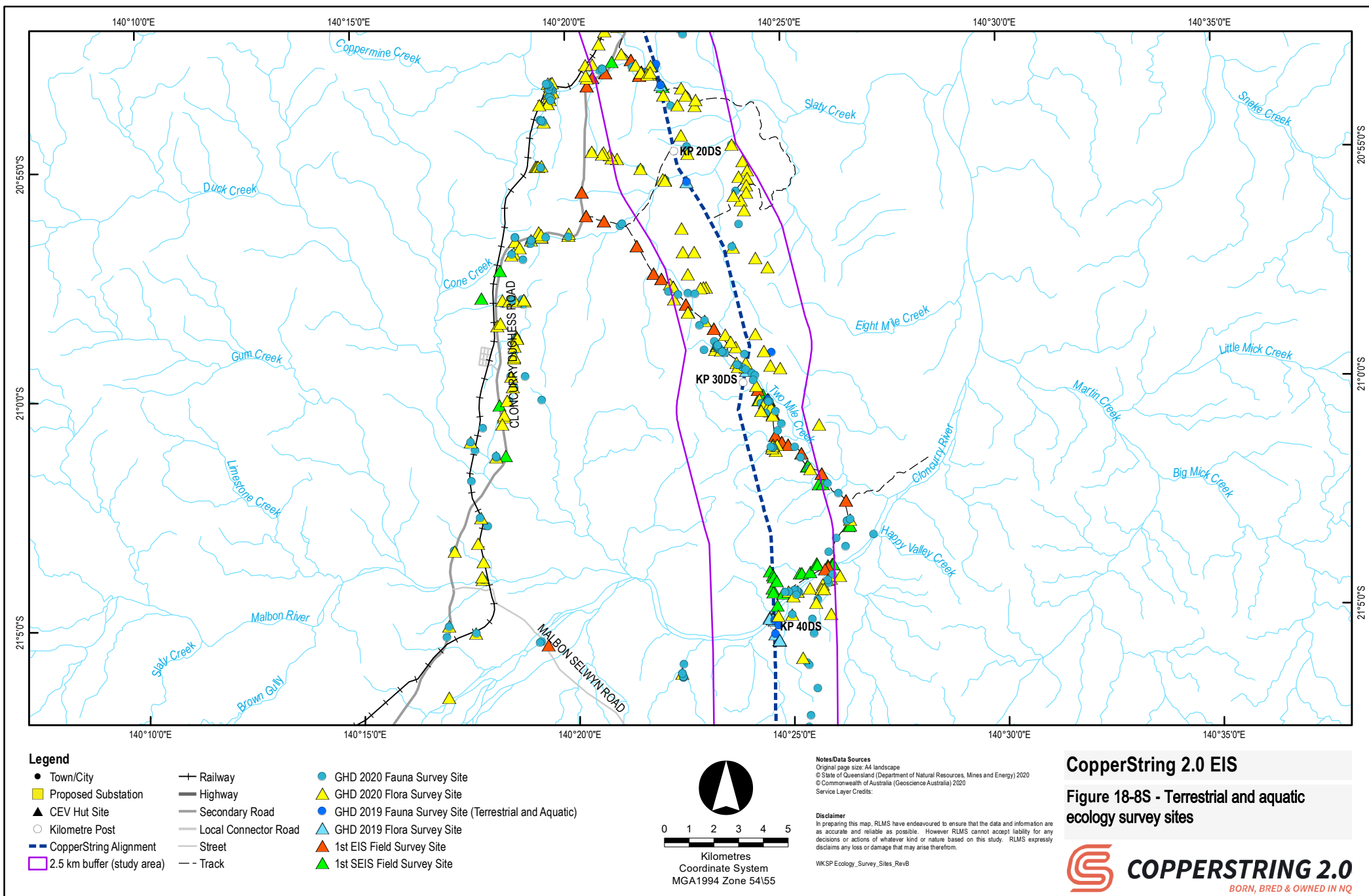
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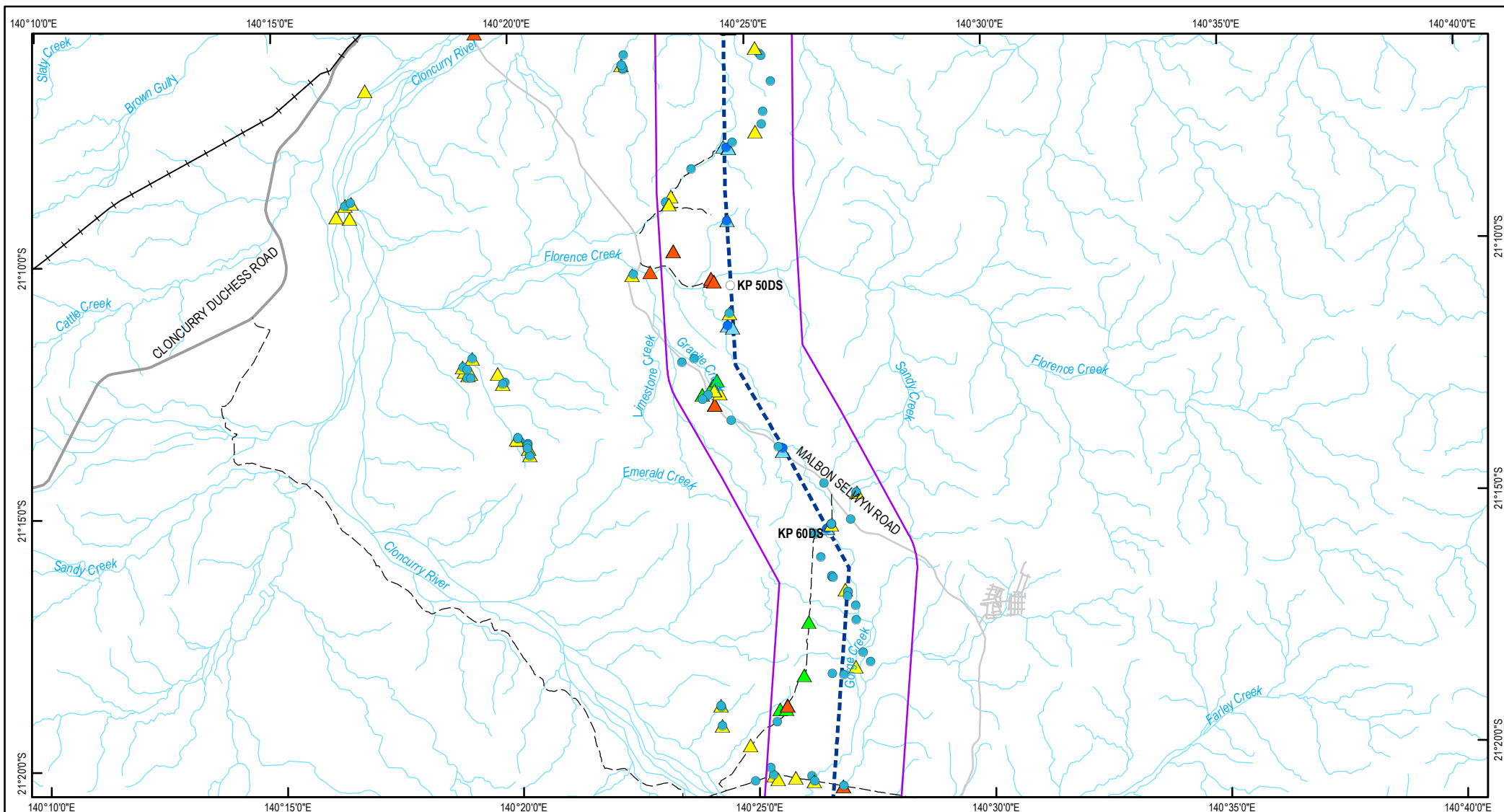
WKSP Ecology_Survey_Sites_RevB

CopperString 2.0 EIS

Figure 18-8R - Terrestrial and aquatic ecology survey sites

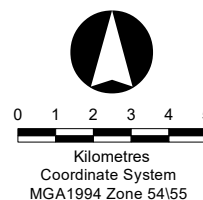






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



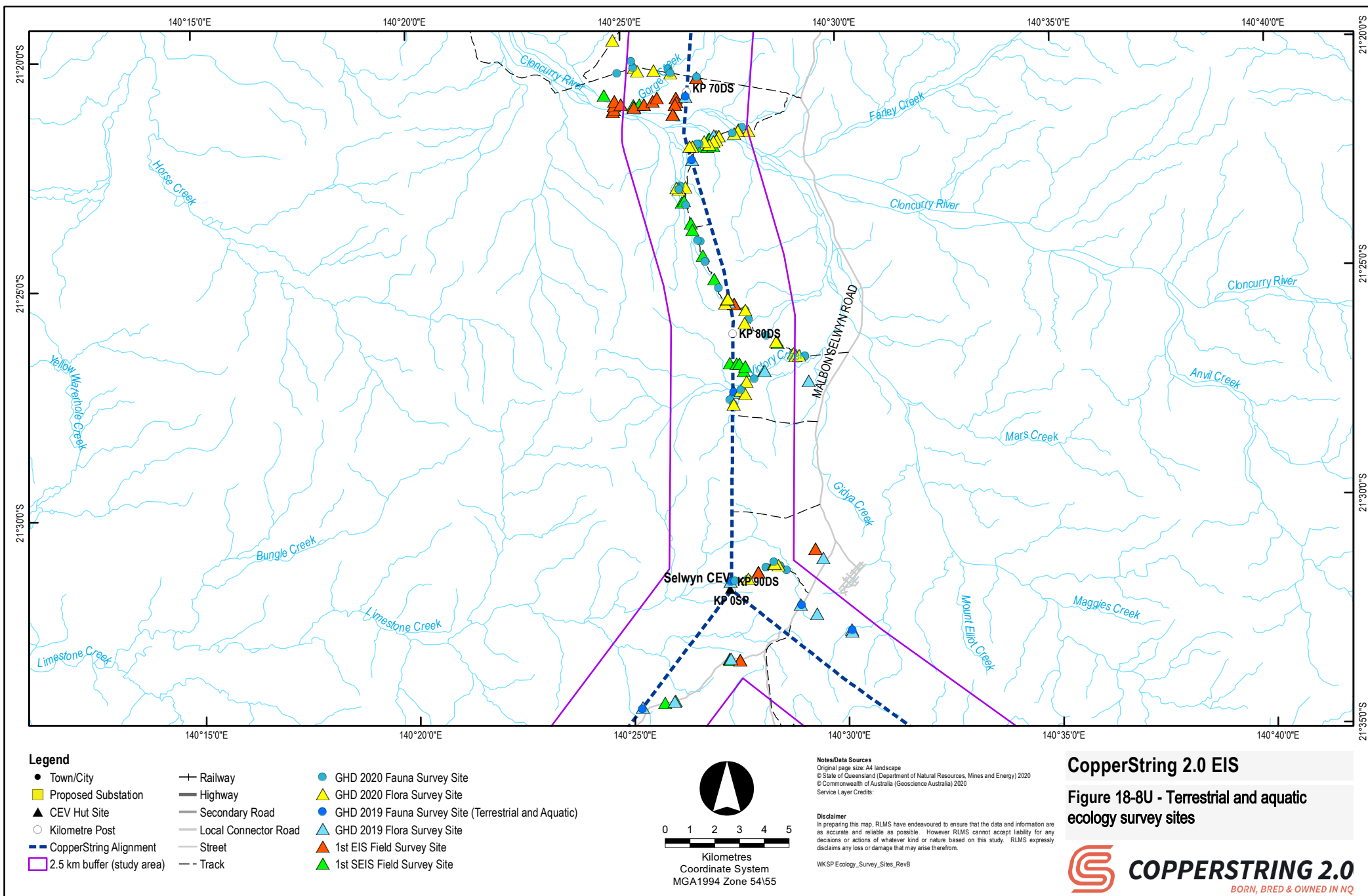
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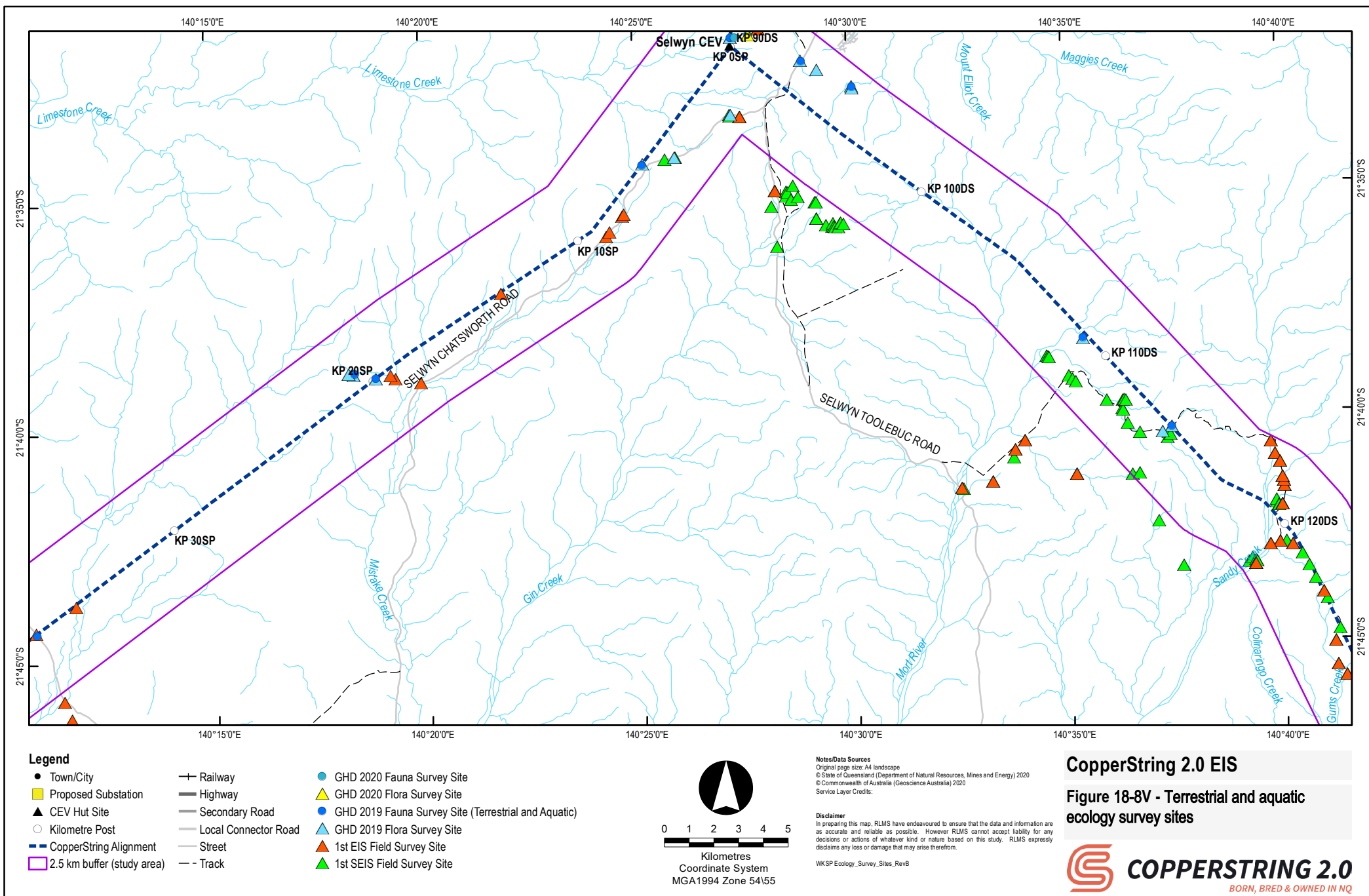
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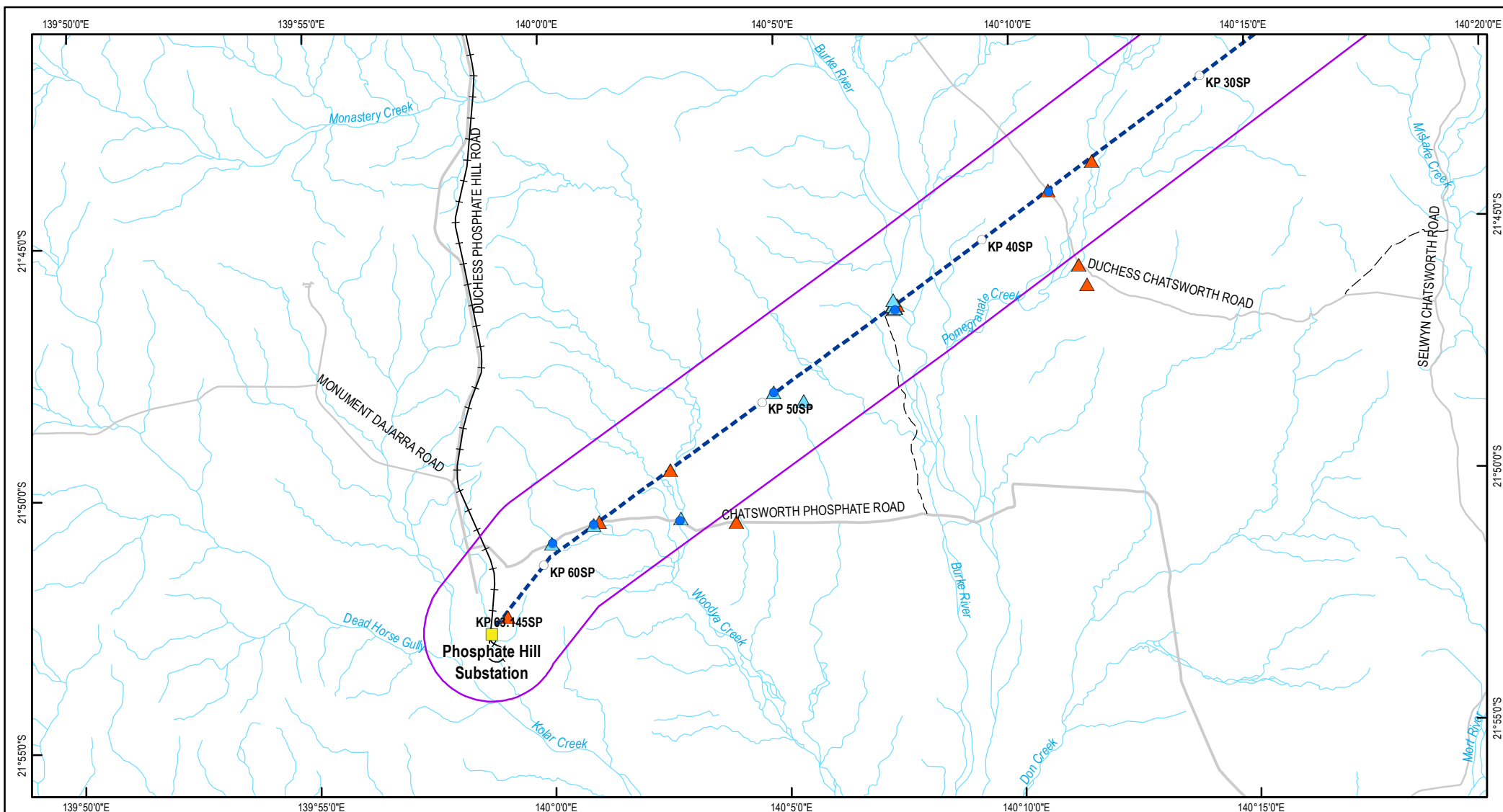
WKSP Ecology_Survey_Sites_RevB

CopperString 2.0 EIS

Figure 18-8T - Terrestrial and aquatic ecology survey sites

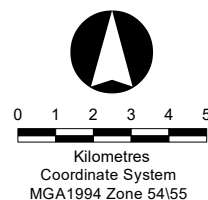






Legend

- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- ✚ Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track
- GHD 2020 Fauna Survey Site
- ▲ GHD 2020 Flora Survey Site
- GHD 2019 Fauna Survey Site (Terrestrial and Aquatic)
- ▲ GHD 2019 Flora Survey Site
- ▲ 1st EIS Field Survey Site
- ▲ 1st SEIS Field Survey Site



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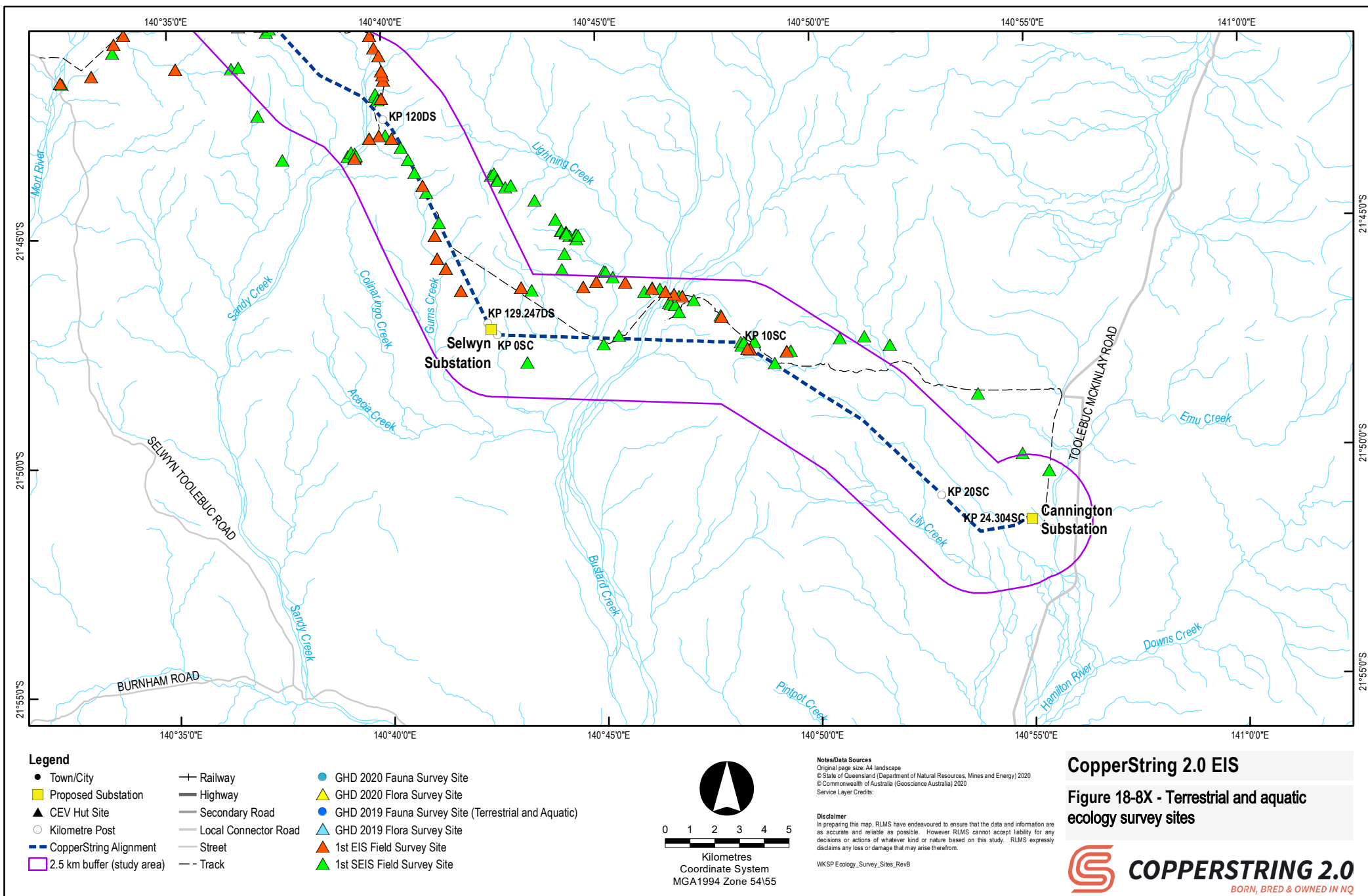
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CopperString 2.0 EIS

Figure 18-8W - Terrestrial and aquatic ecology survey sites





18.4 Existing environment

18.4.1 Regional environmental context

18.4.1.1 Bioregions

The proposed alignment intersects six bioregions: the Northwest Highlands (NWH), Gulf Plains, (GUP), Mitchell Grass Downs (MGD), Einasleigh Uplands (EIU), Desert Uplands (DEU) and Brigalow Belt (BRB) bioregions. The bioregions intersected by each corridor section are indicated in Table 18-23, with a summarised description of each bioregion presented below and displayed in Figure 18-9.

Table 18-26 Bioregions intersected by the corridor sections

Corridor section	Bioregions					
	BRB	EIU	DEU	MGD	GUP	NWH
Renewable Energy Hub	✓	✓	✓	✓		
CopperString Core				✓	✓	✓
Mount Isa Augmentation						✓
Southern Connection						✓
Cannington Connection				✓		✓
Phosphate Hill Connection				✓		✓

Key to table: BRB = Brigalow Belt, EIU = Einasleigh Uplands, DEU = Desert Uplands, MGD = Mitchell Grass Downs, GUP = Gulf Plains, NWH = Northwest Highlands.

Brigalow Belt (Renewable Energy Hub corridor section)

The BRB bioregion stretches from Townsville in the north to the New South Wales (NSW) border in the south and separates Queensland's wet tropical rainforests from the temperate forests of southeast Queensland. The bioregion contains 56,496 km² of mixed landscapes, including undulating hills, low ridges and rises, deep valleys and flat alluvial plains. The bioregion is characterised by the natural overstorey dominance of the silver-foilage wattle named brigalow (*Acacia harpophylla*), however also supports mixed eucalypt woodlands, softwood scrubs and open *Astrelba* and *Dichanthium* grasslands. This bioregion contains an array of listed threatened flora and fauna species. The majority of the bioregion has been cleared for cropping and agricultural purposes with current mapping estimates at 87% of the bioregion's remnant vegetation has been cleared. There are 10 major conservation reserves located within this bioregion. Approximately 5 km of the proposed corridor selection is located with the Brigalow Belt bioregion.

The BRB bioregion is comprised of 38 subregions, one of which (the Townsville Plains) is intersected by the corridor selection between KP 0WD and 10WD.

Einasleigh Uplands (Renewable Energy Hub corridor section)

The EIU bioregion is located along an elevated section of the Great Dividing Range in the eastern highlands of Queensland. The bioregion is geologically significant, containing erosional landforms and rich basaltic soils which support open eucalypt woodlands and dry rainforests that are home to an array of specialised fauna (Kahn and Lawrie, 1987). The headwaters of many of North Queensland's major rivers are located in the Einasleigh Uplands, including the Burdekin River and Herbert River. The ranges to the east are located within the rain shadow of

the Wet Tropics and represent an important mix between eastern (wet) and western (dry) species assemblages. The region contains some of the longest lava flows in the world and collapsed lava tubes provide significant habitat for specialised cave fauna (e.g. *Miniopterus schreibersii* and *M. australis*) and supports relict rainforest communities (Atkinson, 1996; Morgan, 1999).

One subregion of the EIU is intersected by the final corridor selection, namely, the Broken River subregion. This subregion is intersected from KP 10-125WD and covers approximately 107 km of the Project.

Desert Uplands (Renewable Energy Hub and CopperString Core corridor sections)

The DU bioregion is located south of the EIU bioregion and west of the Great Dividing Range. The region is located between coastal and inland catchments and contains the major catchment of the Lake Eyre Basin. This bioregion is characterised by upland landforms largely dominated by sandstone and large areas of deep infertile sand plains. The bioregion is semi-arid and vegetation consists predominantly of acacia woodlands and native pastures of spinifex (*Triodia pungens*), wire grass (*Aristida* spp.) and Mitchell grass (*Astrebla* spp.) (Sattler and Williams, 1999). The bioregion is at the eastern margin of the Great Artesian Basin (GAB) and parts of the region include important recharge areas for GAB aquifers. This bioregion includes the towns of Prairie, Torrens Creek and Homestead.

Three DU subregions are intersected by the final corridor selection, these being the Cape – Campaspe Plains, the Alice Tablelands, and the Prairie – Torrens Creeks Alluvials subregions. The Cape – Campaspe Plains subregion is comprised of the plains of the Cape and Campaspe River systems, and is intersected by the corridor selection between KP 118WD and 188WD. The Alice Tablelands subregion is intersected between KP 188WD and 248WD (Prairie and Pentland) whilst the Prairie – Torrens Creeks Alluvials subregion is intersected by the Project between KP 248WD and 323WD.

Mitchell Grass Downs (CopperString Core, Cannington Connection and Phosphate Hill Connection corridor sections)

The MGD is located within a tropical semi-arid habitat, from the Northern Territory to Southern Queensland, and is bordered by desert habitats to the south, west and southwest. The bioregion covers approximately 335,320 km² of distinct undulating clay plains dominated by Mitchell tussock grass (*Astrebla* spp.) and devoid of major tree cover. The undulating clay plains of the MGD are distinctive in comparison to the highlands and plateaus of surrounding regions. Whilst *Astrebla* spp. are known to occur in neighbouring bioregions, they are only dominant within the MGD. As such, the MGD and the region supports several species of endemic and listed threatened fauna, including the endangered Julia Creek Dunnart and critically endangered night parrot (Hilton-Taylor, 2000; Fisher, 2001). This region undergoes ‘boom and bust’ cycles in response to water availability, with rainfall highly influenced by the summer monsoons in the north.

Three subregions within the MGD are intersected by the Project, namely the Central Downs, Kynuna Plateau and Southwestern Downs subregions. The Central Downs subregion extends from approximately KP 316WD-524WD and KP 544WD-624WD. This subregion covers approximately 285 km of the final corridor selection. The Kynuna Plateau subregion is situated in the centre of the MGD and located between the GP and Channel Country bioregions. The subregion is intersected by the Cannington Connection section of the final corridor selection, between KP 11SC and the Cannington Substation and encompasses approximately 20 km of the final corridor selection. The Southwestern Downs subregion is located within the western portion of the MGD bioregion and extends south near Bedourie. This subregion is intersected by

the Phosphate Hill Connection section of the Project, from KP 25SP to the Phosphate Hill Substation. This subregion is intersected by approximately 39 km of the final corridor selection.

Gulf Plains (western CopperString Core corridor section)

The GP bioregion is characterised by broad alluvial plains and coastal areas. The bioregion contains 211,100 km² of low-lying alluvial plains and off-shore islands. The coastal edge is dominated by marine plains of clay, silt and sand with mangroves, saltpans and mudflats. Further inland, the dominant vegetation types includes grasslands and eucalypt, Melaleuca and Acacia woodlands occurring upon plains and river channels comprised of alluvial soils. Similar vegetation dominates the dissected plateau surfaces of sandstones and siltstones that abut the surrounding bioregions (Sattler & Williams, 1999). Several major river systems intersect the alluvial plains of the Gulf Plains bioregion, including the Leichhardt, Flinders and Norman Rivers.

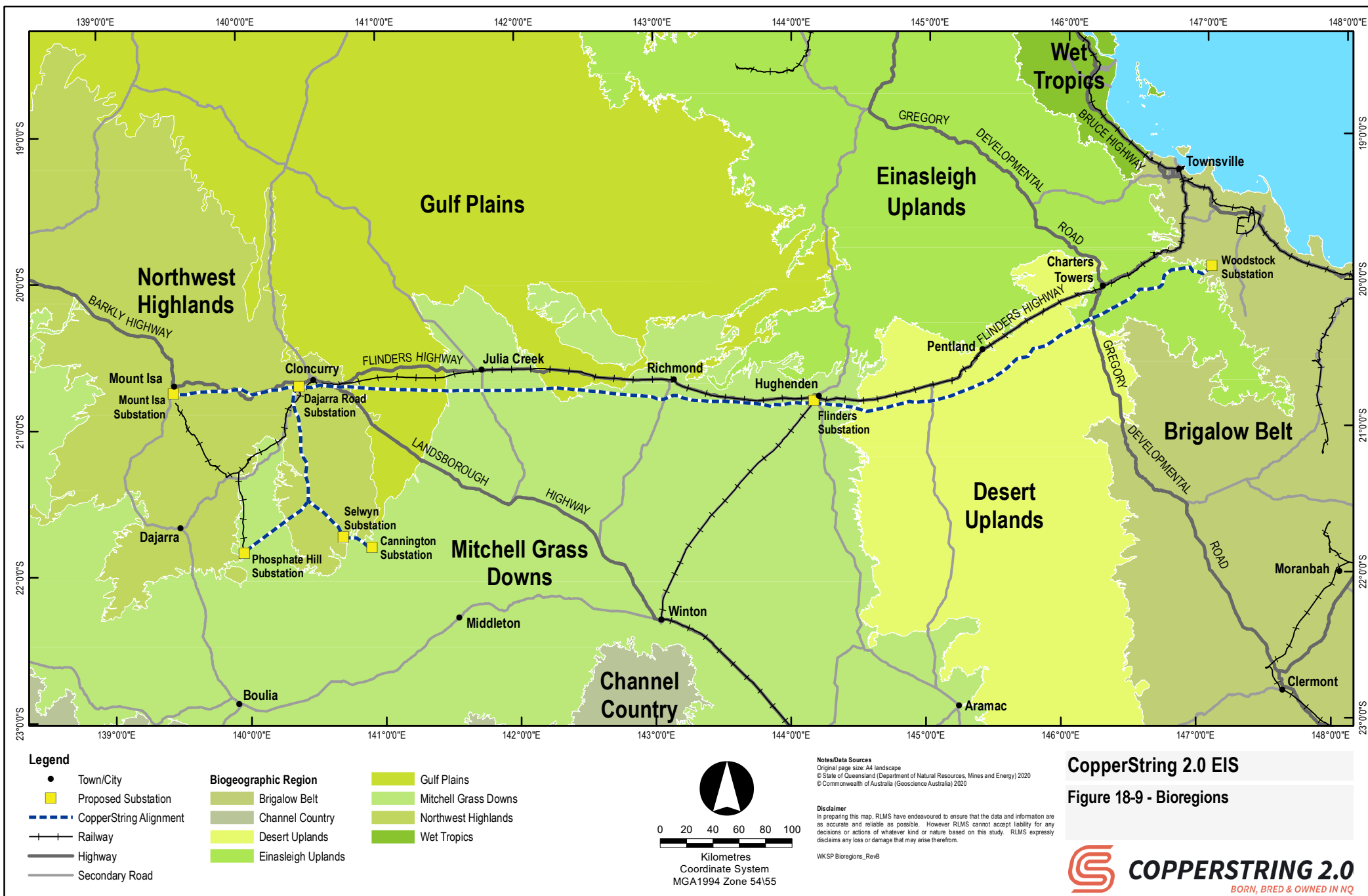
Two of the 10 subregions of GUP are intersected by the Project, namely, the Woondoola Plains subregion and the Donors Plateau subregion. The Woondoola Plains subregion extends from 40 km south of the Gulf of Carpentaria coast, through to the southern reaches of the GUP, approximately 120 km south of the corridor selection. This subregion intersects the corridor at KP 524WD-544WD and KP 624WD-634WD. Approximately 34 km of the final corridor selection is within the Woondoola Plains subregion.

The Donors Plateau subregion occurs as scattered, isolated polygons extending from Gulf of Carpentaria to 15 km northeast of the Cannington Substation. The final corridor selection intersects the Donors Plateau subregion at KP 634WD-694WD, 90 km east of Cloncurry. Approximately 58 km of the corridor selection is within the Donors Plateau subregion. This subregion contains the Bang Bang Jump Ups community, which is recognised as an area of very high endemism, wildlife refugia and species diversity.

Northwest Highlands (Mount Isa Augmentation, Southern Connection, Cannington Connection and Phosphate Hill Connection corridor sections)

The NWH bioregion is located in western Queensland, extending from Dajarra in the south, to Cloncurry in the east, Camooweal to the west and approximately 65 km south of Queensland's northern coastline at the Gulf of Carpentaria. The bioregion covers an area of 66,640 km² and encompasses the towns of Cloncurry and Mount Isa. The predominant vegetation type is low open woodlands with spinifex hummock grass groundcover which occurs upon a range of landforms, including rugged hills, mountain ranges and undulating plains. Both the Leichhardt River and the Cloncurry River originate in this bioregion, before flowing north and northeast into the Gulf Plains bioregion. The major industries for the region are cattle grazing and mining, particular for zinc and copper.

The Project intersects one subregion within the NWH bioregion, namely the Mount Isa Inlier subregion, located between KP 699WD and 99.15DM and the length of the Southern Connection, the Cannington Connection from KP 90DS to 3SC, and the Phosphate Hill Connection from KP 90DS to 25SP.



18.4.1.2 Climate

Existing climatic conditions relevant to the Project area, based on Bureau of Meteorology (BOM) climatic stations indicate that the corridor selection traverses three broad climatic zones, the coastal lowlands, Great Dividing Range and inland zone.

The coastal lowlands lies between Woodstock substation and the Great Dividing Range. This zone receives on average approximately 1,000 mm of yearly rainfall with most rain falling in summer months. Minimum annual average temperatures range from 16 degrees to 20 degrees, with maximum annual average temperatures ranging from 26 degrees to 29 degrees.

Westward from the coastal lowlands the corridor selection crosses the Great Dividing Range. This climate zone is generally equated with the Desert Uplands bioregion. Annual average temperatures range from a minimum of 17 degrees to a maximum of 30 degrees

The inland zone can be further divided into the Flinders River Catchment and the Mount Isa zones. Generally the inland sections are characterised by hotter maximum temperatures, lower relative humidity and reduced rainfall comparative to the coastal lowlands and Great Dividing Range. During summer months the temperature can exceed 40 degrees on a number of days.

Prevailing winds within the Project area are typically southeast to northeast however there is variation between inland and coastal locations.

18.4.1.3 Catchments

The proposed corridor selection intersects six major catchment areas, being the:

- Haughton River catchment (Renewable Energy Hub corridor section KP 7WD-11WD)
- Burdekin River catchment (Renewable Energy Hub corridor section KP 11WD-230WD)
- Cooper Creek catchment (Renewable Energy Hub corridor section KP 230WD-310WD)
- Flinders River catchment (Renewable Energy Hub corridor section KP 310WD-333WD, CopperString Core corridor section (and connections to substations), Mount Isa Augmentation corridor section KP 0DM-51.5DM, and Southern Connection corridor section KP 0DS-86.5DS)
- Leichhardt River catchment (Mount Isa Augmentation corridor section KP 51.5DM-99DM)
- Georgina River catchment (Southern Connection corridor section KP 86.5DS-90DS, Cannington Connection corridor section, and Phosphate Hill Connection corridor section KP 0SP-63SP)

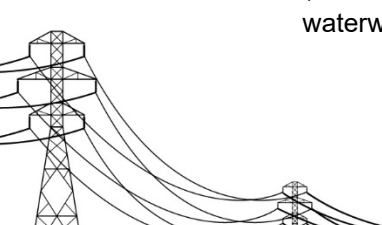
The catchment boundaries and major watercourses are shown in Figure 18-10.

The characteristics of these catchments are further described below.

Haughton River Catchment

The Haughton River catchment has an area of approximately 2,200 km² and extends from Mingela in the west, to the Coral Sea in the east, approximately 30 km south of Townsville in the north and Ayr in the south. It is bounded by Mt Elliot in the north, Barratta Creek in the south and the Harvey Mountain Range in the west. There are two sub-catchments in this catchment, the Haughton River and Barratta Creek sub-catchments. The Major Creek and the Reid River are major tributaries of the Haughton River, while Oaky Creek, Horse Camp Creek and Scott Creek are the major tributaries of Barratta Creek.

The proposed Renewable Energy Hub corridor section crosses one higher order waterways (and their tributaries) in the Haughton River catchment, namely Oaky Creek (KP48WD). Both waterways are identified as high value under the Queensland waterways for waterway barrier



works (WWBW). Both the Houghton River and Baratta Creek enter the Coral Sea approximately 50 - 60 km downstream of the proposed corridor selection (at the eastern-most extent).

The Houghton River catchment drains to the Bowling Green Bay Ramsar site (refer to Section 18.4.5), which is approximately 35 000 ha, is located approximately 40 km northeast of the proposed corridor selection.

Burdekin River Catchment

The Burdekin River catchment is approximately 130,000 km² and is bounded by the Mount Surprise to the north, Tambo in the south, Blackbraes National Park in the west and Finch Hatton in the east. The Burdekin catchment is composed of six major catchments, which are divided further into 52 sub-catchments. The Burdekin River discharges into the Coral Sea at Ayr, approximately 250 km downstream of the proposed corridor selection. Aquatic habitats in the upper catchment have high conservation value and are relatively intact due to the low levels of human disturbance and habitat or flow modification. The ephemeral nature of the creeks in the headwaters of the catchment means that the availability of aquatic habitat is seasonal and limited to periods following rainfall or to isolated perennial pools.

The proposed corridor selection crosses the following higher order waterways (and their tributaries) in the Burdekin River Catchment, including:

- Oaky Creek (KP48WD)
- Pandanus Creek (KP56WD)
- Burdekin River (KP71WD)
- Policeman Creek (KP113WD)
- Oaky Creek (KP124WD)
- Balfe Creek (KP138WD)
- Campaspe River (KP161WD)
- Manoa Creek (KP175WD)
- Cape River (KP180WD)
- Warrigal Creek (KP201WD)

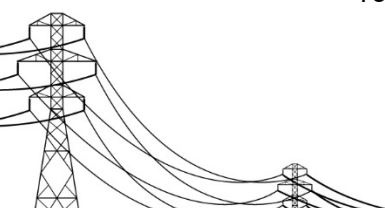
Within this catchment, there are a number of Great Barrier Reef (GBR) Wetland Protection Areas that contain wetlands of high ecological significance, including within the study area at KP177WD and KP180WD.

Cooper Creek Catchment

The Cooper Creek catchment covers an area of approximately 244,000 km² in Queensland. The Great Dividing Range in combination with the Grey, Gowan and Warrego ranges form part of the northern and eastern boundaries of the catchment. Major tributaries of the catchment include Torrens Creek, which joins the Thomson River. The Thomson River merges with the Barcoo River to form Cooper Creek, approximately 40 km upstream of Windorah. The Cooper Creek Catchment flows across the Queensland and South Australia border (near Nappa Merrie), with Lake Eyre as the final receiving environment. The Coongie Lakes Ramsar site is in the Cooper Creek Catchment (refer to Section 18.4.5) in South Australia.

The proposed corridor selection crosses the following higher order waterways (and their tributaries) in the Cooper Creek catchment:

- Torrens Creek (KP248WD)



- Bullock Creek (KP272WD)
- Emu Creek (KP 280WD)
- Prairie Creek (KP288WD)

No mapped palustrine wetlands are intersected by the corridor selection, however two areas of regulated vegetation within 100 m of a wetland are located adjacent to the corridor selection, 150 m south of KP 267WD and 500 m north of KP275WD as shown in Figure 18-11.

Flinders River Catchment

The Flinders River catchment is approximately 109,000 km² and its headwaters are in the Great Dividing Range. The Flinders River flows into the Gulf of Carpentaria, west of Karumba. Major tributaries of the Flinders River are the Cloncurry and Corella rivers. This catchment supports ecological-significant springs fed by Great Artesian Basin, including the Flinders River supergroup. This group of five freshwater springs are located between Julia Creek and Cloncurry. Aquatic habitat in the catchment may have high conservation value and is relatively intact due to the low levels of human disturbance / modification. The ephemeral nature of the creeks in the catchment means that the availability of aquatic habitat is seasonal and limited to periods following rainfall or to isolated perennial pools

The proposed corridor selection within this catchment crosses the following higher order waterways (and their tributaries):

- Corella River (KP30DM)
- Slaty Creek (KP16DS)
- Malbon River (KP40DS)
- Florence Creek (KP50DS)
- Granite Creek (KP55DS)
- Cloncurry River (KP70DS)
- Walker Creek (KP383WD)
- Eastern Creek (KP401WD and KP599WD)
- Sloane Creek (KP401WD)
- O'Connell Creek (KP444WD)
- Alick Creek (KP486WD, KP524WD and KP544WD)
- Julia Creek (KP586WD)
- Eastern Creek (KP599WD)
- Sadowa Creek (KP609WD)
- Gilliat River (KP624WD)
- Gidya Creek (KP634WD)
- Holy Joe Creek (KP639WD)
- Fullarton River (KP674WD)
- Scrubby Creek (KP674WD)
- Williams River (KP682WD)
- Cloncurry River (KP726WD)

Leichhardt River Catchment

The Leichhardt River catchment is approximately 33 000 km² and rises in the Selwyn Ranges, 40 km south-east of Mount Isa. The Leichhardt River flows north, through Mount Isa, Lake Moondarra, and Lake Julius. The Leichhardt River is joined by three major tributaries: Gunpowder Creek, 15 km downstream of Kamileroi; Fiery Creek, 70 km downstream of Lorraine; and the Alexandra River, near Floraville. The Leichhardt River passes through a vast coastal plain and enters the Gulf of Carpentaria 30 km northeast of Burketown.

The Mount Isa Augmentation corridor section intersects the following higher order waterways (and their tributaries) in the Leichhardt River catchment:

- Charlie Creek (KP54DM)
- Leichhardt River (east branch at KP66DM)
- George Creek (KP81DM)
- Leichhardt River (KP98DM)
- Mica Creek (KP98DM)

Georgina River Catchment

The Georgina River catchment is approximately 144,000 km² in Queensland. Major tributaries are the Burke, Hamilton, Buckle, Sander and Ranken rivers. Rivers of the Georgina River catchment flow south to join with the Diamantina Lake catchment, and together these catchments (sometimes known as the Georgina-Diamantina catchment) form part of the Lake Eyre Basin.

Major waterways (and their tributaries) in the Georgina River catchment crossed by the Cannington Connection corridor section include:

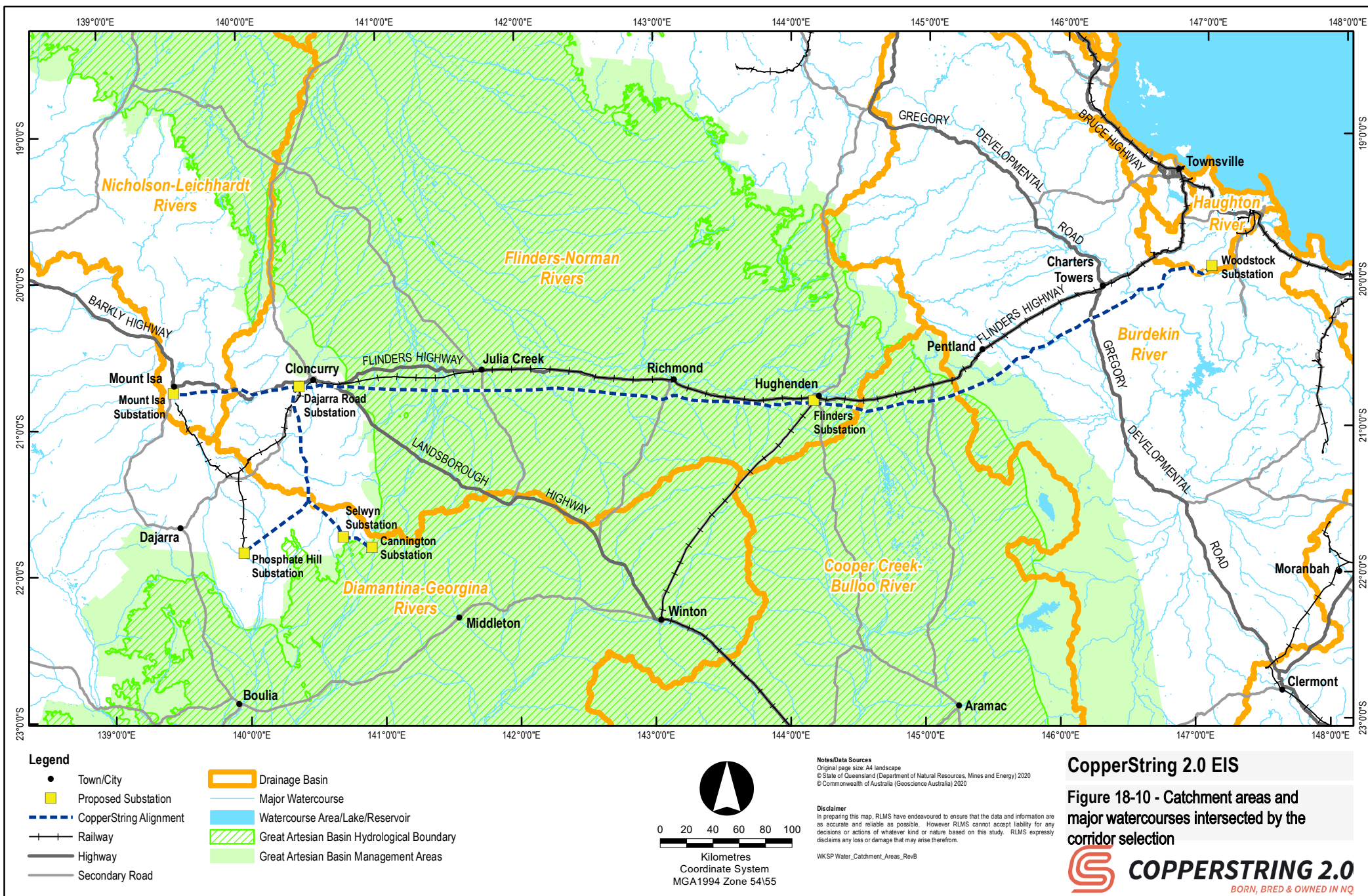
- Mort River (KP100DS)
- Sandy Creek (KP120DS)
- Bastard Creek (KP135DS)

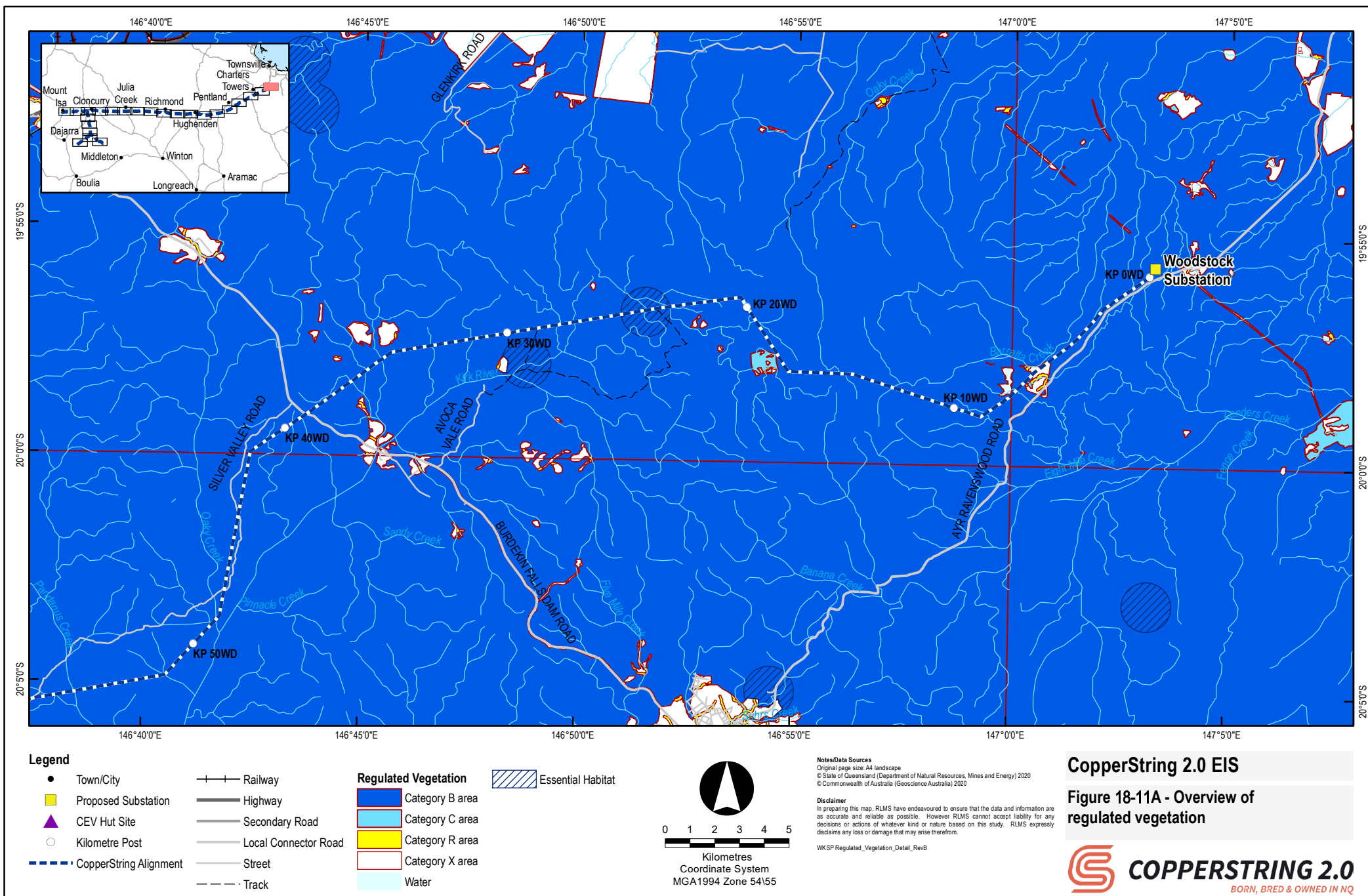
Major waterways (and their tributaries) in the Georgina River catchment crossed by the Phosphate Hill Connection corridor section include:

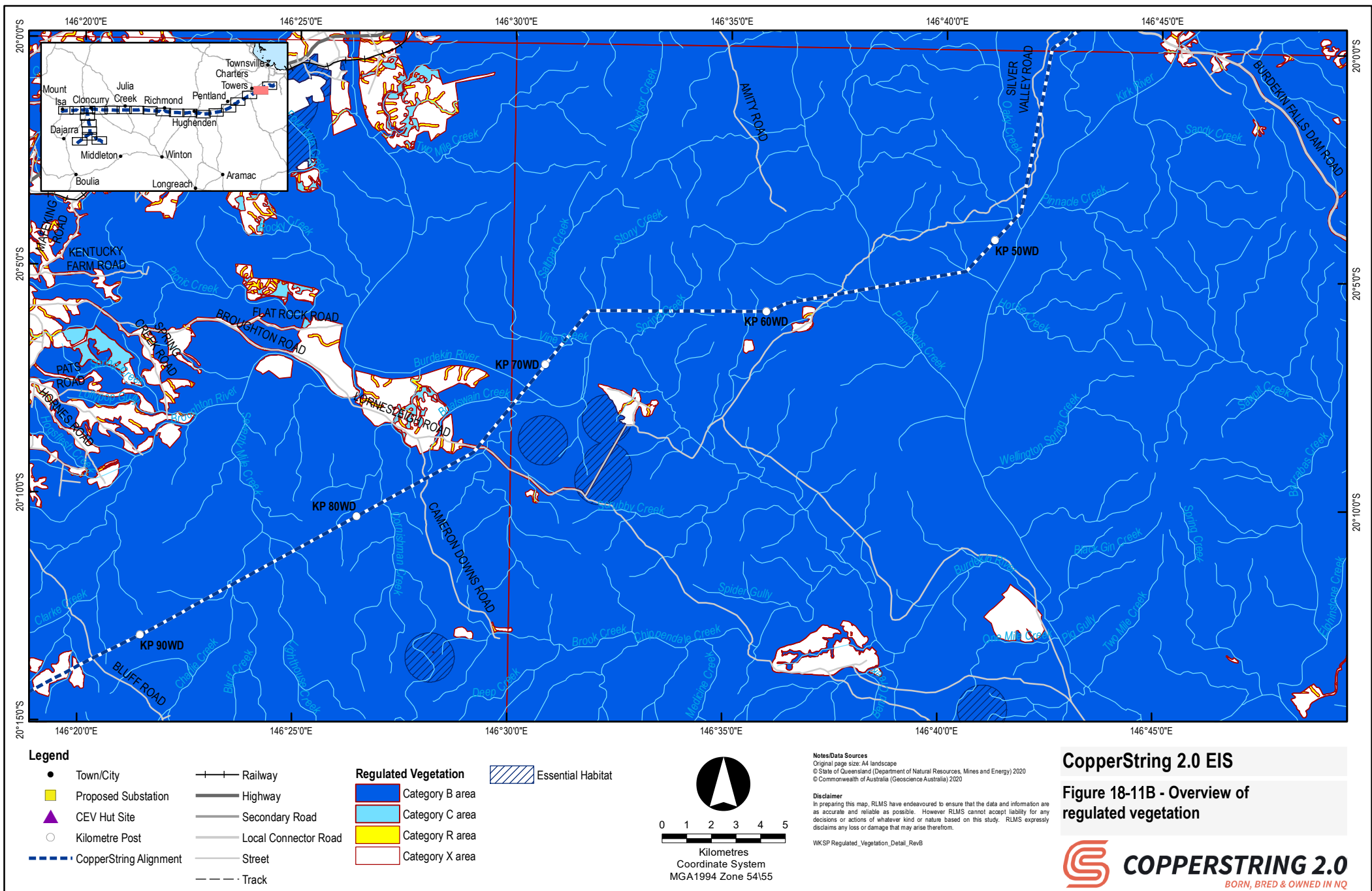
- Burke River (KP44SP)
- Woodya Creek (KP 54SP)

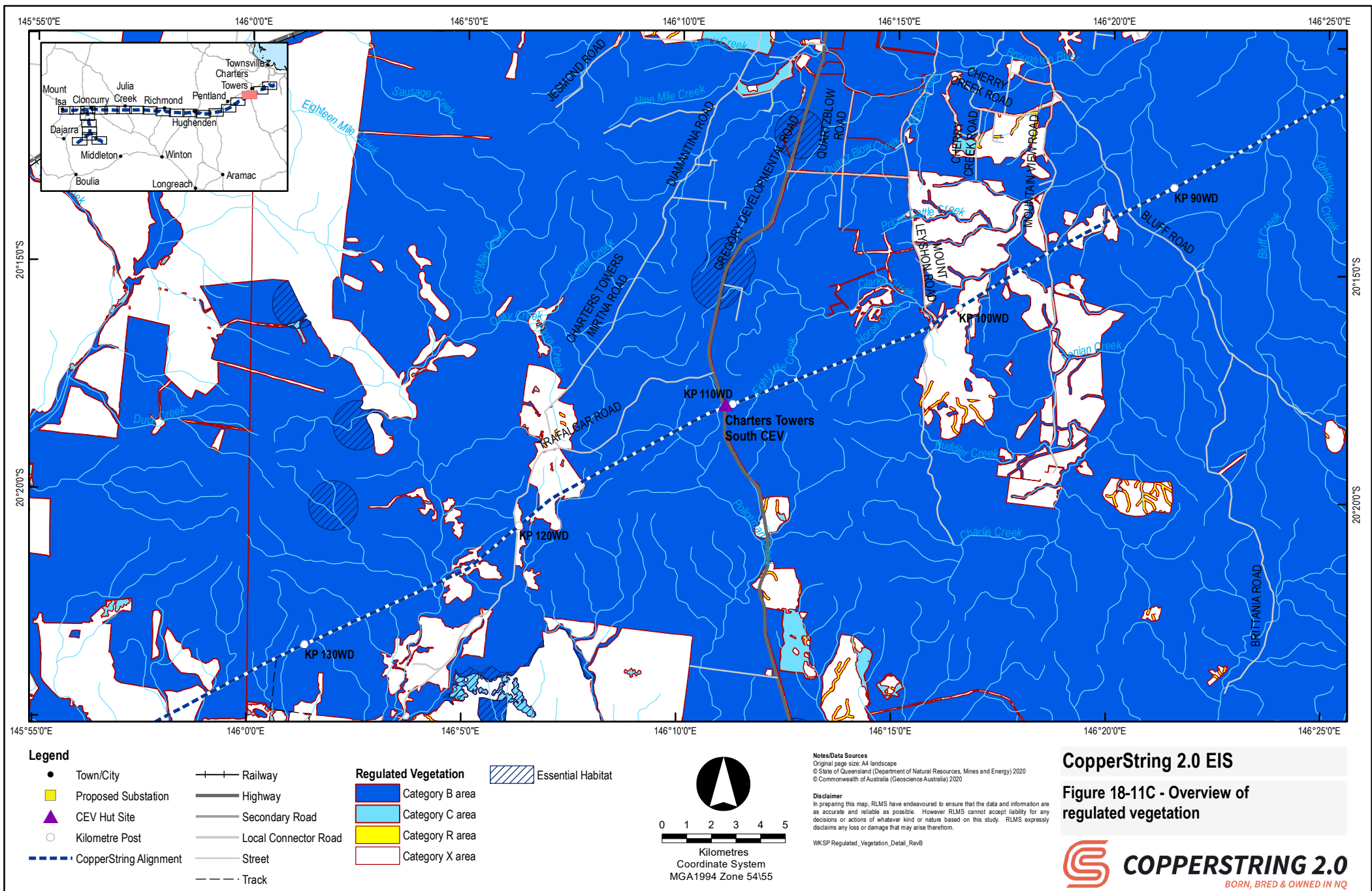
No major watercourses are crossed by the Southern Connector corridor within this catchment.

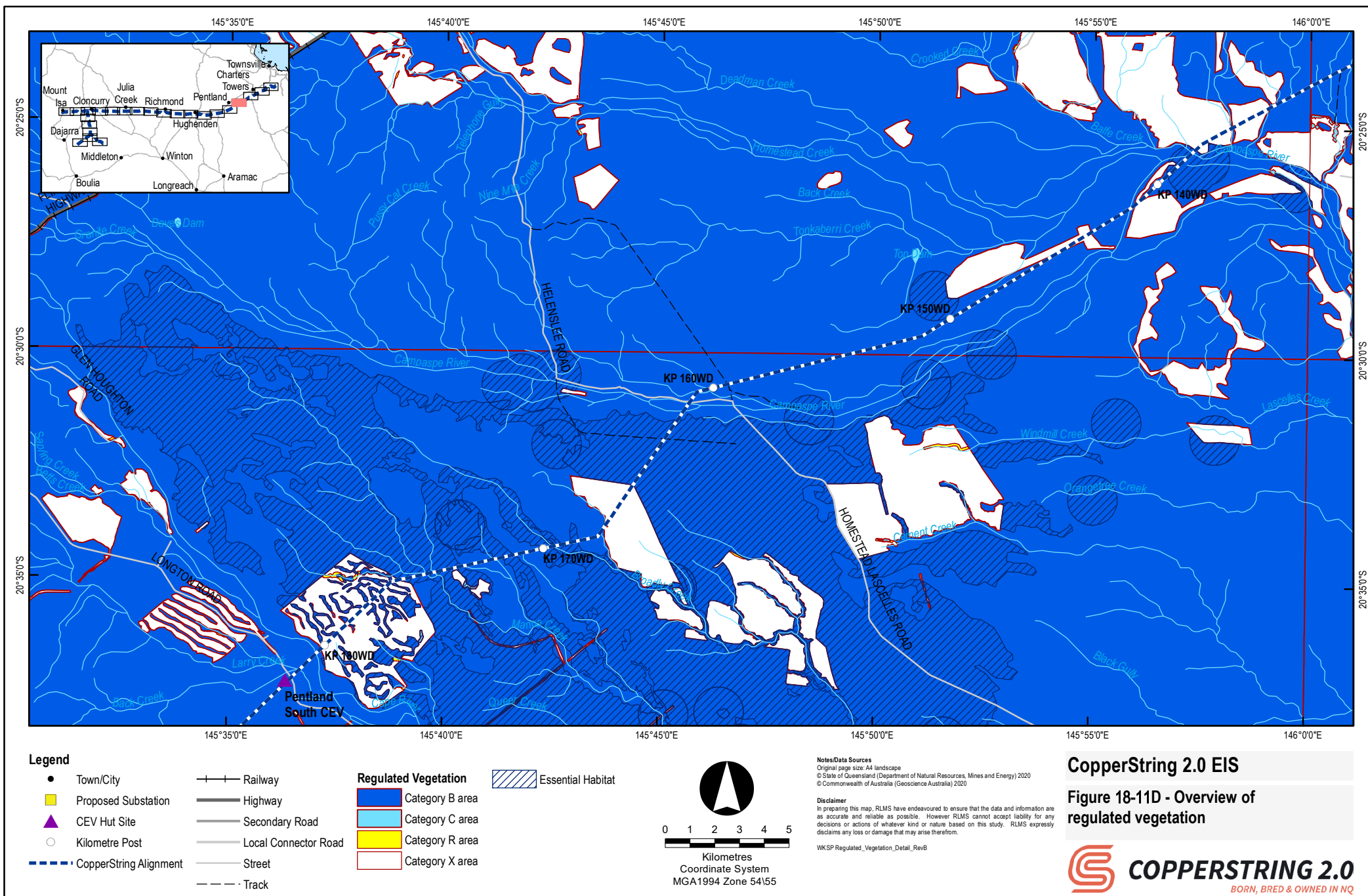
The proposed Phosphate Hill Connection corridor selection crosses a lacustrine wetland (approximately 1.3 km southeast of KP12SP) and one remnant wetland.

