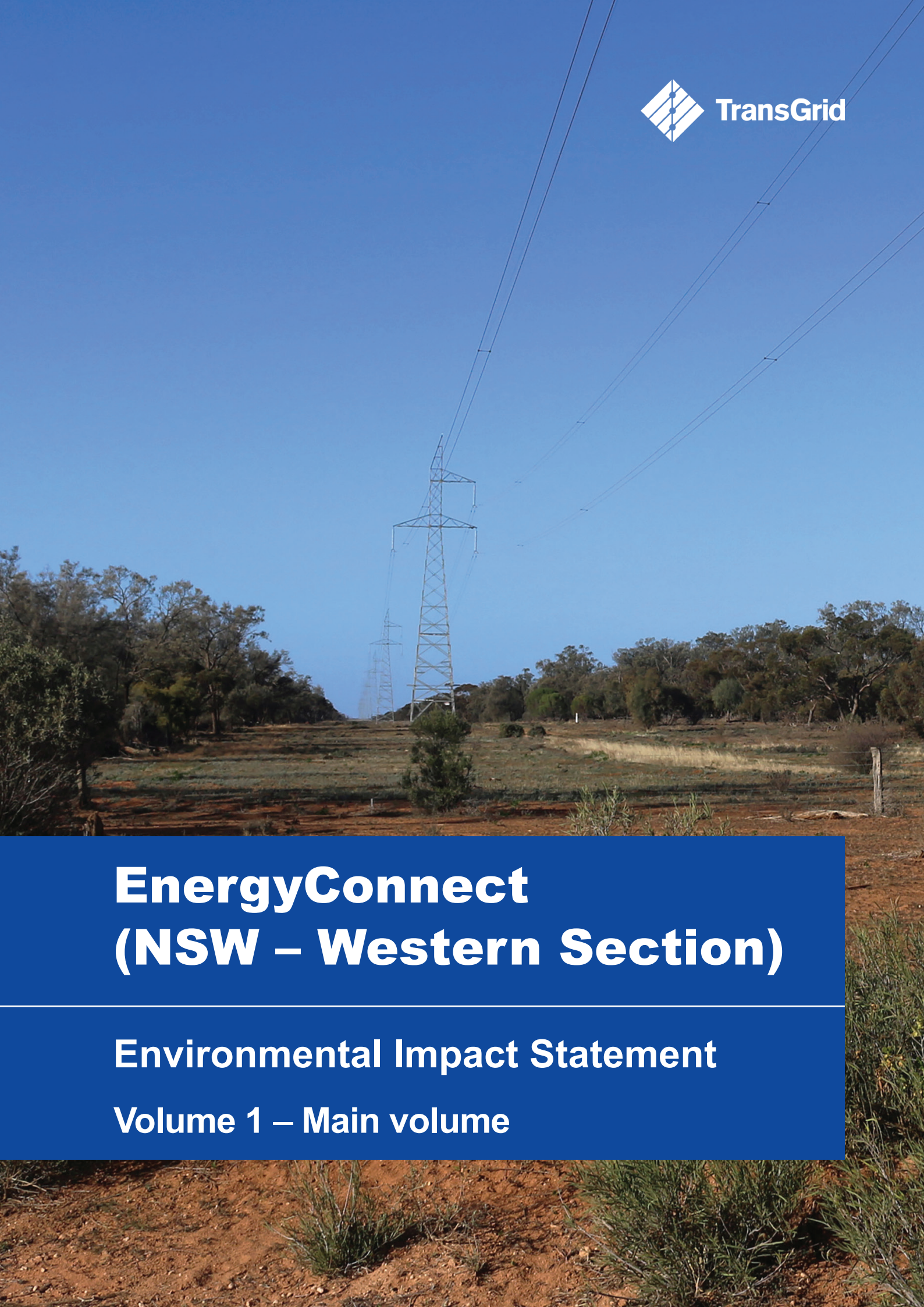

TransGrid

EnergyConnect (NSW – Western Section)