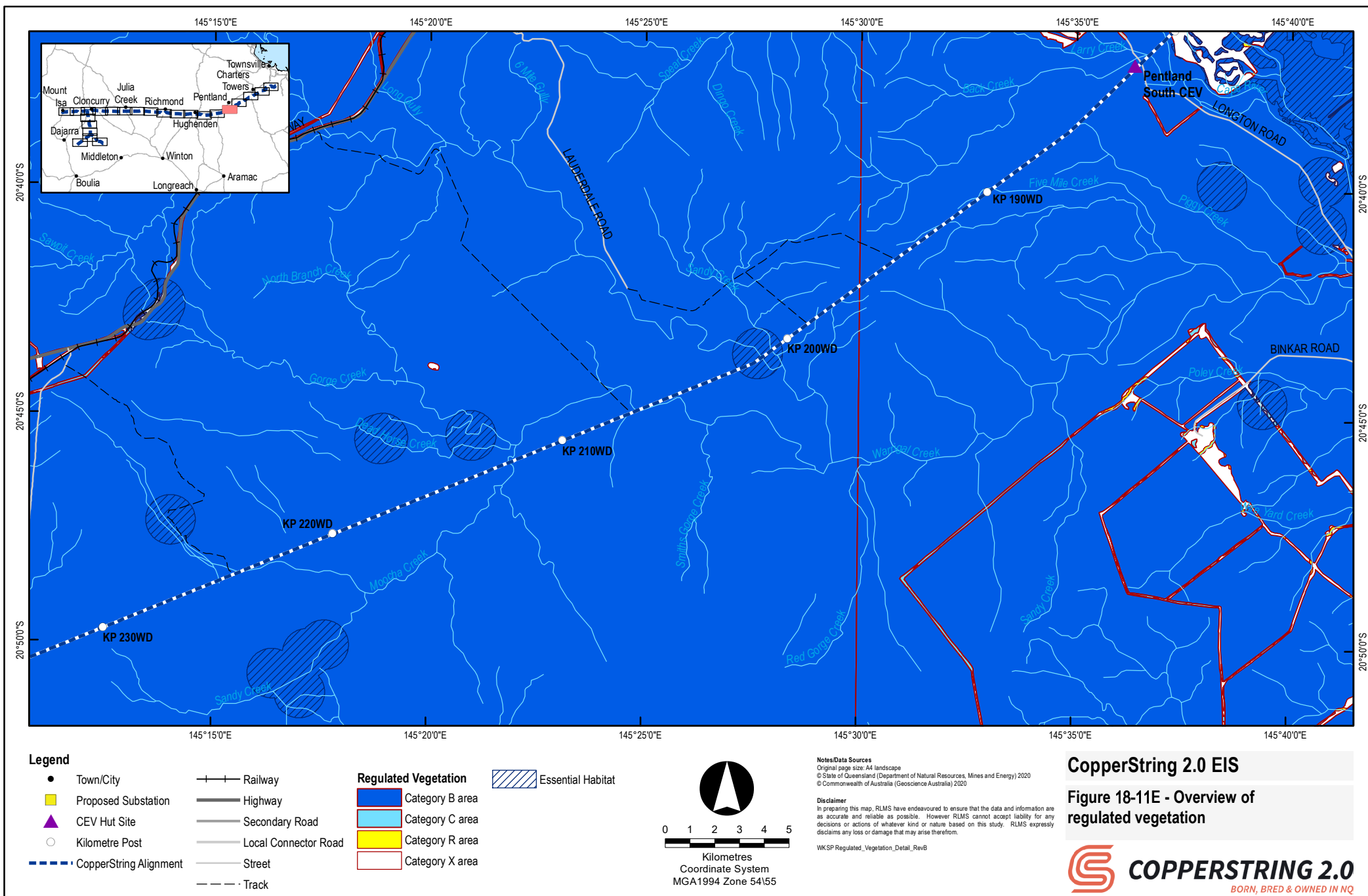


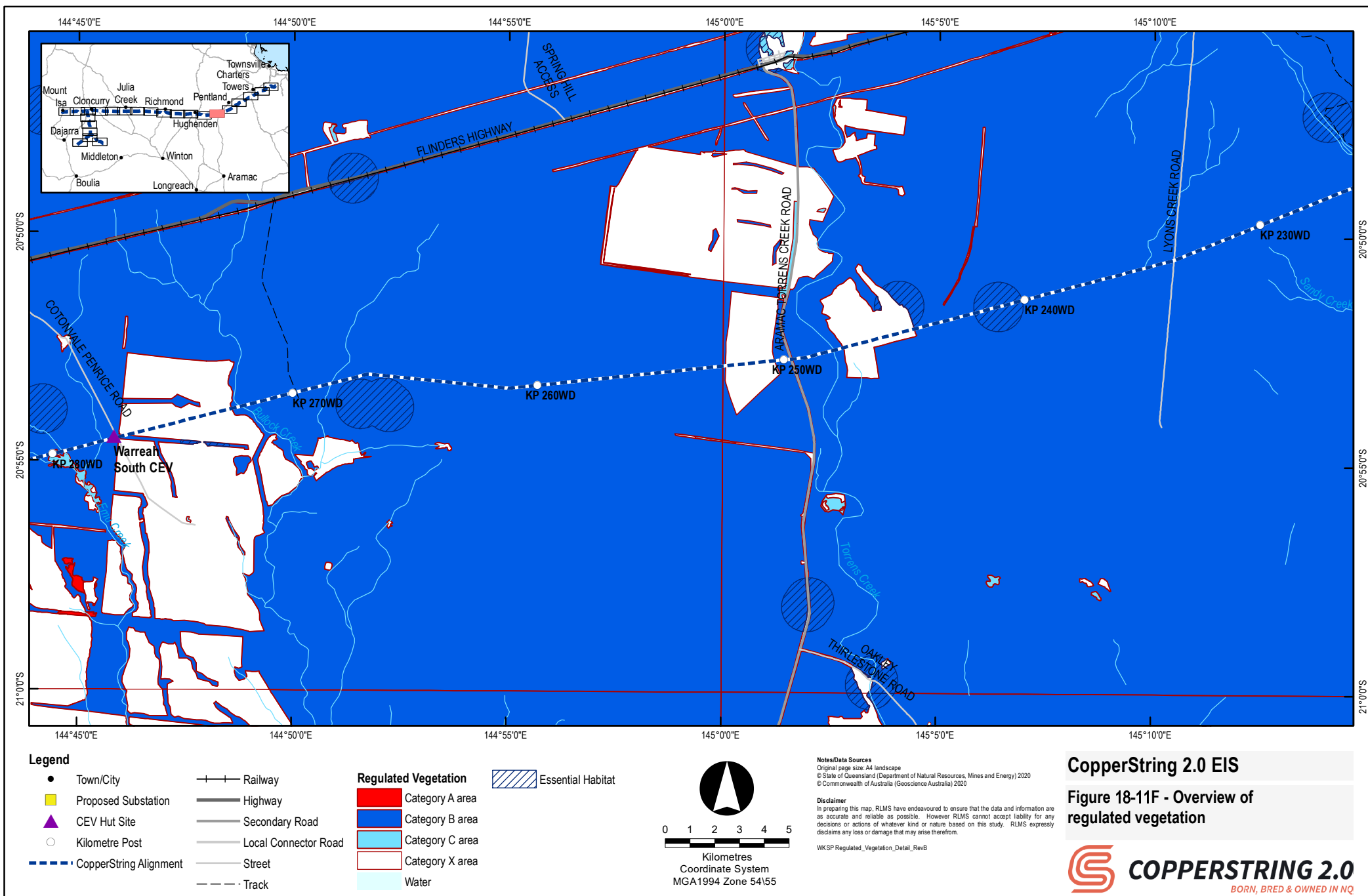


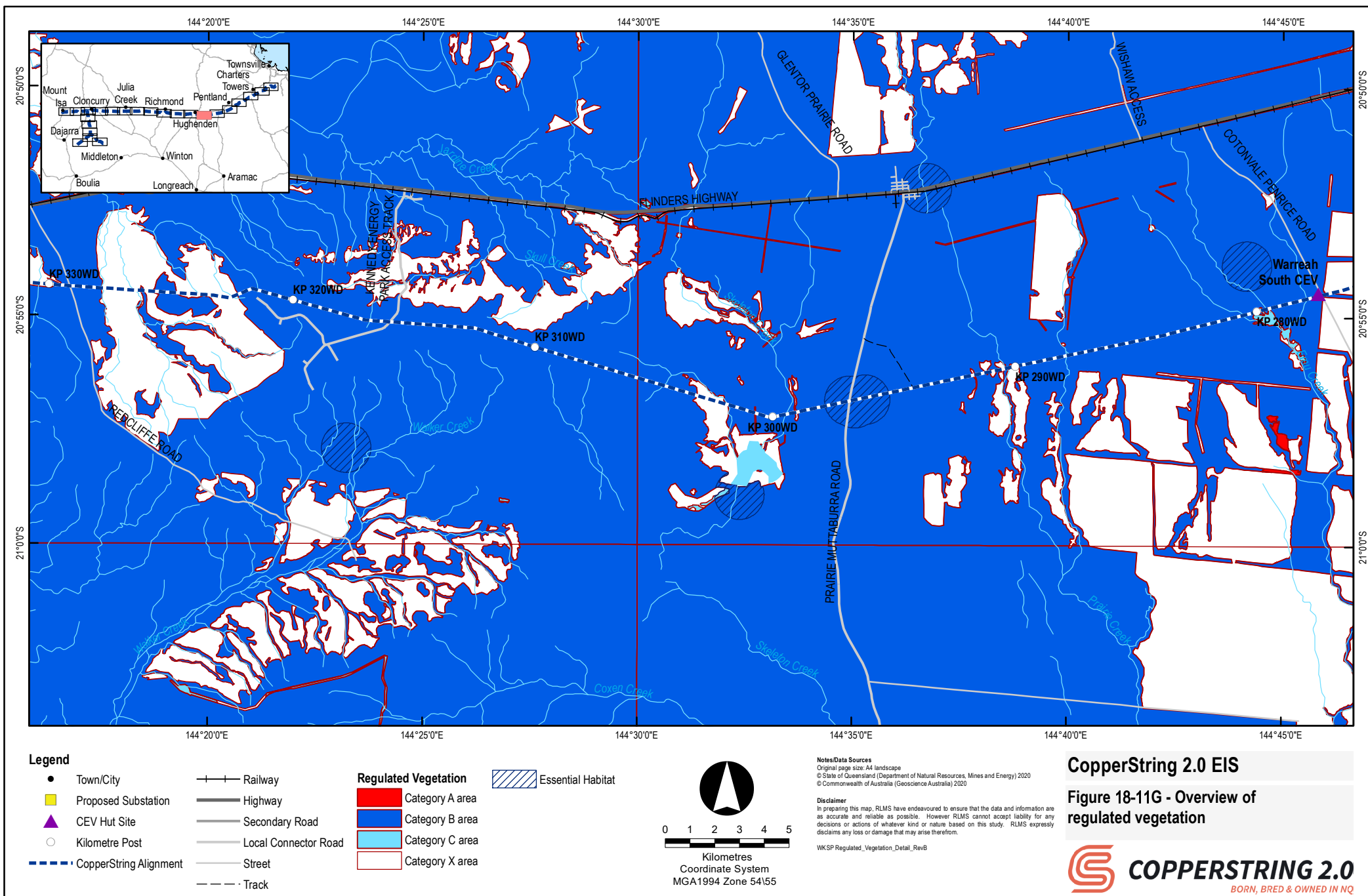


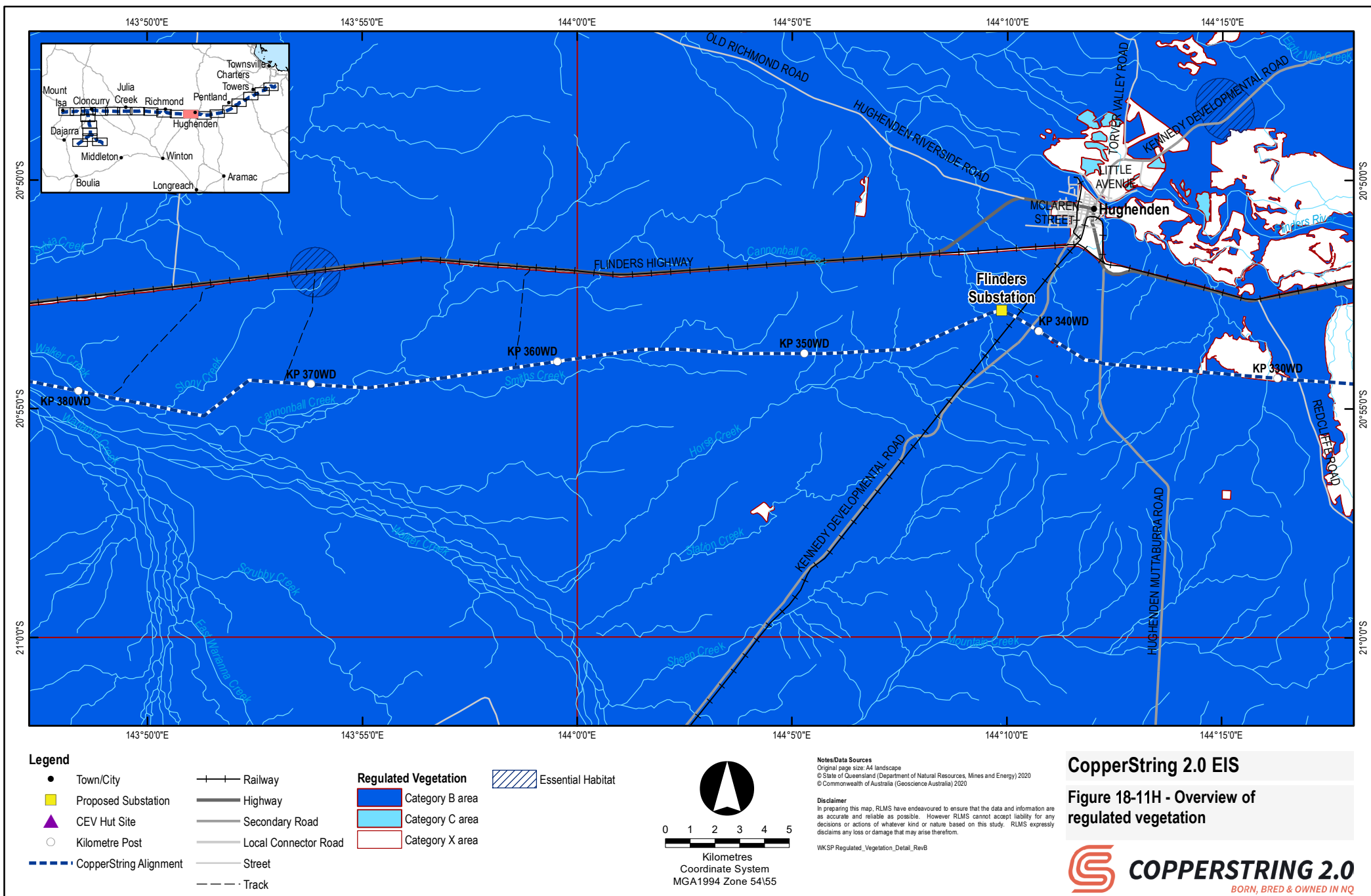


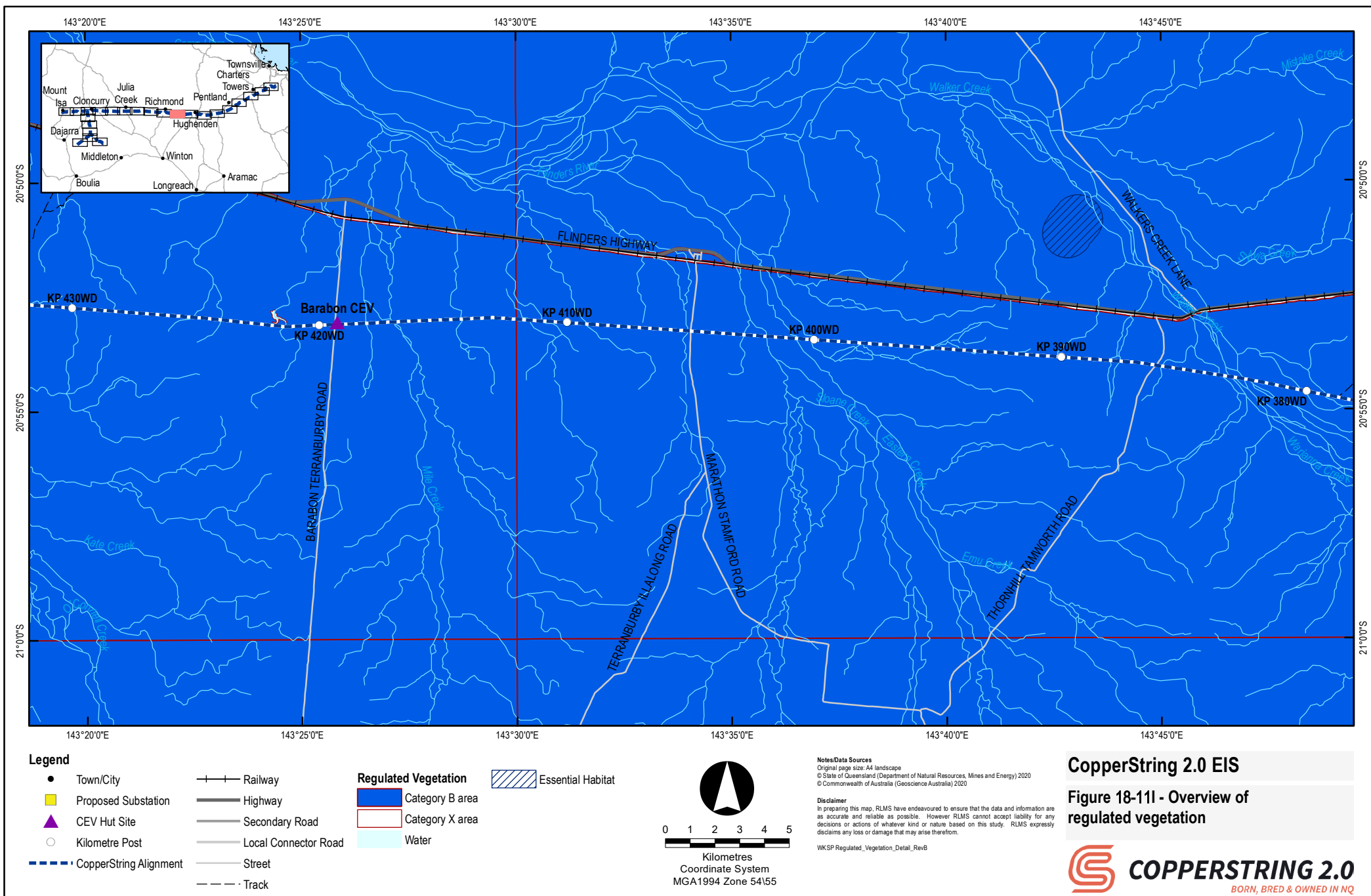


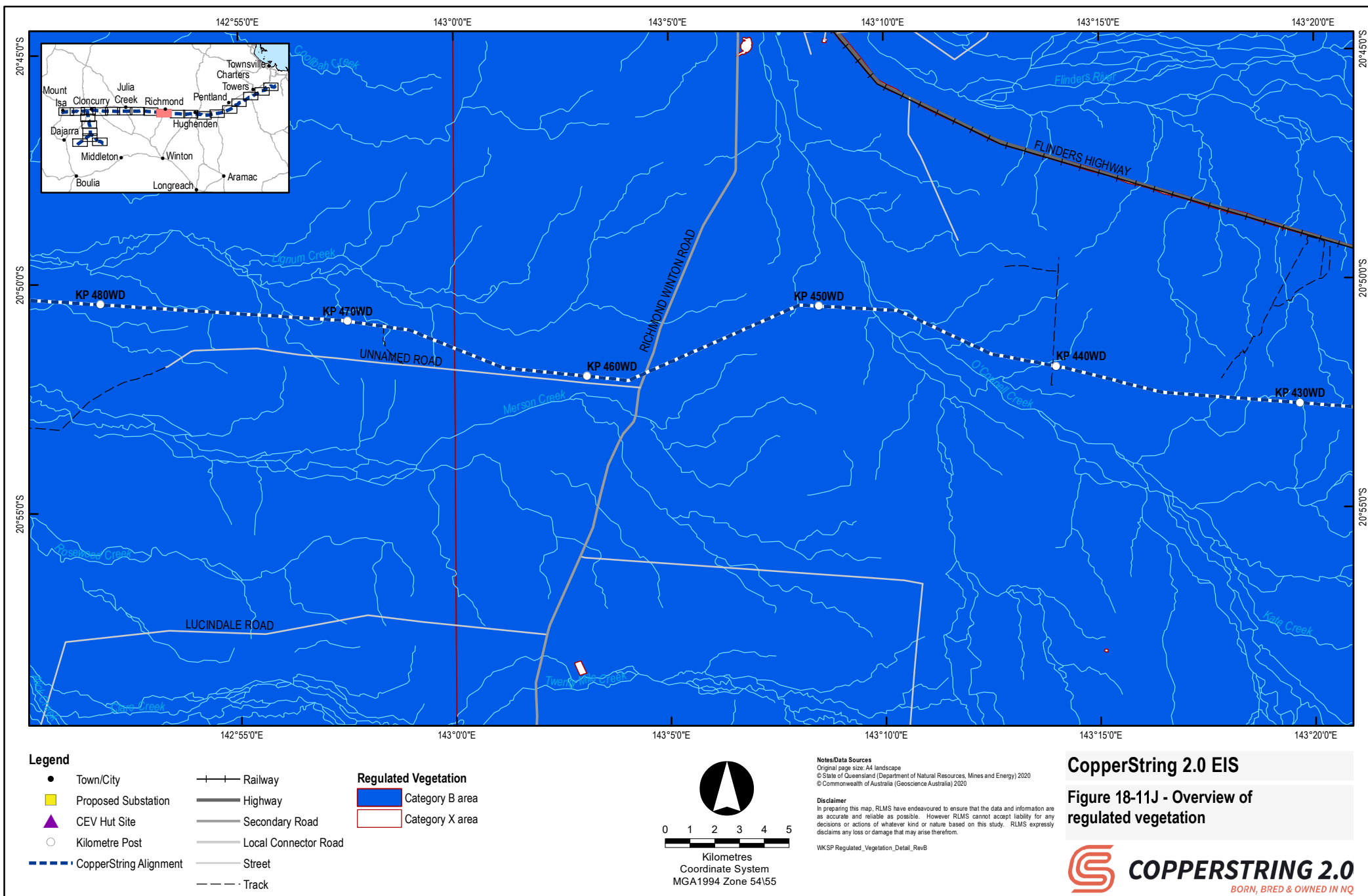


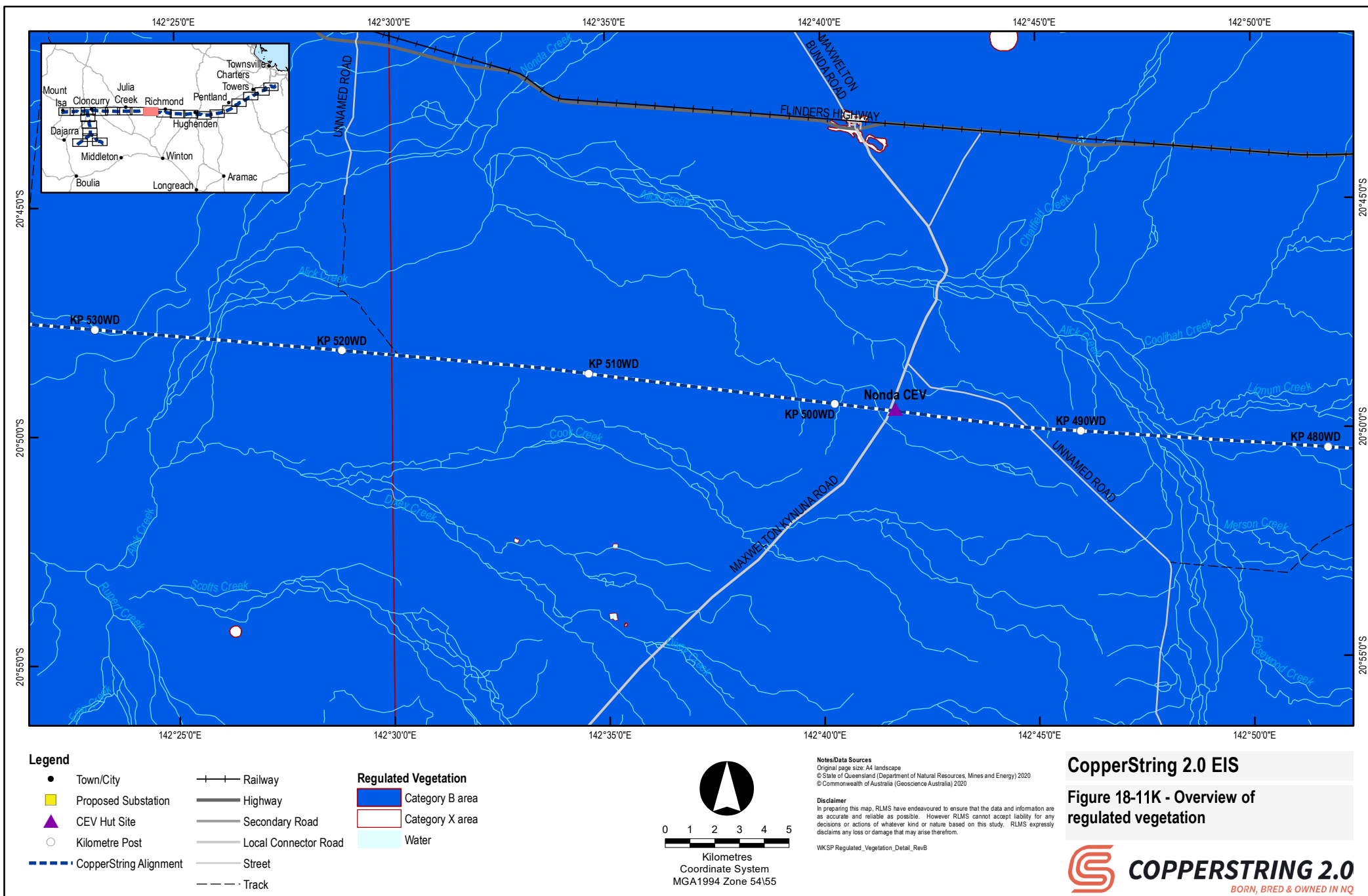


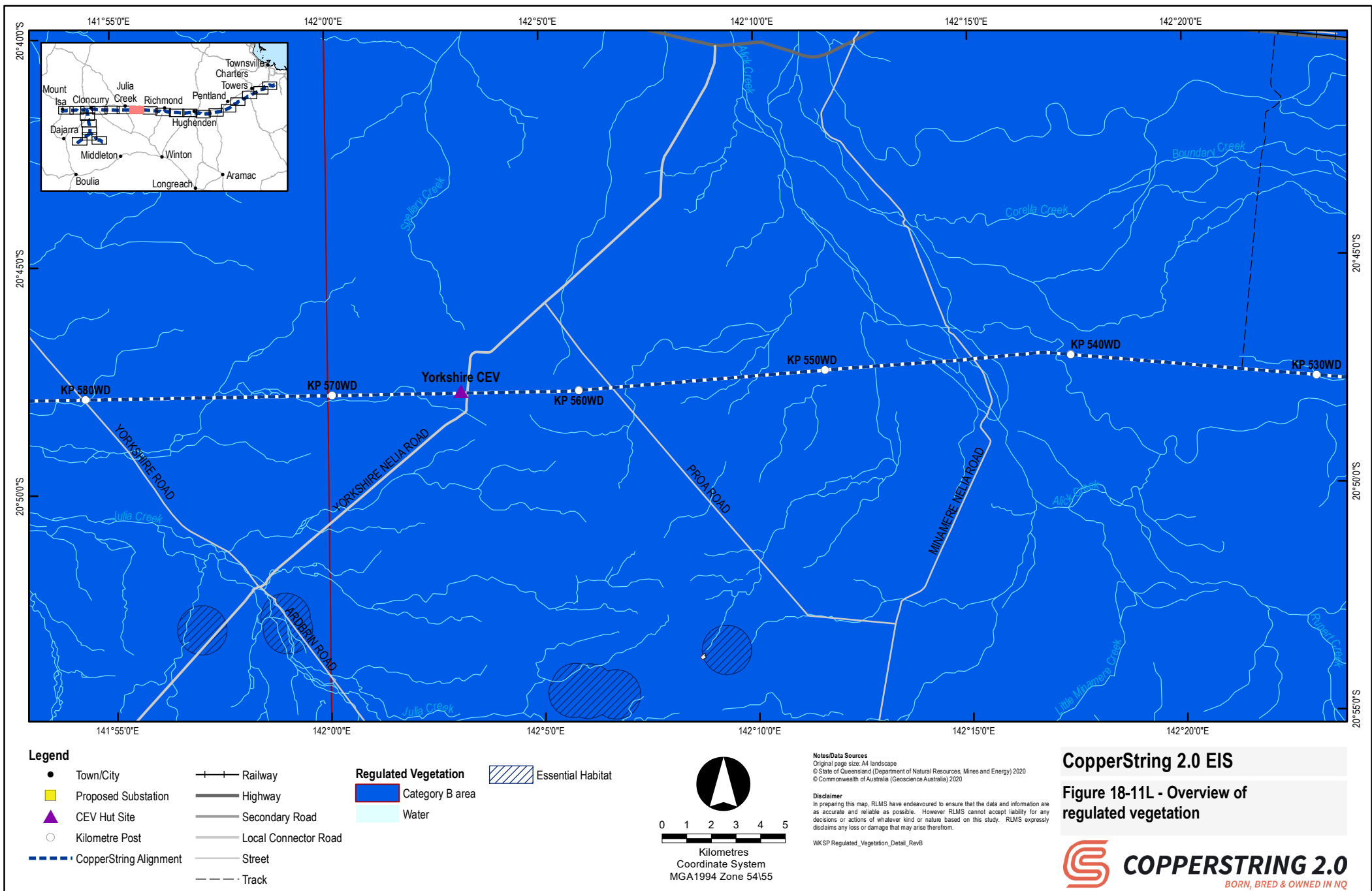


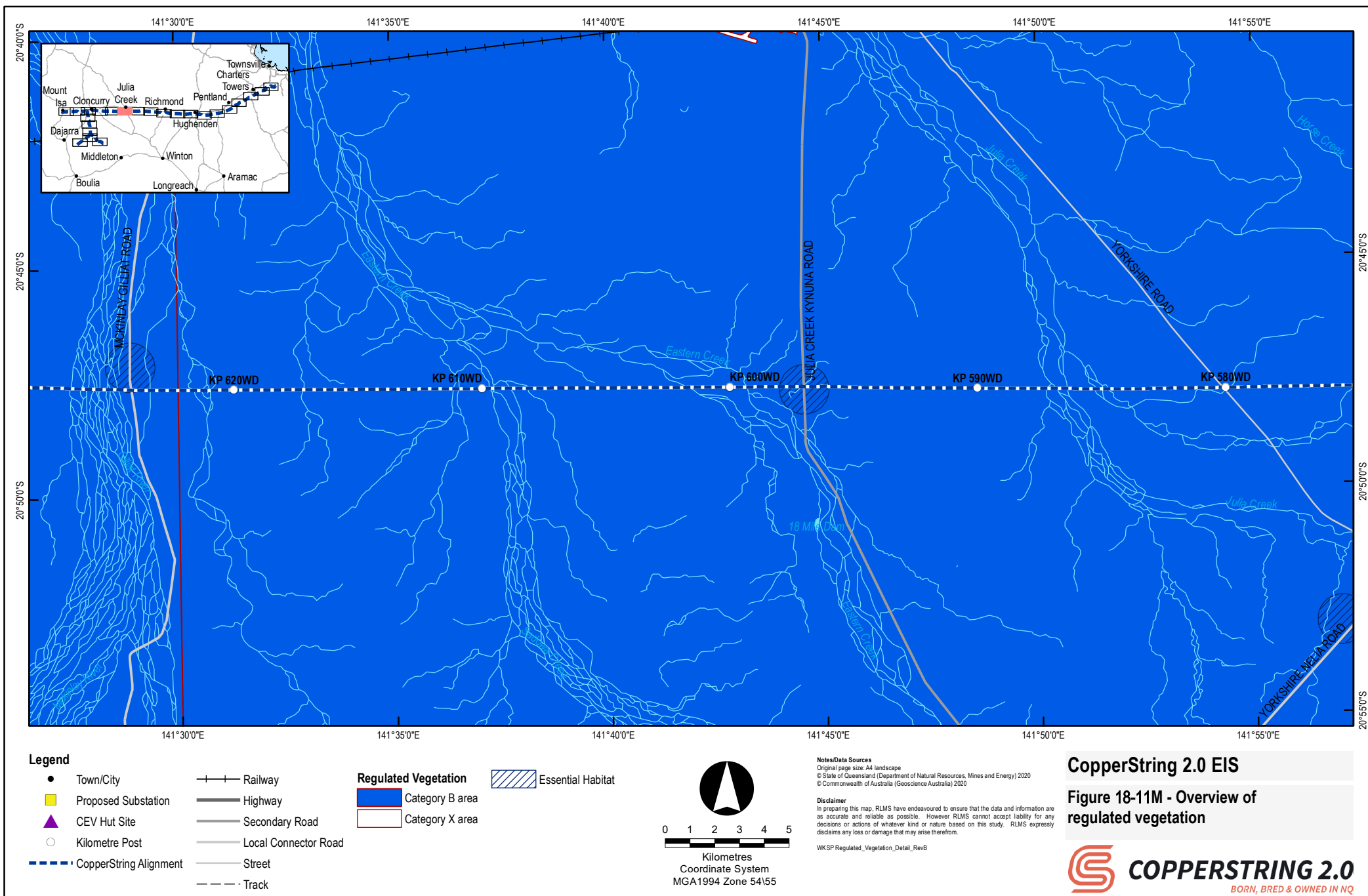


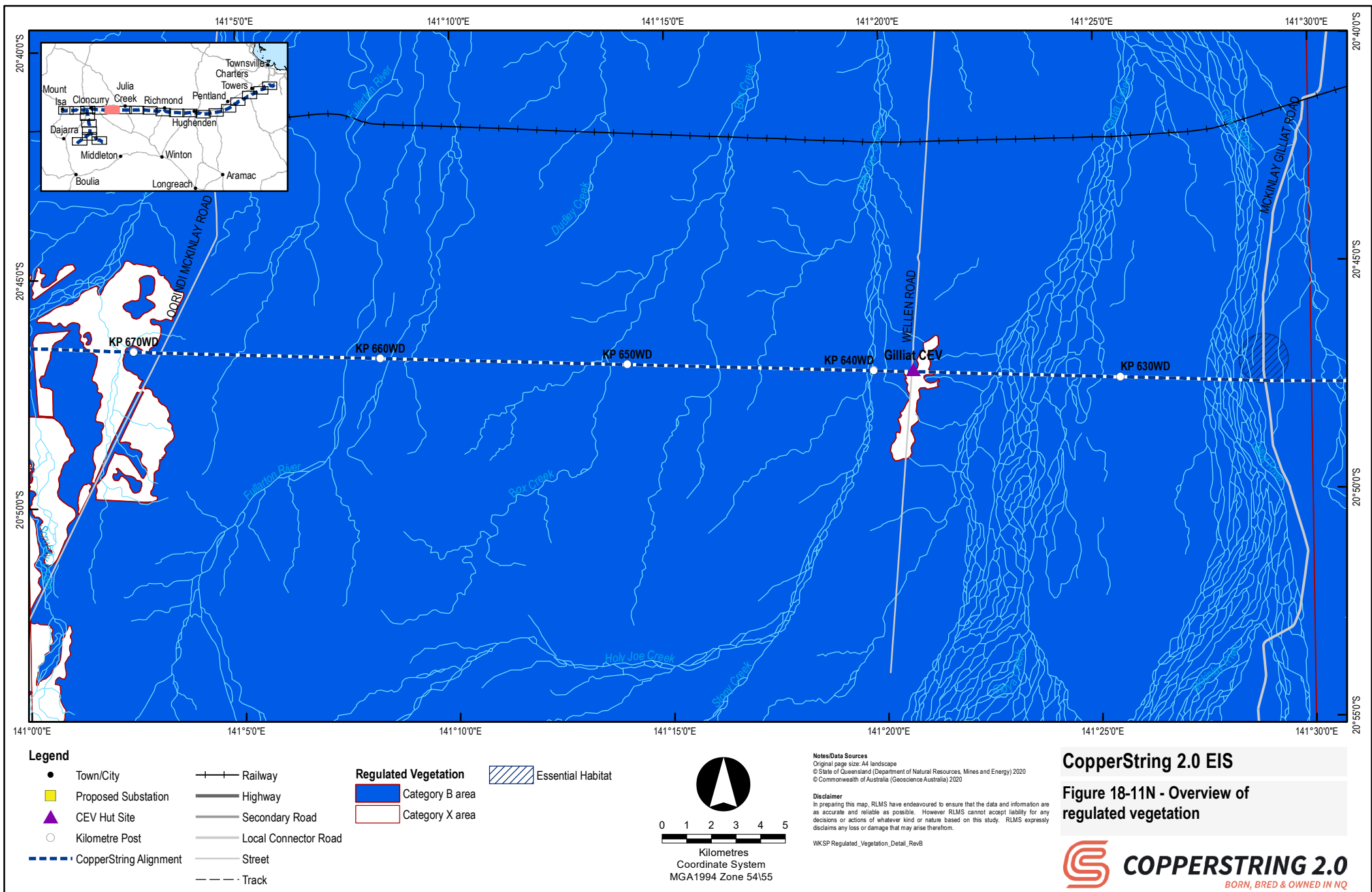


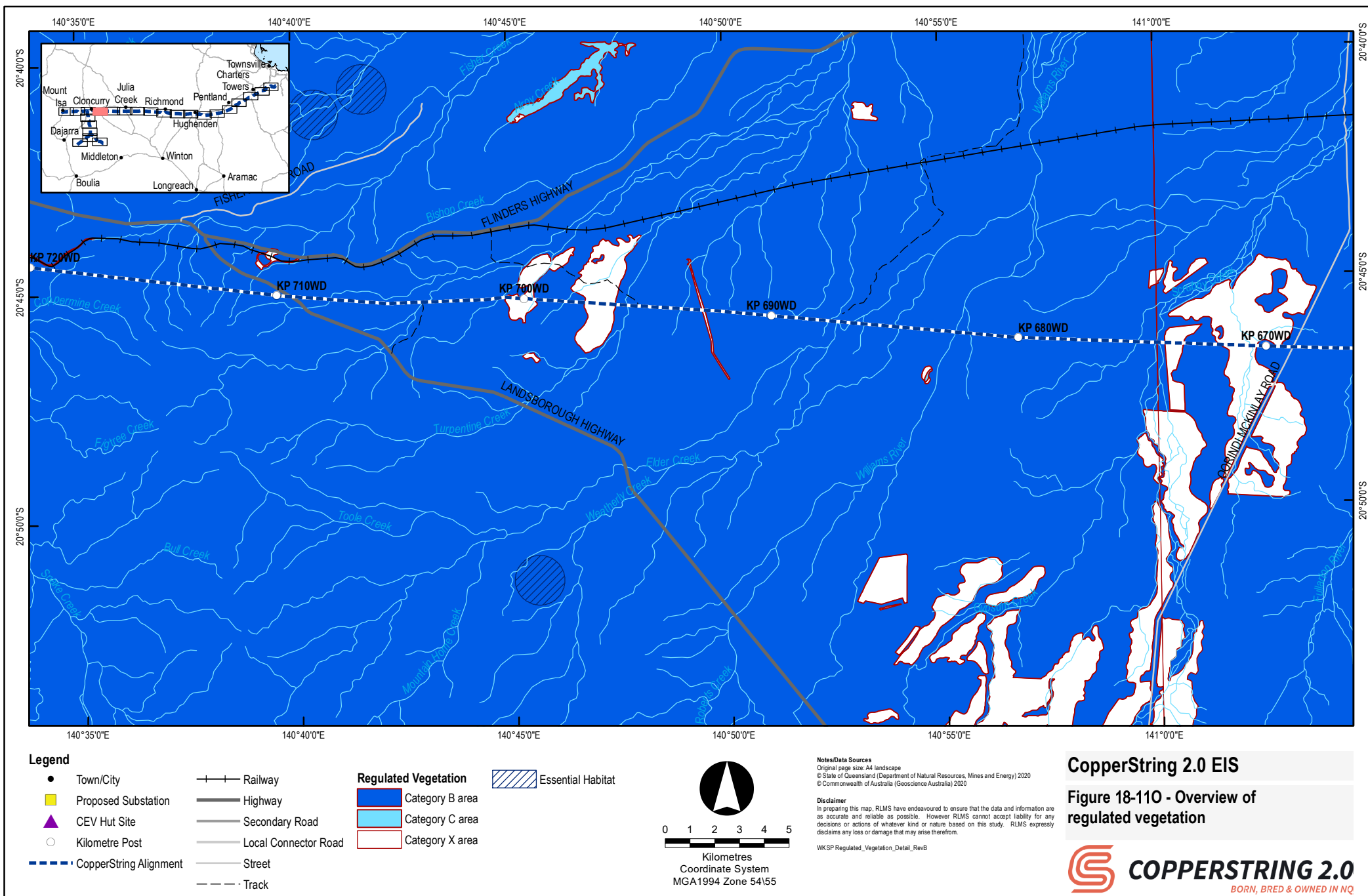


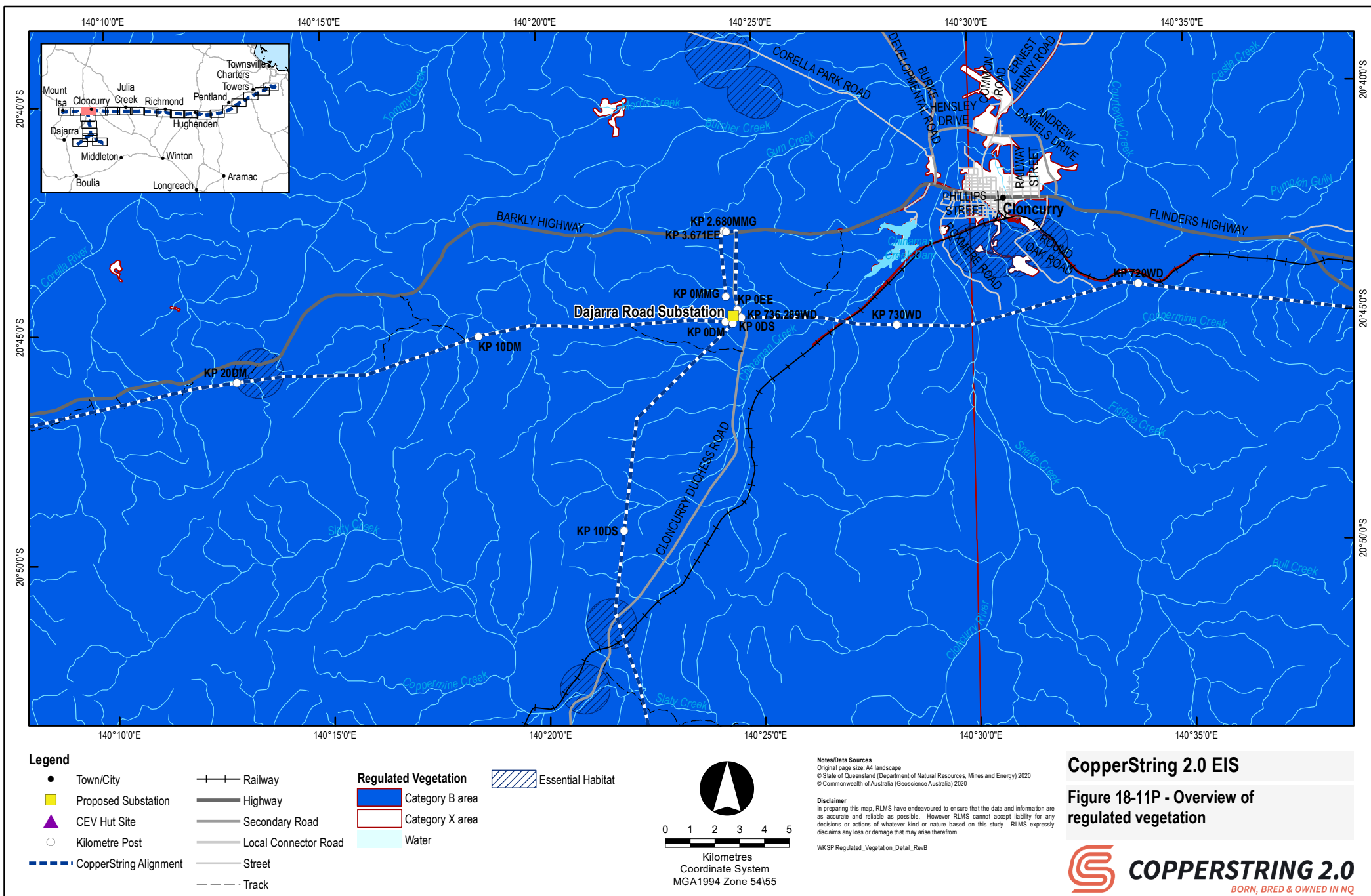


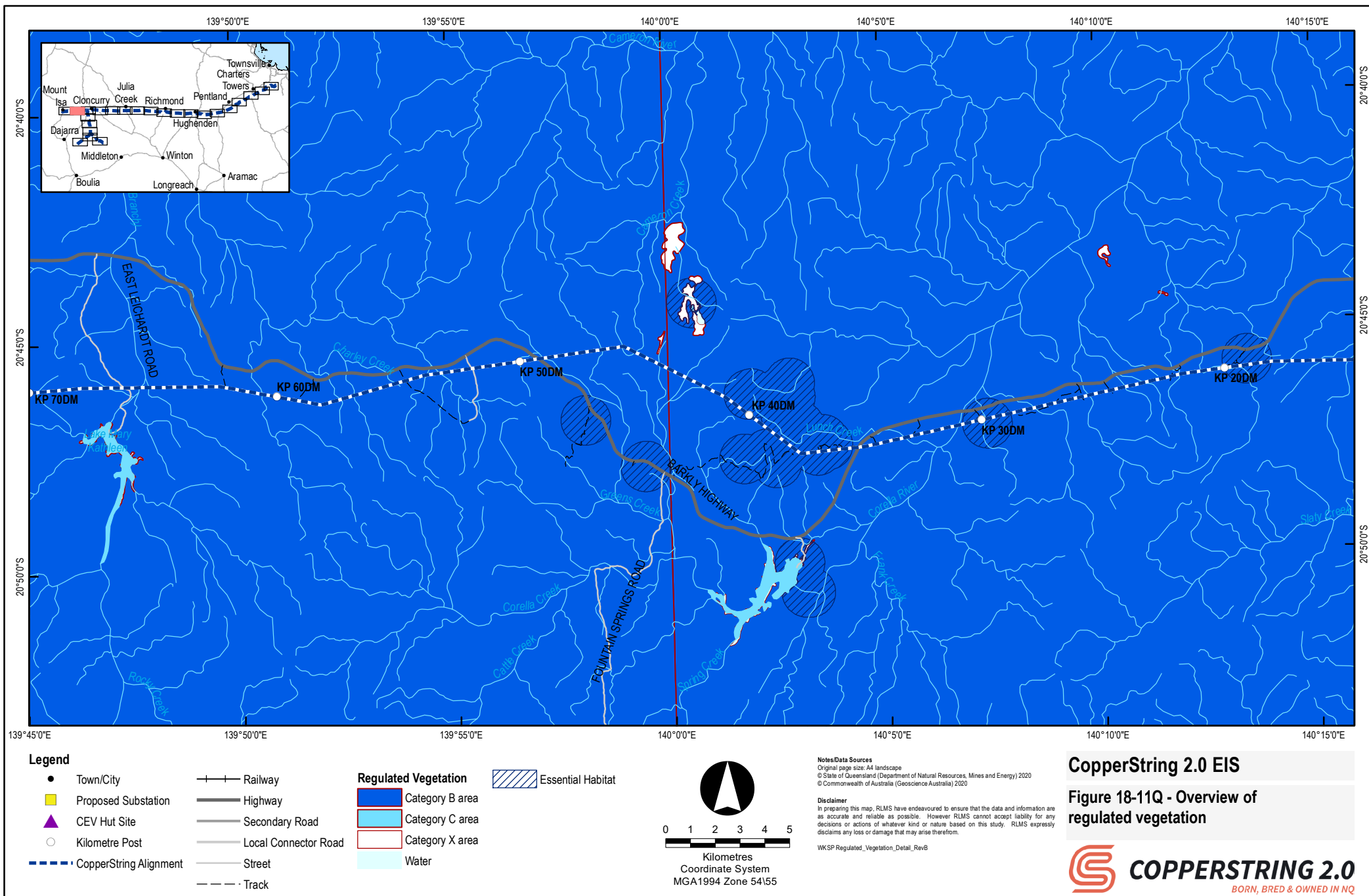


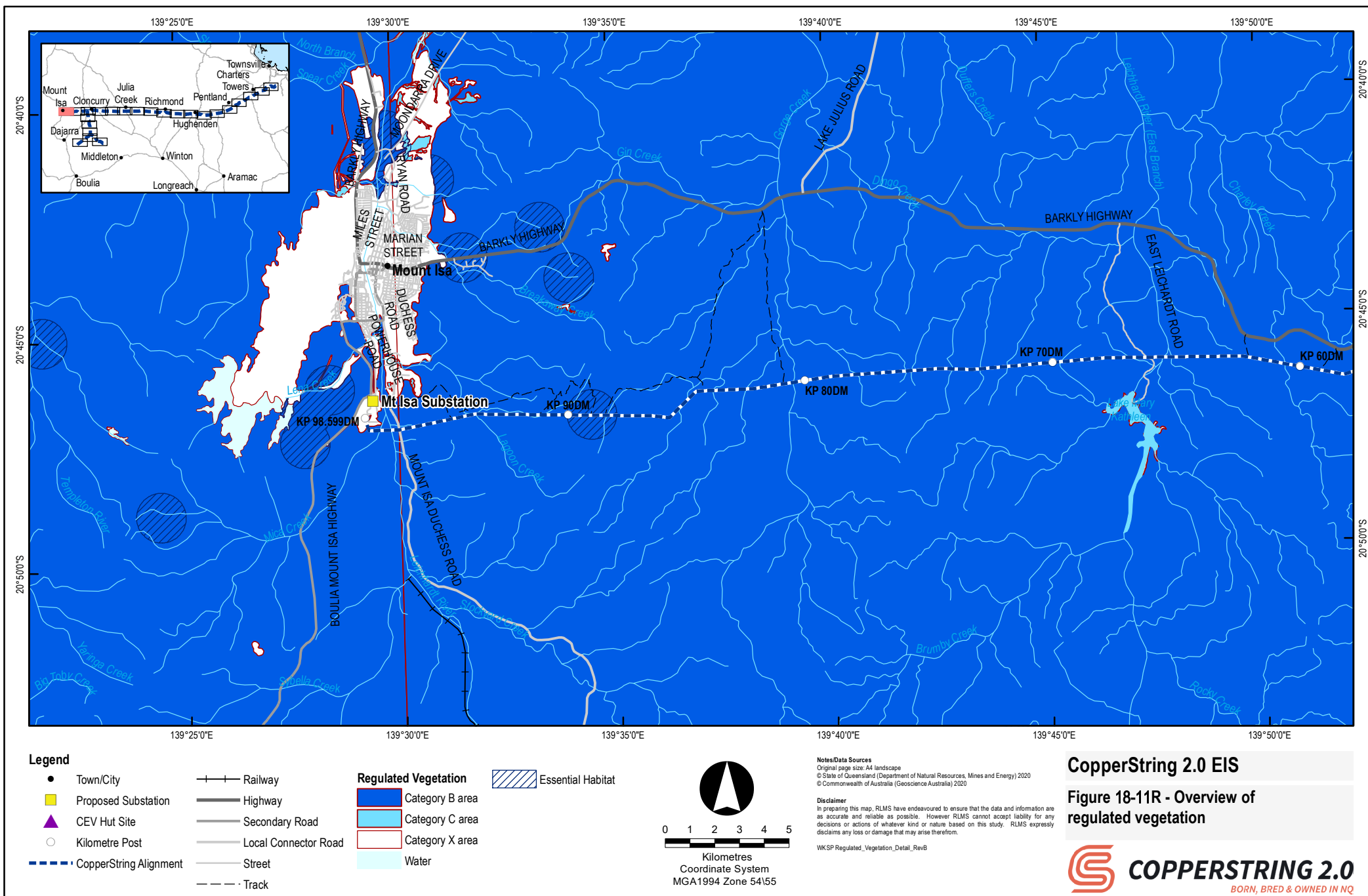


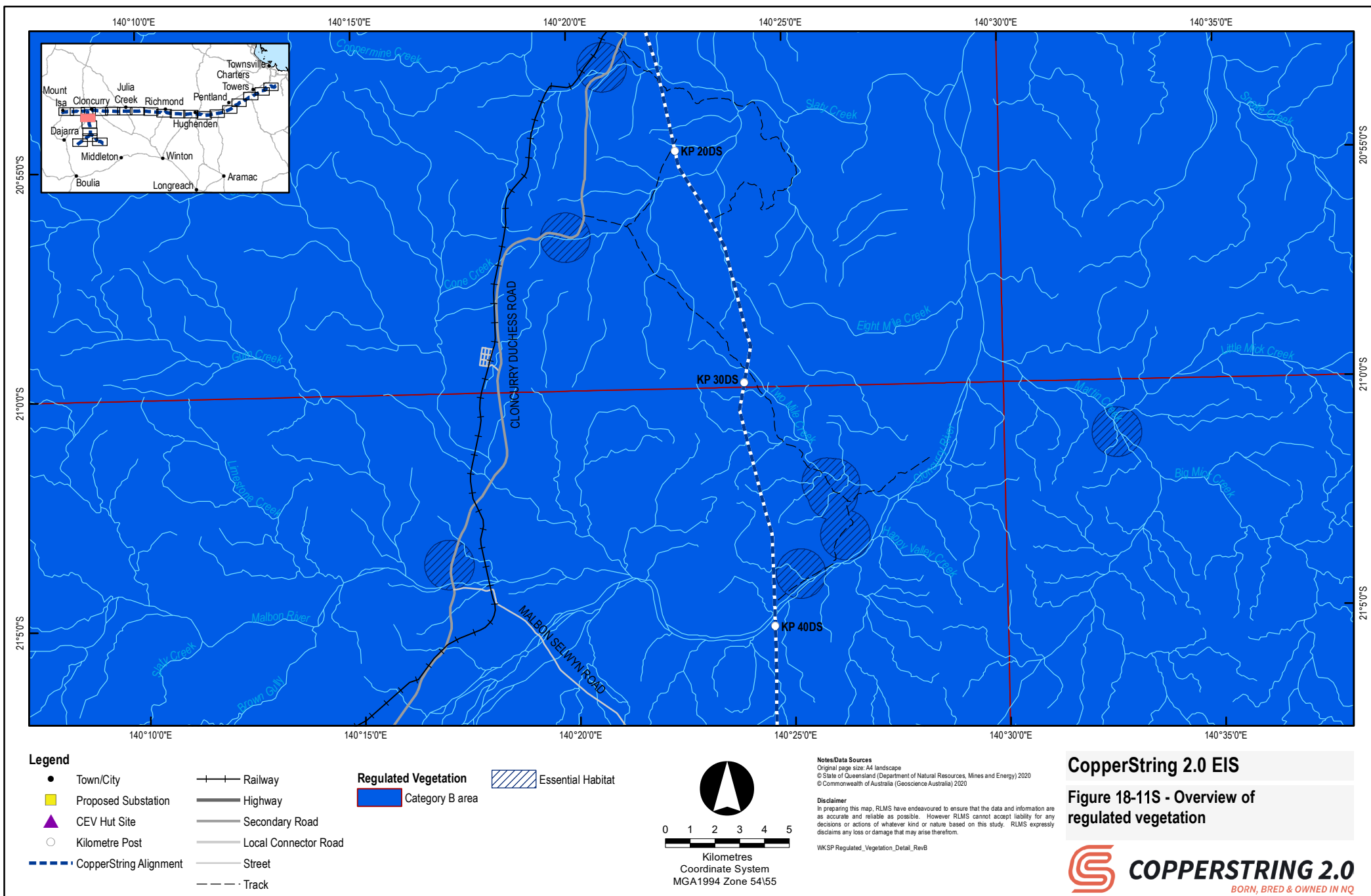


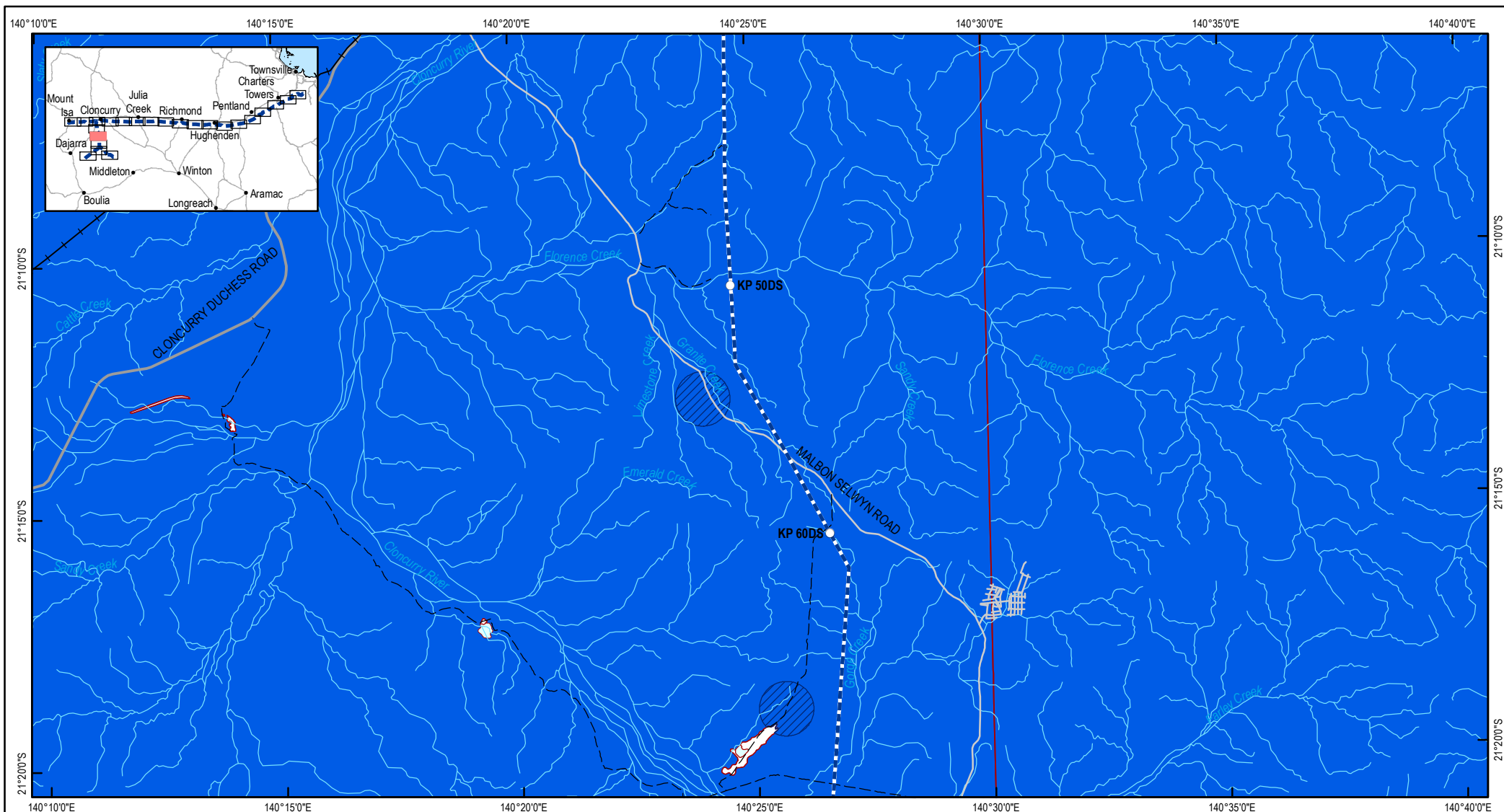












Legend

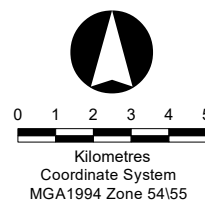
- Town/City
- Proposed Substation
- ▲ CEV Hut Site
- Kilometre Post
- CopperString Alignment
- Railway
- Highway
- Secondary Road
- Local Connector Road
- Street
- Track

Regulated Vegetation

- Category B area
- Category X area
- Water

Essential Habitat

- Essential Habitat



Notes/Data Sources
 Original page size: A4 landscape
 © State of Queensland (Department of Natural Resources, Mines and Energy) 2020
 © Commonwealth of Australia (Geoscience Australia) 2020

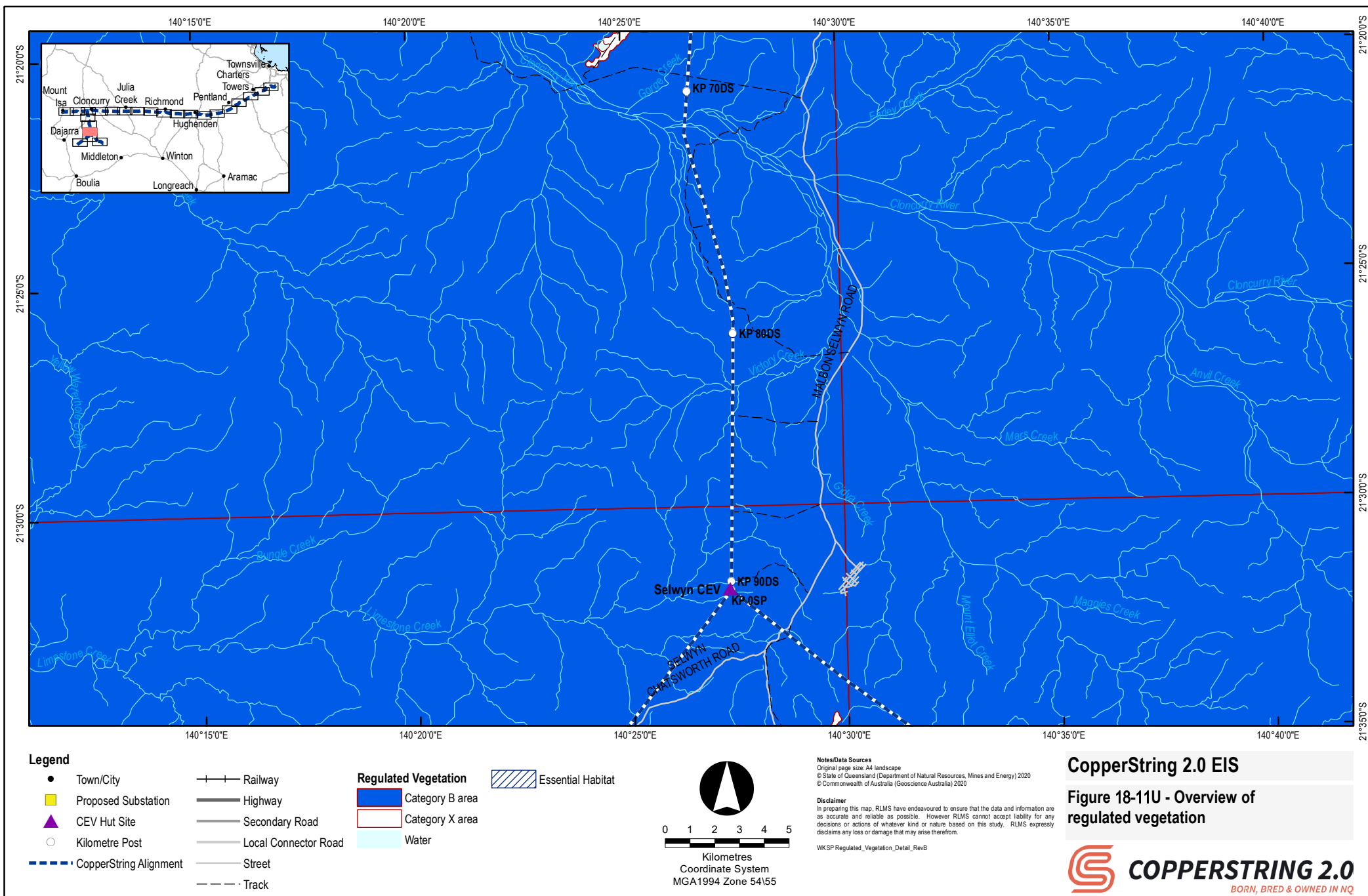
Disclaimer
 In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However, RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

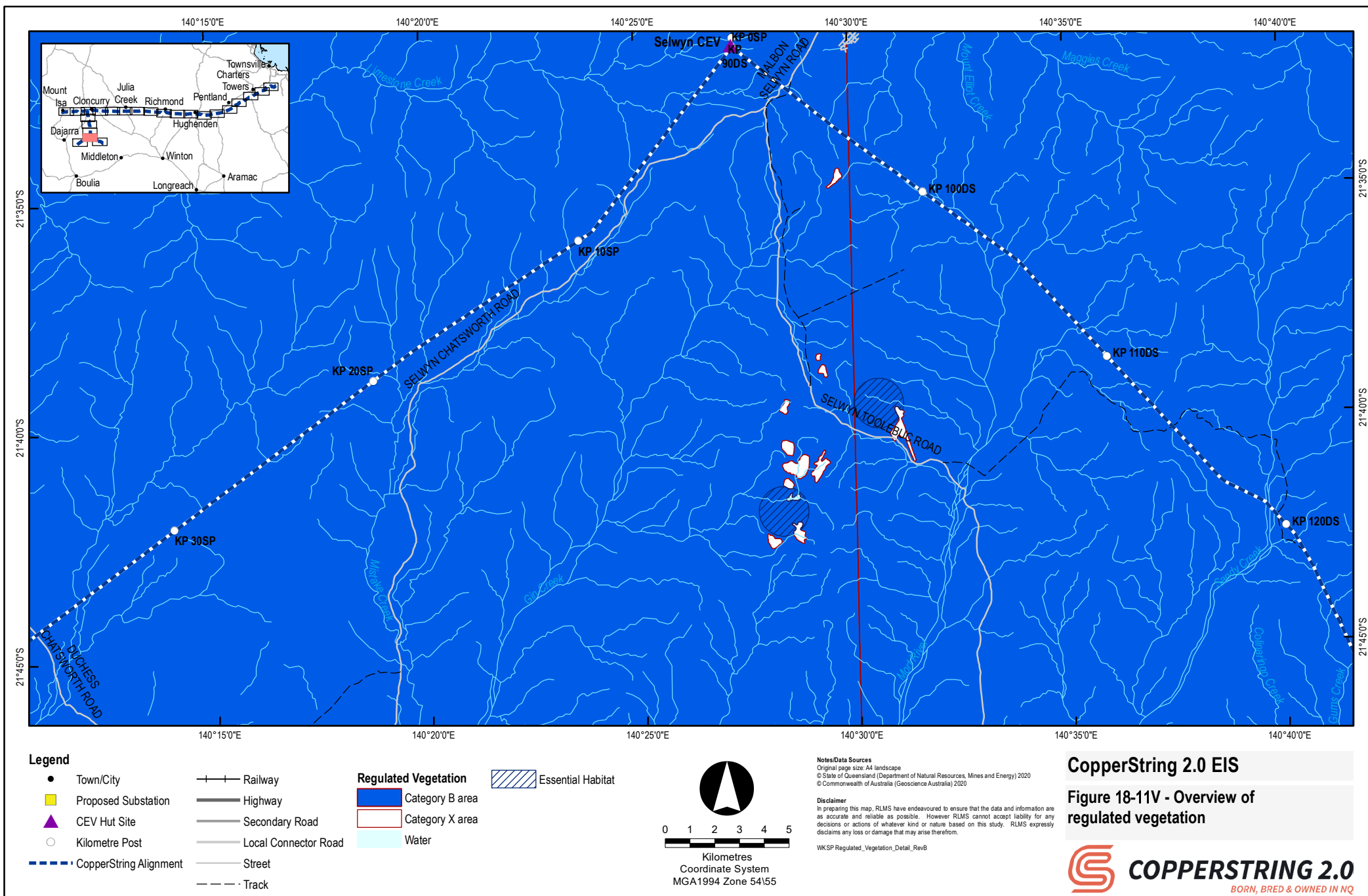
WKSP Regulated_Vegetation_Detail_RevB

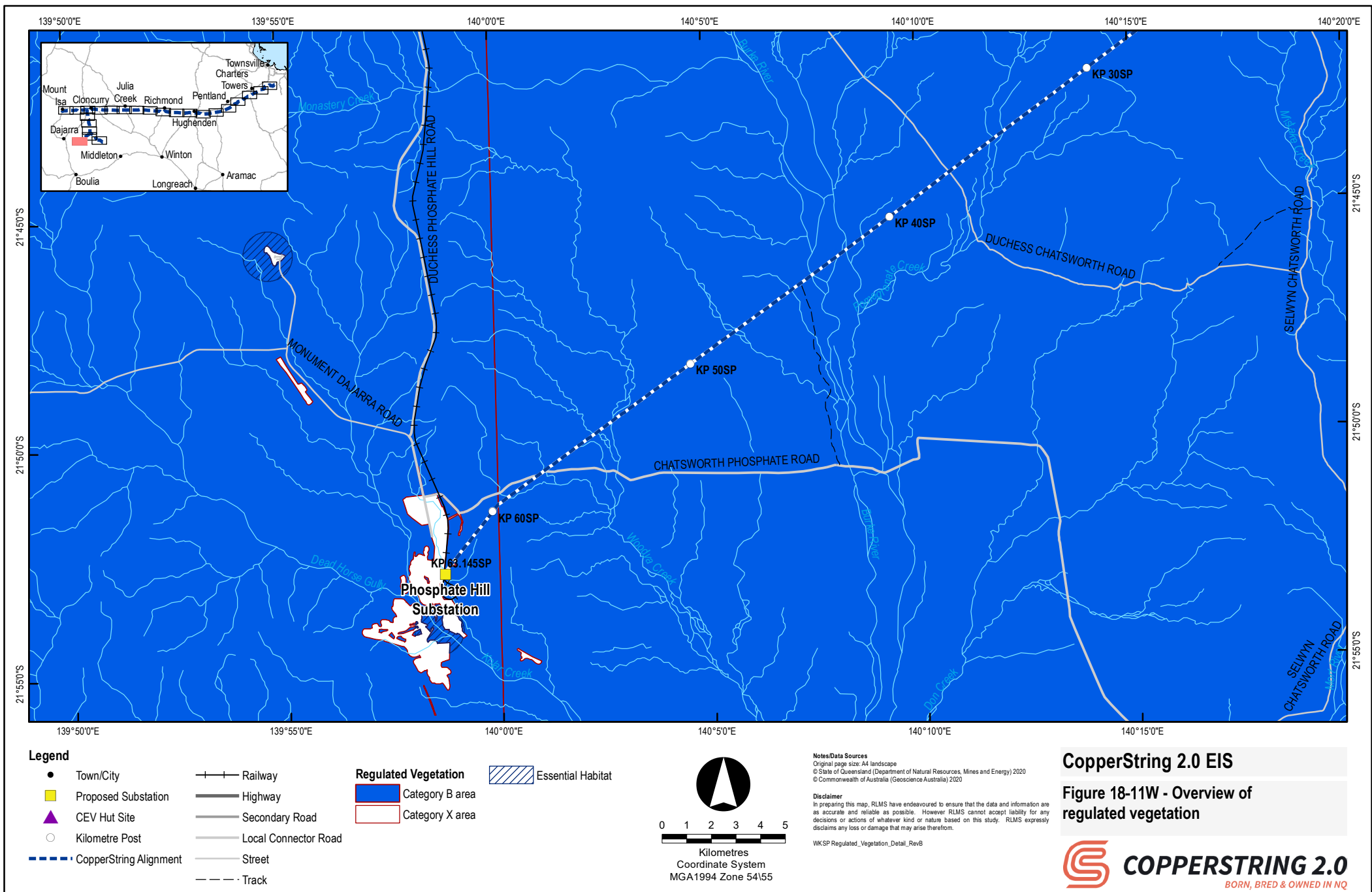
CopperString 2.0 EIS

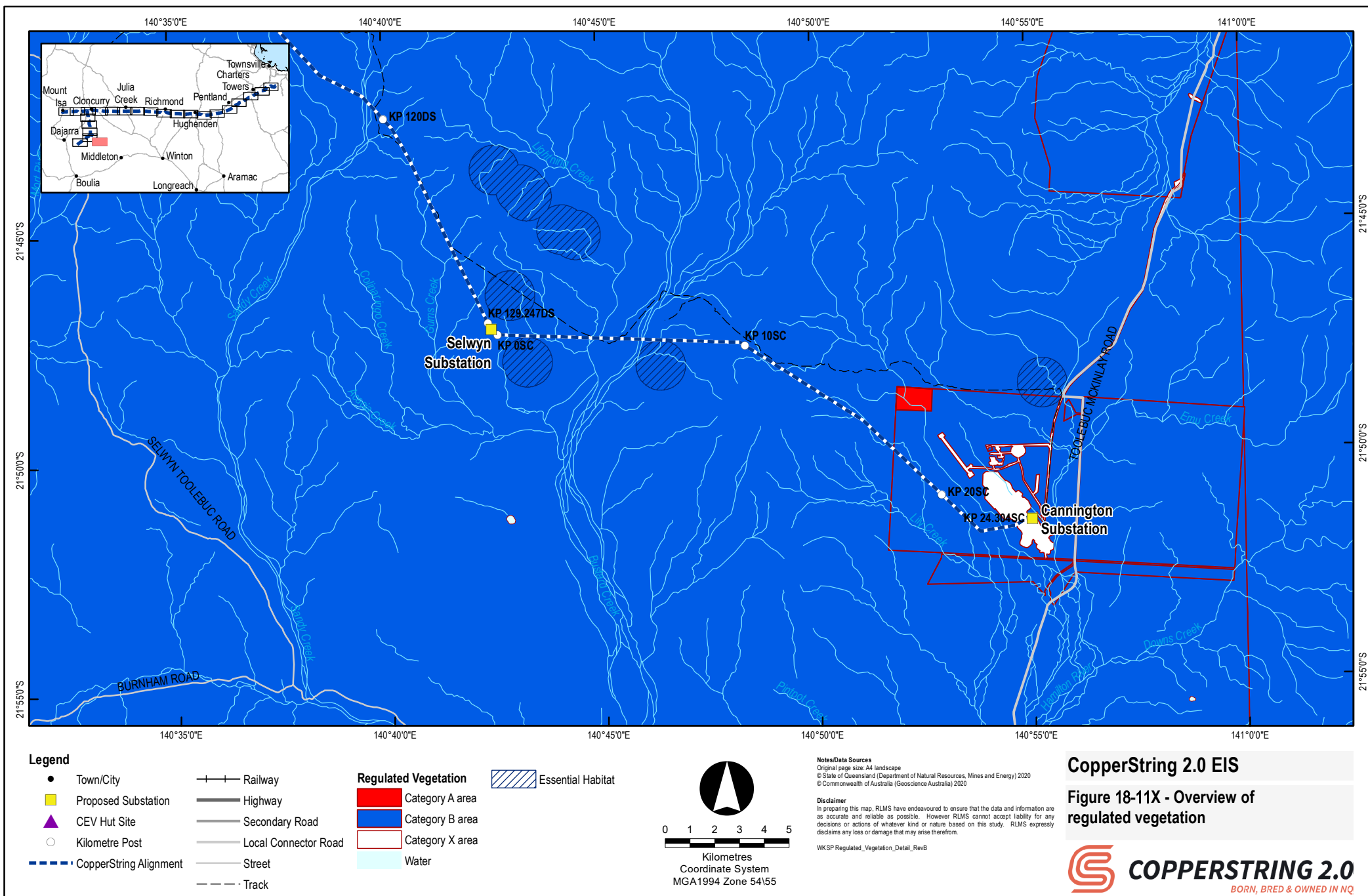
Figure 18-11T - Overview of regulated vegetation

COPPERSTRING 2.0
 BORN, BRED & OWNED IN NQ









18.4.2 World heritage properties

No world heritage areas are located within the study area. The closest world heritage area to the proposed corridor selection is the GBR World Heritage Area (WHA), which is located more than 45 km downstream of the proposed corridor selection. Two catchments intersected by the Project flow into the GBRWHA, being:

- One main tributary of the Haughton River are intersected by the corridor selection within the eastern-most Project area, which flow into the GBRWHA, being Oaky Creek. The watercourse is contained within the Renewable Energy Hub corridor section. Oaky Creek (A) is intersected by the corridor selection at KP48WD. Both creeks are tributaries in the upper reaches of the Haughton River catchment, which drains to the GBRWHA more than 45 km east of the Project.
- Numerous waterways within the Burdekin River catchment are intersected by the Project area, including the Burdekin River and tributaries of Oaky Creek, Pandanus Creek, and tributaries and the main channels of the Campaspe River and Cape River, west until KP 230WD within the Renewable Energy Hub corridor section. These waterways flow into the Burdekin Dam and then into the GBRWHA over 100 km downstream.

The GBR also contains the GBRMP (a MNES) and is a national heritage place (a MNES).

The Wet Tropics of Queensland world heritage property commences approximately 85 km north of the corridor selection and will not be impacted by the project.

18.4.3 National heritage places

No national heritage properties are intersected by the corridor selection. The closest is the GBR, which apart from being a world heritage place is also listed as a national heritage place under the EPBC Act. As discussed in Section 18.4.2, the GBR is located more than 45 km downstream of the proposed corridor selection.

18.4.4 Marine parks

No marine parks are located within the study area. The closest marine park to the proposed corridor selection is the GBRMP, which is located approximately 45 km downstream of the proposed corridor selection. The Haughton River catchment, which intersects the Project within the Renewable Energy Hub corridor section in its upper reaches at KP7WD and KP11WD, drains to the GBRMP. The Burdekin River catchment also drains to the GBRMP further south, more than 100 km downstream of the Burdekin Dam.

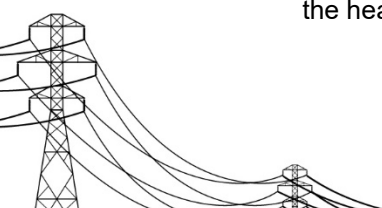
18.4.5 Wetlands of international importance

No wetlands of international importance (Ramsar wetlands) are located within the study area.

Two wetlands of international importance were identified in the PMST search:

- The Coongie Lakes Ramsar wetland, approximately 700-800 km downstream of the CopperString Core corridor section
- The Bowling Green Bay Ramsar wetland, approximately 40 km northeast and downstream of the Renewable Energy Hub corridor section

The Coongie Lakes wetlands are located in South Australia. Although the CopperString Core section is located 700-800 km upstream of the wetland, some of the watercourses within the section (e.g. Towerhill Creek) flow downstream and into the Coongie Lakes Ramsar site. Additionally, the Cannington Mine (within the Cannington Connection at KP152DS) is located at the head of the Hamilton River, which also flows downstream into the Coongie Lakes Ramsar



Site. This wetland system cover approximately 1,980,000 ha of ephemeral and semi-permanent freshwater wetlands. Located within Australia's arid zone, this wetland contains a suite of channels, waterholes, lakes, internal deltas and numerous shallow floodout plains, interdune corridors and swamps. Discharge, flow and inundation within the wetland system is highly variable, with the northern reaches receiving year-round water from Cooper Creek, whilst the southern parts receiving water much less frequently.

The Bowling Green Bay wetlands are located approximately 40 km northeast of the proposed corridor selection within the Haughton River catchment at the eastern-most extent of the Project. The Bowling Green Bay wetlands contains a diverse complex of coastal wetland systems, including inter-tidal seagrass beds, mangrove woodlands and saline saltpan communities on the coast, and brackish to freshwater wetlands inland. This wetland is typical of many coastal and seasonal wetlands in the region, but has a particularly high diversity and wide range of wetland types (DES, 2020a). The Bowling Green Bay Ramsar site provides important habitat for conservation significant marine species such as green turtles, dugong and saltwater crocodiles, and supports substantial numbers (in excess of 20,000) of all Australian waterbird groups, and more than half of the migratory species listed on international conservation agreements (DES, 2020a).

18.4.6 Commonwealth marine areas

No Commonwealth marine areas are within proximity to the study area.

18.4.7 Listed threatened ecological communities

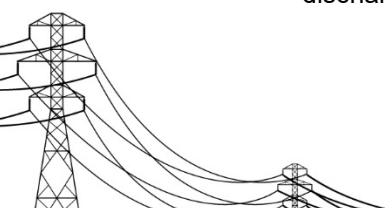
A review of four potentially occurring TECs has been undertaken, including:

- *The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin* (Endangered under the EPBC Act)
- *Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions* (Endangered under the EPBC Act)
- *Brigalow (Acacia harpophylla dominant and co-dominant)* (Endangered under the EPBC Act)
- *Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin* (Endangered under the EPBC Act)

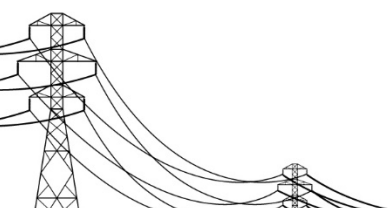
18.4.8 Desktop results

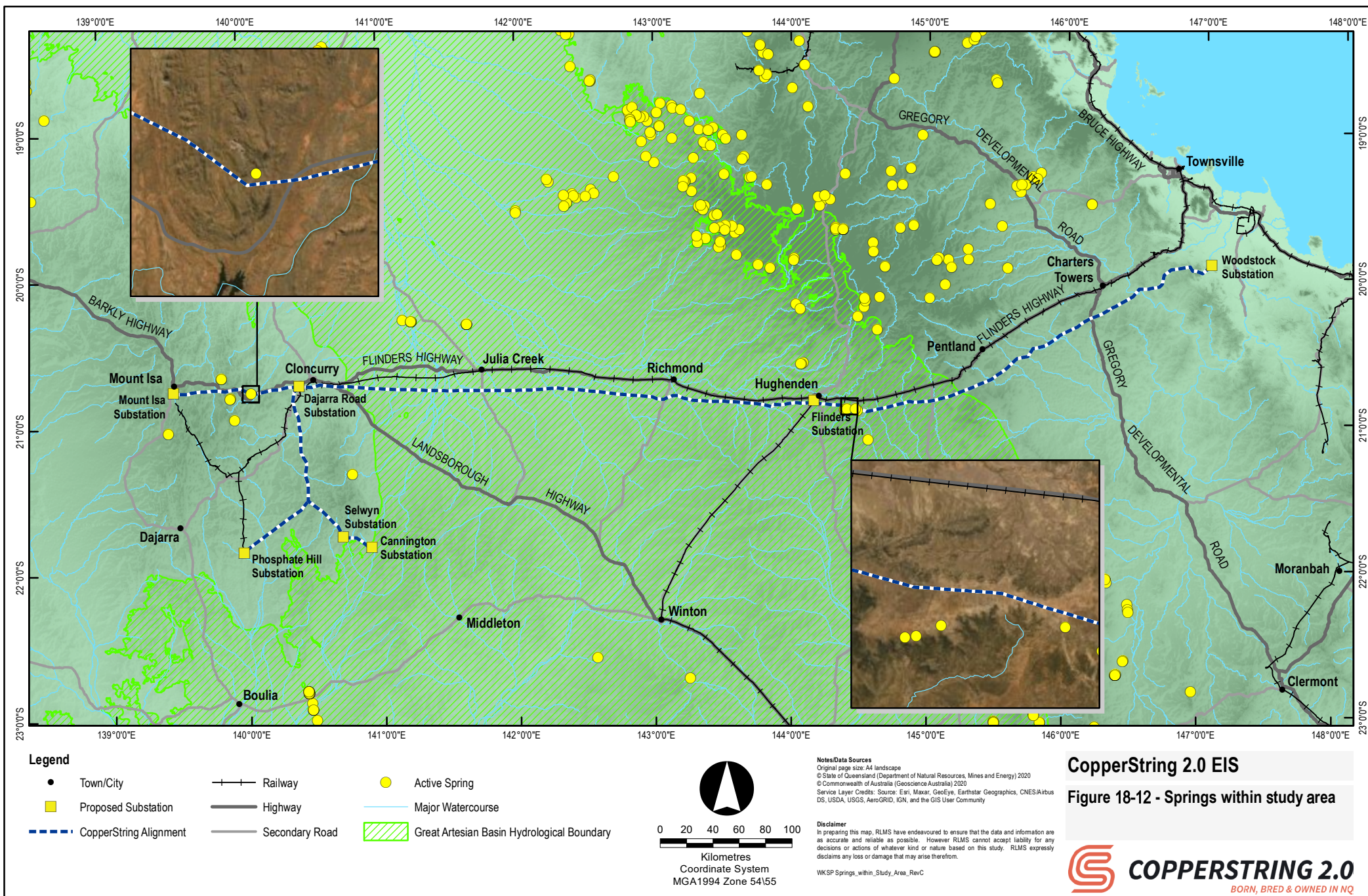
Community of native species dependent on natural discharge of groundwater from the Great Artesian Basin

One TEC was identified by the PMST search as likely to occur within the study area, namely *the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin* TEC (Endangered under the EPBC Act). This TEC includes communities of native species growing in association with springs in discharge areas of the Great Artesian Basin (and not located in Tertiary aquifers) that are part of the following regional ecosystems: RE 2.3.39, 4.3.22, 5.3.23, 6.3.23, 10.3.31 and 11.3.22. None of these REs are mapped within the corridor selection (DoEE, 2019a). Furthermore, no springs are intersected by the corridor selection as show in Figure 18-12. The closest active discharge spring in the Great Artesian Basin is Bauhinia springs, located approximately 50 km north of the corridor selection at KP 608WD. Bauhinia springs is one of only three shallow-water alkaline discharge springs remaining active in the Flinders River supergroup (Fensham *et. al*, 2016). Several inactive discharge springs occur within the vicinity of the CopperString Core but none is within 5 km of



the corridor selection. These springs are completely inactive as a result of aquifer drawdown from bores.





Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

While not indicated in the PMST search, previous surveys reported in the 2011 SEIS identified the *semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions* TEC (Endangered under the EPBC Act) within the study area. This TEC was recorded 200 m south of the 2010/2011 corridor between KP 68WD and 71WD, with additional small patches directly intersected by the 2010/2011 corridor at KP 71WD. The TEC patches identified in the 2011 SEIS have been avoided by the Project corridor selection. The mapped TEC patches are shown in Figure 18-13. The following description of the TEC was provided by BAAM in the 2011 SEIS:

"The dominant extent of this community occurs on residual sands supporting an uneven canopy ranging between 6-18 m in height with a percent canopy cover of 40%. Characteristic canopy species are *Pleiogynium timorense*, *Acacia fasciculifera*, *Acacia disparrima*, *Lysiphyllum carronii*, *Pouteria cotinifolia* var. *pubescens*, *Diospyros humilis*, *Brachychiton australis*, *Alphitonia excelsa*, *Gyrocarpus americanus* subsp. *americanus*, *Terminalia* sp., *Terminalia oblongata* subsp. *oblongata*, *Geijera salicifolia*, *Lysiphyllum carronii*, *Niemeyera antilogum*, *Denhamia oleaster*, *Wrightia millgar*, *Alectryon oleifolius* subsp. *elongatus*, *Ehretia membranifolia*, *Drypetes deplanchei*, and *Flindersia maculata*. The shrub layer is between 1-4 m and with 50-60% cover consisting of the above listed species. Groundcover achieves 60% cover with typical species of *Perotis rara*, *Malvastrum americanum**, *Triumfetta rhomboidea**, *Eragrostis* sp., *Ocimum tenuiflorum*, *Sporobolus australiensis*, and *Pterocaulon sphacelatum*."

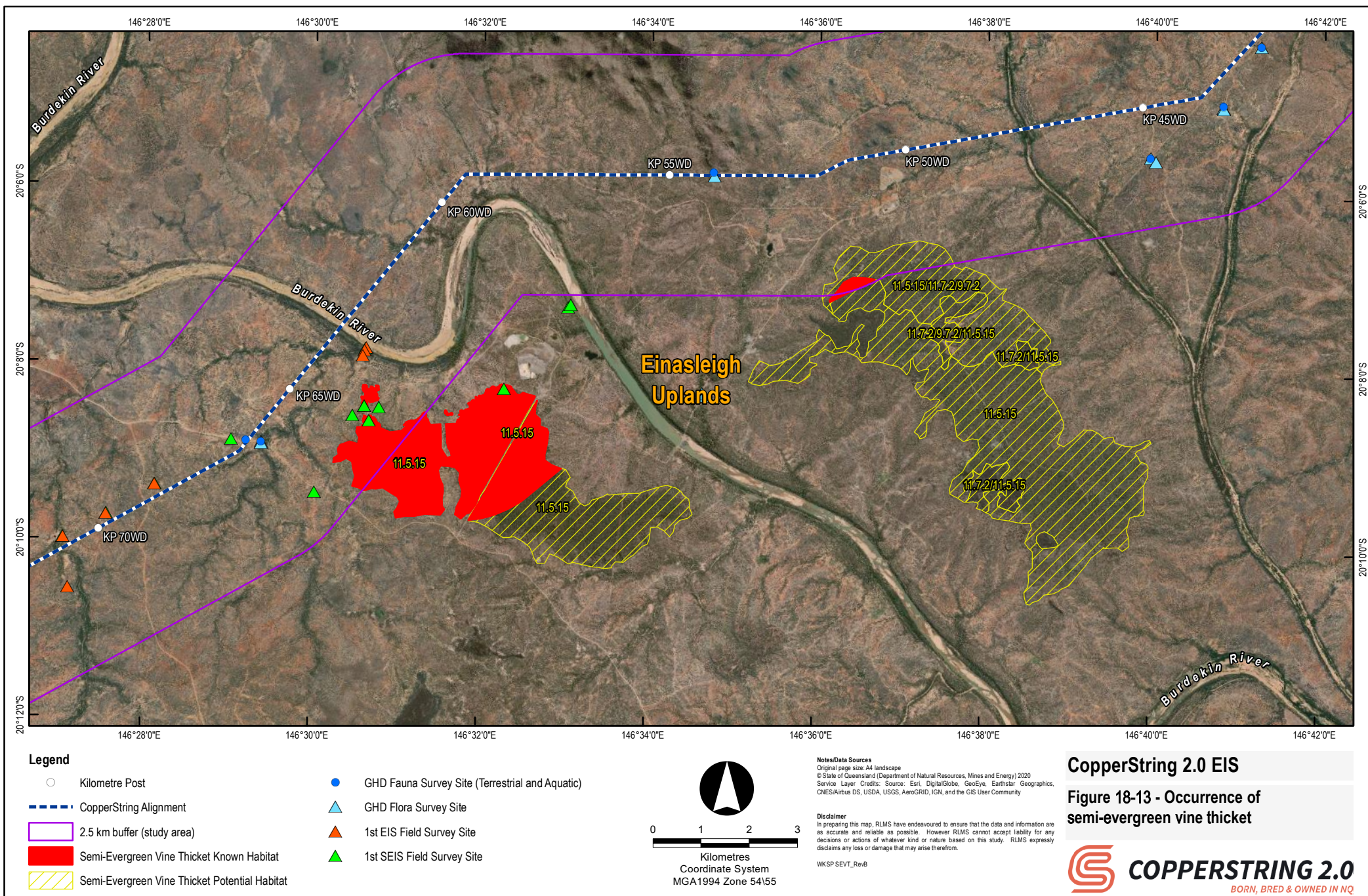
No other areas containing the regional ecosystems considered to be analogous to this TEC within the Brigalow Belt Bioregion (RE 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, 11.11.18 and 11.7.1x1) are mapped within the study area. There are some small patches north and south of the Project area between KP 10 and 13WD that were field-verified by BAAM in 2011 as containing RE 9.12.8 (semi-evergreen vine thicket on steep ravines), which are not listed as comprising the TEC in the Commonwealth Listing Advice (TSSC, 2001) or the National Recovery Plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community (McDonald, 2010).

Brigalow (Acacia harpophylla dominant and co-dominant)

No *Brigalow (Acacia harpophylla dominant and co-dominant)* TEC (Endangered under the EPBC Act) is mapped or has been previously identified within the study area. No regional ecosystems considered to be analogous to this TEC within the Queensland Brigalow Belt Bioregion (RE 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14 and 11.12.21) have been mapped within the study area. The northernmost extent of the predicted distribution of the TEC is 50 km south of the corridor selection (Environment Australia, 2003).

Natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin

No *natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin* TEC (Endangered under the EPBC Act) has been previously identified or mapped within the study area. No regional ecosystems considered to be analogous to this TEC (RE 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.12, 11.11.17) are mapped within the corridor selection (DoEE, 2019a). The northernmost extent of the predicted distribution of the TEC is 125 km south of the corridor selection (DEWHA, 2008).



CopperString 2.0 EIS

Figure 18-13 - Occurrence of semi-evergreen vine thicket

18.4.8.1 Survey results

The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin TEC was identified within the PMST as having potential to occur in the CopperString Core section of the study area. Field surveys undertaken did not identify this community within the study area, nor were the listed corresponding REs recorded or mapped in the study area. Furthermore, no active discharge springs were observed within the study area. Therefore, this TEC is not considered to occur in the study area and is not anticipated to be impacted by the Project.

Several patches of the *semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* TEC were recorded by BAAM (2011) in the study area, the closest of which is approximately 1.1 km beyond the corridor selection. The corridor selection has avoided these TEC patches and they will not be impacted by the Project. No suitable habitat for this TEC occurs within the corridor selection. The mapped TEC patches are shown in Figure 18-13.

The *Brigalow (Acacia harpophylla dominant and co-dominant)* TEC was not recorded in the study area. No REs equivalent to the TEC or vegetation communities meeting the diagnostic criteria for the TEC were observed by GHD in the 2019 survey. BAAM (2011) also concluded that the TEC was unlikely to occur based on the results of the revised vegetation mapping and associated field observations. No suitable habitat for this TEC occurs within the study area and it is not anticipated to be impacted by the Project.

The *natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin* TEC was not recorded in the corridor selection. No REs equivalent to the TEC or vegetation communities meeting the diagnostic criteria for the TEC were observed by GHD in the 2019 survey. No suitable habitat for this TEC occurs within the study area and it is not anticipated to be impacted by the Project.

An assessment of the likelihood of occurrence (based on distributions and habitat requirements, mapped distributions, and the results of habitat assessments and field surveys conducted within the study area) determined that, apart from the *semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* TEC that was confirmed present in the study area; all other TECs identified in the desktop assessment were unlikely to occur in the study area.

18.4.9 Listed threatened flora species

18.4.9.1 Desktop results

A review of the PMST and Wildlife Online databases identified nine flora species listed under the EPBC Act that have been historically recorded or may have suitable habitat present within the desktop search extent (refer to Table 18-24). The presence of an additional two listed threatened species (not recorded in desktop searches) was required to be considered under the terms of reference for the EIS, namely *Eucalyptus paedoglauca* (Vulnerable under the EPBC Act) and *Dichanthium queenslandicum* (Endangered under the EPBC Act).

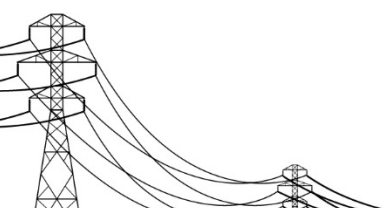
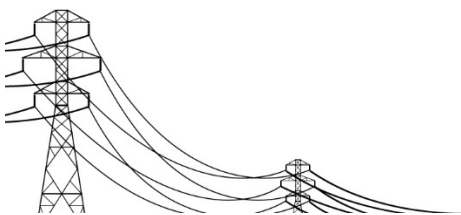


Table 18-27 Listed threatened flora species predicted to occur or historically recorded in desktop searches

Scientific name	Common name	EPBC Act Status	Mount Isa Augmentation	Southern Connection	Phosphate Hill Connection	Cannington Connection	CopperString Core	Renewable Energy Hub
<i>Acacia crombiei</i>	Pink gidgee	V					PMST; WO	PMST; WO
<i>Aristida granitica</i>		E						WO
<i>Bulbophyllum globuliforme</i>	Miniature moss orchid	V						PMST
<i>Dichanthium setosum</i>	Blue grass	V						PMST
<i>Eucalyptus raveretiana</i>	Black ironbox	V						PMST; WO
<i>Livistona lanuginosa</i>	Waxy cabbage palm	V					WO	WO
<i>Marsdenia brevifolia</i>		V						PMST
<i>Omphalea celata</i>		V						PMST
<i>Tephrosia leveillei</i>		V						PMST

Key: E – Endangered; V – Vulnerable; PMST – Protected Matters Search Tool; WO – Wildlife Online



18.4.9.2 Copperstring 1.0 threatened flora findings

Of the listed threatened flora species targeted in the 2010 and 2011 surveys, two were confirmed present in the study area, two were designated as may occur and one was considered unlikely to occur. The results of the Copperstring 1.0 assessments with respect to listed threatened flora species are summarised in Table 18-25.

Table 18-28 Listed threatened flora species

Flora species	EPBC Act status	Likelihood of occurrence	Source
Confirmed present			
<i>Eucalyptus raveretiana</i> Black ironbox	V	Targeted and confirmed present: At the Burdekin River crossing (KP 61WD-66WD), with a plot survey recording five mature trees and two juveniles (7 trees/ha) (populations on the eastern side were not surveyed although considered likely to occur). At Oaky Creek (KP 38-40WD) – a plot survey along the western bank found 31 mature trees and seven juveniles (38 trees/ha), with similar density observed on the eastern bank, occurring on the immediate banks and on the alluvial terrace extending to 20 m from the top of the bank, and up to 500 m upstream and downstream. Habitat was in moderate conditions with infestations of <i>Cryptostegia grandiflora</i> (rubber vine) and <i>Ziziphus mauritiana</i> (chinee apple). Other potential habitat identified in the desktop study was field surveyed and found to be heavily degraded by weeds with no populations recorded.	2010 EIS, 2011 SEIS
<i>Livistona lanuginosa</i> Waxy cabbage palm	V	Targeted and confirmed present: At the Campaspe River crossing at KP 114WD-115WD and 129WD-130.5WD in REs 10.3.13 and 10.3.14. Species counts within 10 survey plots found 57 individuals occurring as scattered populations along the riverbanks and in-stream islands. Considered that the species may occur at KP 116WD, 124-126WD, 127.5WD and 132.5WD-133WD.	2010 EIS, 2011 SEIS
Possible to occur (may occur)			
<i>Marsdenia brevifolia</i> Shrubby bush pear	V	Targeted, not found but was considered possible to occur in suitable habitat areas not surveyed.	2011 SEIS
<i>Eucalyptus paedoglauca</i>	V	Targeted, not found in potential habitat between KP 0-42WD. Considered possible to occur in potential habitat not surveyed, however, unsurveyed habitat is considered to be of relatively low importance for the species.	2011 SEIS

Flora species	EPBC Act status	Likelihood of occurrence	Source
Unlikely to occur			
<i>Acacia crombiei</i> Pink gidgee	V	Targeted, not found (records occur 5-10 km north of the proposed alignment at KP 298-316WD) and considered unlikely to occur.	2010 EIS, 2011 SEIS

Key: V – Vulnerable; NT – Near Threatened; LC – Least Concern; NL – Not Listed

18.4.9.3 2019/2020 listed threatened flora findings

The following two listed threatened flora species were recorded within the study area during the 2019 field survey:

- *Eucalyptus raveretiana* (black ironbark)
- *Livistona lanuginosa* (waxy cabbage palm)

An assessment of the likelihood of occurrence (provided in Section 18.4.12) across the corridor selection for the remaining species identified in the desktop assessment concluded the following:

- One listed threatened flora species was considered likely to occur, namely *Acacia crombiei* (pink gidgee).
- Two species were considered as may occur, namely *Eucalyptus paedoglauca* and *Dichanthium setosum*.
- The remaining species identified in the desktop searches were considered unlikely to occur within the corridor selection due to a lack of species records and/or the lack of suitable habitat. These species included *Aristida granitica*, *Bulbophyllum globuliforme*, *Dichanthium queenslandicum*, *Marsdenia brevifolia*, *Omphalea celata* and *Tephrosia leveillei*.

Species descriptions as well as habitat and occurrence data for those species confirmed present or considered likely to occur are provided in the following subsections. Brief habitat descriptions for the remaining species are provided in the likelihood of occurrence assessment table provided in Section 18.4.12.

Eucalyptus raveretiana – confirmed present in study area

Description

E. raveretiana is a tree to 30 m tall found along rivers and creeks from Rockhampton inland to the rivers north of Duaringa, and also inland from Sarina and Mackay north to Bowen and Townsville. *E. raveretiana* prefers silty or loamy soils and grows with *E. tereticornis* and *Corymbia tessellaris* but also occurs in patches of gallery forest as an emergent. It has the smallest buds and fruit of the eucalypts and is easily distinguished from all eucalypt species with which it grows by the combination of branched inflorescences terminating at the branches, buds and fruit less than 3 mm wide, conical operculum, fruit with conspicuously exerted valves, dull, green crown leaves that are paler underneath, rough grey box-type bark on most or all of the trunk and often riverine habitat (Euclid, 2020). The species flowers between December and January and fruits mature between March and April, with insects thought to be the primary pollinator (TSSC, 2012). This species does not vegetatively reproduce, although it does re-sprout after fire (TSSC, 2012). Based on records available within the species profile (DoE, 2019), the individuals recorded are located at the northern extent of the recorded range.

Occurrence within the study area

This species is known to be present within the Renewable Energy Hub corridor section only, with records occurring between KP 48-49WD along Oaky Creek, and potentially present along the Burdekin River at the crossing of the corridor selection at KP 71-72WD (based on previously observed occurrence in 2010/2011 surveys, however this realigned crossing was not accessed at the time of the 2019 survey).

There were 11 individuals recorded within about 85 m of the corridor selection at Oaky Creek, which ranged in height from 13 m to 22 m tall and diameter at breast height (dbh) between 35 and 110 cm (excluding one juvenile individual to 3-4 m tall). Most individuals were in good health, however two had some damage with the main trunk or large branches dead (one being impacted by rubber vine infestation). No seedlings were identified during the 2019 surveys at this location.

The habitat at Oaky Creek consisted of a dry (ephemeral), sandy creek bed with areas of exposed bedrock and short, steep-sided banks, with riparian open forest consistent with RE 9.3.1 (*Eucalyptus camaldulensis* and/or *E. tereticornis* +/- *Melaleuca spp.* +/- *Casuarina cunninghamiana* fringing woodland on channels and levees) featuring *Eucalyptus raveretiana* on the creek bank and *Melaleuca spp.* growing in the creek bed (refer to Plate 18-5).

Nearby tributaries intersected by the Project were surveyed for *E. raveretiana* on ephemeral drainage lines with *Melaleuca* species present, however these drainage lines were considered to be closer to drainage lines and therefore to be less suitable habitat.

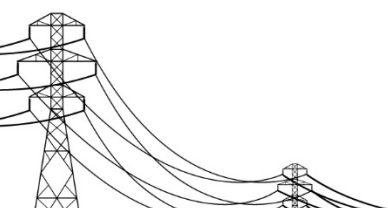
Eucalyptus raveretiana was also confirmed present within the study area during the 2010/2011 EIS field investigations. At the Burdekin River crossing (KP 65WD-66WD), a plot survey recorded five mature trees and two juveniles (populations on the eastern side were not surveyed although considered likely to occur), indicating a population density of 7 trees/ha. At Oaky Creek (KP 46-48WD), a plot survey along the western bank found 31 mature trees and seven juveniles, with similar density observed on the eastern bank, occurring on the immediate banks and on the alluvial terrace extending to 20 m from the top of the bank, and up to 500 m upstream and downstream. This plot survey indicated a population density of 38 trees/ha. Habitat was in moderate condition with infestations of rubber vine and chinee apple present.

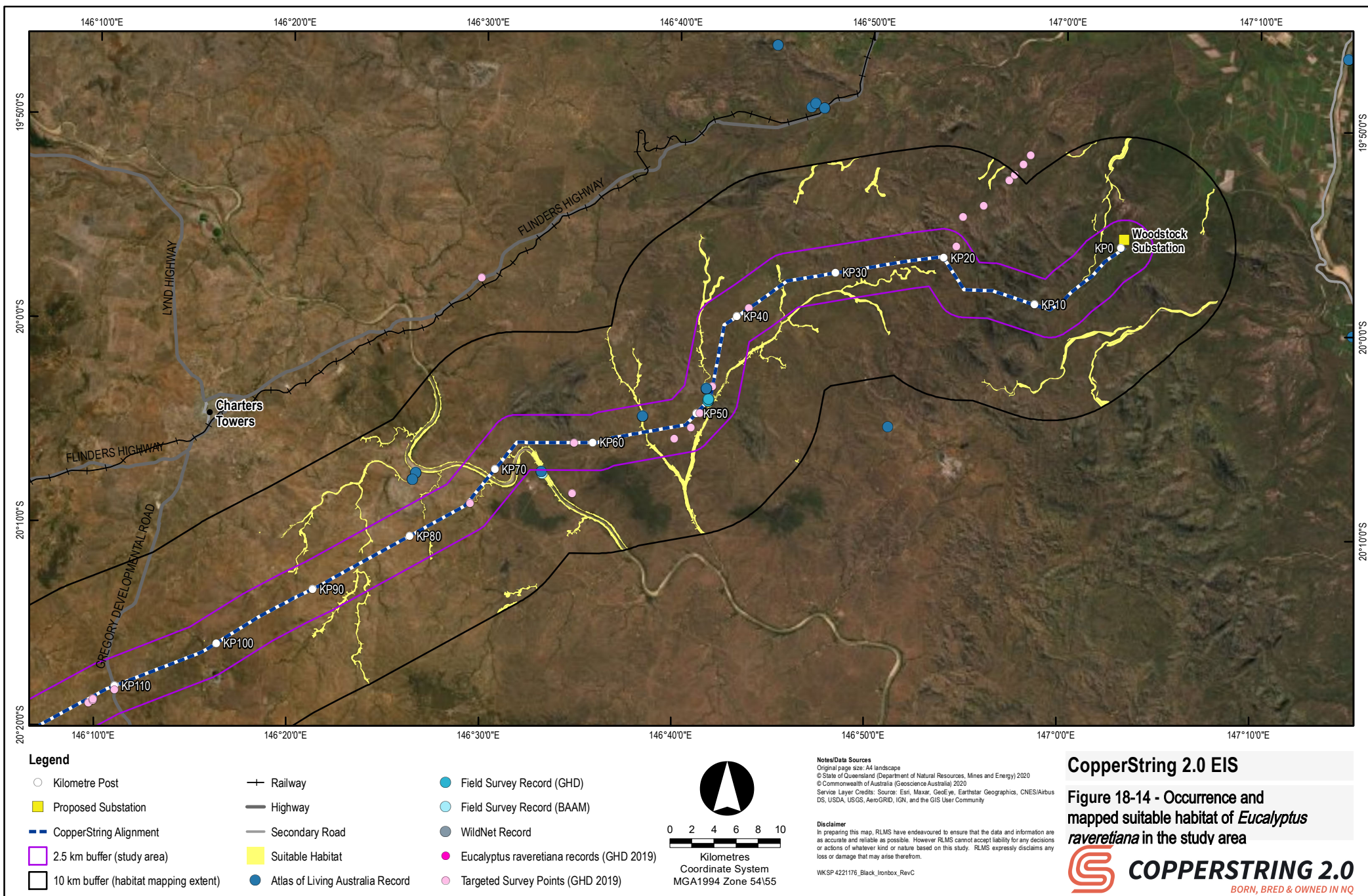
No populations were recorded at the crossings of tributaries of the Kirk River (KP 35WD and 56WD), including at Pandanus Creek crossings (KP 55-57WD) during targeted surveys in 2010/2011. These habitats were heavily degraded by rubber vine and chinee apple infestations.

Suitable habitat has been mapped using RE polygons that contain REs 9.3.1, 8.3.3 and 11.3.25 (as mixed or single RE polygons) only along watercourses that are of stream order four or higher, which is based on previously recorded habitats and documented species habitat preferences, between KP 0-88WD. The occurrence and mapped suitable habitat for this species is shown in Figure 18-14.



Plate 18-6 **Occurrence and habitat of *Eucalyptus raveretiana* in the study area**





Livistona lanuginosa* - confirmed present*Description**

L. lanuginosa is a single-stemmed, typical 'cabbage' palm in that the leaves are broadly circular, reaching up to 190 cm in width. The species grows to approximately 20 m tall. Leaf stems grow up to 200 cm long, and are armed with sharp thorns along the basal margins (Rodd 1998). The species is distinctive for the long woolly hairs on the stems of the leaves and the flower stalks. In addition, *L. lanuginosa* has the largest seed of any Australian *Livistona* species, 25 to 36 mm in diameter (Rodd 1998).

Flowering occurs from March to November (mid-wet to late dry season), and fruit has been recorded from September to January (mid-dry to early wet season) (Dowe 2010). The primary mechanism of seed dispersal appears to be gravity, as evidenced by the large numbers of seedlings clustered around the base of mature female plants. However, numerous isolated individuals have also been recorded, indicating that another dispersal mechanism is active, most likely water (as the populations are almost exclusively located within the zone of flooding) (Petit and Dowe 2003).

L. lanuginosa is endemic to the Burdekin-Ravenswood-Cape River area, with most Australian herbaria specimens collected from tributaries of the Burdekin River, upstream of the Burdekin Dam. A total of seven distinct populations have been identified within its extent of occurrence (DoEE 2019), with many occurrences recorded on the Cape and Campaspe rivers and their tributaries.

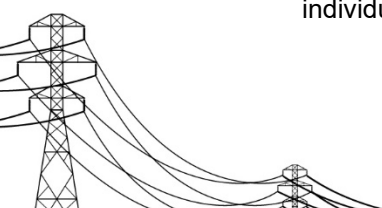
The species typically occurs as scattered individuals along streams; with dense clusters being rare (Pettit & Dowe 2003). Most occurrences have 'limited regeneration and unbalanced recruitment between size classes' (Dowe, quoted in DoEE, 2019). Based on population surveys conducted in 2002 by Dowe and Petit, it was estimated that the total number of adults (i.e. reproductively mature, c. 4 - 18m tall) within the Burdekin River catchment was less than 1000 individuals (Petit and Dowe 2003), with adults accounting for 9.8 % of plants observed.

Observed populations of *L. lanuginosa* occur on sandy, ephemeral watercourses or their floodplains. These watercourses are often braided systems (multiple channel), although populations do occur on single channel streams (Dowe 2010; Rodd 1998; DoEE, 2019). Associated riparian canopy vegetation includes *Eucalyptus camaldulensis*, *E. tereticornis*, *E. platyphylla*, *Melaleuca leucadendra*, *M. fluviatilis*, *Casuarina cunninghamiana* and *Corymbia brachycarpa* (Rodd 1998; DoEE, 2019).

Occurrence within the study area

This species was confirmed present in the study area during the 2019 GHD field surveys within the Renewable Energy Hub corridor section at an eastern tributary of the Campaspe River (Oakey Creek) between KP 124-125WD. Ten individuals were recorded at this location, ranging from juveniles to 10 m tall individuals between 115 m and 520 m from the corridor selection. A population was also observed upstream of the previously recorded population along the Campaspe River, approximately 5 km north-west of KP 146WD.

Livistona lanuginosa was confirmed present during the Copperstring 1.0 surveys at the proposed crossing of the Campaspe River at current KP 137-139WD and the crossing of a tributary (Oakey Creek) at current KP 124WD in REs 10.3.13 and 10.3.14. The habitat on site was riparian woodland (18-22 m in height) on the banks of sandy braided river channels dominated by *Melaleuca fluviatilis* with *Eucalyptus camaldulensis* and *E. tereticornis*. The subcanopy tree layer of 10-20% cover included *Livistona lanuginosa* and *Casuarina cunninghamiana*, *M. fluviatilis* and *Pandanus sp.* Ten survey plots were undertaken with 57 individuals recorded as scattered occurrences along the riverbanks and in-stream channels.



Other similar habitat was previously identified and mapped as potential habitat at current KP 124-125WD, KP 134-136WD, and KP 141-142WD.

Prior to the 2019 field surveys, the corridor selection was moved further south away from a previous record along Oakey Creek near KP 124WD (also avoiding an area of Of Concern and wetland RE 9.3.4).

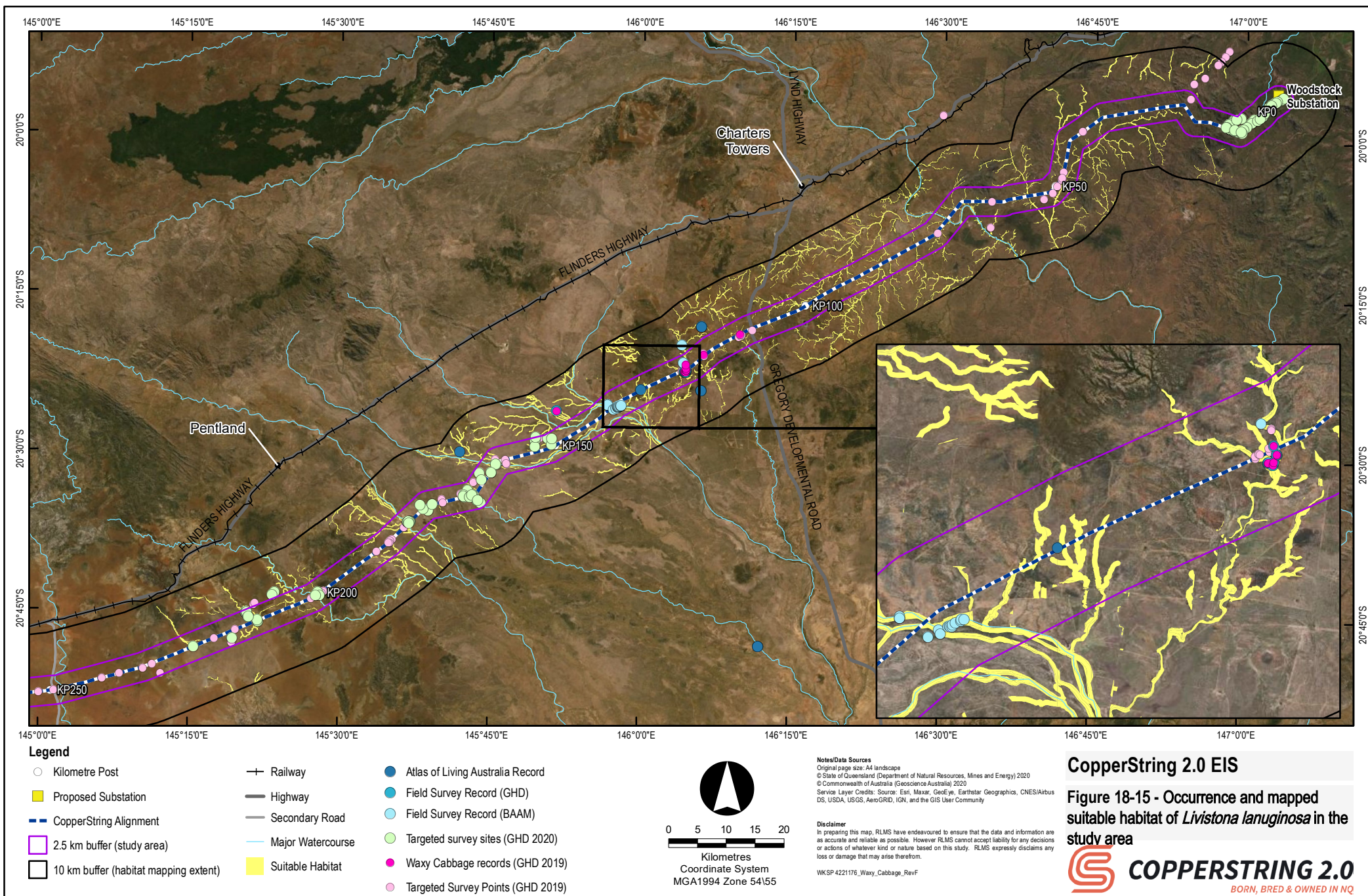
Potential habitat for *Livistona lanuginosa* was recorded across the tributaries of the Campaspe River in the 2019 survey (refer to Plate 18-6). The habitat at this location consisted of *Eucalyptus camaldulensis*, *Corymbia tessellaris*, and *Melaleuca fluviatilis* woodland to open forest on braided sandy watercourse with broad sandy alluvial plain. Weeds present included parthenium and rubber vine.

Potential habitat of RE 9.3.1/9.3.19 was assessed at KP 113WD, however no *Livistona lanuginosa* was identified. Habitat at this location was described as *Melaleuca fluviatilis* open forest with *Eucalyptus camaldulensis* and *Casuarina cunninghamiana* fringing a narrow well-incised waterway. The potential habitat at KP 134-136WD and KP 141-142WD was not accessed during the 2019 field surveys.

Suitable habitat has been mapped within the study area for RE polygons that contain the REs 9.3.1, 10.3.6, 10.3.13, 10.3.14, 10.3.31, 11.3.4, 11.3.25 (as mixed or single RE polygons), based on essential habitat factors and previously recorded habitats from the Copperstring 1.0 surveys, where they occur along the 100 m buffer areas of watercourses. This habitat mapping has been restricted to the Campaspe and Cape Rivers and their tributaries within the known distribution of the species (i.e. within the Burdekin River catchment between KP 0-220WD). The resultant mapping covers a broader extent than what records of the species indicate, to account for dispersal along that river system but indicating that occurrences on other catchment systems are unlikely to occur in that region. The occurrence and mapped suitable habitat for this species is shown in Figure 18-15.



Plate 18-7 Occurrence and habitat of *Livistona lanuginosa* in the study area



***Acacia crombiei* - likely to occur**

Description

Acacia crombiei is a tree growing to 10 m with pale green, narrowly linear phyllodes to 10–15 cm long and 3–8 mm wide. The branchlets are flexuous and angled at the extremities. Flowers are yellow in globular heads with narrowly oblong pods to 10 cm long (Orchard & Wilson 2001).

This species has been previously observed occurring on wooded downs in woodland and open woodland often associated with *Acacia cambagei* and *Atalaya hemiglaucula*, on alluvial, sandstone and basalt derived soils.

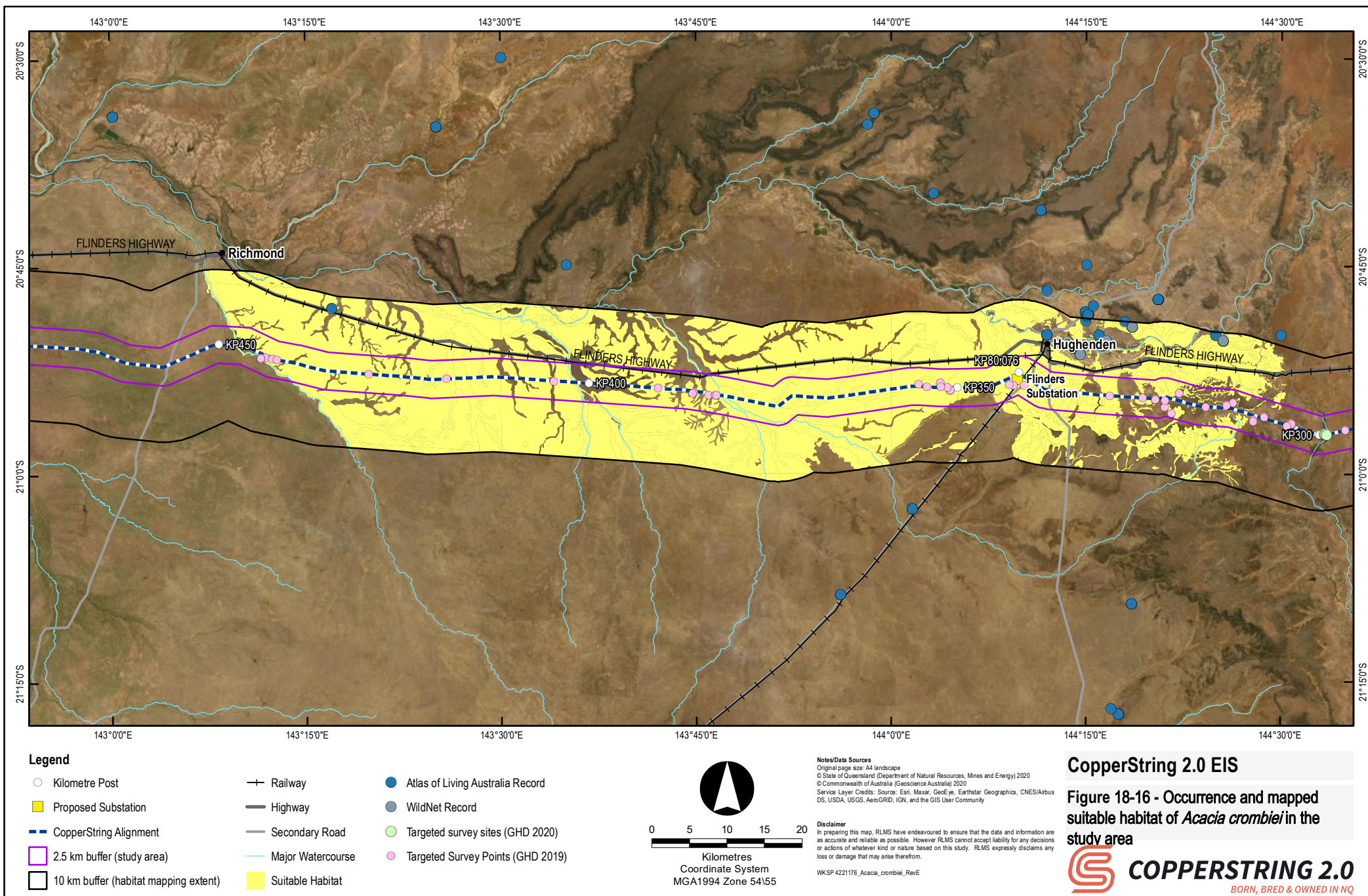
The known distribution of the species is centred on the Hughenden area north of the study area between KP 306-331WD. The species has an area of occupancy of 1,000 km², an extent of occurrence of 34,000 km², occurs at 15 subpopulations and may have an abundance of 76,000 plants (DoEE, 2019).

Occurrence within the study area

A. crombiei has not been recorded within the study area during field surveys for the Project. Targeted surveys were carried out for the Copperstring 1.0 EIS between approximately KP 318-324WD (2011 alignment), SEIS between KP 306-331WD (2011 alignment), and GHD surveys in 2019, with no individuals observed. Potential habitat between KP 318-324WD (2011 alignment) was found to be infested with introduced *Acacia nilotica* with drainage lines containing scattered introduced *Parkinsonia aculeata*. Survey effort in 2011 included 11 sites with random meander searches undertaken in potential habitat.

Historical records occur further north and further south of the study area.

Suitable habitat has been mapped between KP 266WD and 435WD within RE polygons that are (or contain) RE 4.3.3, 4.3.4, 4.3.8, 4.3.14, 4.3.19, 4.3.20, 4.3.23, 4.9.1, 4.9.7, 4.9.8, 4.9.11, 9.8.5, 9.8.6, 9.8.7, 9.10.4, 9.12.18, 10.3.15, and 10.4.5. The occurrence and mapped suitable habitat for this species is shown in Figure 18-16.



18.4.10 Listed threatened fauna species

18.4.10.1 Desktop results

A review of the PMST and Wildlife Online databases identified 31 fauna species listed under the EPBC Act that have been historically recorded or may have suitable habitat present within the desktop search extent. This included 17 bird species, 8 mammal species and 5 reptile species (refer to Table 18-26). The presence of an additional three listed threatened species (not recorded in desktop searches) was required to be considered under the terms of reference for the EIS, namely the spectacled flying-fox (*Pteropus conspicillatus*) (Vulnerable under the EPBC Act), and the Murray Cod (*Maccullochella peelii*) and freshwater sawfish (*Pristis pristis*) (Endangered under the EPBC Act).

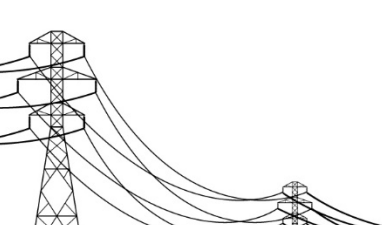
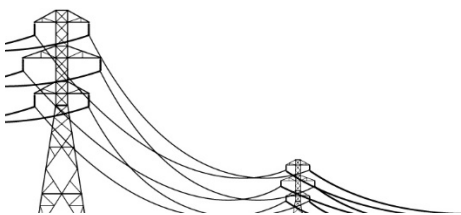


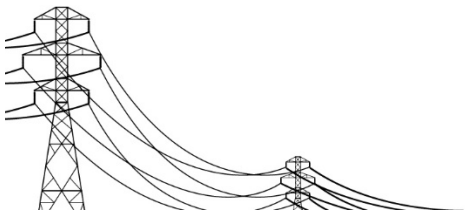
Table 18-29 Listed threatened fauna species predicted to occur or historically recorded in desktop searches

Scientific name	Common name	EPBC Act status	Mount Isa Augmentation	Southern Connection	Phosphate Hill Connection	Cannington Connection	CopperString Core	Renewable Energy Hub
Birds								
<i>Amytornis dorotheae</i>	Carpentarian grasswren	E	PMST					
<i>Calidris ferruginea</i>	Curlew sandpiper	CE, Mig	PMST	PMST	PMST	PMST	PMST; WO	PMST; WO
<i>Charadrius mongolus</i>	Lesser sand plover	E, Mig						
<i>Erythrotriorchis radiatus</i>	Red goshawk	V	PMST	PMST	PMST	PMST	PMST	PMST
<i>Erythrura gouldiae</i>	Gouldian finch	E	PMST	PMST; WO			PMST	WO
<i>Falco hypoleucos</i>	Grey falcon	V	PMST; WO	PMST	PMST	PMST	PMST; WO	PMST
<i>Geophaps scripta scripta</i>	Squatter pigeon	V					WO	PMST; WO
<i>Grantiella picta</i>	Painted honeyeater	V	PMST	PMST; WO	PMST	PMST	PMST; WO	PMST
<i>Hirundapus caudacutus</i>	White-throated needletail	V						WO
<i>Neochmia ruficauda ruficauda</i>	Star finch	E					PMST	PMST
<i>Numenius madagascariensis</i>	Eastern curlew	CE, Mig, M.	PMST	PMST; WO			PMST	PMST
<i>Pezoporus occidentalis</i>	Night parrot	E	PMST	PMST	PMST	PMST	PMST	
<i>Poephila cincta cincta</i>	Black-throated finch (southern)	E					PMST	PMST; WO
<i>Polytelis alexandrae</i>	Princess parrot	V		WO				
<i>Rostratula australis</i>	Australian painted-snipe	E, Mig	PMST	PMST	PMST	PMST	PMST	PMST; WO
<i>Turnix olivii</i>	Buff-breasted button-quail	E						PMST
<i>Tyto novaehollandiae kimberli</i>	Masked owl	V					PMST	PMST
Mammals								
<i>Dasyurus hallucatus</i>	Northern quoll	E						PMST
<i>Macroderma gigas</i>	Ghost bat	V	PMST	PMST	PMST	PMST	PMST	PMST
<i>Macrotis lagotis</i>	Greater bilby	V	PMST	PMST	PMST	PMST	PMST	
<i>Petauroides volans</i>	Greater glider	V						PMST, WO
<i>Phascolarctos cinereus</i>	Koala	V					PMST; WO	PMST; WO



Scientific name	Common name	EPBC Act status	Mount Isa Augmentation	Southern Connection	Phosphate Hill Connection	Cannington Connection	CopperString Core	Renewable Energy Hub
<i>Rhinolophus robertsi</i>	Large-eared horseshoe bat	V						PMST
<i>Saccolaimus saccolaimus nudiclunatus</i>	Bare-rumped sheath-tailed bat	V						PMST
<i>Sminthopsis douglasi</i>	Julia Creek dunnart	V	PMST	PMST		PMST; WO	PMST; WO	PMST
Reptiles								
<i>Acanthophis hawkei</i>	Plains death adder	V	PMST	PMST	PMST	PMST	PMST	PMST
<i>Denisonia maculata</i>	Ornamental snake	V					WO	PMST; WO
<i>Egernia rugosa</i>	Yakka skink	V					PMST	PMST
<i>Elseya lavarackorum</i>	Gulf snapping turtle	E	PMST					
<i>Lerista vittata</i>	Mount Cooper striped skink	V						PMST

Key: CE – Critically Endangered; E – Endangered; V – Vulnerable; NT – Near Threatened; SLC – Special Least Concern; LC – Least Concern; NL – Not Listed; Mig – Migratory



18.4.10.2 Copperstring 1.0 threatened fauna findings

Of those EBPC Act listed fauna species targeted in surveys for the CopperString 1.0 EIS, three species were confirmed present, eight were considered possible to occur and one was considered unlikely to occur. The results of the CopperString 1.0 EIS assessments with respect to listed threatened fauna species are summarised in Table 18-27.

Table 18-30 Listed threatened fauna species

Fauna species	EPBC Act status	Likelihood of occurrence	Source
Confirmed present			
<i>Poephila cincta cincta</i> Black-throated finch	E	Targeted and confirmed present at four locations between KP 264-265WD, where 32 individuals were observed. Extensive potentially suitable habitat was mapped in the eastern section of the corridor selection. Historical records confirmed the species presence within 1 km north of site KP 149WD.	2011 SEIS
<i>Geophaps scripta scripta</i> Squatter pigeon	V	Targeted and confirmed present at 28 locations (between KP0WD and KP308WD) in flocks of up to 27. Extensive potentially suitable habitat was mapped in the eastern section of the corridor selection.	2010 EIS, 2011 SEIS
<i>Sminthopsis douglasi</i> Julia Creek Dunnart	V	Targeted at nine trapping locations and two separate individuals recorded at two sites at KP615WD and KP588WD. Extensive potential habitat was located between Hughenden and Julia Creek	2011 SEIS
Possible to occur			
<i>Neochmia ruficauda ruficauda</i> Star finch	E	Targeted, not found and considered possible to occur in potential habitat that is present. However, no known important habitat ² was mapped within the study area.	2011 SEIS
<i>Erythrura gouldiae</i> Gouldian finch	E	Targeted, not found and considered possible to occur in potential habitat that is present. However, no known important habitat was mapped within the study area.	2011 SEIS
<i>Erythrotriorchis radiatus</i> Red goshawk	V	Targeted, not found and considered possible to occur in potential habitat that is present. However, no known important habitat was mapped within the study area.	2011 SEIS
<i>Rostratula australis</i> Australian painted snipe	E, M	Targeted, not found and considered possible to occur. However, no known important habitat was mapped within the study area.	2011 SEIS

Fauna species	EPBC Act status	Likelihood of occurrence	Source
<i>Hydroprogne caspia</i> Caspian tern	Mig	Confirmed present within the Burdekin River near KP169WD.	2010 EIS
<i>Egernia rugosa</i> Yakka skink	V	Targeted, not found and considered possible to occur in potential habitat that is present. However, no known important habitat was mapped within the study area.	2011 SEIS
<i>Yerista vittata</i> Side-striped fine-lined slider	V	Targeted between KP68WD and KP71WD. Species was not recorded and considered possible to occur in potential habitat that is present. However, no known important habitat was mapped within the study area.	2011 SEIS
<i>Denisonia maculata</i> Ornamental snake	V	Targeted, not found and considered possible to occur in potential habitat (KP173WD) that was present.	2011 SEIS
<i>Falco hypoleucos</i> Grey falcon	V	Not observed but likely to occur from historic records.	2011 SEIS
Unlikely to occur			
<i>Pezoporus occidentalis</i> Night parrot	E	Targeted, not found and considered unlikely to occur. Potentially suitable habitat was identified in the western extent of the project, though no evidence of the species presence was recorded.	2011 SEIS
<i>Maccullochella peelii peelii</i> Murray cod	V	Murray cod have been introduced into Cooper Creek, however the introduced population is thought to no longer exist. Species considered highly unlikely to be impacted by the Project.	2010 EIS
<i>Pristis pristis</i> Freshwater Sawfish	V, Mig	Species considered unlikely to occur given the intermittent nature of the waterways in the study area.	2010 EIS

18.4.10.3 2019/2020 Listed threatened fauna findings

Four listed threatened fauna species were **confirmed present** in BAAM and GHD field surveys of the Project area, as shown in Table 18-28. An additional eight listed threatened fauna species were considered **likely to occur** within the project area and 10 species had a reduced likelihood of occurrence but **may occur** due to the presence of marginal habitat. The remaining thirteen species identified in desktops are considered unlikely to occur. Table 18-28 presents a summary of all listed threatened species confirmed present, considered likely to occur and those that may occur within the project area. The results of the likelihood of occurrence are detailed in Section 18.4.12.

Table 18-31 Listed threatened fauna species that were confirmed present, likely to occur or may occur within the Project area

Species	Common name	EPBC Act Status
Confirmed present		
<i>Phascolarctos cinereus</i>	Koala	V
<i>Sminthopsis douglasi</i>	Julia Creek dunnart	V
<i>Geophaps scripta scripta</i>	Southern squatter pigeon	V
<i>Poephila cincta cincta</i>	Southern black-throated finch	E
Likely to occur		
<i>Acanthophis hawkei</i>	Plains death adder	V
<i>Denisonia maculata</i>	Ornamental snake	V
<i>Erythrorhynchus radiatus</i>	Red goshawk	V
<i>Falco hypoleucos</i>	Grey falcon	V
<i>Pezoporus occidentalis</i>	Night parrot	E
<i>Hirundapus caudacutus</i>	White-throated needletail	V, Mig
<i>Rostratula australis</i>	Australian painted snipe	E
<i>Grantiella picta</i>	Painted honeyeater	V
May occur		
<i>Hipposideros semoni</i>	Semon's leaf-nosed bat	V
<i>Macroderma gigas</i>	Ghost bat	V
<i>Saccolaimus saccolaimus nudiclunatus</i>	Bare-rumped sheath-tail bat	V
<i>Egernia rugosa</i>	Yakka skink	V
<i>Pteropus conspicillatus</i>	Spectacled flying-fox	V
<i>Numenius madagascariensis</i>	Eastern curlew	CE, Mig
<i>Erythrura gouldiae</i>	Gouldian finch	E
<i>Calidris ferruginea</i>	Curlew sandpiper	CE, Mig
<i>Amytornis dorotheae</i>	Carpentarian grasswren	E
<i>Petauroides volans minor</i>	Greater glider (northern)	V

Key to table: CE – Critically Endangered, E – Endangered, V – Vulnerable, Mig – Migratory

Information on the ecology and distribution within the project area is provided in the following subsections for listed threatened fauna species confirmed present and considered likely to occur within the project area. Brief habitat descriptions for the remaining species identified in the desktop assessment are provided in the likelihood of occurrence assessment table provided in Section 18.4.12.

Koala (*Phascolarctos cinereus*) – confirmed present

The koala is listed as Vulnerable under the EPBC Act. In Queensland, this species is widely distributed along the east coast, from Cairns in the north, to the Qld border in the south, to Killarney in the west (DAWE 2020b). The koala is regarded as a specialist feeder, feeding exclusively on the leaves of various *Eucalyptus*, *Corymbia*, *Lophostemon*, *Angophora* and *Melaleuca* species (Martin and Handasyde 1999). The species food tree preference is known to vary with locality, with koalas exhibiting foraging preference towards the tree species with the highly nutritional content, favouring only 30 of the 600 species of Eucalypts available across Australia. Due to the species foraging specificity, the koala is highly dependent on the

distribution and availability of the feeding resource. On average, the species consumes 500 g of leaves per day and can obtain approximately 50% of their water requirements from their food. Key threats include habitat loss and fragmentation, dog attacks, vehicle strikes, disease and drought (DAWE, 2020b).

The koala was confirmed present at 16 locations within the study area (refer to Figure 18-17). One koala was observed (Plate 18-7), and koala pellets (Plate 18-7) were recorded from 15 other locations in riparian woodland near Woodstock, Pentland and Prairie. Koalas have also been historically recorded near Hughenden, Prairie, Pentland and Charters Towers as mapped in Figure 18-17. Eucalypt woodland habitats that represent suitable foraging habitat for koalas occurs in patches throughout the eastern extent of the study area (Plate 18-7). These are predominantly located along watercourses and in open woodland areas on alluvial soils. Within the Ravenswood section of the alignment, pellets were found in association with *Eucalyptus crebra* and suitable habitat was locally abundant.

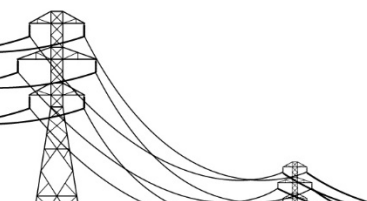
Areas of suitable koala habitat have been mapped in Figure 18-17 using essential habitat factors for the species and the RE layer as a basis, within a 15 km radius of historical records. The quality and condition of koala habitat observed within the study area varied substantially based on a range of natural and anthropogenic factors. Areas of high koala value were generally located along watercourses, as these areas retained a higher local density and connectivity of mature koala food trees than areas on open plains that have in many places been subject to increased loss and fragmentation of habitat. Koala habitats in the west had localised areas of reduced natural value due to the very sparse nature of the canopy and the presence of non-koala food trees (gidgee) along watercourses. Areas of increased natural value koala habitat was observed along watercourses including Emu Creek (near Prairie) and the Campaspe River east of Pentland. Areas where the value of koala habitats is likely to have been reduced by localised fragmentation were observed east of KP78WD and KP178WD. Koala habitats at the very east of the Project area Charters Towers had low-moderate natural values due to the lower density of koala food trees and the presence of some more stunted koala food trees located on rocky substrates in localised parts of that area.

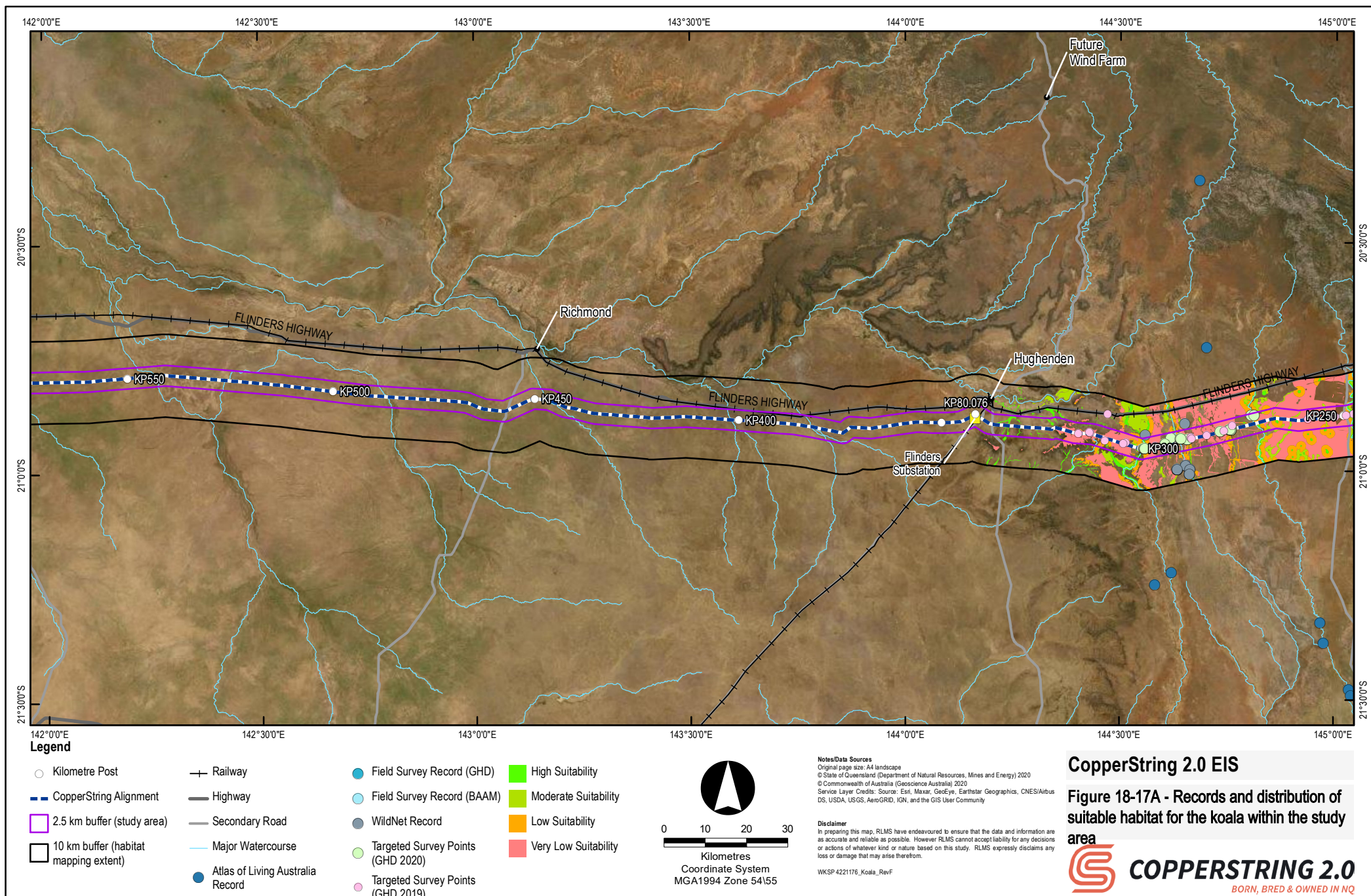


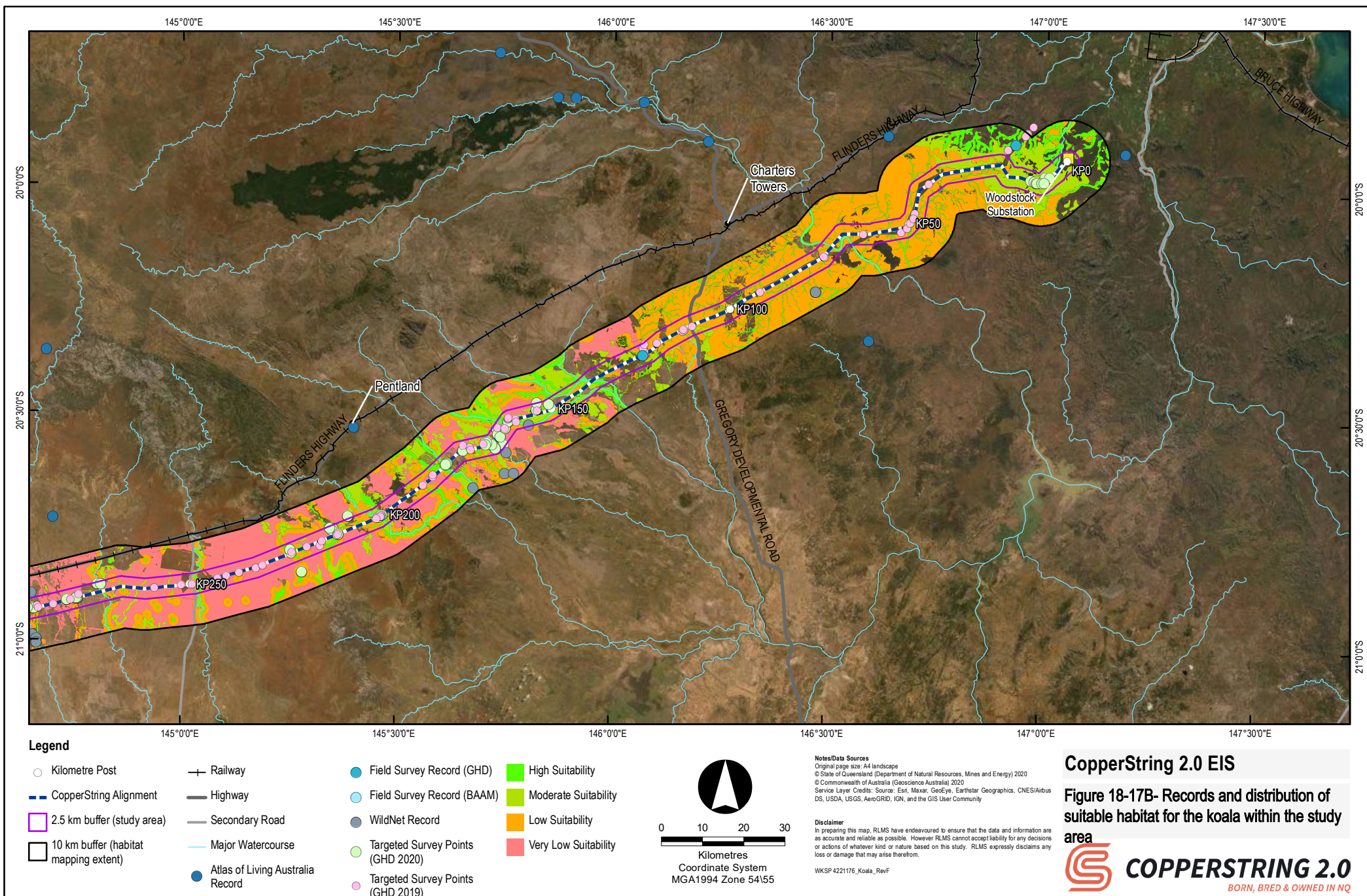
Plate 18-8 Koala (left) and koala pellets (right) recorded in the study area



Plate 18-9 Suitable habitat and koala scratches within the study area







Julia Creek dunnart (*Sminthopsis douglasii*) – confirmed present

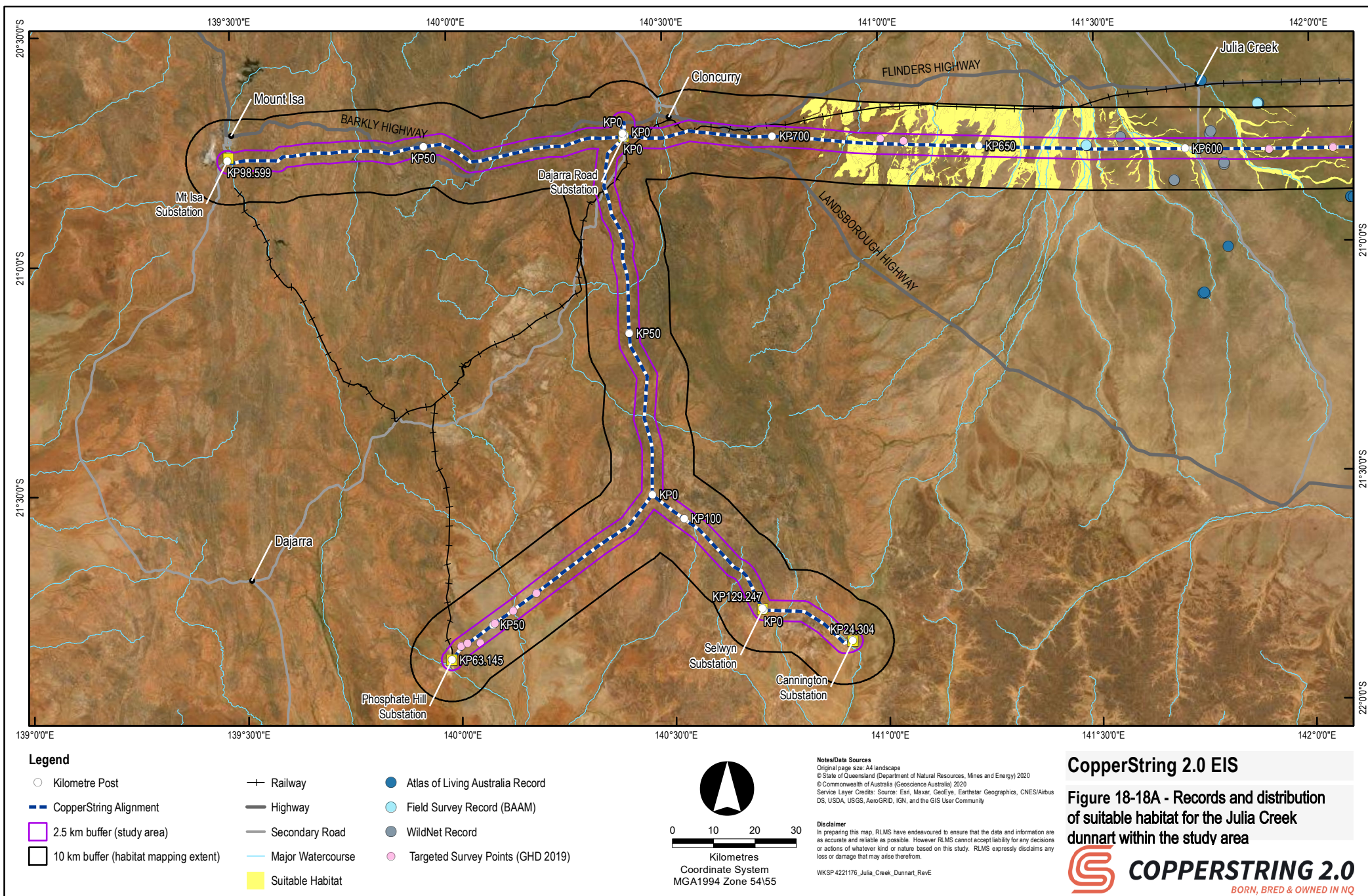
The Julia Creek dunnart is currently listed as Vulnerable under the EPBC Act.

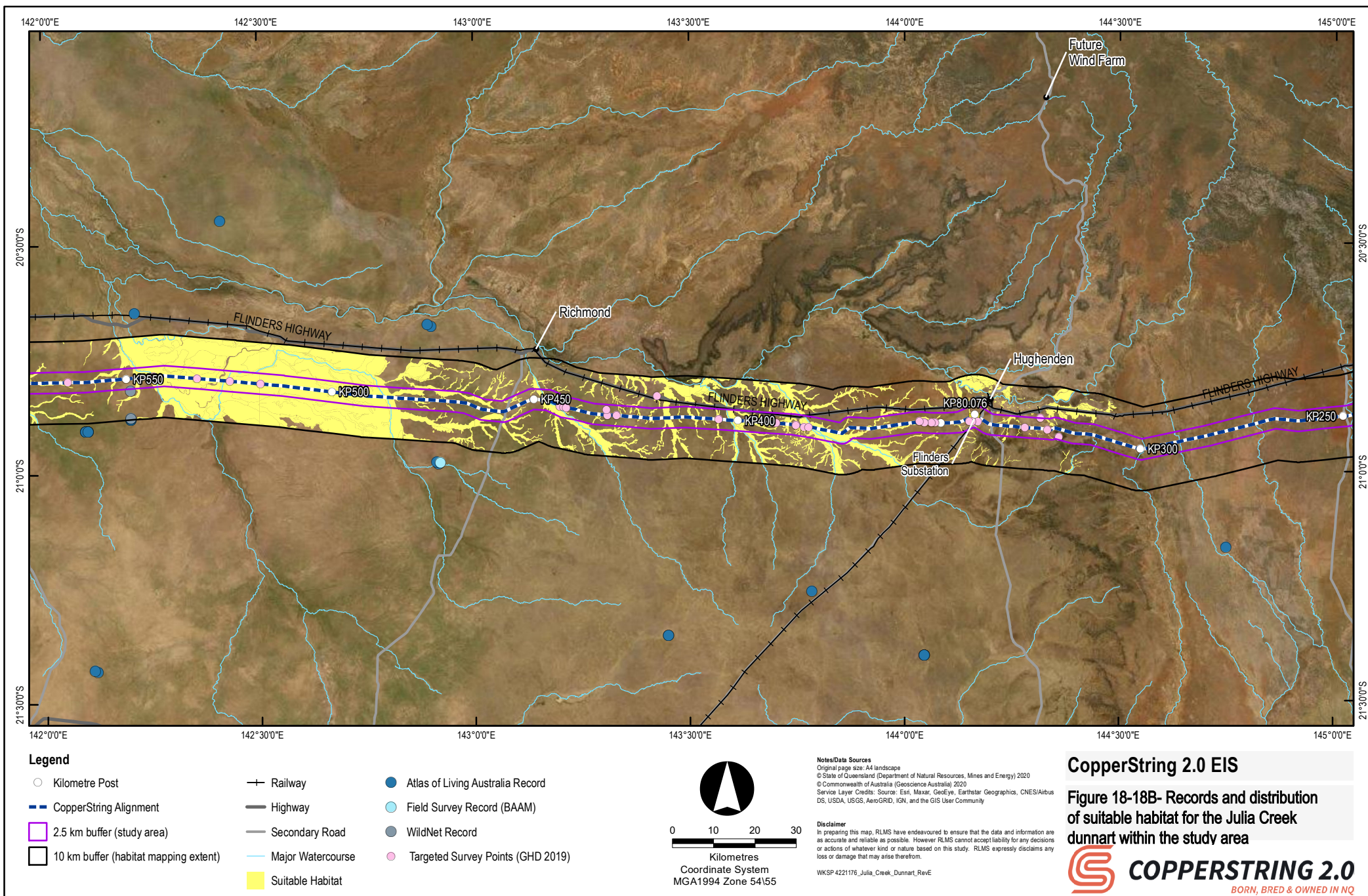
The Julia Creek dunnart is endemic to Mitchell Grass Downs and Desert Uplands bioregions within north-western Queensland. The preferred habitat for this species is tussock Mitchell Grass grasslands within cracking clay soils, with the extent and density of cracking clays and grass cover indicative of habitat quality. This species has a small home range varying from 0.25 to 7 ha (Mifsud 1999) and males are generally more mobile than females (Woolley 2008). Much of this species' distribution occurs on cattle stations and have reduced habitat quality due to overgrazing. Originally, the species was only known from four museum specimens, though increased sampling over the past 20 years has increased the species known distribution to over 25 locations and 60,000 km² (DERM 2009; Woolley 2009). This species is nocturnal in nature, spending the nights hunting their preferred prey of insects (e.g. crickets, spiders and cockroaches) and occasionally small reptiles (DERM, 2009). During the day, this species shelters in the cracking clay or underground vegetation (DERM, 2009).

The species was not recorded during recent field surveys. However suitable habitat was recorded (Plate 18-9) and the species was recorded from two locations in the original CopperString surveys, recorded south of Julia Creek at KP615WD and KP588WD. There is also a further 646 Wildlife Online records and 3 Queensland Museum records within the CopperString Core section. Known habitat for the species is located between KP616WD and KP579WD and potential habitat for the Julia Creek dunnart was mapped within the CopperString Core section of the proposed corridor selection (refer to Plate 18-9). The distribution of suitable habitat and location of historical records for the Julia Creek dunnart are presented in Figure 18-18.



Plate 18-10 Potential Julia Creek dunnart habitat within the study area





Squatter pigeon (southern) (*Geophaps scripta scripta*) – confirmed present

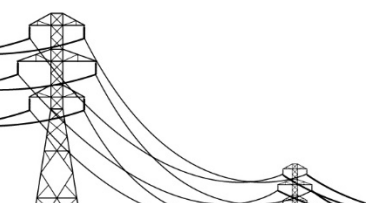
The squatter pigeon (southern) is listed as Vulnerable under the EPBC Act. While important populations of the squatter pigeon (southern) are considered to be those located at the southern extent of the species' range, in areas where the species has experienced significant declines, the local squatter pigeon population is at the northern extent of the species known range and may therefore be considered an important population under the EPBC Act.

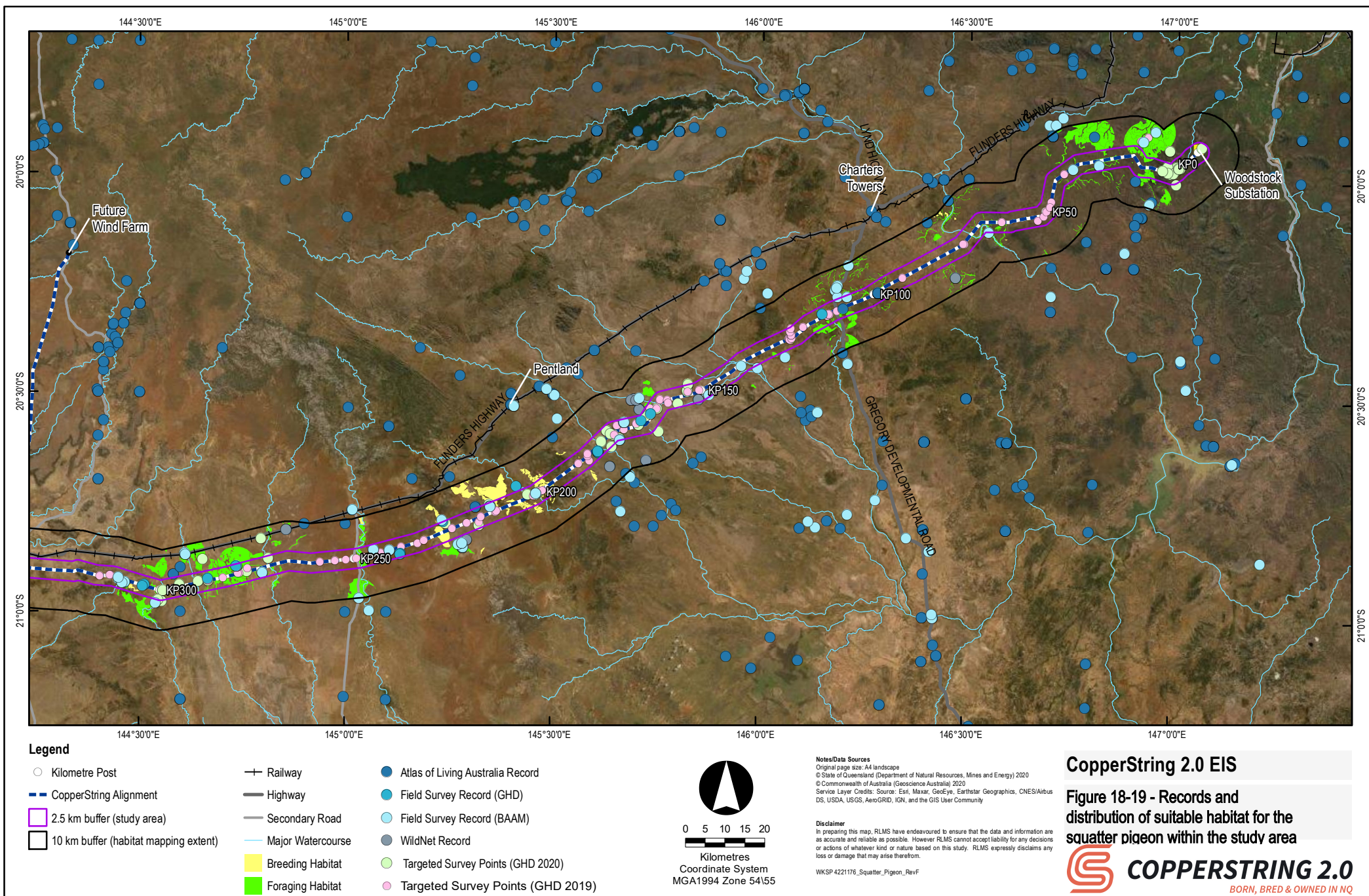
In Queensland, the squatter pigeon (southern) can be found from the Burdekin – Lynd divide to the NSW / Qld border. Generally, the species is encountered west of the Great Diving Range (DAWE 2020b). Squatter pigeons occur in remnant and regrowth open forest and woodland dominated by Eucalyptus, Corymbia, Acacia and Callitris species with tussock grassy understorey within 3 km of water sources (DoEE 2019). Soils are generally a good predictor of their foraging and breeding habitat (Squatter Pigeon Workshop 2011). Breeding and foraging habitat is generally restricted to well-draining, gravelly, sandy or loamy soils with a tussock-grassy understorey (Squatter Pigeon Workshop 2011). These typically have a patchy ground layer composed of native perennial tussock grasses or a mix of native perennial tussock grasses and low shrubs or forbs (Squatter Pigeon Workshop 2011). Key threats to the squatter pigeon are predominantly loss and fragmentation of habitat, overgrazing by stock, degradation of habitat by weeds and exotic pasture (e.g. buffel grass - *Cenchrus ciliaris*), competition with feral herbivores and predation by feral cats and foxes (DoEE 2019).

The squatter pigeon was recorded throughout the majority of the eastern extend of the proposed corridor selection. The species was predominantly observed within highly disturbed environments where water was permanently available. Degraded cattle feeding areas recorded the highest abundance of squatter pigeons with some areas supporting flocks of over 30 (Plate 18-10). Past studies have recorded this species within the Renewable Energy Hub at KP35WD, 135.5WD, 197.5WD and 270WD, and a 20 additional Birds Australia records and 4 Wildlife Online records are recorded within the Renewable Energy Hub and CopperString Core sections. Suitable breeding and foraging habitat for the squatter pigeon was mapped throughout the majority of CopperString Core and Renewable Energy Hub sections (Figure 18-19).



Plate 18-11 Squatter pigeons and suitable habitat recorded within the study area





Black-throated finch (southern) (*Poephila cincta cincta*) – confirmed present

The black-throated finch (southern) is listed as Endangered under the EPBC Act. Although formerly distributed from north Queensland to northern New South Wales, this sub-species has experienced a dramatic range contraction in recent decades. The southern sub-species now only occurs in a few scattered locations throughout northern Queensland, with strongholds centred near Townsville, Charters Towers and in the Galilee Basin of Central Queensland (BirdLife 2020). Within its range, the black-throated finch (southern) inhabits dry grassy open woodland and forest environments in close proximity to water and with an abundance of seeding grasses. The species is locally nomadic and breeding and feeding patterns vary in relation to rainfall and resource abundance. The species feeds predominantly on grass seeds, though also occasionally also take insects, especially during the breeding season. Breeding habitat generally consists of non-remnant grassy woodlands and forest vegetation (DAWE 2020b).

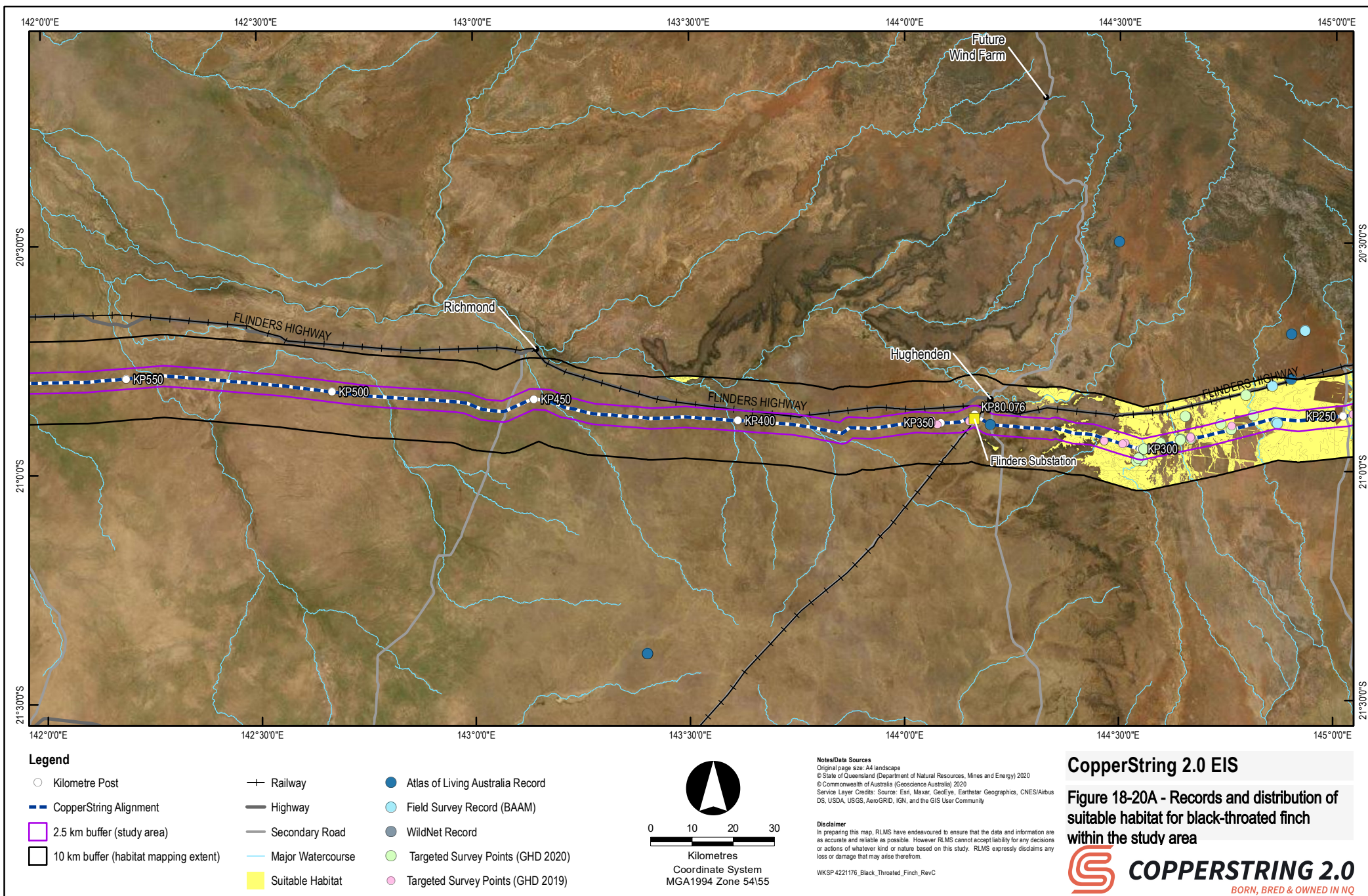
The black-throated finch (southern) was confirmed present immediately north of KP162WD, south-east of Pentland in the 2020 surveys (Plate 18-11). A group of approximately 20 birds was observed foraging in ironbark open woodland with a mid-dense grassy ground layer. The species was previously confirmed present within the Renewable Energy Hub during the CopperString 1.0 EIS surveys, where a group of up to 32 birds were observed south of Torrens Creek near KP264 -265WD. Historical records have also been confirmed 20 km north of this observation (DEWHA, 2009), from Trafalga Station (approximately 1 km from KP149WD) and 7 km south of KP146WD during a CSIRO study (2009). Two Birds Australia records are located at north of KP268WD and KP263WD. Suitable habitat for the black-throated finch was identified within the Renewable Energy Hub, specifically between KP138WD – KP168WD and around KP268WD (refer to Plate 18-12 and Figure 18-20).

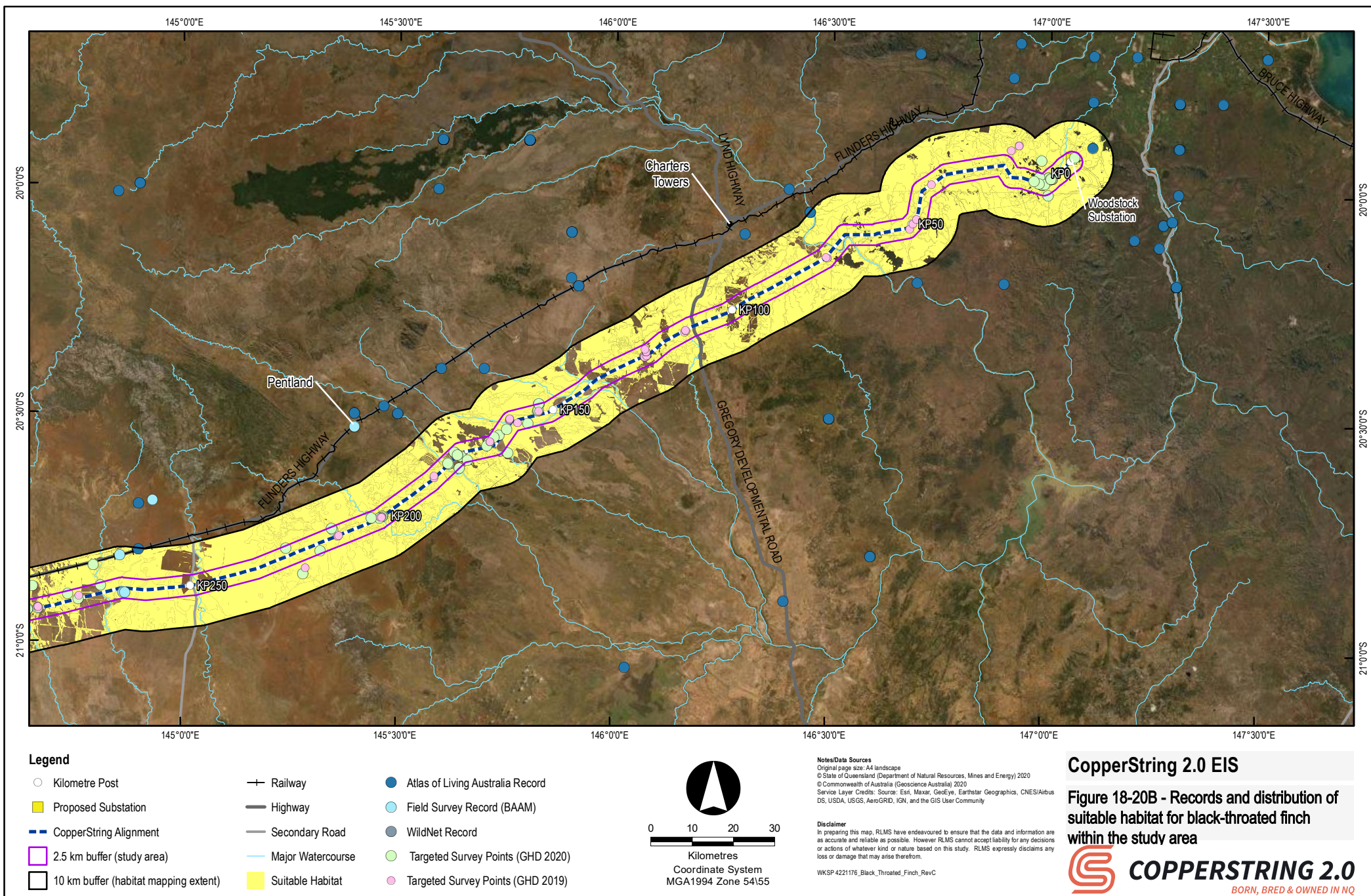


Plate 18-12 Black-throated finches observed within the study area



Plate 18-13 Habitat for the black-throated finch north of KP162WD





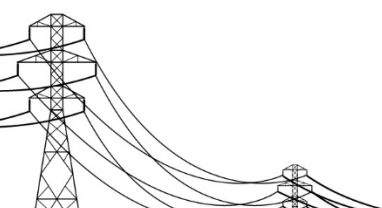
Plains death adder (*Acanthophis hawkei*) – Likely to occur

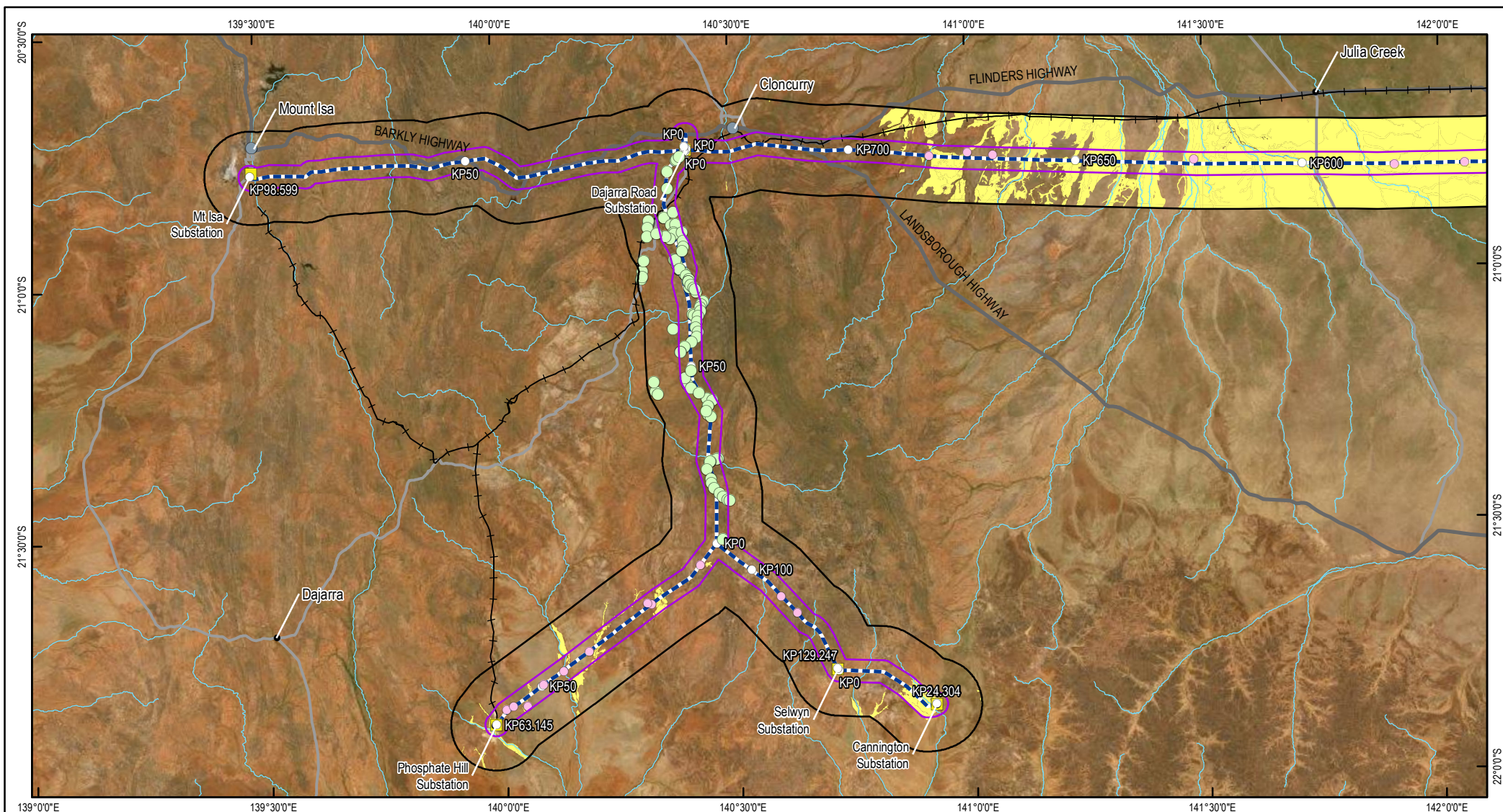
The plains death adder is listed as Vulnerable under the EPBC Act.

Death adders are a highly venomous, cryptic, nocturnal snake which occurs throughout most of Australia. Whilst three subspecies of death adder are recognised, the plains death adder is the variation most commonly associated with cracking black soil country. Currently, the species is known to occupy the floodplains of the Adelaide, Mark and Alligator River, the Barkly Tablelands and Queensland's Mitchell Grass Downs bioregion, though is predicted to occur throughout most black soil floodplains of northern Australia. Suitable habitat consists of flat, treeless, cracking-soil riverine floodplains (Cogger, 2000). Based on the presence of suitable habitat, the geographical range of the plains death adder is thought to extend from western Queensland, across the Northern Territory, and into north Western Australia.

Like all death adders, *Acanthophis hawkei* is a highly venomous ambush predator, predominantly feeding on frogs, lizards and small mammals. The species is well camouflaged within its habitat, where it conceals itself in an ambush position amongst substrate such as leaf litter and sand. To attract prey to within striking distance, the species undulated its specially modified tail-tip to imitate a defenceless insect (Hagman et al. 2008). Frogs and lizards constitute 95% of the diet of young plains death adders, but individuals switch to small mammals, such as rats, once they reach a larger size.

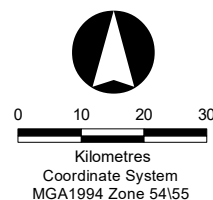
This species was not recorded during field surveys, however suitable habitat for the plains death adder was intermittently mapped within the Mount Isa Augmentation, Southern Connection and Phosphate Hill Substation (refer to Figure 18-21).





Legend

- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- 10 km buffer (habitat mapping extent)
- Railway
- Highway
- Secondary Road
- Major Watercourse
- Suitable Habitat
- Atlas of Living Australia Record
- Field Survey Record (BAAM)
- WildNet Record
- Targeted Survey Points (GHD 2020)
- Targeted Survey Points (GHD 2019)



Notes/Data Sources
Original page size: A4 landscape
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Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

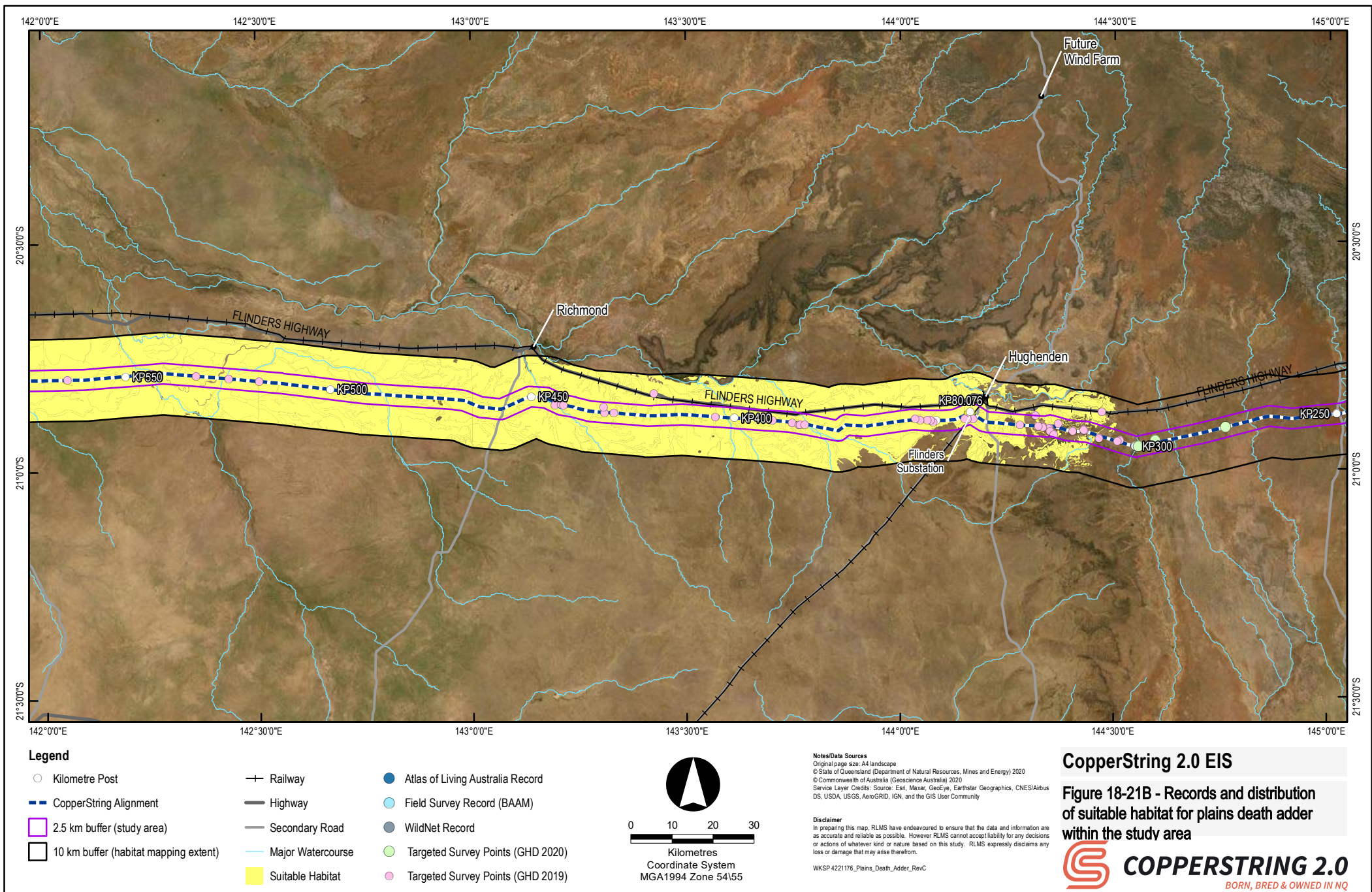
Disclaimer
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However, RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

WKSP 4221176_Plains_Death_Adder_RevC

CopperString 2.0 EIS

Figure 18-21A - Records and distribution of suitable habitat for plains death adder within the study area

COPPERSTRING 2.0
BORN, BRED & OWNED IN NQ



CopperString 2.0 EIS

Figure 18-21B - Records and distribution of suitable habitat for plains death adder within the study area



Ornamental snake (*Denisonia maculata*) – likely to occur

The ornamental snake is currently listed as Vulnerable under the EPBC Act.

The ornamental snake is known only from within the drainage system of the Fitzroy and Dawson Rivers in Queensland between Emerald and Inglewood (McDonald *et al.* 1991; Cogger *et al.* 1993). Important populations occur in remnant vegetation in close proximity to gilgai mounds and depressions (DSEWPac, 2012). The species occurs amongst woodlands and shrublands, preferably brigalow, in low lying areas where deep-cracking clays are abundant. The species utilises a high specialised habitat and can transition from highly abundant to absent within few hundred metres should topography or soil type change (Wilson and Swan, 2008).

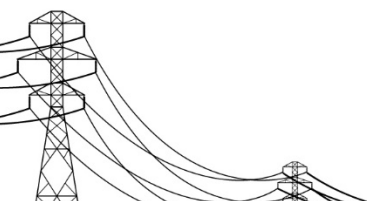
The ornamental snake is brown, grey / brown or black in colouration with lighter coloured body scales often with darker streaks. The head is darker brown / black with lighter flecks, distinctly barred lips, white to cream belly with dark spots on the outer edges (Cogger, 2000). The body length can reach up to 50 cm long. It is a secretive and nocturnal species and feeds almost entirely on frogs (Ehmann, 1992; Wilson and Swan, 2008). The species is more active during the summer months, but may be encountered throughout the year. Activity peaks generally correlate to heavy rains when frogs congregate to breed, and later when young frog emerge (Curtis *et al.* 2012).

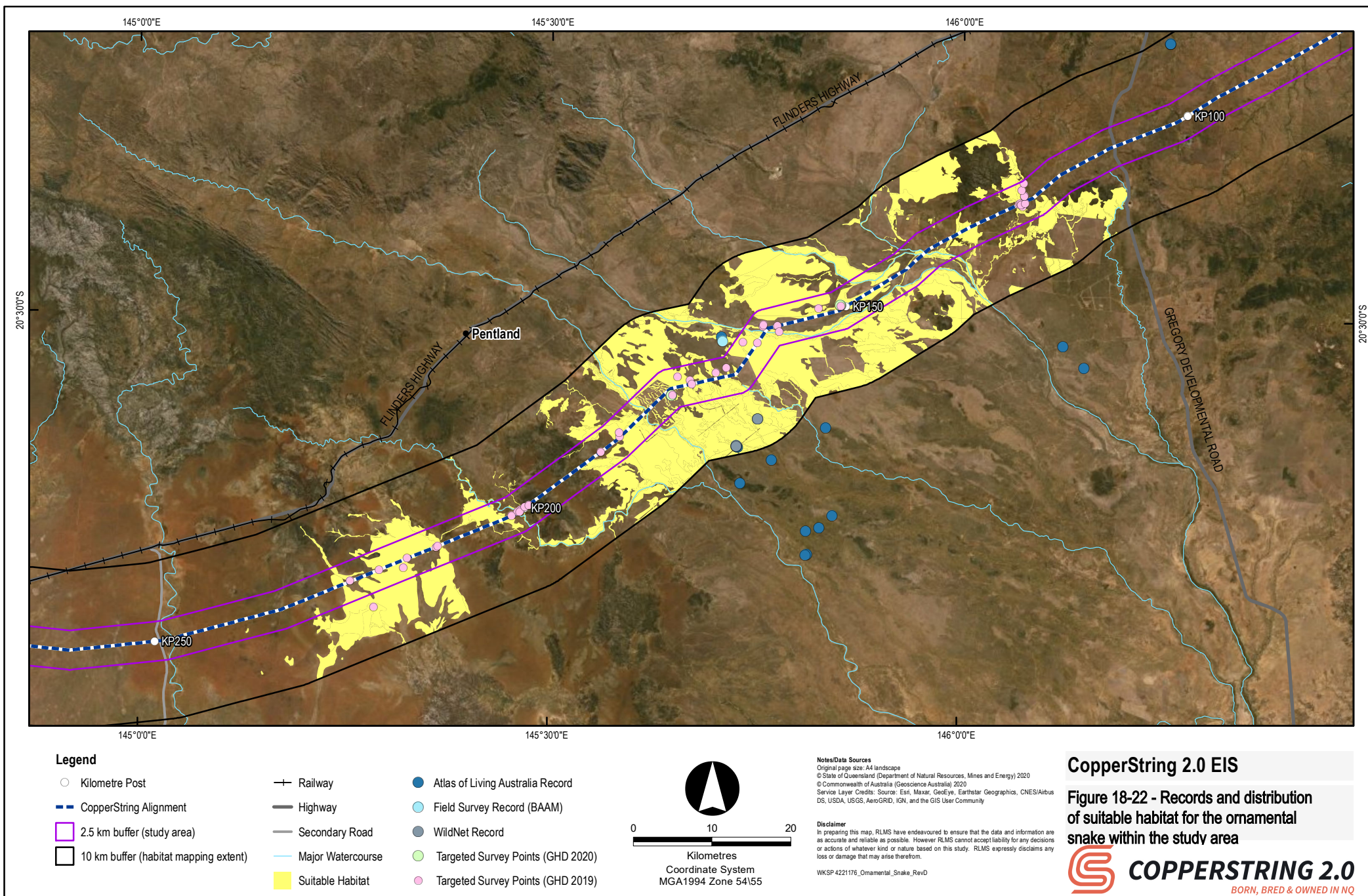
Although the ornamental snake was not recorded during field studies, suitable habitat was identified at five separate locations within the Renewable Energy Hub and Copperstring Core sections. Within the Renewable Energy Hub, suitable habitat was identified between the Cape River and Campaspe River, approximately 24 km from the township of Homestead and between Prairie (KP288WD and KP284WD) and Torrens Creek (KP280WD). Within the Copperstring Core section, suitable habitat was identified within *belah* (*Casuarina crista*) and *gidgee* (*Acacia cambagei*) woodlands with scattered gilgais and had a high abundance of ground cover at KP185WD and between KP307-307.6WD (refer to Plate 18-13). Suitable habitat for the species is broadly mapped within the Pentland region and surrounding Woodstock, where four Wildlife Online records and one Queensland Museum record are located (refer to Figure 18-22).





Plate 18-14 Suitable habitat for the ornamental snake within the study area



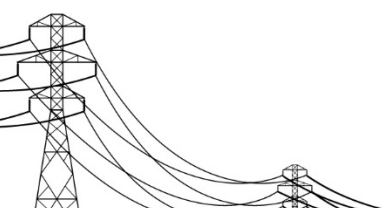


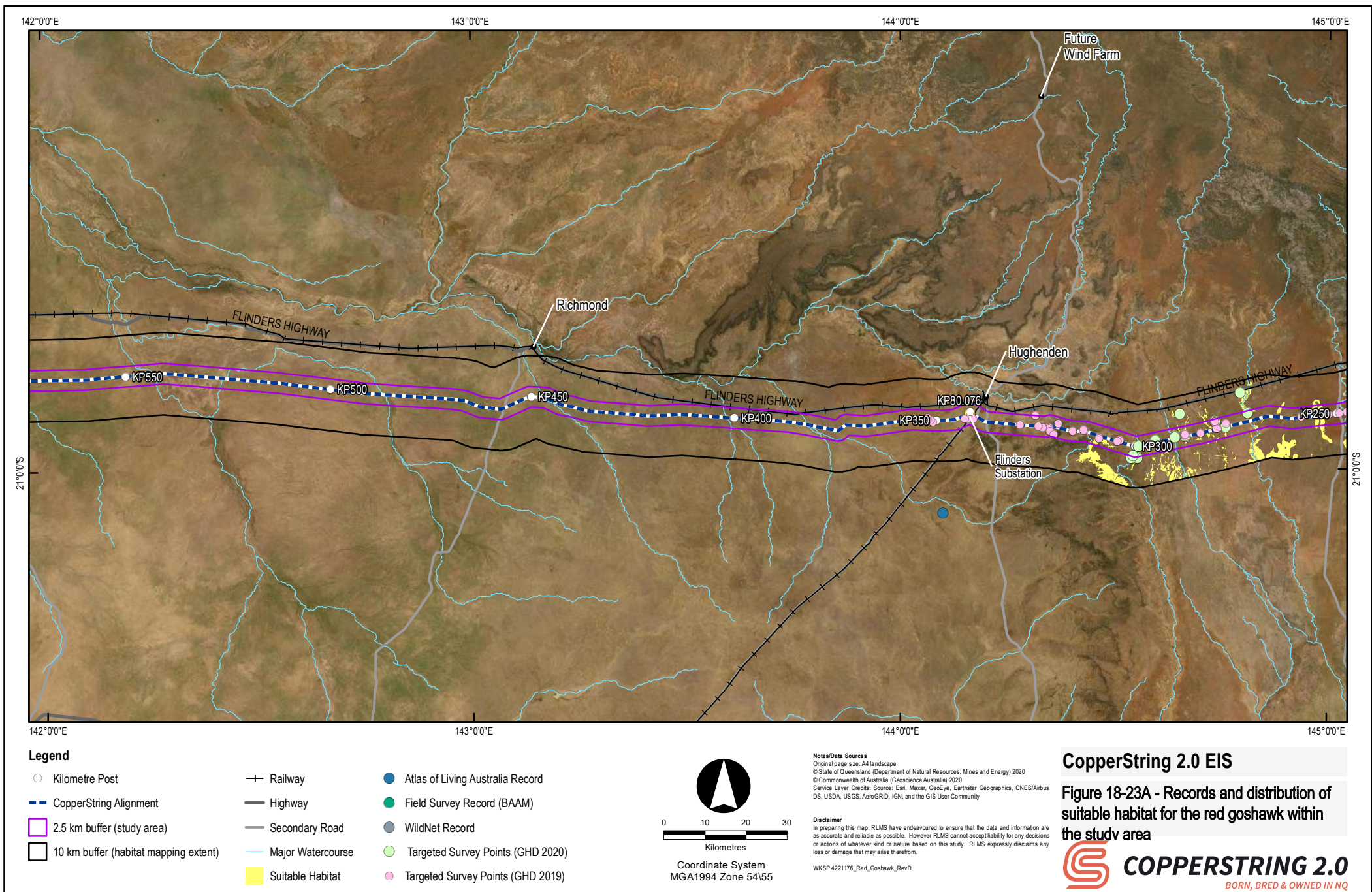
Red goshawk (*Erythrotriorchis radiatus*) – likely to occur

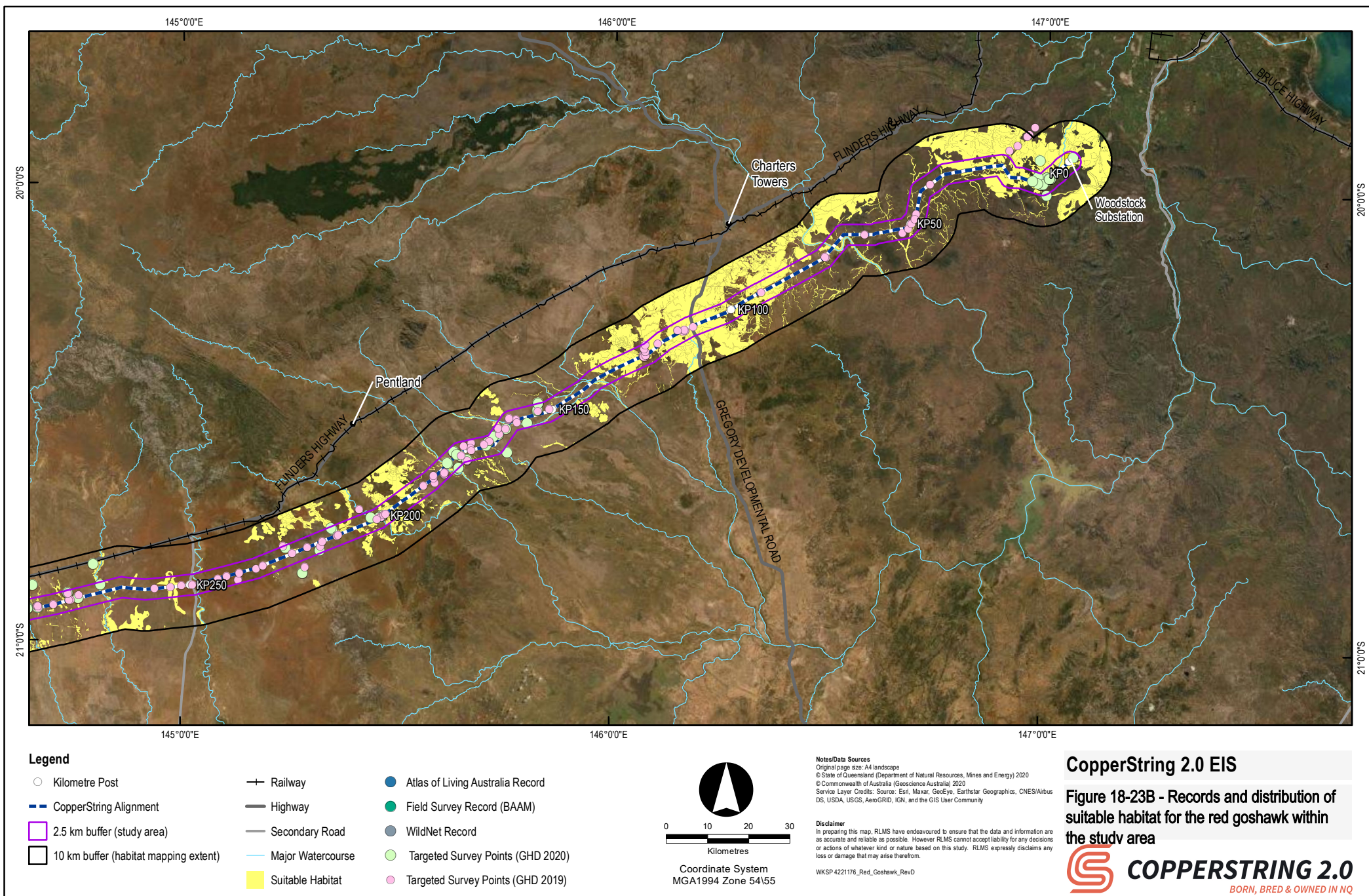
The red goshawk is listed as Vulnerable under the EPBC Act.

This species has the potential to occur throughout coastal and sub-coastal Queensland (DAWE 2020b). Although the species' occurrence in central Queensland is probable, no breeding habitat has been recorded within this region (DAWE 2020b). Although once occurring in areas of New South Wales, it is believed that the species range may have contracted to the north as limited sightings have been confirmed in recent years (Red Goshawk Recovery Team 2015). Preferred habitat includes semi-closed Eucalypt woodlands, tall open forests, gallery rainforests, swamp sclerophyll forests and rainforest margins with a mosaic of vegetation types and in proximity to permanent water (Marchant and Higgins 1993). The species favours the ecotone between different forest types where it remains concealed amongst the midstorey hunting for small birds, lizards and snakes). Within its range, the red goshawk is considered sparsely distributed and occurs in low densities. Males occupy a home range of over 200 km² while females occupy a reduced range of 120 km² (DAWE 2020b).

This species was not recorded during field surveys though suitable habitat was identified in the eastern and western sections of the corridor selection. The species was considered unlikely to occur throughout the central section of the Project due to the lack of woodland / forest habitats. Additionally, there are four Wildlife Online records for the species located within the study area around the Mount Isa region. Suitable habitat for the red goshawk was mapped throughout the eastern and western extent of the proposed corridor selection (refer to Figure 18-23).







Night parrot (*Pezoporus occidentalis*) – likely to occur

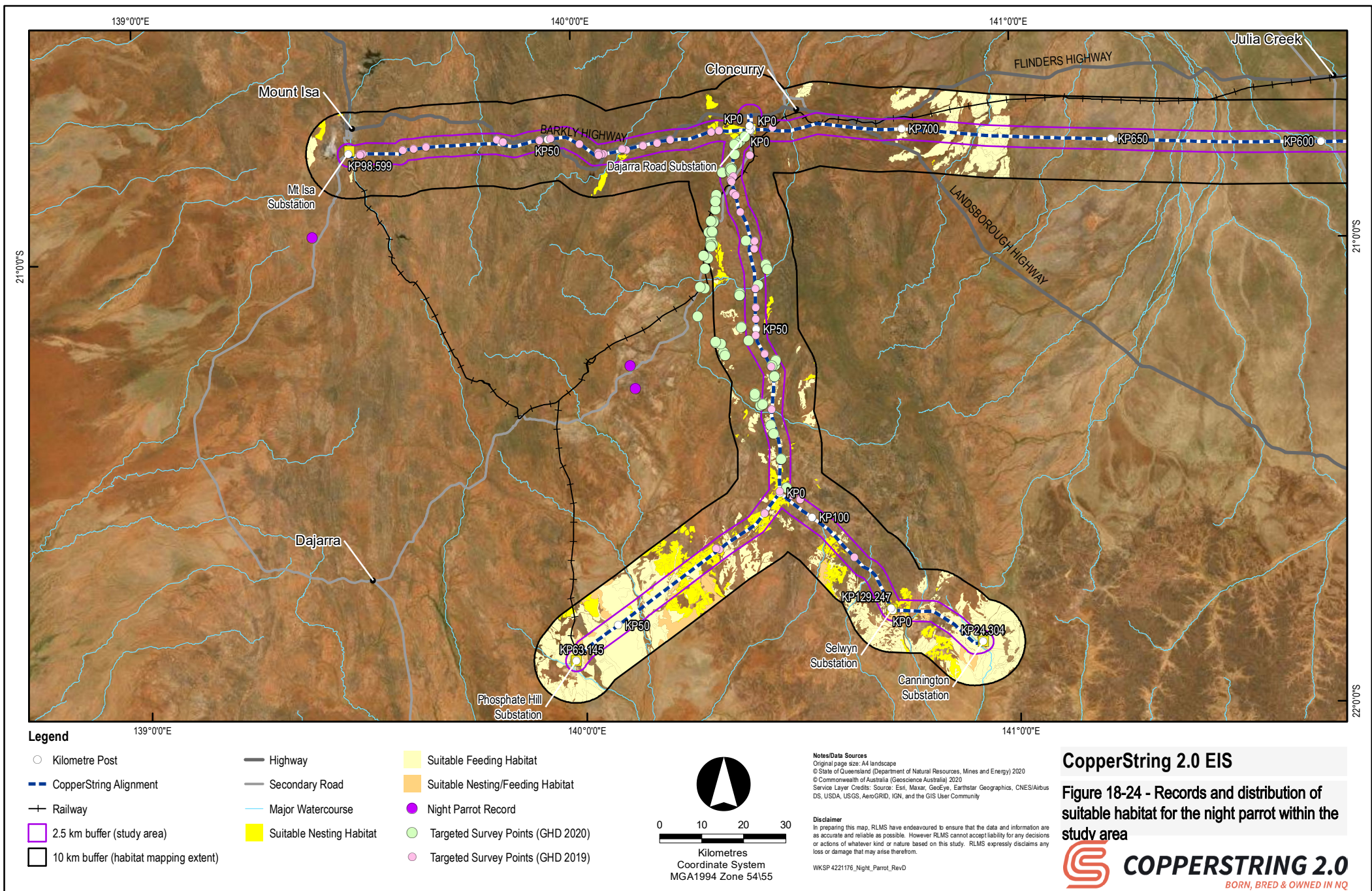
The night parrot is currently listed as Endangered under the EPBC Act.

This species was previously thought to be extinct, before two dead specimens were found in western Queensland in 1990 and 2006 (Cupitt and Cupitt 2008). The species' existence was later confirmed with a photograph in 2013 (Dooley 2013), followed by two unconfirmed sightings in 2016 (McLeish 2016) and 2017 (Jones 2017) from central-western Queensland and Western Australia respectively. The preferred habitats for the species includes arid and semi-arid grasslands dominated by spinifex, where the species nests in tunnel-like burrows amongst dense grass. Although less common, sightings have also been recorded amongst samphire, bluebush and saltbush shrublands (DAWE 2020b). Despite the potential to inhabit a large area of inland and arid Australia, the night parrot is regarded as a cryptic and elusive and only known from a number of locations. In order to protect the species, there is a high level of secrecy and restrictions on the release of information on the location of night parrot populations. As such, a conservative approach has been adopted for the Project and the species has been assessed as likely to occur to ensure it receives appropriate protection from any clearing impacts.

No night parrots were recorded during the field surveys or in past or recent sampling events. Targeted assessments for the species were conducted at 27 sites within the Ballara Nature Refuge, with songmeters deployed at three locations. No known calls of the night parrot were recorded at these locations, and therefore these areas unlikely to support a long-term stable night parrot population. Potentially suitable habitat was located south of Mount Isa and Cloncurry, where there are several unconfirmed sightings from the 1990s (Garnett et al. 1993). One patch of spinifex (*Triodia longiceps*) grassland (RE 1.5.2) suitable for nesting habitat was recorded 3.8 km west of the alignment from KP42 DS (beyond the study area) within Ballara Nature Refuge. Patches of currently low value potential feeding habitat was observed approximately 10 km south of Ballara Nature Refuge. This habitat was limited due to lack of annual grasses observed during the survey and cattle disturbance.

Additionally, five individuals were reported in the desktop assessment conducted for the initial EIS (BAAM 2011), however this species was not reported within the 2019 desktop search extent.

Potential nesting and feeding habitat has been mapped through this area based on REs that are predominantly spinifex grassland for nesting habitat and grassland and forbland for feeding habitat. Known nesting and feeding habitat characteristics from Pullen Pullen Reserve (approximately 170 km south-east of the Project area) where the REs they occur in are better-documented. The desktop mapping was partially ground-truthed during field surveys of the nature refuge and surrounding areas in October 2020. Many of the mapped REs were considered to be too woody or too recently burnt to provide adequate habitat value for the night parrot. Further desktop mapping to refine these REs is currently being undertaken in consultation with members of the Night Parrot Recovery Team. Additional field survey will then be conducted to thoroughly ground-truth the potential nesting and feeding habitat areas, and to do targeted searches for night parrot individuals using songmeters and subsequent data analysis by the Night Parrot Recovery Team members. Suitable habitat for the night parrot is presented in Figure 18-24.



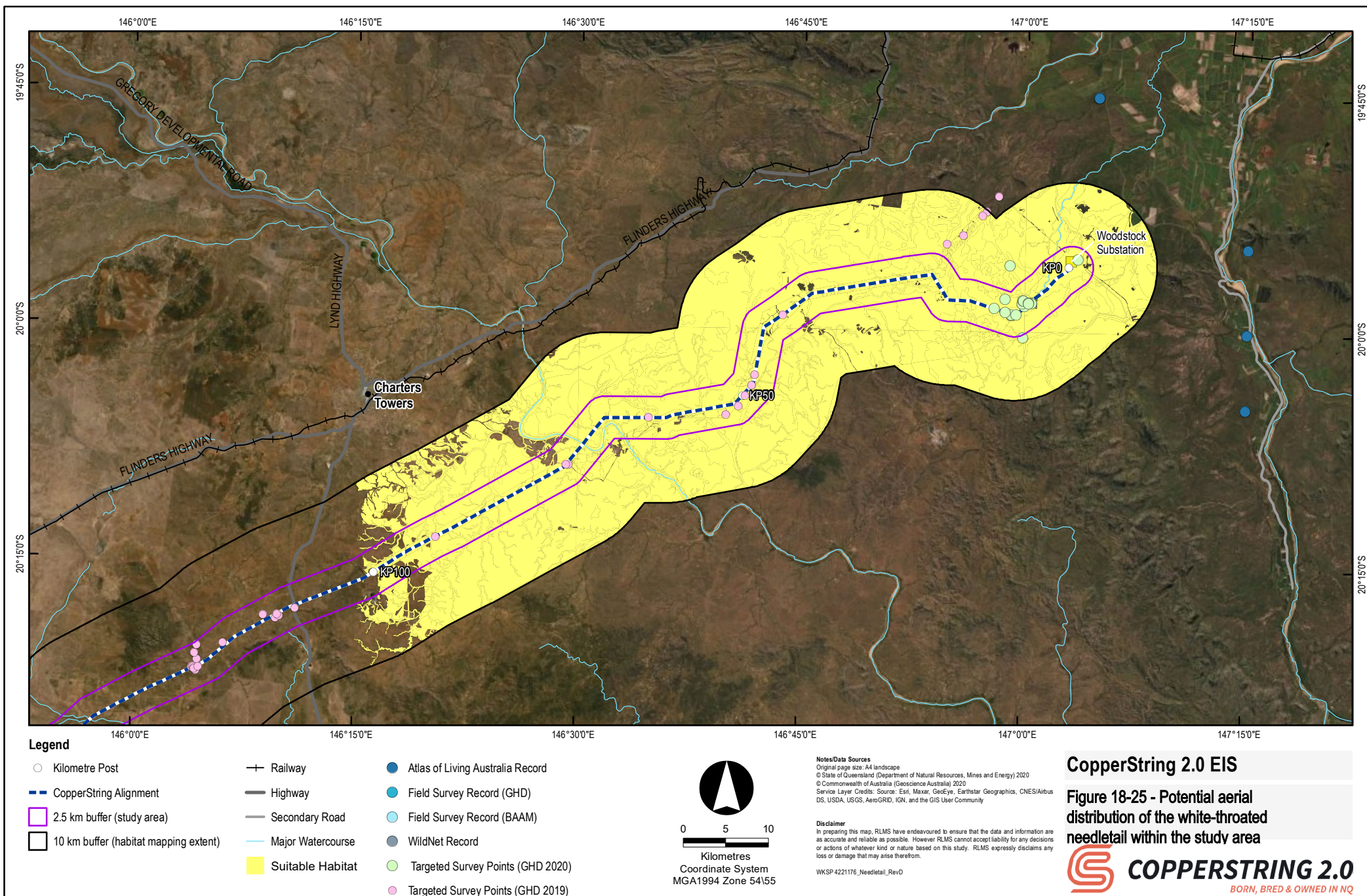
White-throated needletail (*Hirundapus caudacutus*) – likely to occur

The white-throated needletail is listed as Vulnerable and migratory under the EPBC Act.

The white-throated needletail is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground (Coventry 1989; Tarburton 1993; Watson 1955). Due to its aerial nature, the species does not have strict associations with habitat types (Cramp 1985). In Queensland, it is recorded in all coastal regions, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DAWE 2020b). The species forages over a range of habitat types including woodland, open forest, rainforest, heathland and partly cleared pasture and agricultural land (Higgins 1999). In Australia, the species is gregarious, often occurring in large flocks of up to hundreds or thousands of birds (DoEE 2019), before migrating to Asia to breed. Breeding occurs throughout Asia, including Siberia, Mongolia, Japan and China and spending the non-breeding season (i.e. October to April) in Australasia (Higgins 1999).

Although the white-throated needletail was not observed during field surveys, the species is likely to occur over all habitats at the eastern extent of the proposed corridor selection, between Hughenden and Woodstock and several records were reported within desktop study area. The potential aerial distribution of the white-throated needletail is mapped in Figure 18-25).

As the white-throated needletail is exclusively aerial and has no conventional reliance on terrestrial habitats (Cramp 1985), it should be noted that the area mapped in Figure 18-25 shows the species distribution only and does not indicate reliance on habitats at ground level. As such, no predicted habitat has been mapped for this species.



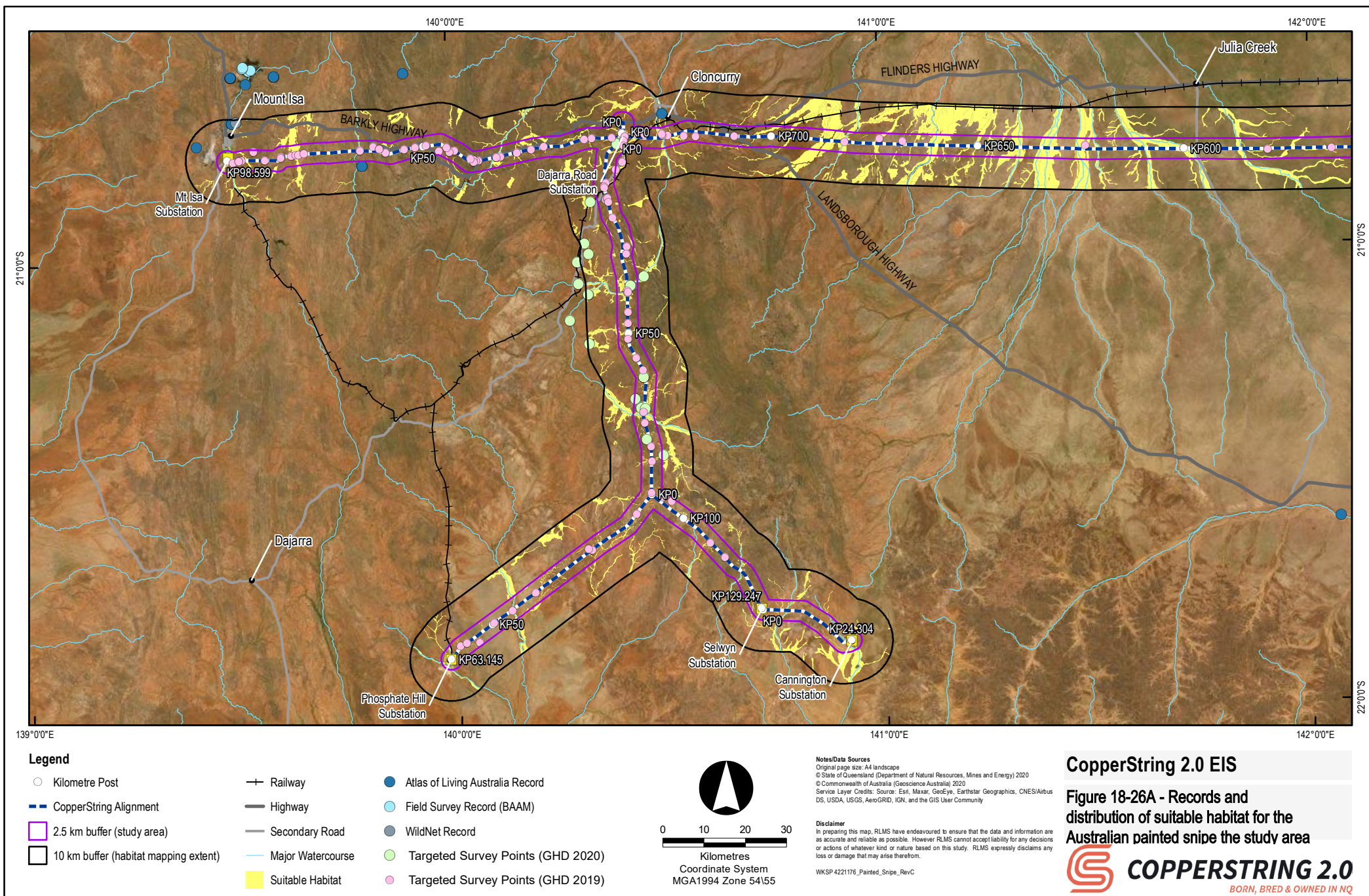
Australian painted-snipe (*Rostratula australis*) – likely to occur

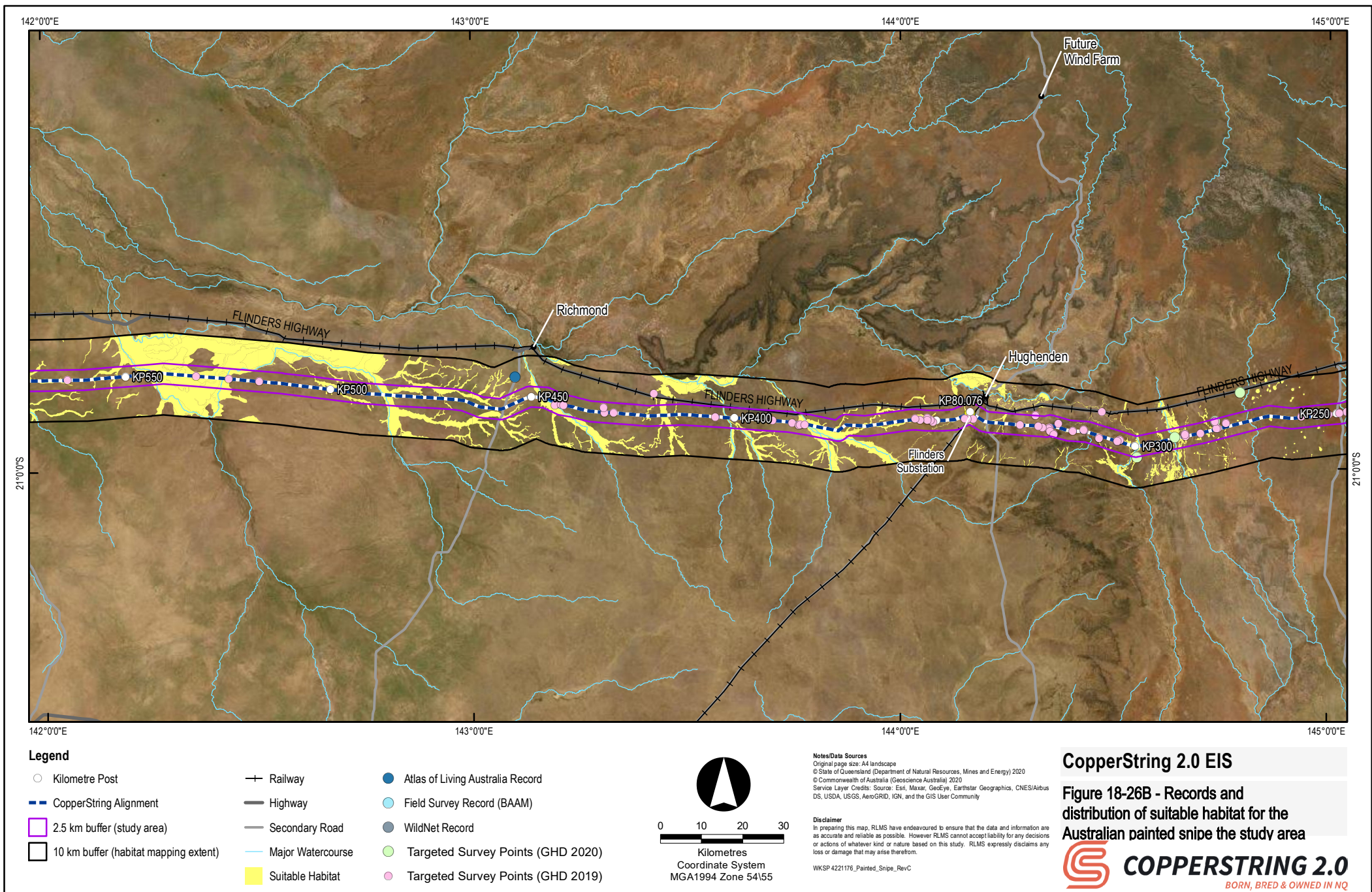
The Australian painted snipe is listed as Endangered under the EPBC Act.

The Australian painted snipe has a broad distribution and is known to occur in all mainland states of Australia. The Murray–Darling drainage system appears to have been a key area for this species, with many records of this species coming from this region. Usually sightings only include a single individual although flocks of up to 30 are known to occur. Their preferred habitats includes the fringe of a wide variety of permanent and/or temporary shallow, brackish and freshwater wetlands. Suitable wetlands usually support a mosaic of low, patchy vegetation, as well as lignum and cane grass. Nesting occurs within a scrape on the ground amongst reeds and tussocks which is lined with twigs, leaves and stalks of grass. Breeding is often in response to local conditions; generally occurs from September to December. Three or four dull-coloured, spotted and blotched eggs are laid, and these are incubated by the male, who provides most of the care for the young. The female is polyandrous.

The Australian painted-snipe was not recorded during field surveys though this species was previously been recorded within the desktop search extend at -20.7351, 145.4476; -20.2830, 146.2343; 20.5019, 145.8291; -20.5940, 145.6663 and two individuals have been recorded around Charters Towers. A single Queensland Museum record is also located at KP167WD.

Records for the species are located between KP178WD and KP 168WD and suitable habitat for the Australian painted snipe was intermittently mapped throughout the majority of the eastern section of the Project (refer to Figure 18-26).





Grey falcon (*Falco hypoleucos*) – likely to occur

The grey falcon was recently listed as Vulnerable under the EPBC Act, as of July 2020.

The grey falcon is considered the rarest falcon in Australia (Olsen and Olsen, 1986; Marchant and Higgins, 1993), and one of the rarest falcon species in the world (Schoenjahn *et al.*, 2019). Despite being recorded throughout most of Australia, the species is normally confined to hot, arid, inland environments (Schoenjahn, 2019). It inhabits a range of habitat types, including lightly timbered woodlands, Acacia shrublands and Triodia grasslands with annual rainfall under 500 mm (Marchant and Higgins, 1993). The species' core breeding habitat is restricted to Australia's hottest climatic regions (Schoenjahn, 2013). Consequently, there is a recognised lack of sampling of the species' breeding habitat. Similar to other falcon species, the grey falcon utilises old nests of other birds of prey and ravens, usually located in living Eucalypts near water.

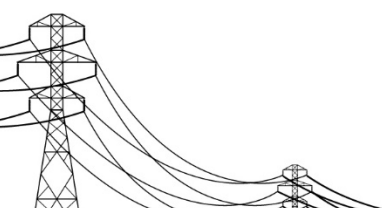
No grey falcons were recorded during field surveys, however the species is known to occur around Mount Isa and Cloncurry where it has been reported as an occasional, non-breeding, winter visitor. Confirmed sightings are also located near Richmond, Cloncurry, Six Mile Plains and Julia Creek and within the White Mountain Nature Reserve. Potential habitat for the grey falcon was mapped within CopperString Core, Mount Isa Augmentation, Southern Connection, Cannington Connection and Phosphate Hill Connection sections of the Project (refer to Figure 18-27).

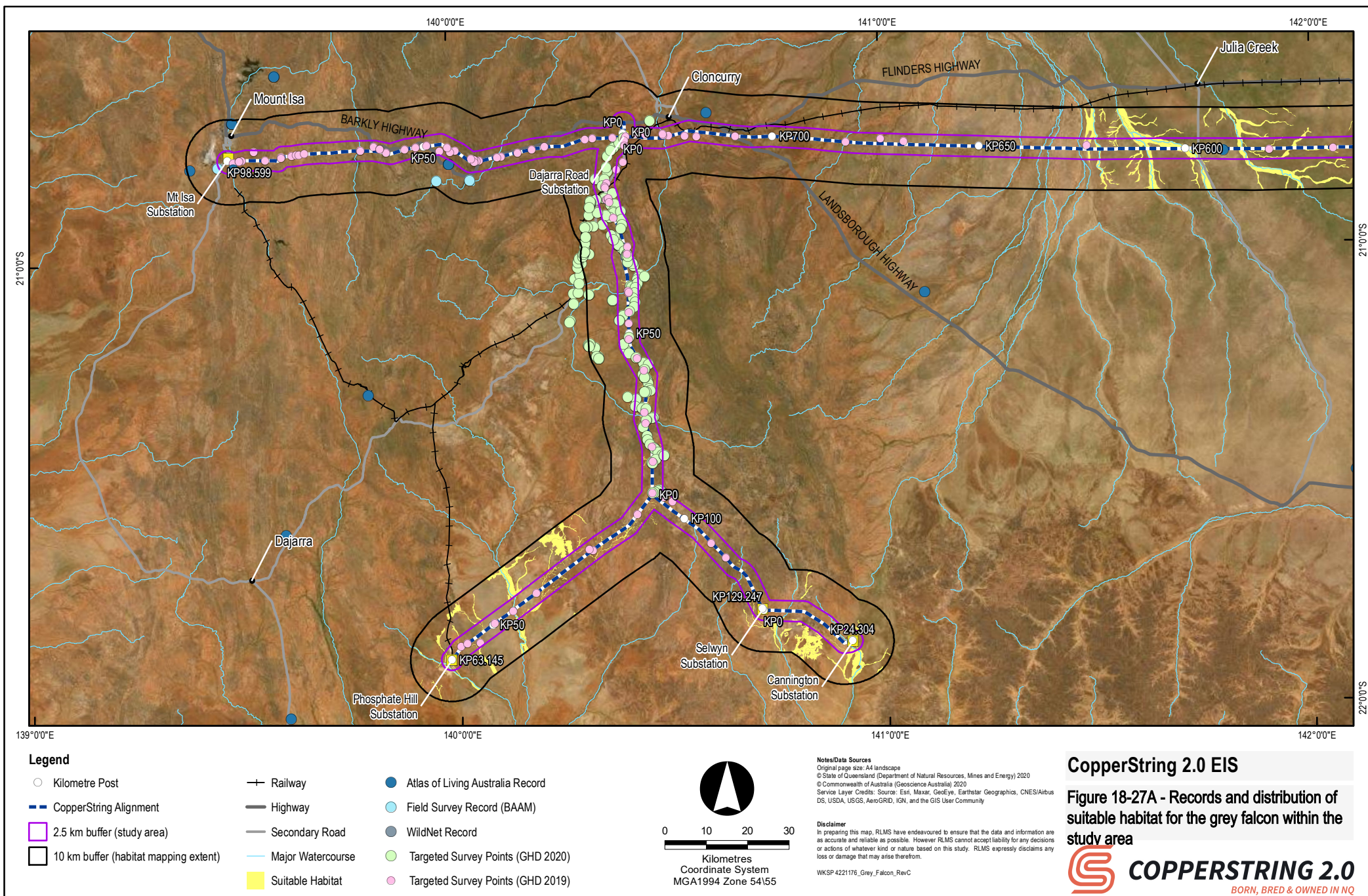
Painted honeyeater (*Grantiella picta*) – likely to occur

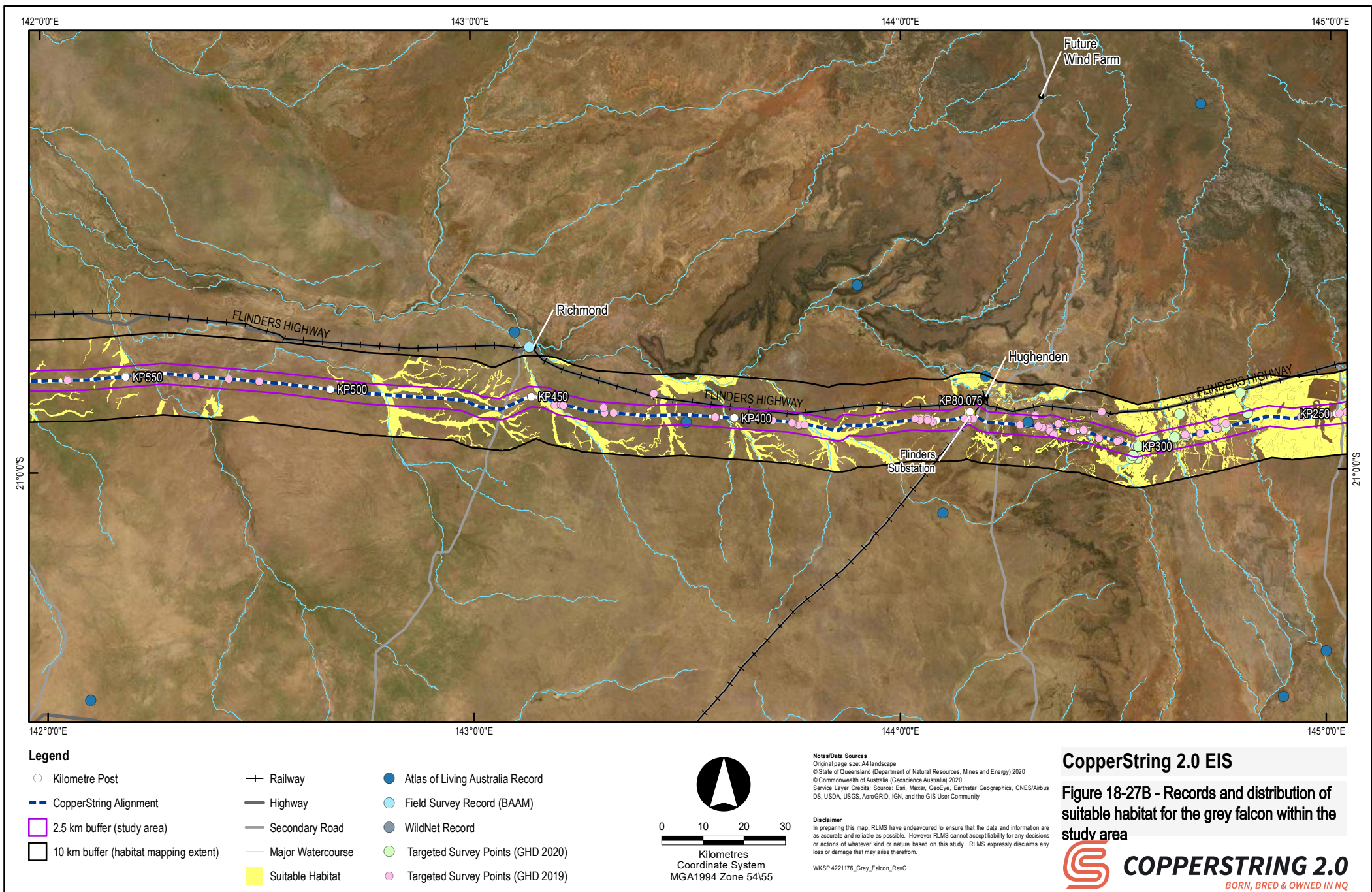
The painted honeyeater is currently listed as Vulnerable under the EPBC Act.