Environmental Impact Statement

Volume 1 – Main volume

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Abbreviations

Proposal term / acronym	Definition
4WD	Four-wheel drive
ABC	Australian Broadcasting Corporation
AC	Alternating current
ACHAR	Aboriginal cultural heritage assessment report
ACT	Australian Capital Territory
AEP	annual exceedance probability
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AHIMS	Aboriginal heritage information management system
ANO	Authorised Network Operator
APZ	asset protection zone
AQMS	Air quality monitoring stations
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASRIS	Australian Soils Resource Information System
ASS	Acid sulfate soils
AVTG	Assessing Vibration: A Technical Guideline, DEC 2006
AWS	Automatic Weather Station
BAM	Biodiversity Assessment Method
BC Act	(NSW) *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BMEET	Barkindji Maraura Elders Environment Team
BoM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
CLM Act	(NSW) *Contaminated Land Management Act 1997*
CNVMP	construction noise and vibration management plan
CO	Carbon monoxide

Proposal term / acronym	Definition
CSEP	Community and Stakeholder Engagement Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSSI	Critical State significant infrastructure
CTMP	construction traffic management plan
DAWE	(Australian) Department of Agriculture, Water and the Environment
DC	Direct current
DCP	Development Control Plan
DCS	Department of Customer Service
DECCW	(former) Department of Environment, Climate Change and Water
DELWP	(Victorian) Department of Environment, Land, Water and Planning
DPE	(former) Department of Planning and Environment
DPI	Department of Primary Industries
DPIE	(NSW) Department of Planning, Industry and Environment
EEC	Endangered ecological community
EES Group of the DPIE	Environment, Energy and Science Group – a division of the Department of Planning, Industry and Environment (DPIE) (formerly NSW Office of Environment and Heritage)
EIS	Environmental Impact Statement
ELF	extremely low frequency
EMF	Electric and magnetic fields
EMP	Environmental management plan
EMS	environmental management system
EP&A Act	(NSW) *Environmental Planning and Assessment Act 1979*
EP&A Regulation	(NSW) Environmental Planning and Assessment Regulation 2000
EPA	(NSW) Environment Protection Authority
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically sustainable development
FM Act	(NSW) *Fisheries Management Act 1994*

Proposal term / acronym	Definition
FTE	Full time equivalent
GDE	Groundwater Dependent Ecosystem
GIS	Geographical Information Systems
IAQM	Institute of Air Quality Management
ha	hectare
HVDC	high voltage direct current
HumeLink	Proposed interconnector to access Snowy Hydro's existing and future generation capacity
HV	High Voltage
IAQM	Institute of Air Quality Management
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronics Engineers
Infrastructure SEPP	(NSW) *State Environmental Planning Policy (Infrastructure) 2007*
ISCA	Infrastructure Sustainability Council of Australia
ISP	Integrated System Plan
ITU	the International Telecommunication Union
kV	kilovolt
LEP	Local environmental plan
LGA	Local government area
LIDAR	Light Detection and Ranging
LLS	Local Land Services
LSC	Land and Soil Capability
mAHD	metres above Australian Height Datum
MDBA	Murray-Darling Basin Authority
ML	megalitres
MP	Member of parliament
MVA	mega volt ampere

Proposal term / acronym	Definition
MVAr	megavar
MW	megawatts
NEM	National Electricity Market
NEPC	National Environment Protection Council
NEPM	National Environmental Protection Measure
NGIS	the National Groundwater Information System
NHVR	National Heavy Vehicle Regulator
NIAA	National Indigenous Australians Agency
NMLs	Noise Management Levels
NOx	Nitrogen oxides
NPfI	Noise Policy for Industry
NPI	National Pollutant Inventory
NP&W Act	(NSW) *National Parks and Wildlife Act 1974*
NSW	New South Wales
NTSCORP	Native Title Service Provider for Aboriginal Traditional Owners in New South Wales and the Australian Capital Territory
OEH	(former) NSW Office of Environment and Heritage to be referred to as the Environment, Energy and Science Group of DPIE from the 1 July 2019
OOHW	out of hours works
OPGW	overhead optical ground wire
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	polychlorinated biphenyls
PCT	Plant community types
$PM_{2.5}$ data	particulate matter with diameter less than 2.5 microns
PM_{10} data	particulate matter with diameter less than 10 microns
PNTLs	project noise trigger levels
POEO Act	(NSW) *Protection of the Environment Operations Act 1997*
QNI Upgrade	Proposed Queensland and NSW interconnector