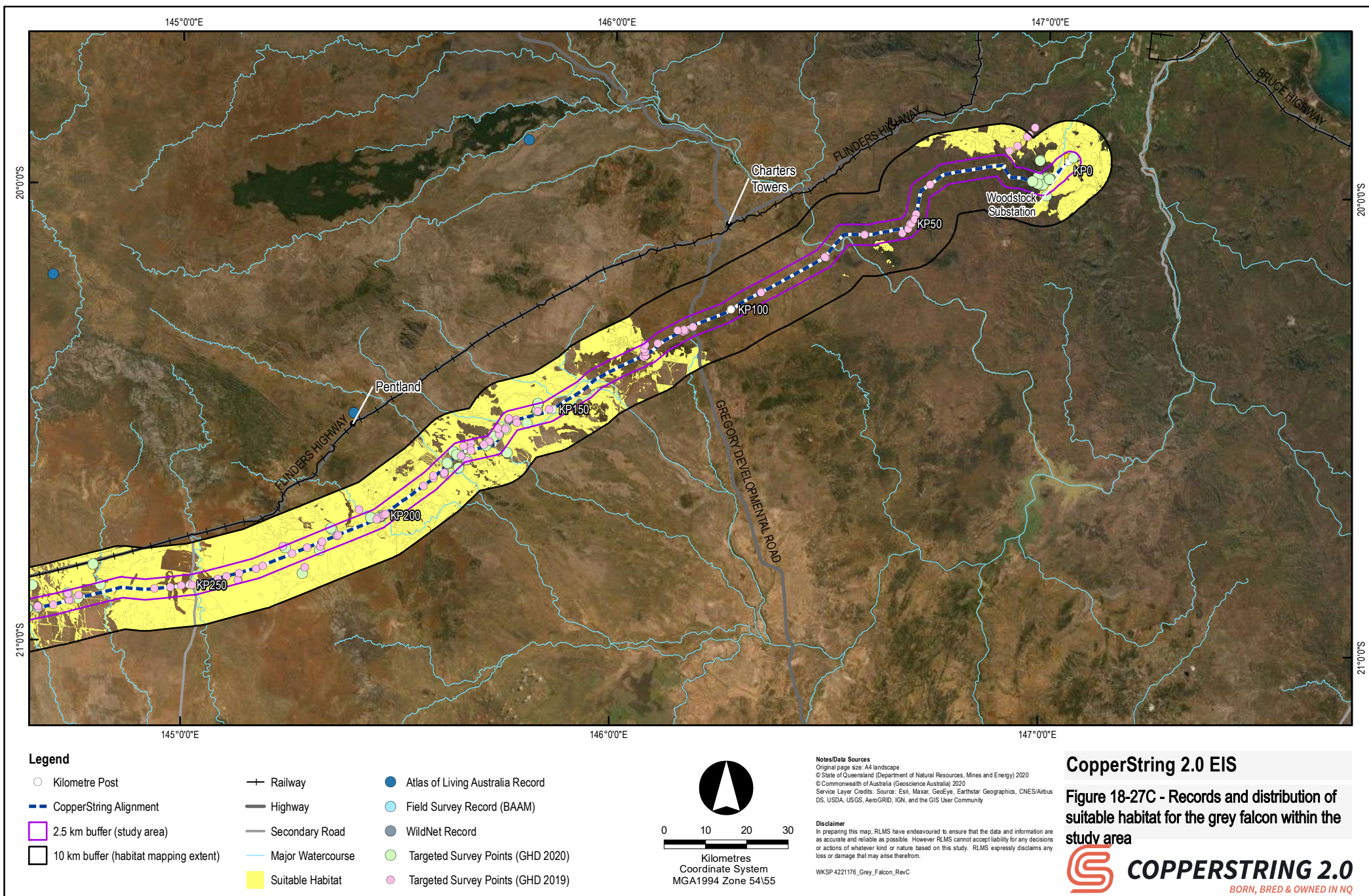
The painted honeyeater is highly nomadic, ranging from northern Queensland to southern Victoria. Although primarily residing west of the Great Dividing Range, non-breeding pairs have been recorded around coastal areas and along the eastern seaboard (Watson 2012). During winter, birds are known to migrate to northern Queensland and eastern areas of the Northern Territory. Their preferred habitat includes woodland ecosystems, although the species is known to occur in riparian woodlands and acacia scrubs. The species has a highly specialised diet, feeding almost exclusively on mistletoe fruit and flowers (Oliver *et al.* 2003) and the birds rely heavily on grey mistletoe (*Amyema quandang*) and needle-leaved mistletoe (*A. cambagei*) for breeding and foraging (Barea and Watson 2007; Watson 2012). Breeding occurs between October and March and occurs in response to resource availability. Pairs nest in *Eucalyptus* spp., *Acacia homalophylla* and *Callitris glaucophylla* with nests chosen in relation to proximity to mistletoe availability.

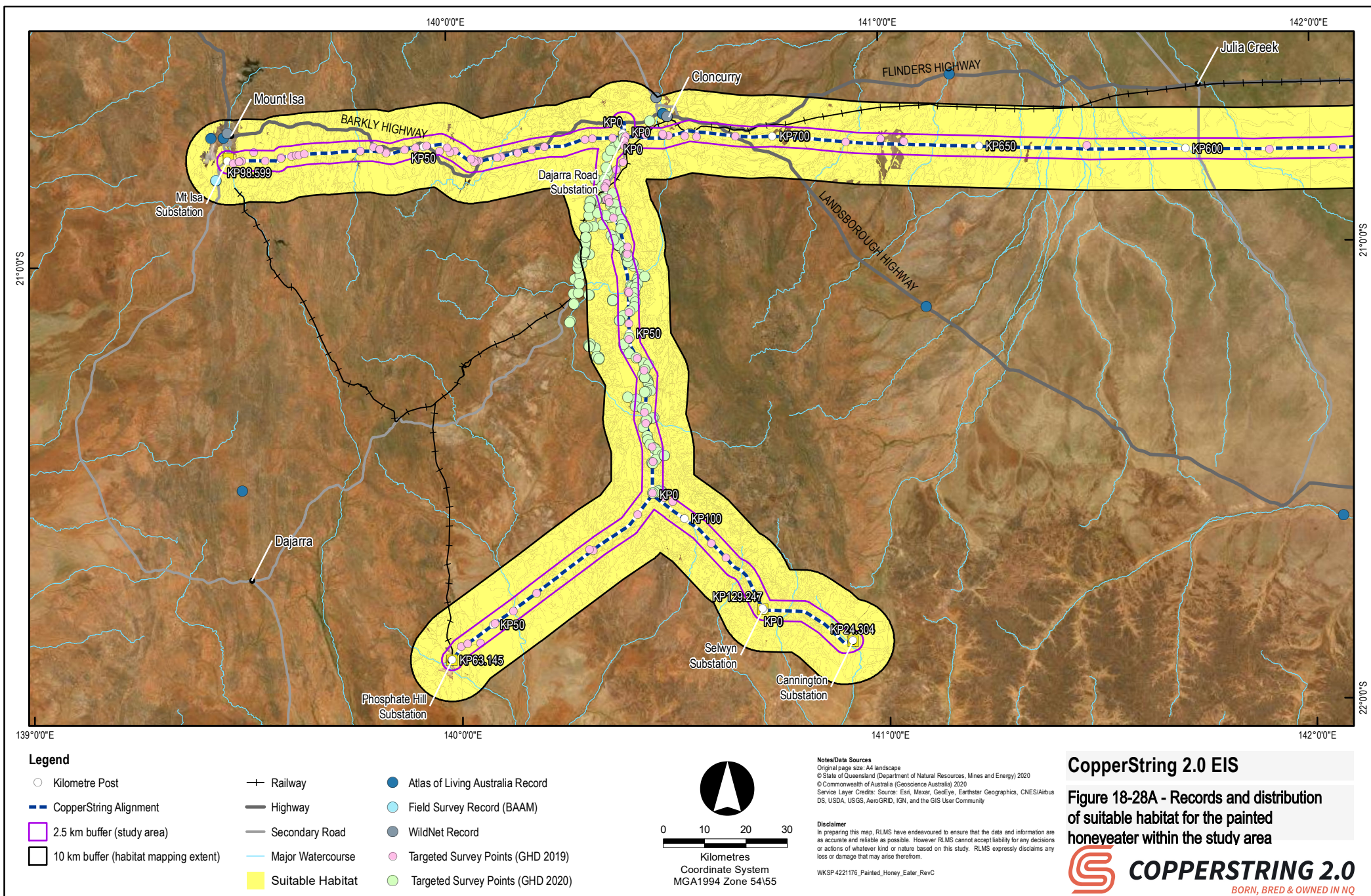
No painted honeyeaters were recorded during field survey however suitable habitat was identified around within the central and western sections of the corridor selection. A high abundance of mistletoe was also recorded at KP 125 WD. Past surveys mapped potential habitat around sections KP26SC, KP30.5DS, KP 39DS, KP 53DS and KP71DS and the species has been recorded within desktop search extent at - 20.9069, 144.2859 (Figure 18-28).

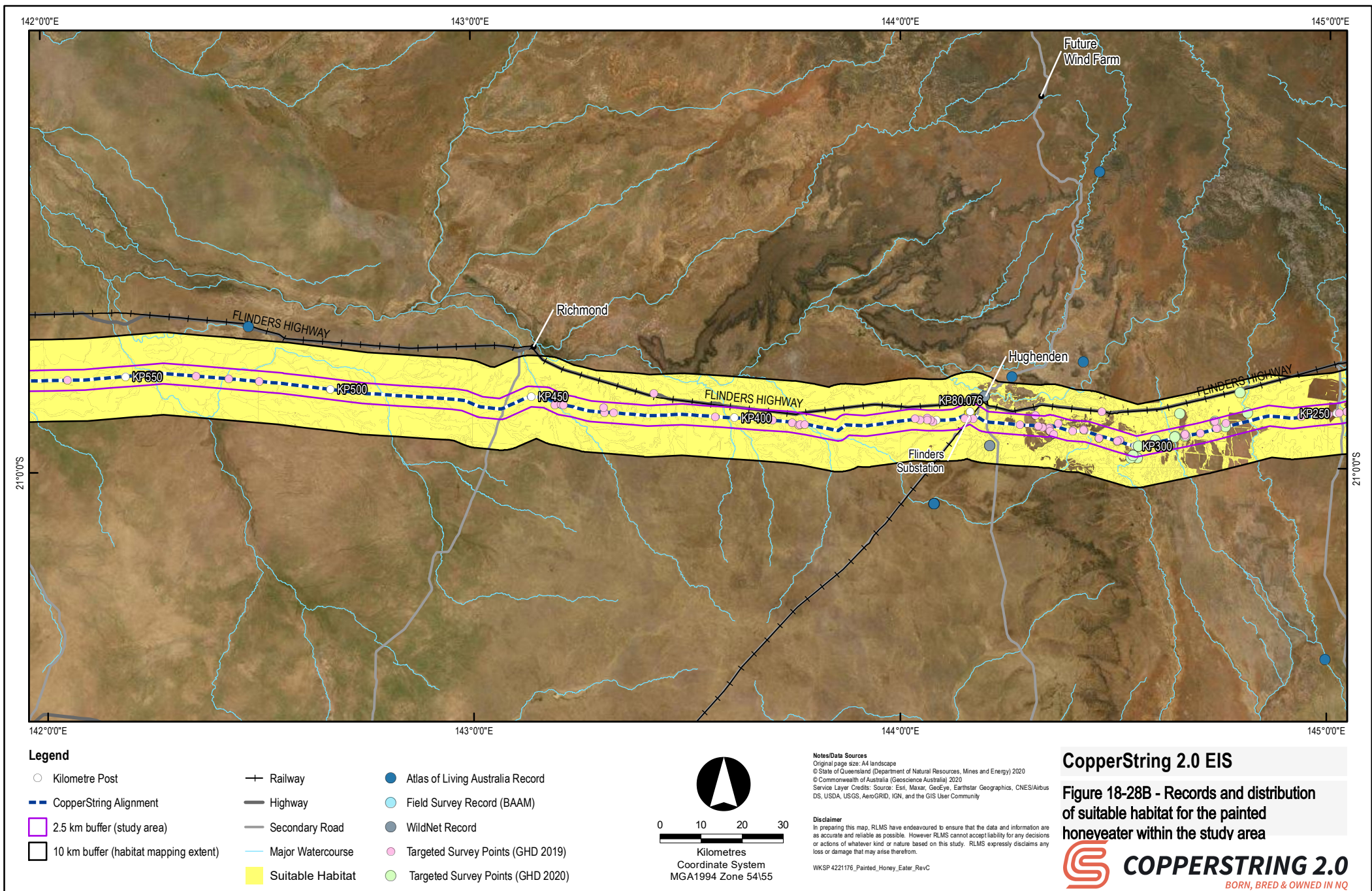


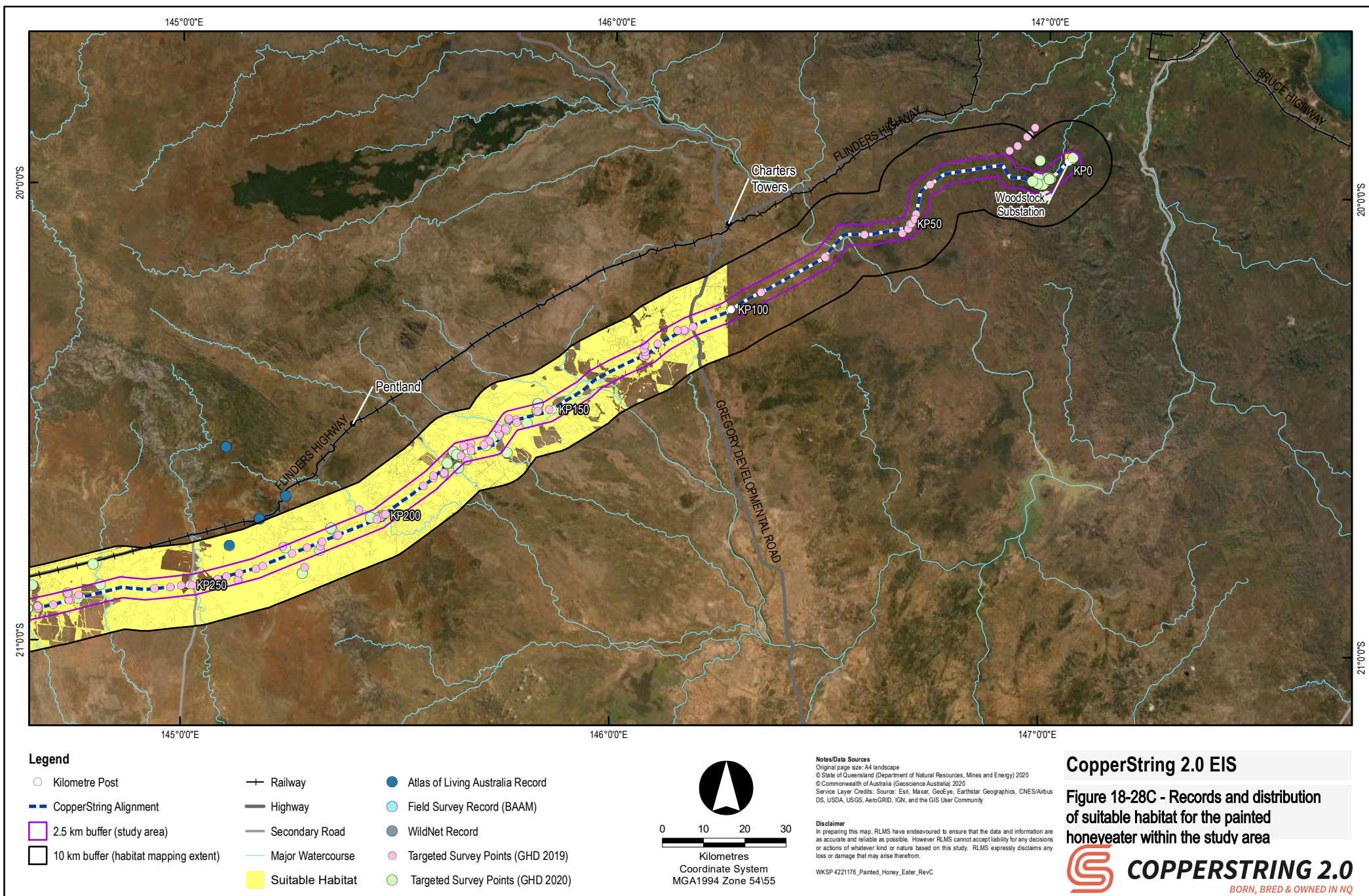












18.4.11 Listed migratory species

18.4.11.1 Desktop results

A review of the PMST and Wildlife Online databases identified 38 migratory species (37 migratory bird species and one reptile species) listed under the EPBC Act that have been historically recorded or may have suitable habitat present within the desktop search extent (refer to Table 18-29). Most of the species were recorded or predicted to occur in the Renewable Energy Hub and Mount Isa Augmentation sections of the corridor selection. Nine species were recorded or assessed as 'likely to occur' across the entire corridor selection.

One additional listed migratory species (white-throated needletail) has been assessed as a listed threatened species (refer to Section 18.4.10).

The presence of an additional listed threatened migratory species (not recorded in desktop searches) was required to be considered under the terms of reference for the EIS, namely the freshwater sawfish (*Pristis pristis*).

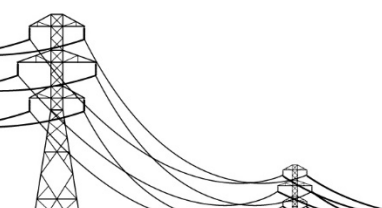
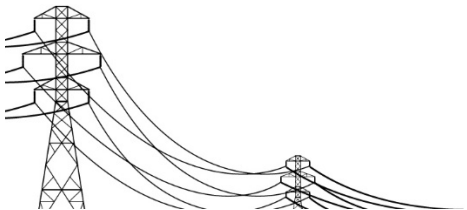
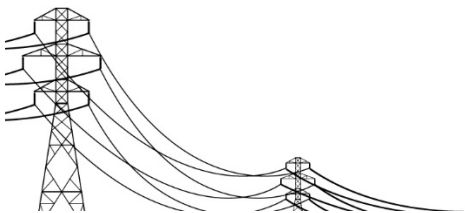


Table 18-32 Migratory species predicted to occur or historically recorded in desktop searches

Scientific name	Common name	Mount Isa Augmentation	Southern Connection	Phosphate Hill Connection	Cannington Connection	CopperString Core	Renewable Energy Hub
Birds							
<i>Actitis hypoleucos</i>	Common sandpiper	PMST; WO	PMST	PMST	PMST	PMST; WO	PMST; WO
<i>Apus pacificus</i>	Fork-tailed swift	PMST; WO	PMST; WO	PMST	PMST	PMST; WO	PMST; WO
<i>Arenaria interpres</i>	Ruddy turnstone	WO					
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	PMST; WO	PMST	PMST	PMST	PMST; WO	PMST; WO
<i>Calidris alba</i>	Sanderling					WO	
<i>Calidris ferruginea</i>	Curlew sandpiper	PMST	PMST	PMST	PMST	PMST	PMST
<i>Calidris melanotos</i>	Pectoral sandpiper	PMST	PMST	PMST	PMST	PMST	PMST
<i>Calidris ruficollis</i>	Red-necked stint	WO				WO	WO
<i>Calidris subminuta</i>	Long-toed stint	WO					
<i>Charadrius veredus</i>	Oriental plover	PMST; WO	PMST	PMST	PMST	PMST; WO	WO
<i>Chlidonias leucopterus</i>	White-winged black tern	WO					WO
<i>Cuculus optatus</i>	Oriental cuckoo	WO				PMST	PMST
<i>Gallinago hardwickii</i>	Latham's snipe	WO				PMST	PMST; WO
<i>Gallinago megala</i>	Swinhoe's snipe	WO					
<i>Gelochelidon nilotica</i>	Gull-billed tern	WO	WO				WO
<i>Glareola maldivarum</i>	Oriental pratincole	PMST; WO	PMST	PMST	PMST	PMST; WO	
<i>Hirundo rustica</i>	Barn swallow	WO					
<i>Hydroprogne caspia</i>	Caspian tern	WO	WO			WO	WO
<i>Limosa limosa</i>	Black-tailed godwit	WO					WO
<i>Monarcha melanopsis</i>	Black-faced monarch						PMST; WO
<i>Monarcha trivirgatus</i>	Spectacled monarch						PMST; WO
<i>Motacilla cinerea</i>	Grey wagtail	PMST	PMST	PMST	PMST	PMST	PMST
<i>Motacilla flava</i>	Yellow wagtail	PMST	PMST	PMST	PMST	PMST	PMST
<i>Myiagra cyanoleuca</i>	Satin flycatcher						PMST; WO
<i>Numenius madagascariensis</i>	Eastern curlew	PMST	PMST			PMST	PMST
<i>Numenius minutus</i>	Little curlew	WO				WO	WO
<i>Pandion cristatus</i>	Eastern osprey	WO					



Scientific name	Common name	Mount Isa Augmentation	Southern Connection	Phosphate Hill Connection	Cannington Connection	CopperString Core	Renewable Energy Hub
<i>Pandion haliaetus</i>	Osprey	PMST	PMST			PMST	PMST
<i>Phalaropus lobatus</i>	Red-necked phalarope	WO					
<i>Plegadis falcinellus</i>	Glossy ibis	WO	WO		WO		WO
<i>Pluvialis fulva</i>	Pacific golden plover	WO			WO		
<i>Rhipidura rufifrons</i>	Rufous fantail						PMST; WO
<i>Tringa brevipes</i>	Grey-tailed tattler						WO
<i>Tringa glareola</i>	Wood sandpiper	WO					WO
<i>Tringa nebularia</i>	Common greenshank	PMST	PMST		WO	PMST	PMST; WO
<i>Tringa stagnatilis</i>	Marsh sandpiper	WO			WO		WO
<i>Xenus cinereus</i>	Terek sandpiper	WO					
Reptiles							
<i>Crocodylus porosus</i>	Salt-water crocodile						PMST



18.4.11.2 Survey findings

Nine species of migratory bird were **confirmed present** during field surveys or considered **likely to occur**. The Mount Isa Augmentation, CopperString Core and Renewable Energy Hub sections of the corridor selection were identified as key areas containing habitat for migratory species, particularly around Mount Isa, Charters Towers and Pentland.

Information on the ecology and distribution within the project area is provided in the following subsections for listed migratory species confirmed present and considered likely to occur within the project area. Brief habitat descriptions for the remaining species identified in the desktop assessment are provided in the likelihood of occurrence assessment table provided in Section 18.4.12.

Glossy ibis (*Plegadis falcinellus*) – confirmed present

Usually occurs east of the Kimberly in WA and the Eyre Peninsula in SA. Only patchily distributed through the remainder of WA. It is a rare visitor to TAS. It inhabits fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. The largest, continuous areas of prime habitat is inland and northern floodplains (DoEE, 2019b). Migrates in response to rainfall within Australia, however its core breeding area is within the Murray-Darling Basin in NSW and VIC, the Macquarie Marshes in NSW and southern QLD. It often moves north in autumn then returns south to the breeding areas in spring and summer (DoEE, 2019b).

This species was recorded in GHD 2019 and 2020 field surveys for the project and has been historically recorded extensively throughout the entirety of the desktop search extent (Plate 18-14). Hotspots include around Mount Isa and Charters Towers. Numerous individuals were observed at the Skeleton Creek wetland south of KP308 WD. The corridor has been re-aligned to avoid impact on that area. This species was also recorded at Chinaman Creek near Cloncurry (4 km north of KP 734WD) and at an artificial dam near Ravenswood at KP7WD. Suitable breeding or foraging habitat has been mapped for this species for lakes, dams and wetlands (refer to Figure 18-30).



Plate 18-15 Glossy ibis within the study area

Marsh sandpiper (*Tringa stagnatillis*) – Confirmed present

The marsh sandpiper utilises a range of permanent and ephemeral wetlands and waterbodies throughout coastal and inland parts of Australia including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats (DAWE 2020). The species breeds in eastern Europe and Siberia and occurs in Australia between September and March/April. In Queensland, the species is primarily found in coastal areas, with records located along the coast from south-east Queensland to Cairns and extensive areas along the northern coastline within the Gulf of Carpentaria. Inland records are known from Reeves Lake, northwest of Charters Towers, Lake Numalla in Currawinya National Park and Lake Moondarra, north of Mount Isa. Approximately ten individuals were observed foraging at the edges of the Skeleton Creek wetland, south-west of Prairie KP300 WD (Plate 18-15). Non-breeding habitat for this species has been mapped in the study area (refer to Figure 18-30).



Plate 18-16 Marsh sandpiper observed within the study area

Wood sandpiper (*Tringa glareola*) – Confirmed present

The wood sandpiper inhabits well-vegetated freshwater lakes, swamps and billabongs with emergent, aquatic plants or grass and taller fringing vegetation (DAWE 2020). The species is often observed foraging upon shallow mud flats and lake edges for insects, molluscs, worms and crustaceans (DAWE 2020). The species is a non-breeding visitor to Australia from August - and is known to broadly occur across northern Australia, particularly throughout the Kimberly and Mount Isa regions. The species breeds throughout northern Eurasia and occurs in Australia between August and April.

This wood sandpiper was observed during the 2020 surveys at Chinaman Creek Dam, approximately 4 km north of the alignment at KP730WD. Historical records for the species are also located Mount Isa, Cloncurry, Pentland and Charters Towers (ALA, 2020). Non-breeding habitat for this species has been mapped in the study area (refer to Figure 18-30).

Caspian tern (*Hydroprogne caspia*) – Confirmed present

In Queensland, the caspian tern is widely distributed throughout coastal regions, from the southern Gulf of Carpentaria to Torres Strait, and along the eastern coastline. This species occurs mostly in sheltered coastal environments, particularly harbours, lagoons, estuaries and river deltas. Preference is shown to systems containing defined sandy or muddy margin. They are also occur in near-coastal or inland terrestrial wetlands (both fresh and saltwater), lakes, reservoirs, rivers and creeks.

The caspian tern was observed at foraging at the Chinaman Creek Dam approximately 4 km north of the alignment near Cloncurry at KP729WD. Additionally, this species was confirmed present during the 2010 field surveys, where it was observed on the Burdekin River at KP 61WD, within the Renewable Energy Hub (BAAM 2010). There are also multiple historical records for the species reported within the desktop search extent, specifically within the Renewable Energy Hub, CopperString Core, Mount Isa Augmentation and Southern Connection sections. Suitable breeding habitat has been mapped for this species at Lake Moondarra, north of Mount Isa. Suitable foraging habitat has been mapped along watercourses, wetlands, lakes and dams (refer to Figure 18-29).

Oriental pratincole (*Glareola maldivarum*) – Confirmed present

The species is widespread across northern Australia from the Pilbara region to part of the Gulf of Carpentaria with occasional records in southern Australia (DoEE, 2019b). Non-breeding habitat consists of open plains, floodplains or short grassland and the species often occurs near terrestrial wetlands. Oriental Pratincoles breed in southern, south-eastern and eastern Asia, from northern parts of the Indian subcontinent, east through Bangladesh, Burma, Thailand and Vietnam to southern, eastern and northern China, Mongolia and adjacent areas of south-eastern Siberia. The species migrates to Australia for the non-breeding season from late October until April (DoEE, 2019b).

This species was confirmed present during field surveys (Plate 18-16) with the species recorded within the CopperString Core section of the final alignment, specifically between Julia Creek and Richmond. Non-breeding habitat for this species has been mapped in wetland habitats within the study area (refer to Figure 18-30).

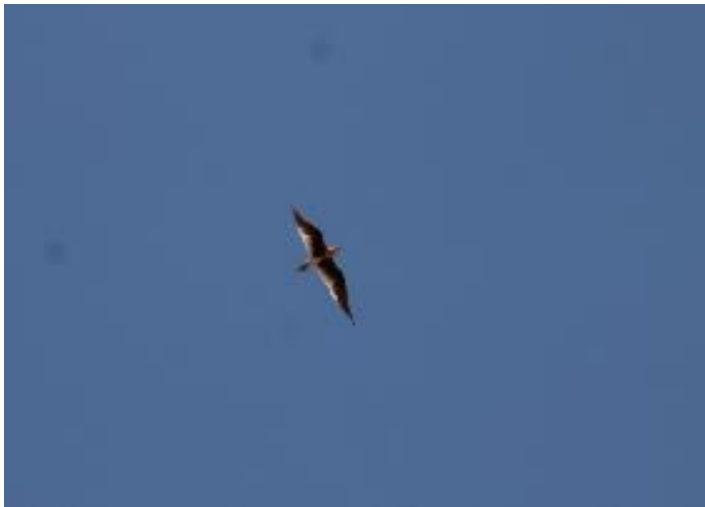
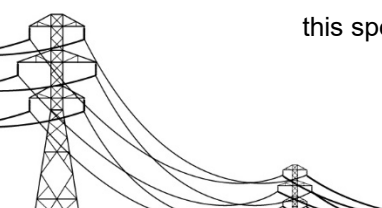


Plate 18-17 Oriental pratincole recorded within the study area

Latham's snipe (*Gallinago hardwickii*) – Likely to occur

Latham's snipe are generally solitary or in loose congregations of few individuals (Higgins and Davies, 1996). Habitat includes permanent and ephemeral wetlands with dense vegetation for cover. Distribution covers east and southeast Australia, and breeding occurs in Japan and eastern Russia (DoEE, 2019b). Departs from breeding grounds from July through to November (Higgins and Davies, 1996). Birds commence the return journey in late February, passing over the QLD coast heading north (DoEE, 2019b).

This species has not been recorded during field surveys for the project. However, the species has been historically recorded in the desktop search extent with concentrated sightings within the Mount Isa Augmentation and the Renewable Energy Hub section. Non-breeding habitat for this species has been mapped within wetland habitats in the study area (refer to Figure 18-30).



Gull-billed tern (*Gelochelidon nilotica*) – Confirmed present

Gull-billed terns are widely distributed throughout Australia, and can occur throughout all of Queensland. This species inhabits freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grassland (DoEE 2019b). There is a lack of records in central WA and western SA (DoEE, 2019b). This species is known to migrate to New Guinea and Indonesia, but can also occur throughout Australia, particularly north Australia, throughout the year (DoEE, 2019b). The gull-billed tern is known to occur on all continents except Antarctica.

This species has been widely recorded throughout the study area, especially around Mount Isa Richmond, and the eastern extent of the Renewable Energy Hub section. Two individuals were observed foraging at the Skeleton Creek wetland, south-west of Prairie KP300WD. Suitable breeding or foraging habitat for this species has been mapped within wetland habitats in the study area (refer to Figure 18-29).

Fork-tailed swift (*Apus pacificus*) – Likely to occur

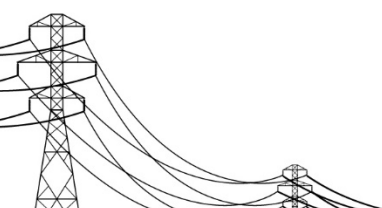
The fork-tailed swift is known to occur throughout all of mainland Australia (DoEE 2019; Higgins 1999). In Queensland, the species is widespread throughout the State's south-east and areas west of the Great Dividing Range. This species is predominantly aerial and occurs across a range of environments between 1 m to over 300 m above sea level (DAWE 2020). Known to utilise a variety of habitats, this species can occur within woodlands, grasslands, coastal dunes, saltmarshes and riparian corridors, though is mostly commonly encountered throughout inland plains (DAWE 2020). Throughout its distribution, the fork-tailed swift is highly mobile and known to travel in response to low-pressure systems, which are thought to provide optimal feeding conditions for the species (DAWE 2020).

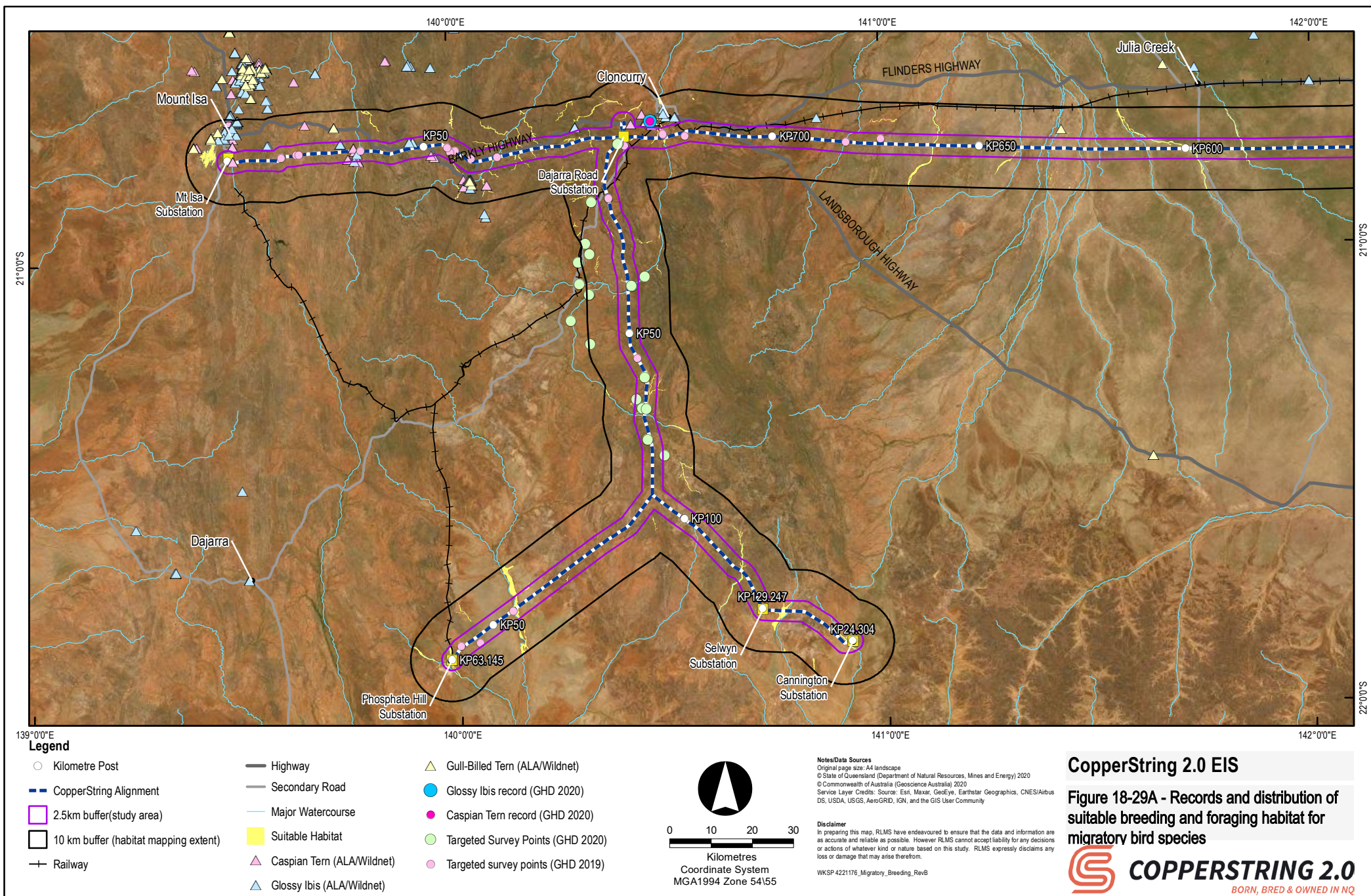
Although this species was not confirmed present during past field surveys, historical records are located throughout the majority of the study area, particularly within the Renewable Energy Hub, CopperString Core, Mount Isa Augmentation and Southern Connection sections. This species is likely to occur across the majority of the study area. Previous records for this species are shown on Figure 18-30).

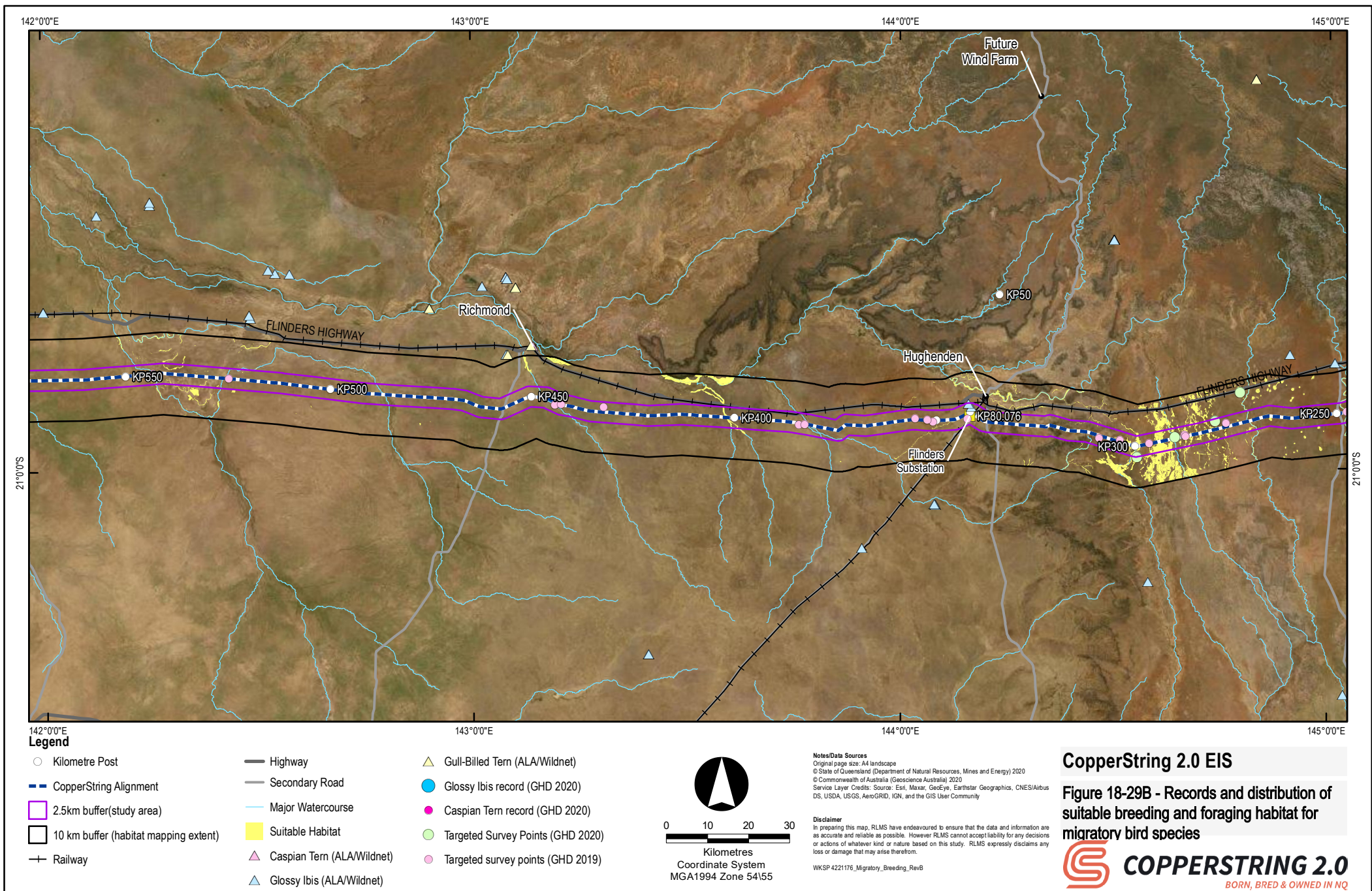
White-throated needletail (*Hirundapus caudacutus*) – Likely to occur

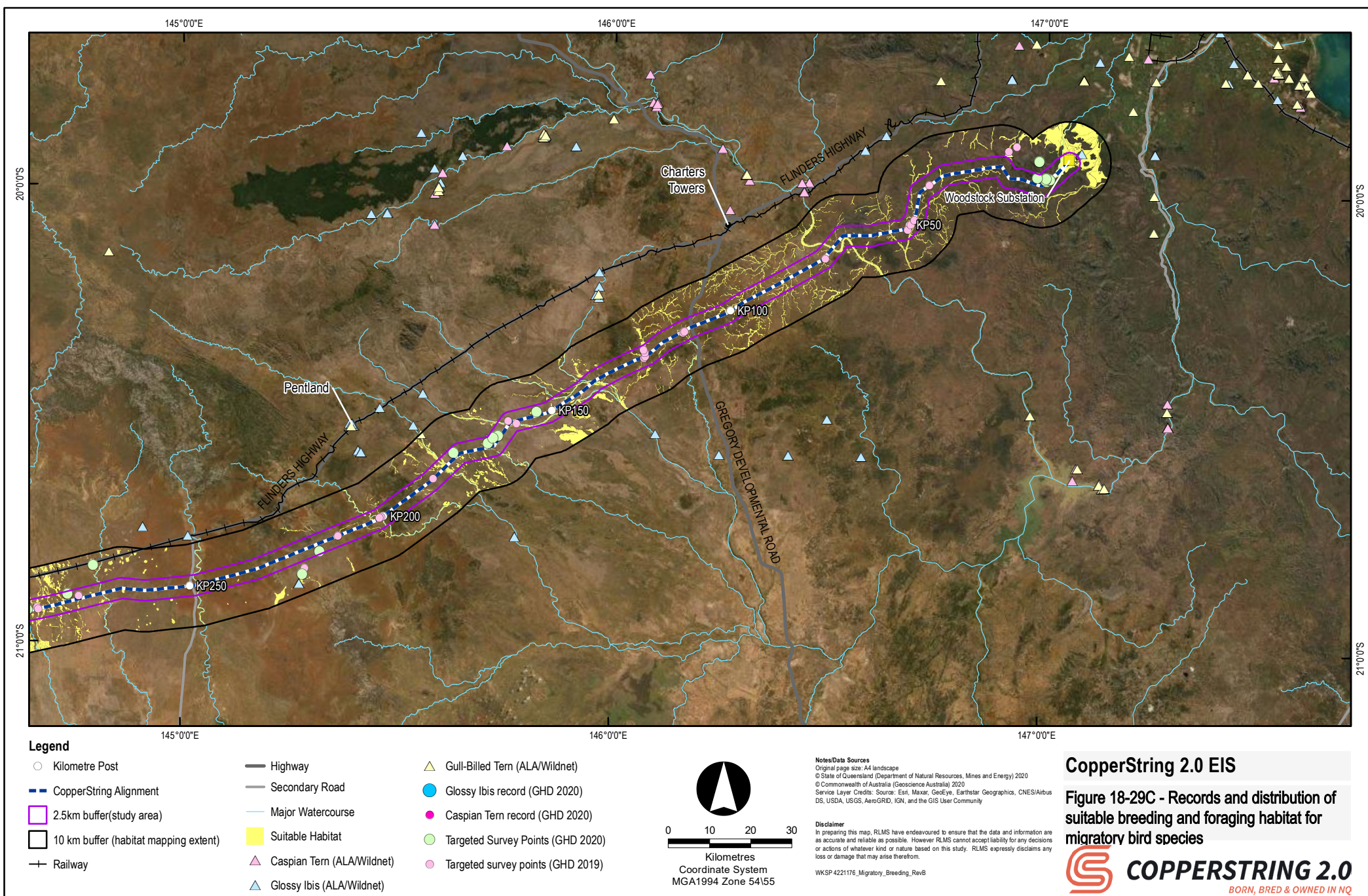
The white-throated needletail is exclusively aerial and has a broad distribution throughout eastern Australia. Although the white-throated needletail was not observed during field surveys, the species is likely to occur over all habitats at the eastern extent of the proposed corridor selection, particularly between Hughenden and Woodstock. Several historical records were reported within desktop search extent in the Renewable Energy Hub.

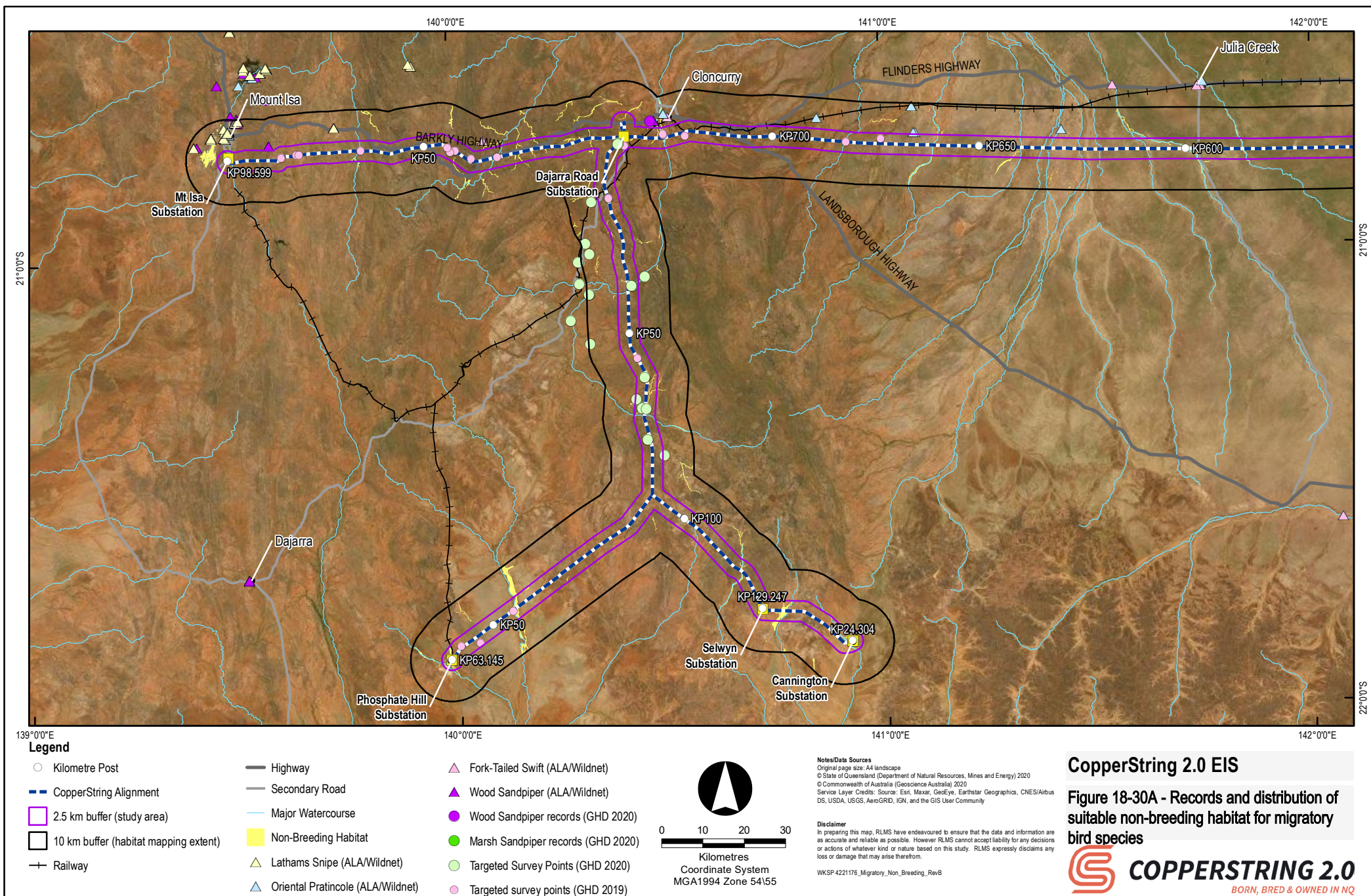
This species also listed as Vulnerable under the EPBC Act, and is discussed further in Section 18.5.5.

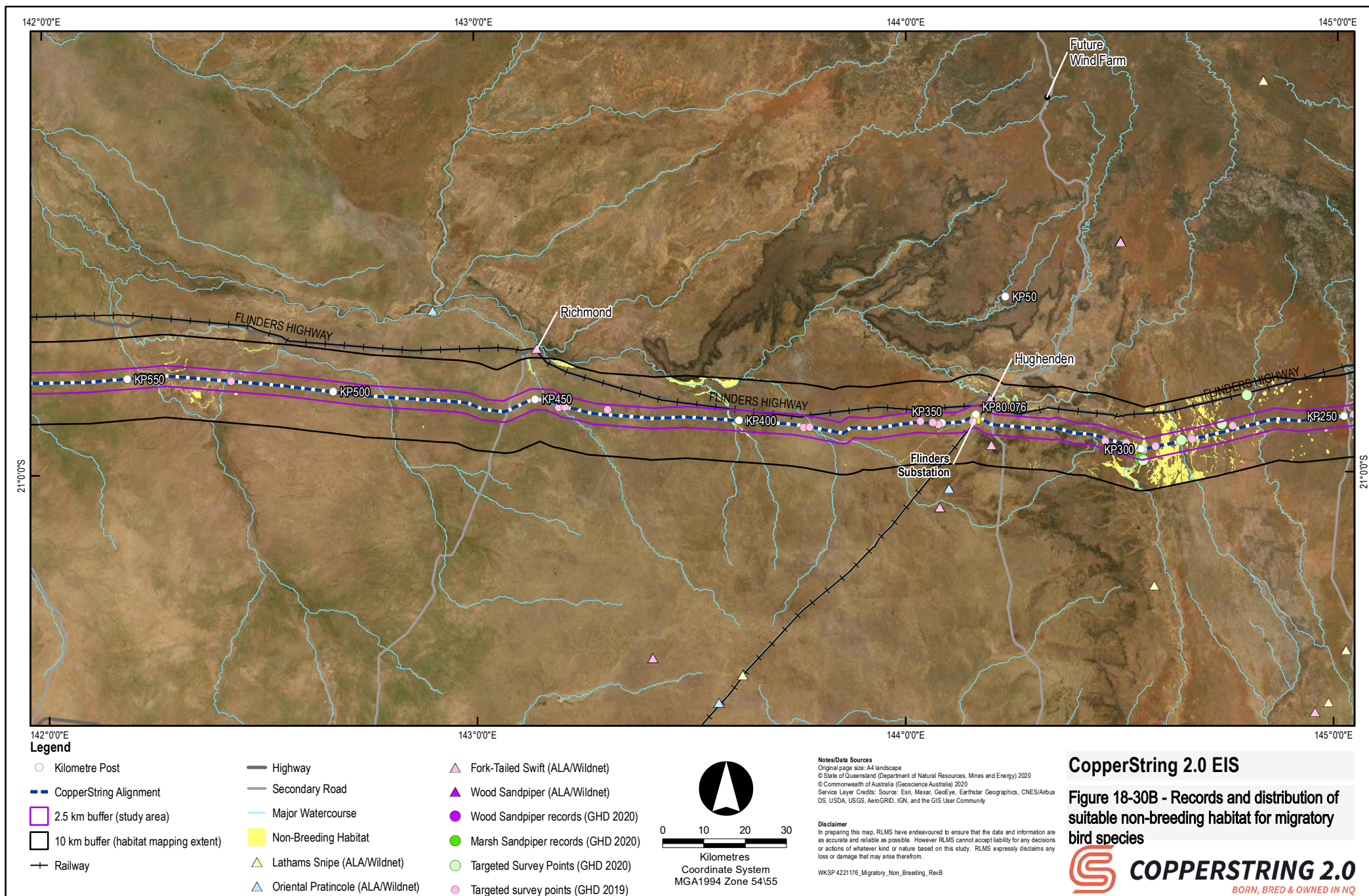


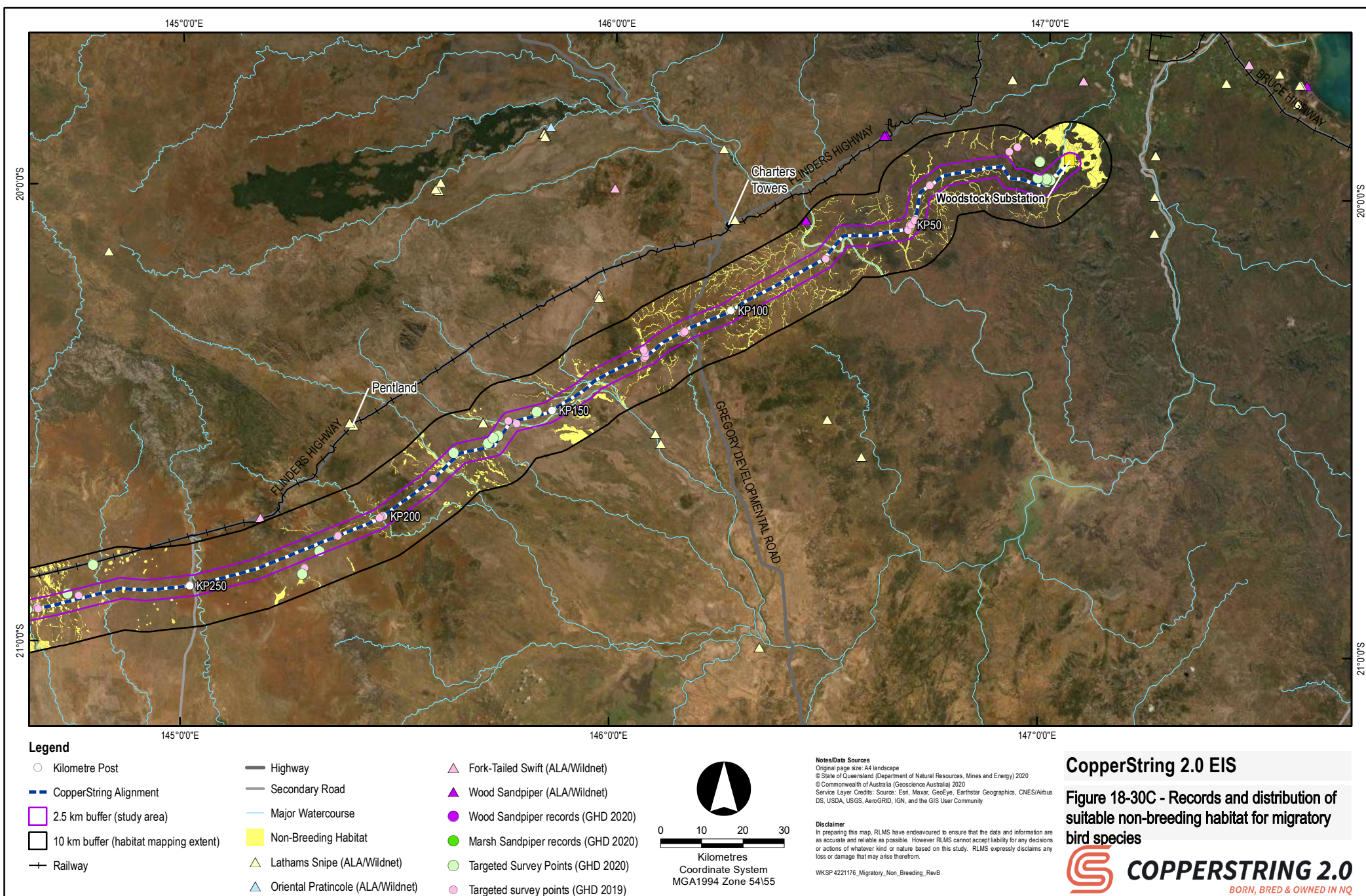








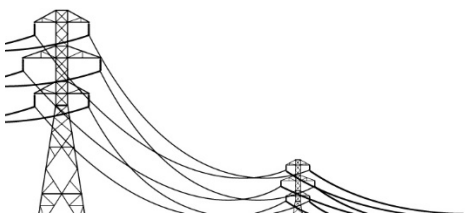




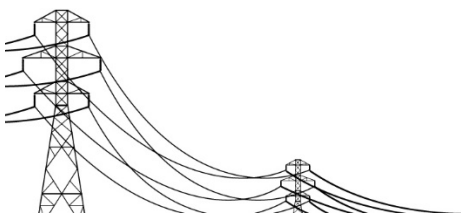
18.4.12 Likelihood of occurrence assessment

Table 18-33 Likelihood of occurrence assessment for listed threatened species

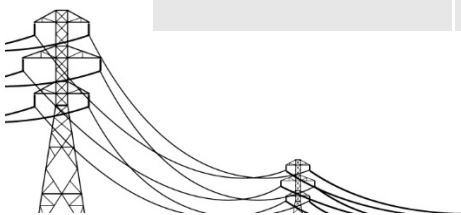
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
Plants				
<i>Acacia crombiei</i> pink gidgee	V	V	Occurs on wooded downs in woodland and open woodland often associated with gidgee (<i>Acacia cambagei</i>) and whitewood (<i>Atalaya hemiglauca</i>), on alluvial, sandstone and basalt derived soils. It is distributed through central QLD in small, isolated subpopulations with most records being within 100 km south and 150 km north-west of Hughenden (DoEE, 2019b).	Likely to occur Although this species has not been historically recorded within the study area, potential habitat has been mapped between KP298WD and KP450WD.
<i>Aristida granitica</i>	E	E	Known only from the foothills of Mt Pring, 10 km west of Bowen, QLD where it is common. It grows in sandy soils derived from granite sand in eucalypt woodlands containing <i>Eucalyptus exserta</i> and <i>Lysicarpus angustifolius</i> (DoEE, 2019b).	Unlikely to occur This species has not been previously recorded in proximity to the study area. Suitable soils were largely absent within the corridor selection.



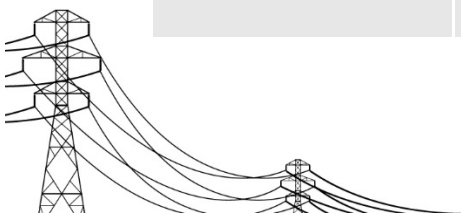
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Bulbophyllum globuliforme</i> miniature moss-orchid	V	NT	The Miniature Moss-orchid is a host-specific species, only growing on the Hoop Pine, where it colonises the upper branches of mature tree. The Hoop Pine occurs in upland (usually 100-900 m above sea level) subtropical rainforest communities that have a discontinuous distribution along the Australian east coast (DoEE, 2019b).	Unlikely to occur No hoop plant communities were encountered during field surveys and this species has not been previously recorded in proximity to the study area.
<i>Dichanthium setosum</i> blue grass	V	LC	Occurs in heavy soils (predominantly cracking clays or alluvium, often in gilgai) in woodland or open woodland usually dominated by Acacia (brigalow) and/or Eucalypt species. Species is distributed from inland NSW from Sydney through to just north of Cairns in QLD (DoEE, 2019b).	Likely to occur Potential habitat has been mapped along alluvial land zones along watercourses within the study area, particularly, east of KP 194WD
<i>Eucalyptus raveretiana</i> black ironbox	V	LC	Grows along watercourses and occasionally on river flats. It occurs in open forest or woodland communities. The species prefers sites with moderately fertile soil and adequate sub-soil moisture. The alluvial soils in which it grows are sands, loams, light clays or cracking clays. A tree endemic to sub-tropical Queensland found along rivers and creeks from Rockhampton inland to the rivers north of Duaringa, and also inland from Sarina and Mackay north to Bowen and Townsville (EUCLID, 2019 and DES, 2019).	Confirmed present This species was recorded within the Burdekin River and major tributaries east of Charters Towers. Past studies have recorded the species at KP57WD-58WD and KP38WD-40WD.



Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Livistona lanuginosa</i> waxy cabbage palm	V	V	Only occurs in open eucalypt forest along sandy river and creek channels that flow seasonally, but with permanent pools or soaks. It grows at altitudes between 150-300 m above sea level. It is endemic to the Burdekin-Ravenswood-Cape River area inland from Ayr. It mostly occurs in the lower Cape River (DoEE, 2019b).	Confirmed present Ten individuals were recorded at Oaky Creek within the Renewable Energy Hub (KP 116-117WD). Previously recorded within the Campaspe River between KP 129-130.5WD.
<i>Marsdenia brevifolia</i>	V	V	This species has an apparent disjunct distribution in northern and central QLD with collections having been made near Townsville, Springsure and north of Rockhampton. Around Springsure <i>M. brevifolia</i> has been collected from woodland dominated by <i>Corymbia erythrophloia</i> and <i>Eucalyptus crebra</i> , with dense <i>Themeda triandra</i> understorey on basalt. Plants occurring north of Rockhampton grow on serpentine rock outcrops or on black crumbly soils derived from serpentine in woodland dominated by <i>Corymbia xanthope</i> and <i>Eucalyptus fibrosa</i> . Despite this close association with serpentine, the species is not a serpentine endemic or a nickel hyper accumulator. At Hidden Valley west of Paluma, plants grow in woodland on granite soils dominated by <i>Eucalyptus granitica</i> , <i>Corymbia leichhardtii</i> and <i>E. acmenoides</i> (DES, 2019).	Unlikely to occur This species has been recorded within 5 km of the Renewable Energy Hub however is not known from the corridor selection. Suitable habitat was not identified during field studies.
<i>Omphalea celata</i>	V	V	Occurs in fragmented semi evergreen vine thicket or araucarian microphyll vine forest. Recorded along watercourses in steep sided gorges and gullies on weathered metamorphic or granitic soils. Associated species include <i>Eucalyptus raveretiana</i> , <i>E. tereticornis</i> , <i>Lysiphyllum hookeri</i> and <i>Ficus opposita</i> . This species is distributed in central QLD, including Hazlewood Gorge, near Eungella; Gloucester Island, near Bowen; and Cooper Creek in the Homevale Station area, north-west of Nebo (DoEE, 2019b).	Unlikely to occur This species has not been previously recorded in proximity to the study area. The corridor selection does not contain suitable habitat for this species.

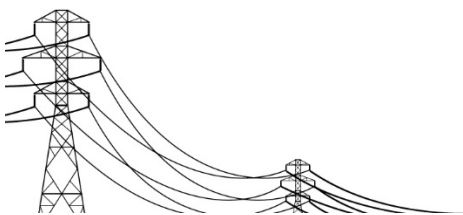


Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Tephrosia leveillei</i>	V	V	This species occurs in Cullen's Ironbark (<i>Eucalyptus cullenii</i>) woodland on alluvial plains, gum-topped Bloodwood (<i>Corymbia erythrophloia</i>) and Cooktown Ironwood (<i>Erythrophleum chlorostachys</i>) woodland with Bushman's Clothes-peg (<i>Grevillea glauca</i> , <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. tall open forest over dense Bunch Spear-grass (<i>Heteropogon contortus</i>) on red sand. Little data is available on distribution, however samples have been collected from Almaden, between Chillagoe and Walsh River, near Ravenswood, Mt Fox, 35 km south-west of Mt Garnet and 2.4 km east of Chudleigh Park Homestead (DoEE 2019b).	Unlikely to occur This species has not been previously recorded in proximity to the study area.
Mammals				
<i>Dasyurus hallucatus</i> Northern quoll	E	LC	Occurs in a range of habitats, including open dry sclerophyll forest and woodland, riparian woodland, low dry vine thicket, the margins of notophyll vine forest, mangroves, sugarcane farms and in urban areas. They are most abundant in hilly or rocky areas close to permanent water.	Unlikely to occur This species has not been previously recorded within the study area, with the closest confirmed record of the species is located 60 km north east of Hughenden. This species is generally restricted to coastal and sub-coastal regions.
<i>Hipposideros semoni</i> Semon's leaf-nosed bat	V	E	The distribution of Semon's leaf-nosed bat is relatively unknown, with only two separate regions known to support the species, between Cape York and Cooktown and from the Kroombit Tops near Gladstone. Unlike a lot of bats, this species does not have obligatory requirement to roost in caves and is known to occur within tropical rainforest, monsoon forest, wet sclerophyll forest and open savannah woodland.	May occur This species has not been recorded within the desktop extent and the Project is located outside the species known range. Due to the species distribution being relatively unknown, a conservative approach has been adopted when assessing this species likelihood to occur.

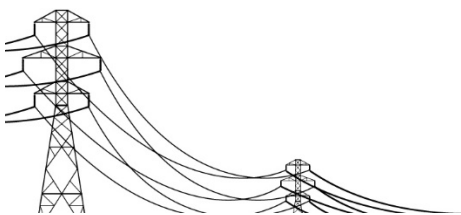


Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Macroderma gigas</i> Ghost bat	V	E	The ghost bat is known from three particularly location, the Northern Pilbara and Kimberley in Western Australia, and the Top End of the Queensland, where the species occurs in small isolated pockets within each region. Preferred habitats include rainforest areas, vine shrub, open woodlands and arid zone, and roosts in caves, rock crevices and old mine shafts (DAWE 2020).	May occur This species has not been previously recorded within the desktop search extent. The closest record for this species is located approximately 65 km north of Mount Isa.
<i>Macrotis lagotis</i> Greater bilby	V	E	Although once possess a broad distribution in Queensland, this species is now generally restricted to the State's south west corner. Within this region, the species inhabits treeless grass plains, sandstone ridges, gibber plains, rocky soils with little ground cover, hummock and tussock grasslands, and Acacia shrublands.	Unlikely to occur Although suitable habitat was identified within the study area, the Project is located well outside of the species current range. The closest records of this species are located approximately 180 km south east of Hughenden.
<i>Petauroides volans</i> Greater glider	V	V	The species is largely restricted to eucalypt forests and woodlands, and typically favours habitats containing relatively old trees with an abundance of large tree hollows (TSSC, 2016b). Modelling suggests that the species requires native forest patches of at least 160 km ² to maintain viable populations (Eyre 2002).	May occur Confirmed records are located within the eastern extent of the corridor selection and the woodland environments are considered potential habitat for this species.
<i>Phascolarctos cinereus</i> Koala	V	V	Scattered populations occur throughout Queensland, occurring in moist forests along the coast, sub-humid woodlands in southern and central Queensland, and in some eucalypt woodlands along water courses in semi-arid environments of the western part of the State (DoEE 2019b).	Confirmed present This species was confirmed present in the eastern extent of the survey and potential habitat is located east of Hughenden.

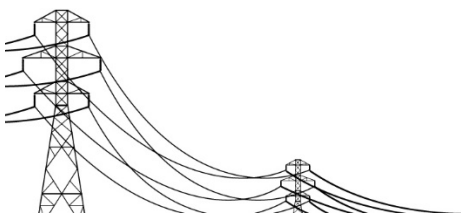
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Pteropus conspicillatus</i> Spectacled Flying-fox	V	V	The spectacled flying-fox occurs in north-eastern Queensland, generally between Ingham and Cooktown, and between the McIlwraith and Iron Ranges near Cape York (DAWE 2020). This species is generally restricted to tropical rainforests, however historical records have been recorded within woodland environments (DES 2020c). The foraging range of the species is relatively unstudied, with further research required to determine the foraging distribution of this species (DAWE 2020).	May occur This species has not been previously recorded within the desktop search extent and the nearest confirmed record is approximately 75 km north of the study area. Potential foraging habitat was identified within the Renewable Energy Hub section.
<i>Rhinolophus robertsi</i> Large-eared horseshoe bat	V	NL	Occurs in north-eastern QLD from Cape York to Townsville. Mostly coastal distribution, but does extend inland where suitable cave systems are present. This species is poorly-known and generally uncommon, occurring in low densities, even within core habitats. It occurs in rainforests, riparian forests, eucalypt open forests and woodlands. It roosts in tree hollows, open habitats under creek banks and road culverts in rock piles and shallow caves (Woinarski et al. 2014).	Unlikely to occur Although suitable habitat may occur within the eastern extent of the study area, the nearest confirmed sightings are located more than 600 km north.
<i>Saccolaimus saccolaimus nudicluniatus</i> Bare-rumped sheath-tailed bat	V	E	Occurs in north-eastern QLD and the monsoonal tropics of NT and is likely to occur in the Kimberley area in WA. Mostly coastal distribution in QLD. Occurs in mostly eucalypt forests and woodlands, generally in near-coastal areas. It is associated with coastal lowland rainforests and open forests dominated by <i>Eucalyptus</i> and <i>Corymbia</i> species (Milne et al. 2009).	May occur Scattered sightings exist along the coast of Northern Queensland, approximately 60 km from the proposed corridor selection. This species is considered to be restricted to coastal Queensland.



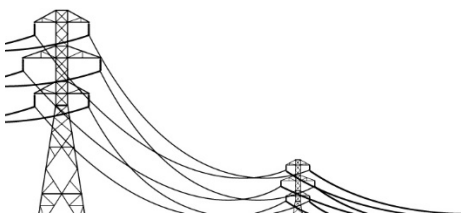
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Sminthopsis douglasi</i> Julia Creek dunnart	V	E	This species is only found in the Mitchell Grasslands of north-west QLD. It has a patchy distribution east of Cloncurry extending south-east to Barcaldine. It occurs in cracking clay soils dominated by Mitchell grass (<i>Astrebla spp.</i>) (DoEE 2019b).	Confirmed present This species has been recorded during past surveys within the cracking clay pastures surrounding Julia Creek (located at KP 580WD and KP 620WD). Known and suitable habitat exists within the study area.
Fish				
<i>Pristis pristis</i> Freshwater sawfish	V, Mig	NL	The freshwater sawfish has the potential to occur in all large rivers of northern Australia from the Fitzroy River, Western Australia, to the western side of Cape York Peninsula, Queensland. This species prefers habitats containing mud bottoms, e.g. river embankments and estuaries. They are usually found in large, turbid large rivers more than 1 m deep, but they will move into shallow waters when travelling upstream or while hunting prey (DAWE 2020)	Unlikely to occur This species has not been previously recorded within the desktop search extent. The nearest historical record is located 350 km north of the Mount Isa Augmentation.
<i>Maccullochella peelii</i> Murray cod	V	NL	The Murray Cod is the largest freshwater fish in Australia. Historically, the species was distributed throughout the Murray-Darling Basin, from southern Queensland, through New South Wales, the ACT, Victoria and South Australia (DAWE 2020). In Queensland, the Murray Cod has been successfully introduced to the Burnett and Fitzroy River systems, and the Cooper Creek system. Within it's distribution, the species is found in the main channels of rivers and larger tributaries where it inhabits clear rocky streams to slow-flowing, turbid lowland rivers and billabongs (DAWE 2020)	May occur This species has not been previously recorded within the desktop search extent.



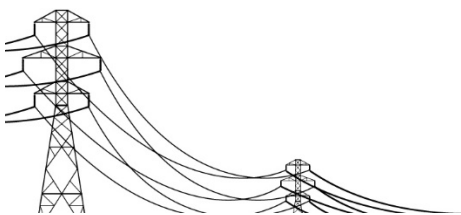
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
Reptiles				
<i>Acanthophis hawkei</i> Plains death adder	V	V	Suitable habitat for this species includes flat, treeless cracking clay riverine floodplains (Cogger, 2000). Its distribution is not well defined, but based on its habitat preference, this species is most likely distributed from western QLD, across north NT through to north-east WA (DoEE, 2019b).	Likely to occur Suitable habitat exists within the western extent of the study area between Cloncurry and Mt Isa. That area is mapped as an area in which the species is considered likely to occur in modelled DAWE habitat mapping.
<i>Denisonia maculata</i> Ornamental snake	V	V	This species is distributed from Townsville to Gladstone in QLD, extending inland within the Brigalow Belt bioregion. The preferred habitat is within, or adjacent to, habitat that is favoured by frogs. The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai mounds and depressions in REs on land zone 4, but also lake margins and wetlands (DoEE 2019b).	Likely to occur Confirmed records are located around Charters Towers and east towards Ravenswood. Known and suitable habitat for this species exists within the study area around KP165WD – 140WD.
<i>Egernia rugosa</i> Yakka skink	V	V	The species is typically found in open dry sclerophyll forest or woodland. This skink uses refuges in dense ground vegetation, in hollow logs, cavities in soil-bound root systems and beneath rocks. It occurs from the coast of QLD to the hinterland of sub-humid to semi-arid eastern QLD from Cape York to approximately the QLD/NSW border (DoEE 2019b).	May occur Confirmed records of the species are located around Ravenswood, however no database records are located within the study area and this species was not recorded during field surveys. Suitable habitat for the species exists within the study area around Charters Towers and Woodstock.



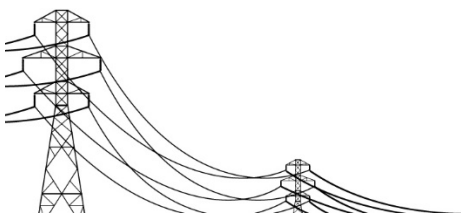
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Elseya lavarackorum</i> Gulf snapping turtle	E	V	This species occurs along the southern catchment of the Gulf of Carpentaria in QLD and NT, south to approximately Mount Isa in QLD. It inhabits large rivers and overflow lagoons and oxbow lakes. It occurs in deeper permanent pools and rivers, upstream of the saline regions. It prefers steep rocky gorges and rivers with intact banks (Cogger, 2000).	Unlikely to occur This species has not been previously recorded in proximity to the study area and is not known to inhabit the catchments intersect by the corridor selection. The majority of confirmed sightings are located around Lawn Hill, approximately 200 km NW of Mount Isa.
<i>Lerista vittata</i> Mount Cooper striped skink	V	V	Distribution is severely fragmented due to agricultural clearing. It has been historically recorded around Charters Towers. Occurs in ironbark and bloodwood dominated woodlands with shrub/grassy understorey on deep red soils, undulating plains and steep hills on granitic rocks. Also occurs in semi-evergreen vine thickets and spinifex communities (DoEE, 2019b).	Unlikely to occur The Mount Cooper striped skink is extremely localised and known from only two locations – Dalrymple Lake and Blackbraes National Park. No previous records are located within the study area.
Birds				
<i>Amytornis dorotheae</i> Carpentarian grasswren	E	E	Endemic to southern Gulf of Carpentaria region of northern Australia. The largest population persists in the Mount Isa region of QLD. It is restricted to sandstone outcrops in mature spinifex (<i>Triodia</i> spp.) hummock grassland in its northern range and long-unburnt spinifex with stony areas between hummocks which grow a range of short grasses, forbs and patchy low trees and shrubs. This species does not persist in burnt areas (Higgins <i>et al.</i> , 2011; Garnett <i>et al.</i> , 2000).	May occur This species is known to occur in small areas north of Mount Isa and northwest towards the NT. Two confirmed records are located north of Mount Isa and several.



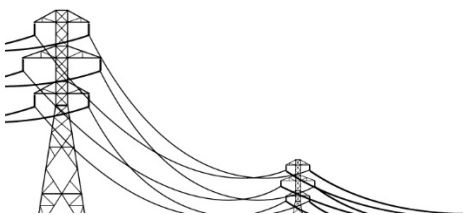
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Calidris ferruginea</i> Curlew sandpiper	CE, Mig	E	The curlew sandpiper occurs along the coastlines and inland waters of Australia. Commonly found foraging on sheltered intertidal mudflats and roosting on dry beaches, spits and islets. Breeding occurs during June and July in Siberia. Species depart breeding grounds in early August, and arrive in Australia in late August and early September. Flocks stopover in northern Australia and arrive in south-eastern Australia in September (DoEE, 2019b).	May occur Suitable habitat occurs within the study area and this species has previously been recorded within the study area.
<i>Charadrius mongolus</i> Lesser sand plover	E, Mig	E	The lesser sand plover occurs in coastal regions of all states, but mainly through north and east Australia. Internationally important sites in QLD include Moreton Bay and the Great Sandy Strait. Migrates from breeding grounds in northeast and central Asia, to northern Australia in August, and disperses along the coastlines to southern areas. Commences the return journey to breeding grounds in April (DoEE, 2019b; Marchant and Higgins, 1993).	Unlikely to occur This species was not recorded during field surveys and rarely ventures from coastal environments. Non validated records are located around Charters Towers and Mount Isa.
<i>Erythrotriorchis radiatus</i> Red goshawk	V	E	The species occurs in a range of habitats, often at ecotones, including coastal and sub-coastal tall open forests, tropical savannahs crossed by wooded or forested watercourses, woodlands, the edges of rainforests and gallery forests along watercourses, and wetlands that include <i>Melaleuca</i> and <i>Casuarina</i> species. The species typically nests in tall trees within 1°km of permanent water, and occurs in habitats that support a high abundance of bird species (DoEE 2019b).	Likely to occur Suitable habitat exists within the study area and sightings have been recorded around Mount Isa (a total of four within the study area). Although not recorded during field surveys, this species renowned for its low detectability.



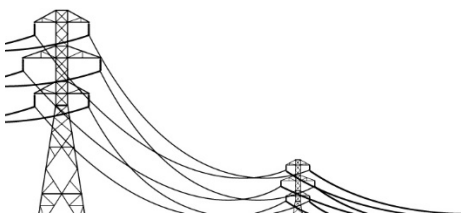
Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Erythrura gouldiae</i> Gouldian finch	E	E	This species is distributed through northern Australia from Cape York Peninsula through to north-west QLD and northern NT to the Kimberley Region of WA. Species may congregate around waterholes. Species nests in tree hollows between April – July. Species feeds and depends on a relatively small number of grass species that seed at different times throughout the year (Dostine et al., 2001).	May occur No sightings of this species have been recorded within the study area and this species generally occurs north of the proposed corridor selection. There are 22 Wildlife online records located within the western extent of the study area.
<i>Geophaps scripta scripta</i> Squatter pigeon	V	V	The species occurs in open-forests to sparse, open-woodlands and scrub that are dominated by <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Acacia</i> or <i>Callitris</i> species, remnant and regrowth in close proximity of water (DoEE, 2019b).	Confirmed present This species was confirmed present throughout the study area with widespread suitable habitat identified.
<i>Grantiella picta</i> Painted honeyeater	V	V	Species sparsely distributed from south-eastern Australia to north-western QLD and eastern NT. Species exhibits north-south movements in response to the fruiting of mistletoe. The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips (Garnett et al., 2011)	Likely to occur Scattered records for the species are located within the study area from Mount Isa to Charters Towers. Mistletoe (a dependent resource for this species) was also observed within woodland habitats in the study area.



Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Hirundapus caudacutus</i> White-throated needletail	V	SLC	Almost exclusively aerial, it does prefer wooded, inland areas and heathland. In coastal areas they have been seen flying over mudflats and beaches. Widespread throughout eastern and south-eastern Australia. It has been recorded along all coastal regions of QLD and NSW (Barrett <i>et al.</i>, 2003). The subspecies <i>caudacutus</i> leaves breeding grounds in eastern Siberia, north-eastern China and Japan between August to October. They arrive in Australia via the Torres Strait during September and October. Upon arrival they move south along both sides of the Great Dividing Range in QLD and NSW. They head north again, passing through QLD in February and March (DoEE, 2019b).	Likely to occur This species is known to inhabit the eastern section of the corridor selection, with several scattered records around Townsville, Charters Towers and Hughenden.
<i>Neochmia ruficauda</i> Star finch (eastern)	E	E	The species occurs in low numbers in central Queensland. Mainly inhabits grasslands and grassy woodlands in close proximity to permanent freshwater. Species are closely associated to habitats that consist certain tree species, including <i>Eucalyptus coolabah</i>, <i>Eucalyptus tereticornis</i>, <i>Eucalyptus tessellaris</i>, <i>Melaleuca leucadendra</i>, <i>Eucalyptus camaldulensis</i> and <i>Casuarina cunninghamii</i> (DoEE, 2019b).	Unlikely to occur No sightings have been recorded within the study area. Although suitable vegetation exists within the eastern section of the study area, from Torrens Creek to Woodstock.
<i>Numenius madagascariensis</i> Eastern curlew	CE, Mig	E	The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DoEE, 2019b).	May occur This species generally inhabits coastal environments, rarely venturing inland to within the study area. One unconfirmed sighting has been recorded around Mount Isa.



Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Pezoporus occidentalis</i> Night parrot	E	E	A rare and cryptic species, its current distribution is not known. Historical records are from remote arid and semi-arid inland regions of WA, NT, SA and QLD. More recent records suggest populations may persist in western QLD and the Pilbara in WA. Habitat descriptions have been largely based on anecdotal observations, however most records occur within spinifex grasslands and/or chenopod shrublands, Mitchell grasslands, shrubby samphire, scattered trees and shrubs, <i>Acacia aneura</i> woodland, treeless areas and bare gibber (Garnett <i>et al.</i> 2011).	Likely to occur The species has not been recorded during field surveys though potentially suitable habitat is mapped within the western extent of the proposed corridor selection and previous sighting was recorded around Mount Isa. Five Wildlife Online records are located within the western extent of the Project.
<i>Poephila cincta cincta</i> Black-throated finch (southern)	E	E	Mainly inhabits grassy, open woodlands and forests, often in the vicinity of water. Species are closely associated to habitats that are dominated by <i>Eucalyptus</i> , <i>Corymbia</i> , and <i>Melaleuca</i> (DoEE, 2019b).	Confirmed present This species has been previously recorded within the study area (KP 256 – 257 WD) and suitable habitat exists within the study area, east of Hughenden.
<i>Polytelis alexandrae</i> Princess parrot	V	LC	Species distribution is confined to arid regions of WA, NT and SA. This species inhabits sand dunes and sand flats in arid western and central Australia. Occurs in open savannah woodland and shrublands with scattered stands of eucalypts, casuarinas and shrubs including acacias, cassias, grevilleas, hakeas and sennas with a ground cover dominated by <i>Triodia</i> species (Garnett, 1993).	Unlikely to occur This species known distribution is located west of the survey (WA, NT and SA) however one unconfirmed sighting has been recorded around Mount Isa.



Species	EPBC Act status	NC Act status	Habitat requirements	Likelihood of occurrence
<i>Rostratula australis</i> Australian painted-snipe	E	V	The species generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps, claypans and waterlogged grasslands (DoEE, 2019b).	Likely to occur Scattered sightings have been recorded along the corridor selection at Mount Isa, Cloncurry, Richmond and between Pentland and Charters Towers. Known and potential habitat is located west of Charters Towers.
<i>Turnix olivii</i> Buff-breasted button-quail	E	E	Occurs in north-east QLD with the only records being in the Iron Range from approximately 150 km south of Cape York, through to Mackay. This species occurs in patches of short and sparse grassland, lower slopes of hills and ridges on small stones (Garnett and Crowley, 2000).	Unlikely to occur Sightings of this species are restricted to coastal environments and this species is not known to inhabit the study area.
<i>Tyto novaehollandiae kimberli</i> Masked owl	V	V	This species occurs from the Kimberly in WA across north Australia through to Mackay in QLD. This species has been recorded in riparian forest, rainforest, open forest, <i>Melaleuca</i> swamps and edges of mangroves and margins of sugar cane fields (Higgins, 1999).	Unlikely to occur No sightings have been recorded within the study area, with the majority of confirmed sightings located in NT. Limited potential habitat was located during field surveys.

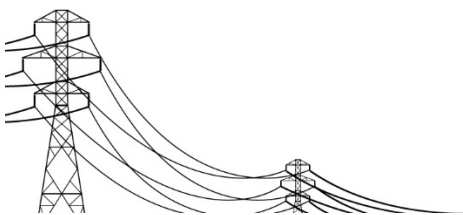
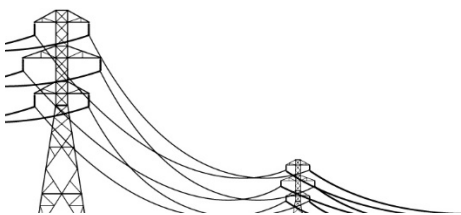
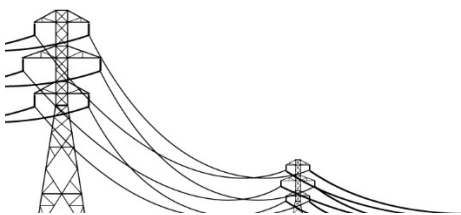


Table 18-34 Likelihood of occurrence assessment for listed migratory species

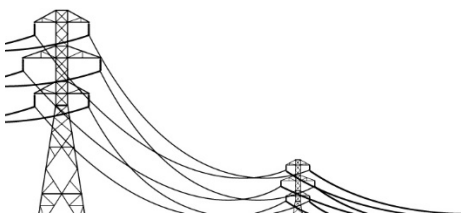
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
Reptiles			
<i>Crocodylus porosus</i> Salt-water crocodile	This species occurs across northern Australia, from norther WA, across NT through to Mackay in QLD. The species is found in wide range of habitats including rivers, estuaries, creeks, swamps, lagoons and billabongs up to 150 km inland from the coast (DoEE 2019b).	This species movements as adults is not well documented, but has been shown to move up to 280 km after being relocated. Hatchlings may move up to 20 km in the first 6 months, and 2-6 years olds may move up to 80 km. Species arrives in QLD in August (DoE, 2020).	May occur This species is widespread along eastern Australia though rarely extends inland to overlap the study area. Two unconfirmed record exists near in the Burdekin River, approximately 40 km from the eastern end of the corridor selection.
Migratory birds			
<i>Actitis hypoleucos</i> Common sandpiper	This sandpiper is a shoreline bird common to most coastlines of Australia. It forages in shallow marine, estuarine and freshwater environments (DoEE, 2019b).	This sandpiper breeds in Eurasia and migrates south arriving in Australia from July onwards. Species arrives in QLD in August (DoEE, 2019b).	May occur This species is predominantly coastal, but utilises a range of inland wetland habitats. The species has been historically recorded within the desktop search extent, however habitats within the study area were generally suboptimal.
<i>Apus pacificus</i> Fork-tailed swift	The fork-tailed swift is a non-breeding visitor to all states and territories of Australia (Higgins, 1999) and is almost exclusively aerial and mainly occur over foothills an in coastal areas in Australia. It is widespread but scattered throughout Australia (DoEE, 2019b).	The fork-tailed swift usually arrives in northern Australia to head south around October (DoEE, 2019b). It is a highly mobile species whilst within Australia.	Likely to occur The species is known to utilise a range of environments and previous records are scattered throughout the study area. Species was recorded during past surveys.



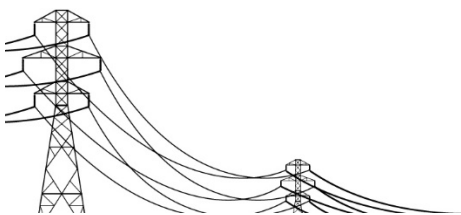
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Arenaria interpres</i> Ruddy turnstone	Widespread in coastal regions of Australia, although has been recorded inland (Higgins and Davies, 1996). Closely associated with rocky coastlines or coral reefs and does not breed in Australia (DoEE, 2019b).	Species generally moves south during the non-breeding season. East Australian and New Zealand population migrate south from east Asia across the Pacific Ocean, arriving from September (DoEE, 2019b).	Unlikely to occur This species mostly inhabits coastal regions. Limited habitat is located in the study area.
<i>Calidris acuminata</i> Sharp-tailed sandpiper	Inhabits the muddy margins of freshwater wetlands. Forages on bare substrate or in shallow water. Inhabits coastal and inland waters throughout Australia (DoEE, 2019b).	Departs breeding grounds in late June, moving down through Asia and New Guinea. Arrives in Australia mid-August. Returns to breeding grounds in April (DoEE, 2019b).	May occur This species is distributed throughout Queensland and has been historically recorded from the desktop search extent. The species can occur in both coastal and inland waterways, but has a very sparse and patchy inland distribution. Habitats within the study area are suboptimal, but the species may occur.
<i>Calidris alba</i> Sanderling	A small wader of coastal and inland waters in Australia. Generally found on sandy beaches or rocky outcrops exposed to wave action (DoEE, 2019b; Higgins and Davies, 1996).	Moves from breeding areas to the south in the non-breeding season. Arrives in northwest Australia in September. Generally arrives in the south-east QLD area in August and departs around April (Higgins and Davies, 1996).	Unlikely to occur This species is largely restricted to the coast and there are no confirmed sightings in the study area.



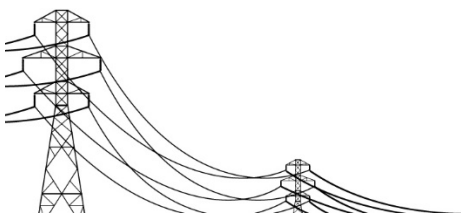
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Calidris melanotos</i> Pectoral sandpiper	The species prefers coastal and near coastal wetland habitats that have open fringing mudflats and low, emergent or fringing vegetation (Higgins and Davies, 1996). Species is widespread, but scattered throughout QLD with most individuals occurring around Cairns (DoEE, 2019b).	Breeding occurs in northern Russia and North America, and the species is transient through Central America and the Caribbean while on corridor to non-breeding areas in South America. There are also scattered records from Hawaii, Polynesia and Australasia (DoEE, 2019b).	May occur This species is commonly encountered through eastern Australia. Two sightings have been reported around Mount Isa.
<i>Calidris ruficollis</i> Red-necked stint	This species occurs near coastal and inland waters, but are known to use wet paddocks and grasslands (Higgins and Davies, 1996).	Departs from breeding grounds June through to August. Reaches Australia from August, although most arrive in September. Within southeast Australia, birds inhabit inland wetlands from October to November, and then move to marine embayments in December until early March to April (DoEE, 2019e).	May occur This species has been previously recorded within the desktop search extent from multiple spots along the corridor selection.
<i>Calidris subminuta</i> Long-toed stint	This species is more commonly recorded in the western half of Australia, however it has sparse, scattered records across all states and territories, inland and on the coastline. It occurs in a variety of terrestrial wetlands, preferring shallow, freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds. It also occurs on muddy shorelines, growths of short grass, weeds, sedges, low or floating aquatic vegetation, reeds and rushes (DoEE, 2019b).	Migrates from breeding grounds in Siberia to Australia around July, arriving in northern Australia in October. Depart for breeding grounds between February and April (DoEE, 2019b).	May occur Several sightings of this species are located within the desktop search extent around the Mount Isa area. Freshwater wetlands may constitute potential habitat. Habitats within the study area were generally suboptimal.



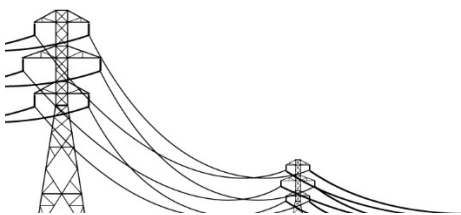
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Charadrius veredus</i> Oriental plover	Occurs in both coastal and inland areas, mostly in northern Australia. Commonly recorded along the north-western coast, between Exmouth Gulf and Derby in WA. After arriving in Australia, they occur in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland (DoEE, 2019b). Thereafter they usually inhabit flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps.	This species breeds in the northern hemisphere and flies south for the boreal winter. It leaves breeding grounds in July, arriving in Australia between September and October. Departs Australia in February to April (DoEE, 2019b).	May occur This species has been previously recorded in scattered locations within the desktop search extent. Multiple records are located around Mount Isa. Habitats within the study area were generally suboptimal but the species may occur.
<i>Chlidonias leucopterus</i> White-winged black tern	Non-breeding migrant to Australia. It is widespread and common along south-western, northern and central-eastern coasts (DoEE, 2019). This species mostly inhabits fresh, brackish or saline and coastal or subcoastal wetlands. They frequent tidal wetlands, including harbours, bays, estuaries and lagoons and the associated tidal sandflats and mudflats (DoEE, 2019b).	This species breeds in Eurasia from late July to late August to spend the boreal winter in the Southern Hemisphere, including Australia (DoEE, 2019b).	May occur Several old records for the species are located from the desktop search extent around Mount Isa and Richmond. Habitats within the study area were suboptimal. However the species may occur.
<i>Cuculus optatus</i> Oriental cuckoo	Non-breeding migrant to Australia. A largely terrestrial species preferring forested, open woodland or shrubland habitats. It also has a preference for Australia's coastal areas (DoEE, 2019b).	This bird breeds in Eurasia and migrates south arriving in Australia from September to April. (DoEE, 2019b).	May occur Several records of this species are located within the desktop search extent, from around Townsville, though limited sightings have been reported west towards the study area.