Proposal term / acronym	Definition
RAPs	Registered Aboriginal Parties
REZs	Renewable Energy Zones
RFI	Radio Frequency Interference
RIT-T	Regulatory Investment Test for Transmission
RMS	(former) Roads and Maritime Services
RNP	NSW Road Noise Policy
SA	South Australia
SAII	Serious and irreversible impacts
SEARs	Secretary environmental assessment requirements
SEPP	State environmental planning policy
SES	State Emergency Service
SHR	State heritage register
SO_2	Sulphur Dioxide
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SRTM	Shuttle Radar Topography Mission
SSI	State significant infrastructure
TEC	Threatened ecological community
TSP	Total suspended particulates
VMP	Vehicle Movement Plan
VNI Upgrade	Proposed Victoria and NSW interconnector
VOCs	Volatile Organic Compounds

Glossary

Proposal term	Definition
brake/winch sites	A brake and winch site is a temporarily cleared area where plant and equipment is located for the purposes of spooling and winching a conductor into place on erected towers along a transmission line corridor. Dependent upon the angle of line deviation, the location of the brake and winch site at that angle may or may not be within the nominated transmission line easement. The brake and winch site is only required for the construction phase of the proposal. It does not need to be maintained for ongoing operation and / or maintenance of the transmission line.
disturbance area	Refers to the area that would be directly impacted by both construction and operation (including the areas that would be impacted by maintenance activities) of the proposal including all proposal infrastructure elements (including the proposed transmission line alignment, substation site works and other ancillary works i.e. the operational footprint) as well as locations for currently proposed construction elements such as construction compounds, access tracks and site access points, laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps. This area would be mostly contained within the transmission line corridor and would be determined during detailed design in consideration of avoidance and impact minimisation. For heritage and biodiversity assessments, an *indicative* disturbance area has been applied (refer to Chapter 8 of this EIS). The disturbance area would have varying degrees of physical disturbance along the transmission line alignment to reflect construction and operational requirements – specifically: > Disturbance area A, in which ground disturbance would be required > Disturbance area B, in which ground disturbance is not required except in limited circumstances From time to time during operation, at risk trees may be removed from within the easement but outside the disturbance area.
disturbance area A	Refers to an area around transmission towers and between transmission towers in which vegetation would be removed during construction and subject to ongoing maintenance during operation (i.e. removal to ground level) for operational and safety requirements (including bushfire). This zone is a subset to the disturbance area.
disturbance area B	Refers to an area between transmission towers in which trimming would only be required to meet the vegetation clearance heights, which would not require disturbance at ground level. However, where trees within this area would or have the potential to exceed vegetation clearance heights, these trees may need removal which may result in temporary ground disturbance. Vegetation clearance heights are set by TransGrid for operational and safety requirements, including bushfire risk management. This zone is a subset to the disturbance area.

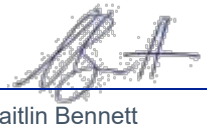
Proposal term	Definition
EnergyConnect	An electrical interconnector of approximately 900 kilometres between the electricity grids of South Australia and New South Wales, with an added connection to north west Victoria. In NSW, EnergyConnect comprises two sections – Western Section (the proposal the subject of this EIS) and the Eastern Section (which will be subject to separate environmental assessment).
permanent works footprint	Refers to the area that would be directly impacted by permanent components of the proposal, including all proposed infrastructure elements such as the proposed transmission towers, any new substation infrastructure and permanent access tracks.
preliminary alignment corridor	A 10 kilometre corridor identified during the initial assessment of transmission line corridor options which is generally based on desktop assessments only.
proponent, the	The proposal is proposed to be undertaken by NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as TransGrid). TransGrid is the operator and manager of the main high voltage (HV) transmission network in NSW and the Australian Capital Territory (ACT), and is the Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.
proposal, the	The proposal is known as 'EnergyConnect (NSW – Western Section)' as described in Chapter 5 and Chapter 6 of this document.
proposal study area	The study area for this EIS, which comprises a one kilometre wide corridor between the SA/NSW border near Chowilla and Buronga substation and a 200 metre wide corridor between Buronga substation and the NSW/Victoria border at Monak, near Red Cliffs. It encompasses the indicative disturbance area and transmission line corridor, which has been applied to identify the constraints nearby to the proposal which may or may not be indirectly impacted by the proposal. Some access tracks could be located within the proposal study area.
transmission line corridor	A 200 metre corridor in which the final transmission line easement and transmission line infrastructure would be contained within. Construction activities associated with the transmission line would be expected to be contained within this area.
transmission line assessment corridor	A 120 metre corridor that has been assessed for operational assessments for operational noise and electric and magnetic fields (EMF)
transmission line easement	An area surrounding and including the transmission lines, which is a legal 'right of way' and allows for ongoing access and maintenance of the lines and will be acquired from landholders. The easement width would be up to 80 metres wide for the 330kV transmission line component and 50 metres wide for the 220kV transmission line component.

Certification

Submissions of Environmental Impact Statement

This environmental impact statement has been prepared under Part 5, Division 5.2 of the *Planning and Assessment Act 1979* (NSW) and in accordance with Part 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

Environmental impact statement prepared by:

	EnergyConnect (NSW – Western Section)	
NAME	Emma Taylor on behalf of WSP Australia Pty Ltd	Caitlin Bennett on behalf of WSP Australia Pty Ltd
QUALIFICATIONS	Bachelor of Environmental Science Advanced (Honours) (Land Resources), University of Wollongong Certified Environmental Practitioner Environment Institute of Australia and New Zealand	Bachelor of Science (Environmental Biology), University of Technology, Sydney Master of Urban and Regional Planning, University of Sydney
ADDRESS	Level 27, Ernst & Young Centre 680 George Street Sydney NSW 2000	
PROPONENT NAME AND ADDRESS (THE PROPONENT)	NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as TransGrid) 180 Thomas Street Sydney, NSW, 2000	
PROPOSED DEVELOPMENT	The proposal would comprise around: > about 135 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the SA/NSW border near Chowilla and the existing Buronga substation > an upgrade of the existing, 24-kilometre-long 220kV single circuit transmission line between the existing Buronga substation and the NSW/Victoria border at Monak, near Red Cliffs in Victoria to a 220kV double circuit transmission line > an upgrade and expansion of the existing Buronga substation to a combined operating voltage 220kV/330kV Full details of the proposed development are included in Chapters 5 and 6 of the Environmental Impact Statement.	
LAND TO BE DEVELOPED	Generally the land which comprises a one kilometre wide corridor between the SA/NSW border near Chowilla and the existing Buronga substation at Buronga and a 200 metre wide corridor between the Buronga substation at Buronga and the NSW/Victorian border at Monak, near Red Cliffs.	
ENVIRONMENTAL IMPACT STATEMENT	This environmental impact statement addresses all matters specified in accordance with Division 5.2 of the (NSW) *Environmental Planning and Assessment Act 1979* and Schedule 2 of the (NSW) Environmental Planning and Assessment Regulation 2000.	
DECLARATION	I certify that we have prepared this environmental impact statement in accordance with the Secretary's environmental assessment requirements (SSI 10040) dated 31 July 2020. This environmental impact statement contains all available information that is relevant to the environmental assessment of the infrastructure to which the statement relates. To the best of our knowledge, the information contained in the environmental impact statement is neither false nor misleading.	
SIGNATURE(S)		
NAME	Emma Taylor	Caitlin Bennett
DATE	26 October 2020	26 October 2020

Executive summary

Executive summary

Overview of the proposal

What is EnergyConnect?

TransGrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new high voltage (HV) interconnector of about 900 kilometres between NSW and SA, with an added connection to north-west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect comprises several sections (shown on Figure ES.1) that would be subject to separate environmental planning approvals under the relevant jurisdictions. The subject of this proposal is the NSW – Western Section of EnergyConnect.

TransGrid is seeking planning approval for the NSW – Western Section (the proposal) under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) to construct and operate the proposal, which is the subject of this Environmental Impact Statement (EIS). The proposal has been declared a controlled action and will require a separate approval under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*.