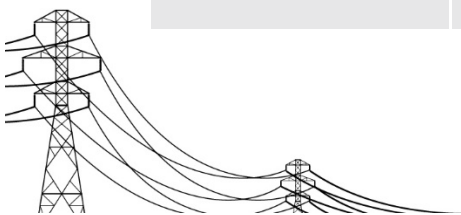
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Gallinago hardwickii</i> Latham's snipe	Generally solitary or in loose congregations of few individuals (Higgins and Davies, 1996). Habitat includes permanent and ephemeral wetlands with dense vegetation for cover. Distribution covers east and southeast Australia, and breeding occurs in Japan and eastern Russia (DoEE, 2019b).	Departs from breeding grounds from July through to November. Flocks start to arrive in Australia in July (Higgins and Davies, 1996). Birds commence the return journey in late February, passing over the QLD coast heading north (DoEE, 2019b).	Likely to occur This species has been previously recorded around Charters Towers, Woodstock and Mount Isa.
<i>Gallinago megala</i> Swinhoe's snipe	Specific habitat to Australia includes dense clumps of grass and rushes along edges of fresh and brackish wetlands (Higgins and Davies, 1996). Occurs along eastern Australia's coastlines from QLD to eastern SA. Scattered distribution in appropriate habitat is suggested along the WA and NT coastline (DoEE, 2019b).	Suitable habitat exists along the east coast of Australia, however, few definite records exist. The species breeds in central Siberia and Mongolia and moves southeast through Russia from August to late September. The species arrives in Australia from October to April, with records occurring mostly in the northern coastal areas. Species leaves Australia in April (Higgins and Davies, 1996).	May to occur This species has been previously recorded within the desktop search extent around Mount Isa. Habitats within the study area were generally suboptimal.
<i>Gelochelidon nilotica</i> Gull-billed tern	This species is found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grassland (DoEE 2019b). Species distributed along most of the Australian coastline and mainland. Lack of records in central WA and western SA (DoEE, 2019b).	Can migrate to New Guinea and Indonesia, but can also occur throughout Australia, particularly north Australia, throughout the year (DoEE, 2019b).	Likely to occur This species has been widely recorded throughout the desktop search extent, especially around Mount Isa and Richmond.



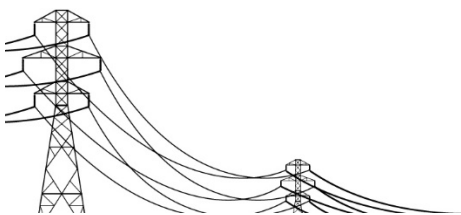
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Glareola maldivarum</i> Oriental pratincole	The species is widespread across northern Australia from the Pilbara region to part of the Gulf of Carpentaria (DoEE, 2019b). Occasional records of the species exist in southern Australia. Nonbreeding habitat consists of open plains, floodplains or short grassland. Often occurs near terrestrial wetlands.	Breeding does not occur in Australia, with the species migrating from the northern hemisphere and arriving in Australia for the non-breeding season from late October until April (DoEE, 2019b).	Confirmed present This species was recorded during GHD field surveys around Julia Creek and Richmond.
<i>Hirundo rustica</i> Barn swallow	This species occurs in northern Australia, on offshore northern islands and patchily along the north coast of the mainland from the Pilbara region in WA through to Fraser Island in QLD. Occurs in open country in coastal lowlands, often near water, towns and cities (DoEE, 2019b).	Species breeds in the boreal spring and summer throughout the temperate and subtropical northern hemisphere. It then migrates south to southeast Asia and Australia. This species breeds in northern America and spends the boreal winter in central and southern America (DoEE, 2019b).	May occur One sightings of this species has been recorded around Mount Isa. Suitable habitat was widely recorded within the study area.
<i>Hydroprogne caspia</i> Caspian tern	This species is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred (DoEE 2019b). Occurs mostly along the SA and WA coastline, with scattered records along the QLD, VIC and TAS coastlines.	This species is a resident and present throughout the year at breeding sites. Some seasonal migrations have been observed where breeding occurs on the Australian coastline during summer, then they migrate to inland Australia along watercourses during the winter (DoEE, 2019b).	Confirmed present This species has been recorded in large numbers between Mount Isa and Cloncurry and was confirmed present during past surveys near KP 61WD



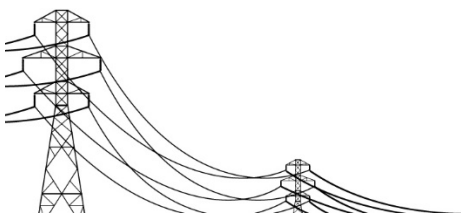
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Limosa limosa</i> Black-tailed godwit	The black-tailed godwit occurs singly or in small or large groups, within the coastal fringes of Australia, including NSW. The largest populations reside between Darwin and Weipa with small populations along remaining coastal regions of Australia (Watkins, 1993). Inhabits sheltered estuaries, bays and lagoons with intertidal sandflats or mudflats (DoEE, 2019b).	Breeds in the northern hemisphere, and migrates into Australia from late August (Higgins and Davies, 1996). Returns to breeding grounds from late summer into early Autumn (DoEE, 2019b).	May occur This species has been previously recorded from the desktop search extent around Mount Isa, Richmond and Charters Towers. However habitats within the study area were suboptimal.
<i>Monarcha melanopsis</i> Black-faced monarch	It is widespread in eastern Australia from the islands off the Torres Strait, south along the coast, and occasionally offshore islands, through to southern Victoria. Occurs from tropical to temperate rainforests, open eucalypt forests and in woodlands with an understorey (DoEE, 2019b).	It flies south across the Torres Strait from their wintering grounds in New Guinea around August to their breeding areas in eastern Australia around September – May. It returns to New Guinea around May (DoEE, 2019b).	Unlikely to occur This species is widely recorded east of the GDR. No records are located in the study area.
<i>Monarcha trivirgatus</i> Spectacled monarch	It prefers thick understory habitat in rainforests, wet sclerophyll forests and mangroves, foraging for insects (DoEE, 2019b). Occurs along the QLD and NSW coastline.	Migratory patterns are not wholly understood. Some individuals reside in north east QLD. Others are migratory. The migrants fly south across the Torres Strait from their wintering grounds in New Guinea and Indonesia around August to their breeding areas in eastern Australia around September – May. They return around May (DoEE, 2019b).	Unlikely to occur This species inhabits coastal regions to the east of the GDR. No records are located within the study area.
<i>Motacilla cinerea</i> Grey wagtail	This species has sparse, scattered historical records throughout the Australian mainland, coasts and coastal waters DoEE, 2019b).	Breeding occurs in Europe and Asia and migrates to tropical regions in Asia, Africa and Australia during the boreal winter (DoEE, 2019b).	Unlikely to occur This species has not been previously recorded in the study area.



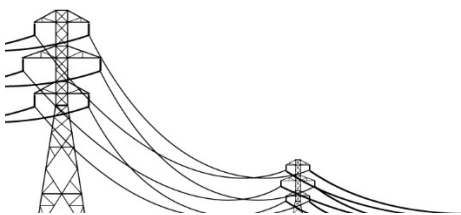
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Motacilla flava</i> Yellow wagtail	Species is found in highly variable habitats, but typically found in open grassy flats near water. Habitats include open areas of low vegetation such as grasslands, pastures, sports fields and damp open areas (DoEE 2019b). Occurs throughout Australian mainland and coasts.	Breeds in Europe, Russia and Asia, wintering in Australia during the Australian summer (DoEE, 2019b).	Unlikely to occur This species has not been previously recorded within the study area.
<i>Myiagra cyanoleuca</i> Satin flycatcher	It is widespread but scattered across QLD and eastern Australia. This species is widespread throughout southeast QLD and its coast. Satin flycatchers inhabit heavily vegetated gullies in eucalypt forests, taller woodlands, coastal forests and mangroves. They mainly forage for insects (DoEE, 2019b).	This species departs QLD in April to fly north to spend winter in northern Australia and New Guinea. Some fly along the coast. They return to QLD in August – November along the coast to the south-east.	May occur This species commonly encountered in coastal environments. This species may occur around the far eastern extent of the study area.
<i>Numenius minutus</i> Little curlew	Known from coastal regions in Australia, distributed largely between Port Headland, WA and QLD coast. It is widespread along the QLD coast (Higgins and Davies 1996). This species moves in flocks of thousands. Forages in grasslands and sedgeland near to pools or floodplains. Also known to inhabit sheltered beaches, grassy flats and saltmarshes (DoEE, 2019b).	Arrives on breeding grounds, Russia, in late May, and leaves during the second half of July. Arrives in northern Australia in late October, and then disperses south or inland during November to December (DoEE, 2019b).	May occur Recent records (2018) of the species were reported north of Mount Isa and historic records are located around Richmond. Habitats within the study area were generally unsuitable. This species occur within the study area, during favourable conditions.



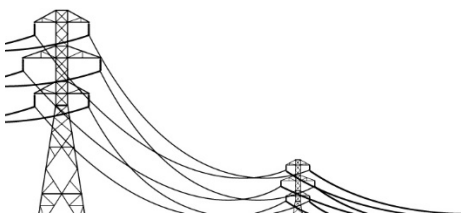
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Pandion cristatus</i> Eastern osprey	Primarily inhabits coastal and estuarine habitats (Marchant and Higgins, 1993). The species prefers littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands for roosting and foraging (DoEE, 2019b). Occurs from Esperance in WA to NSW, where records become scarcer towards the south, and into VIC and TAS, where the species is a rare vagrant.	Breeding range extends around the northern coast of Australia from Albany in WA to Lake Macquarie in NSW, with a second breeding population on the coast of SA (DoEE, 2019b).	May occur This species has been recorded on multiple occasions within the desktop search extent, from around Mount Isa and Cloncurry. The species may occur throughout the corridor selection in areas near large waterbodies.
<i>Phalaropus lobatus</i> Red-necked phalarope	The species is a wader which regularly occurs at sea as well as inland and in coastal lakes. It has been sparsely recorded in all Australian states and territories, inland and on the coastline (DoEE, 2019b).	It breeds in the Arctic and subarctic North America, Europe and Russia and winters in Australia, being sighted from mid-October to early April (Higgins and Davies, 1996).	Unlikely to occur Limited data for this species was available. Two historic sightings have been recorded around Mount Isa.
<i>Plegadis falcinellus</i> Glossy ibis	Usually occurs east of the Kimberly in WA and the Eyre Peninsula in SA. Only patchily distributed through the remainder of WA. It is a rare visitor to TAS. It inhabits fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. The largest, continuous areas of prime habitat is inland and northern floodplains (DoEE, 2019b).	Migrates in response to rainfall within Australia, however its core breeding area is within the Murray-Darling Basin in NSW and VIC, the Macquarie Marshes in NSW and southern QLD. It often moves north in autumn then returns south to the breeding areas in spring and summer (DoEE, 2019b).	Confirmed present This species is has been recorded extensively throughout the entirety of the study area. Hotspots include around Mount Isa and Charters Towers.



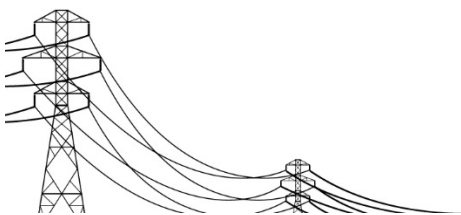
Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Pluvialis fulva</i> Pacific golden plover	They often form flocks of between 20-50 individuals and occur throughout the coastal margins of Australia and occasionally inland wetlands. They are known to occur on east-coast areas, they are widespread along the QLD and NSW coastlines. A nationally important site in QLD is the Great Sandy Strait. They occur and forage on beaches, mudflats and sandflats in usually sheltered areas such as harbours (DoEE, 2019b).	Breeds in northern hemisphere and migrates into Australia for the boreal winter (DoEE, 2019b). Departs Australia in autumn, prior to the austral winter (Marchant and Higgins, 1993).	May occur This species has been previously recorded from the desktop search extent, around Mount Isa and Richmond. Scattered records are located north of Charters Towers. Habitats within the study area were generally suboptimal. However the species may occur.
<i>Rhipidura rufifrons</i> Rufous fantail	This species occurs in coastal and near coastal areas of northern and eastern Australia (Lindsey 1992). It breeds from the QLD-NSW border up to Cairns, QLD (Higgins et al. 2006). It mainly inhabits wet sclerophyll forests in south-east Australia. They can also occur in subtropical and temperate rainforests. This species forages mainly for insects (DoEE, 2019b).	This species departs breeding areas in March to early April, towards north QLD, Torres Strait Islands and New Guinea. However, some birds remain as residents (Morris et al. 1981). They return to the breeding grounds in August – December.	May occur There are widely distributed records east of Charters Towers and Ravenswood. The species may occur in the far eastern extent of the study area.
<i>Tringa brevipes</i> Grey-tailed tattler	A moderately sized wading bird found in the coastal regions of Australia, although is most concentrated in the north (Higgins and Davies, 1996). It is found along the entire QLD coastline with important sites including the Great Sandy Strait and Moreton Bay. Generally prefers sheltered coastal habitats, and roosts in mangrove forests (DoEE, 2019b).	Species is known to breed in Siberia. Moves south from breeding grounds along the east coast of Asia. Arrives in north Australia in August onwards. Commences the return journey in April (DoEE, 2019b).	Unlikely to occur This species is generally recorded around coastal Australia. Single records exist around Mount Isa and north of Charters Towers.



Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Tringa glareola</i> Wood sandpiper	Most commonly recorded in north-west Australia, with all nationally important areas being located within WA. Species is sparsely recorded in QLD, generally south of 17°S but has been recorded in Cairns. Scattered records are also present throughout central NSW and coastal VIC (DoEE, 2019b). Species uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially <i>Melaleuca</i> and River Red Gums <i>Eucalyptus camaldulensis</i> and often with fallen timber.	Species breeds in Eurasia, leaving by early September and arriving in Australia from August. Departs for breeding grounds from Australia in April (DoEE, 2019b).	Confirmed present This species was confirmed present at Chinaman Creek Dam near Cloncurry. Several historical records exist around Mount Isa and scattered records are located around Charters Towers.
<i>Tringa nebularia</i> Common greenshank	The species occurs singly or in small to large flocks along coastal and inland wetlands. It has been recorded in most coastal regions of Australia (DoEE, 2019b). The Great Sandy Strait has been listed as an important site for this species.	The species breeds in the Palearctic, migrating south for the boreal winter. Arrives in Australia from August, mainly in the west and spreading inland and to the east from September. They return to their breeding grounds from March to April (DoEE, 2019b).	May occur This species has been widely recorded in the desktop search extent, particularly around Mount Isa and scattered locations along the corridor selection. Habitats within the study area are generally sub-optimal, however the species may occur.



Species	Habitat requirements	Migratory patterns	Likelihood of occurrence
<i>Tringa stagnatilis</i> Marsh sandpiper	Found on coastal and inland wetlands throughout Australia. It is widespread in coastal QLD up to around Cooktown. It is recorded throughout particularly central NSW. It is a vagrant to TAS. It has scattered records throughout SA. In WA and NT it has scattered records, mostly along the coasts (DoEE, 2019b). Occurs in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. In North Australia they prefer intertidal mudflats.	Species breeds in east Europe, southern Siberia and northern China and migrates south for the boreal winter to non-breeding areas in Africa, Asia and Australia. Departs breeding grounds from July to September. Birds arrive in Australia from September. Returns to breeding grounds in March – April. (DoEE, 2019b).	Confirmed present Approximately ten individuals were observed foraging at the edges of the Skeleton Creek wetland, south-west of Prairie KP300 WD. This species has also been previously recorded from the desktop search extent around Mount Isa, Cloncurry and Pentland.
<i>Xenus cinereus</i> Terek sandpiper	The Terek sandpiper is a wader that generally roosts communally in mangrove areas, and forages on mudflats. It is widespread and more common in northern and eastern Australia, including south-east QLD, than southern Australia. (DoEE, 2019b). The Great Sandy Strait and Moreton Bay have been listed as important sites for this species.	Breeds in Eurasia and leaves around July. Moves south into non-breeding areas along the east coast of Australia during boreal winter between August to September and a second wave in November. This species returns to breeding grounds in March – April (DoEE, 2019b).	May occur This species is widely recorded throughout coastal Australia. Two records are located within the desktop search extent– at Charters Towers and Mount Isa. Habitats within the study area were generally sub-optimal.



18.5 Potential impacts and mitigation

18.5.1 Overview

This section provides a summary of the potential impacts that construction and operation of the Project is anticipated to have on the ecological values of the receiving environment. During the construction phase, the Project is expected to cause localised losses of habitat, predominantly due to clearing of the easement, access tracks and transmission line towers, and temporary disturbance of wildlife through construction light, noise, vibration and increased vehicle movements, as well as the potential for erosion and sedimentation. During the operational phase, the Project will be largely benign for most environmental matters. Nevertheless, the Project will pose an ongoing operational risk of collision with transmission lines and towers for a small number of low-flying bird and bat species and collision with maintenance vehicles. A key management measure for the Project (across phases) will be the implementation of an EMP, the draft of which is included at Volume 3 Appendix Q Framework environmental management plan.

In considering the potential Project impacts, it is important to note significant opportunity exists to avoid or minimise impacts to MNES through the siting of towers and spanning of important ecological areas. This includes specification of tower heights to increase the separation between transmission lines and vegetation, consideration of construction access and ongoing maintenance requirements.

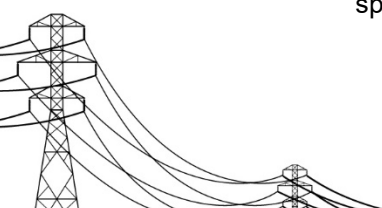
The impacts also need to be considered with respect to the following:

- The Project is a long and narrow linear infrastructure project
- The transmission line will not create a barrier to fauna movement
- Clearing requirements for the Project will result in the loss of some habitat features, however for most species, given the linear nature of disturbance, the loss of habitat will be highly localised and is unlikely to impact the species' capacity to persist locally
- Impacts may be temporary and minor within individual areas and may not impact species presence in the landscape
- Operational impacts are likely to be negligible, with low levels of maintenance access required along the length of the Project.

Proposed mitigation measures have followed the principles of a hierarchy of effectiveness, being avoid impacts on MNES in the first instance, then minimise disturbance, then mitigate through additional actions. The proposed avoidance strategies are considered to be highly effective in managing potential impacts to MNES from the Project. The proposed minimising and mitigation strategies are considered to have improved effectiveness when managed through a framework EMP as is proposed for the Project. When carried out in combination, the measures are considered to be effective for the Project and the particular MNES that are considered likely to occur.

This section has the following structure:

- Section 18.5.2 details the likely construction phase impacts of the Project and proposed mitigation measures to be implemented.
- Section 18.5.3 details the likely operation phase impacts of the Project and proposed mitigation measures to be implemented
- Section 18.5.4 details the following with respect to listed threatened communities and species confirmed present or likely to occur:



- threatening processes
- potential impacts
- proposed avoidance and mitigation measures
- likelihood and duration of residual impacts
- reliability of residual impact predictions.
- Section 18.5.5 presents an assessment of the Projects' impacts against the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013) for listed threatened communities and species that have been confirmed present or considered likely to occur within the study area
- Section 18.5.6 presents the cumulative impacts assessment
- Section 18.5.7 gives a summary of proposed mitigation measures for the phases of the Project
- Section 18.5.8 provides a overview of the environmental management plan framework, elements and management strategies

18.5.2 Construction phase impacts and mitigation measures

Impacts associated with construction of the transmission line have been reduced by selecting the corridor selection that minimises direct impacts on MNES, such as mapped patches of Semi-evergreen Vine Thicket TEC and records of listed threatened species and/or associated habitat. Despite this, due to the length of the Project and the extent of mapped native vegetation communities, the Project area intersects a substantial area of native vegetation.

The following general impacts are expected to result from construction of the Project:

- Disturbance or clearing of vegetation and habitat including potential habitat for listed threatened species
- Injury and mortality of wildlife
- Habitat fragmentation and reduced connectivity where clearing of canopy vegetation is required
- Disturbance of wildlife behaviours by increased light, noise and vibration
- Habitat degradation through increased dust, run-off and sedimentation
- Introduction and spread of invasive species
- Disturbance of watercourses, waterbodies or GDEs

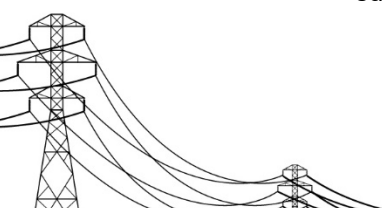
These impacts and mitigation measures are discussed in detail below.

The locations of additional infrastructure areas such as off-easement access, construction camps and laydown areas has not yet been selected, but have been assumed to be placed in areas of previously cleared and disturbed land and away from areas of ecological significance. Therefore the impacts of these activities and infrastructure have not been assessed further.

18.5.2.1 Disturbance or clearing of vegetation and habitat

Potential impacts resulting from disturbance of native vegetation can include:

- Loss of habitat leading to reduced biodiversity, including long term impacts to local populations and genotypes
- Loss of microhabitats including tree hollows, hollow logs, leaf litter, rocks and substrate suitable for specific fauna



- Loss of resources such as foliage, flowers, nectar, fruit and seeds
- Fragmentation of populations, which can reduce genetic exchange between smaller isolated populations
- Loss of habitat and resources for listed threatened species that are already subject to threatening processes

Disturbance footprints

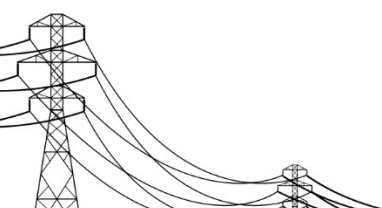
An assessment of the Project area against the landscape types mapped using the 1:1 million BVGs demonstrates that a number of areas contain vegetation communities that feature low and/or very sparse canopy vegetation and therefore result in reduced clearing impacts. The landscape types are shown in Figure 18-31. There is a design requirement to clear all woody vegetation within the transmission line easement that is, or may grow to be, over five metres in height. In some landscapes this may require only trimming of taller trees, or only selective clearing of taller vegetation may be required while lower vegetation may remain. However, all vegetation within the standard impact footprint for towers, CEV huts and substations will be required to be cleared.

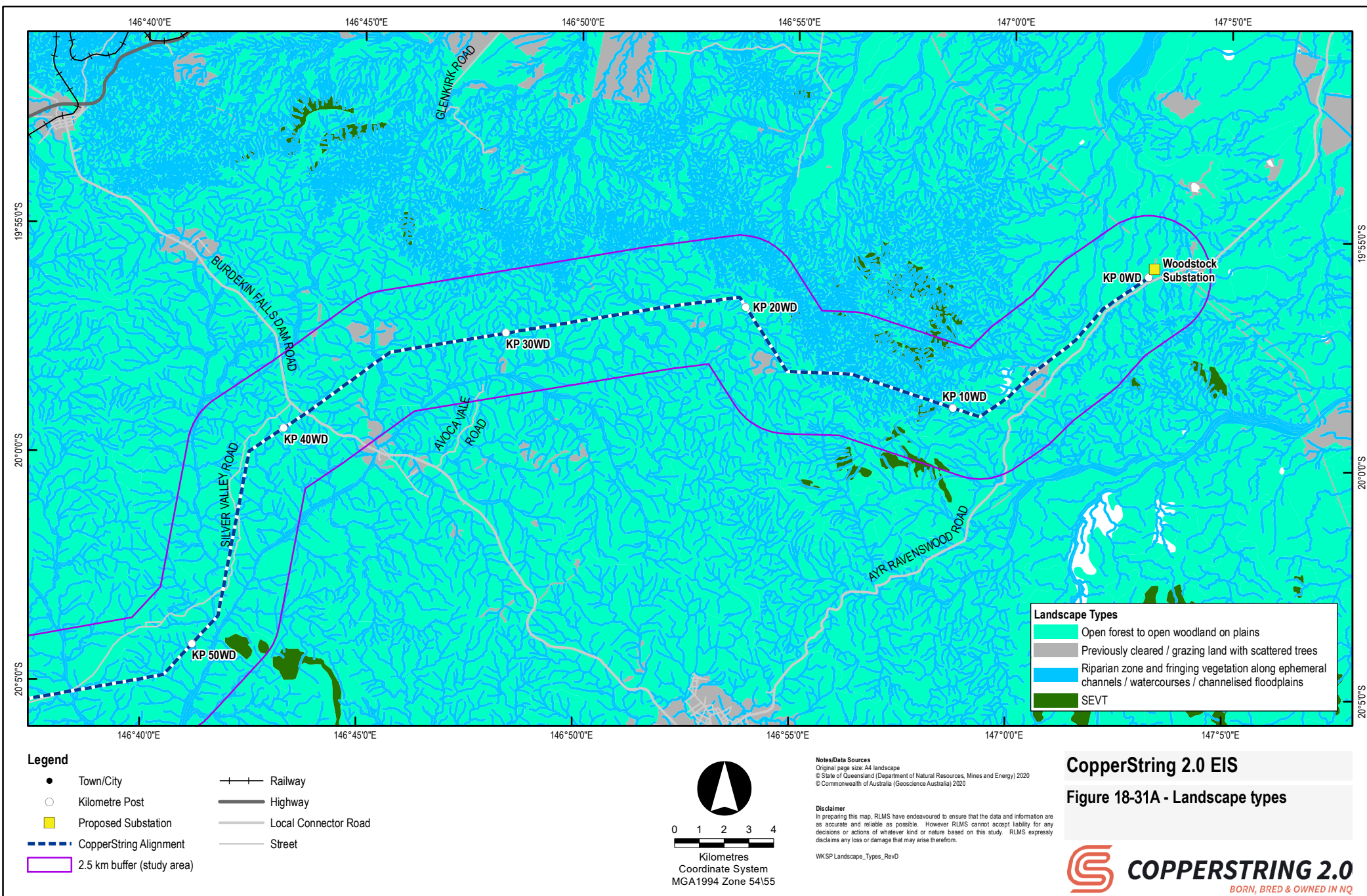
The calculations presented represent a worst-case scenario for habitat disturbance with important areas retaining potential for MNES and MSES to be highlighted. The design and construction management process will seek to avoid and minimise impacts through appropriate tower selection and siting, spanning of areas and consideration of vegetation clearing requirements.

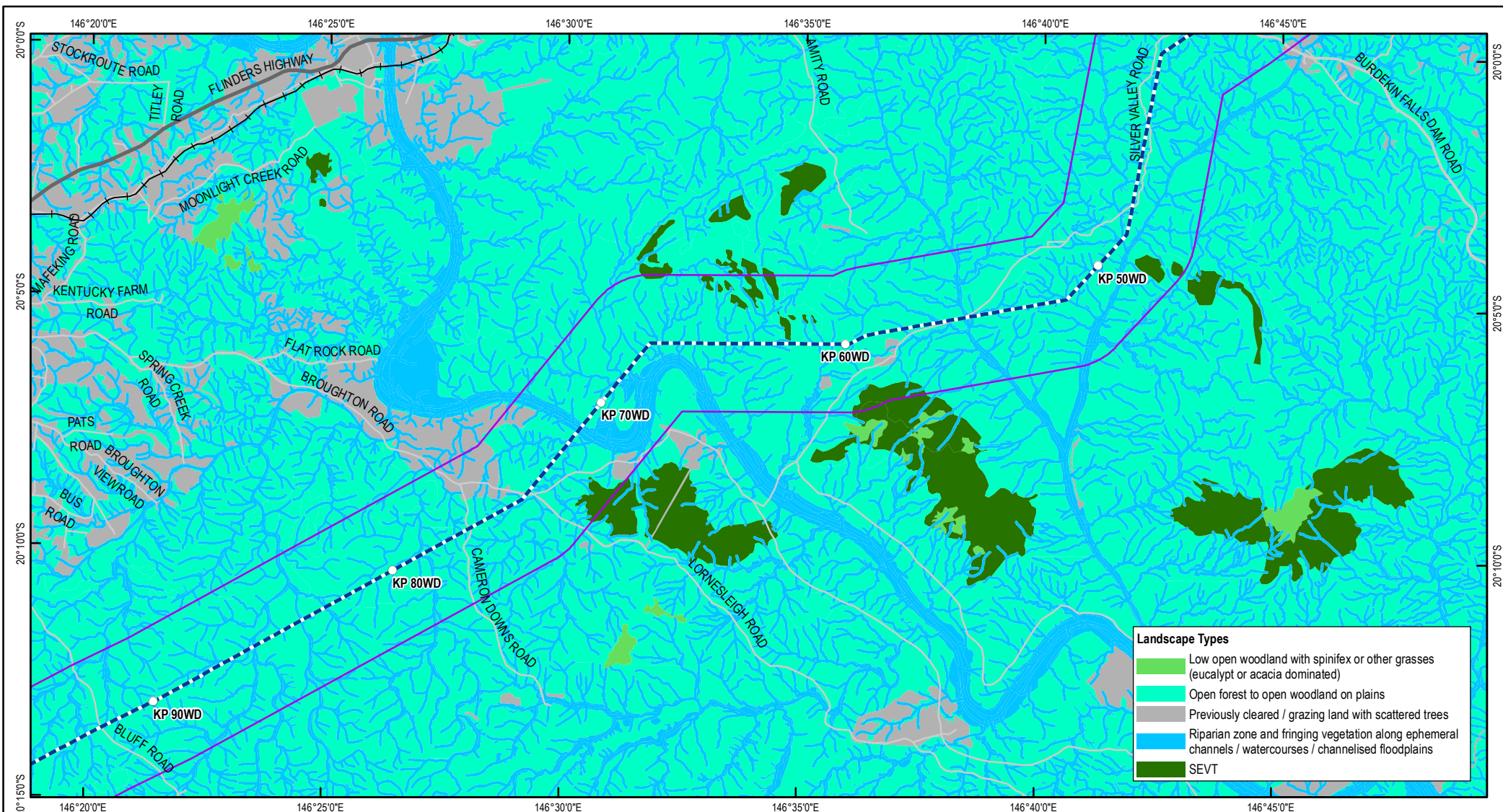
The landscape types that have been broadly mapped throughout the Project area and the percentage of disturbance per type within the corridor easement is estimated to be:

- Open forest to open woodland (eucalypt / melaleuca / belah dominated) on flat to undulating plains – 10.1% of the landscape type disturbed within the Renewable Energy Hub and CopperString Core corridor sections
- Riparian zone and fringing vegetation along ephemeral channels, watercourses and channelised floodplains – 0% of the landscape type disturbed due to the ability of infrastructure to span and avoid the riparian corridors. No riparian areas will be disturbed from the construction or operation of the transmission line, however access tracks may require removal of vegetation to cross a waterway/riparian vegetation corridor for an assumed 25% of scenarios.
- Low open woodland to wooded spinifex grassland (eucalypt / acacia dominated) on slopes, crests and scarps – 0.2-3.9% of the landscape type disturbed, depending on the relevant corridor section
- Mixed low woodland with spinifex (gidgee / mulga / eucalypt dominated) on plains – 0-0.3% of the landscape type disturbed, depending on the relevant corridor section
- Tussock/hummock grassland – 0-0.4% of the landscape type disturbed, depending on the relevant corridor section
- Cleared grazing land with scattered trees – 0-0.1% of the landscape type disturbed within the Renewable Energy Hub, CopperString Core and Phosphate Hill Connection corridor sections

These percentages represent the more likely clearing impacts within the different landscape types present in the Project area. The estimated disturbance area for each landscape type mapped within each corridor section are provided in Table 18-32.



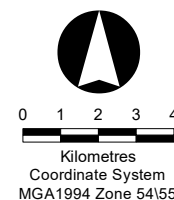




Landscape Types	
■	Low open woodland with spinifex or other grasses (eucalypt or acacia dominated)
■	Open forest to open woodland on plains
■	Previously cleared / grazing land with scattered trees
■	Riparian zone and fringing vegetation along ephemeral channels / watercourses / channelised floodplains
■	SEVT

Legend

- Town/City
- Kilometre Post
- CopperString Alignment
- 2.5 km buffer (study area)
- Railway
- Highway
- Local Connector Road
- Street



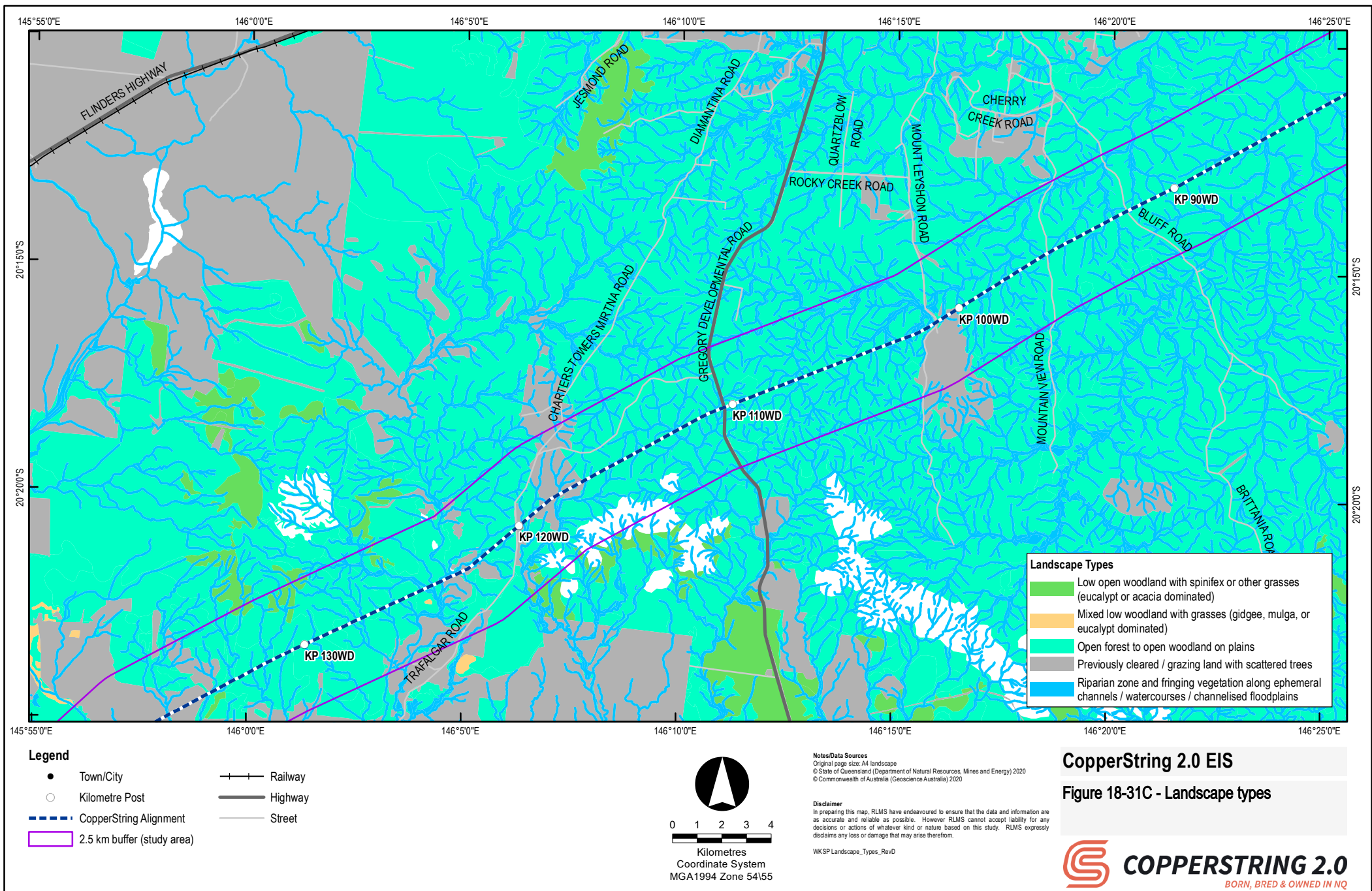
Notes/Data Sources
Original page size: A4 landscape
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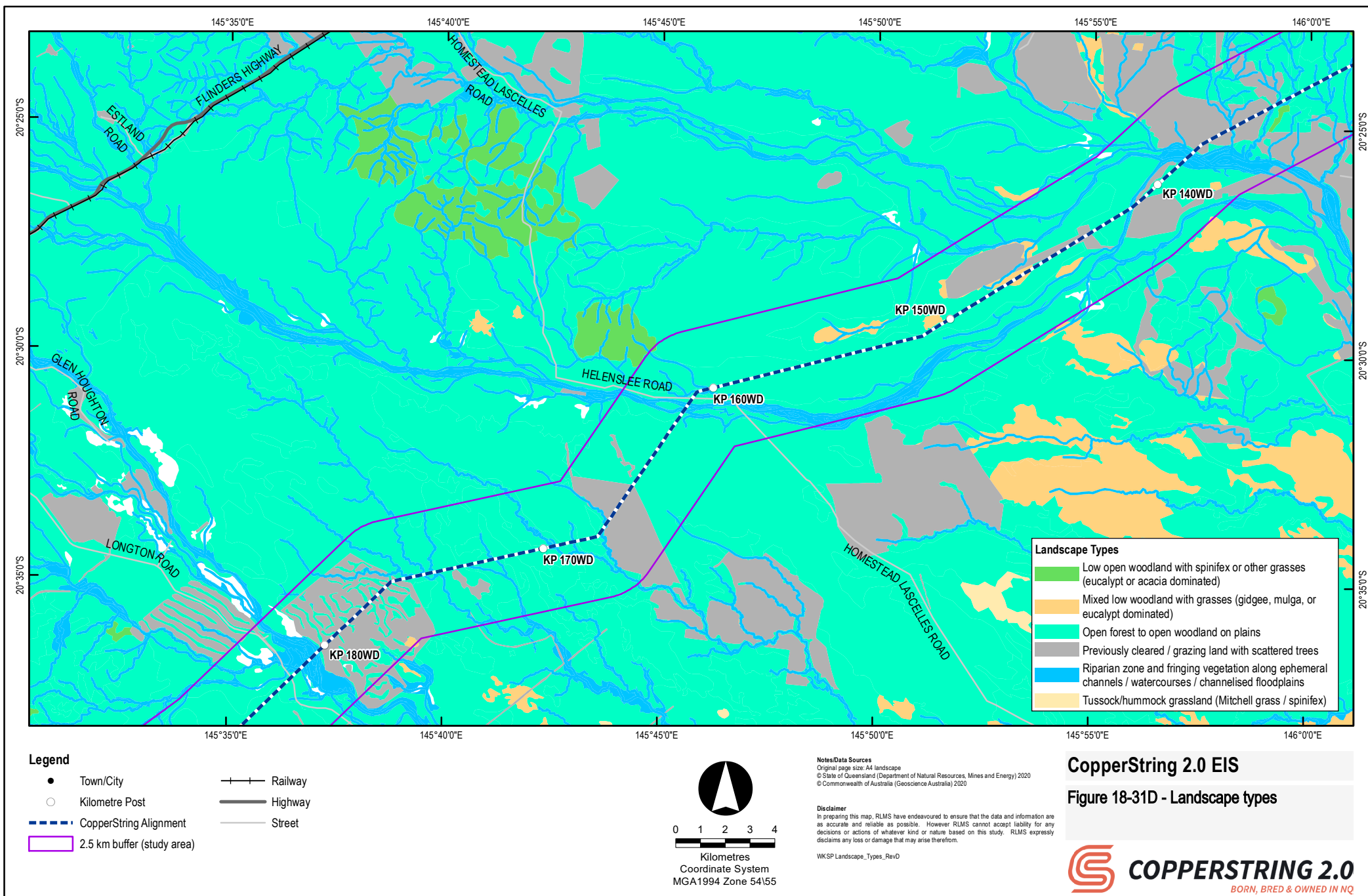
Disclaimer
In preparing this map, RLMS have endeavoured to ensure that the data and information are as accurate and reliable as possible. However RLMS cannot accept liability for any decisions or actions of whatever kind or nature based on this study. RLMS expressly disclaims any loss or damage that may arise therefrom.

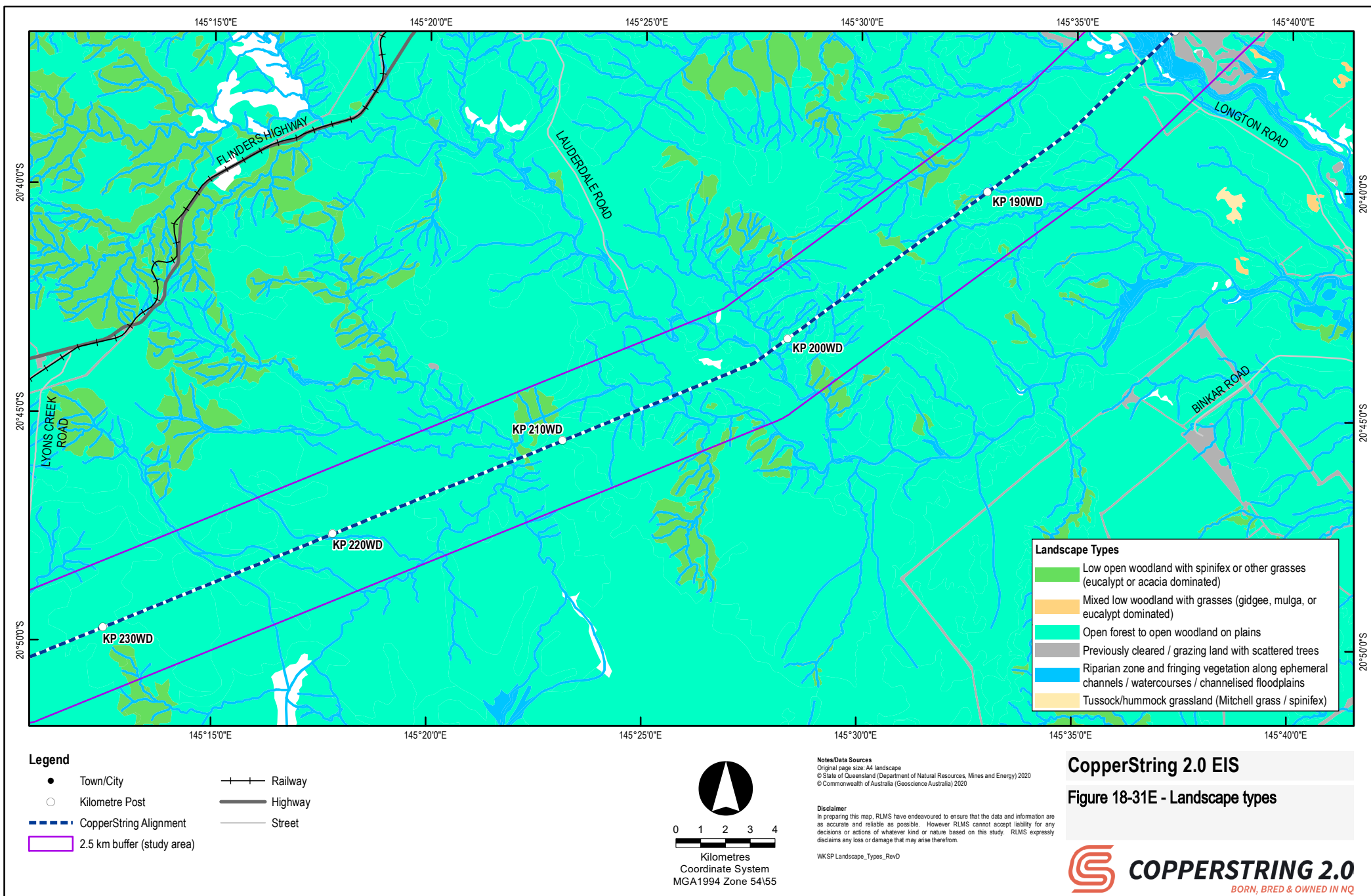
WKSP Landscape_Types_RevD

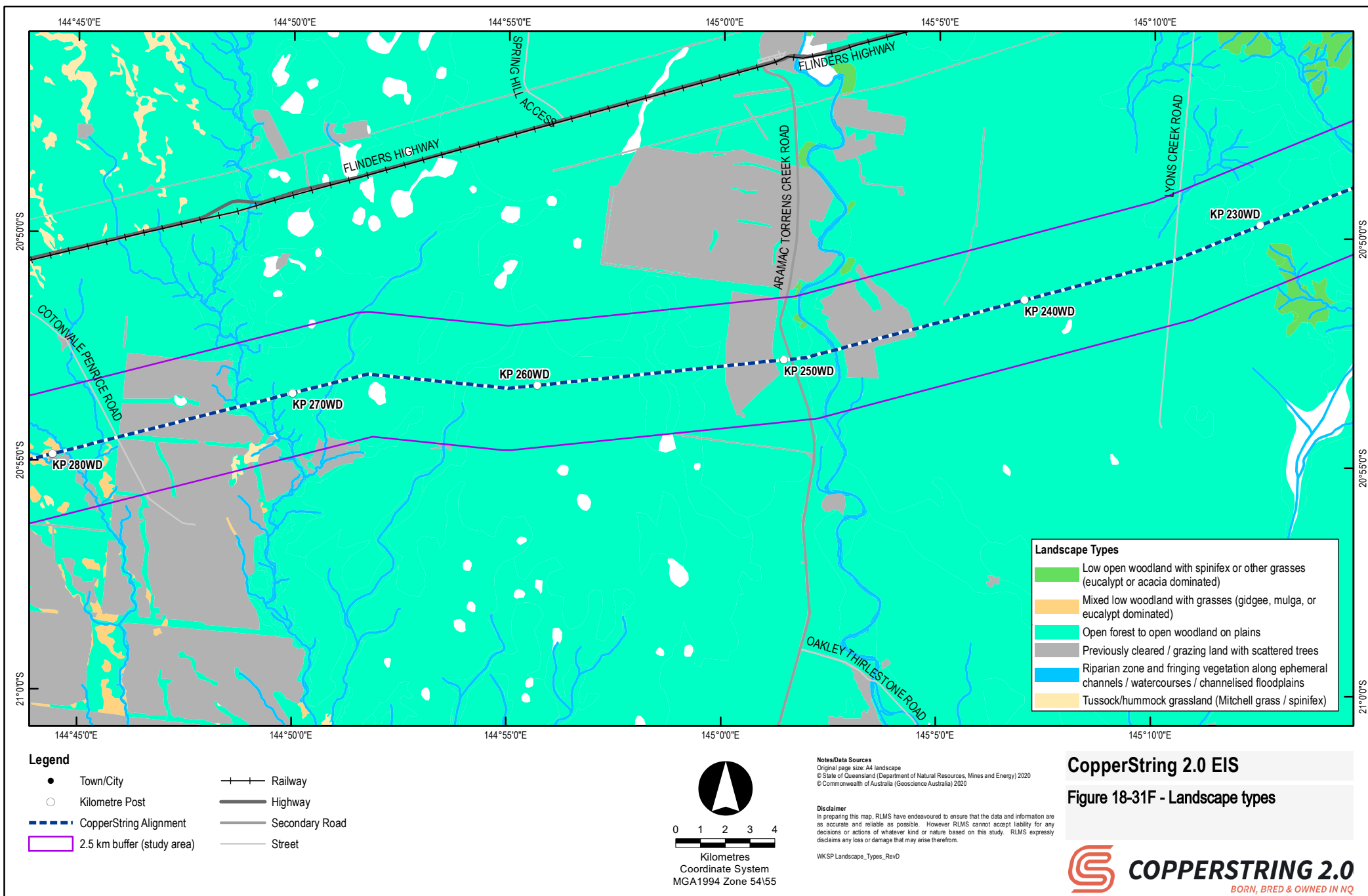
CopperString 2.0 EIS

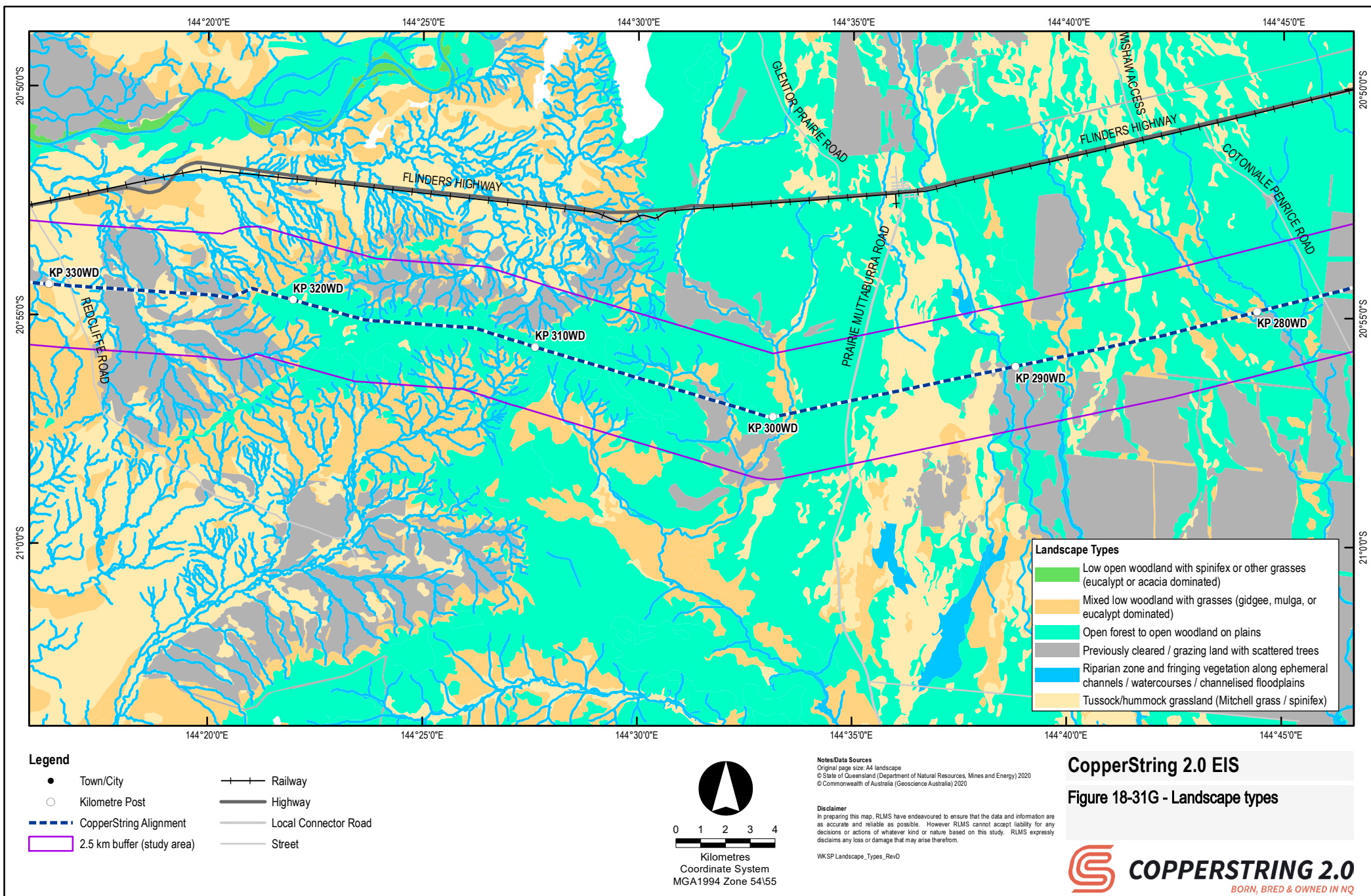
Figure 18-31B - Landscape types

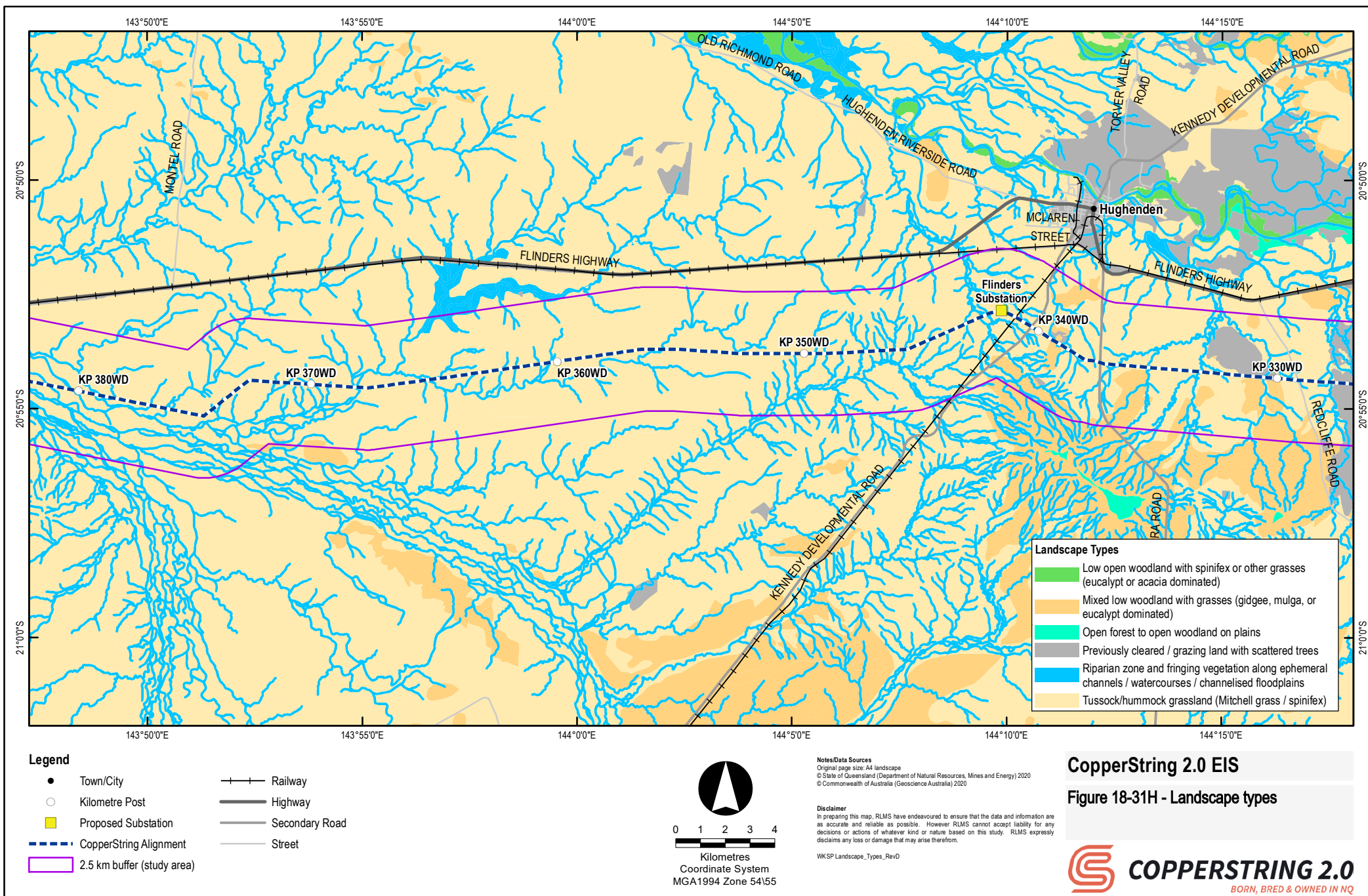


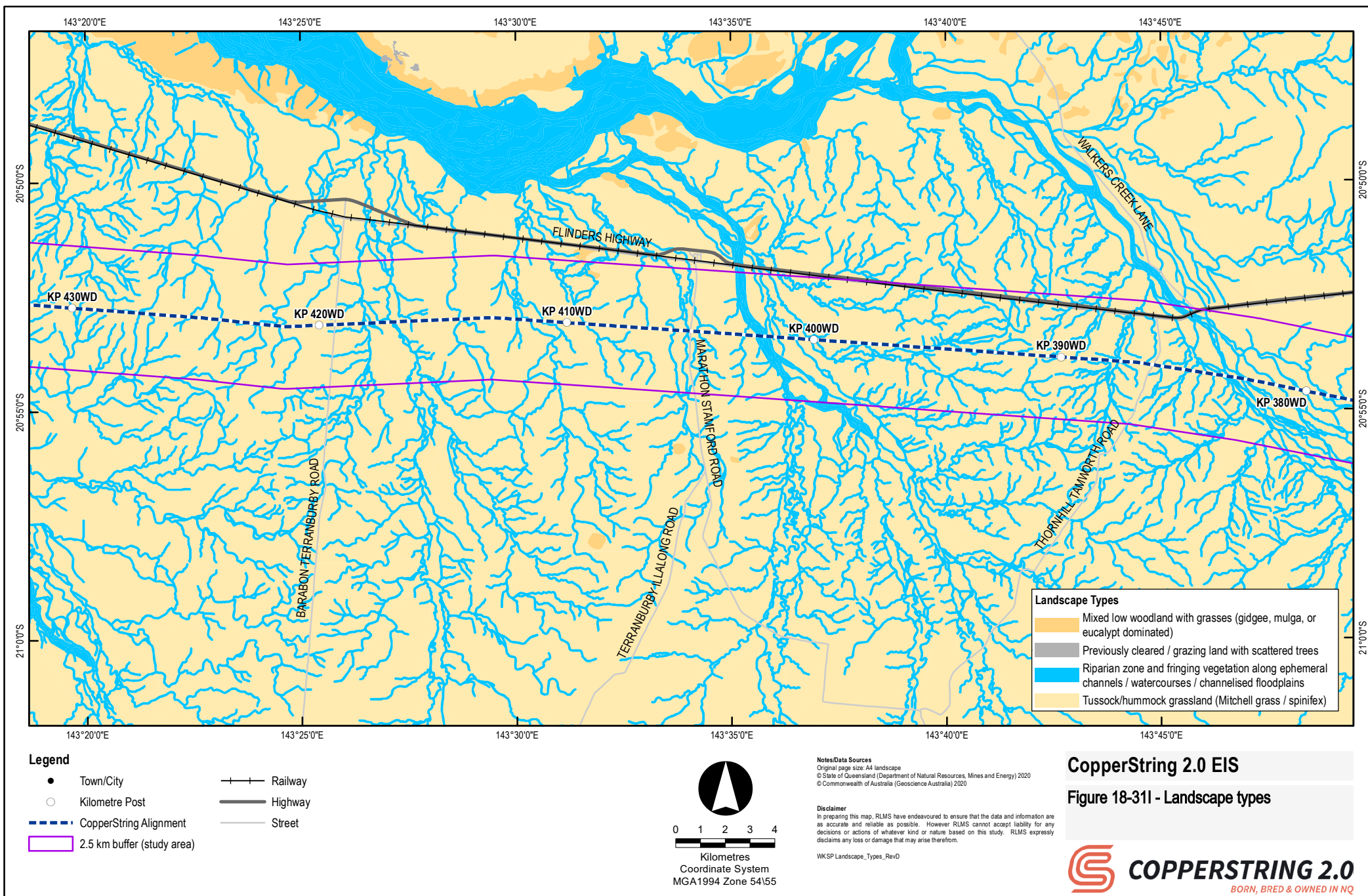


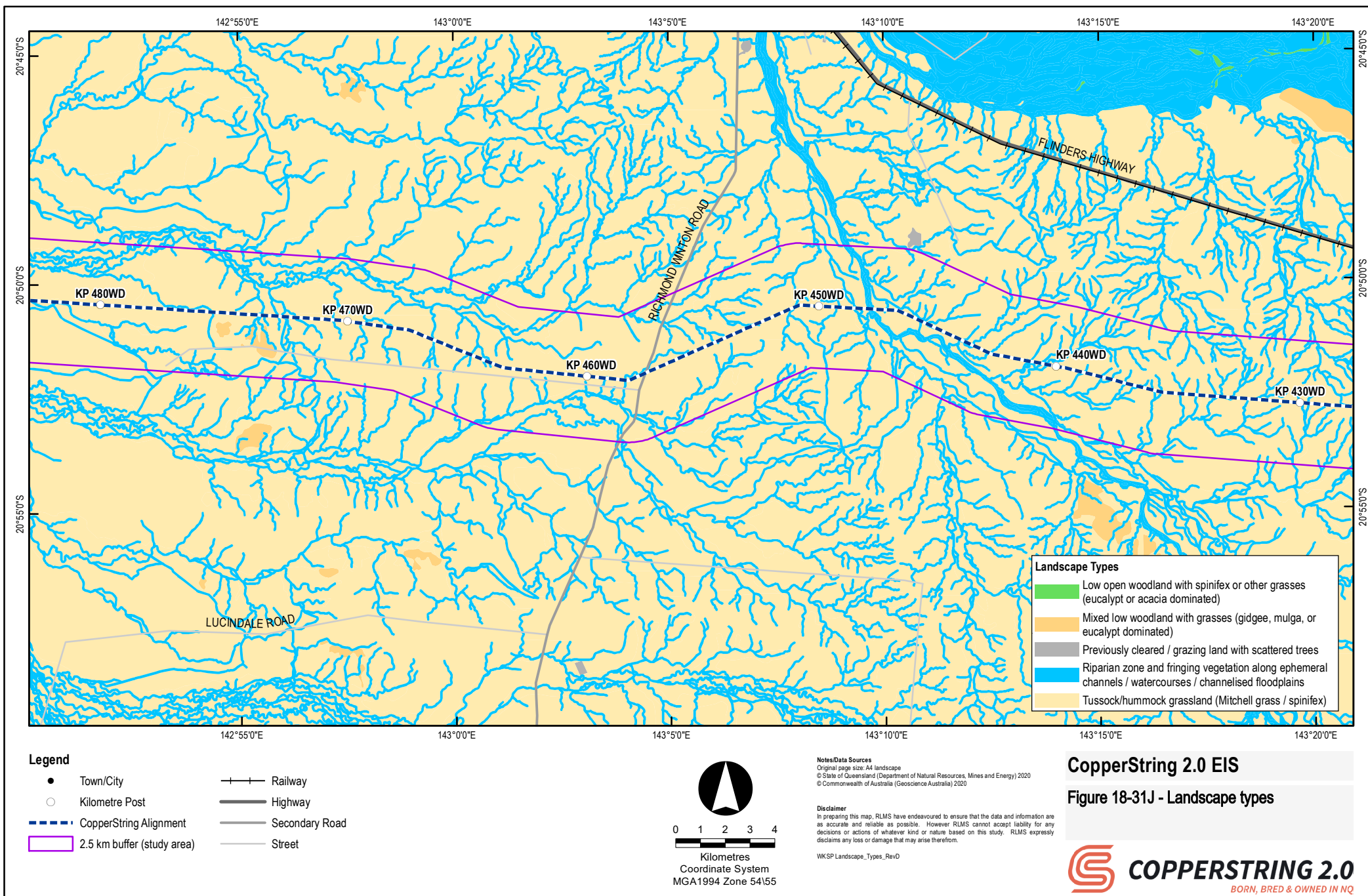


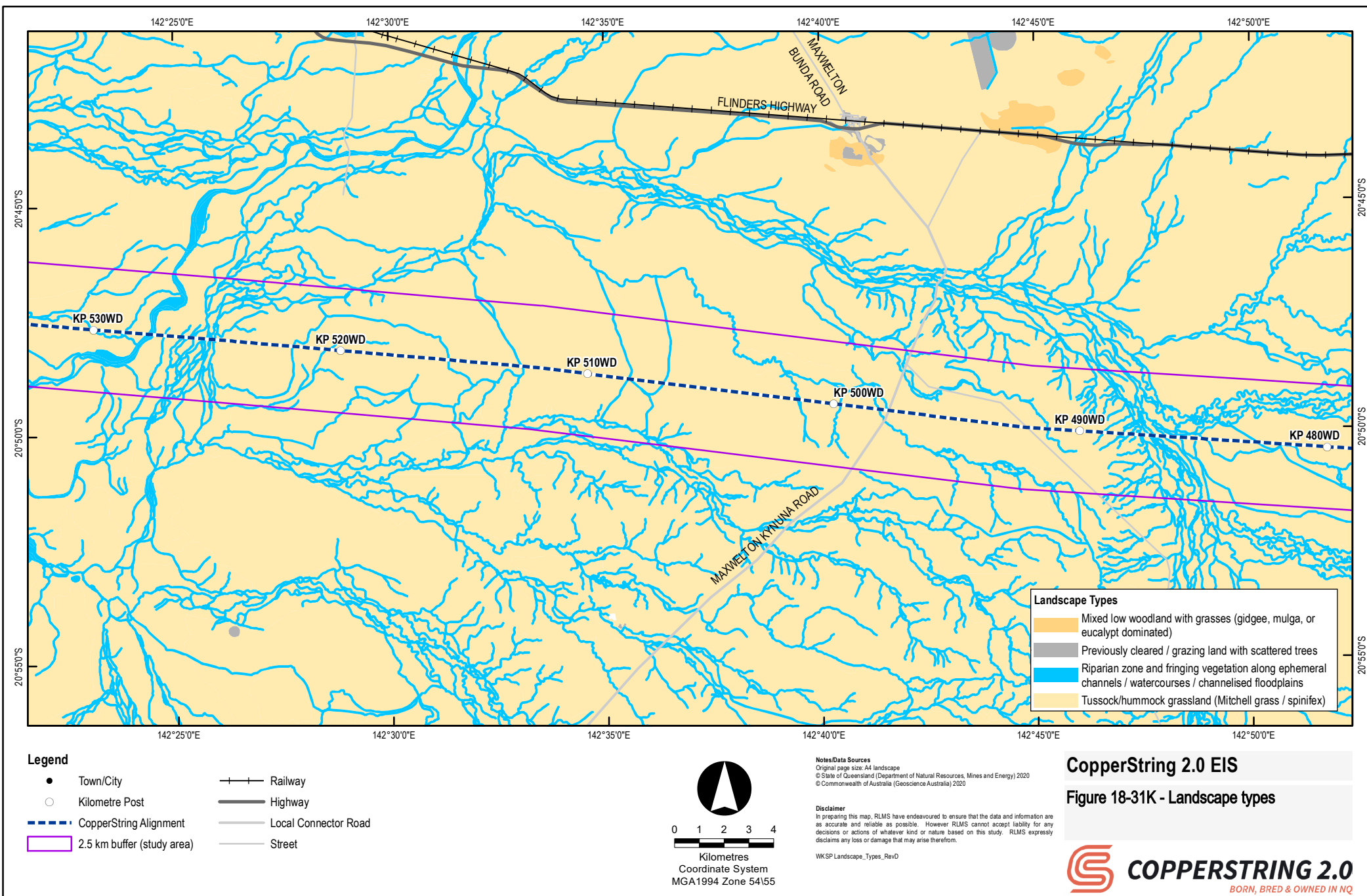


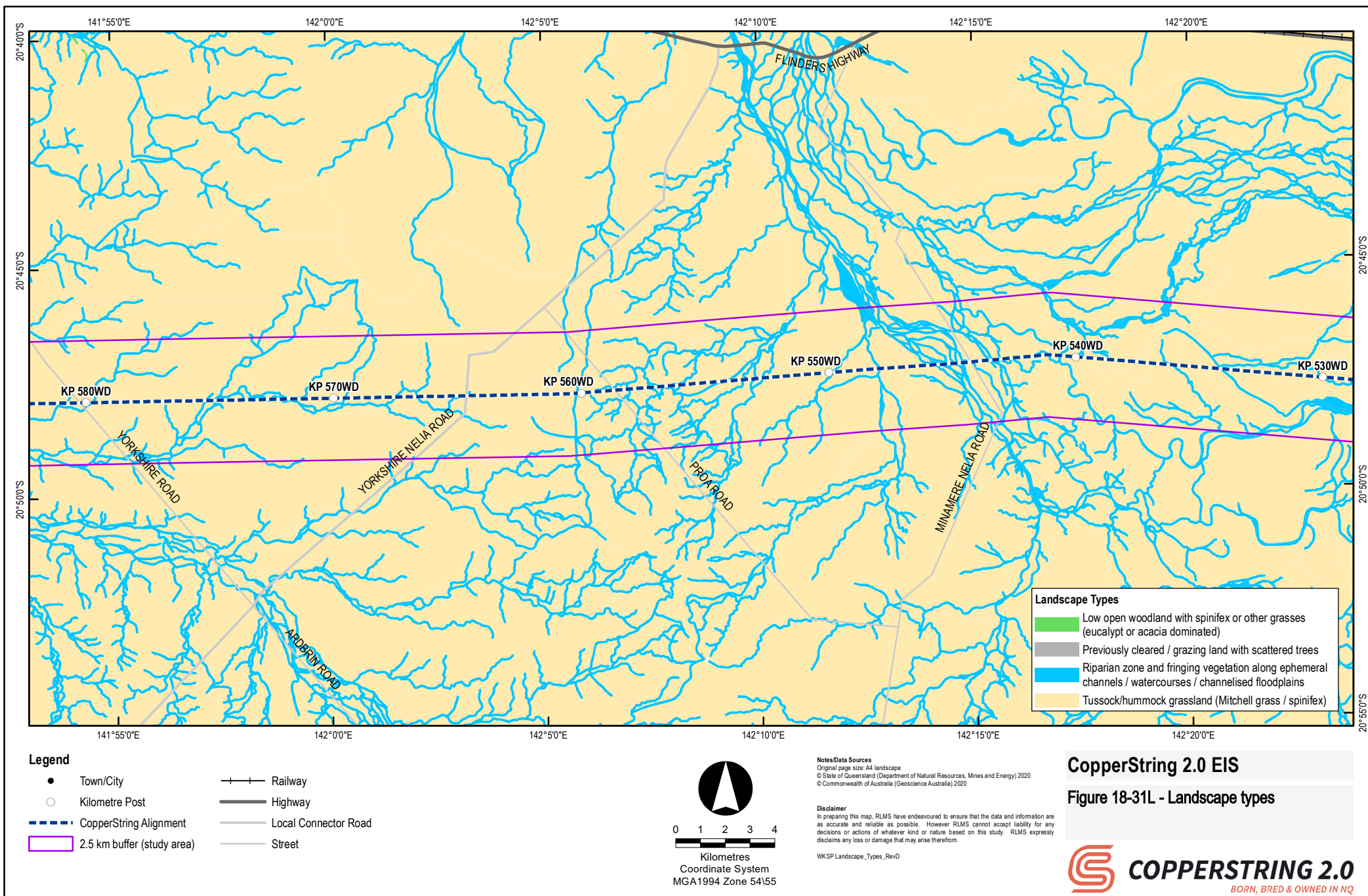


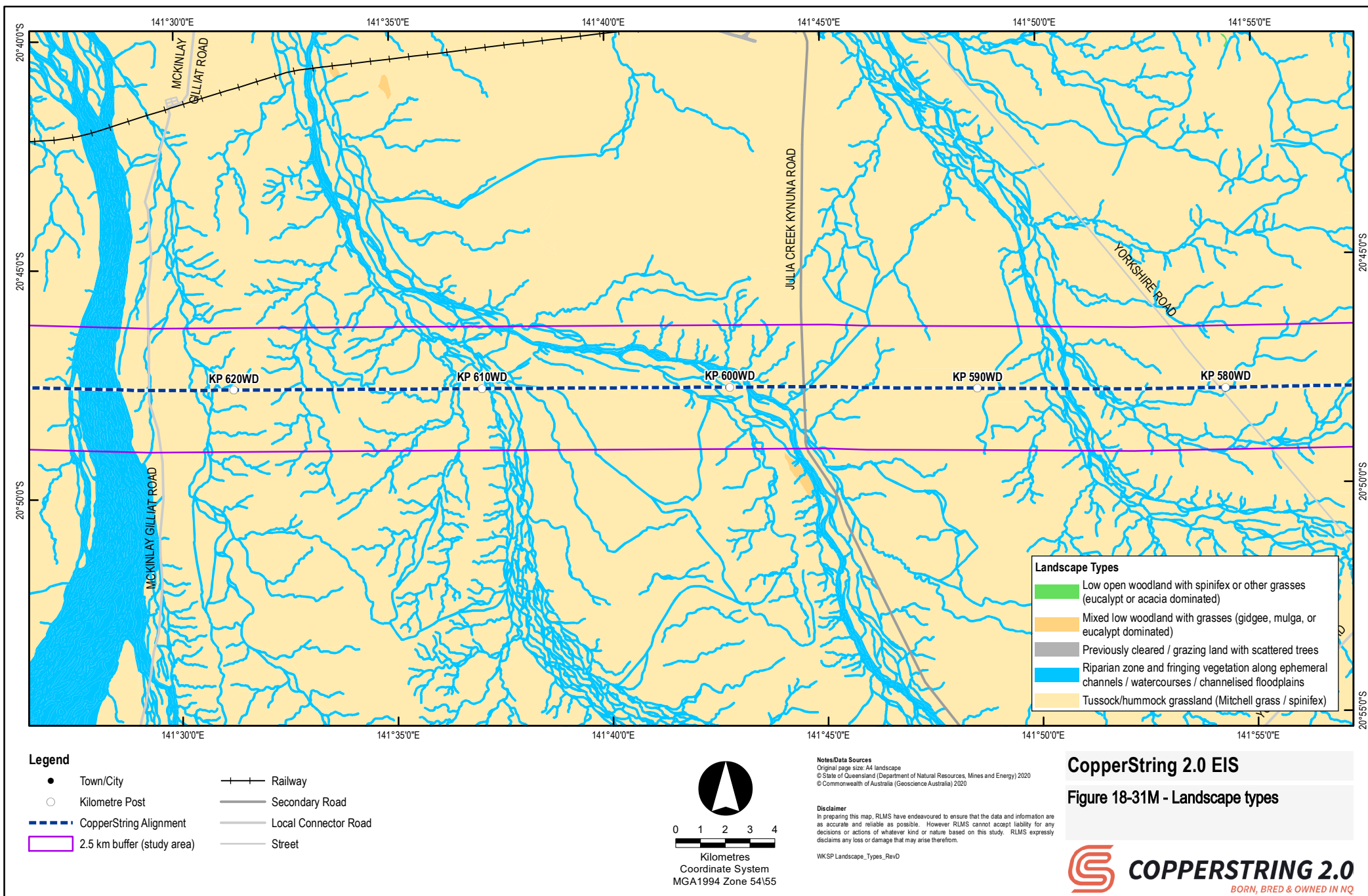


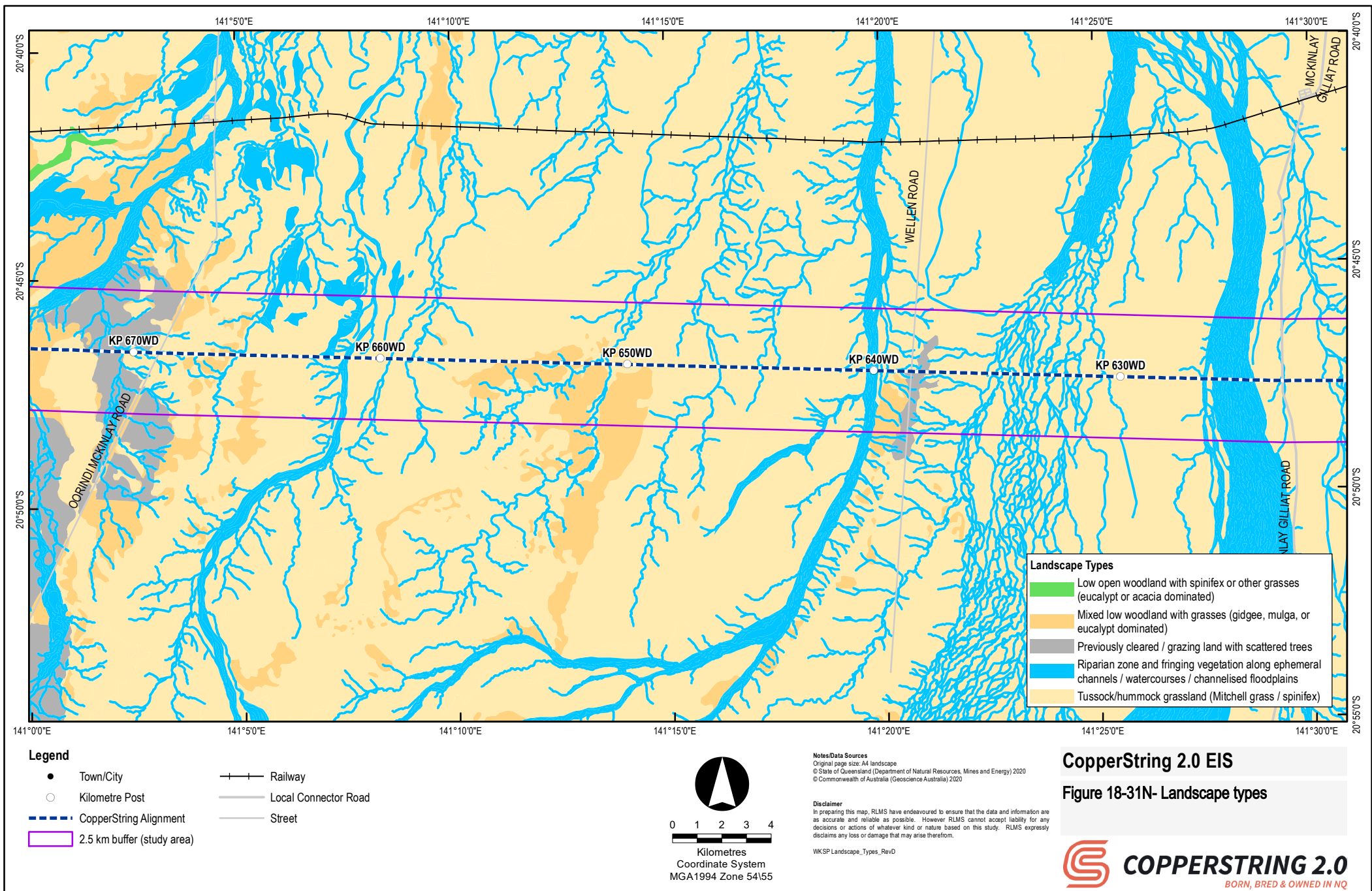


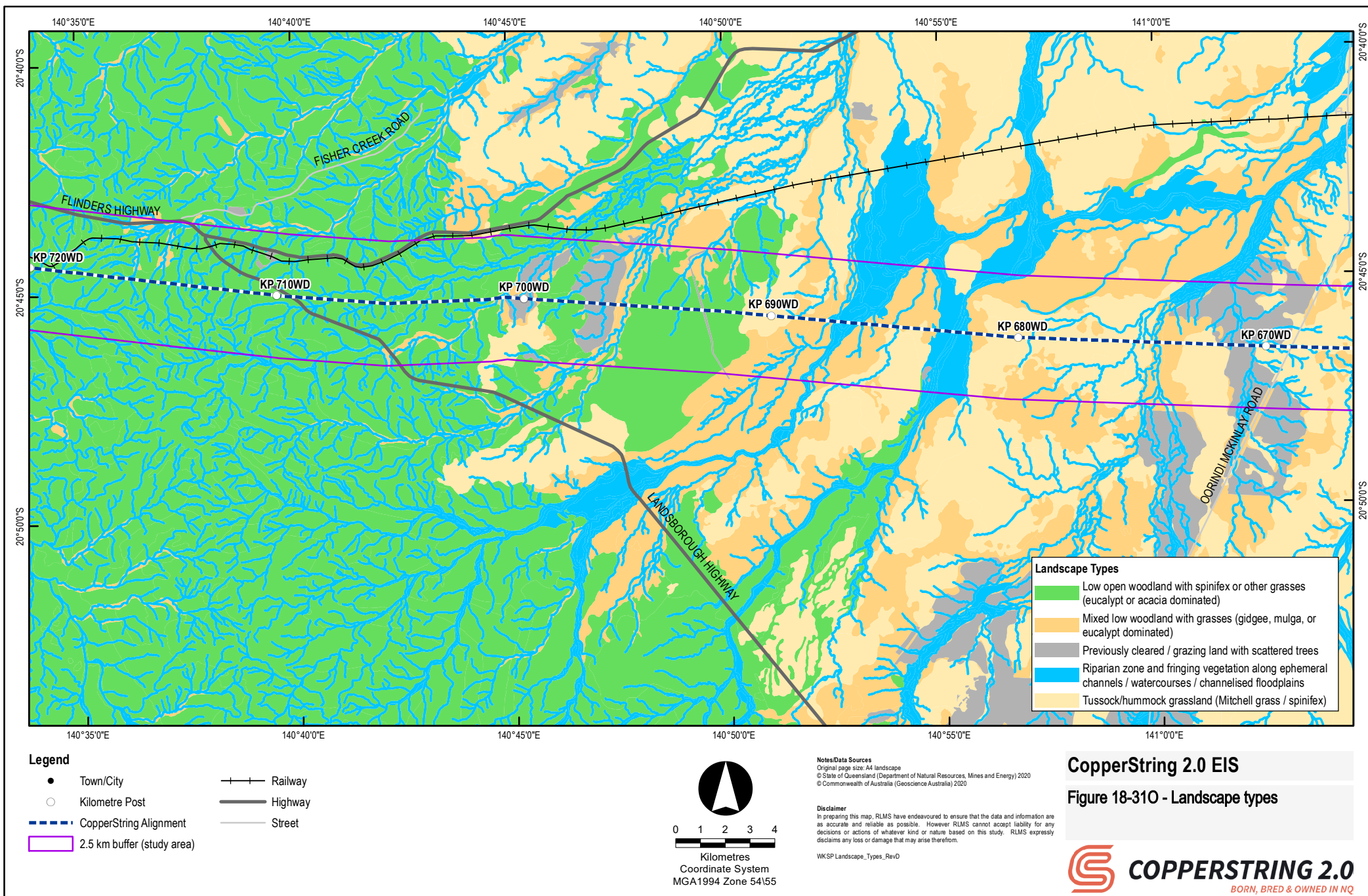


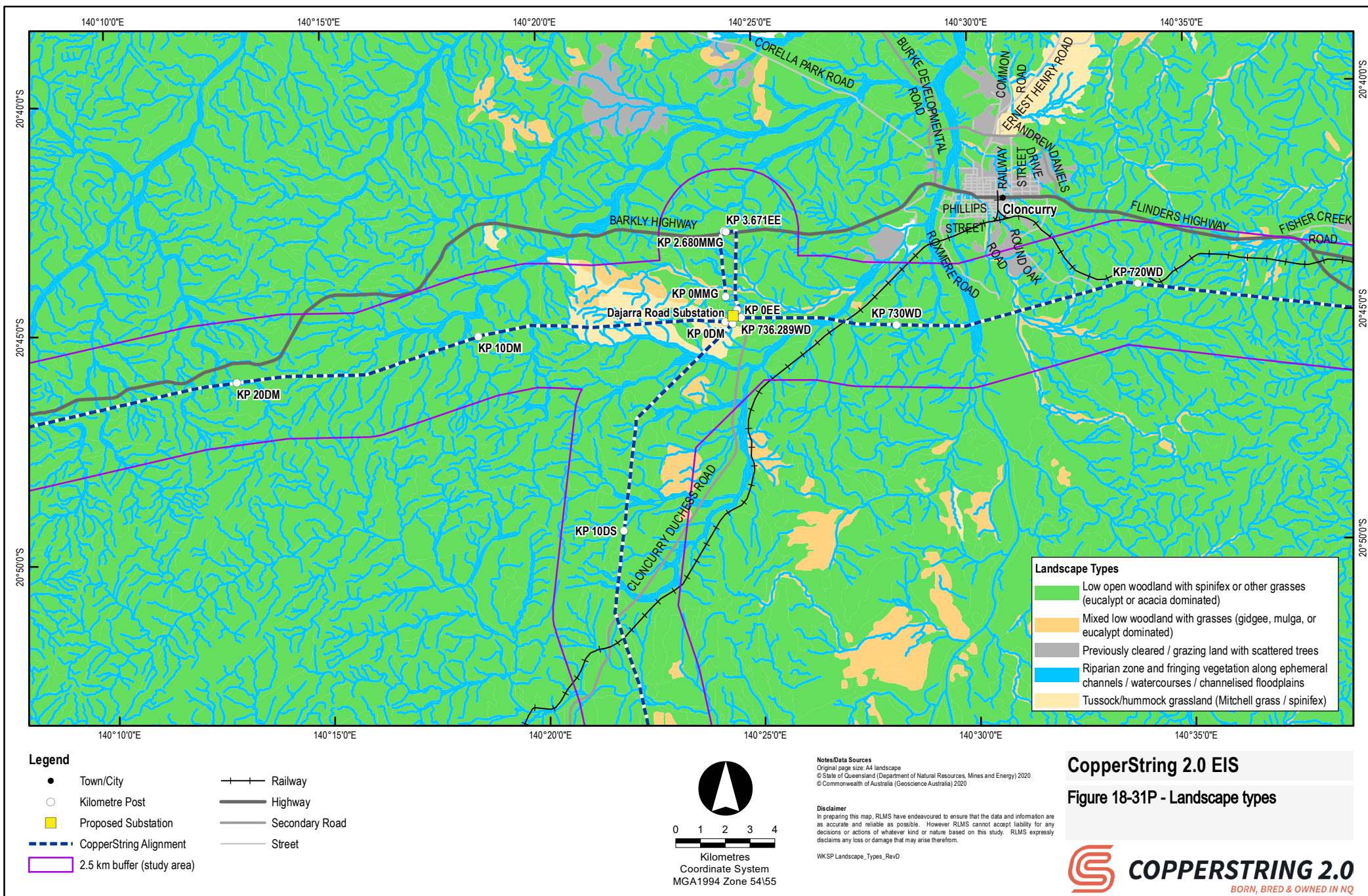


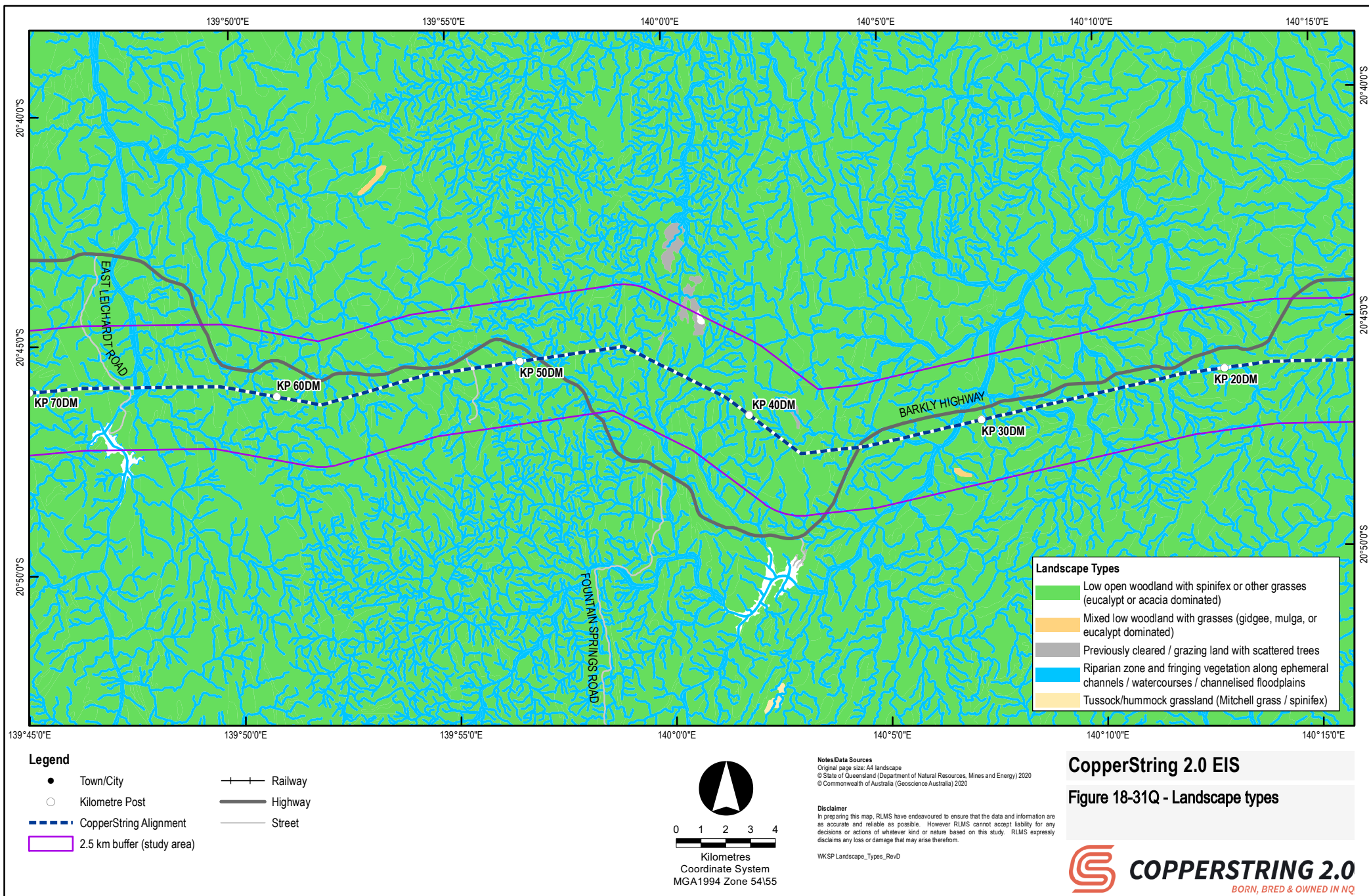


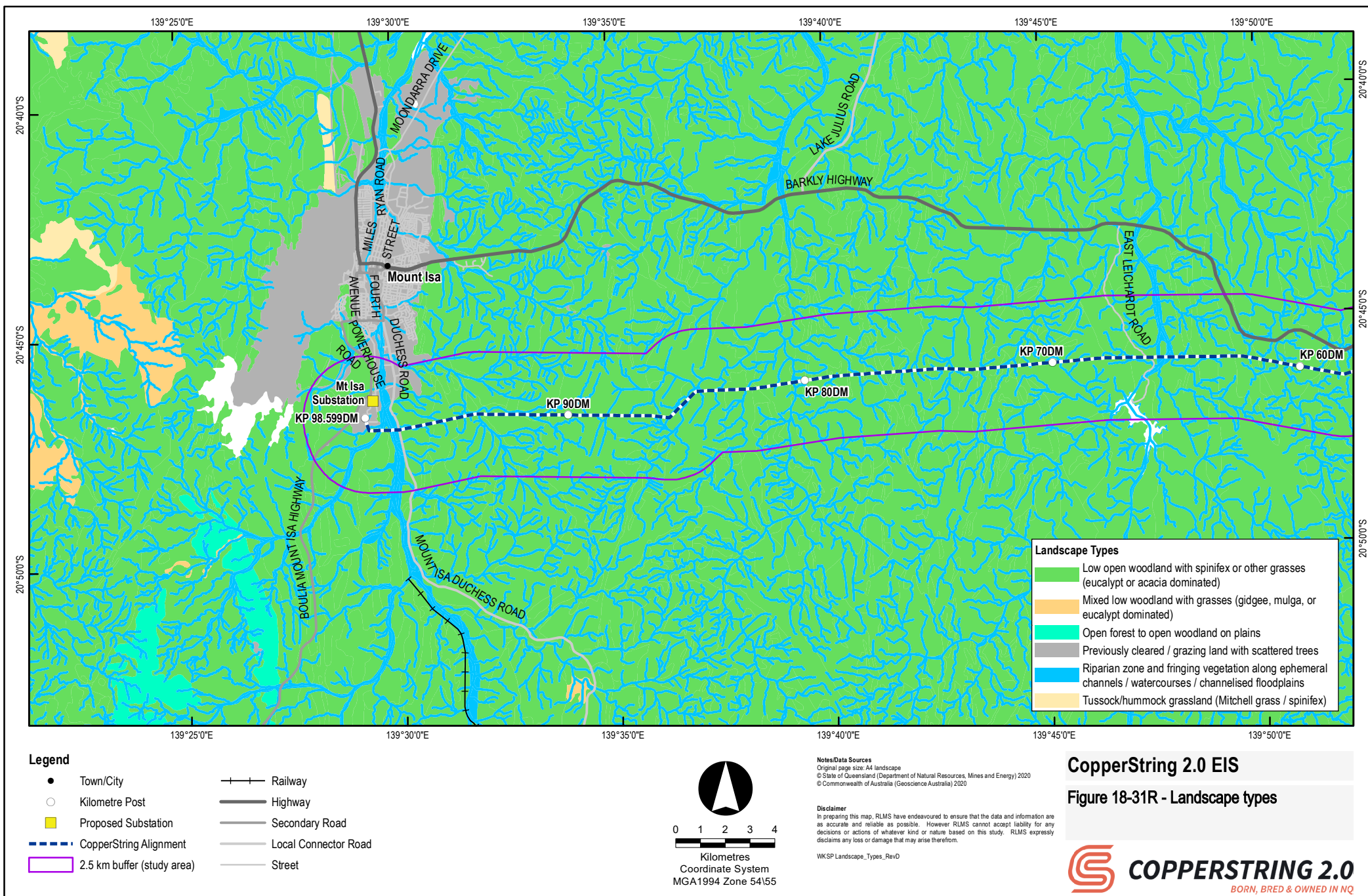


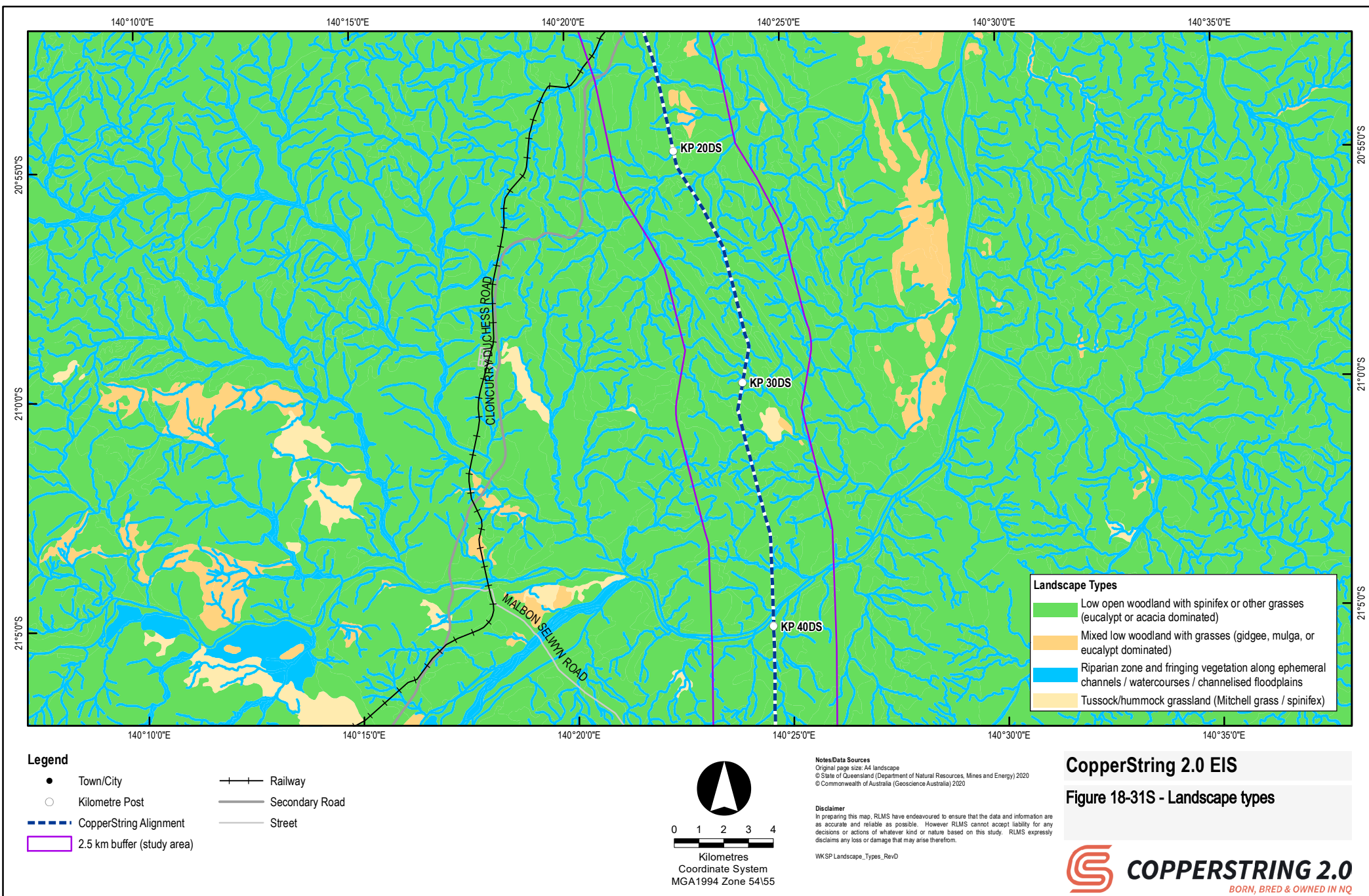


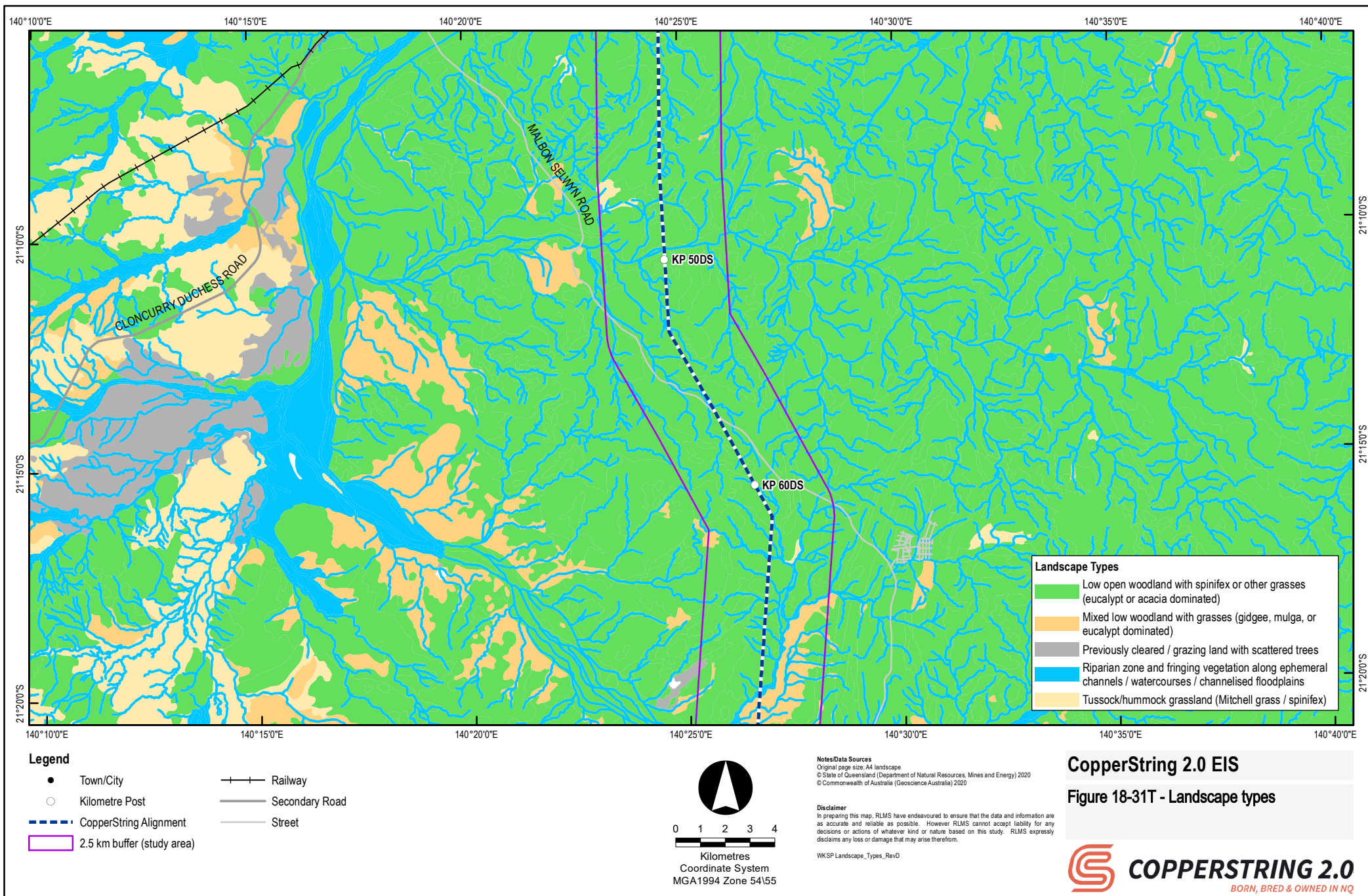


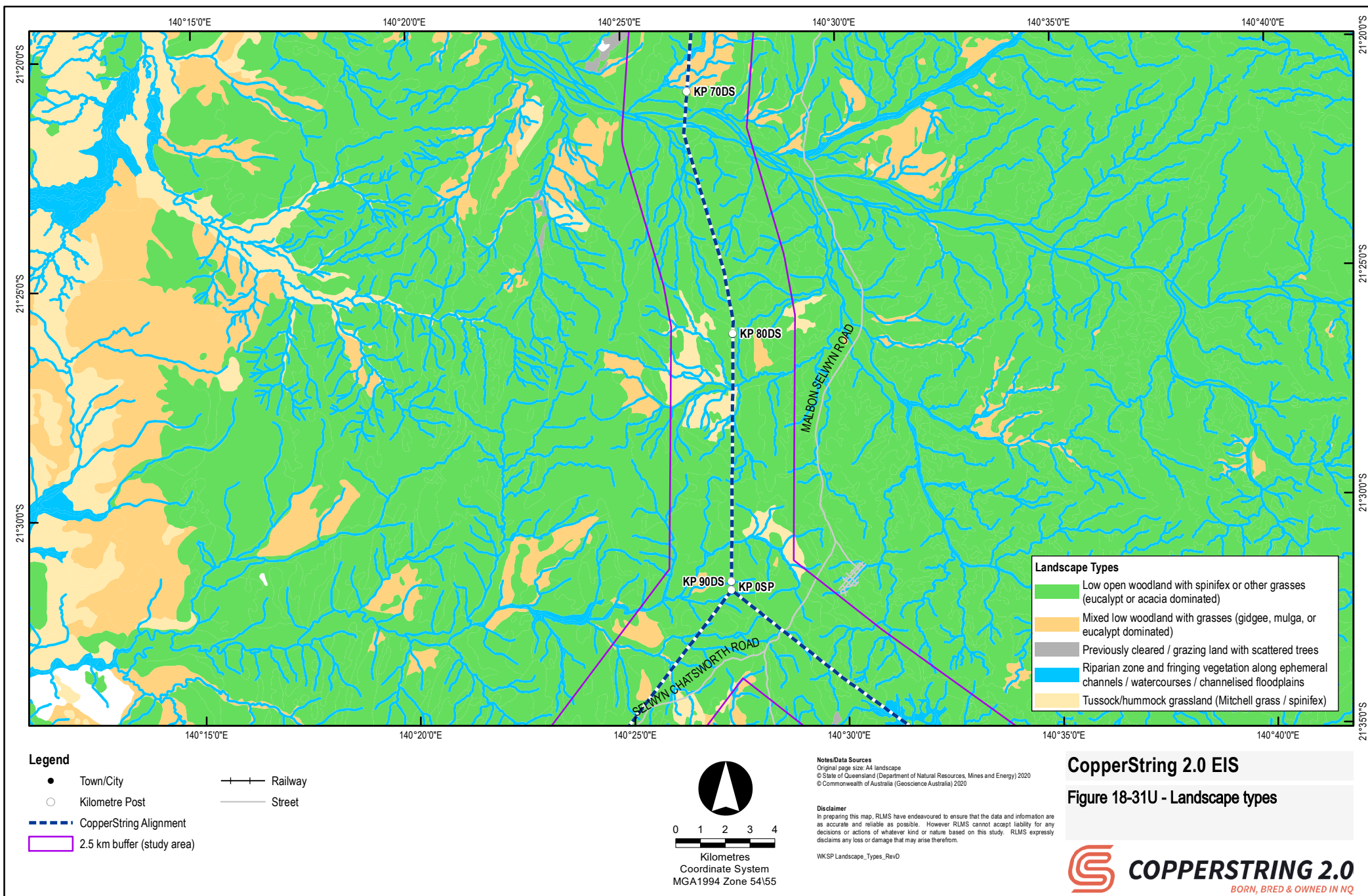


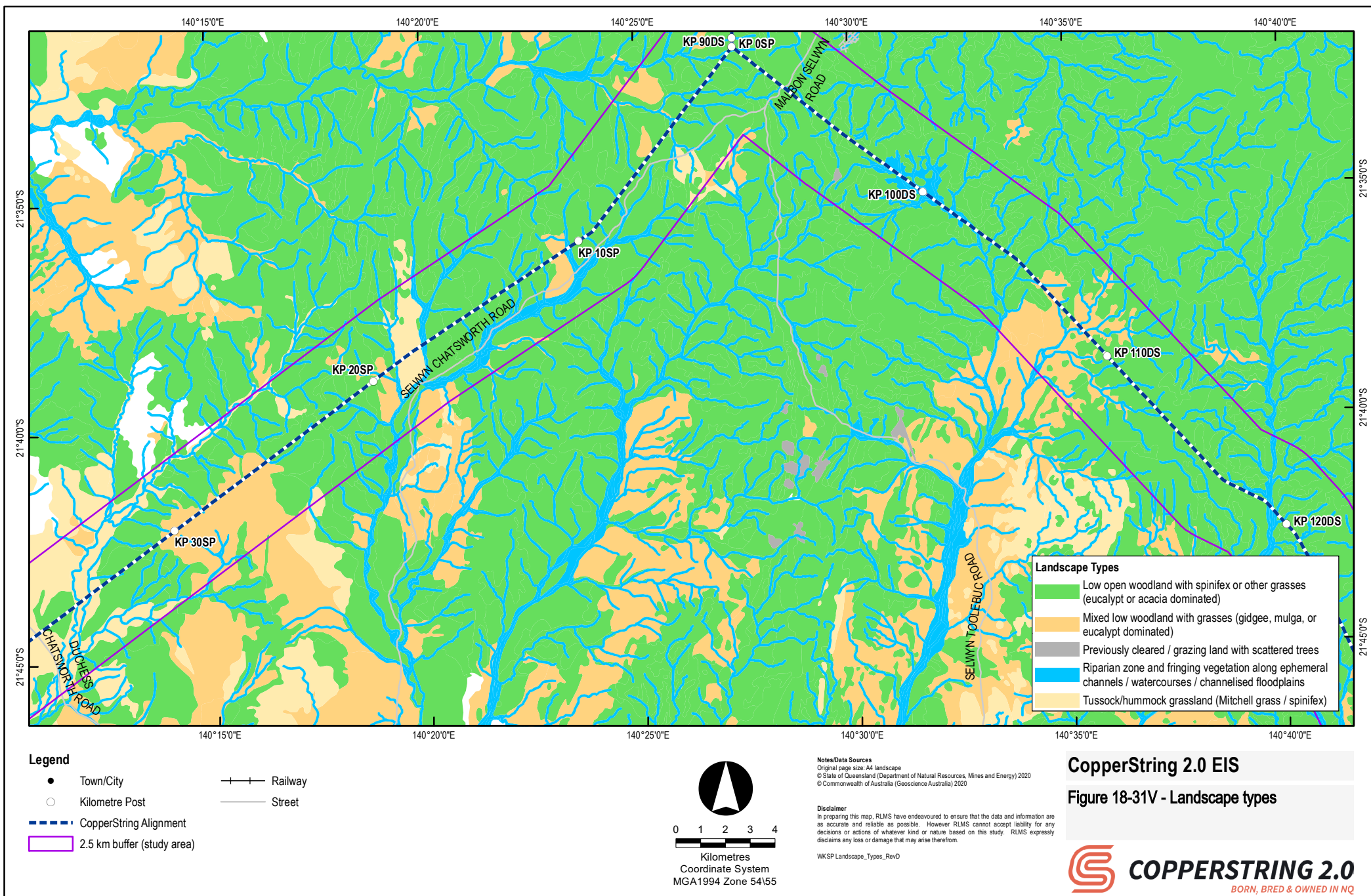


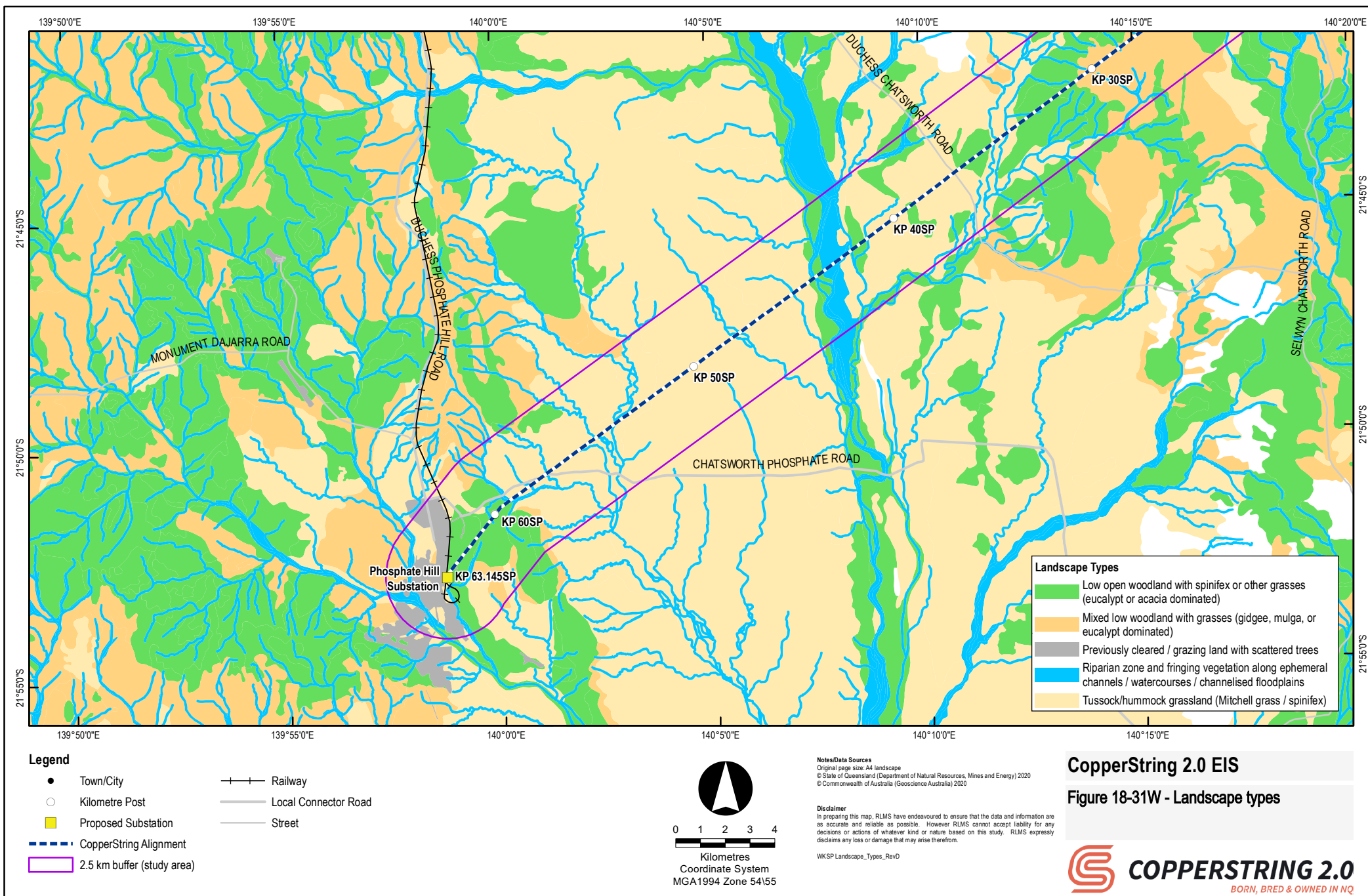


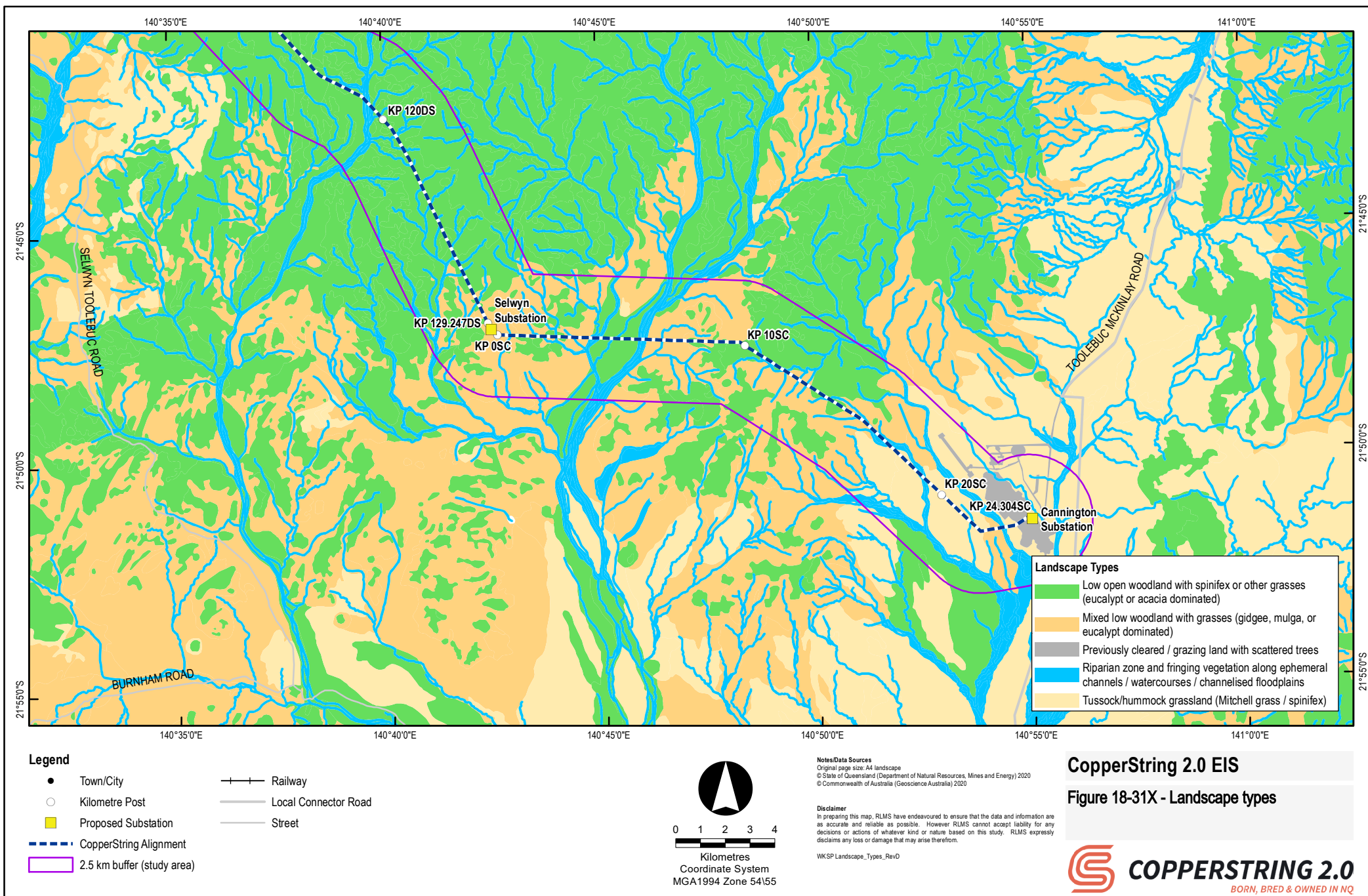












Disturbance within the easement includes temporary and permanent disturbance footprints. Temporary disturbance activities include the Brake and winch sites and the Tower construction footprints. Permanent disturbance includes clearing loss for the transmission line clearance to canopy, access tracks and towers. As described in Table 18-32, the permanent loss of vegetation across the corridor will vary depending on the corridor section. However the permanent loss in any section is not expected to exceed 15% of the total corridor.

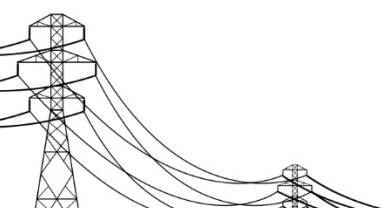
Table 18-35 Estimated clearing loss

Section	Length (km)	Width (km)	Area (ha)	Total Disturbance in easement (ha)	Temporary disturbance in easement (ha)	Permanent loss (% of easement)
Renewable Energy Hub	342	0.06	2052	426.53	144.89	13.73
CopperString Core	395	0.06	2370	430.87	162.85	11.31
Chumvale connections	7	0.06	42	14.76	9.61	12.27
Mount Isa Augmentation	99	0.06	594	68.30	45.83	3.78
Southern Connection	129	0.06	774	125.04	62.46	8.08
Cannington Connection	23	0.06	144	18.64	13.01	3.91
Phosphate Hill Connection	63	0.06	378	41.57	29.21	3.27

Tower siting plans have been produced for the Project area, in order to place towers, model tower heights and consider span lengths with regard to the canopy heights and ground elevations, as well as avoid ecological constraints, such as riparian corridors, significant wetland habitats, and known locations of conservation significant flora species. An example of the tower siting plans that have been produced across the whole Project area is provided in Plate 18-18.

Transmission towers will be designed to maintain a clearance of the transmission line above local terrain in compliance with Queensland legislation. Transmission tower heights will vary from location to location depending on the topography of each specific location, however will range from a minimum of 49-60 m to a maximum of 70-81 m depending on the corridor section. The distance between transmission towers will typically be in the range of 400–500 m. This may vary (and in special circumstances exceed 500 m) depending on the topography and conductor clearance required areas of the easement.

The concept transmission tower sites have been selected after careful consideration of all physical constraints such as sensitive environmental areas, rock/soil types, significant waterways / watercourse infrastructure crossings, existing land use and amenity. The transmission towers will be sited to make the best use of available terrain providing both sound foundations whilst minimising impacts to the environment and adjacent land uses. Transmission towers and associated construction materials will be located outside of active watercourses and wetlands. Where the corridor selection crosses large braided ephemeral systems, some of which are more than 1 km wide, tower sites have been individually selected to avoid existing channels and the tower design will be sufficient to withstand seasonal flows or larger flooding events.



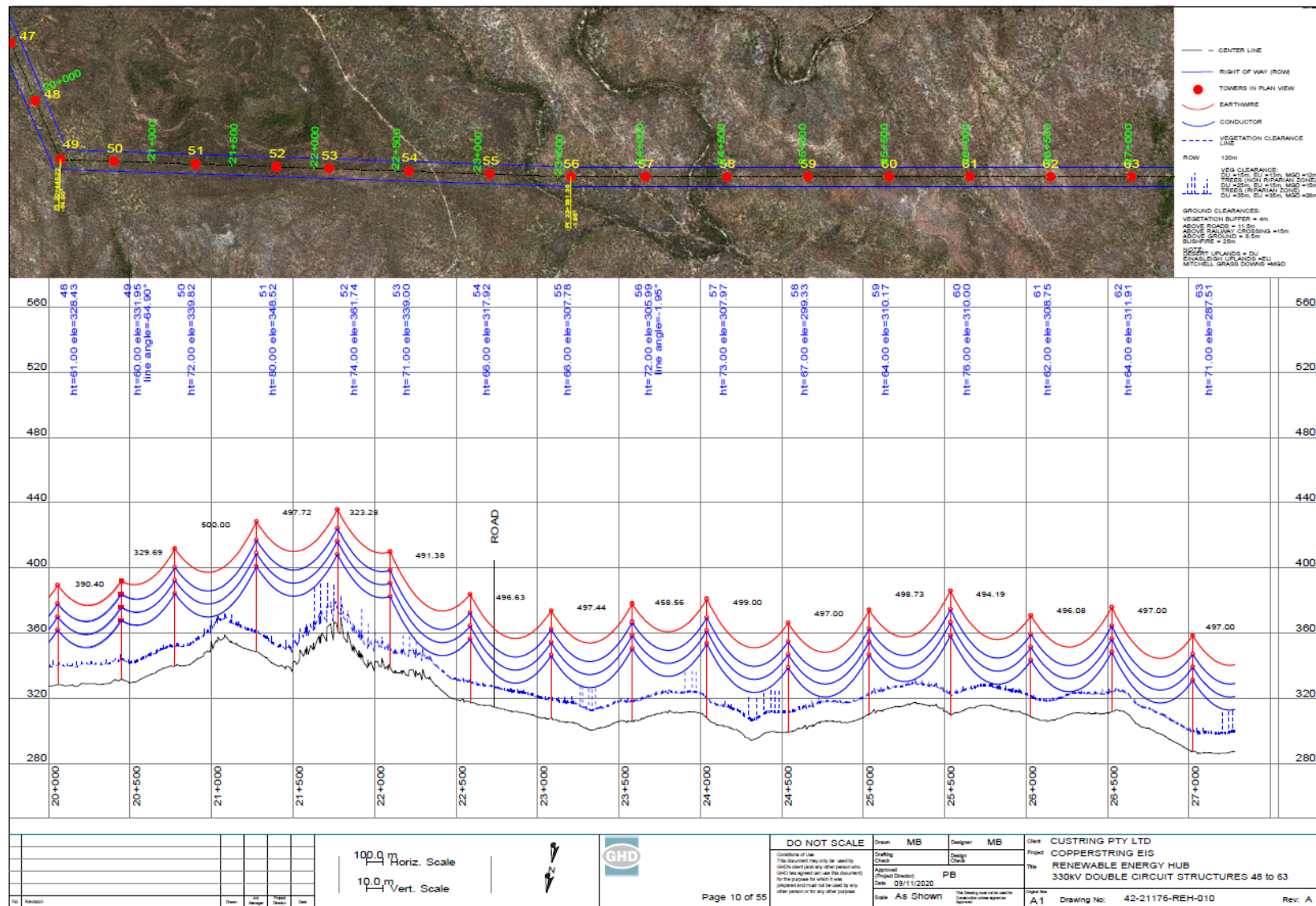


Plate 18-18 Example of tower siting plan

The access tracks will generally be contained within the transmission line easement however where terrain, environmentally or culturally sensitive areas and water crossings do not permit this, the access track may be located outside of the easement, with spur tracks linking the main access track to each transmission tower site. In vegetated areas, existing cleared paths will be utilised where possible so that clearing by the Project is kept to a minimum. It is intended to utilise the existing road network and private access tracks, though some new tracks will be required to provide access for construction and maintenance teams. The access tracks for the Project will be constructed to a standard suitable for dry weather use for 4WDs at low speed. Where tracks are to be constructed as part of the Project, they will generally be unsealed tracks that follow the natural ground contours. Access constraints may require some landform re-shaping to construct a safe access track.

Impacts to habitat for terrestrial conservation significant species and communities

The EPBC Act listed TEC *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* is present within the study area, however this community is avoided by the corridor selection. A significance of impact assessment has been undertaken and considered that impacts are unlikely to occur to this TEC. No other TECs have been identified or are mapped within the corridor selection, therefore impacts to TECs are unlikely to occur as a result of the Project.

Approximately 126.32 ha of mapped essential habitat (mapped only for species that are also NC Act listed conservation significant species) is intersected by the Project area. Some of these areas contain value for the species they are mapped for; however, as they are a buffer of a previous record, some mapped areas will not contain values for the species they are mapped for. The permanent loss in any corridor section is not expected to exceed 15% of the total corridor (refer to estimated clearing losses in Table 18-32), The relevant corridor sections, areas and species are provided in Table 18-33.

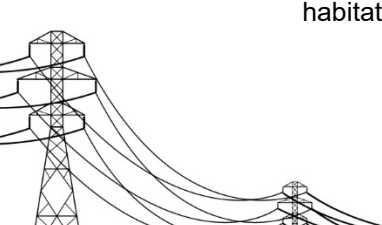
Table 18-36 Mapped essential habitat within the Project area

Corridor Section	Area intersected (ha)	Species mapped
Renewable Energy Hub	109.9	Ornamental snake, squatter pigeon, waxy cabbage palm
CopperString Core	16.42	Julia Creek dunnart
Total mapped	126.32	
Area within Project activities	18.95	

Approximately 12.1 ha of protected plant high risk trigger area is intersected by the Project area, for *Livistona lanuginosa* (waxy cabbage palm) between KP 128 and 132WD in the Renewable Energy Hub corridor section, which is trigger mapping that determines the requirement for a targeted flora survey in accordance with the Queensland Flora Survey Guidelines (DES, 2019).

Potential habitat for three conservation significant flora species and 11 conservation significant fauna species listed under the EPBC Act (that are confirmed present or considered likely to occur) is intersected by the Project area. The areas of suitable habitat impacted for these species has been calculated based on predictive habitat mapped within the study area. There is also habitat for the seven listed migratory bird species mapped as non-breeding, breeding or foraging habitat. A breakdown of these potentially impacted areas is provided in Table 18-34.

Table 18-35 provides the estimated areas of habitat disturbance for each conservation significant species and the proportions of that habitat loss when compared to the mapped habitat available at a local (2.5 km radius) and regional (10 km radius) scale.



Proposed impacts and mitigation measures for the TEC and conservation significant species is provided in Section 18.5.4.

The potential for significant impacts to these species as a result of the Project has been assessed in Section 18.5.5.

Table 18-37 Estimated habitat within Project activity areas for conservation significant species

Species	Mapped habitat intersected (ha)	Corridor Section/Infrastructure	Infrastructure area (ha)	Habitat within Project activities (ha)	
				Area (subset)	Total
Flora					
<i>Eucalyptus raveretiana</i>	7.23	Renewable Energy Hub (13.73%) (Riparian zone 0%)	0.012	0.002	0.002
<i>Livistona lanuginosa</i>	57.80	Renewable Energy Hub (13.73%) (Riparian zone 0%)	57.75	2.14	
		Pentland CEV	0.05	NA	2.18
<i>Acacia crombiei</i>	660.08	Renewable Energy Hub (13.73%)	84.57	11.61	
		CopperString Core (11.31%)	543.08	61.42	
		Barabon CEV	0.43	NA	
		Flinders Substation	32	NA	105.46
Fauna					
Squatter pigeon (southern)	186.42	Renewable Energy Hub (13.73%)	Breeding: 28.23 Foraging: 134.05	Breeding: 5.25 Foraging: 18.40	37.8
Koala	700.39	Renewable Energy Hub (13.73%)	699.36	96.02	97.04
		Charters Towers CEV	0.4	NA	
		Pentland South CEV	0.62	NA	
Black-throated finch	1711.48	Renewable Energy Hub (13.73%)	1711.48	234.99	290.99
		Charters Towers CEV	0.40	NA	
		Pentland South CEV	0.62	NA	
		Warreah South CEV	15.88	NA	
		Woodstock Substation	39.11	NA	

Species	Mapped habitat intersected (ha)	Corridor Section/Infrastructure	Infrastructure area (ha)	Habitat within Project activities (ha)	
				Area (subset)	Total
Julia Creek dunnart	867.36	Renewable Energy Hub (13.73%)	2.85	0.39	107.22
		CopperString Core (11.31%)	854.31	96.62	
		Flinders Substation	9.7	NA	
		Nonda CEV	0.5	NA	
Red goshawk	398.99	Renewable Energy Hub (13.73%)	359.48	49.36	88.87
		Woodstock Substation	39.11	NA	
		Charters Towers CEV	0.40	NA	
Night parrot (nesting and feeding habitat)	627.74	CopperString Core (11.31%)	70.05	7.92	62.57
		Mount Isa Augmentation (3.78%)	31.94	1.21	
		Southern Connection (8.08%)	104.43	8.44	
		Cannington Connection (3.91%)	86.02	3.36	
		Phosphate Hill Connection (3.27%)	303.58	9.93	
		Dajarra Substation	0.14	NA	
		Selwyn CEV	5.74	NA	
		Selwyn Substation	25	NA	
		Phosphate Hill Substation	0.82	NA	
Painted honeyeater	5646.19	Renewable Energy Hub (13.73%)	1240.77	170.36	661.09
		CopperString Core (11.31%)	2340.25	264.68	
		Mount Isa Augmentation (3.78%)	598.12	22.61	
		Southern Connection (8.08%)	784.29	63.37	
		Cannington Connection (3.91%)	144.29	5.64	
		Phosphate Hill Connection (3.27%)	382.74	12.52	

Species	Mapped habitat intersected (ha)	Corridor Section/Infrastructure	Infrastructure area (ha)	Habitat within Project activities (ha)	
				Area (subset)	Total
Australian painted-snipe	884.26	Chumvale Connections (12.27)	38.55	4.73	138.63
		8 CEV, 4 Substations	117.18	NA	
		Renewable Energy Hub (13.73%)	142.78	19.6	
		CopperString Core (11.31%)	518.22	58.61	
		Mount Isa Augmentation (3.78%)	41.93	1.58	
		Southern Connection (8.08%)	104.61	8.45	
		Cannington Connection (3.91%)	9.45	0.37	
		Phosphate Hill Connection (3.27%)	15.91	0.52	
		Chumvale Connections (12.27)	2.14	0.26	
		Flinders Substation	9.7	NA	
		Selwyn CEV	0.31	NA	
		Woodstock Substation	39.21	NA	
Ornamental snake	248.58	Renewable Energy Hub (13.73%)	247.96	34.04	34.66
		Pentland CEV	0.62	NA	
Grey falcon	1215.18	Renewable Energy Hub (13.73%)	905.33	124.30	216.20
		CopperString Core (11.31%)	210.61	23.82	
		Southern Connection (8.08%)	14.97	1.21	
		Cannington Connection (3.91%)	3.30	0.13	
		Phosphate Hill Connection (3.27%)	14.71	0.48	
		Flinders Substation	9.7	NA	
		Pentland CEV	0.62	NA	
		Phosphate Hill Substation	0.51	NA	

Species	Mapped habitat intersected (ha)	Corridor Section/Infrastructure	Infrastructure area (ha)	Habitat within Project activities (ha)	
				Area (subset)	Total
		Selwyn CEV	0.31	NA	
		Warreah CEV	16	NA	
		Woodstock Substation	39.11	NA	
Plains death adder	2069.2	Renewable Energy Hub (13.73%)	84.70	11.63	261.47
		CopperString Core (11.31%)	1885.63	213.27	
		Cannington Connection (3.91%)	43.36	1.70	
		Phosphate Hill Connection (3.27%)	21.32	0.70	
		Barabon CEV	0.43		
		Flinders Substation	32		
		Nonda CEV	0.5		
		Phosphate Hill Substation	0.83		
		Yorkshire CEV	0.42		
Migratory bird - non-breeding / breeding habitat	244.54	Renewable Energy Hub (13.73%)	141.73	19.46	65.15
		CopperString Core (11.31%)	14.90	1.69	
		Mount Isa Augmentation (3.78%)	15.09	0.57	
		Southern Connection (8.08%)	8.82	0.71	
		Cannington Connection (3.91%)	13.16	0.51	
		Phosphate Hill Connection (3.27%)	8.92	0.29	
		Mount Isa Substation	2.10	NA	
		Phosphate Hill Substation	0.51	NA	
		Warreah CEV	0.20	NA	
		Woodstock Substation	39.11	NA	

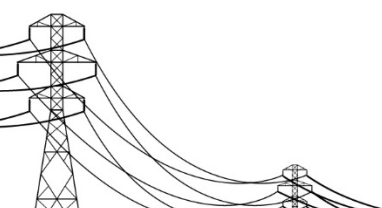
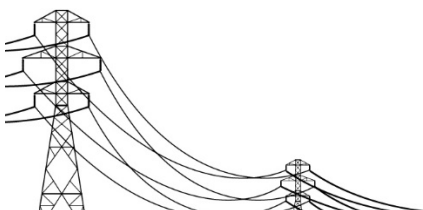


Table 18-38 Proportions of habitat within Project activities and the region for conservation significant species

Species	Total mapped habitat intersected by Project area (ha)	Total habitat within Project activities (ha)	Habitat within Project activities as a proportion of remaining local habitat (within a 2.5 km radius of Project centreline) (%)	Habitat within Project activities as a proportion of remaining regional habitat (within a 10 km radius of Project centreline) (%)
FLORA				
<i>Eucalyptus raveretiana</i>	7.23	0.002	<0.001	<0.001
<i>Livistona lanuginosa</i>	57.80	2.18	0.029	0.007
<i>Acacia crombiei</i>	660.08	105.46	0.19	0.05
FAUNA				
Squatter pigeon (southern)	38.23 (breeding)	5.25	0.14	0.05
	148.19 (foraging)	32.54	0.3	0.07
Koala	700.39	97.04	0.11	0.02
Black-throated finch	1711.48	290.99	0.2	0.05
Julia Creek dunnart	867.36	107.22	0.16	0.04
Red goshawk	398.99	88.87	0.23	0.05
Night parrot	627.74	62.57	0.14	0.03
Painted honeyeater	5646.19	661.09	0.14	0.04
Australia painted-snipe	884.26	138.63	0.4	0.19
Ornamental snake	248.58	34.66	0.14	0.04
Grey falcon	1215.18	216.2	0.5	0.22
Plains death adder	2069.2	261.47	0.15	0.04
Migratory birds	244.54	65.15	0.36	0.07



Planning phase measures to reduce loss of vegetation and habitat

During the planning phase of the Project, a number of measures have been employed to avoid and reduce the direct loss of vegetation/habitat in general as well as for listed threatened species. A preliminary ecological constraints assessment was undertaken at the commencement of the Project based on previous surveys and desktop information to identify and avoid areas of high ecological value wherever possible. Key outcomes included:

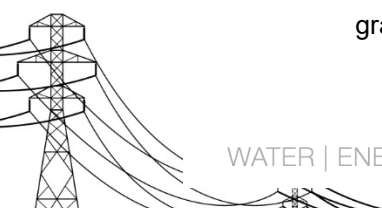
- Avoiding areas of known TECs, natural heritage areas, Of Concern REs, mapped essential habitat, known occurrences of conservation significant species, where possible
- Avoiding adjacent protected areas
- Minimising impact to watercourses by positioning the corridor selection for shorter traverses
- Using existing tracks and locating proposed tracks within previously disturbed areas wherever possible
- Clearing of vegetation to establish vehicle access across a watercourse shall not occur within 10 m of the defining high bank of a watercourse, other than where it cannot be avoided.
- Locating laydown, camps and other associated infrastructure areas in previously disturbed areas wherever possible

The Volume 3 Appendix R Field development plan has been prepared for use in the detailed design and construction phases by the relevant contractor/s with the aim of detailing avoidance and mitigation measures to minimise impacts to sensitive receiving environments.

Construction phase measures to reduce loss of vegetation and habitat

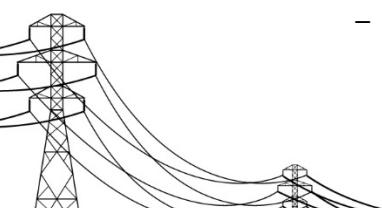
The following measures will be implemented during construction of the Project to substantially reduce the loss of vegetation and habitats:

- Vegetation clearing will be restricted to the minimal amount necessary for the construction of the Project footprint. Micro-siting of infrastructure, such as tower footprints, brake and winch sites, and assembly areas, will be undertaken during the detailed design phase to further reduce impacts and to ensure areas of high ecological significance are avoided as a priority.
- Vegetation will only be cleared or trimmed where it is within five metres of the transmission line at maximum sag. Clearing of all vegetation to ground level will be required to accommodate transmission line infrastructure including tower foundations, substations, laydown areas, etc, where it cannot be placed in cleared areas. Clearing may also be required for trees taller than five metres if they fall within the five metre safety buffer. Where possible, any trees taller than five metres within the easement or with overhanging branches that spread into the easement will be trimmed to a reduced height so as not to be within the five metre safety buffer
- Areas of high terrain will allow spanning of the majority of vegetated areas, particularly in habitats of low open woodlands that feature very sparse canopy trees of very low height. In such areas, clearing is likely to be limited to that required for tower footprints and access tracks. These tower and access locations will be determined during the detailed design phase.
- Areas of grassland habitats feature very few and low trees or shrubs (frequently confined to drainage line corridors), therefore clearing of vegetation will be minimal in these areas and will span riparian corridors wherever possible. Ground disturbance will occur in these grassland habitats, which have value for ground-dwelling mammals and reptiles, however



disturbance will be restricted to pre-determined areas and will be temporary apart from permanent infrastructure locations.

- Pre-clearance surveys will be undertaken during the detailed design phase within known and potential habitat areas of listed threatened species in order to plan infrastructure placement, tower heights, spans and resulting clearing to avoid known occurrences and habitat for listed threatened species.
- Areas assessed as being of high ecological value will aim to be spanned across wherever possible using higher towers (i.e. up to 75 m height) and shorter or longer spans, as appropriate to the ecological values and depending on the terrain. This will enable vegetation below 20 m to be retained and mature trees over 20 m may be trimmed if necessary for safety and maintenance requirements.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors.
- Waterway crossings containing riparian vegetation corridors will be spanned in most instances, and particularly where values for and occurrences of listed threatened flora and fauna species have been identified by desktop mapping or surveys. Larger waterways will have higher towers and longer spans in order to avoid the bed and banks of waterways and place towers as far back from fringing vegetation. For access tracks across ephemeral waterways, existing crossings or clearings will be used. Any clearing required within a riparian corridor will be minimised with larger habitat trees retained.
- Pre-clearance surveys will be undertaken prior to final locating of towers and other infrastructure, to avoid individual occurrences of *Livistona lanuginosa* and *Eucalyptus raveretiana*, span across lower-height trees or avoid removal of trees at the margins of the corridor selection. *Livistona lanuginosa* are typically less than 20 m tall, therefore higher towers should be able to span across occurrences of this species, with no trimming or maintenance required. Trimming of the mature trees of *Eucalyptus raveretiana* that are greater than 20 m tall may be required, depending on the final placement of towers, with periodical maintenance required during the operation of the Project.
- Approximately 12.1 ha of protected plant high risk trigger area is intersected by the Project area mapped for *Livistona lanuginosa* in the Renewable Energy Hub corridor section. Clearing within 100 m of a protected plant within this area will require a compliant flora survey and clearing permit (under the Qld NC Act) within this high risk trigger area. Removing a protected plant outside of a high risk trigger area will also require a clearing permit. This may apply to occurrences of *Livistona lanuginosa* that are confirmed during pre-clearance surveys. A Protected Plant Impact Management Plan is required as part of the clearing permit application. Mature individuals of this species are visible on high resolution imagery, and the placement of tower footprints has avoided such visible locations. If pre-clearance flora surveys locate juvenile individuals at these locations, minor alterations of tower locations can be made. Individuals to be retained will be included in a clearing permit where they occur within a high risk trigger area if clearing is required within 100 m of a protected plant location.
- Areas of high ecological sensitivity will require targeted management measures to mitigate construction impact. Local ecological management plans will be developed as part of the Field Development Plan for the Project during the design phase to manage construction risks to the following key areas:
 - Ballara Nature Refuge



- Areas of potential habitat for the night parrot
- Areas of potential breeding habitat for the ornamental snake
- Areas of potential nesting habitat for the black-throated finch (southern)
- Areas of koala habitat particularly koala movement corridors
- Areas of potential denning habitat for the greater glider
- Known populations of conservation significant plants
- All site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas as a priority.
- Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken after these facilities are no longer required. Rehabilitation works will include planting of native species and ongoing weed management.
- A Construction Environmental Management Plan (CEMP) will be prepared and implemented for standards such as weed hygiene, erosion, fuels and hazardous substances, fire, etc.
- All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance will be clearly defined and detailed in site inductions.
- Clearing native vegetation is regulated under the VM Act and made assessable through the Planning Act. Schedule 10 Part 3 of the Planning Regulation states that operational work that is clearing native vegetation is prohibited development, unless it is for a relevant purpose (under the VM Act section 22A), exempt clearing work (under the Planning Regulation Schedule 21) or accepted development (under the VM Act Schedule 7). Where it can be demonstrated that the proposed activities are undertaken by an electricity entity or transmission entity or undertaken on a designated premises under the Planning Act, then the clearing works would be exempt and a development approval for clearing native vegetation under the Planning Act would not be required. CuString have commenced the regulatory process with the Queensland state government to be endorsed as an electricity entity under the Electricity Act and therefore clearing of native vegetation for the project may occur as exempt clearing work.
- Additional clearing activities (e.g. accommodation camps) that are not included in the transmission line corridor (assessed as part of the EIS process and infrastructure designation, which will be exempt or accepted development) may require Operational Works application for clearing of native vegetation or as included as part of an MCU application. It is likely that any accommodation camps or construction laydown areas requiring an MCU development permit assessable under the local government planning scheme could be situated in areas that are not identified as MNES or MSES, however this is proposed to be the responsibility of the construction contractor.
- The DES have advised that there is no specific approval mechanism or authority for transmission line infrastructure traversing through a nature refuge. The Ballara Nature Refuge is structured as a conservation agreement between the landholder and the State, therefore the proponent is required to engage with the landholder and potentially apply for an amendment to the agreement.

18.5.2.2 Injury and mortality to wildlife

Summary of impact

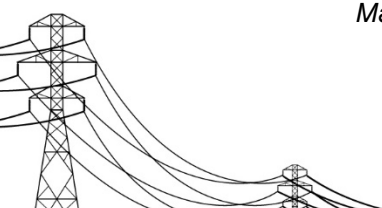
Vegetation clearance during construction of the transmission line will inevitably cause injury and mortality to local fauna sheltering in hollows, nests, ground habitat (logs, burrows, soil, leaf litter, beneath rocks). Increased traffic during the construction phase may also increase local incidence of fauna injury and mortality. Species most at risk include nocturnal species that are likely to be sheltering during clearing activities and slow moving species or sedentary species that are unlikely to be able to flee the clearing zone (e.g. koalas, small ground-dwelling mammals, reptiles and frogs). Entrapment of wildlife within excavations poses an additional threat to wildlife. Most at risk wildlife includes wide-roaming fauna like macropods, snakes and echidnas.

Breeding places for conservation significant species including the Julia Creek dunnart, southern black-throated finch, squatter pigeon (southern) and possibly the night parrot have the potential to be directly impacted during clearing of the Project footprint, causing a loss of critical ecological resources and the potential for injury and mortality of individual animals. Other conservation significant species with heightened risk of injury or mortality during construction include the koala (due to its local abundance and relatively slow movement), and squatter pigeon (due to its sedentary nature and habitat of foraging on access tracks). Although turtles and platypus have the potential to burrow and nest along the banks of watercourses within the study area, these habitats will have minimal impact during construction of the Project. Access tracks may traverse smaller, ephemeral watercourses, however pre-clearance surveys for breeding places will identify any such burrows and nests and guide avoidance of such habitats during construction.

Measures to reduce injury and mortality of wildlife

The following measures will be implemented to minimise wildlife injury and mortality during construction of the transmission line:

- Pre-clearance surveys will be undertaken to mark and where possible avoid the locations of all potential breeding places for wildlife and the locations of any breeding places for conservation significant species. These will target areas with potential to support breeding habitat for the following species:
 - Julia Creek dunnart - all areas of predicted habitat will need to be scouted prior to locating towers to micro-site and avoid areas with high densities of cracking-clay soil wherever possible. As microhabitat values for the species are highly localised, small-scale adjustments are likely to be effective in minimising impact on breeding places.
 - Southern black-throated finch – areas of predicted habitat within 600 m of permanent waterbodies, particularly at three locations of high value habitat near KP138-141WD and KP255 -260WD.
 - Squatter pigeon (southern) – areas of predicted breeding habitat located in suitable REs on land zone 5 and 7 as mapped in Figure 18-19.
 - Night parrot – areas of predicted habitat subjected to direct clearance will be subject to targeted survey prior to clearing. Habitat will be ground-truthed and songmeters deployed to detect any night parrot individuals within proximity to proposed disturbances. Consultation with members of the Night Parrot Recovery Team are ongoing.
- Preparation of a high risk Species Management Program (SMP) will be undertaken in accordance with the requirements of Section 332 of the *Nature Conservation (Wildlife Management) Regulation 2006*. Key species likely to be targeted in the high risk SMP



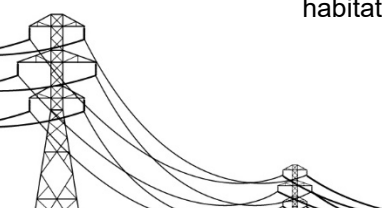
include the squatter pigeon (southern), black-throated finch, Julia Creek dunnart (and NC Act listed species: purple-necked rock wallaby and short-beaked echidna).

- Pre-clearance surveys will specifically target areas of potential habitat for listed threatened species that have the potential to occur within the clearing footprint. Pre-clearance surveys will be required as part of the standard requirements of the high risk SMP.
- All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. In suitable habitat that has been identified as containing breeding places for fauna, searching and, if necessary, relocating breeding places and/or resident fauna will be undertaken. Significant habitat features will be left in-situ during construction if possible, or placed into adjacent habitat areas. Fauna would be relocated to the nearest suitable, safe habitat outside the clearing disturbance area.
- Temporary exclusion fencing will be established around cleared areas in locations of high ecological sensitivity to prevent wildlife from returning to works areas where deemed appropriate.
- Employment of sequential clearing practices and use of suitably qualified koala spotters in accordance with guidelines for reducing impact on koalas.
- Areas of potential habitat for the squatter pigeon (southern) are to be flushed immediately prior to clearing (i.e. spotter-catcher to walk in front of clearing machinery).
- Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing.
- A Traffic Management Plan will be developed for the construction site with designated access routes, speed limits and sensitive ecological areas (i.e. particularly areas where squatter pigeons (southern) have the potential to occur on access roads).
- Given the specific susceptibility of the squatter pigeon (southern) to vehicle collision - warning signs will be erected on all tracks that intersect locations in which the squatter pigeon has been confirmed present. Squatter pigeon awareness will be included in all worker inductions and in the Traffic Management Plan. A register of squatter pigeon sightings will be maintained to identify areas that have a high risk of collision.
- The CEMP will include protocols to limit injury and mortality to fauna including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols.
- Establish 'go slow zones' (40 km/hr) for vehicles and machinery where non-gazetted roads or tracks are located adjacent to areas of woodland, wetlands, and rock outcrop/jump-up areas.

18.5.2.3 Habitat fragmentation and reduced connectivity

Summary of impacts

Habitat fragmentation is the process in which large, continuous habitats are converted into smaller, more isolated patches, often separated by a matrix of human-induced land cover (Haddad *et al* 2015). Habitat fragmentation can isolate populations by causing barriers to local fauna movement and the dispersal of plant seeds and fruit. The quality of persisting habitats can be substantially degraded by edge effects associated with increased exposure to light, noise, run-off, sedimentation, erosion and weed and pest infestation. The transmission line intersects landscape that have already been extensively fragmented for agriculture. As much of the Project footprint has been located within areas already subject to clearing, the impacts of habitat fragmentation are expected to be relatively minor and localised. The transmission line will



result in some fragmentation where it intersects several large areas of intact remnant vegetation, particularly in the Renewable Energy Hub section. For most species, the extent of clearing is within the context of the existing landscape, is unlikely to create a substantial barrier effect. Clearance of vegetation for the Project easement intersects habitat remnants that are larger and more intact than those observed within the wind farm. However, the localised scale at which this occurs is unlikely to significantly restrict fauna movement. The movement of koalas and other listed threatened species that are known to occur within the study area is unlikely to be limited by the gaps created. Nevertheless, the fragmentation of habitat is expected to have localised impacts on the composition of forest bird assemblages, reptile and small ground mammal species, by reducing the area of available habitat for edge-sensitive forest species that only occur in protected intact woodland remnants.

Measures to mitigate loss of connectivity

The sensitivity of habitats and wildlife populations to fragmentation has been considered during the planning and design stage of the Project. A route-selection process was undertaken to limit and where possible, avoid intersecting areas important for maintaining habitat connectivity. Despite this, some localised habitat fragmentation will occur. The following mitigation measures will be implemented during construction to limit fragmentation and reduced connectivity:

- Access tracks will be restricted to areas that are already disturbed as a priority.
- Construction laydown areas and stockpiles will be limited to areas that have already been cleared to minimise unnecessary clearing.
- The footprint needed for ancillary activities and hardstand areas will be minimised where possible without compromising the safety and integrity of structures.
- Temporary construction areas will be rehabilitated after the completion of construction works to reconnect fragmented habitats.
- During the detailed design phase, areas of high habitat connectivity that are intersected by the Project will be identified and measures investigated that would improve or restore connectivity across the corridor selection (e.g. placement of key habitat features within the corridor such as shelter or forage resources, or retention of vegetation between large remnant patches that hold significant habitat value).

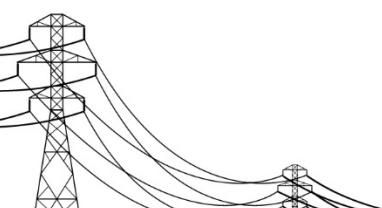
18.5.2.4 Disturbance to wildlife through increased, light, noise and vibration

Summary of impacts

Clearance of vegetation has the capacity to cause indirect degradation of adjacent habitats due to an increase in the exposure to light, noise and vibration. Consequentially, this has the potential to adversely impact native wildlife through the disruption of foraging, breeding and nesting behaviours (Longcore and Rich, 2004; Slabbekoorn *et al.* 2010; Popper and Hawkins, 2016). Construction will result in a substantial, localised increase in vehicle movements in the short-term. This will increase light, noise and vibration disturbance on local wildlife. Increased light, noise and vibration can alter individual species' behaviours, and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments.

Measures to mitigate light, noise and vibration disturbance

Routine mitigation measures shall be undertaken to minimise the impact that noise, light, vibration and disturbance have on local wildlife populations. This will be particularly important



within the vicinity of habitat for listed threatened fauna species. The following measures will be used to minimise the impacts of light, noise and vibration during construction:

- Site lighting will be kept to the minimum needed for safety
- Construction activities will be prioritised to be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat and to reduce noise and vibration impacts on nocturnal fauna species.
- A Traffic Management Plan will be developed for the construction site to control vehicle movements and reduced the unnecessary generation of vehicular noise.
- All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction.

18.5.2.5 Habitat degradation by increased dust, run-off and sedimentation

Summary of impact

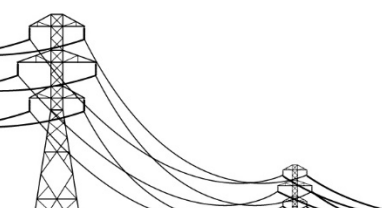
Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, decreasing water quality, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species. Some areas of the receiving environment has already been subject to high levels of erosion and sedimentation as a result of existing land-clearing and grazing activities. Nevertheless, sensitive ecological receptors (e.g. larger woodland remnants and aquatic habitats) are particularly susceptible to adverse impacts associated with dust, run-off, erosion and sedimentation. These areas require protection through the implementation of sediment and erosion control measures during construction.

Adverse weather conditions during construction can exacerbate the potential impact of erosion and sedimentation. High rainfall has the potential to remove exposed top soil, destabilise creek beds and distribute sediment through creek line. Strong winds have the potential to spread exposed top soil, decreasing the likelihood of recolonisation by vegetation and potentially distributing dust into nearby sensitive environments.

Measures to mitigate habitat degradation by dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the transmission line:

- An Erosion and Sediment Control Plan (ESCP) will be developed as part of the CEMP for the Project.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where disturbance must be undertaken within or adjacent to wetted waterways.
- Areas subject to clearing will be stabilised with priority given to areas of steeper gradient.
- All vehicle movement should stay on the designated tracks and not deviate from them unless necessary.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.



- Construction activities will cease during adverse weather conditions (e.g. high wind / high rainfall) that have the potential to distribute dust or increase run off and sedimentation.
- Duration of in-stream works will be minimised to reduce the potential for sedimentation.
- Rehabilitation of temporary construction areas will be undertaken after completion of construction.

18.5.2.6 Introduction and spread of invasive species

Summary of impacts

Construction activities typically have the potential to introduce invasive species through the increased movement of people and machinery. Additionally, established weed populations may be further distributed throughout the easement Project personnel and work vehicles during construction, operation and decommissioning stage of the Project. Notwithstanding extant infestations across the rangeland landscape, a number of these species remain as a risk to the Project and require special management consideration to mitigate environmental and adverse economic impacts to landholders.

Introduction and spread of pest fauna species

Construction activities have the potential to introduce and/or spread exotic pests throughout the construction area. This can result in substantial disruptions to natural ecosystem functioning by altering the balance of inter-species competition and predation. Inappropriate waste disposal and provision of water has the capacity to attract higher local concentrations of feral predators, increasing the predation pressures on local wildlife. Pest fauna species recorded within the study area included feral camels (*Camelus dromedarius*), feral pigs (*Sus scrofa*), dog (*Canis lupus*), cat (*Felis catus*) and fox (*Vulpes vulpes*). Access tracks created for the Project have the potential to facilitate movement of feral predators such as dogs and foxes, thereby increasing predation pressures on local wildlife. Although the study area is already exposed to relatively high levels of pest infestation, mitigation measures will be required to limit any spread of pest animals that could result from construction activities.

Measures to mitigate the introduction and spread of pest fauna species

The following mitigation measures will be used to minimise the introduction and spread of pest fauna species during construction for the Project:

- A Waste Management Plan will be prepared as part of the CEMP. This will detail the location and specifications for disposal and removal of waste from the construction site.
- Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
- Sightings or evidence of pest animals will be recorded during construction. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Construction staff will not bring domestic animals to the study area.
- All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of feral animals.

Introduction and spread of weed species

Construction activities have the potential to introduce and spread weeds throughout the study area. This occurs predominantly via the movement of contaminated vehicles, fill and vegetative material. Additionally, surface water flow has the potential to distribute weed species from construction areas to nearby watercourses, resulting in weeds being distributed further downstream during the wet season. This can cause significant damage to Queensland's primary industries and undermine the ecological integrity of bushland remnants by competitively excluding native plant species that provide food, shelter and nesting resources for native wildlife. Given the Project is located within a predominantly agricultural landscape, the risks of weed introductions carry heightened consequences. Clearance of native vegetation creates areas of disturbance that are naturally susceptible to colonisation by invasive weed species. These can form a local source of future weed infestations within the surrounding landscape.

Past field surveys reported the presence of 43 exotic species within the study area, including five species listed as Weeds of National Significance (WoNS) (BAAM 2010, 2011). Additionally, eight restricted invasive plants under the Biosecurity Act were recording within the study area during the 2019 field surveys:

- Rubber vine (*Cryptostegia grandiflora*)
- Parkinsonia (*Parkinsonia aculeata*)
- Mesquite (*Prosopis pallida*)
- Prickly acacia (*Vachellia nilotica*)
- Chinee apple (*Ziziphus mauritiana*)
- Parthenium (*Parthenium hysterophorus*)
- Bellyache bush (*Jatropha gossypifolia*)
- Singapore daisy (*Sphagneticola trilobata*)

All species have the potential to be spread into new areas as a result of construction activities. Appropriate treatment and disposal of restricted matter (weeds) is required under the Biosecurity Act.

Measures to mitigate the introduction and spread of invasive species

The following measures will be implemented to minimise the introduction and spread of weeds:

- A Weed Management Plan will be prepared for the Project and included within the CEMP.
- The Weed Management Plan will include hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
- All construction vehicles / equipment travelling from declared weed areas will undertake a wash down and possess a current weed hygiene inspection certificate from an accredited inspection station that is required to carry as evidence of quarantine clearance.
- Resources sought from outside the study area (e.g. fill for access tracks) will be required to hold weed free declarations.
- Restrict vehicle access to existing roads and tracks where possible.
- The Weed Management Plan will include protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density.

- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the study area to inform the Weed Management Plan.

18.5.2.7 Disturbances of surface waterways and waterbodies or groundwater systems

Summary of impact

The proposed corridor selection has been sited to minimise the number of water crossings and excavations are not anticipated to reach depths that will impact groundwater. Nevertheless, the Project intersects a number of mapped watercourses, waterways providing fish passage and ephemeral creek lines. These areas provide varying levels of ecological values for aquatic and terrestrial fauna, with waterways supporting permanent pools the most susceptible to construction-related disturbance. Alteration of hydrological regimes or groundwater interactions are unlikely to result from the construction or operation of the Project.

The majority of aquatic habitats are already exposed to a number of existing disturbances, including:

- Erosion and scouring of stream banks due to vegetation clearing
- Cattle and pig disturbance within riparian habitat
- Farm activities such as tracks within the riparian habitat.
- Degradation by invasive weed species.

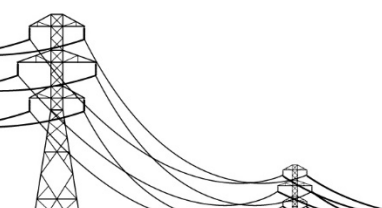
The Project has the potential to exacerbate existing environmental disturbances to aquatic habitats.

Direct loss of aquatic habitat

In most instances, the transmission line will span watercourses and no loss of aquatic habitat will occur. Existing waterway crossings will be utilised as a priority. Minor waterways may be temporarily impacted during the construction period through construction of temporary access tracks and waterway bed level crossings. These waterways are ephemeral and expected to be dry at all time during construction, excluding periods of rainfall. New bed level waterway crossings will be constructed within timeframes specified by the *Accepted development requirements for operation work that is constructing or raising waterway barrier works* (DAF, 2018) (i.e. within 180 days for major impact (purple) or high impact (red) waterways, or 360 days on moderate impact (amber) or low impact (green) waterways). No aquatic habitat for conservation significant fauna species is anticipated to be impacted by the Project, however habitat for one conservation significant aquatic species, the diamond head turtle (*Emydura subglobosa worrelli*) has the potential to occur within the study area.

The Project has been designed to minimise the direct loss of aquatic habitat. Within the Project area, transmission towers will not be constructed within the high banks of waterways, other than where it cannot be avoided (especially within large braided ephemeral systems wider than 500 m). Clearing of vegetation to establish vehicle access across a watercourse shall not occur within 10 m of the defining high bank of a watercourse and access tracks will be a maximum of 7 m wide and developed through a combination of vehicle compaction or minor grading.

Many surface and riverine associated GDEs will be avoided by the Project through the spanning of bed and banks of waterways by the transmission lines, and use of existing crossings and access routes. Permanent infrastructure footprints will not be placed within these riverine and wetland communities due to the incompatible hydrological nature of these landforms. The nature of the Project is unlikely to have impacts on groundwater resources in general, therefore is also unlikely to affect subterranean GDEs.



Increased sedimentation and erosion

There is the potential for erosion once vegetation has been cleared and soil is exposed to the effects of wind or rain during the construction phase of the Project. Sediment laden runoff has the potential to degrade water quality within the Project area and at sites downstream.

A CEMP encompassing an ESCP will be implemented to provide environmental management and mitigation procedures to minimise potential impact of construction activities on the environment. The CEMP and ESCP shall provide effective erosion and sediment control practices to prevent the potential effects of construction on watercourses within the study area and adjacent landscape. The ESCP shall also provide effective management of stormwater runoff to prevent soil erosion and ensure that only uncontaminated water leaves the project site.

Degradation of aquatic habitats

While the Project will have minimal direct impact on watercourses, earthworks, vehicle movements and other construction activities have the potential to cause indirect degradation of aquatic habitats. Construction activities within and/or in the vicinity of watercourses have the potential to cause degradation of aquatic and riparian habitats through:

- Removal of riparian vegetation
- Run-off, sedimentation and erosion
- Point-source pollution (chemical and fuel spills)
- Establishing barriers to the movement of aquatic fauna
- Disturbance associated with noise, vibration and/or artificial lighting.

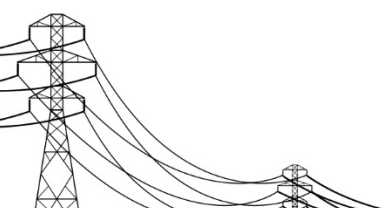
Release of sediments into aquatic habitats can result in altered water chemistry (e.g. increased turbidity, decreased oxygen levels, reduced light penetration), change in channel morphology and alteration of substrate composition (Wood and Armitage 1997; Wheeler *et al.* 2005). These impacts can affect aquatic fauna both directly and indirectly by reducing habitat value and altering trophic dynamics (particularly where substrate and macrophytes are smothered) and feeding behaviours. Use of construction machinery in and around aquatic habitat also has the potential to result in the introduction of contaminants, such as fuels and lubricants. These can result in long-term impacts to aquatic wildlife and their habitats, and lead to a decline in aquatic species diversity as sensitive species are competitively excluded by more tolerant species, particularly exotic pest species that typically tolerate degraded habitats.

No permanent waterway barrier works that will restrict the movement of fish or other aquatic species are likely to be required for the Project.

The Project intersects approximately 4.7 ha of the trigger area at the edge of a GBR catchment wetland protection area at KP 169WD, however does not intersect the wetland itself (the edge of the mapped wetland is approximately 350 m southeast of the corridor selection). The wetland area contains palustrine wetland RE 10.4.7 (*Casuarina cristata* open woodland on Cainozoic lake bed). The section of trigger area for the wetland protection area that is intersecting the corridor selection contains regrowth Acacia habitat. Due to the low impact earthworks likely to be required through this area and the distance to the wetland area, it is unlikely that direct or indirect degradation of the wetland would result.

Measures to mitigate the disturbance of waterways, waterbodies and groundwater systems

The following mitigation measures will be used to minimise the disturbance of waterways, waterbodies and groundwater during construction of the transmission line:



- The potential for direct impact on waterways has been largely avoided by locating the Project footprint away from existing waterways during the preliminary design phase. Impact to waterways is limited to waterway crossings along access tracks and where braided channel systems occur that cannot be completely spanned across.
- Watercourse crossings will be located at established crossing points on existing access tracks as a priority. Where this is not safe to do so, the disturbance area will be minimised and any large habitat trees retained as a priority.
- Duration of in-stream works will be minimised.
- The ESCP will specify measures to mitigate impacts of erosion and sedimentation on waterways.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Dust suppression activities will be undertaken where appropriate. Stabilisation of disturbed areas will be undertaken after disturbance with priority given to areas of steeper gradient.
- Rehabilitation of cleared areas adjacent to waterways will be undertaken after clearing.
- Refuelling will be undertaken away from waterways.
- Storage of fuels, chemicals, wastes and other potentially environmentally hazardous substances will be bunded or otherwise contained areas away from waterways.
- Emergency response protocols and procedures will be developed for implementation in the event of a contaminant spill or leak and provision of spill response equipment.
- During the construction phase, the Project will utilise existing waterway crossings and where a temporary crossing is required it will be required to meet the Accepted development requirements for operational work that is constructing or raising waterway barrier works. Therefore waterway crossings are unlikely to require development approval and address the State Code 18: Constructing or raising waterway barrier works in fish habitats.
- Construction of bed level waterway crossings will be undertaken during dry conditions as a priority. Construction during dry conditions will assist in minimising potential indirect impacts to aquatic ecosystems at construction sites and downstream. Where waterway bed level crossings are required, existing crossings will be utilised as agreed with the property owner.
- A riverine protection permit (RPP) may be required under the Water Act to destroy vegetation, excavate or place fill in a watercourse, lake or spring. Watercourses are defined under Section 5 of the Water Act, whereas lake and spring are defined under Schedule 4 of the Water Act. A permit is not required if the Project can undertake the works in accordance with Section 4 - minimum requirements of the RPP Exemptions Requirements - WSS/2013/726 Version 2.01 dated 2019 (RPP exemption requirements). As CuString will be an electricity entity under the Electricity Act and therefore will be approved to use the RPP exemption requirements. The exemption requirements are considered likely to apply to any clearing of vegetation required to be undertaken within a watercourse, provided that clearing can meet the conditions of the exemption requirements. For the exemption to apply, vegetation clearing must be:
 - Carried out under an accepted development vegetation clearing code (other than category A), or
 - Of an area that is less than 0.5 ha of a least concern RE in a category B area, or
 - Of an area that is less than 0.5 ha in a category C, R or X area.

- Access tracks will be constructed at a maximum of 7 m wide and developed through a combination of vehicle compaction or minor grading.
- Access tracks will be constructed in a manner which will not undermine the existing natural bank stability and positioned so as to minimise potential interruption of low flow conditions and scour or erosion.
- Approximately 4.7 ha of mapped GBR WPA trigger area is intersected by the Project area at KP 169WD, however the Project is unlikely to trigger approval for high impact earthworks in a WPA due to being electricity operating works and being likely to comply with Schedule 14 of the Planning Regulation. No works will occur within or directly adjacent to the wetland within the WPA.
- Construction and operation actions are completed in accordance with the recommendations outlined in the Volume 3 Appendix R Field development plan.

18.5.3 Operations phase impacts and mitigation measures

The Project has the potential to cause direct injury and mortality of a small number of bird species that forage at the height of the transmission line. For flora and most other fauna, the Projects' operation phase impacts are expected to be relatively limited. The following ecological impacts have been considered:

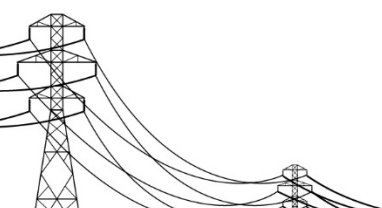
- Injury and mortality of wildlife by collision with vehicles, entanglement and entrapment
- Disturbance of wildlife behaviour through exposure to light, noise and vibration
- Localised habitat degradation through exposure to dust, run-off and sedimentation
- Introduction and spread of invasive species
- Barrier effects and reduced fauna movement
- Altered fire regimes

These impacts and mitigation measures are discussed in detail below

18.5.3.1 Injury and mortality of wildlife by collision with vehicles, entanglement and entrapment

Summary of impacts

Operation of the Project will carry additional injury and mortality risks to wildlife through collision with vehicles and collision and entanglement in fencing and transmission lines. The transmission line will create a local collision risk for birds and bats, particularly flying foxes. The operation phase of the Project will also see small numbers of occasional vehicle movements associated with maintenance activities. However, as the volume of traffic movements is not expected to be substantially higher than that currently undertaken by property managers, the risks to wildlife are considered relatively low. Nevertheless, species particularly susceptible to traffic collisions include larger and slow-moving snakes, monitors and other large lizards, macropods, frogs (during wet periods) and the squatter pigeons. Additionally, the increase in vehicular traffic may also result in an increase in the loss of habitat for shelter sites for some species by compacting soil cracks (e.g. the ornamental snake and Julia Creek dunnarts. Measures to mitigate the injury and mortality of wildlife



Measures to mitigate the injury and mortality of wildlife

The following mitigation measures will be used to minimise the injury and mortality of wildlife during operation of the transmission line:

- Use of transmission-line visibility measures (e.g. line markers) where the transmission line crosses watercourses, corridors and other high collision-risk areas where there is likely to be increased longitudinal movement of birds and bats.
- All travel will be restricted to designated access tracks and roads.
- All vehicles and plant will adhere to site rules relating to speed limits. Speed limits will be clearly signposted to minimise the potential for road kill.
- No fencing is proposed for the Project. This will reduce the risk of flying fox entanglement, which often occurs on barbed-wire fencing.
- Warning signs will be placed where access tracks intersect areas where the risk of collision with squatter pigeons is high (i.e. confirmed squatter pigeon habitat).
- Species management plans will be constructed for listed threatened species with predictable breeding habitat located within the study area. This includes the black-throated finch (southern), Julia Creek dunnart, squatter pigeon (southern) and koala.

18.5.3.2 Disturbance of wildlife behaviour through exposure to vibration, light and noise

Summary of impacts

Vibration and sound impacts are anticipated to be negligible during operation of the Project. No artificial lighting is proposed. As a result, the potential for disturbance of wildlife behaviour through exposure light is considered low. The following measures will be used to mitigate any residual impacts.

Measures to mitigate disturbance of wildlife behaviour through exposure to vibration, light and noise

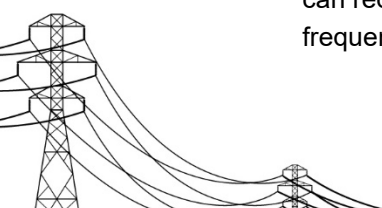
The following measures will be implemented to reduce the risk of impact to terrestrial fauna by dust, noise and lighting:

- No artificial lighting will be used on transmission towers or supporting infrastructure
- Work hours will be restricted to the hours of 7 am and 6 pm
- Reduced vehicle speed limits to reduce dust dispersal in areas of exposed soil.

18.5.3.3 Localised habitat degradation through exposure to dust, run-off and sedimentation

Summary of impacts

The Project will create new unsealed roads with associated periodic low-level traffic of operational and maintenance staff. Although the temporary disturbance footprint for the transmission line and new buildings will be rehabilitated, the new unsealed roads will contribute to dust and sedimentation to the environment. Movements of maintenance vehicles have the potential to cause localised habitat degradation through exposure to dust, run-off and sedimentation. This can reduce the ecological value of surrounding habitats through physical smothering of vegetation (including aquatic macrophytes), changes in nutrient levels, increased weed incursions and declines in species diversity. Dust impacts are typically localised in their extent, generally affecting areas within 10 m of unsealed access roads (Goosem 2007). Dust can reduce the photosynthetic capacity of the plants and impede plant growth. Given the frequency of vehicle movements will be low, the impacts are expected to be minimal and not



inconsistent with those impacts in the surrounding pastoral landscape. However, the long-term degradation of tracks over time could increase local erosion and sedimentation risk.

Measures to mitigate localised habitat degradation through exposure to dust, run-off and sedimentation

The following measures will be implemented to reduce the risk of impact from localised habitat degradation through exposure to dust, run-off and sedimentation:

- Reduced vehicle speed limits to reduce dust dispersal in areas of exposed soil.
- Minimising vehicle access to waterways and exposed surfaces by establishing designated watercourse crossings.
- Any bed-level watercourse crossings will utilise existing formed tracks wherever possible to reduce the need for additional clearing and erosion impacts along watercourses.
- Continued employment of sediment and erosion control measures and track maintenance to provide ongoing management of erosion prone areas (e.g. waterways).
- Should additional clearing be required during operation, rehabilitation will take place after cessation of the use of the area.

18.5.3.4 Introduction and spread of invasive species

Summary of impacts

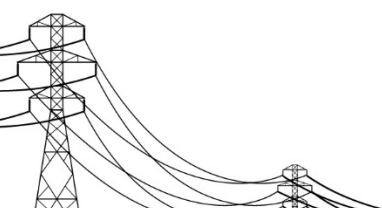
Project operation has the potential for introduction and spread of invasive species through the ongoing movement of people and vehicles.

Past field surveys reported the presence of 43 exotic species within the study area, including five species listed as Weeds of National Significance (WoNS) (BAAM 2010, 2011). Additionally, eight restricted invasive plants under the Biosecurity Act were recorded within the study area during the 2019 field surveys. These species have the potential to cause damage to the ecological integrity of bushland remnants by excluding native plant species that provide food, shelter and nesting resources for native wildlife. Maintenance vehicles servicing the transmission line have the potential to spread weeds. Implementation of specific operational protocols can help limit the unintentional spread of weeds into and/or throughout the study area.

As detailed in section 18.5.2.6, invasive fauna species are known to occur within the study area. Pest species that are likely to be relatively common and ubiquitous within the region include the cat (*Felis catus*), fox (*Vulpes vulpes*), dog (*Canis lupus familiaris*) and pig (*Sus scrofa*). The clearing and disturbance of remnant vegetation within the Project area has the potential to facilitate ongoing movement of feral animals, as these are typically capable of better utilising heavily altered landscapes. There is potential for pest species to use the final corridor as a linear pathway for movement, leading to the introduction of pest species in previously pest-free habitats. An increase in the prevalence of these animals may adversely impact native fauna through:

- Increased competition for resources
- Increased predation (of native species by introduced animals)
- Habitat degradation (i.e. pig damage of riparian areas).

Impacts of weeds and pests are expected to be manageable, provided that the mitigation and management measures outlined in the Weed and Pest Management Plan are implemented.



Measures to mitigate the introduction and spread of invasive species

The following mitigation measures will be used to minimise the introduction and spread of invasive species during the operational phase:

- A Weed and Pest Management Plan will be developed and implemented for the Project's operation phase.
- Ensuring all Project personnel are aware of the 'general biosecurity obligations' under the *Biodiversity Act 2014*.
- Under the GBO, individuals and organisations whose activities pose a biosecurity risk must take all reasonable and practical steps to prevent or minimise each biosecurity risk.
- The Weed Management Plan will include protocols for periodic visual monitoring and management of weeds to identify and appropriately respond to changes in weed distribution and density.
- All vehicles that have access to designated access tracks will be restricted to designated access tracks to minimise the risk of spreading invasive plants.

18.5.3.5 Barrier effects and reduced fauna movement

Summary of impacts

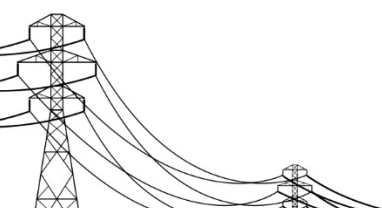
Linear clearing (such as for roads and fences) can cause barrier effects by limiting the capacity for movement, particularly among ground-dwelling fauna. As the Project occurs in a landscape that has already been subject to high levels of fragmentation, vegetation clearing resulting from the Project is likely to impose relatively few barrier effects on local wildlife. As no fencing will be established as part of the Project, the permanent barrier effects on wildlife are expected to be minimal. Despite this the Project has the potential to restrict movement of fauna where the corridor selection crosses wildlife corridors and watercourses and other areas with high vegetation connectivity.

In addition, wildlife may become trapped in excavations that remain open for any period of time such as during construction of foundations for towers and substations. This may lead to mortality either by exposure, starvation, thirst or predation by other species. Watercourse crossings established during construction have the potential to cause ongoing restrictions to movement of fish, turtles and other aquatic fauna along watercourses. These can act as partial or complete barrier to fauna movement.

Measures to mitigate barrier effects and reduced fauna movement

The following mitigation measures will be used to mitigate barrier effects on fauna movement during operation of the Project:

- Where the Project crosses watercourses and wildlife corridors and other areas of increased sensitivity to fragmentation, the crossing width and utilise taller towers to increase the capacity to span native vegetation.
- Practical measures will be implemented to maintain and increase habitat connectivity where the Project intersects areas important for fauna movement. These measures could include localised planting of vegetation or placement of glider poles.
- Ongoing maintenance of tracks to reduce dust and erosion that have the potential to exacerbate localised barrier effects for smaller ground-dwelling fauna species
- Ongoing use and maintenance of designated waterway crossing points to minimise disruption to longitudinal movement of wildlife along watercourses.



- A large proportion of the footprint will be subject to temporary vegetation clearance only and rehabilitated or naturally regenerated after construction. Corridors and watercourses may be subject to targeted rehabilitation and revegetation after construction to maximise fauna movement during the Project's operation phase.
- Excavations created during construction will be filled after construction or engineered to incorporate escape options for fauna.

18.5.3.6 Altered fire regimes on flora and fauna

Summary of impacts

The Project is relatively benign in terms of its impact on fire and is unlikely to cause any significant change in fire regime. The easement has the potential to act as a fire break, restricting the local extent of natural fires. Given the increasing fire risks associated with climate change, the introduction of fire breaks in the landscape has the potential for positive impacts by limiting the capacity for fires to burn out entire areas of habitat. By restricting localised spread of fire, the easement has the potential to promote localised variation in fire consistent with small-scale mosaic burning. The Project has the potential for accidental fires where vegetation comes into contact with transmission lines or through inappropriate disposal of cigarettes by maintenance staff. The incidence of regulated management burns may also change in frequency. Accidental or uncontrolled fires have the potential to negatively impact upon vegetation (and habitat) within, and adjacent to, the final corridor in particular.

Measures to mitigate the impacts of altered fire regimes on flora and fauna

The following mitigation measures will be used to mitigate the impacts of altered fire regimes during operation of the Project:

- Routine management of vegetation beneath and adjacent to the Project will reduce the risk of accidental fires that may be started through contact between vegetation and transmission lines.
- Development and implementation of fire management plans for areas of ecological sensitivity.
- Routine protocols governing safe work practices with regard to fire risks will limit the risk of accidental fires during operation.
- Training of all staff in fire response and use of fire extinguishers.

18.5.4 Threatening processes, impacts and mitigation measures for listed threatened communities and species

An assessment of the proposed activities during construction and operation of the Project has been undertaken to identify potential impacts on the ecological values of the receiving environments (Table 18-36). Threatening processes cited in the respective Species Profile and Threats Database (DAWE 2020), together with potential impacts to existing ecological values have been described, as well as impacts specific to locations and/or species or faunal-groups, as relevant. Avoidance, mitigation and minimisation measures have been proposed to reduce the potential for impacts to species, their habitat and other ecological values, with an overall predicted effectiveness for those measures in mitigating potential impacts for each species. Predicted effectiveness ratings are defined as follows:

- Very high effectiveness: complete avoidance of known occurrences and/or habitats
- High effectiveness: substantial avoidance of known occurrences and/or habitats

- Moderate effectiveness: areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.
- Low effectiveness: mitigation of impacts only through implementation of EMP, spotter-catchers, pest fauna and weed control.
- Very low effectiveness: No mitigation strategies proposed.

An assessment of the likelihood and duration of residual impacts following proposed management measures has been included for key communities or species assessed.

A predicted reliability of assessments has been included, with species reliability index ratings provided as follows:

- 3 = species life history and distribution within Study Area well known
- 2a = species life history poorly known, distribution within Study Area well known
- 2b = species life history well known, distribution within Study Area poorly known
- 1 = species life history and distribution within Study Area poorly known

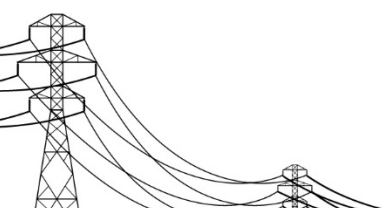
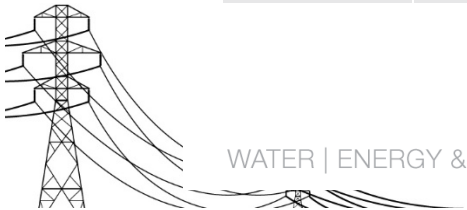
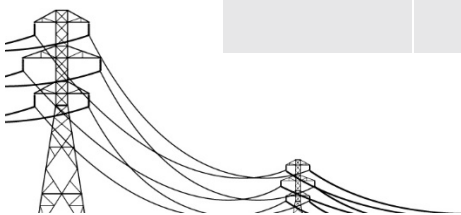


Table 18-39 Threatening processes, potential impacts and key mitigation measures

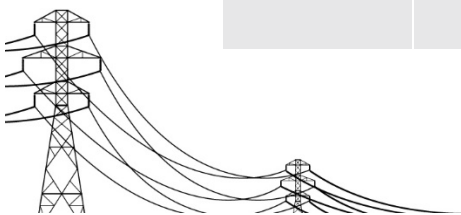
Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predict on Reliability Index
Listed threatened ecological community						
<i>Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions.</i>	• Fragmentation and lack of connectivity between fragments • Continued clearing • Inappropriate fire regimes • Invasion by introduced pasture species • Increased grazing by domestic stock and native animals • Changing climate conditions	• Decreased habitat condition through weed invasion, changed fire regimes, disease, excessive dust.	• Proposed corridor has been selected to avoid known occurrences • Implementation of EMP, including environmental training, weed control and fire management.	High effectiveness Substantial avoidance of known occurrences and/or habitats.	Impacts are unlikely and of short duration.	3
Listed threatened flora						
<i>Eucalyptus raveretiana</i>	• Habitat disturbance and smothering by rubber vine (<i>Cryptostegia grandiflora</i>) • Disturbance of habitat during timber harvesting operations • Increased fire frequency from weeds and introduced grasses • Stream bank erosion	• Loss of potential habitat and individuals through vegetation clearing. • Decreased population viability through isolation. • Decreased habitat quality through edge effects, increased weed invasion, excessive dust, changed fire regimes, altered surface hydrology, increased riparian erosion, and altered drainage and nutrient dynamics.	• Pre-clearance surveys in suitable habitats to identify all individuals within corridor selection. • Utilising taller towers set back from the riparian zone to span occurrences and trimming taller trees rather than felling. • Retention of supporting riparian vegetation through set back of towers, spanning and trimming of taller vegetation. • Siting additional infrastructure, such as tracks and assembly areas outside of known and potential habitat for this species.	High effectiveness Substantial avoidance of known occurrences and/or habitats.	Any impacts likely to be minor and of short duration.	3



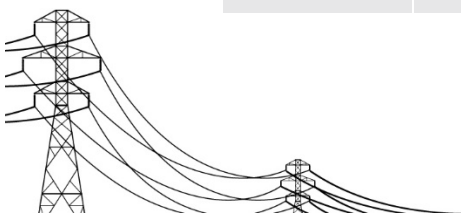
Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predicti on Reliabilit y Index
			• Construction and operation management practices, including weed control.			
<i>Livistona lanuginosa</i>	• Fire • Trampling and grazing by stock • Clearing for agricultural development • Dams that affect water level and flow in the area of occurrence • Introduction of invasive weeds	• Loss of habitat and individuals through vegetation clearing and riparian degradation. • Decreased population viability through isolation. • Decreased habitat quality through edge effects, increased weed invasion (rubber vine and parkinsonia), excessive dust, changed fire regimes, altered surface hydrology, increased riparian erosion, altered nutrient dynamics.	• Pre-clearance surveys in suitable habitats to identify all individuals potentially impacted • Avoiding or spanning occurrences • Retention of supporting riparian vegetation • Additional infrastructure, such as tracks and assembly areas, will avoid the known and potential habitat for this species. • Construction and operation management practices, including weed control.	High effectiveness Substantial avoidance of known occurrences and/or habitats.	Any impacts likely to be minor and of short duration.	3
<i>Acacia crombiei</i>	• Overgrazing • Habitat fragmentation and clearing	• Loss of potential habitat through vegetation clearing. • Decreased population viability through isolation. • Decreased habitat quality through edge effects. • Decreased habitat quality through edge effects, increased weed invasion, excessive dust, changed fire regimes, altered surface hydrology, increased riparian erosion, and altered drainage and nutrient dynamics.	• Proposed corridor has been selected to avoid known occurrences; however, pre-clearance surveys will be undertaken in suitable habitats to identify any undetected individuals. • Avoiding any individuals by micro-siting or spanning • Retention of supporting vegetation through micro-siting or spanning of infrastructure and trimming of taller supporting vegetation.	Very high effectiveness Complete avoidance of known occurrences and/or habitats.	Unlikely to be impacted. Any impacts likely to be minor and of short duration.	3



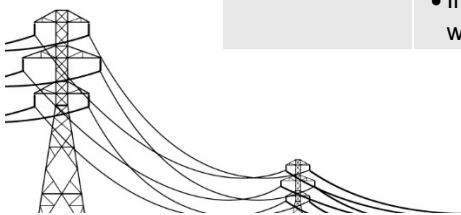
Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predicti on Reliabilit y Index
			• Construction and operation management practices, including weed control.			
Listed threatened fauna						
Squatter pigeon (southern)	• Ongoing vegetation clearance and fragmentation • Loss of habitat through overgrazing by livestock and feral herbivores, such as rabbits, • Introduction of weeds • Inappropriate fire regimes • Thickening of understorey vegetation • Predation by feral cats and foxes • Trampling of nests by domestic stock • Illegal shooting.	• Loss of foraging habitat • Injury and mortality from clearing and/or vehicle strikes • Habitat fragmentation and reduced connectivity • Disturbance from increased light, noise and vibration • Habitat degradation through increased dust, run-off and sedimentation • Introduction and spread of invasive fauna species • Introduction and spread of weed species • Disturbance of surface waterways and waterbodies	• Areas of potential habitat are to be fished immediately prior to clearing. • Access to water sources and local on-ground connectivity between breeding and foraging habitat will be maintained during all stages of the Project. Tracks will be retained and managed as dusty, unsealed tracks to maintain opportunities for dispersal and local movement. • Impacts to watercourses to be avoided by Project infrastructure • Critical drinking sources will be maintained as a priority to support the viability of local breeding habitats. • Pre-clearance surveys to microsite towers to avoid direct impacts on confirmed or potential nesting habitat. • Preparation of a high risk SMP will be undertaken in accordance with the requirements of Section 332	Moderate to high effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/lif e cycles are minimised through design and construction methods. Habitat connectivity maintained.	Impacts likely to be minor and of short duration, restricted to construction risks and minor localised loss of habitat.	3



Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predictions on Reliability Index
			of the <i>Nature Conservation (Wildlife Management) Regulation 2006</i>. • Go-slow zones (40 km) and warning signs will be established for vehicles and machinery where non-gazetted access roads or tracks are located adjacent to areas of confirmed sightings. • Use of trained and qualified spotter-catchers throughout clearing • Implementation of EMP, including fauna management, traffic management, weed control and erosion and sediment control.			
Koala	• Habitat loss, fragmentation and degradation • Mortality from vehicles strikes and dog attacks • Spread of disease • Drought impacts	• Loss of potential habitat, including food resources • Injury and mortality during clearing and vehicle collisions • Habitat degradation by increased dust run-off and sedimentation • Introduction and spread of pest fauna species	• Identification and avoidance of areas of suitable habitat during design, including use of previously disturbed areas and spanning over corridors of potential movement and connectivity to maximum span width. • Sequential clearing (outside of peak breeding season as a priority) and allowing koalas to self-disperse. • Use of trained and qualified spotter-catchers throughout	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and	Minor, long-term loss of food trees, localised short duration impacts to habitat	3

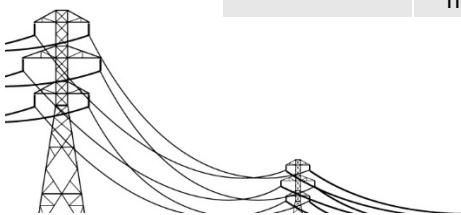


Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predicti on Reliabilit y Index
			clearing within suitable habitats • Implementation of vehicle speed limits on non-gazetted access roads and tracks. • Implementation of EMP, including environmental training, traffic management, erosion and sediment control, weed management and waste management. • Revegetation of riparian areas or potential connectivity areas (koala movement corridors) to restore and enhance habitat usage. • Feral animal control during construction • Natural regeneration of disturbed areas not required for operations	construction methods.		
Black-throated finch (southern)	• Clearance and fragmentation of woodlands, riparian habitats and wattle shrublands • Degradation of habitat by domestic livestock and rabbits, including the alteration of fuel loads, vegetation structure and the availability of food during the wet season • Alteration of habitat by changes in fire regimes • Invasion of habitat by exotic weeds, including exotic grasses	• Loss of potential habitat, including nesting habitat through clearing of grassland and/or grassy woodland, earthworks or excavation and the construction of roads, structures and/or hard surfaces. • Increased likelihood of fires. • Increased access to habitat by feral predators and increased predation. • Disruption to breeding cycle	• Pre-clearance surveys in areas of suitable habitat to identify and avoid potential nesting sites. • Micrositing towers to avoid direct impacts on confirmed or potential nesting habitat. • Should clearing of nesting habitat be required, a high risk SMP will be prepared and implemented in accordance with the	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/lif e cycles are minimised	Impacts likely to be minor and of short duration.	3



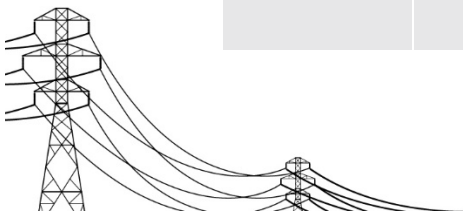
Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predictions on Reliability Index
	• Illegal trapping • Predation by introduced predators • Hybridization with the northern subspecies.	• Degradation of downstream aquatic ecosystems through pollution and sedimentation in runoff from vehicle use of maintenance tracks.	requirements of Section 332 of the <i>Nature Conservation (Wildlife Management) Regulation 2006</i>. • Maintenance of 'no go' buffer zones around nesting sites. • Use of trained and qualified spotter-catchers throughout clearing • Scheduling majority of clearing during the dry season, outside the species' usually breeding period • Implementation of EMP, including environmental training, pest animal, noise, weed, erosion and sediment control and fire management. • Natural regeneration of native grasses in disturbed areas not required for operations	through design and construction methods.		
Julia Creek dunnart	• Cat (<i>Felis catus</i>) predation • Invasion of habitat by Prickly Acacia (<i>Vachellia nilotica</i>) • Heavy grazing • Potential threats may include: – inappropriate fire regimes, climatic factors and small population size	• Direct mortality from earthworks and other invasive construction activities • Mortality by maintenance vehicle collisions. • Compaction of soil cracks (reducing shelter sites) by maintenance vehicle activities. • Increased likelihood of weed invasion leading to choking of groundcover and reducing foraging opportunities.	• Micrositing towers to avoid areas of high microhabitat value (i.e. areas with high densities of deep cracking clay) • Preparation of a high risk SMP will be undertaken in accordance with the requirements of Section 332 of the <i>Nature Conservation (Wildlife Management) Regulation 2006</i>.	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised	Impacts likely to be minor and of short duration.	2b

Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predictions on Reliability Index
		Increased access to habitat by feral predators and possible increased predation.	- Use of trained and qualified spotter-catchers throughout clearing - Scheduling majority of clearing during the dry season, outside the species' usually breeding period - Minimise maintenance vehicle and machinery access and subsequent soil compaction beyond designated access tracks. - Implement vehicle speed limits on non-gazetted access roads and tracks. - Implementation of EMP, including environmental training, pest fauna, weed, traffic management and fire management. - Natural regeneration of ground cover within disturbed areas not required for operations	through design and construction methods.		
White-throated needletail	- Use of insecticides and the loss of roosting sites - Loss of forest and woodland habitats may have also resulted in reduction in invertebrate prey - Logging of forests and hunting in breeding grounds of the northern hemisphere	Collision with transmission lines.	- No specific mitigation strategies are proposed for the species. - Insecticide use will not be required for the project.	Very low effectiveness No mitigation strategies proposed.	Negligible impacts anticipated.	3



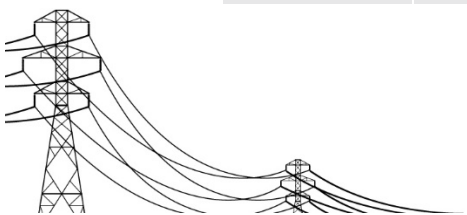
Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predicted on Reliability Index
Red goshawk	- Habitat loss and fragmentation - Forestry operations - Illegal egg collecting - Potential threats may include: - habitat alterations within a breeding pairs home range - application of persistent pesticides (outside Australia) - Reduce prey availability from land management practices - fire and changed burning regimes - shooting of Red Goshawks - disease - catastrophic events, such as wildfire and tropical storms, which may exaggerate the impact of existing threats - possible genetic bottlenecks in the population - secondary poisoning - persistent disturbance by birdwatchers at know nests	- The removal of large trees will result in a more open vegetative structure for the communities within and adjacent to the easement. Because this species is an ambush predator that hunts within the midstorey, a more open canopy structure could reduce the species' ability to forage in the vicinity of the Project area. - Disturbance to foraging/ breeding by noise pollution/ vehicle movement. - Increased likelihood of fire leading to reduction or loss of shelter and foraging habitat. - Increased likelihood of weed invasion leading to increased fuel load.	- Proposed corridor has been selected to avoid key foraging areas such as ecotone boundaries, vegetated watercourses and wetland ecosystems in design phase. - Pre-clearance surveys in areas of suitable habitat to identify potential nesting sites (normally large trees within 1 km of water). - Micrositing towers to avoid direct impacts on confirmed or potential nesting habitat. - Minimisation of clearing to maintain canopy cover. - Use of trained and qualified spotter-catchers throughout clearing - Implementation of EMP, including environmental training, pest fauna, weed, chemical spills and storage and fire management.	Moderate to high effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods. Habitat connectivity maintained.	Impacts likely to be minor and of short duration.	2b
Night parrot	- There are no known threats to this species. Potential threats may include: - Predation by feral cats (<i>Felis catus</i>) and foxes (<i>Vulpes vulpes</i>) - Degradation of habitat around water points by livestock and feral herbivores	- Direct loss of suitable habitat - Mortality by maintenance vehicle collision. - Increased likelihood of fire leading to reduction or loss of shelter. - Increased likelihood of weed invasion leading to increased fuel load.	- Proposed corridor has been selected to avoid water sources. - Targeted pre-clearance surveys prior to construction to minimise the potential for impact on breeding or nesting habitat.	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to	Impacts unlikely but any direct impact would have severe consequences.	1

Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predictions on Reliability Index
	– Competition for food by livestock or feral herbivores – Human-induced fire events and increased fire extent – Disease – Illegal collection of birds or eggs – Disturbance from bird watching activities – Fence collisions – Reduction in water availability through overuse of waterholes by camels or reduced waterhole maintenance	• Increased access to habitat by feral predators and possible increased predation. • Degradation of downstream aquatic ecosystems through pollution and sedimentation in runoff from vehicle use of maintenance tracks.	• Implement vehicle speed limits on non-gazetted access roads and tracks. • Implementation of EMP, including environmental training, pest fauna, weed, erosion and sediment control and fire management. • Implementation of the Department of Environment and Heritage (2006) hygiene and reporting protocols for psittacine beak and feather disease (PBFD). • Natural regeneration within disturbed areas not required for operations will be assisted to re-establish and maintain connectivity of ground-level habitats.	behaviours/life cycles are minimised through design and construction methods.		
Painted honeyeater	• Habitat loss • Grazing by livestock, native macropods and rabbits, as grazing inhibits recruitment through consumption of seedlings • Competition with the aggressive noisy miner • Predation by invasive species • Pasture improvement activities • Collision with road vehicles • Nest predation	• Direct loss of foraging habitat • Injury and mortality • Habitat fragmentation and reduced connectivity • Disturbance from increased light, noise and vibration • Habitat degradation through increased dust, run-off and sedimentation • Introduction and spread of invasive fauna species • Introduction and spread of weed species	• Implementation of EMP, including environmental training, pest fauna, weed, erosion and sediment control and fire management. • Implementation of the Department of Environment and Heritage (2006) hygiene and reporting protocols for psittacine beak and feather disease (PBFD). • Natural regeneration within disturbed areas not required	Low effectiveness Mitigation of impacts only through implementation of EMP (weed management).	Impacts likely to be minor and of short duration.	2b



Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predicti on Reliability Index
			for operations will be assisted to re-establish and maintain connectivity of ground-level habitats.			
Australian painted-snipe	• Loss and degradation of wetlands, principally from the drainage of wetlands and diversion of water to agriculture and reservoirs • Grazing and associated trampling of wetland vegetation by cattle and/or sheep • Potential threats may include: – Prolonged drought – Changed fire regimes – Replacement of endemic wetland vegetation by invasive, noxious weeds may have a detrimental impact – Predation by feral animals	• Degradation of downstream aquatic ecosystems through pollution and sedimentation in runoff from vehicle use of maintenance tracks. • Increased access to habitat by feral predators and possible increased predation.	• Proposed corridor has been selected to avoid the majority of sensitive environmental areas (e.g. wetlands) which the species may utilise. • Where avoidance is not possible, such environments will be spanned. • Establishment and maintenance of 'no-go' zones around areas of suitable habitat. • Implementation of EMP, including environmental training, chemical management measures, pest fauna and weed control. A Sediment and Erosion Control Plan will also be implemented as part of the EMP.	Moderate to high effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods. Substantial avoidance of known habitats.	Impacts likely to be minor and of short duration.	3
Grey falcon	• Predation by cats • Increased temperatures in arid and semi-arid Australia • Small population size • Grazing by exotic herbivores • Nest shortage • Birdwatchers and photographers	• Loss of foraging habitat • Loss of nesting sites • Introduction / encroachment by invasive species • Disturbance to roosting by light and noise pollution.	• Targeted pre-clearance surveys prior to construction to minimise the potential for impact on nesting habitat. • Implementation of EMP, including environmental training, pest fauna and weed	Moderate effectiveness Areas of direct impact are minimised and/or	Impacts likely to be minor and of short duration.	2b

Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predictions on Reliability Index
	• Collision with traffic • Collision with fences and powerlines • Harvesting	• Disturbance to foraging by noise pollution	management and noise and light controls.	indirect impacts to behaviours/life cycles are minimised through design and construction methods.		
Ornamental snake	• Habitat loss through clearing (roads, ploughing, railways, mining-related activities, pipeline constructions) • Habitat fragmentation • Habitat degradation by overgrazing by stock, especially cattle, or grazing of gilgais during the wet season leads to soil compaction and compromising of soil structure • Alteration of landscape hydrology in and around gilgai environments • Alteration of water quality through chemical and sediment pollution of wet areas • Contact with the Cane Toad • Predation by feral species • Invasive weeds	• Direct mortality and loss of habitat from earthworks and other invasive construction activities • Mortality by maintenance vehicle collisions. • Compaction of soil cracks (reducing shelter sites) by maintenance vehicle activities. • Sedimentation of habitat • Light spill disrupting nocturnal hunting • Increased likelihood of weed invasion leading to choking of groundcover and reducing foraging opportunities. • Increased access to habitat by feral predators and possible increased predation.	• Localised risk of impact to individuals during clearing will be mitigated through the use of pre-clearance surveys by experienced spotter-catchers. • Pre-clearance surveys to identify areas of high micro-habitat value. Micro-siting towers to avoid such areas (i.e. areas with gilgais) • Should clearing of breeding habitat be required, a high risk SMP will be prepared and implemented in accordance with the requirements of Section 332 of the Nature Conservation (Animals) Regulation 2020. • Use of trained and qualified spotter-catchers throughout clearing • Scheduling of works in the dry season months to avoid the species' peak period of	Moderate effectiveness Areas of direct impact are minimised and/or indirect impacts to behaviours/life cycles are minimised through design and construction methods.	Minor, localised long-term loss of habitat	2b

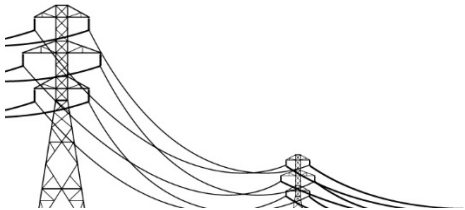


Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predicti on Reliabilit y Index
			breeding activity (i.e. the wet season). • Minimise maintenance vehicle and machinery access and subsequent soil compaction beyond designated access tracks. • Implement vehicle speed limits on non-gazetted access roads and tracks. • Implementation of EMP, including environmental training, pest fauna, sediment and erosion control, light controls and traffic management. • Natural regeneration of ground cover within disturbed areas not required for operations			
Plains death adder	• Contact with the Cane Toad • Potential threats may include: – Habitat modification due to over-grazing by cattle and inappropriate fire regimes – Spreading waterpoints to reduce grazing pressure which can result in an increase in total grazing pressure, reduced groundcover that could act as refugia and increased spread of cane toads.	• Loss of habitat. • Removal of groundcover that the species uses for shelter and a potential reduction in the species feed source (frogs and lizards) due to earthwork disturbances • Mortality during clearing activities. • Mortality by vehicle collision. • Mortality by being trapped in excavations during construction. • Disruption of the breeding cycle of the species at a local level • Increase in edge effects.	• Localised risk of impact to individuals during clearing will be mitigated through the use of pre-clearance surveys. • Use of trained and qualified spotter-catchers throughout clearing • Mitigation measures to reduce the impacts of Project on the species (e.g. vehicle strikes) have been designed and included within the Project EMP	Moderate to low effectiveness Mitigation of impacts only through implementation of EMP, spotter-catchers, pest fauna and weed control. Habitat	Negligible long-term loss of habitat	2b

Species	Threatening processes#	Potential impacts	Key avoidance, mitigation measures	Mitigation effectiveness	Likelihood and duration of residual impacts	Predictions on Reliability Index
		- Increased access to habitat by feral predators and possible increased predation. - Increased likelihood of trampling by livestock due to increased access to habitat. - Increased prevalence of cane toads and mortality from attempted predation. - Provision of shelter resources under stored equipment/ building materials resulting in possible subsequent mortality. - Increased likelihood of fire leading to direct mortality. - Increased likelihood of fire leading to reduction or loss of shelter. - Increased fuel load due to weed invasion. - Increased likelihood of weed invasion leading to choking of groundcover and reducing foraging opportunities.	- Implementation of EMP, including environmental training, pest fauna and weed controls and traffic management. - Natural regeneration of ground cover within disturbed areas not required for operations	connectivity maintained		
	•	•	•			
	•	•	•			

sourced from the Species Profile and Threats Database (DAWE, 2020) unless otherwise indicated

Species reliability index ratings: 3 = species life history and distribution within Study Area well known; 2a = species life history poorly known, distribution within Study Area well known; 2b = species life history well known, distribution within Study Area poorly known; 1 = species life history and distribution within Study Area poorly known.