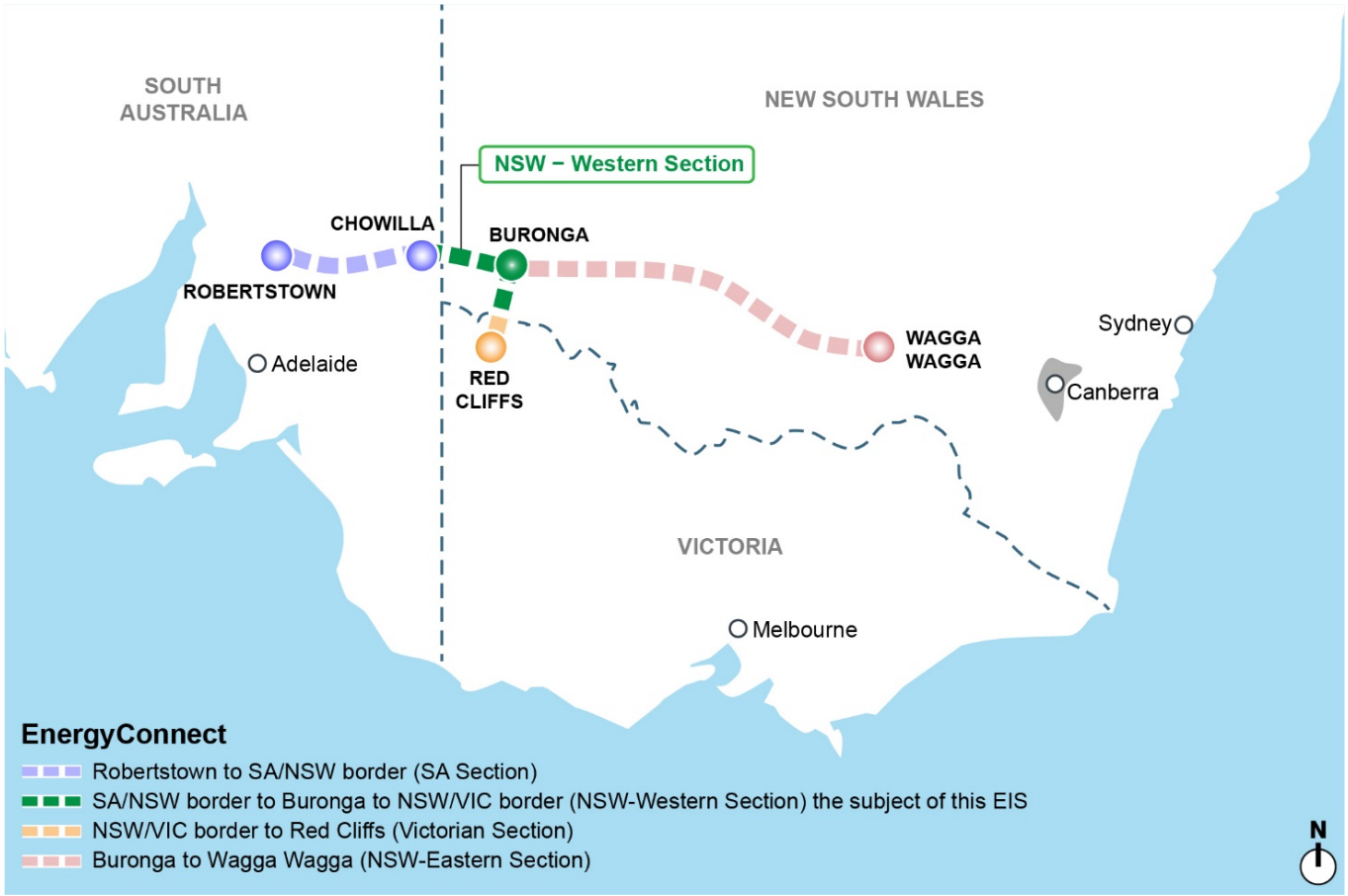


Figure ES.1 Overview of EnergyConnect

What is EnergyConnect (NSW – Western Section)?