18.5.5 Significance of residual impacts on MNES

18.5.5.1 Overview

This section assesses the significance of the Projects' impacts on listed threatened communities and species that have been confirmed present or considered likely to occur within the study area. Assessments against the EPBC Significant Impact Guidelines 1.1 (DoE 2013) have been made for the following MNES that have been confirmed present or considered likely to occur within the corridor selection:

- *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions*
- *Eucalyptus raveretiana*
- *Livistona lanuginosa*
- *Acacia crombiei*
- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- Koala (*Phascolarctos cinereus*)
- Black throated-finch (*Poephila cincta cincta*)
- Julia Creek dunnart (*Sminthopsis douglasi*)
- White-throated needletail (*Hirundapus caudacutus*)
- Red goshawk (*Erythrotriorchis radiatus*)
- Night parrot (*Pezoporus occidentalis*)
- Painted honeyeater (*Grantiella picta*)
- Australian painted-snipe (*Rostratula australis*)
- Ornamental snake (*Denisonia maculata*)
- Plains death adder (*Acanthophsis hawkei*)
- Grey falcon (*Falco hypoleucos*)
- Glossy ibis (*Plegadis falcinellus*)
- Latham's snipe (*Gallinago hardwickii*)
- Gull-billed tern (*Gelochelidon nilotica*)
- Caspian tern (*Hydroprogne caspia*)
- Fork-tailed swift (*Apus pacificus*)
- Oriental pratincole (*Glareola maldivarum*)
- Marsh sandpiper (*Tringa stagnatillis*)
- Wood sandpiper (*Tringa glareola*)

A summary of the outcomes of the assessment of significant impacts on MNES communities, flora and fauna is summarised in Table 18-37. The threatened species and communities that are assessed as being likely to occur or confirmed present are considered unlikely to be significantly impacted by the Project. Justification for the assessment outcomes for specific listed threatened communities and species that have been confirmed present or considered likely to occur are provided in the following sections.

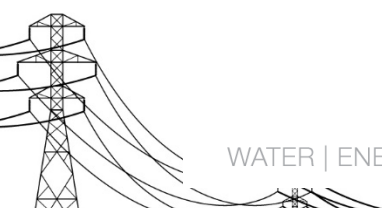
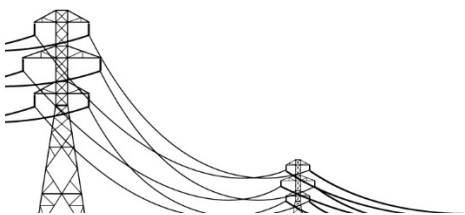


Table 18-40 Summary of significant impacts on MNES communities and species

Species	Significant impact criteria								
	Lead to a long-term decrease in size	Reduce the area of occupancy	Result in fragmentation	Adversely affect habitat critical to the species survival	Disrupt the breeding cycle	Impact the species habitat	Introduce invasive species	Introduce disease that may cause the species to decline	Interfere with the recovery of the species
Threatened ecological communities									
<i>Semi-evergreen vine thickets</i>	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Threatened flora									
<i>Eucalyptus raveretiana</i>	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
<i>Livistona lanuginosa</i>	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
<i>Acacia crombiei</i>	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Threatened fauna									
Squatter pigeon	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Koala	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Black-throated finch	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Julia Creek dunnart	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
White-throated needletail	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely



Species	Significant impact criteria								
	Lead to a long-term decrease in size	Reduce the area of occupancy	Result in fragmentation	Adversely affect habitat critical to the species survival	Disrupt the breeding cycle	Impact the species habitat	Introduce invasive species	Introduce disease that may cause the species to decline	Interfere with the recovery of the species
Red goshawk	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Night parrot	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Painted honeyeater	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Australia painted snipe	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Plains death adder	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Ornamental snake	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Migratory species									
Eight bird species (combined)	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely

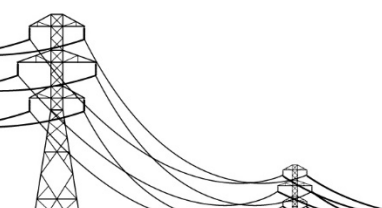


18.5.5.2 Listed Threatened Ecological Communities

A significance of impact assessment of the Project on the *semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* TEC is provided in Table 18-38. The remaining TECs identified in the desktop assessment were not assessed as they were considered unlikely to occur within the study area.

Table 18-41 Significant impact assessment – semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC

Significant impacts criteria	Assessment
Reduce the extent of an ecological community.	Unlikely Several patches of the TEC were identified within the study area; however, the Project has been designed to avoid all of these patches, such that the closest TEC patch is 1 km from the corridor selection. No reduction in the extent of the TEC will occur as a result of the project. Furthermore, the TEC patches within the study area are up-gradient of the corridor selection, such that any indirect impacts from erosion and sediment transport are unlikely to occur.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	Unlikely No TEC patches occur within the corridor selection. No clearing within the vicinity of the TEC patches is proposed. The project will not result in the fragmentation of any TEC patches.
Adversely affect habitat critical to the survival of an ecological community.	Unlikely No TEC patches occur within the corridor selection, with the closest patch located approximately 1 km from the corridor selection. Accordingly, no habitat critical to the survival of the TEC will be directly impacted. Weed and fire control measures will be implemented to prevent any indirect impacts to the habitats of nearby TEC patches.
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 The landscape is not proposed to be altered in a way that will impact the abiotic features necessary for the TEC. Where access tracks are available, existing tracks will be used within the project area. Weed and fire control measures will be implemented to prevent any indirect impacts to the TEC. Groundwater will not be impacted and surface water drainage patterns will remain largely unchanged. Furthermore, the TEC patches within the study area are up-gradient of the corridor selection, such that any indirect impacts from erosion and sediment transport are unlikely to occur.



Significant impacts 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 No significant change in the species composition of the TEC is expected. The introduction of a weed control program through the CEMP is likely to result in the overall reduction of invasive species within the corridor selection. Equipment and personnel will be subject to weed hygiene requirements and are unlikely to contribute to the introduction of additional invasive species to the area. Fire control measures will also be implemented to prevent impacts to the habitats of nearby TEC patches.
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, or	Unlikely The introduction of a weed control program through the CEMP is likely to result in the overall reduction of invasive species across the corridor selection. Equipment and personnel will be subject to weed hygiene conditions and are unlikely to contribute to the introduction of additional invasive species to the site. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases. Chemical use will be strictly controlled through the implementation of the CEMP. Given the distance to the nearest TEC patches and their up-gradient position in the landscape, indirect impacts from chemicals is not expected to occur.
Interfere with the recovery of an ecological community.	Unlikely No TEC patches occur within the corridor selection. Consequently, no clearing of vegetation within a TEC is proposed for the Project. Indeed, the introduction of weed and fire control measures will likely result in improved conditions for the recovery of the community. Large areas of historically cleared land will also remain available for the regeneration of the TEC.

18.5.5.3 Listed threatened flora

Three listed threatened flora species were confirmed present or considered likely to occur in the corridor selection. An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) for these species was undertaken, with results presented in the following sub-sections. The assessment indicates that no significant impacts to listed threatened species will occur as a result of the Project.

Eucalyptus raveretiana

A significance of impact assessment of the Project on *Eucalyptus raveretiana* (Vulnerable under the EPBC Act) is provided in Table 18-39.

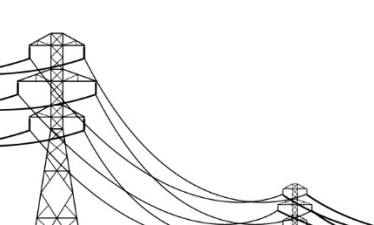


Table 18-42 Significant impact assessment – *Eucalyptus raveretiana*

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The total mapped suitable habitat for the species within Project activity areas is estimated as 0.002 ha. This represents a very small percentage (<0.001 %) of habitat available within a local (2.5 km) and region (10 km) buffer of the Project area and is unlikely to lead to long-term decrease in the size of the population. The occurrences of <i>E. raveretiana</i> within the corridor selection may be considered an important population due to their location near to the north-western limit of the species range. These individuals are potentially part of a sub-population that is within a larger overall population. The species is known from at least 23 sites and is considered to potentially have >100 sub-populations throughout its range (DoEE, 2019). Due to the concentrated location of this species within the riparian corridors of only a selection of waterways in the study area between KP48-49 WD and KP71-72 WD (Burdekin River to the south of the corridor selection), the Project corridor selection will be able to span the occurrences of recorded individuals. At the waterways that are known habitat, higher towers placed closer to the riparian areas will be designed so as to avoid needing to remove individuals present and their immediate supporting habitat. Trimming of the mature trees that are greater than 20 m tall may be required, depending on the final placement of towers, with periodical maintenance required during the operation of the Project. Trimming will only occur where it is within five metres of the transmission line at maximum sag. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. No alteration of hydrological regimes or groundwater interactions will results from the construction or operation of the Project. Construction and operation management practices, including weed control, will assist with reducing long-term effects on the habitat for this species. The Project is therefore unlikely to decrease the size of the <i>E. raveretiana</i> population.
Reduce the area of occupancy of an important population	Unlikely Due to the concentrated location of this species along the banks and within the riparian corridors of only a selection of waterways in the study area between KP48-49WD and south of KP71-72 WD, the Project corridor selection will be able to span the occurrences of individuals. At the waterways where the species is known to occur, higher towers placed closer to the riparian areas will be used to avoid needing to remove individuals present. Trimming of the taller mature trees may be required depending on the final placement of towers, with periodical maintenance required during the operation of the Project. Therefore the Project is unlikely to reduce the area of occupancy of the <i>E. raveretiana</i> population.
Fragment an existing important population into two or more populations	Unlikely The Project intersects at least one known occurrence of individuals of <i>E. raveretiana</i> along Oakey Creek, and a likely occurrence along the Burdekin River, however the design will be able to avoid clearing individuals of this species and may only require trimming of trees greater than 20 m height, depending on the final placement of towers. Additional

Significant impacts criteria	Assessment
	infrastructure, such as access tracks, will avoid clearing within supporting habitats along the riparian corridor. Existing crossings and clearings will be used where present. Therefore the riparian corridor will remain intact wherever possible at these locations of suitable habitat. Although the Project has potential to introduce weed species that can reduce habitat value, the implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable habitat. Therefore, the Project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely Due to the occurrences within the study area potentially being important populations of <i>E. raveretiana</i>, it is considered that the known occurrences can also be considered to be habitat critical to the survival of a species. Due to the concentrated location of this species along the banks and within the riparian corridors of only a selection of waterways in the study area between KP48-49 WD and south of KP71-72 WD, the Project corridor selection will be able to span the occurrences of individuals. Trimming of the taller mature trees may be required depending on the final placement of towers, with periodical maintenance required during the operation of the Project. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. It is not considered that the mapped suitable habitat areas are habitat critical to the survival of the species, due to the absence of records of individuals during previous and current field surveys. Wherever possible given construction and landholder constraints, areas of suitable habitat for <i>E. raveretiana</i> will be avoided by the Project (i.e. by spanning over corridors and placing associated infrastructure in pre-existing clearings and crossings). Due to the proposed avoidance of these habitat areas, the Project is unlikely to adversely affect any habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely The species flowers between December and January and fruits mature between March and April, with insects thought to be the primary pollinator (TSSC, 2012). This species does not vegetatively reproduce, although it does re-sprout after fire (TSSC, 2012). Due to the proposed retention of the existing populations of <i>E. raveretiana</i> and its supporting habitat, through the placement of higher towers in a manner that avoids clearing of this species, pollination and seed dispersal is expected to continue without disruption. Any potentially required trimming of the taller trees will be undertaken outside of the summer-autumn flowering and fruiting period for the species. Therefore the Project is not expected to disrupt the reproductive cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that	Unlikely The corridor selection has potential to disturb approximately 0.002 ha of mapped suitable habitat for <i>E. raveretiana</i>. This represents a small percentage (<0.001 %) of habitat available within a 10 km buffer of the Project and is unlikely to decrease the availability or quality of surrounding habitat.

Significant impacts criteria	Assessment
the species is likely to decline	The Project proposes to avoid habitat for this species through designing the placement and heights of towers outside of and spanning across riparian corridors of higher order streams that are known or likely to have this species present. Other infrastructure, such as access tracks and assembly areas, will avoid clearing of any riparian corridors mapped as known or potential habitat for this species. No impacts from the Project will result in the altered hydrological regime of the waterways that are supporting habitat for this species. There is potential for impacts during the operation of this Project, such as through increased weed spread, however weed management will occur within those areas over the lifetime of the Project to mitigate such impacts. Access during construction and operation to or through riparian corridors that are suitable habitat will be avoided, using existing access and crossings where present. Therefore, the Project is unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Known threats from invasive species include smothering by rubber vine (<i>Cryptostegia grandiflora</i>) (TSSC, 2012). The species is also threatened by exotic grasses that inhabit creek banks, such as <i>Panicum maximum</i>, and other weeds if they grow in large infestations, such as lantana, bellyache bush and chinee apple. Feral pigs and overgrazing can also be a threat to this species. The 2011 SEIS noted that the riparian habitat along Burdekin River was heavily degraded by the above weed species, and the habitat along Oakey Creek was in better condition however still impacted by rubber vine and chinee apple. The general presence of these species in the local area was confirmed during the 2019 surveys. Due to the avoidance measures (spanning across the riparian corridors and avoiding clearing within the riparian corridors) and mitigation measures (weed management protocols during construction and operation), it is considered unlikely that additional invasive species would be introduced or increase spread of existing weed species would result from the Project construction or operation. Weed management protocols will include weed hygiene protocols (e.g. washdowns) for vehicles and machinery between certain properties that have invasive species infestations and those areas that are weed free or have ecological significance, and restrictions to existing access tracks in the vicinity of the riparian habitats. Chemicals for weed control will be prohibited in proximity to known occurrences of <i>E. raveretiana</i>, however may be used appropriately in other areas of suitable habitat. Weed control will be undertaken during construction and operation of the Project. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's Environmental Management Plan (EMP). Therefore the Project is considered unlikely to result in invasive species becoming established in the <i>E. raveretiana</i> habitat.
Introduce disease that may cause	Unlikely

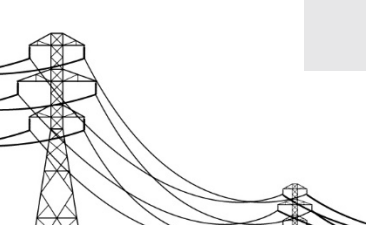
Significant impacts criteria	Assessment
the species to decline	No diseases or pathogens are identified among current known threats to <i>E. raveretiana</i> . The weed washdown and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. The risks to this species associated with disease or pathogen introduction are therefore considered negligible.
Interfere substantially with the recovery of the species	Unlikely The corridor selection has potential to disturb approximately 0.002 ha of mapped suitable habitat for <i>E. raveretiana</i>. This represents a small percentage (<0.001 %) of habitat available within a 10 km buffer of the Project and is unlikely to interfere substantially with the recovery of the species. While the Project intersects areas where known occurrences of <i>E. raveretiana</i> occur, the Project will avoid clearing individual trees and adjacent supporting habitat within the corridor selection and for any additional temporary or permanent infrastructure or construction activity. Access during construction and operation to or through riparian corridors that are suitable habitat will be avoided, using existing access and crossings where present. If mature trees greater than 20 m tall are required to be trimmed along the corridor selection, this will be undertaken outside of the known summer-autumn flowering and fruiting period to avoid disrupting the species reproductive cycle. Therefore the Project is considered unlikely to interfere substantially with the potential recovery of the <i>E. raveretiana</i>.

Livistona lanuginosa

A significance of impact assessment of the Project on *Livistona lanuginosa* (Vulnerable under the EPBC Act) is provided in Table 18-40.

Table 18-43 Significant impact assessment - *Livistona lanuginosa*

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The total mapped suitable habitat for the species within Project activity areas is estimated as 2.18 ha. This represents a small percentage (0.007 %) of habitat available within a 10 km buffer of the Project and is unlikely to lead to a long-term decrease in the size of the population. The occurrences of <i>L. lanuginosa</i> within the corridor selection are considered to be part of an important population due to only seven distinct populations being recorded in Queensland and their location near to the north-western limit of the species range. There were 57 individuals recorded at the Campaspe River crossing (BAAM, 2011), with another individual observed further upstream at the edge of the study area. Another occurrence was recorded on an easterly tributary to the Campaspe River within the study area, with 11 individuals recorded in 2019. Due to the concentrated location of this species within the riparian corridors and adjacent alluvial plains of only a selection of waterways in the study area (recorded between KP123 WD and KP148 WD, the Project corridor selection will be designed to either avoid or span over the occurrences of individuals. At the waterways that have known occurrences, higher towers will be placed either side of the riparian habitats so as to avoid removing individuals present and additional



Significant impacts criteria	Assessment
	disturbances in their supporting habitat. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences and/or span across lower height trees or trees at the margins of the corridor selection. Locations of adult individuals can also be seen on high resolution aerial imagery, so towers can be placed to avoid prior to the pre-clearance surveys. There is a longer section of known habitat between KP 138-139 WD, being up to 750 m wide, which may require a tower to be placed in between braided channels in narrower sections of the waterway crossing. The <i>L. lanuginosa</i> trees are typically less than 20 m tall, therefore higher towers should be able to span across occurrences of this species, with no trimming or maintenance required. Additional infrastructure, such as tracks and assembly areas, will avoid the known occurrences and their supporting habitat for this species. Existing access and clearings will be used where present. No alteration of hydrological regimes or groundwater interactions will results from the construction or operation of the Project. Construction and operation management practices, including weed control, will assist with reducing long-term effects on the habitat for this species. The Project is therefore unlikely to decrease the size of the <i>L. lanuginosa</i> population.
Reduce the area of occupancy of an important population	Unlikely Due to the concentrated location of this species within the riparian corridors of only a selection of waterways in the study area between KP123 WD and KP148 WD, the Project corridor selection will be able to span the occurrences of individuals. At the waterways that have known occurrences, higher towers will be placed either side of the riparian habitats so as to avoid removing individuals present and additional disturbances in their supporting habitat. Pre-clearance surveys will be undertaken prior to final locating of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. The trees are typically less than 20 m tall, therefore higher towers should be able to span across occurrences of this species, with no trimming or maintenance required. Therefore the Project is unlikely to reduce the area of occupancy of the <i>L. lanuginosa</i> population.
Fragment an existing important population into two or more populations	Unlikely The Project intersects at least two known occurrences of individuals of <i>L. lanuginosa</i> along Oakey Creek and Campaspe River, however the design will be able to avoid clearing individuals of this species, through the final placement of towers and increased tower heights. There is a longer section of known habitat between KP138-139 WD, being up to 750 m wide, which may require a tower to be placed in between braided channels in narrower sections of the waterway crossing. However the individuals occurring on different sides of the corridor selection will not be fragmented into different populations because the Project will avoid clearing of individuals of the species, and the transmission line infrastructure will not have the effect of fragmenting habitat areas with the species maximum height being typically below 20 m (which is the maximum clearance for spans using higher towers (75 m). Additional infrastructure, such as access tracks and assembly areas, will avoid clearing within the riparian corridor through using existing accesses and crossings where present and finding alternative access routes if necessary. Therefore the riparian corridor will remain intact at these locations of known occurrences and supporting habitat. Although the Project has potential to introduce weed species that can reduce habitat value, the implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime

Significant impacts criteria	Assessment
	of the Project is expected to maintain the connectivity and extent of suitable habitat. Therefore, the Project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely Due to the occurrences within the study area being considered important populations of <i>L. lanuginosa</i>, it is considered that these known habitats can also be considered to be habitat critical to the survival of a species. Due to the proposed avoidance of these known occurrences, the Project is unlikely to adversely affect any habitat critical to the survival of the species. Pre-clearance surveys will be undertaken prior to final siting of towers and other infrastructure, to avoid individual occurrences or span across lower height trees or trees at the margins of the corridor selection. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. It is not considered that the mapped suitable habitat areas are habitat critical to the survival of the species, due to the limited occurrence of this species and absence of observations of individuals during previous and current field surveys. There is additional suitable habitat along the Campaspe and Cape Rivers and their tributaries, either side of the corridor selection. Wherever possible, given construction and landholder constraints, areas of suitable habitat for <i>L. lanuginosa</i> will be avoided by the Project (i.e. by spanning over corridors and placing associated infrastructure in pre-existing clearings and crossings).
Disrupt the breeding cycle of an important population	Unlikely The species flowers during spring and fruits in summer-autumn, with dispersal via flood water and along waterways (DoEE, 2019). Due to the proposed avoidance of the existing populations of <i>L. lanuginosa</i> and its known habitat, through the placement of higher towers in a manner that avoids clearing of this species. No trimming is will be required due to the higher towers (75 m tall) being able to span vegetation less than 20 m tall. No alteration of hydrological regimes or groundwater interactions will results from the construction or operation of the Project. Therefore the Project is not expected to disrupt the reproductive cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The Project will potentially approximately 2.18 ha of mapped suitable habitat. This represents a small percentage (0.007 %) of habitat available within a 10 km buffer of the Project and is unlikely to lead to a decrease in the availability or quality of habitat for <i>L. lanuginosa</i>. The Project proposes to avoid individual occurrences and surrounding supporting habitat for <i>L. lanuginosa</i> through siting of towers and other infrastructure and spanning across riparian corridors. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species. There is potential for impacts during the operation of this Project, such as through increased weed spread, however weed protocols and management will occur within those areas over the lifetime of the Project to mitigate such impacts. Therefore, the Project is unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the	Unlikely Known threats to the species include the introduction of invasive weed species. A number of weeds currently exist in the riparian habitats, such as parthenium and rubber vine. The species is also threatened by trampling by grazing stock.

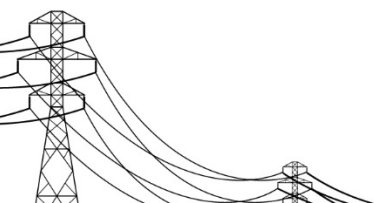
Significant impacts criteria	Assessment
vulnerable species' habitat	The 2011 SEIS noted that the riparian habitat along the Campaspe River was in good condition with scattered infestations of rubber vine and parkinsonia. Due to the avoidance measures (spanning across the riparian corridors and avoiding clearing within the riparian corridors) and mitigation measures (weed management protocols during construction and operation), it is considered unlikely that additional invasive species would be introduced, or increased spread of existing weed species would result, from the Project construction or operation. Weed management protocols will include weed hygiene measures (e.g. washdowns) for vehicles and machinery between certain properties that have invasive weed infestations and those areas that are weed free or have ecological significance, and restrictions to existing access tracks in the vicinity of the riparian habitats. Chemicals for weed control will be prohibited in proximity to known occurrences of <i>L. lanuginosa</i>, however may be used appropriately in other areas of suitable habitat. Weed control will be undertaken during construction and operation of the Project. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of this with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's EMP. Therefore the Project is considered unlikely to result in invasive species becoming established in the <i>L. lanuginosa</i> habitat.
Introduce disease that may cause the species to decline	Unlikely No diseases or pathogens are identified among current known threats to <i>L. lanuginosa</i>. The weed washdown and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. The risks to this species associated with disease or pathogen introduction are therefore considered negligible.
Interfere substantially with the recovery of the species	Unlikely While the Project intersects areas mapped as known or potential habitat for the species, the Project will avoid clearing in the known habitat of <i>L. lanuginosa</i> (and any potential habitat occurring further upstream and downstream and on associated tributaries) within the corridor selection and for any additional temporary or permanent infrastructure or other disturbance. Additional infrastructure, such as tracks and assembly areas, will avoid the supporting habitat for this species by using existing access and crossings where present. General construction access to the supporting habitats for this species will be minimised. No alteration of hydrological regimes or groundwater interactions will results from the construction or operation of the Project. Therefore the Project is considered unlikely to interfere substantially with the potential recovery of the <i>L. lanuginosa</i>.

Acacia crombiei

A significance of impact assessment of the Project on *Acacia crombiei* (Vulnerable under the EPBC Act) is provided in Table 18-41.

Table 18-44 Significant impact assessment – *Acacia crombiei*

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely No individuals of <i>Acacia crombiei</i> have been recorded within the study area in the CopperString 1.0 EIS or 2019/2020 field surveys. The total mapped suitable habitat for the species within Project activity areas is estimated as 105.46 ha. This represents approximately 0.05% of the available habitat mapped at the regional scale (within a 10 km buffer of the Project). The species occurs outside the study area in areas to the north and south, in 15 subpopulations, and potentially comprising 76,000 plants (DoEE, 2019). It is unlikely that impacts to mapped potential habitat within the corridor selection will lead to a long-term decrease in the size of the population. Pre-clearance surveys will be undertaken in potential habitat prior to final siting of towers and other infrastructure, to avoid any potential individual occurrences. Should any individuals be identified, the transmission line can be designed to span over individuals as they are typically less than 10 m tall, and avoid impacting surrounding open woodland clearing by using taller towers and greater spans where safety will not be compromised. Construction and operation management practices, including weed control, will assist with reducing long-term effects on the potential habitat for this species. The Project is therefore unlikely to decrease the size of the <i>A. crombiei</i> population.
Reduce the area of occupancy of an important population	Unlikely No individuals of <i>A. crombiei</i> have been recorded within the study area in the CopperString 1.0 EIS or 2019/2020 field surveys. The area of occupancy is stated as 1,000 km² in the species profile (DoEE, 2019), and does not currently include the study area or Project area. Therefore the Project is unlikely to reduce the area of occupancy of the <i>A. crombiei</i> population.
Fragment an existing important population into two or more populations	Unlikely The current distribution is considered to consist of 15 subpopulations, which occur both north and south of the study area. No individuals are known to occur within the Project area. Pre-clearance surveys will be undertaken within suitable habitat to confirm that individuals of <i>A. crombiei</i> do not exist within areas to be cleared. If individuals are identified, the infrastructure will be placed to avoid clearing of occurrences and span across habitats using higher towers and/or greater span distances. The transmission line infrastructure will not have the effect of fragmenting an existing population or likely habitat areas. Although the Project has potential to introduce weed species that can reduce habitat value, the implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable habitat. Therefore, the Project is unlikely to fragment the population into two or more populations.



Significant impacts criteria	Assessment
Adversely affect habitat critical to the survival of a species	Unlikely No occurrences of <i>A. crombiei</i> are known from within the study area. The mapped suitable habitat areas are not considered to be habitat critical to the survival of the species, due to the absence of observations of individuals during previous and current field surveys. There is suitable habitat mapped within the study area and in areas further north and south of the study area, outside of the corridor selection. The Project is unlikely to adversely affect any habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely There is limited information available in public databases regarding the reproductive cycle of this species. Considering the lack of recorded individuals in the study area and the availability of surrounding potential habitat, it is unlikely that the Project would disrupt the reproductive cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The Project has the potential to disturb 105.46 ha of mapped suitable habitat for <i>A. crombiei</i>. This represents approximately 0.05% of the available habitat mapped at the regional scale (within a 10 km buffer of the Project). These suitable habitat areas generally have existing disturbances due to grazing, clearing and weed invasion. There is potential for impacts to mapped suitable habitat during the construction and operation of this Project, such as through increased weed spread; however weed protocols and management will occur within those areas over the lifetime of the Project to mitigate such impacts. The Project is considered unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely A number of weed species have been recorded within the potential habitat areas mapped for <i>A. crombiei</i>, including prickly acacia, parkinsonia and pasture grasses such as buffel grass. The species is also threatened by overgrazing from domestic stock and occurs across land used for cattle grazing. Due to the mitigation measures (weed management protocols during construction and operation), it is considered unlikely that additional invasive species would be introduced, or increased spread of existing weed species would result, from the Project. Weed management measures will include weed hygiene protocols (e.g. washdowns) for vehicles and machinery between certain properties that have invasive weed infestations and those areas that are weed free or have ecological significance, and restrictions to existing access tracks in the vicinity of the ecologically significant habitats. The Project is unlikely to result in increased feral animal or grazing stock abundance as the Project will not introduce any external food or water sources or changed grazing regimes. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of this with the intent to prevent negative impacts of invasive species as a result of the proposed action. Mitigation measures will be outlined further in the Project's EMP. Therefore the Project is considered unlikely to result in invasive species becoming established in the <i>A. crombiei</i> habitat.
Introduce disease that may cause the species to decline	Unlikely No diseases or pathogens are identified among current known threats to <i>A. crombiei</i>. The weed washdown and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. The risks to this species associated with disease or pathogen introduction are therefore considered negligible.

Significant impacts criteria	Assessment
Interfere substantially with the recovery of the species	Unlikely While the Project intersects areas mapped as suitable habitat for the species, the Project will not impact any known occurrence or supporting habitat of <i>A. crombiei</i> within the corridor selection or for any additional temporary or permanent infrastructure or other disturbance. Therefore the Project is considered unlikely to interfere substantially with the potential recovery of the <i>A. crombiei</i> .

18.5.5.4 Listed threatened fauna

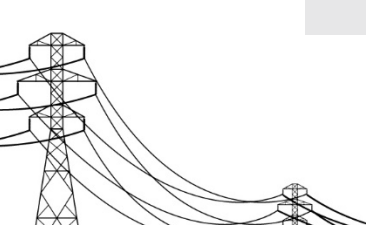
Thirteen species of MNES conservation significant fauna species were confirmed present or likely to occur within the study area. A significance of impacts assessment under the EPBC Act for each MNES species is presented below. A number of species have the potential to be significantly impacted by the Project. These are generally species such as the ornamental snake, southern black-throated finch and red goshawk, which are reliant on localised high value resources that would experience significant impact if directly affected. However, through appropriate mitigation measures, for all species, the impacts can be reduced to a non-significant level.

Squatter pigeon (southern)

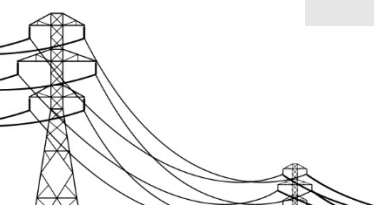
A significance of impact assessment of the Project on the squatter pigeon (Vulnerable under the EPBC Act) is provided in Table 18-42.

Table 18-45 Significant impact assessment – squatter pigeon

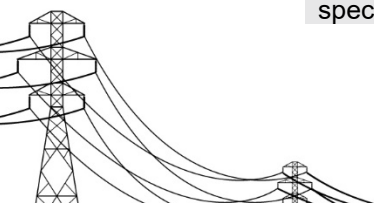
Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely Important populations of the squatter pigeon (southern) are listed as those small, isolated and sparsely distributed sub-populations at the southern extent of the sub-species current range. This includes areas south of the Carnarvon Range (Squatter Pigeon Workshop 2011). The local population is not among the important populations recognised by the Squatter Pigeon Workshop (2011). While the local population is at the northern extent of the sub-species range, squatter-pigeons are locally abundant and therefore unlikely to represent an important population. The total mapped suitable habitat for the species within Project activity areas is estimated as 32.54 ha of foraging habitat (representing 0.3% and 0.07% of foraging habitat within a 2.5 km and 10 km buffer of the Project respectively) and 5.25 ha of breeding habitat (representing 0.14% and 0.05% of breeding habitat within a 2.5 km and 10 km buffer of the Project respectively) is unlikely to lead to a long-term decline of an important population and is considered unlikely to lead to a significant decline in the local population. Construction of the Project has the potential to cause direct mortality and injury of squatter pigeons as result of clearing activities and / or vehicle strikes. This will be managed to minimise impact, but is not expected to be of sufficient scale to cause a drain on the local population, given that there will be no broad-scale land clearance. The Project is expected to be relatively benign in terms of its impact during the operational phase with negligible noise, lighting and vibration. Increased land management, particularly the potential for



Significant impacts criteria	Assessment
	control of weeds has the potential to enhance the value of local habitats for the squatter pigeon. The Project is therefore unlikely to decrease the size of the local squatter pigeon population.
Reduce the area of occupancy of an important population	Unlikely As detailed above, the local population is unlikely to be considered an important population. The potential loss of 32.54 ha of foraging habitat will not lead to a reduction in the area of occupancy of the local population, as 99.8% of habitat will be retained within a 10 km buffer. The species is therefore likely to persist within the proposed corridor selection. Given the relatively benign nature of the Project in its operational phase, and the continued presence of suitable habitat within the local area, the Project is unlikely to reduce the area of occupancy of the local squatter pigeon (southern) population.
Fragment an existing important population into two or more populations	Unlikely Within the Project area, the squatter pigeon (southern) already utilises habitats that have been subject to a level of fragmentation, occurring in sparse, open woodland habitats impacted by cattle grazing, dams and local track networks. Clearing for the Project is expected to be linear with the rehabilitation of cleared areas not required for operation to significantly reduce the impacts of the Project. Habitat connectivity will be maintained among areas of habitat both within the study area and adjacent to it by maintaining ground-level substrates and vegetation and by retaining existing unsealed tracks that provide pathways for local squatter pigeon movement. Although the Project has potential to introduce weed species that can reduce habitat value, this is not expected to be at a magnitude substantially greater than existing pastoral land use. The implementation of a weed management plan will mitigate this risk. Increased weed management through the lifetime of the Project is expected to maintain the connectivity and extent of suitable ground-level habitats and continue to facilitate ground-level movement of the squatter pigeon (southern). Given the loss of habitat represents only 0.6% of habitat locally available (i.e. within a 2.5 km buffer) and dispersal corridors along unsealed tracks will be increased, the Project is unlikely to fragment the population into two or more sub-populations.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species is not defined in the Commonwealth listing advice but is likely to include breeding habitat, particularly breeding habitat for important populations. The total mapped suitable habitat for the species within Project activity areas is estimated as 5.25 ha of breeding habitat. However, this loss is not likely to be considered significant in the context of the regional landscape, representing only 0.14% of that available locally (i.e. within a 2.5 km buffer) and 0.05% of that available regionally (i.e. within a 10 km buffer). Further reduction of impact on breeding habitat will be achieved through targeted surveys to identify and avoid nesting habitat by micro-siting towers, access tracks and other supporting infrastructure. Access to water sources and local on-ground connectivity between breeding and foraging habitat will be maintained during all stages of the Project.



Significant impacts criteria	Assessment
	Tracks will be retained and managed as dusty, unsealed tracks to maintain opportunities for dispersal and local movement. While the Project will impact on habitat critical to the survival of the species, with a combination of habitat management and rehabilitation, the result of the Project is unlikely to adversely affect the local population.
Disrupt the breeding cycle of an important population	Unlikely As detailed above, the local population is not among those important populations identified in the Commonwealth listing advice for the species. Breeding habitat for the squatter pigeon (i.e. hills and rises with rocky, loamy and sandy soils) occur within the eastern extent of the study area. While approximately 5.25 ha of potential breeding habitat is mapped within Project activity areas, this represents only 0.14% of potential breeding habitat available locally (i.e. within 2.5 km of the Project) and 0.05% of that available regionally (i.e. within 10 km). Micro-siting of towers and other infrastructure will be undertaken to further minimise the impact on breeding habitat. Connectivity will be maintained with adjacent drinking sources (e.g. dams and water troughs) to support the viability of local breeding habitats. Construction activities have the potential to cause short-term disruption to breeding activities immediately adjacent to construction areas. Construction will be prioritised to be undertaken during dry conditions to reduce the potential for indirect impacts to tracks and adjoining habitats from stormwater run-off from construction areas. While this coincides with the peak breeding season for the species, the impact will be temporary and is unlikely to result in a loss of an entire annual cohort as the species is expected to continue to breed in some areas that are located further from construction areas and the species is known to breed all year round (Squatter Pigeon Workshop 2011). The Project is therefore not expected to disrupt the breeding cycle of the 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 will have only minimal impact on breeding habitat, resulting in a potential loss of 5.25 ha (as a maximum), representing 0.14% of that available within a 2.5 km buffer. The loss of 32.54 ha of foraging habitat is unlikely to represent a significant decrease in the availability of foraging habitat for the species at a population level, as it represents only 0.05% of the available foraging habitat within the surrounding 10 km buffer. Where towers or construction laydown areas are situated within squatter pigeon (southern) habitat, these areas of foraging habitat will still be available after construction. Given the small magnitude of the loss of habitat and the potential for ongoing use of these areas, the Project is unlikely to cause a decline in the local population.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Known feral predators of the squatter pigeon (southern) (i.e. dogs, cats and foxes) have been confirmed present within the study area. The Project will not introduce any external food sources that could increase the local densities of feral predators. Feral animal management protocols will be implemented during the clearing, construction, operation and decommissioning phases of the Project with the intent to prevent negative impacts of invasive species. Mitigation measures will



Significant impacts criteria	Assessment
	be outlined further in the Project's EMP. Unmitigated, the Project has the potential to reduce the extent and quality of local foraging habitat by facilitating the on-site spread of weeds. The inclusion of weed management controls (also contained in the Project EMP) has the potential to enhance the local foraging habitat values and result in positive outcome for the squatter pigeon (southern).
Introduce disease that may cause the species to decline	Unlikely No diseases or pathogens are identified among current known threats to the squatter pigeon (southern). The weed-washdown and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. This risks to squatter pigeons associated with disease transmission are therefore considered negligible.
Interfere sustainably with the recovery of the species	Unlikely The Project is considered unlikely to adversely affect the potential recovery of the species. As previously mentioned, the loss of foraging habitat is unlikely to be significant at a local or regional scale. Implementation of a Weed Management Plan for the Project has the potential to increase the value of local habitats. Local noise disturbance and mortality threats associated with the Project are also expected to be low and any removal, isolation or decrease in availability or quality of habitat for this species is unlikely to interfere with the recovery of the species.

Koala

The significance of the Project's impacts on the koala has been assessed in accordance with the EPBC Referral Guidelines for the vulnerable koala (DoE, 2014b), specifically including:

- An assessment of the potential to impact 'habitat critical to the survival of the koala.
- An assessment of the potential to interference with the recovery of the species.

The significance of impacts are then summarised using the framework detailed in the Significant Impact Guidelines 1.1 (DoE 2013) to provide consistency of approach with other conservation significant species listed under the EPBC Act.

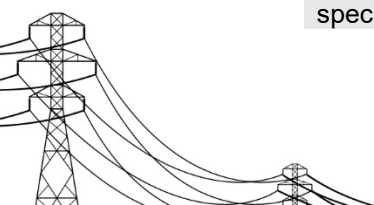
The Project is **unlikely** to have a significant impact on the koala as detailed in Table 18-43. Justification for this assessment is provided below, and has been made with reference to the Referral guidelines for the vulnerable koala (DoE 2014).

Habitats within the Project area are considered habitat critical to the survival of the species, scoring 8 on the habitat assessment toolkit in the Referral guidelines for the vulnerable koala (DoE 2014) as shown in Table 18-44. Habitat scoring ≥ 5 is considered habitat critical to the survival of the species. The EPBC Act Referral Guidelines for the Koala (DoE 2014) outlines the criteria and assessment process required for determining critical habitat for the survival of the koala. The population known to occur within the study area was assessed as an inland population as the region receiving annual rainfall of < 800 mm.

Table 18-46 Significant impact assessment - koala

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of a species	Unlikely The concept of 'important populations' has not been applied for koala, given a lack of sufficient information on the national population (DAWE 2020b) and the Project does not occur near the edge of the species' known range (for combined populations of Qld, NSW and the ACT). The suitable habitat identified during desktop assessments and field surveys occurs within the Renewable Energy Hub, with the potential for the Project activities to disturb up to 97.04 ha of suitable koala habitat (comprising high, moderate and low value koala habitats). This represents a small percentage (0.02 %) of habitat available within a 10 km buffer of the Project area and is unlikely to lead to long-term decrease in the size of the population. The use of sequential clearing practices and the employment of a fauna spotter catcher during clearing will further mitigate to risks to the species. Additionally, the likelihood of vehicle strikes can be mitigated by the implementation of safe driving practices.
Reduce the area of occupancy of an important population	Unlikely The Project is not expected to result in the disappearance of koalas from a 2 km x 2 km area that would result in a reduction in the area of occupancy of the species. While the Project will intersect 700.39 ha of mapped suitable koala habitat, substantial avoidance of koala habitat has been achieved to reduce the on-ground clearance of koala food trees. By micro-siting towers, elevating spans to avoid riparian woodland and selecting construction access routes that minimise the need to clear koala food trees, the loss of koala habitat has been reduced to 97.04 ha. . For example, by avoiding the high value riparian habitats, the area of disturbance was reduced by 13.52 ha. The loss of 97.04 ha of koala habitat is accumulated over a linear distance of approximately 350 km. The loss of 97.04 ha is dispersed over a broad area and represents only 0.02 % of foraging habitat within a 10 km buffer of the Project. As a consequence, the local impacts within any 2 km x 2 km area will be relatively minor. Once operational, the Project will have negligible impact on the species, forming no barrier to koala movement. Given these factors, no reduction in the area of occupancy of the species is anticipated.
Fragment an existing important population into two or more populations	Unlikely The Project will cause an estimated loss of 97.04 ha of koala habitat. Koalas predominantly utilise riparian corridors for movement, particularly in the inland areas. Koala movement corridors have been protected from impact by elevating spans to avoid impact on riparian woodland. This will substantially reduce potential fragmentation that could otherwise have resulted from the Project. In more densely vegetated areas at the east of the Project, there will be a requirement to clear a 60 m-wide corridor. In the context of that landscape, the impact is not a substantial increase in fragmentation and not expected to pose a barrier to koala movement. No fencing or permanent access tracks will be required, further limiting the potential for barrier effects. Due to the high-set nature of the Project and the low density of woodland habitats along most of the project area, the Project will not

Significant impacts criteria	Assessment
	cause a substantial fragmentation of koala habitat or impose restrictions to koala movement.
Adversely affect habitat critical to the survival of a species	Unlikely The Project is unlikely to have an adverse impact on habitat critical to the survival of the species. The Project will result in a loss of 97.04 ha of koala habitat scoring 8 in the Commonwealth habitat toolkit. While this exceeds the threshold given in the Referral guidelines for triggering a significant impact, the guidelines state that the thresholds may not be relevant to all projects. Given the impact is dispersed over a linear distance of 350 km and impacts multiple koala populations that are spatially isolated from one another, the localised impacts are considered substantially reduced. The anticipated loss of habitat represents only 0.11% and 0.02% of koala habitat within a 2.5 km and 10 km buffer of the Project respectively. Given the method of clearing, incorporating a mix of selective and sequential clearing under the direction of koala-specialist spotter-catchers, the lack of anticipated fragmentation (due to the very sparse density at which koala food trees occur in the surrounding landscape) and the low density at which koalas occur, the Project is considered unlikely to have a significant adverse impact on habitat critical to the survival of the species in the context of the existing receiving environment.
Disrupt the breeding cycle of an important population	Unlikely The Project is not expected to disrupt the breeding cycle of the population. The koala breeding season is generally between September and March, with females giving birth to a single young between October and May. During the breeding season, males actively seek females and koala movements are more extensive. Without mitigation, the Project could lead to an increased risk of vehicle strike. Traffic volume, speed and visibility influence the koala collision rate. Prevett <i>et al.</i> (1995) found that road kills occurred where vehicle speeds exceeded 80 km/hr and where wider habitat corridors or linear forests occurred on both sides of the road. Potential impacts will be mitigated through implementation of on-site speed limits and signage in koala habitat areas. Clearing within koala habitat areas will be planned to occur outside of peak breeding season (if possible) and standard best practice sequential clearing using koala spotters will be exercised.
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 activities are predicted to occur within 97.04 ha of mapped suitable koala habitat, which accounts for only 0.02% of koala habitat within 10 km of the Project area. Although clearing will cause minor additional fragmentation of habitat and reduce the area of available habitat, the extent of linear habitat disturbance is not likely to decrease the availability or quality of habitat available to the local population to the extent that the species will decline.
Result in invasive species that are harmful to a vulnerable species becoming	Unlikely Invasive species including wild dogs already occur throughout the study area. Predatory species are attracted to prey opportunities presented by cleared linear corridors or prey moving away from disturbance areas. While new infrastructure has the potential to increase the risk of wild dog



Significant impacts criteria	Assessment
established in the vulnerable species' habitat	attack on koala by facilitating regional movement of dogs, these threats are already present within the receiving environment. Feral animal control measures will be implemented throughout the duration of the Project and have been designed to mitigate such risks. There is also potential for the spread of invasive weeds during the construction and operation phase. This potential will be addressed within a Weed Management Plan, and could provide the opportunity to enhance the quality of the environment utilised by the koala by providing mitigation measures to combat introduced species. The eradication of ground-covering weeds could enhance local koala movement. If mitigation measures are implemented correctly, the Project is unlikely to result in the introduction of invasive species that are harmful to the koala.
Introduce disease that may cause the species to decline	Unlikely The Project is not anticipated to introduce new diseases that may cause the species to decline. Stress may lead to an increase in the expression of chlamydia in koalas, however the implementation of mitigation measures such as sequential clearing, site speed limits, use of experienced spotter-catchers during clearing and the requirement to allow koalas to self-disperse will reduce disturbance-related stress and risk of disease. Additionally, the species is susceptible to <i>Phytophthora cinnamomi</i> due the soil fungus's ability to infect eucalypt species. Biosecurity requirements (e.g. weed and seed declarations) will be implemented for the Project, and thus, this risk has been assessed as low.
Interfere substantially with the recovery of the species	Unlikely Impacts will be relatively limited in spatial extent and will occur within a landscape in which koala habitat is relatively extensive and widespread. The Project is unlikely to substantially increase the mortality of koalas in the long term or lead to a substantial loss in habitat connectivity or barrier effects. All impacts are expected to be localised to within the Project area. Impacts along the transmission line are expected to be consistent with existing levels of impact from habitat fragmentation and exposure to road noise and traffic. The Project is unlikely to substantially interfere with the recovery of the species.

Assessment of koala habitat value

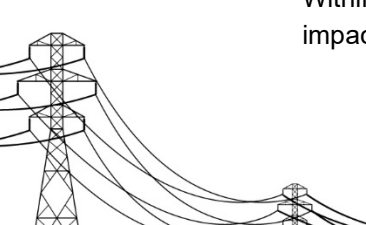
The Referral guidelines for the vulnerable koala (DoE 2014) provide a framework for scoring koala habitat value. These suggest that one koala habitat value should be assigned to a project area. However, this may not be appropriate for a linear project that spans over 1,000 km. To accurately reflect the value of habitats across the Project, habitat scores have been assigned for each habitat type (high, moderate and low) and section (coastal, inland and) in Table 18-23. All high, moderate and low value habitat within the coastal area scored 5 or more and were considered habitat critical to the survival of the species. Potential habitat further than 5 km from drought refuge in inland areas and further than 1 km from drought refuge in western inland areas scored less than 5 and were not considered habitat critical to the survival of the species. The assessment of impact has been undertaken based on the magnitude of the loss of habitat critical to the survival of the species and consideration of the significance of impact due to interference with the recovery of the species.

Table 18-47 Koala habitat assessment

Attribute	Score	Description	Justification
Koala occurrence	+ 2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of the koala was recorded from two locations within the corridor selection.
Vegetative composition	+ 2 (high)	Has forest, woodland or shrublands with emerging trees with 2 or more known koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata	Mixed eucalypt woodlands were recorded throughout much of the Renewable Energy Hub and areas in the east of the CopperString Core sections of the corridor selection.
Habitat connectivity	+ 2 (high)	Area is part of a contiguous landscape $\geq$ 1000 ha.	The corridor selection intersects a landscape that contains patches of vegetation above 1000 ha.
Key existing threats	+ 1 (high)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence,	The corridor selection extends through areas that are relatively uncleared and separate from large road networks. In addition, the corridor selection is not in proximity to any urban areas, thereby reducing the likelihood of dog attack. However, local koala populations are known to be subject to periodic threats from drought.
Recovery value	+ 1 (high)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context,	The habitat within the corridor selection is likely to be important in achieving the interim recovery objectives for the species. These being: • Protect and conserve the quality and extent of habitat refuges for the persistence of the species during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility . • Maintain the quality, extent and connectivity of large areas of koala habitat surrounding habitat refuges
Total	8	Habitat is considered critical to the survival of the species.	

Significance of impact on habitat critical to the survival of the species

Within areas of mapped koala habitat, the Project is able to achieve substantial avoidance of impact on koala food trees. Much of the vegetation intersected is less than 15 m in height and



can be spanned. Similarly, impact on taller riparian woodland vegetation has been avoided in most instances by elevating spanning heights at watercourse crossings. Formal access tracks do not need to be constructed and given the vegetation in most moderate and low value koala habitat areas is sparse to very sparse, construction vehicles can wind a path through open woodland to the tower locations without clearing vegetation. The total koala habitat areas (habitat critical to the survival of the koala) that have been mapped within Project activity areas is estimated in Section 18.5.2. Based on this, there is potential for the Project to disturb 97.04 ha of habitat critical to the survival of the koala. This represents 0.11% of koala habitat within a 2.5 km buffer and 0.02% of koala habitat within a 10 km buffer. While the magnitude of impact is not trivial, the loss of habitat is accumulated over a large geographic scale and will impact on koala populations that functionally isolated by large areas of unsuitable habitat. Population impacts will be limited to a local scale. The Referral guidelines for the vulnerable koala (DoE 2014) provide threshold limits above which a project may be likely to have a significant impact. However, the guidelines suggest that these thresholds may not apply to all projects. The thresholds may not be appropriate to assess impacts on a linear project of this scale is, as the loss of habitat is likely to be impacting multiple isolated koala populations.

Under such circumstances, the guidelines suggest the significance of a project's impact on habitat critical to the survival of the koala can be assessed using the assessment criteria for 'Impacts uncertain' as specified in Figure 2 of the Referral guidelines for the vulnerable koala (DoE 2014). In accordance with the guideline, the significance of the Project's impact on habitat critical to the survival of the koala was assessed based on the following factors:

- Koala habitat score:** Koala habitats within the Project area vary in quality across the extent of the Project ranging between scores of 4 and 8. High value habitats generally scored 8 - 9, moderate value habitats scored 7 - 8 and low value habitats scored 4 - 5. Koala scores have been factored into risk avoidance strategies. Areas of high value adjacent to watercourses will be spanned requiring only minimal clearance of vegetation. Lower value habitats have lower height and tree densities, allowing more opportunities for avoidance by spanning and micro-siting of towers.
- Amount of habitat to be cleared:** There is potential for the Project to disturb 97.04 ha of habitat critical to the survival of the koala (ranging from low to high value habitat for koala). This represents 0.11% of koala habitat within a 2.5 km buffer and 0.02% of koala habitat within a 10 km buffer. While the cumulative area of habitat loss is substantial, the open woodland habitats impacted typically have sparse to very sparse tree densities. The physical loss of koala habitat trees per hectare is therefore substantially lower than it would be in areas of woodland. The loss of habitat is accumulated over a large spatial scale and is unlikely to result in a significant reduction in the proportion of habitat locally available to koala populations. Measures will be undertaken to reduce the magnitude of habitat loss by micro-siting access tracks and other infrastructures and spanning areas with increased local densities of koala food trees and potential movement corridors such as riparian vegetation.
- Method of clearing:** The Project has the flexibility to refine tower positions at a localised scale to minimise direct loss of koala food trees. In areas of important koala habitat, surveys will be undertaken to identify the most appropriate tower locations. High value areas have been mapped to allow avoidance by spanning vegetation, particularly at watercourse crossings. Construction of the project does not require a formal cleared access track or the persistence of a permanent access track for maintenance. Clearing can be substantially minimised. Clearing will be required in some localised areas of sensitive koala habitat. Where this occurs, clearing will be directed by koala sensitive clearing protocols, selectively clearing individual koala trees in localised areas and sequentially clearing koala

habitat in other areas. All clearing will be supervised by koala-specialist spotter-catchers and will allow koalas to disperse on their own accord.

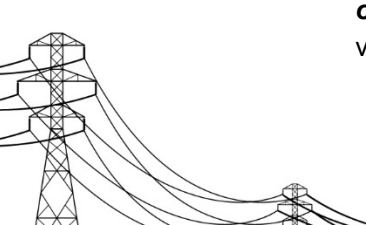
- **Density and abundance at which koalas occur** Koalas are known to occur in low densities in inland regions of Queensland. The low number of records observed in field surveys for the Project supports this. Riparian woodlands represent areas of increased local importance, critical for foraging and movement of individuals. However, even in those areas, densities of individuals is typically low.
- **Level of fragmentation caused by the project:** The Project is unlikely to cause any substantial fragmentation of koala habitat as it impacts areas with very sparse natural tree densities in a landscape that has existing levels of fragmentation due to land clearing for pastoral activities. The Project will have a high span, no permanent access track or fencing. While the Project intersects numerous watercourses that provide important pathways for koala movement, impacts on these corridors has been avoided by elevating spans at watercourse crossings. The Project is therefore unlikely to cause any substantial fragmentation of koala habitat or impose any barrier to koala movement.

While the Project will result in a relatively large magnitude of impact, this is spread over a very large geographic area as a linear footprint, and will result in only minor losses of habitat when considered at a local scale, equating to a loss of 0.11% within a 2.5 km buffer of the Project. Given the method of clearing, the lack of anticipated fragmentation and the low density at which koalas occur in the local landscape, the Project is considered unlikely to have a significant adverse impact on habitat critical to the survival of the species in the context of the existing receiving environment.

Significance of impact due to interference with the recovery of the species

The Project is unlikely to significantly interfere with the recovery of the species. The Project is anticipated to be relatively benign in terms of its likely impact on koalas. As detailed in the Referral guidelines for the vulnerable koala (DoE 2014), an assessment of the potential interference with the recovery of the species has been undertaken considering the following factors:

- ***Will the Project increase fatalities due to dog attacks to a level that is likely to result in multiple, ongoing fatalities?*** The Project is not expected to result in any change in the abundance of wild dogs. While the Project will result in the creation of new maintenance access tracks that will facilitate local movement of wild dogs, a large number of farm tracks exist in the landscape and are already utilised by wild dogs for movement. Accordingly, the introduction of additional access tracks is not expected to have a measurable impact on local dog numbers or the subsequent frequency of dog attacks on koalas. Wild dog control currently occurs throughout the region. Feral animal control will be undertaken through the construction and will reduce or at least maintain current risks of dog attacks for koalas.
- ***Will the Project increase koala fatalities due to vehicle strikes to a level that is likely to result in multiple ongoing fatalities?*** The Project will result in an increase in vehicle movements during the construction period. This carries a risk of increased vehicle strike however, this will be mitigated through standard controls such as speed limits and workforce awareness. During operation, the risks of ongoing mortality from vehicle strikes is low, given the Project will only result in very occasional movements of maintenance vehicles not dissimilar to that already experienced in the receiving environment.
- ***Will the Project facilitate the introduction or spread of pathogens such as *Chlamydia* or *Phytophthora cinnamomi* that are likely to significantly reduce the reproductive output or the carrying capacity of the habitat?*** The use of standard hygiene protocols in vehicle movements during construction means that the potential for introduction of



Phytophthora is relatively limited. The Project is relatively benign during the operational phase and is unlikely to have any impact on levels of Chlamydia in the local koala population (DotE 2014a).

- ***Will the Project create a barrier to movement between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala?*** The Project is not expected to result in any substantial fragmentation of habitat. The Project in most cases, spans vegetation and does not require permanent access tracks or fencing. The Project is therefore unlikely to pose any barrier to koala movement or fragmentation of koala habitat.
- ***Will the Project change hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term?*** The Project will have no substantial impact on hydrology that could degrade the quality of koala habitat. Watercourse crossings will have no impact on bed or banks that could alter hydrology.

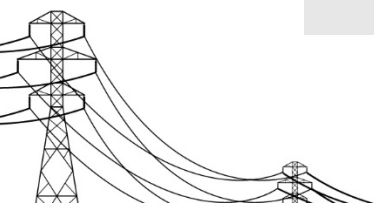
Based on these factors, the Project is considered unlikely to significantly interfere with the recovery of the species.

Black-throated finch (southern)

A significance of impact assessment of the Project on the black-throated finch (Endangered under the EPBC Act) is provided in Table 18-45.

Table 18-48 Significant impact assessment – black-throated finch

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population of the species	Unlikely In recent years, the range of the black-throated finch (southern) has undergone considerable contractions as a result of habitat clearing and fragmentation and the species is now locally common at only a few sites around Charters Towers / Townsville (NSW and Queensland Governments, 2004). Therefore, the local population may be considered important in the context of the whole species and any impacts to local populations may equate to a long-term decrease to the species. The area between Prairie and Torrens Creek is also recognised as an important area for the species in the Significant impact guidelines for the black-throated finch (southern) (DEWHA 2009). The Project has incorporated substantial measures to avoid impact on key habitats. Waterbodies that represent key drinking sites have been identified and avoided in the corridor selection process. The Project will result in no loss of drinking sites. Breeding habitats surrounding those waterbodies have also been largely avoided. While the corridor does intersect some areas of potential breeding habitat, these areas will be subject to targeted surveys to microsite towers and access routes to avoid direct impact on breeding habitat. As the Project does not require permanent access tracks and will form construction tracks through vehicle movements, the permanent impact on foraging habitat is also limited. While the Project intersects 290.99 ha of mapped black-throated finch (southern) suitable habitat, the footprint impacts within that area will be substantially reduced through avoidance and mitigation measures. The loss represents only 0.2% of local habitat (i.e. within a 2.5 km buffer) and 005% of regional



Significant impacts criteria	Assessment
	habitat (10 km buffer). Given the avoidance measures implemented, the Project is unlikely to have an impact at a population level, that would result in a decrease in the size of the local population.
Reduce the area of occupancy of the species	Unlikely Permanent occupancy of an area by the black-throated finch is generally limited to areas where there are patch sizes of woodland vegetation in excess of 40 ha, proximity to permanent water (within 400 m) and a variety of perennial and annual grasses available all year round (NRA 2006). Where these factors are not met, black-throated finches can be locally nomadic, and will temporarily access available resources (e.g. perennial seeding native grasses) on an opportunistic basis. The Project intersects approximately 290.99 ha of potential habitat for the black-throated finch (southern). This is spread over a large geographic area and represents 0.2% of the habitat locally available within a 2.5 km buffer. Key breeding and drinking sites have been avoided in early corridor selections and will be further avoided by undertaking targeted surveys of potential breeding habitat to microsite towers and access tracks in areas of low habitat value. As a consequence of these measures, the majority of impact is on foraging habitat in areas away from water points. Within land adjacent to the study area, there are adequate alternative foraging areas to sustain the species during construction should construction operations deter the species. Permanent access tracks will not be formed. The impacts imposed by construction vehicle movements, which will be restricted to a single dedicated route will be temporary in nature. Post construction, groundcover (in the form of grasses) will recolonise and provide continued resources for the local black-throated finch (southern) populations. Additionally, pest management practices have the potential to enhance the quality of existing habitat by reducing weed and pest abundance. Given the avoidance and mitigation measures implemented, the Project is not expected to result in the disappearance of the black-throated finch (southern) from any 2 km x 2 km area and is therefore unlikely to result in a reduction in the area of occupancy of the species.
Fragment an existing population into two or more populations	Unlikely Considering the species' nomadic nature, the easement is considered unlikely to fragment the species into two or more populations. As no physical barriers will be constructed and grasses will persist within the easement, the species is anticipated to continue to use the area without restriction. Given the high span of the Project and the avoidance measures that have been implemented to avoid impact on key drinking sites, the Project is not expected to represent a constraint to movement or fragment the existing population.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species is likely to include key breeding habitats associated with drinking sites and areas of high value foraging habitat. The majority of key drinking and breeding sites have been identified and avoided in the corridor selection process. Targeted surveys of potential breeding habitat will be undertaken in

Significant impacts criteria	Assessment
	early 2021 to allow local micro-siting of towers and selection of temporary access routes to avoid key habitat areas. While the Project intersects 290.99 ha of foraging habitat, the impact on these areas will be substantially reduced, as the powerlines will in most cases, span vegetation with minimal requirement for permanent clearing. As no earthworks or grading will be undertaken for access, movement of construction vehicles will cause only temporary disturbance to foraging habitat. Areas of key foraging habitat will be rehabilitated after construction. Clearing for the Project is anticipated to be linear across a large geographic area and cleared areas within the easement are not required to remain clear during operations. Therefore, the majority of cleared black-throated finch (southern) habitat can be rehabilitated with native grasses after construction. Additionally, pest management practices have the capacity to enhance the quality of existing habitat by reducing weed abundance and feral pests within the study area. The employment of a fauna spotter catcher to ensure environmentally responsible clearing practices are employed and that no clearing is undertaken in 'no go' areas will further mitigate potentially adverse impacts to the specie's habitat. Based on these considerations, the Project is unlikely to adversely affect the habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	Unlikely The majority of Project construction works are scheduled to occur during the dry season, outside the species' usually breeding period. The black-throated finch generally breeds during the wet season (February – May), though breeding can occur throughout the year under optimal conditions (Higgins et al. 2006; NRA 2007). Nests are usually made within 400 m of a perennial watercourse or waterbody. Key drinking and breeding sites have been identified and avoided through the corridor selection process. Some areas of breeding habitat surrounding waterpoints will be intersected. These areas will be subject to targeted surveys in 2021 to identify and avoid areas of confirmed and potential value as breeding and nesting sites. This can be achieved by micro-siting towers and temporary construction access routes. These measures will allow the Project to avoid impact on key breeding habitats. Increased noise, clearing of habitat and the construction of transmission lines and site offices have the potential to disrupt the species breeding cycle of the population. Strict measures will be outlined in the Project's EMP and implemented in these areas to minimise indirect impacts on breeding activities. This will involve scheduling construction in areas of black-throated finch breeding habitat outside the key breeding period (February – May). Given the avoidance measures achieved, the Project is unlikely to adversely affect the breeding cycle of a population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to	Unlikely As previously mentioned, potential drinking and breeding sites have been avoided through the corridor selection process. Targeted surveys will be undertaken in the few areas of potential breeding habitat that will still be intersected to micro-site construction access routes to avoid

Significant impacts criteria	Assessment
the extent that the species is likely to decline	impact on breeding habitat. Despite the avoidance measures, some foraging habitat will be directly impacted. Clearing will occur in localised areas along a linear footprint. Disturbance for access tracks will be temporary, with no excavation or grading required. Grasses will not be cleared for construction access. Foraging habitat will persist within the easement. The Project does not align with any of the actions known to diminish habitat quality for the species, as outlined in the Significant Impact Guidelines for the species (DEWHA 2009). Clearing of grassy woodland, earthworks and excavation will only be required at localised areas, i.e. hardstands where stringing and pulling of lines is required during construction. These will be micro-sited to avoid areas of high habitat value. Given the avoidance measures implemented, the Project is not expected to modify, destroy or isolate habitat to the extent that populations will 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 implementation of a weed control program, as part of the Project's EMP, will be designed to limit the introduction of invasive species during construction and rehabilitate areas of current weed infestations. This can increase the abundance of native grass species by reducing competition by exotic species, whilst also potentially reducing predation risks by pest species e.g. feral cats. This has the potential to not only preserve the current condition of the site. By introducing increased pest management investment in an area that is already subject to weed and pest infestations has the potential to enhance the quality of the habitat for black-throated finch (southern) within the study area.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases affecting black-throated finches that could be introduced through the construction of the proposed works. There is a very rare chance that soil pathogens that affect the health of vegetation may be introduced via construction machinery although washdown procedures (designed to limit the spread of weeds) are considered adequate to remove foreign soil prior to entering site. In all cases, there would be no known introduced diseases that may cause the species to decline.
Interfere with the recovery of the species	Unlikely With the application of habitat management and weed management practices, it is expected that any modification, removal, fragmentation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to interfere with the recovery of the species. Furthermore, the Project has the potential to increase the quality of habitat within the study area, which could support local recovery efforts for the species.

Julia Creek dunnart

A significance of impact assessment of the Project on the Julia Creek dunnart (Vulnerable under the EPBC Act and Endangered) is provided in Table 18-46.

Table 18-49 Significant impact assessment – Julia Creek dunnart

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population	Unlikely The installation and construction of transmission towers has the potential to impact on the species directly if individuals are residing locally within the impact areas. Earthworks are expected to impact the integrity of the soil crack networks within the immediate vicinity of the construction areas. This could directly impact on the species foraging and breeding habitat. However, impacts are relatively localised and suitable foraging and breeding habitat is patchy and locally abundant where the species occurs. As such, towers can be micrositied to avoid areas of high microhabitat value (i.e. areas with high densities of deep cracking clay). Given the local prevalence of habitat, any local habitat loss is unlikely to have a significant impact on the local or regional availability of habitat. Furthermore, rehabilitation efforts following construction have the ability to restore the species' habitat and increase even increase habitat quality following the implementation of weed and pest management techniques. Overall, the Project is considered unlikely to lead to a long-term decrease in the size of a population of the species.
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 107.22 ha of mapped potentially suitable habitat for the species. This equates to only 0.16% of the potential habitat within a 2.5 km buffer and 0.04 with a 10 km buffer, as suitable habitat is locally abundant. Earthworks and other invasive construction activities have the potential to cause direct mortality of individuals. However this can be mitigated by micrositing towers away from areas of high microhabitat value and through the use of suitably qualified fauna spotter-catchers. The Project is expected to be relatively benign during the operational phase. Provided the construction risks can be mitigated, the Project is unlikely to result in the disappearance of individuals from any 2 km x 2 km area (i.e. the scale at which area of occupancy is measured). As such, the Project is unlikely to result in a reduction in the area of occupancy of the species.
Fragment an existing important population into two or more populations	Unlikely As previously mentioned, the linear removal of 107.22 ha only represent a minor portion (0.2%) of the potential habitat available within the local landscape (i.e. within a 2.5 km buffer). Due to the linear nature of the required clearing and the distance (400 m) between sites of ground disturbance (tower locations) the Project is considered unlikely to fragment an existing population into two or more populations. No physical barriers will be constructed as part of the Project and the species will maintain the ability to move through the surrounding area. Following construction, groundcover is to be reinstated / rehabilitated which could further promote species' abundance in the area and reduce the likelihood of population fragmentation.

Significant impacts criteria	Assessment
Adversely affect habitat critical to the survival of a species	Unlikely The Project is situated within a mosaic of moderate to high quality habitat. Within these areas, impacts are scattered and will not be applied across the entirety of the corridor selection. The mitigation measures outlined in the EMP (e.g. machinery restricted to previous roads, establishment of 'no go' zones) the Project are anticipated to reduce the effects of the Project on the habitat of the species. Considering that suitable habitat was locally abundant within the study area, and towers can be micro-sited to minimise local impact on high value microhabitats, the loss of habitat is not considered likely to be significant.
Disrupt the breeding cycle of an important population	Unlikely Construction is anticipated to be undertaken during the dry season (autumn/winter), outside of the species breeding season. Clearing footprints in areas of potential habitat for the Julia Creek dunnart will be reduced to areas required for construction of towers and other hard infrastructure. Towers will be micro-sited to avoid areas with high densities of cracking clay that may represent potentially suitable breeding habitat. Experienced spotter-catchers will direct all clearing activities in areas of suitable habitat for the Julia Creek dunnart in accordance with the requirements of a High Risk SMP. Based on these factors, the Project is unlikely to significantly disrupt the breeding cycle of an important population of the Julia Creek dunnart.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely Although the Project will potentially result in the modification, destruction, removal or degradation of 107.22 ha of potential habitat, these impacts are considered unlikely to cause the species to decline. Potential habitat is abundant in areas adjacent to the Project area and considering that groundcover will be reinstated following construction, all impacts are considered temporary and unlikely to be of a magnitude that would cause the species to decline. The majority of construction impacts are anticipated to be mitigated by the employment of environmental management techniques outlined in the Project EMP.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely The Project area is currently used for cattle grazing, and exotic species are present within the Project area. The development of the Project area has the potential to result for a positive outcome by reducing the total of occupancy of weeds (notably prickly acacia) through weed management practices contained within the Project's EMP. Prickly acacia is a recognised threat to the Julia Creek dunnart (QPWS 2005) so any localised reduction in weed extent within areas of habitat will benefit local populations. While the Project has the potential to facilitate movement of feral animals such as cats, dogs and foxes, as these preferentially move along tracks, the magnitude of change is unlikely to represent a material difference to the existing landscape, where tracks are relatively abundant on adjacent pastoral properties.

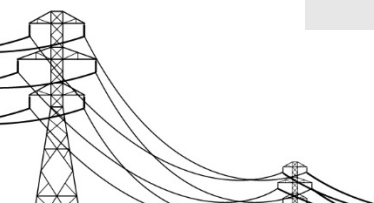
Significant impacts criteria	Assessment
Introduce disease that may cause the species to decline	Unlikely There are no known diseases affecting the Julia Creek dunnart that could be introduced through Project. There is a very rare chance that soil pathogens that affect the health of Mitchell grasslands habitat may be introduced via clearing machinery but there are no known introduced diseases that may cause the species to decline.
Interfere substantially with the recovery of the species	Unlikely Current recovery efforts are focused on known populations of the species. The Project is intersecting grasslands which surround Julia Creek and supports a known population of the Julia Creek dunnart. The National recovery plan for the Julia Creek dunnart (DERM 2009) outlines six specific objectives for the species' conservation, of which the Project has the potential to contribute to three, specifically: • Verifying the distribution of the species and map 'essential habitat'. • Reducing the impact of threatening processes on Julia Creek dunnart populations. • Promoting awareness of Julia Creek dunnart. Detailed surveys conducted as part of the Project have the potential to advance these specific recovery objections. In relation to construction impacts, although the Project will require earthworks which could impact the species, the application of habitat rehabilitation techniques will aid in mitigating the impacts to the Project. Additionally, weed and pest management activities targeted at reducing exotic plant invasion and feral pest predation pressure will further advance recovery efforts for the species within the Project area.

White-throated needletail

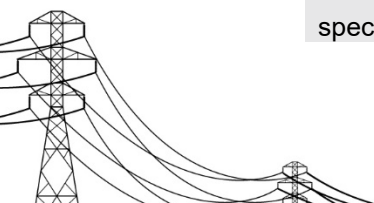
A significance of impact assessment of the Project on the white-throated needletail (Vulnerable and listed migratory under the EPBC Act) is provided in Table 18-47.

Table 18-50 Significant impact assessment – white-throated needletail

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The white-throated needletail is regarded as a transient visitor to the study area, as the species moves through the region in response to climatic conditions (e.g. bushfires, wind fronts and storm fronts). The species is almost exclusively aerial and is therefore not reliant on terrestrial habitat types (Cramp 1985). Clearing and earthworks activities are unlikely to lead to a long-term decrease in the size of the population of the species as no habitats or resources critical to the species will be impacted. Construction based impacts (e.g. increased dust) are anticipated to be temporary.
Reduce the area of occupancy of an	Unlikely This nomadic species possesses no specialised habitat requirements, due to its exclusively aerial nature. Therefore, although clearing will be



Significant impacts criteria	Assessment
important population	required for the Project, the Project will have negligible impact on habitat. The Project is likely to be relatively benign in its impact on the species during the operational phase. The species has some potential for collision with transmission lines. However the risks are considered low. Any impact would affect individuals and be unlikely to result in any change in the area of occupancy of the species.
Fragment an existing important population into two or more populations	Unlikely This species is highly nomadic and can form large, mixed-species feeding flocks. The exclusively aerial, migratory species is capable of long-distance flight. The species movements will not be restricted by the Project. As such, the Project will not fragment the population in any way.
Adversely affect habitat critical to the survival of a species	Unlikely As previously mentioned, the species is exclusively aerial and has no reliance on terrestrial habitats (Cramp 1985). The species is nomadic and known to fly above a range of habitats in response to climatic conditions and is widespread throughout coastal Queensland and on the western slopes of the Great Dividing Range. As a result, the Project is unlikely to impact any habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely The species is a non-breeding visitor to Australia. The species breeds during October – May throughout Siberia, China, Japan and Mongolia (Chantler 1999; Orn. Soc. Japan, 2000). The Project is unlikely to impact on the breeding cycle of the population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely This species is truly ubiquitous, foraging over all habitat types throughout its distribution. As it is exclusively aerial the species has no typical association or reliance on terrestrial habitat types (Cramp 1985). The Project will not result in any loss of habitat for the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely The white-throated needletail is not known to be vulnerable to introduced predators such as the fox or cat. The Project is therefore expected to have negligible impact on the species due to the introduction of invasive species.
Introduce disease that may cause the species to decline	Unlikely There are no know diseases that could potentially introduced by the Project. Therefore, the risk of the Project introducing disease that may cause the species to decline is considered unlikely.
Interfere substantially with the recovery of the species	Unlikely The proposed works are considered unlikely to negative impact the species, let alone interfere with the recovery of the species.



Red goshawk

A significance of impact assessment of the Project on the red goshawk (Vulnerable under the EPBC Act and Endangered under the NC Act) is provided in Table 18-48.

Table 18-51 Significant impact assessment – red goshawk

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species. However, this loss of habitat will be accumulated over a large geographic range, with only minor loss of habitat at any local scale. The red goshawk has not been confirmed present within the greater survey area. Any impact on nest sites would have the potential to have an adverse impact at a population level by reducing breeding success, however targeted pre-clearance surveys will be undertaken to identify and avoid any impact on nest sites. Although clearing will be required for the easement, the width is only 60 m, meaning the majority of the potential habitat for the species will remain intact. Considering this widely roaming species utilises a large home range (approx. 200 km²), the removal of a 60 m linear easement is unlikely to have any impact on the availability of habitat within the broader landscape. The Project is therefore unlikely to have any impact at a population level.
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species, representing a 0.23% and 0.05% reduction of habitat for the species at a local (2.5 km buffer) and regional (10 km buffer) scale. Although the clearing of vegetation may result in edge effects (e.g. reduced cover) immediately adjacent to the easement, the red goshawk will still be capable of occupying the habitats either side of the easement and continued utilisation is anticipated. Additionally, considering this widely roaming species utilises a large home range (approx. 200 km²), disturbance within a 60 m linear easement is unlikely to render the greater landscape uninhabitable to the point that species' area of occupancy is reduced.
Fragment an existing important population into two or more populations	Unlikely The red goshawk has a large home range (approx. 200 km²) (Aumann and Baker-Gabb 1991) and a capacity to fly over areas of localised clearing. While the effects of fragmentation on the species are unknown (DAWE 2020b), they are expected to predominantly impact the species' use of habitat in coastal regions of Queensland where fragmentation has dramatically altered the nature of the landscape. The small, localised clearing extent that will result from this Project will not fragment the population.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species would include all known sites for nesting, food resources, water, shelter, essential travel routes, dispersal, buffer areas, and sites needed for the future recovery as defined by the EPBC Act (DERM 2012). While the Project will result in a loss of foraging habitat, the magnitude of loss is unlikely to have an adverse impact on the local population. The Project's most substantial

Significant impacts criteria	Assessment
	potential impact would be on nesting sites. Unmitigated, the Project has the potential to have a significant impact on habitat critical to the survival of the species should a nest be directly impacted. However, measures will be implemented to negate this risk. No nesting sites have been recorded during field surveys and pre-clearance surveys will be undertaken in areas of potential habitat to identify and avoid impact on nesting sites prior to construction. Any confirmed nesting site identified during pre-clearance surveys will be avoided by micro-siting towers. The Project is therefore unlikely to have a significant impact on any habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely In North Queensland, the species breeds in vegetated mountain areas and rarely within fragmented native vegetation (Czechura 2001). Within the study area, the majority of potential habitat is mapped within patches of relatively fragmented remnant vegetation. Therefore, the likelihood of the Project impacting the species breeding cycles is considered unlikely due to limited breeding habitat within the Project area. The rarity and inconsistencies in recorded sightings further indicates that there is limited breeding habitat for the species within the study area. Regardless, employing a fauna spotter catcher prior to clearing to investigate the presence of nest sites (normally large trees within 1 km of water) will further reduce the likelihood of the Project impacting 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 Clearing will represent the greatest threat to the species as the removal of large trees will result in a more open vegetative structure for the communities within and adjacent to the easement. Because this species is an ambush predator that hunts within the midstorey, a more open canopy structure could reduce the species' ability to forage in the vicinity of the Project area. However, this is a localised impact that is unlikely to affect the local population, given its large home-range. Key foraging areas include ecotone boundaries, vegetated watercourses and wetland ecosystems (Czechura and Hobson, 2000). The proposed corridor selection has been designed to avoid / minimise impacts in the aforementioned ecosystems and mitigation measures contained in the EMP will be designed to further reduce the Project's potential impact. Furthermore, towers are anticipated to stretch approximately 400 m and of sufficient length to span the majority of watercourses. Considering the location of the corridor selection and the mitigation measures proposed, 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 vulnerable species becoming established in the	Unlikely Feral animal management protocols will be implemented for the clearing, construction, operation and decommissioning phases of this Project. Inclusion of such measures into the EMP is expected to be sufficient to prevent negative impacts of invasive species as a result of the proposed action.

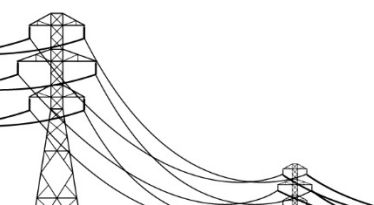
Significant impacts criteria	Assessment
vulnerable species' habitat	
Introduce disease that may cause the species to decline	Unlikely There are no known disease affecting the species and no diseases or inflection that could be potentially introduced by the proposed works. Provided that the Project abides by the biosecurity measures contained in the EMP, the Project is considered unlikely to introduce foreign species / disease that may cause the species to decline.
Interfere substantially with the recovery of the species	Unlikely The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species. This represents 0.05% of the potential habitat within a 10 km buffer. Given the small magnitude, the loss of habitat is unlikely to reduce the foraging or breeding success of the species by altering resource availability. The Project will be relatively benign during the operation phase. Given these factors, the Project is unlikely to interfere with the recovery of the species.

Grey falcon

A significance of impact assessment of the Project on the grey falcon (Vulnerable under the EPBC Act) is provided in Table 18-49.

Table 18-52 Significant impact assessment of residual impacts – grey falcon

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The Project is unlikely to lead to a long term decrease in the size of the population of the species. Potential impacts posed by the Project include a loss of foraging habitat, loss of nesting sites and the introduction / encroachment by invasive species. The Project activities will occur within an estimated 88.87 ha of mapped suitable habitat for the species. This represents only 0.5% and 0.22% of habitat within a 2.5 km and 10 km buffer of the Project area, respectively. Habitat loss will be experienced a largely linear, 60 m wide corridor. Although this may correspond to a reduction in foraging habitat, the presence of towers is anticipated to increase the abundance of potential nest sites (Schoenjahn, 2018). Grey falcons are known to utilise artificial structures for nesting (Schoenjahn, 2013) and the retention of power line towers has been reported as beneficial for the species ongoing conservation (Schoenjahn, 2018). Risk of increased predation pressure by introduced carnivores will be addressed by the inclusion of pest fauna management techniques in the Project EMP. These measures have been designed to suppress the abundance of feral cats and foxes within the study area. Overall, the proposed works are unlikely to lead to a long-term decrease in the size of a population of the species.



Significant impacts criteria	Assessment
Reduce the area of occupancy of an important population	Unlikely The Project will require the clearing of a 60 m wide corridor for transmission lines and towers, however vegetation clearing is expected to have little impact on the species. The grey falcon has been observed hunting in treeless areas, tussock grasslands and open woodlands (Olsen and Olsen 1986). This implies that the species is well adapted to open areas, and therefore, the clearing of a narrow, linear corridor is unlikely to further reduce the area of occupancy for the species. In contrast, the Project could provide additional nesting habitat for the species. The grey falcon is known to nest in powerline towers (Schoenjahn, 2013), with recent studies reporting 40% of grey falcons nest being observed in artificial structures (Schoenjahn, 2018). Regardless, the species is considered highly mobile (Schoenjahn, 2019) and a narrow, linear loss of 585.8 ha of potential habitat is unlikely to reduce the area of occupancy for the species.
Fragment an existing important population into two or more populations	Unlikely The grey falcon is nomadic, capable of long-distance movements throughout its range. The species occurs at low densities and often forages in open landscapes. The localised clearing that will be result from the Project has no capacity to restrict the movement of the grey falcon or fragment populations.
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species has not been defined. However this is likely to include nesting habitat. Nest sites in particular are considered a limiting factor within the species breeding range. Breeding generally occurs in hot inland areas and is unlikely to occur within the Project area. The Project is therefore unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely As detailed above, the grey falcon breeds in the hottest parts of Australia's arid zone, occurring in areas with less than 500 mm annual rainfall. While the species has been recorded within the centre and western end of the Project corridor, near Richmond and Mount Isa respectively, no breeding habitat is expected to occur within the vicinity of the Project. As such, the Project is unlikely to have an adverse impact on breeding. The species is known to nest on artificial structures provided by powerlines. This has the potential to increase potential nesting habitat.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely Although grey falcons have been recorded within the area, the species has been reported as a non-breeding, winter visitor. Although this implies that the grey falcon is not a resident species, parts of the Project may still be utilised for foraging and resting. Regardless, the Project poses little risks to the species as suitable habitat of similar quality is abundant within the surrounding landscape. <i>F. hypoleucos</i> is known to occupy large areas, the corridor selection is unlikely to be the only habitat utilised by the species. Furthermore, although the species has not been recorded breeding, the inclusion of transmission line towers will provide potential nesting sites and may contribute to greater regional utilisation by the species.

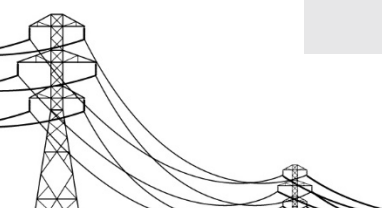
Significant impacts criteria	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Introduced carnivore species are known threats for the species (Schoenjahn, 2019). Feral cats and foxes have been confirmed within the Project area and pest fauna management techniques have been designed to reduce the likelihood of pest species becoming established within the Project area. Such measures will be contained within the Project EMP. Following appropriate implementation, the Project is unlikely to result in invasive species becoming established.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases that could potentially introduced by the Project. The five most common disease in falcons are frounce, aspergillosis, coccidia, sour crop and bumblefoot. Frounce, coccidian and sour crop are transmitted by the consumption of infected prey and will not be influenced by the Project. Similarly, bumblefoot is a result of injuries to the species feet and as such is not relevant. Aspergillosis is caused by the fungus <i>Aspergillus fumigatus</i> , which is highly unlikely to be present within the Project area. Normally, this fungus is encountered where there are wet or damp substances, or materials that promote the growth of fungus such as burlap, hay, or straw. Nevertheless, vehicle hygiene protocols implemented for weed management are likely to eliminate the risk of the fungus being introduced during construction.
Interfere substantially with the recovery of the species	Unlikely The Project is unlikely to interfere with the recovery of the species. In contrast, the Project could serve to counteract several threatening processes for the species within the Project area. A shortage in nest sites is a recognized threat for the species (Garnett et al. 2011) as a result of large-scale clearing and selective logging of larger trees. Considering the species' willingness to nest in power line towers (Schoenjahn, 2013; 2018) and the lack of large infrastructure in the area, the Project could serve to improve the species recovery by providing additional nest sites (Schoenjahn, 2018). This could also limit the effects of overgrazing, which has been identified as preventing the regeneration of suitable nesting sites (Garnett et al. 2011). The pressure of introduced predators (e.g. cats and foxes) has also addressed through the inclusion of pest fauna management controls within the Project EMP.

Night parrot

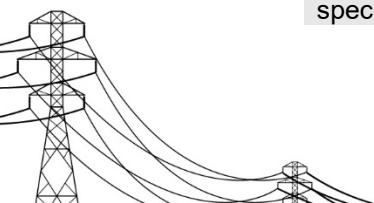
A significance of impact assessment of the Project on the night parrot (Endangered under the EPBC Act and NC Act) is provided in Table 18-50. For this species it should be noted that a relatively conservative approach has been applied given the cryptic nature of the species and the lack of publicly available information on its current locations. Risks are generally considered to be associated with the potential for direct impact on birds rather than a loss of habitat.

Table 18-53 Significant impact assessment – night parrot

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population of the species	Unlikely Loss of suitable habitat for this species resulting from clearing for the proposed easement will largely be linear and considered to be minor considering the extent of habitat available in the surrounding landscape. Within the proposed corridor selection, areas cleared during construction that are not required to remain cleared during operation will be rehabilitated. As the species is dependent on ground-level vegetation and microhabitats and is located in areas with sparse tree densities, there will be substantial opportunities to minimise the on-ground clearing footprint by restricting clearing to the minimum amount necessary. This is likely to include selective removal of trees and clearing of a reduced footprint for access tracks and tower pads. Feral animal, weed and ecological fire management protocols will be implemented for the clearing, construction, operation and decommissioning phases of this Project and have the potential to increase the quality of available habitat within and adjacent to the Project area. It is expected that any possible decrease in any possible local population would be minor and temporary.
Reduce the area of occupancy of the species	Unlikely The Project activities will occur within an estimated 62.57 ha of mapped suitable habitat for the species. Loss of suitable habitat for this species resulting from the proposed corridor selection will be linear and will likely be minor due to the nature of the rugged terrain where the majority of the species' habitat exists. Within areas of potential habitat, the clearing footprint will be minimised. Areas that are subject to temporary construction clearing will be rehabilitated to maximise the local habitat coverage. The area of habitat cleared represents only 0.14% of that available within a 2.5 km buffer. As such, the species is likely to persist locally and will not experience any loss in the area of occupancy of the species.
Fragment an existing population into two or more populations	Unlikely The associated linear clearing will not fragment any possible population for this mobile species. Within areas of suitable habitat, clearing widths will be minimised to reduce the potential impact. Local rehabilitation of the easement will be undertaken to maintain connectivity of ground-level habitats. Through these measures the Project is unlikely to fragment the population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely All habitat within the proximity of known records would be considered habitat critical to the survival of the species. While unconfirmed historical records are known from the Cloncurry region, as mapped in essential habitat within the Ballara Nature Refuge, the species has not been recorded with the Project area. Potential habitat is widespread and abundant in the area between Cloncurry and Mt Isa, however no high-quality habitat for the species has been identified during field surveys due to a combination of recent fire events and high abundance of wooded vegetation. Impacts will be localised and are therefore considered to have minimal impact in the context of the surrounding



Significant impacts criteria	Assessment
	landscape. Cleared areas within the easement that are not required to remain cleared during operation will be rehabilitated after construction activities have concluded. Feral animal, weed and ecological fire management protocols will be implemented for the clearing, construction, operation and decommissioning phases of this Project. With the combination of habitat management and rehabilitation, the result of the proposed action is not expected to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	Unlikely There is a paucity of biological information known for this species and few occurrence records. There is no indication that there is habitat present that is critical to the breeding cycle of an important population. The Night Parrot Recovery Team will be consulted to assess risks to potential breeding and assist in recommending risk mitigation strategies for clearing and construction. The detection of breeding sites is difficult as the species nests within clumps of dense vegetation, primarily old and large Spinifex clumps, but sometimes other vegetation types (Higgins 1999, Murphy 2017). Targeted pre-clearance surveys will be undertaken prior to construction to minimise the potential for impact on breeding or nesting habitat. Additionally, the inclusion of a combination of habitat management and rehabilitation activities, any disruption of the breeding cycle of a local population as a result of the proposed action is expected to be minor and temporary. Following these mitigation measures the Project is unlikely to disrupt the breeding cycle of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely As detailed above, potential habitat suitable for this species is widely distributed throughout a broad area between Cloncurry and Mt Isa. The loss of habitat will be localised and areas will be rehabilitated locally following construction. Although the proposed action may modify, destroy, remove, isolate or decrease the availability or quality of habitat, it is unlikely to be to the extent that the species is likely to decline. All impacted habitat will be rehabilitated following construction to minimise the temporal duration of any impacts. Additionally, the Project has the opportunity to increase the quality of habitat within the study area by implementing the pest fauna and flora management techniques contained in the Project EMP.
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 Predation by feral cats and foxes are highlighted as key threatening processes for the species (TSSC, 2016b). The implementation of actions directed at reducing invasive predator abundance are a priority of conservation advice for the species. The Project has the potential to exacerbate the feral predation threat by providing a dispersal corridor that may encourage movement of cats, dogs and other feral predators. Feral predators are an existing threat in the landscape and the area already contains many existing farm tracks that would be utilised by feral predators. As such the magnitude of change in exposure to feral predators is unlikely to be significant. Feral animal and weed management protocols will be implemented for the clearing,



Significant impacts criteria	Assessment
	construction, operation and decommissioning phases of this Project. The Project will provide an impetus for increased feral animal control in a landscape that already exposed to feral threats. The inclusion of such measures in the EMP is expected to be sufficient to prevent any potential impacts of invasive species as a result of the proposed action.
Introduce disease that may cause the species to decline	Unlikely The Project is considered unlikely to introduce disease/s that may cause the species to decline. Regardless, the impacts of psittacine beak and feather disease (PBFD) have been considered. All endangered Australian psittacine bird species are susceptible to PBFD (Raidal <i>et al.</i>, 2015). Although the Department of Environment (2015) reports a low-level of concern for the species, following the Department of Environment and Heritage (2006) established hygiene and reporting protocols will further reduce the risk of the spread of PBFD into the Project area.
Interfere with the recovery of the species	Unlikely If unmitigated, there is potential that the Project may interfere with the recovery of the species via direct impact on individual birds during construction. However, with the application of habitat management and rehabilitation, any impacts to the availability or quality of habitat for this species in the study area would be significantly reduced, and unlikely to interfere with the recovery of the species.