The key components of the proposal include:

- about 135 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the SA/NSW border near Chowilla and the existing Buronga substation
- an upgrade of the existing 22 kilometre 220kV single circuit transmission line between the existing Buronga substation and the NSW/Victoria border at Monak, near Red Cliffs in Victoria to a 220kV double circuit transmission line, and the decommissioning of the 220kV single circuit transmission line (known as Line 0X1)
- a significant upgrade and expansion of the existing Buronga substation to a combined operating voltage of 220kV/330kV
- a minor realignment of the existing 0X2 220kV transmission line, in proximity to the Darling River
- new and/or upgrade of access tracks as required
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

The proposal is located in western NSW within the Wentworth Local Government Area (LGA), approximately 800 kilometres west of Sydney at its nearest extent. The proposal is around 160 kilometres in length.

An overview of the proposal is provided in Figure ES.2. Further details of the key components of the proposal are provided in Chapters 5 and 6 of this EIS.

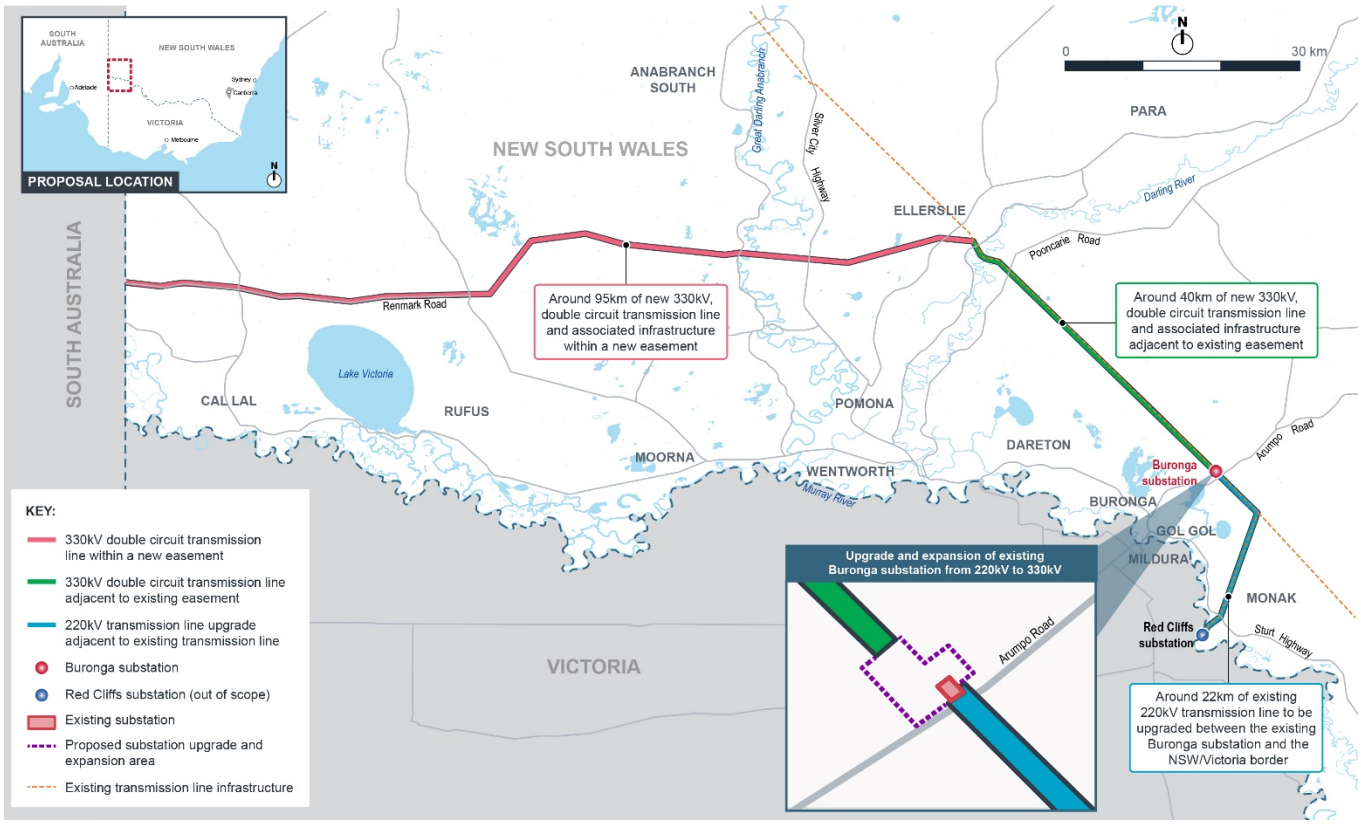


Figure ES.2 Overview of the proposal

What is the timing of construction?