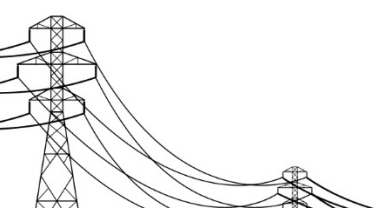
Painted honeyeater

A significance of impact assessment of the Project on the painted honeyeater (Vulnerable under the EPBC Act) is provided in Table 18-51.

Table 18-54 Significant impact assessment – painted honeyeater

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely Painted honeyeaters are dispersive, migrating across Qld, NSW, SA and NT in response to resource availability (mistletoe). The species is considered likely to occur within the Project and the Project activities will occur within an estimated 661.09 ha of the species' mapped suitable foraging habitat. This represents 0.14% and 0.04% of habitat available within a 2.5 km and 10 km buffer of the Project respectively. As the species has a broad distribution, the loss of 661.09 ha of potential foraging habitat is unlikely to lead to a long-term decrease in the size of a population of the species.

Significant impacts criteria	Assessment
Reduce the area of occupancy of an important population	Unlikely The species is known to occur in a broad range of habitats, with distribution largely dictated by the presence of mistletoe (favoured feeding resource). The Project activities will occur in an estimated 661.09 ha of potential habitat for the species, however these areas are continuous within the surrounding landscape and are believed to represent similar habitat quality. Although the Project will result in a reduction in the area of occupancy to the species, the extent of impacts is minor and reduced area of occupancy is negligible when considering the extent of available habitat in adjacent areas.
Fragment an existing important population into two or more populations	Unlikely Due to the species dispersive nature, the species is considered to have a single population (Garnett et al. 2011). Considering the species is distributed across four states (NSW, Qld, SA and NT), the potential impacts within 661.09 ha of linear Project area is unlikely to fragment the population in two or more populations. Furthermore, as no physical barrier are being constructed and the clearing extent is only 60 m wide, the species is anticipated to continue to utilise the area once construction activities have concluded.
Adversely affect habitat critical to the survival of a species	Unlikely No habitat critical to the survival of the species is intersect by the proposed corridor selection. Additionally, no essential habitat polygons are mapped within the greater study area. No breeding habitat will be impacted by the Project as the species is species generally breeds over 400 km south of the Project area (Higgins 1999). Although areas with increased mistletoe abundance may be present in the study area, mistletoe is actively dispersed by avian frugivores (e.g. mistletoe birds) and therefore, areas of high resource abundance areas is variable and not restricted a narrow geographical extent.
Disrupt the breeding cycle of an important population	Unlikely The species is a north – south migrant to the area, with movement dictated by resource (mistletoe) availability. Although the species is known to inhabit the region, almost all records of breeding come from south of 26°S, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland (Higgins et al., 2001). The Project is unlikely to disrupt the breeding cycles of the species.
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 Project area intersecting 661.09 ha of potential habitat, this impact is unlikely to be of the extent that the species is likely to decline. Similar habitats to that that are intersect by the corridor selection are present adjacent and surrounding the Project area and the impacts habitats represent only 0.14% available at a local scale (2.5 km buffer) and 0.04% at a regional scale (10 km buffer).



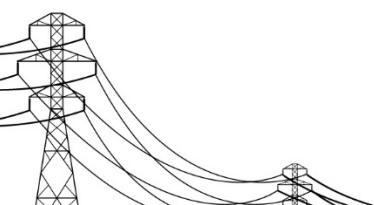
Significant impacts criteria	Assessment
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely No increase in invasive species is anticipated as a result of the Project. Rather, the Project has the opportunity to reduce the abundance of invasive species by implementing pest flora and fauna management controls. Feral cats and European foxes are known predators contributing to the species' decline and implementing control measures could equate to a net benefit to the local painted honeyeater population.
Introduce disease that may cause the species to decline	Unlikely The Project is considered unlikely to introduce disease/s that may cause the species to decline. Regardless, the impacts of psittacine beak and feather disease (PBFD) have been considered. All endangered Australian psittacine bird species are susceptible to PBFD (Raidal et al. 2015). Although the Department of Environment (2015) reports a low-level of concern for the species, following the Department of Environment and Heritage (2006) established hygiene and reporting protocols will further reduce the risk of the spread of PBFD into the Project area.
Interfere substantially with the recovery of the species	Unlikely The Project is unlikely to interfere with the recovery of the species as the proposed works are not significant contributing to any of the species' threatening processes. Although the Project activities will occur within 661.09 ha of potential habitat, these impacts are anticipated to be minor and temporary and will be accompanied by management measures that could benefit the species.

Australian painted snipe

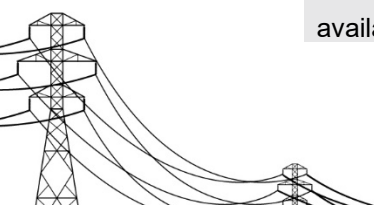
A significance of impact assessment of the Project on the Australian painted snipe (Endangered under the EPBC Act) is provided in Table 18-52.

Table 18-55 Significant impact assessment – Australian painted snipe

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of a population of the species	Unlikely The species utilises wetland habitats that will be avoided or spanned by the Project. All major wetlands and waterbodies that represent potential foraging habitat for the Australian painted snipe have been avoided through the corridor selection process. This identified and avoided key wetlands at KP308 WD, KP539 WD, KP38 DM and KP68 DM. A range of ephemeral watercourses provide potential foraging habitat for the species. The Project activities will occur within an estimated 138.63 ha of potentially suitable foraging habitat associated with ephemeral watercourses. However, in most cases the Project will span watercourses and can avoid impact on habitats within the riparian zone. Where the corridor selection crosses large braided ephemeral systems, some of which are more than 1km wide, tower sites have been individually selected to avoid existing channels.



Significant impacts criteria	Assessment
	The Project will be relatively benign during the operational phase, unlikely to cause any ongoing disturbance or fragmentation of habitat. Considering these factors, the Project is unlikely to lead to a long-term decrease in the size of a population of the species.
Reduce the area of occupancy of the species	Unlikely The Australian painted snipe occurs in shallow freshwater wetlands, both ephemeral and permanent, such as lakes, swamps and inundated or waterlogged grassland/saltmarshes with good vegetative cover (Marchant and Higgins, 2003) and has been recorded at wetlands in all states and territories (Barrett <i>et al.</i> 2003; Blakers <i>et al.</i> 1984). The proposed corridor selection has been selected to avoid the wetland ecosystems due to the associated construction complications (e.g. waterlogged soils, difficult access for machinery). As such the Project will avoid or span most areas of potential habitat. While the Project activities will occur within an estimated 138.63 ha of suitable habitat, this represents only 0.4% and 0.19% of habitat within a 2.5 km and 10 km buffer of the Project area respectively. The magnitude of impact is considered negligible considering the species vast distribution in the surrounding area. Furthermore, Overall the Project is considered unlikely to reduce the area of occupancy of the species
Fragment an existing population into two or more populations	Unlikely The distribution of the Australian painted snipe within the Project area is non-uniform and concentrated around areas with adequate available water. As the corridor selection has been designed to avoid the majority of this areas it is unlikely to Project will fragment an existing population into two or more populations. Rather, local populations are expected to transition between a number of sites throughout northern Queensland.
Adversely affect habitat critical to the survival of a species	Unlikely All major wetlands that represent potential foraging habitat for the Australian painted snipe have been avoided. Direct impact on ephemeral watercourses has also been avoided in most cases by elevating spans and placing towers outside the riparian zone. The Project has the potential to cause indirect degradation of ephemeral water bodies that may impact habitat for the Australian painted snipe. These impacts will be mitigated in the Sediment and Erosion Control Plan for the Project. Additionally, establishing and clearing identifying 'No Go' zones near suitable habitat will help to ensure these areas are not impacted during construction.
Disrupt the breeding cycle of a population	Unlikely The Australian painted snipe is considered to occur in a single, contiguous breeding population (Garnett and Crowley, 2000). Habitat in the Project area is not a known roosting site for the species and the extent of foraging habitat removal would not be of such a magnitude as to impact on the breeding success of the species. Regardless, implementing buffer zones around wetlands will significantly reduce the likelihood of disrupting the species breeding cycle.
Modify, destroy, remove, isolate or decrease the availability or	Unlikely The Project activities will occur within an estimated 138.63 ha of potential habitat for the species. The extent of occurrence of the Australian painted snipe is estimated, with low reliability, to be



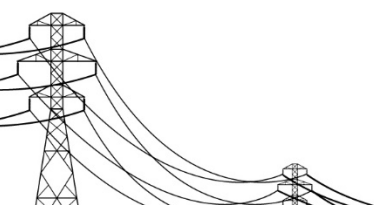
Significant impacts criteria	Assessment
quality of habitat to the extent that the species is likely to decline	2000 km ² (Garnett et al. 2011). The loss of small areas of habitat is very unlikely to result in the further decline of the species.
Result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Critically Endangered or Endangered species' habitat	Unlikely The Project is unlikely to introduce an invasive species into the study area. Rather, the Project has the potential to reduce the abundance of pest species. The replacement of native wetland vegetation by weeds is a key threat to the species (Rogers et al. 2005). The implementation of weed management practices within the Project area could serve as a benefit for the species and help mitigate weed encroachment in the vicinity of the proposed works. Also, like many native birds, the Australian paint snipe is susceptible to predation by feral cats and European foxes. The employment of pest fauna control measures could in turn increase the quality of the habitat for this species by reducing predation pressure on local populations.
Introduce disease that may cause the species to decline	Unlikely This species is not known to be susceptible to any disease which may be transferred or introduced to the Project area as a result of the proposed action.
Interfere with the recovery of the species	Unlikely The proposed works are considered unlikely to interfere with the recovery of the species as the habitat impacted by the Project represents only 0.4% of habitat within a 2.5 km buffer. Furthermore, the Project's weed and pest management practices could generate a positive outcome for the species by reducing the impact of a key threatening process in the region.

Plains death adder

A significance of impact assessment of the Project on the plains death adder (Vulnerable under the EPBC Act) is provided in Table 18-53.

Table 18-56 Significant impact assessment – plains death adder

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely Important populations of the plains death adder have not been defined in the Commonwealth listing advice. The Project is not unlikely to result in a long-term decrease in the species population. This species is an ambush predator, known to remain in a single spot for days at a time. Considering the sedentary nature of the species, pre-clear surveys by fauna spotter-catchers would be relatively effective in detecting and relocating individuals prior to Project works. The Project activities will occur within an estimated 261.47 ha of suitable habitat. This will occur over a large geographic area. Habitat is relatively uniform and widely available within the surrounding landscape. The potential impact represents only 0.15% and 0.04% of suitable habitat for the species within a 2.5 km and 10 km buffer of the Project respectively. Mitigation measures to reduce the impacts of Project on the species (e.g. vehicle strikes) have been designed and included within the Project EMP. Based on these factors the Project is unlikely to result in a long-term decrease in the size of the local population.
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 261.47 ha of potential habitat for the species, which is entirely contained within the western extent of the Project. This represents only 0.15% and 0.04% of the potential habitat available within a 2.5 km and 10 km buffer of the Project, respectively. The loss of habitat is therefore not considered significant. The Project is expected to be relatively benign during the operational phase. The magnitude of habitat loss or impact on local populations is unlikely to result in the disappearance of individuals from any 2 km x 2 km area (i.e. the area at which area of occupancy is quantified).
Fragment an existing important population into two or more populations	Unlikely The proposed works are unlikely to fragment an existing population. Outside of breeding, the species is nomadic and can occur anywhere within the species distribution (Ward and Phillips 2012). As the proposed corridor width is only 60 m and will contain no barriers to movement, the Project is unlikely to restrict gene flow in the species. As a result the Project is unlikely to fragment an existing population into two or more populations.



Significant impacts criteria	Assessment
Adversely affect habitat critical to the survival of a species	Unlikely Habitat critical to the survival of the species has not been defined in the Commonwealth listing advice for the plains death adder. Although the proposed works will adversely affect habitats located within the easement, these habitats have not been identified as 'critical' to the survival of the species. The species utilises Mitchell grass plains habitat with cracking clay soils. These habitats are generally relatively uniform and locally abundant within the local landscape. As such, the habitats impacted by the Project are unlikely to represent habitat critical to the survival of the species. The Project activities will occur within an estimated 261.47 ha of habitat from a relatively broad geographic area. This represents only 0.15% and 0.04% of potential habitat available within a 2.5 km and 10 km buffer of the Project, respectively. The magnitude of habitat loss is therefore unlikely to have a significant impact on the species.
Disrupt the breeding cycle of an important population	Unlikely The species generally breeds from October to November, with young born between February to March. Males will attempt to breed every year, but females will only breed every one–two years depending on prey availability. Seeing as the Project has the potential to influence the abundance of prey in the immediate proximity to the Project area, the Project has the potential to disrupt the breeding cycle of the species at a local level. However, in a broad landscape context, the likelihood of the Project disrupting the species' breeding cycle of an important population is unlikely.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely The proposed works have potential to modify, destroy, remove, isolate or decrease 261.47 ha of potential habitat for the species. This represents 0.15% of potential habitat within the surrounding 2.5 km buffer. No degradation of habitats is anticipated in areas outside of the 60 m easement that is required to the transmission line. These impacts are minor considering the availability of habitats nearby. Impacts can be further mitigated by the employment of a fauna spotter catcher to survey the Project area prior to clearing. This can allow for the success identification and relocation of 'resident' individuals. Furthermore, the implementation of pest and weed management practices could serve to improve the quality of habitats immediately adjacent to the Project area.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely Cane toads are a recognized threatening process for the species. In the NT, cane toad have resulted in an 89% decline in the abundance of the plains death adder and the species is known to die in large number when toads are introduced (Hagman et al. 2008; Phillips et al. 2010). Cane toads are predicted to occupy almost all of the species home range by 2030 (Phillips et al. 2003). The Project is unlikely to exacerbate the spread of cane toads.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases that may be introduced to the species as a result of the Project.

Significant impacts criteria	Assessment
Interfere substantially with the recovery of the species	Unlikely The exact distribution of the plains death adder is unclear. Areas of potential habitat are relatively uniform and locally widespread. The footprint impacts are therefore expected to result in minimal proportional loss of habitat. The Project activities will occur within an estimated 261.47 ha of suitable habitat, which represents only 0.15% and 0.04% of suitable habitat within a 2.5 km and 10 km buffer of the Project respectively. Greatest impacts are from the potential direct mortality of individuals. However, these risks will be minimised through the use of preclearance surveys by suitably qualified spotter-catchers. Additionally, the removal of grazing and the management of fire regimes could provide additional benefits for the species that offset the potential impacts of the Project.

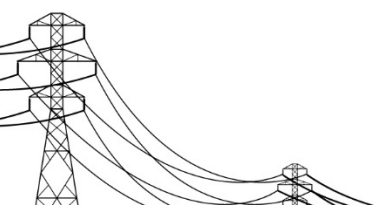
Ornamental snake

A significance of impact assessment for the ornamental snake (Vulnerable under the EPBC Act) is provided in Table 18-54.

Table 18-57 Significant impact assessment – ornamental snake

Significant impacts criteria	Assessment
Lead to a long-term decrease in the size of an important population of the species	Unlikely The occurrence of 'important habitat' has been adopted as a surrogate for an important population when assessing the impacts on the ornamental snake (DAWE, 2020b). Important habitat is considered to be any gilgais or mounds within areas of known habitat and connecting habitat that links gilgais (DSEWPac 2011). The draft referral guidelines for the nationally listed brigalow belt reptiles (DSEWPac 2011) indicates that a loss of more than 2 ha of important habitat risks a significant impact. The Project activities will occur within an estimated 34.66 ha of potential habitat, only a small proportion of that area would constitute gilgai areas or habitat linking gilgais. Gilgai areas have been actively avoided in the corridor selection process, to minimise disturbance to breeding habitat for the ornamental snake, but also to minimise the constructability issues that can be caused by gilgais given their dynamic and swampy nature. The majority of vegetated gilgai areas representing potential breeding habitat for the ornamental snake have been avoided. Areas of gilgai habitat that have not been avoided will be subject to targeted survey to microsite towers and access routes to avoid and minimise impact on gilgais. All clearing will be supervised by experienced fauna spotter-catcher to reduce the potential for injury or mortality. Given the avoidance measures implemented, the Project is unlikely

Significant impacts criteria	Assessment
Reduce the area of occupancy of an important population	Unlikely The Project activities will occur within an estimated 34.66 ha of potential habitat for the ornamental snake. This represents 0.14% and 0.04% of the potential habitat within a 2.5 km and 10 km buffer of the Project area respectively. Habitat for the species is patchily distributed. Without mitigation, it is therefore possible that a small, localised impact could result in the disappearance of individuals from a 2 km by 2 km area and result in a reduction in the area of occupancy. However, targeted preclearance surveys will be undertaken to identify and avoid areas of high local value by micro-siting towers. The use of spotter-catchers during clearing will also mitigate the potential risks of localised mortality. These avoidance measures will mitigate the potential for a reduction in the area of occupancy.
Fragment an existing important population into two or more populations	Unlikely If the species is present, it is anticipated to occupy scattered habitats with populations unlikely to be of an insufficient size for fragmentation to occur.
Adversely affect habitat critical to the survival of a species	Unlikely The ornamental snake is highly dependent on gilgais for shelter. The ornamental snake displays a high degree of habitat specificity, and is known to transition from highly abundant to absent over a few hundred metres (DAWE 2020b). As detailed above, gilgai areas have been largely avoided through the corridor selection process. Targeted surveys will be undertaken in all areas of potential breeding habitat still intersected to avoid impact on breeding areas by micro-siting towers and access routes away from areas of high microhabitat value. Construction activities have the potential to cause indirect impacts through sedimentation of adjacent foraging habitat or light spill that could disrupt the species nocturnal hunting behaviour. These temporary impacts can be mitigated through routine construction controls.
Disrupt the breeding cycle of an important population	Unlikely The Project is unlikely to disrupt the breeding cycle of an important population as suitable habitat for this species will largely be avoided by micro-siting towers away from areas of high habitat value. Due to the operational and logistic constraints associated with undertaking construction during the wet-season, works will take place in dry season months and therefore avoid the species' peak period of breeding activity (i.e. the wet season). Through spatial and temporal avoidance, the Project is expected to have minimal impact on breeding cycles of the ornamental snake.



Significant impacts 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 The Project activities will occur within an estimated 34.66 ha of potential habitat for the ornamental snake. This represents 0.14% of the potential habitat within the local landscape (2.5 km buffer) and 0.04% of potential habitat within the regional landscape (10 km buffer). As this species has specialised habitat requirements, it generally does not occur across broad regions, but has a patchy, localised distribution, with habitat found in distinct areas, particularly gilgais. This patchy distribution allows the opportunity to effectively avoid areas of habitat through local micro-siting of towers. While the Project has the potential to indirectly impact habitat through sedimentation and light spill, the impacts can be mitigated through routine construction controls. Maintaining connectivity between gilgais will be important. Pre-clearance surveys will be needed to identify areas important for movement between foraging areas. These areas will needed to be protected from impact as a priority and rehabilitated as after construction. Unmitigated the Project has the potential to cause direct and indirect impact on habitats. Provided the measures detailed above are undertaken the Project is not expected to result in any significant loss, modification, isolation or reduction in the quality of habitat.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely As this species feeds almost exclusively on frogs, the ornamental snake is considered to be at risk from lethal ingestion of cane toads (Phillips et al. 2003). Cane toads are already known to occur within the Project area and the Project works are unlikely to exacerbate the risks. The Project is therefore expected to have negligible impact on the species due to the influence of cane toads or other pest species.
Introduce disease that may cause the species to decline	Unlikely There are no known diseases that could be introduced by the Project works.
Interfere substantially with the recovery of the species	Unlikely The Project activities will occur within an estimated 34.66 ha of potential habitat, representing 0.14% and 0.04% of suitable habitat for the species at a local scale (2.5 km buffer) and regional scale (10 km buffer) respectively. Considering that suitable habitat for this species has been largely avoided by the corridor selection, and localised impacts on habitat can be avoided by micro-siting towers away from areas of high value habitat the Project is unlikely to interfere with the recovery of the species.

18.5.5.5 Listed migratory bird species

A significant impact assessment of the Project on eight of the confirmed present or likely to occur migratory bird species is provided in Table 18-55. The white-throated needletail is assessed separately in Section 18.5.5.4 as it is also a listed threatened species.

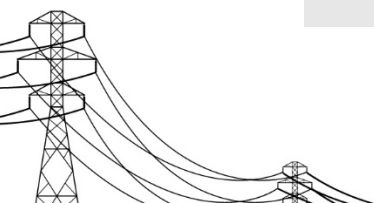
The Project is considered to be consistent with Australia's obligations under the:

- Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention)
- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)

Specific obligations under the above agreements that will be complied with include taking appropriate measures to preserve and prevent damage to the environment of migratory birds.

Table 18-58 Significant impact assessment – migratory bird species

Significant impact criteria	Assessment
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	Unlikely Mount Isa, particularly Lake Moondarra, may represent important habitat for a number of migratory species, with the oriental pranticole and Latham's snipe using the region as a resting place before continuing to migrate south or east. Lake Moondarra is recognised as an ecologically important wetland and water source for birds migratory across arid Australia (Porter et al. 2006). Within the Mount Isa Augmentation, the final corridor selection does not intersect or come in proximity to any wetland areas or water sources and is approximately 20 km south of Lake Moondarra. Although the Project activities will occur within an estimated 65.15 ha of non-breeding or breeding habitat for migratory bird species, this consists mostly of ephemeral waterbodies and watercourses that represent sub-optimal habitat and are distributed across a large geographic area. None of the mapped potential is likely to represent 'important habitat' as the species would likely be recorded as transient visitors. No single, large waterbody that represents a communal source of habitat will be directly or indirectly impacted. The final corridor selection has been designed with consideration of the ecological values present within the Project area and largely avoids wetland areas. Ephemeral watercourses are anticipated to be relatively unimpacted as transmission lines span a great distance (400 m) than the average width of the watercourses. Where watercourses or wetlands may be impact, mitigation measures will be included in the Project EMP to reduce the likelihood, extent and severity of impacts.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	Unlikely Feral cats and European foxes are known occur in the area. Both species represent invasive species that are harmful to migratory species and increase predation pressure of species resting within the Project area. Considering both species are already locally established, the Project is unlikely to introduce additional invasive fauna to the Project area. Invasive flora species poses a threat to migratory species through the degradation of habitat and potential impacts to foraging resources. The risk of invasive fauna species has been addressed by the requirement of weed and seed declaration for all Project vehicles on site. Additionally, weed management practiced implemented throughout the Project's lifespan will be targeted towards reducing weed abundance and encroachment into the



Significant impact criteria	Assessment
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	area. This could benefit migratory species by increase the quality of habitat. Unlikely The Project area does not contain breeding habitat for any of the migratory species confirmed present or likely to occur, as discussed below. Glossy ibis – This species breeds in colonies in trees or shrubs growing in water throughout Australia. No habitat was identified during field surveys. Latham's snipe – The species breeds in Japan and eastern Russia between March and November (DoEE, 2019b; Higgins and Davies, 1996). Gull-billed tern – The breeding season of the Gull-billed Tern is flexible, however there are few breeding reports north of about 25°S. The Project is located between 20 - 21°S. Caspian tern – The species breeding habitat is dispersed throughout its' range. In Queensland, breeding habitat is associated with offshore islands including the Wellesley Islands, Bird Island, Three Isles and islands off Shoalwater Bay. Inland breeding has been recorded at Lake Brindegolly and Lake Moondarra (Higgins and Davies 1996). No suitable breeding habitat was observed within the study area or is expected to be impacted by the Project. Fork-tailed swift – The fork-tailed swift does not breed in Australia, with breeding activities restricted to Siberia between August and September (Higgins 1999). White-throated needletail – The white-throated needletail does not breed in Australia. Breeding occurs in Japan, Siberia and Pakistan (Higgins 1999). Oriental pratincole – Oriental pratincoles breed in southern, south-eastern and eastern Asia, from northern parts of the Indian subcontinent, east through Bangladesh, Burma, Thailand and Vietnam to southern, eastern and northern China, Mongolia and adjacent areas of south-eastern Siberia. Marsh sandpiper - The species breeds in eastern Europe and Siberia and occurs in Australia between September and March/April. Wood sandpiper - The species is a non-breeding visitor to Australia from August - and is known to broadly occur across northern Australia, particularly throughout the Kimberly and Mount Isa regions. The species breeds throughout northern Eurasia and occurs in Australia between August and April.

18.5.6 Cumulative impacts of the Project with other proposed projects

This section assesses the cumulative impacts to MNES of the Project with those of other proposed projects in the region. An assessment of cumulative impacts was undertaken for the Project and is included in Volume 2 Chapter 20 Cumulative impacts. The cumulative impact assessment study area included the seven local government areas (LGAs) through which the corridor selection traverses, as well as Townsville City Council (refer to Figure 18-32).

18.5.6.1 Existing and proposed development

This section outlines the existing and proposed projects in the region of the Project. The locations of these projects in relation the Project is shown in Figure 18-33.

Townsville Port Expansion

The Townsville Port Expansion Project involves the expansion of the Port of Townsville including capital dredging of 11.48 million cubic metres of sediment, establishing a 152 ha reclamation area, construction of rock revetments and a breakwater, and construction of six new berths. The project has been approved by the Queensland Coordinator General and is a long-term development that has begun construction and will be completed by 2040.

Hells Gate Dam and Irrigation project (including Big Rocks Weir)

The Hells Gate Dam and Irrigation project is a proposed water infrastructure development on the upper Burdekin River catchment that includes 50,000 ha of irrigated agriculture, pumped hydro power and water storage. The detailed business case is scheduled for completion in 2022.

15 Mile Irrigated Agricultural Development

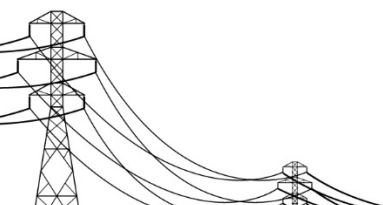
The 15 Mile Irrigated Agricultural Development is a proposed irrigated agricultural precinct near the Flinders River, approximately 12 km north-northwest of Hughenden. This project has been approved by the Queensland Coordinator General and is expected to be completed in 2020.

Key features of the development include:

- 305.7 ha of developable land for high value horticultural crops
- 156.6 ha of developable land for farming infrastructure
- 450.2 ha of land for environmental protection purposes
- Additional infrastructure including water storage and irrigation networks, amenities, machinery and chemical storage sheds, and packaging and logistics facility.

Kennedy Energy Park

The Kennedy Energy Park is a proposed hybrid wind, solar and storage project located approximately 80 km north of Hughenden. The EPBC Act referral document for the Project, dated October 2016, was reviewed and considered for cumulative impacts. The disturbance area for this project was reported to cover less than 100 ha (0.6% of the subject land), with the remainder being retained for ongoing cattle grazing uses. Of the potential MNES predicted to occur, the environmental assessment identified that squatter pigeon may be present, however with a lack of water sources constraining its occurrence. Black-throated finch was considered to occur in the Charters Towers and Townsville area, and may occur in the wet season when the Cape River is flowing. Some food trees for koala were present at the site, although no evidence of koalas was observed. No significant impact to MNES was identified as being likely to result from the action.



Queensland Drones Strategy

The Queensland Drones Strategy is a Queensland Government initiative that is developing a testing facility for unmanned aerial systems (drones) at Cloncurry Airport. During the initial stages of operation, drones will make test flights of up to 25 km along a designated flight path. Construction is expected to be completed by October 2020.

Hughenden Industrial Estate

The Hughenden Industrial Estate is an area of 35.9 ha located 2 km west of Hughenden. The Flinders Shire Council is proposing a stage 2 expansion of the estate by undertaking a reconfiguration of remaining land in the “medium impact industry zone”.

Hughenden Beef Processing Facility

The Hughenden Beef Processing Facility is a project proposed by the Flinders Shire Council that includes a beef processing plant, processing between 800 to 1,500 head of cattle per day, and a 50,000 head feedlot. A pre-feasibility study has been undertaken and the facility is expected to be operational in 2022.

Mt Colin Mine

Mt Colin Mine is an underground copper/gold mine owned by Round Oak, located between Mount Isa and Cloncurry, with a nominal production rate of 420,000 t/year. First processing of ore began in October 2019 and is expected to extend until August 2022, or further if exploration of ore zones extends the mine life.

Northern Outback Queensland Meat Processing

A study has been commissioned jointly by Queensland and Commonwealth Government departments in conjunction with regional stakeholder groups to investigate the viability of a new meat processing facility in the Cloncurry area. The study prescribes a minimum of 380 ha of land to satisfy buffer distance requirements for an abattoir with processing capacity of 100,000 head of cattle per annum.

18.5.6.2 Cumulative impacts to MNES

Some projects in the region have limited published information available in relation to their activities and proposed and actual impacts to MNES. It has been estimated that the most significant cumulative impact on MNES will be the potential loss of habitat and impact to species listed under the EPBC Act.

As described previously, the Project has carefully selected the route of the transmission lines and substation sites to avoid, where possible, conservation significant ecological communities, species occurrences and their supporting habitat.

Few of these other projects are in the vicinity of the Project area; however there are historic mining sites and associated disturbances (particularly in the western corridor sections) and energy projects (e.g. wind farm/solar farm) in the central areas that are present in close proximity to the Project.

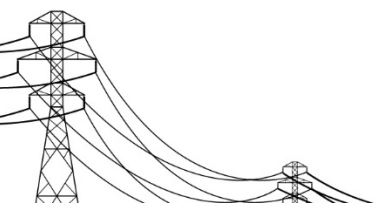
The mining sites are typically localised in their impacts, with some being underground mines, and some are no longer active and have been preserved for historic cultural (and natural in the case of mine shafts providing habitat for bats) values. It is considered unlikely that these Projects would have significant residual impacts to MNES.

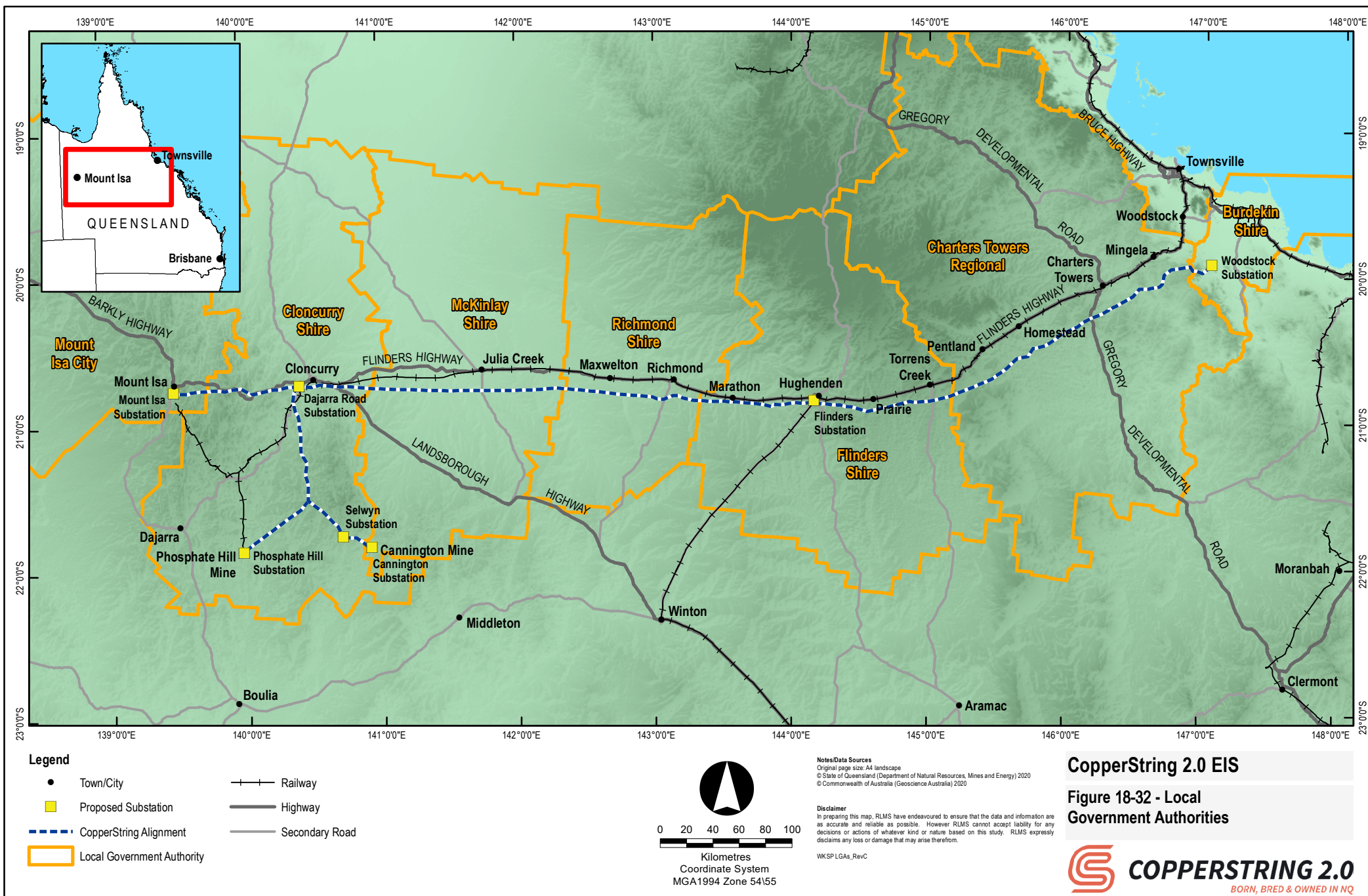
The wind farm/solar farm project near Hughenden identified limited habitat value for the MNES species that were considered to have potential to occur, being koala, squatter pigeon and black-throated finch. No significant residual impacts were considered likely. It is also considered

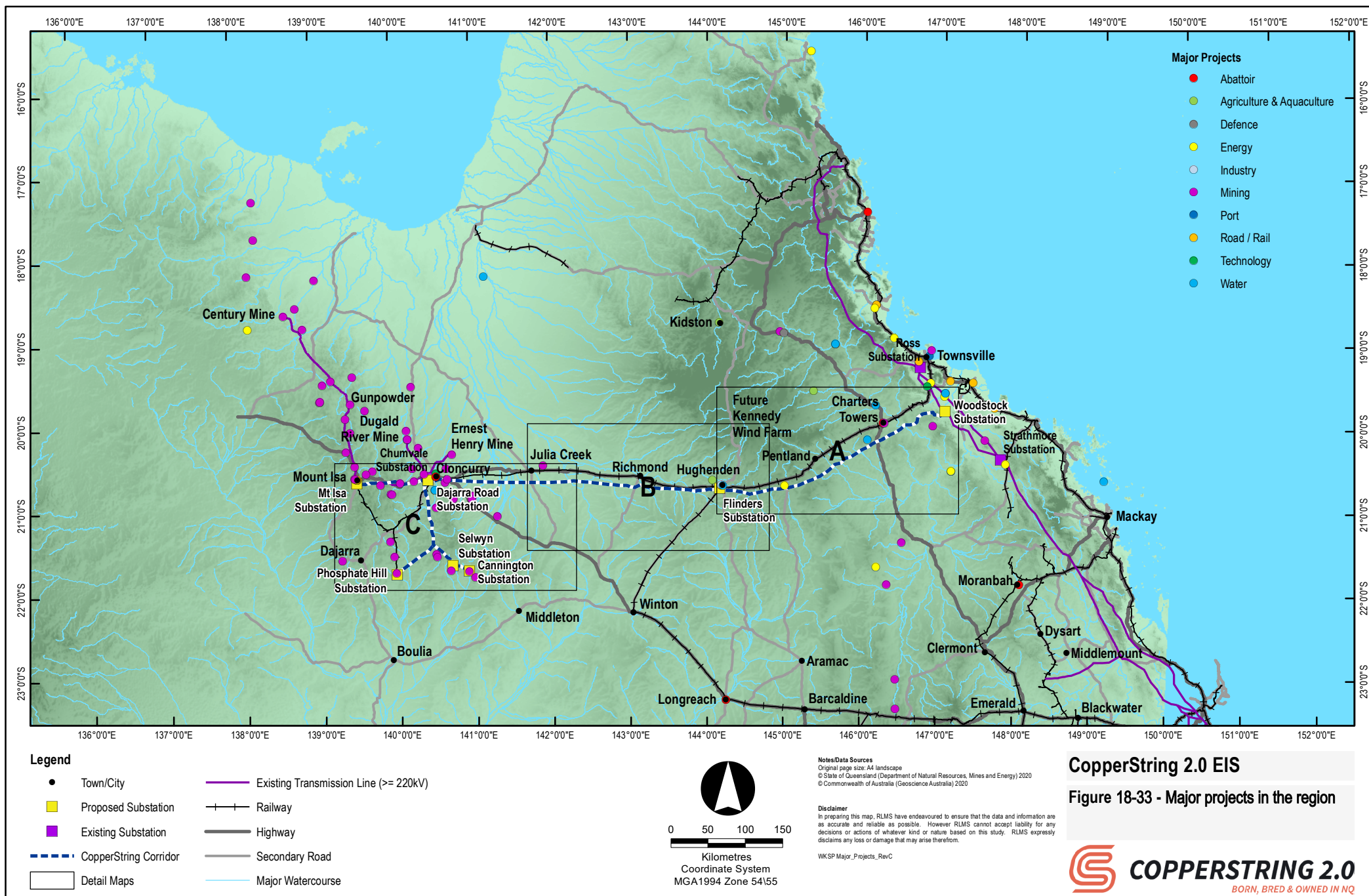


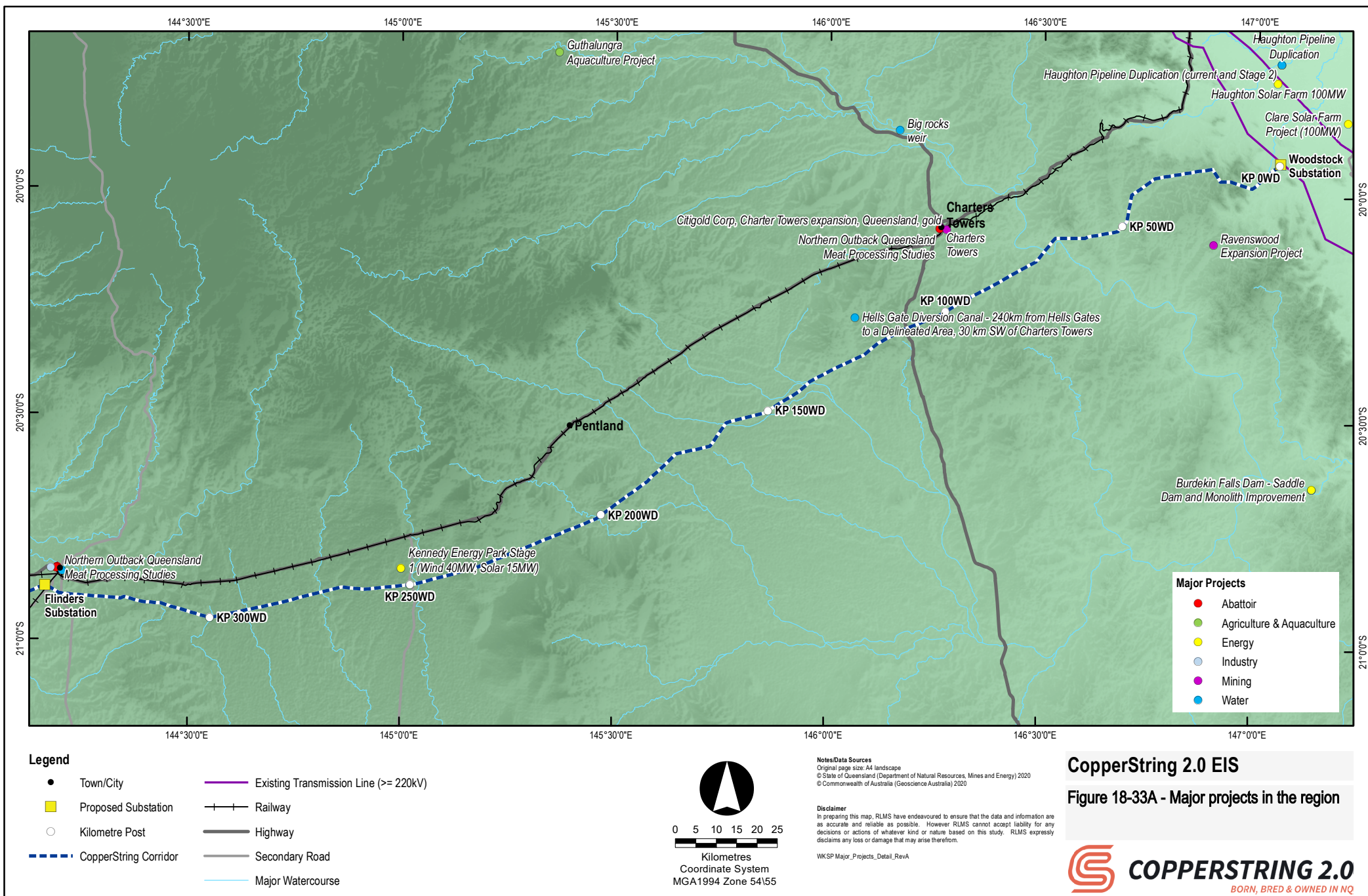
unlikely that there will be cumulative significant residual impacts to these or other MNES as a result of the current Project at the local or regional scale.

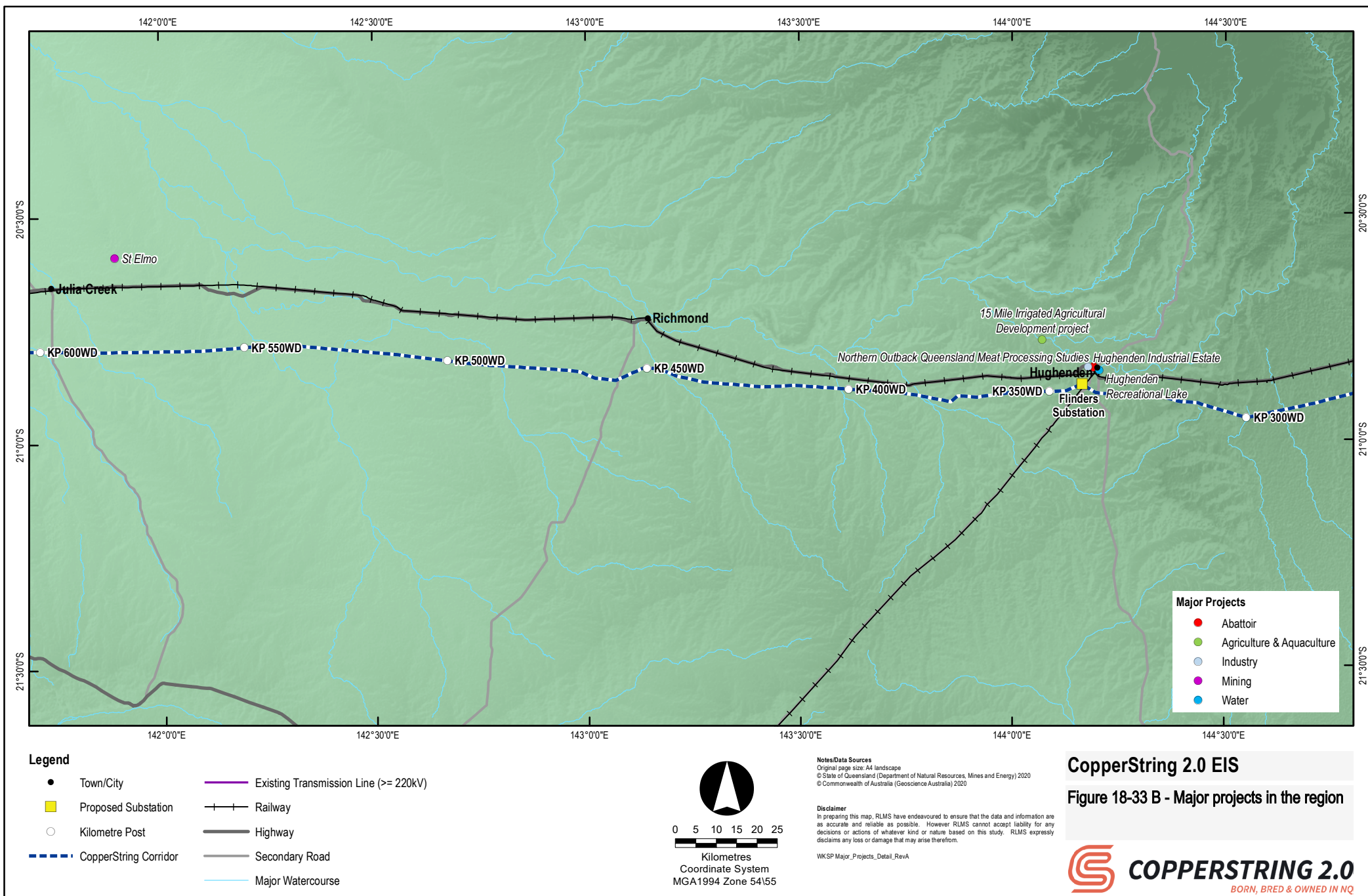
The proposed avoidance and mitigation of any significant residual impacts to MNES from the Project is considered to also avoid and mitigate potential cumulative impacts on MNES at the local and regional scales. Therefore no significant cumulative impacts to MNES are likely to result from the Project.

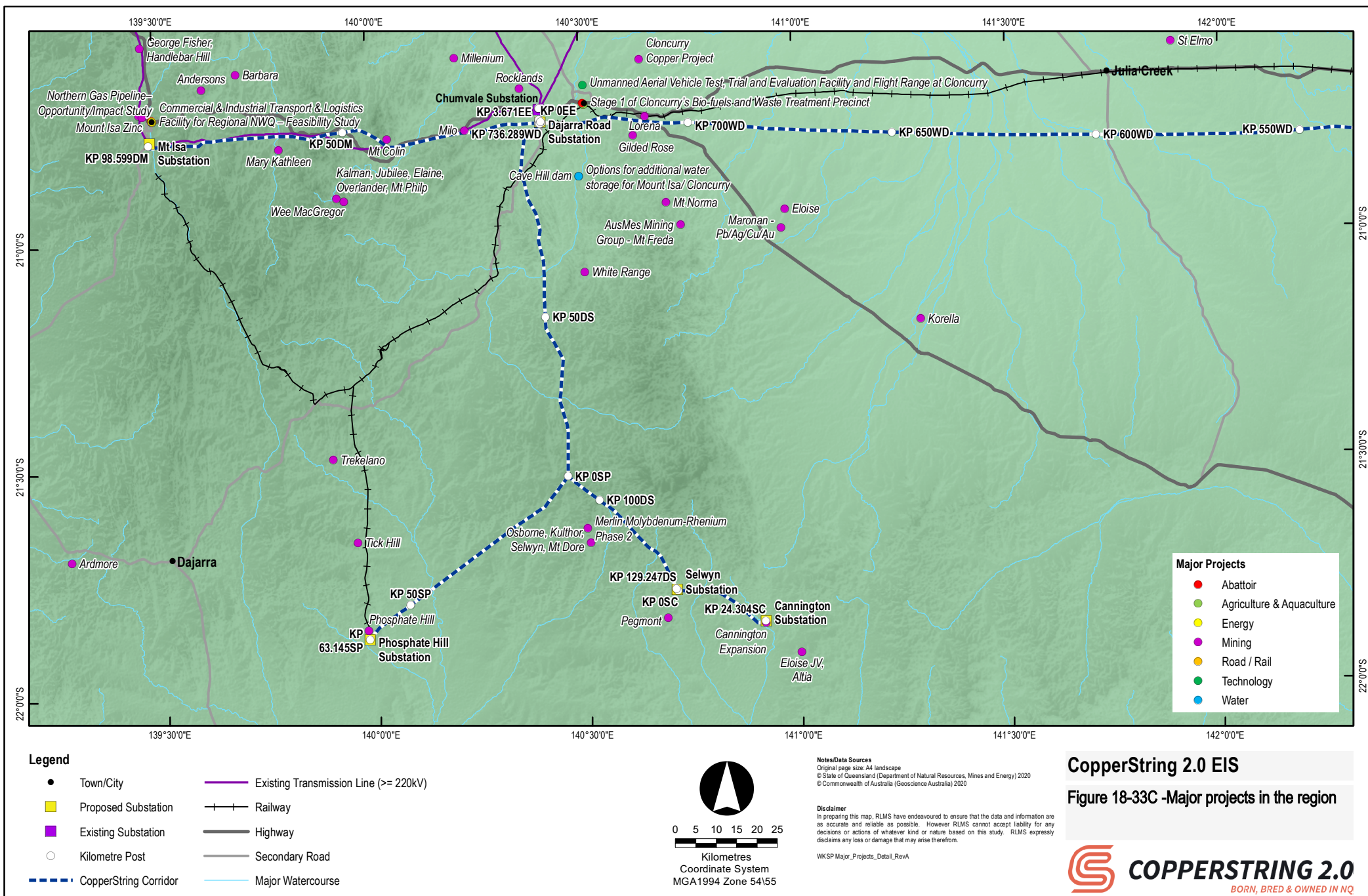












18.5.7 Summary of proposed mitigation and management measures

The mitigation and management measures in Table 18-56 will be implemented to minimise and avoid the potential impacts of the CuString 2.0 Project on MNES. These mitigation and management measures will be implemented in combination with measures outlined in other chapters of the EIS, including:

- Volume 2 Chapter 6 Geology and soil
- Volume 2 Chapter 7 Flora and fauna
- Volume 2 Chapter 8 Biosecurity
- Volume 2 Chapter 9 Water resources and water quality
- Volume 2 Chapter 10 Air and greenhouse gas
- Volume 2 Chapter 11 Noise and vibration
- Volume 2 Chapter 19 Environmental management
- Volume 2 Chapter 21 Environmental offsets
- Volume 3 Appendix O Visual amenity
- Volume 3 Appendix P Ecological assessment
- Volume 3 Appendix Q Framework environmental management plan
- Volume 3 Appendix R Field development plan
- Volume 3 Appendix S Concept erosion and sediment control plan
- Volume 3 Appendix U Concept biosecurity plan

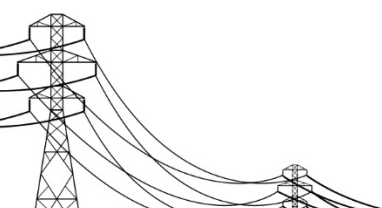
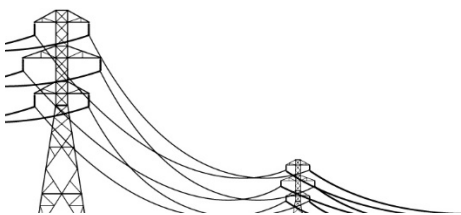
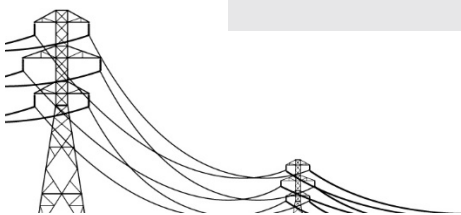


Table 18-59 Mitigation and management measures

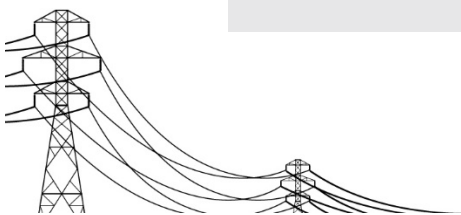
Timing	Mitigation and Management Measures
Pre-construction	The layout of temporary and permanent structures and infrastructure (including construction areas, site offices, stockpile, laydown areas, access tracks and construction camps) will be designed to minimise clearing of vegetation (in particular endangered, of concern and threshold REs).
Pre-construction	Habitat assessment and condition surveys will be undertaken in areas identified as potential habitat in the Draft EIS. These investigations will inform the Flora and Fauna Management Plan, and other targeted management plans for sensitive areas and species.
Pre-construction	A Flora and Fauna Management Plan will be developed prior to construction commencing. The Flora and Fauna Management Plan will include details relevant to the general management of flora and fauna impacts as well as Species Management Plans for identified conservation significant species that will be impacted. Where necessary, the Flora and Fauna Management Plan will incorporate flora and fauna monitoring activities. Specifically, ongoing monitoring and survey requirements necessary to assess the persistence and health of conservation significant populations will be outlined (i.e. EVNT flora and fauna species impacted by the Project). For more information on the flora and fauna management plan, refer to Volume 3 Appendix Q Framework environmental management plan.
Pre-construction	Species specific avoidance, mitigation and management measures will be incorporated within the Flora and Fauna Management Plan.
Pre-construction	Towers will be strategically located to allow the corridor to span across watercourses. This will also eliminate the need for waterway barriers.
Pre-construction	Where possible, the corridor selection should be located within cleared area to reduce to amount of clearing required.
Pre-construction	The final corridor selection should be designed to avoid sensitive areas (e.g. wetlands and semi-evergreen vine thicket) and areas with large trees.
Pre-construction	A Decommissioning and Rehabilitation Plan for areas to be temporarily disturbed during construction will be developed prior to construction commencing with the overall aim of minimising the amount of land disturbed at any one time during the construction of the Project. As soon as practicable after cleared areas are no longer required (i.e. temporary construction camps, laydown areas, quarries, borrows, turning circles and access tracks), rehabilitation will commence. Temporary construction infrastructure will be decommissioned and removed from site. The sites will then be rehabilitated to a state generally consistent with the natural environment. The Decommissioning and Rehabilitation Plan will include: • Removal of potentially hazardous stored substances • Remediation of any contaminated areas



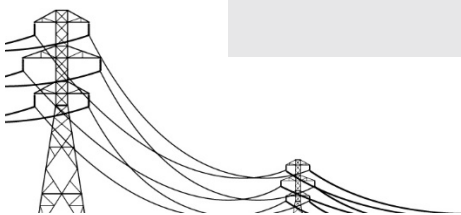
Timing	Mitigation and Management Measures
	- Grading of disturbed surface landscapes to a state generally consistent with a natural environment (if required) and to ensure that permanent drainage lines are not compromised - Application of topsoil and revegetation with native species. Revegetation would use flora species of local provenance that were present prior to clearing commencing and species specific to the RE cleared at that site - A mechanism for rehabilitation strategies to be refined throughout the life of the Project to implement methods which have been most reliable and successful - Requirements and mechanisms for post construction monitoring and audit of rehabilitation success. Material cleared during construction is planned to be chipped, mulched and stockpiled for reuse during rehabilitation. Materials with special habitat value, such as hollow bearing logs or trees, will be selectively removed for reuse during rehabilitation, or placed in nearby bushland. Any watercourse areas crossed will be restored and rehabilitated with measures to improve connectivity and provide enhancements to suitable habitat, where referenced in the Flora and Fauna Management Plan. The Decommissioning and Rehabilitation Plan will also outline specific objectives and methodology for the following: - Seed collection - Flora regeneration - Landscape architecture (i.e. topography) - Creation of supplementary habitats (e.g. nesting boxes), if necessary.
Pre-construction	Weed mapping will be undertaken during the pre-construction phase. Weed mapping will cover the final corridor selection and ancillary infrastructure, with particular focus on high risk locations.
Pre-construction	Weed control will be undertaken in areas that are very heavily infested or where WoNS or Class 1, 2 or 3 weeds declared under the <i>Biosecurity Act 2014</i> (BS Act) are known to occur.
Pre-construction	A Weed and Pest Management Plan will be developed prior to construction commencing. The weed and pest management plan will include details relating to the monitoring, management and, where necessary, eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols.
Pre-construction	Light requirements identified during the detailed design will consider positioning security lighting at permanent facilities to minimise the potential for lighting impacts on fauna.
Construction	Vegetation clearing will be restricted to the minimal amount necessary for the construction of the Project footprint. Micro-siting of infrastructure, such as tower footprints, brake and winch sites, and assembly areas, will be undertaken during the detailed design phase to further reduce impacts and to ensure areas of high ecological significance are avoided wherever possible.
Construction	Vegetation will only be cleared or trimmed where it is within five metres of the transmission line at maximum sag. Clearing of all vegetation to ground level will be required to accommodate transmission line infrastructure including tower foundations,



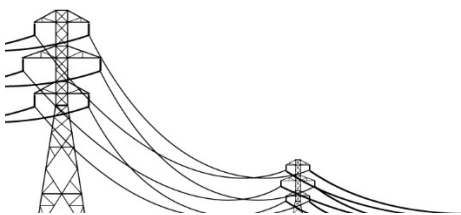
Timing	Mitigation and Management Measures
	substations, laydown areas, etc, where is cannot be placed in cleared areas. Clearing may also be required for trees taller than five metres if they fall within the five metre safety buffer. Where possible, any trees taller than five metres within the easement or with overhanging branches that spread into the easement will be trimmed to a reduced height so as not be within the five metre safety buffer
Construction	Areas of high terrain will allow spanning of the majority of vegetated areas, particularly in habitats of low open woodlands that feature very sparse canopy trees of very low height. In such areas, clearing is likely to be limited to that required for tower footprints and access tracks. These tower and access locations will be determined during the detailed design phase.
Construction	Areas of grassland habitats feature very few and low trees or shrubs (frequently confined to drainage line corridors), therefore clearing of vegetation will be minimal in these areas and will span riparian corridors wherever possible. Ground disturbance will occur in these grassland habitats, which have value for ground-dwelling mammals and reptiles, however disturbance will be restricted to pre-determined areas and will be temporary apart from permanent infrastructure locations
Construction	Pre-clearance surveys will be undertaken during the detailed design phase within known and potential habitat areas of conservation significant species and within significant communities such as Of Concern REs in order to plan infrastructure placement, tower heights, spans and resulting clearing to avoid known occurrences and habitat for species
Construction	Areas of high ecological significance will aim to be spanned across wherever possible using higher towers (i.e. up to 75 m height) and shorter or longer spans, as appropriate to the ecological values and depending on the terrain. This will enable vegetation below 20 m to be retained and mature trees over 20 m may be trimmed if necessary for safety and maintenance requirements
Construction	The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors
Construction	Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks or clearing) will be used. Where this is not in alignment with safety standards, the Project footprint will be minimised and large habitat trees retained. Waterway crossings in known habitat for conservation significant flora and fauna species will aim to avoid occurrences of flora species and span across the riparian habitat corridors wherever possible
Construction	Approximately 12.1 ha of protected plant high risk trigger area is intersected by the Project area mapped for <i>Livistona lanuginosa</i> in the Renewable Energy Hub corridor section. Clearing within 100 m of a protected plant within this area will require a compliant flora survey and clearing permit (under the NC Act) within this high risk trigger area. Removing a protected



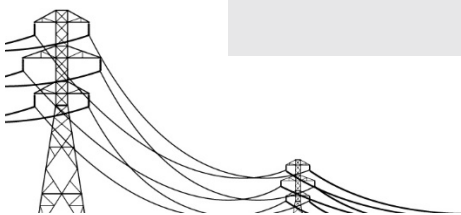
Timing	Mitigation and Management Measures
	plant outside of a high risk trigger area will also require a clearing permit. This may apply to occurrences of <i>Livistona lanuginosa</i> that are confirmed during pre-clearance surveys. A Protected Plant Impact Management Plan is required as part of the clearing permit application. While the Project is considered to be able to avoid occurrences of these individuals, there may be some trimming of mature trees required and individuals to be retained within the Project area that will require a clearing permit
Construction	All site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas as a priority
Construction	Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken after these facilities are no longer required
Construction	A CEMP will be prepared and implemented for standards such as weed hygiene, erosion, fuels and hazardous substances, fire, etc.
Construction	All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions
Construction	Habitat enhancement features (e.g. salvaged hollows and nesting boxes).will be established outside the clearing area within suitable habitat.
Construction	Pre-clearance surveys will be undertaken to mark and where possible avoid the locations of all potential breeding places for wildlife and the locations of any breeding places for conservation significant species. These will target areas with potential to support breeding habitat for the squatter pigeon, greater glider, Julia Creek dunnart, southern black-throated finch and the night parrot.
Construction	Preparation of a high risk Species Management Program (SMP) will be undertaken in accordance with the requirements of Section 332 of the <i>Nature Conservation (Wildlife Management) Regulation 2006</i> . Key species likely to be targeted in the high risk SMP include the squatter pigeon, black-throated finch, Julia creek dunnart.
Construction	Pre-clearance surveys will specifically target areas of potential habitat for conservation significant species that have the potential to occur within the clearing footprint. Pre-clearance surveys will be required as part of the standard requirements of the high risk SMP
Construction	All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve searching and clearing all hollow trees and logs prior to clearing and relocating any resident fauna to the nearest suitable, safe habitat outside the clearing footprint



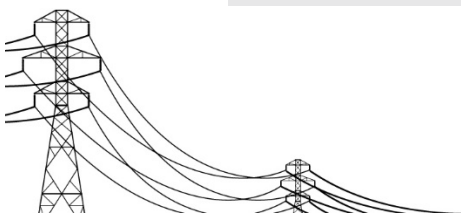
Timing	Mitigation and Management Measures
Construction	Temporary exclusion fencing will be established around cleared areas in locations of high ecological sensitivity to prevent wildlife from returning to works areas where deemed appropriate
Construction	Employment of sequential clearing practices and use of suitably qualified koala spotters in accordance with guidelines for reducing impact on koalas
Construction	Areas of potential habitat for the squatter pigeon are to be flushed immediately prior to clearing (i.e. spotter-catcher to walk in front of clearing machinery).
Construction	Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing
Construction	A Traffic Management Plan will be developed for the construction site with designated access routes, speed limits and sensitive ecological areas (i.e. particularly areas where squatter pigeons have the potential to occur on access roads).
Construction	Given the specific susceptibility of the squatter pigeon to vehicle collision - warning signs will be erected on all tracks that intersect locations in which the squatter pigeon has been confirmed present. Squatter pigeon awareness will be included in all worker inductions and in the Traffic Management Plan. A register of squatter pigeon sightings will be maintained to identify areas that have a high risk of collision
Construction	The Construction EMP will include protocols to limit injury and mortality to fauna including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols
Construction	Establish 'go slow zones' (40 km/hr) for vehicles and machinery where non-gazetted roads or tracks are located adjacent to areas of woodland, wetlands, and rock outcrop/jump-up areas
Construction	Access tracks will be restricted to areas that are already disturbed as a priority.
Construction	Construction laydown areas and stockpiles will be limited to areas that have already been cleared to minimise unnecessary clearing.
Construction	The footprint needed for ancillary activities and hardstand areas will be minimised where possible without compromising the safety and integrity of structures
Construction	Where possible, temporary construction areas will be rehabilitated after the completion of construction works to reconnect fragmented habitats



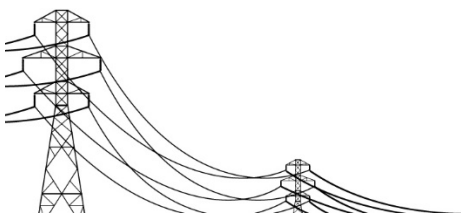
Timing	Mitigation and Management Measures
Construction	During the detailed design phase, areas of high habitat connectivity that are intersected by the Project will be identified and measures investigated that would improve or restore connectivity across the corridor selection (e.g. placement of key habitat features within the corridor such as shelter or forage resources, or retention of vegetation between large remnant patches that hold significant habitat value).
Construction	Site lighting will be kept to the minimum needed for safety
Construction	Construction activities will be prioritised to be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat and to reduce noise and vibration impacts on nocturnal fauna species
Construction	A Traffic Management Plan will be developed for the construction site to control vehicle movements and reduced the unnecessary generation of vehicular noise
Construction	All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction
Construction	An Erosion and Sediment Control Plan (ESCP) will be developed as part of the CEMP for the Project (refer to Volume 3 Appendix S Concept erosion and sediment control plan).
Construction	Routine dust suppression and monitoring will be undertaken throughout construction and operation
Construction	Erosion and sediment control measures will be installed where disturbance must be undertaken within or adjacent to wetted waterways
Construction	Areas subject to clearing will be stabilised with areas of steeper gradient prioritised.
Construction	All vehicle movement should stay on the designated tracks and not deviate from them unless necessary
Construction	Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
Construction	Construction activities will cease during adverse weather conditions (e.g. high wind / high rainfall) that have the potential to distribute dust or increase run off and sedimentation
Construction	Duration of in-stream works will be minimised to reduce the potential for sedimentation
Construction	Rehabilitation of temporary construction areas will be undertaken after clearing
Construction	A Waste Management Plan will be prepared as part of the CEMP. This will detail the location and specifications for disposal and removal of waste from the construction site



Timing	Mitigation and Management Measures
Construction	Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site
Construction	Sightings or evidence of pest animals will be recorded during construction. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers
Construction	Construction staff will not bring domestic animals to the Project area
Construction	All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of feral animals
Construction	A Weed Management Plan will be prepared for the Project and included within the CEMP
Construction	The Weed Management Plan will include hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation
Construction	All construction vehicles / equipment travelling from declared weed areas will undertake a wash down and possess a current weed hygiene inspection certificate from an accredited inspection station that is required to carry as evidence of quarantine clearance
Construction	Resources sought from outside the study area (e.g. fill for access tracks) will be required to hold weed free declarations
Construction	Restrict vehicle access to existing roads and tracks where possible
Construction	The Weed Management Plan will include protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
Construction	Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the study area to inform the Weed Management Plan
Operation	All travel will be restricted to designated access tracks and roads
Operation	All vehicles and plant will adhere to site rules relating to speed limits. Speed limits will be clearly signposted to minimise the potential for road kill
Operation	All fencing used on the Project will use fencing without barbed wire on the top strand to minimise incidence of flying fox entanglement.



Timing	Mitigation and Management Measures
Operation	Warning signs will be placed where access tracks intersect areas where the risk of collision with squatter pigeons is high (i.e. confirmed squatter pigeon habitat).
Operation	Species management plans will be constructed for conservation significant species with predictable breeding habitat located within the study area. This includes the black-throated finch (southern), Julia Creek dunnart, squatter pigeon (southern) and greater glider.
Operation	No artificial lighting will be used on transmission towers or supporting infrastructure
Operation	Work hours will be restricted to the hours of 7 am and 6 pm
Operation	Reduced vehicle speed limits to reduce dust dispersal in areas of exposed soil.
Operation	Minimising vehicle access to waterways and exposed surfaces by establishing designated watercourse crossings
Operation	Continued employment of sediment and erosion control measures and track maintenance to provide ongoing management of erosion prone areas (e.g. waterways).
Operation	Should additional clearing be required during operation, rehabilitation will take place after cessation of use of the area
Operation	Continued implementation of responsible driving practices will reduce the amount of noise generated during construction
Operation	Ongoing maintenance of tracks to reduce dust and erosion that have the potential to exacerbate localised barrier effects for smaller ground-dwelling fauna species
Operation	Ongoing use and maintenance of designated waterway crossing points to minimise disruption to longitudinal movement of wildlife along watercourses
Operation	A large proportion of the footprint will be subject to temporary vegetation clearance only and rehabilitated after construction
Operation	Poles or planks will be placed in open excavation areas (e.g. pits and holes) to allow trapped fauna to escape



18.5.8 Framework Environmental Management Plan

A Project Framework Environmental Management Plan (FEMP) has been developed in accordance with the Department of Agriculture, Water and Environments 'Environmental Management Plan Guidelines' (2014) and incorporates the outcomes of the assessment undertaken in the EIS. The Project FEMP is provided in Volume 3 Appendix Q Framework environmental management plan.

Environmental management plan

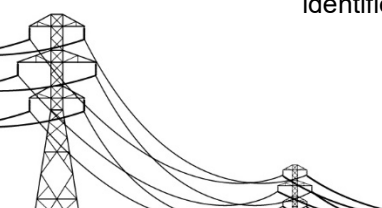
A FEMP has been presented as part of the Project EIS to inform project planning, design, construction and operations. The extensive environmental studies and investigations which have been undertaken as part of the EIS, have been used to inform the development of the FEMP. The Project FEMP identifies the overarching components of the Project FEMP and will serve to guide the implementation of the plan during planning and design and further development of the EMP (Construction) and EMP (Operations). The components of the environmental management plan include:

- Environment and Sustainability Policy
- Planning, objectives and legal obligations
- Resources, roles, responsibilities and authorities
- Competence, training and awareness
- Communication, consultation and involvement
- Documentation, document control and records
- Operational controls
- Emergency preparedness and response
- Monitoring, inspections and audits
- Incident management
- Complaints management
- Non-conformity, corrective action and preventative action
- Environmental reporting
- Management review and continuous improvement.

Relationship to environmental design

The Project FEMP provides overarching environmental objectives and performance criteria to be achieved throughout the life of the Project and incorporates the management measures from the EIS which are to be implemented during the planning and design of the Project. Additional studies will be undertaken during the design phase to inform the EMP (Construction) including site specific assessments of the potential impacts associated with key construction areas such as laydowns and accommodation footprints, and finalising the location footprints of permanent infrastructure.

These management measures will ensure that the Project is designed to minimise adverse impacts to the environment during construction and operations phases. Where significant impacts are expected to occur, further management and monitoring programs have been identified for the construction and operations phases. These management measures are



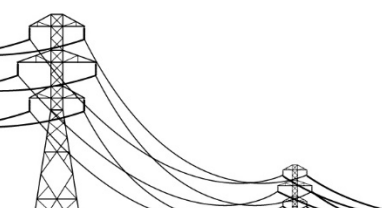
outlined in the Project FEMP and will be subsequently incorporated into the development of the EMP (Construction) and EMP (Operations).

Environmental aspects and structure of management plans

The Project FEMP identifies the aspects of the Project which are likely to have significant environmental impacts as identified in the EIS and subsequently require consideration during the planning phase and further management and monitoring during the construction and operations phases. The Project FEMP outlines the proposed management plans for the relevant environmental aspects and impacts associated with the Project, which will inform development of the EMP (Construction) and EMP (Operation). These management plans provide environmental management objectives for each aspect and outlines management measures to be implemented, the timing and the responsibility for each, across the Project. The general structure of each management plan is outlined in Table 18-57.

Table 18-60 Structure of management plans

Element	Description of Content
Conditions of approval	Cross reference the conditions of approval from the Coordinator General and/or other approvals.
Project Description	A description of the project and activities to be undertaken.
Objectives	Objectives of the environmental management plan should be defined and tailored to the environmental issues outlined in the plan.
Environmental management roles and responsibilities	Allocation of roles and responsibilities for compliance with conditions and implementation of the commitments made in the environmental management plans.
Reporting	A description of internal and external reporting requirements and include a list of required reports, the required content, any reporting triggers, document control and reporting recipient. Reporting requirements should be consistent with any conditions of approval.
Environmental training	All people involved with the Project should receive relevant environmental training to ensure responsibilities are understood when implementing environmental management plans.
Emergency contacts and procedures	Identify key emergency contact responsible for management of environmental emergencies. Establish procedures for managing environmental emergencies.
Environmental management measures	
Existing environmental values and potential impacts	A description of the environmental values likely to be impacted by the Project (direct and indirect), including the nature of the impact and any short or long term effects.
Risk assessment	Undertake a risk assessment for each potential impact including estimating the likelihood and consequence of each impact.
Management objective(s)	The overarching objective to be achieved for the environmental value likely to be affected by the Project.



Element	Description of Content
Performance criteria	Measurable outcomes or indicators prescribed to gauge whether the management objectives are being met.
Management and mitigation measures	The strategies, tasks or methods proposed to achieve the performance criteria. This section provides the measures relevant to design, construction and operation.
Monitoring requirements and corrective actions	The proposed monitoring activities to measure the performance criteria against relevant thresholds or trigger values and the corrective actions to be implemented where certain performance criteria are not met.
Closeout / Project completion	Recorded evidence that no further actions or monitoring is required and performance standard has been achieved.
Environmental auditing and review of environmental management plan	Include a schedule or triggers for auditing the implementation and effectiveness of the plan. Should include both internal and external audit requirements.

The mitigation measures identified within this MNES chapter have been incorporated into the FEMP (Volume 3 Appendix Q Framework environmental management plan).

EMP (Construction) and EMP (Operation)

The EMP (Construction) and EMP (Operation) will set out a detailed procedure for managing environmental impacts during the construction and operation of the Project respectively and will be developed in accordance with the objectives, performance criteria, management measures and monitoring requirements stipulated in the Project FEMP. The EMP (Construction) and EMP (Operation) will also incorporate the approval conditions issued for the Project and any commitments made by CuString in the EIS.

Where it was determined in the EIS, that particular areas along the Project are environmentally sensitive or where the proposed construction activities demonstrate a high risk for environmental damage, a site-specific, site based management plan will be prepared.

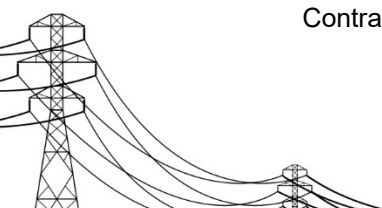
Site based environmental management plans

Where required, the EMP (Construction) and EMP (Operation) will identify the need for a site based management plan(s) for specific activities of the Project.

A site based management plan will be developed to accompany the respective permit / approval application where required for certain (generally high-risk) activities. Once the permit / approval has been granted, the site based management plan will be updated to incorporate any relevant conditions of the approval.

Environmental monitoring

The Construction Contractor and Operation and Maintenance Service Provider are required to develop and implement an environmental monitoring program consistent with the requirements of this FEMP. This monitoring program will address the EIS commitments and approval, permit and licensing conditions, and be reviewed and approved by CuString as part of the Construction Contractor's CEMP and Operation and Maintenance Service Provider's OEMP.



Monitoring activities will be conducted by a person who is suitably trained and qualified. Monitoring will be carried out in accordance with guidelines and standards specified in permit and approval conditions.

The results of the monitoring programs will be interpreted and reviewed regularly. Results will be reported to relevant authorities within agreed timeframes as determined in approval conditions. The incident management procedures will describe the procedures for instances, where monitoring results trigger the need for a management and/or reporting response.

Environmental inspections

The Construction Contractor and Operation and Maintenance Service Provider will be required to conduct regular environmental site inspections at a frequency appropriate to the work activity being undertaken. The inspections will review all environmental controls that are relevant to the construction activities underway at the time of the inspections.

The date and time of the inspections shall be recorded as well as comments on non-conformance and corrective action taken. Copies of the site inspection checklist will be signed and maintained in a logbook. Where the non-conformance does not present a significant risk of environmental harm, and can be corrected promptly, the corrective action will be closed out on the checklist. Where the risk of environmental harm is more significant and/or the corrective action cannot be undertaken promptly, the action will be recorded in the corrective action register.

Where an incident or near miss is observed during inspections, the incident investigation and reporting procedure will be followed.

Environmental auditing

The Construction Contractor is responsible for periodic internal audits of compliance with the requirements of the CEMP. The Operation and Maintenance Service Provider is responsible for periodic internal audits of compliance with the requirements of the OEMP.

CuString may choose to engage an independent, suitably qualified and experienced auditor to conduct external audits of the Construction Contractor's implementation of the CEMP and FEMP and/or the Operation and Maintenance Service Provider's implementation of the OEMP and FEMP.

CuString will develop and implement an environmental auditing program to determine compliance with the CEMP, OEMP and permit and approval conditions over the life of the Project. Auditing of the performance of construction activities against the CEMP will be carried out at least monthly and auditing of performance of the operations and maintenance phase OEMP will be carried out annually.

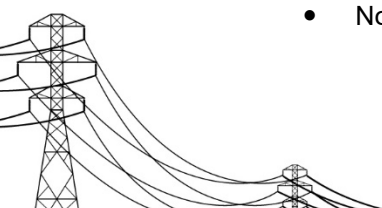
CuString will maintain all audit records and will be responsible for scheduling follow-up inspections to ensure that corrective actions are being implemented for any non-compliances detected.

18.5.8.1 Environmental Management Plan – Flora and Fauna

The following outlines the environmental management plan elements for the Project for managing flora and fauna aspects.

Management objective

- Avoid or minimise impacts from Project activities to terrestrial and aquatic flora and fauna (and fauna habitat) and ecological communities
- No introduction of new pest plants and animal species in the Project area



- No sustained increase in extent of existing pest plants and animals

Performance criteria

- Vegetation clearing is conducted in accordance with the performance requirements of the *Planning Act 2016*
- No permanent disturbance to flora or fauna outside of the Project area (easement, CEV hut, access tracks and substation sites) except where approved for construction access
- Self-sustaining groundcover and understorey is established in the easement post construction
- All necessary statutory approvals are obtained prior to construction
- No introduction of new pest animal or plant species to the Project area
- No sustained increase in distribution of weeds in the areas disturbed by or influenced by construction activities

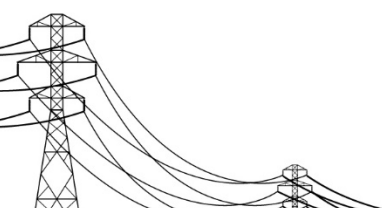
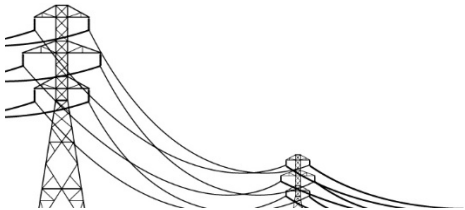
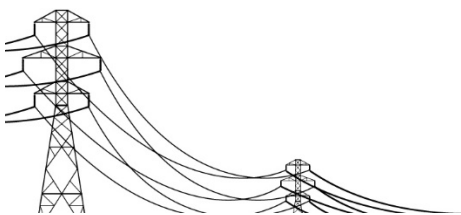


Table 18-61 EMP – Flora and Fauna Elements

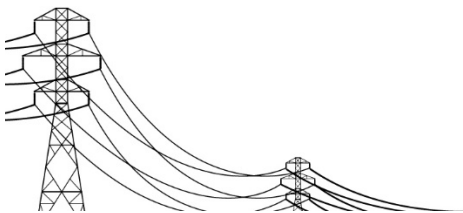
Timing	Controls	Responsibility	Trigger/Applicability	Documentation
Design	Refinement of the corridor selection during landholder negotiations and detailed design phase will consider measures to minimise vegetation removal The use of taller transmission line structures near waterways where practical will be considered with the aim of spanning of riparian vegetation Existing roads and tracks will be used for access where possible. Access tracks will be clearly marked. During site investigations and surveys no unauthorised use of alternative accesses will be permitted	CuString / Design Manager	Design	Volume 3 Appendix R Field development plan
Design	An Offset Strategy will be developed in consultation with regulators during the detailed planning/design for the Project, if required.	CuString	Design	Offset Strategy
Design	A field assessment will be undertaken within planned disturbance areas (easement or access tracks) to ground truth flora and fauna constraints (such as known occurrences of conservation significant vegetation communities, flora species and fauna species) for refinement of corridor selection	CuString / Design Manager	Design	Field assessment report
Design	Refinement of clearing requirements within areas of high ecological value, such as riparian corridors, will be minimised where identified in the Flora and Fauna management measures in the CEMP/OEMP and will be rehabilitated to restore connectivity to a level that considers the requirements of maintaining permanent infrastructure. All cleared areas which are no longer required will be rehabilitated in a way that facilitates the movement of fauna.	CuString / Design Manager	Design	Detailed Design



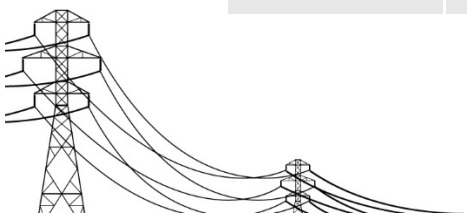
Timing	Controls	Responsibility	Trigger/Applicability	Documentation
All Project Phases	Vegetation clearing will be avoided during wet conditions Ground cover and understorey of vegetated areas required for construction will be flattened rather than removed where practical Existing roads and tracks will be used for access where possible. Access tracks will be clearly marked and no unauthorised use of alternatives will be permitted	CuString / Design Manager / Construction Contractor / Maintenance Service Provider	-	Volume 3 Appendix R Field development plan
Pre-Construction	Development of flora and fauna management measures for inclusion in the CEMP including: - Details relevant to the general management of flora and fauna - Species Management Plans for identified conservation significant species that will be impacted, including for interference with animal breeding places. - Where necessary, incorporate flora and fauna monitoring activities. Specifically, ongoing monitoring and survey requirements necessary to assess the persistence and health of conservation significant populations will be outlined (i.e. conservation significant flora and fauna species known to occur within or directly adjacent to the Project area).	Construction Contractor	Contract	CEMP
All Project Phases	Implement and maintain protocols for handling and removal of fauna of conservation significance encountered during on-site work Fauna spotter-catchers shall be suitably qualified and experienced fauna handlers A DES-authorized wildlife care group shall be contacted to attend to any injured wildlife. Alternatively, a veterinary clinic shall be contacted.	CuString / Design Manager / Construction Contractor / Maintenance Service Provider	Identified need for on-site surveys or work -	CEMP



Timing	Controls	Responsibility	Trigger/Applicability	Documentation
Design / Pre-Construction / Operational Readiness	Develop the relevant EMP including Biosecurity management measures that includes pest plant and animal prevention and management procedures and in particular addresses the spread of Weeds of National Significance and <i>Biosecurity Act 2014</i> listed weed species. Procedures shall include: • Control of topsoil and fill brought on to site • Nominated site access and wash-down points • Requirements for wash-down of plant and equipment prior to commencing work on site and when moving from a weed-infested area into a weed-free area • A vehicle wash-down logbook will be maintained in each vehicle and plant • Regular monitoring will be carried out along the easement and at substation sites • Movement protocol for vehicles will be established • Pest animals will be controlled by: • Limiting the introduction of pest animals into the area of interest • Rapidly controlling any pest animals that become established on the site • Regularly monitoring the area of interest • Preparing a control/eradication plan with follow up action when and where needed • Banning domestic animals owned by personnel and subcontractors from the Project easement and substation sites • Relevant operation and maintenance personnel will be trained in weed identification and weed control procedures	CuString / Design Manager / Construction Contractor / Maintenance Service Provider	Identified need for on-site surveys or work	EMP



Timing	Controls	Responsibility	Trigger/Applicability	Documentation
All Project Phases	Develop the relevant EMP including vegetation and clearing procedures to be implemented prior to the clearing of the corridor selection. These procedures will include: - Recording fauna interactions and activity that will require attention of the spotter/catcher - All adjacent vegetation and buffer extents that are not to be disturbed by clearing activities (due to being identified as comprising significant values for communities or species) will be clearly cordoned off creating 'no go zones' for vehicles, machinery, materials, workers, excavated soil or fallen timber	CuString / Design Manager / Construction Contractor	Identified need for on-site surveys or work	CEMP
Pre-Construction	Development of the CEMP including erosion and sediment control procedures to be implemented prior to construction activities commencing in a particular construction zone, to minimise impact on aquatic and terrestrial habitat. These procedures will include: - For large waterways, existing crossings will be used to access tower construction sites - No new watercourse crossings will be constructed unless for safety reasons - Conductor and earth wire pull cables that cross watercourses will be installed by helicopters, where possible - Machinery access on cracking soils beyond those areas necessary for the construction of the Project will be minimised in order to avoid unnecessary soil compaction - Machinery access and subsequent soil compaction within and adjacent to retained vegetation will be minimised	Construction Contractor	Contract	CEMP



Timing	Controls	Responsibility	Trigger/Applicability	Documentation
Pre-Construction	Development of the CEMP to outline rehabilitation and revegetation procedures for the Project. Following the construction phase, cleared woodland and grassland areas that are not required for on-going maintenance, access and/or fire safety obligations will be allowed to regenerate naturally. Revegetation may be used where natural regeneration is not successful, or where a high risk of degradation occurs, such as riparian corridors that were not able to be avoided or buffer areas to wetland habitats.	Construction Contractor	Contract	CEMP
Construction	Implement and maintain the CEMP	Construction Contractor	Contract -	CEMP
Operation and Maintenance	Implement and maintain the OEMP	Operation and Maintenance Service Provider	Contract -	OEMP
Operational Readiness	Record the as-constructed design flora and fauna management parameters in the Project GIS including: - any sensitive sites that require ongoing monitoring and management - location of any species/habitat management area - locations of line mounted devices such as bird diverters	CuString / Design Manager	Construction	Project GIS
Operation and maintenance	When generating maintenance works plans include relevant flora and fauna information from Project GIS.	Operation and Maintenance Service Provider	Maintenance activities	OEMP
Operation and Maintenance	Maintain the Project GIS with history and update information pertaining to: - any sensitive sites that require ongoing monitoring and management - location of any species/habitat management area - locations of line mounted devices such as bird diverters	CuString / Operation and Maintenance Service Provider	-	Project GIS

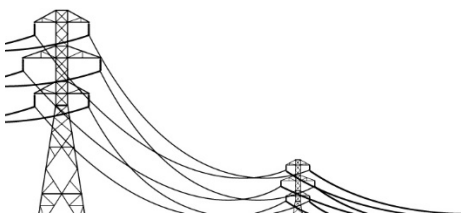
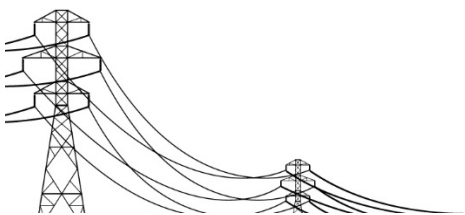
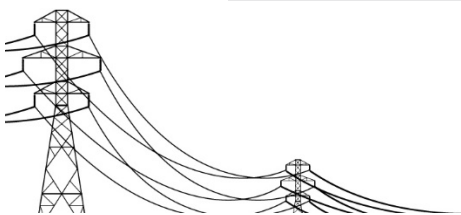


Table 18-62 EMP – Monitoring and Corrective Actions

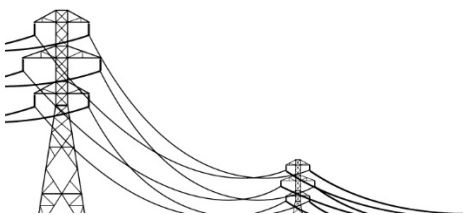
Timing	Monitoring activity	Responsibility	Frequency	Corrective action
Construction / Operation and Maintenance	Review mitigation and management measures outlined in the relevant EMP Vegetation and habitat managed in accordance with the relevant EMP	Construction Contractor / Operation and Maintenance Service Provider	Ongoing	Inspections and reporting against the relevant EMP
Construction	Rehabilitation success as detailed in the rehabilitation component of the CEMP. Three-monthly monitoring of regeneration of areas cleared for construction and no longer needed for operations or maintenance. Monitoring to coincide with weed and feral animal monitoring	Construction Contractor	Quarterly	To be outlined in the CEMP



Timing	Monitoring activity	Responsibility	Frequency	Corrective action
Construction / Operation and Maintenance	Where new species of pest plants or animals are reported, a review of the weed control procedures and training will be carried out. New infestations will be eradicated <i>in situ</i> or removed and disposed of appropriately.	Construction Contractor / Operation and Maintenance Service Provider	Triggered on detection	Procedures outlined in the CEMP/OEMP will be reviewed and changed where necessary. New infestations will be removed and disposed of appropriately.
Construction	A summary of weed control procedures and monitoring results is to be included in the monthly report Three-monthly visual check for weed and feral animal infestation of all easement and access roads in construction zones that have been completed, until commissioning is completed.	Construction Contractor	Quarterly or on report of weeds or pest animals	Procedures outlined in the CEMP will be reviewed and changed where necessary. New infestations will be removed and disposed of appropriately.
Construction	Monthly reporting of vegetation clearing, fauna activity and regeneration success to Project Manager.	Construction Contractor	Monthly	As required by CEMP



Timing	Monitoring activity	Responsibility	Frequency	Corrective action
Construction	Regular visual inspection to ensure that clearing is occurring as per the CEMP. Record instances of unauthorised clearing outside clearing boundaries	Construction Contractor	Daily	As outlined in the CEMP
Construction / Operation and Maintenance	Regular visual inspection of access roads and easement	Construction Contractor / Operation and Maintenance Service Provider	Variable based on utilisation and seasonal weather patterns	As outlined in CEMP/OEMP
Operation and Maintenance	A monitoring program will be developed and implemented to assess the success of the pre-construction and construction mitigation and management measures for flora and fauna.	Operation and Maintenance Service Provider / CuString	Monitoring of rehabilitated areas will commence 1-2 years after establishment. It is proposed that annual monitoring and maintenance be undertaken thereafter for a duration of five years.	As a result of monitoring, any incident reporting and corrective actions will be undertaken in accordance with the EMP.

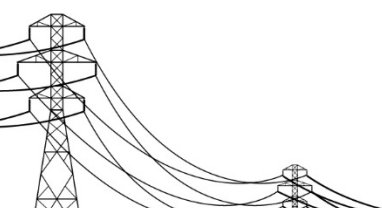


18.6 Offsets

Where the Project will have unavoidable impacts on certain environmental values, offsets are required under the EPBC Act and the EPBC Act Environmental Offsets Policy, administered by DAWE.

The significant impact assessments undertaken in Section 18.5.5 found that the Project will have no significant residual impacts on any MNES, as the proposed avoidance and mitigation strategies during design and construction will avoid, minimise and mitigate any significant impacts. As such, there are no offset requirements under the EPBC Act triggered for the Project.

The Terms of Reference relating to offset requirements are therefore not relevant to the Project and have not specifically been addressed.



18.7 Conclusion

This chapter has assessed the impacts of the Project on listed threatened species and communities, and listed migratory species that were confirmed present or considered likely to occur in the study area. The significant impact assessments included one TEC, three threatened flora species, 13 threatened fauna species and six additional migratory bird species.

The nature of the Project, being a long, linear infrastructure project with Species-specific and general avoidance, minimisation and mitigation measures have been proposed to reduce the potential for significant residual impacts to MNES resulting from the Project.

The significant impact assessments found that the Project will not have any significant residual impacts on any MNES. The delivery of environmental offsets for significant residual impacts is therefore not required for the Project.

The proposed avoidance and mitigation of any significant residual impacts to MNES from the Project is considered to also avoid and mitigate potential cumulative impacts on MNES at the local and regional scales. Therefore no significant cumulative impacts to MNES are likely to result from the Project.

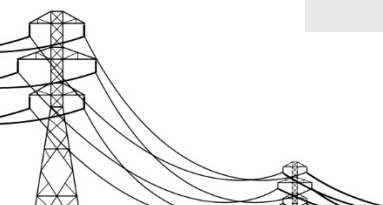
The Project has been designed with the objective of achieving environmentally sustainable outcomes through the following steps:

- The corridor selection avoids environmentally sensitive areas
- All potential environmental impacts of the Project have been assessed
- Potential impacts are mitigated through design criteria and industry standard management measures
- Comprehensive management plans have been developed to manage potential impacts
- Monitoring of ongoing impacts during the life of the Project through the development of adaptive management and monitoring protocol

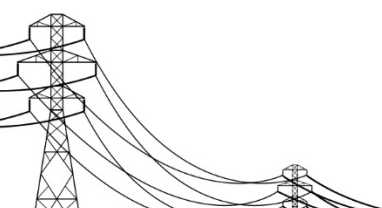
The assessment has found that the development of the Project is environmentally acceptable and meets the requirements of the EPBC Act, including the principles of ecologically sustainable development (ESD) as outlined in Table 18-60.

Table 18-63 How the Project meets the principles of ESD

ESD principle	How the Project meets the ESD principle
(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	The EIS has assessed the potential beneficial and adverse impacts for the lifetime of the Project. Mitigation and management measures have been developed to ensure there are no significant adverse impacts to economic development, environmental values, or social values and development.
(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	The Project design and corridor selection has aimed to reduce the risk of serious and irreversible environmental damage. Extensive stakeholder consultation was undertaken and a range of technical specialists were engaged to apply scientific rigour to the assessment of potential impacts. Where lack of full scientific certainty has occurred, the precautionary principle has been applied and a conservative approach used with a clear commitment

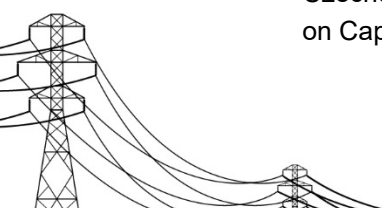


ESD principle	How the Project meets the ESD principle
	for further necessary scientific studies prior to construction commencement.
(c) the principle of intergenerational equity-that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations	The Project represents a long-term investment in northern Queensland's electricity infrastructure with significant economic and social benefits for current and future generations including: • Substantial employment opportunities during construction (peak workforce of 700) • Access to the state electricity grid for consumers in the NWPS • Access to competitively-priced electricity will significantly contribute to the prolonged economic development of the region, with considerable social benefits for local communities • Participation in the NEM will provide opportunities for new industrial facilities and larger agricultural projects in the NWMP • Opportunities for renewable energy projects to connect to the state electricity grid While the Project may have short and long-term environmental impacts, a number of mitigation measures will be implemented to avoid and limit serious, long-term and irreversible environmental damage.
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	A thorough ecological assessment has been undertaken for the Project to identify and manage potential impacts on biological diversity and ecological processes. The corridor selection was established taking into consideration sensitive environmental areas and culturally significant areas. Where possible, modifications will continue to be made to the Project design to avoid or minimise its effect on threatened species and communities.
(e) improved valuation, pricing and incentive mechanisms should be promoted	This EIS assesses the environmental consequences of the Project and identifies suitable mitigation and management measures for potential adverse impacts. The implementation of these measures represents an economic cost to CuString and will increase the capital cost of construction and operation of the Project. The appropriateness of proposed mitigation measures (i.e. cost and practicality) was determined based upon the severity of the impact being mitigated which demonstrates that environmental resources were given appropriate valuation.



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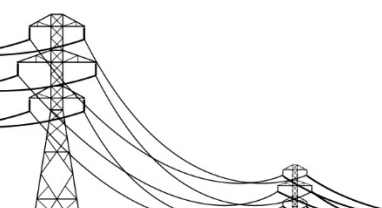
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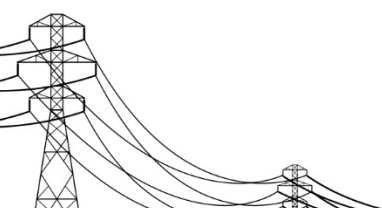
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