Once relevant approvals are obtained, it is anticipated that construction of the proposal would commence in mid-2021. The construction of the transmission lines would take approximately 18 months. The Buronga substation upgrade and expansion would be delivered in two components and would be initially operational by the end of 2022. Site decommissioning and rehabilitation to be completed by mid-2024. The final construction program would be confirmed during detailed design.

Who is the Proponent?

The proposal would be carried out by NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as TransGrid). TransGrid is the operator and manager of the main high voltage transmission network in NSW and the Australian Capital Territory (ACT) and is an Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015.*

What are the objectives of the proposal?

The primary objective for the proposal is to secure increased electricity transmission capacity between SA, NSW and Victoria of about 800 megawatts (MW) and facilitate the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy generation sources. More specifically, the proposal aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

Proposal need and benefits

Why is EnergyConnect needed?

The Australian Government has ratified the United Nations Paris Agreement and has set interim emission reduction targets, including a commitment to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. Independently, every state and territory in Australia has set a goal or target to achieve net zero emissions by the second half of this century. Electricity generation is Australia's largest source of emissions, accounting for 34 per cent of Australia's total annual emissions (Climate Change Authority, 2020).

Australia's energy markets are undergoing rapid change as the sector transitions to generating lower carbon emissions, with a greater uptake of renewable generation and emerging technologies. To date, the pace of development in new renewable and distributed energy generation has been even faster than anticipated in the *2018 Integrated System Plan* (ISP) and is predicted to continue transitioning over the next two decades (AEMO, 2020). The *2020 Integrated System Plan* (2020 ISP) (AEMO, 2020) estimates that over 26 gigawatts of new grid-scale renewables is needed to replace the approximately 15 gigawatts, or 63 per cent, of Australia's coal-fired generation that will reach the end of its technical life and so likely retire by 2040. This will increase pressure on energy supply, particularly as energy consumption continues to increase in NSW (TransGrid, 2018). The National Electricity Market (NEM) needs to identify and connect to new low emission energy generation sources to continue to have enough energy to meet the future demand, while meeting Australia's carbon emissions policy commitments (ElectraNet, 2019a).

Current interest in new energy generation projects in the NEM exceeds the existing transmission network capacity in several locations, meaning that not all projects would be viable. In response, several Renewable Energy Zones (REZs) have been identified across the NEM, which are areas of high energy resource potential where strategic transmission infrastructure upgrades can connect multiple projects at lower cost (AEMO, 2020).

EnergyConnect is one of these strategic transmission infrastructure upgrades. It has been identified as one of four priority transmission projects in the *NSW Transmission Infrastructure Strategy* (DPE, 2018), an immediate priority project in the 2018 ISP and a 'no regret' actionable project in the 2020 ISP. This is due to its ability to 'increase transfer capacity between SA and NSW by 750 MW, achieve fuel cost savings and unlock already stranded renewable investments' within the REZs in western NSW, SA and north-west Victoria (AEMO, 2020).

EnergyConnect would also complement several additional major inter-regional interconnectors that have been identified in the 2020 ISP. Together, these interconnectors would augment the national transmission grid and address cost, security and reliability issues.

EnergyConnect is expected to deliver positive net market benefits and support the energy market transition to a lower carbon emissions future as soon as it can be built. In particular, it would reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term. This is because it would allow for a greater sharing of energy resources across regions to smooth demand and supply fluctuations, reduce reliance on increasingly expensive gas generation in SA and meet overall demand and system reliability requirements at lowest cost.

How would the proposal address the identified need?

This proposal, which is an essential component of EnergyConnect, would enhance the energy transmission link between the SA, NSW and Victorian transmission networks, as it would:

- complete the missing transmission link between SA and NSW
- enhance the capacity of the network to provide electricity between NSW and Victoria
- enable the development of solar generation around Red Cliffs Terminal Station, and the export of this power to SA and NSW via EnergyConnect.

Planning, design and approval process

How was the proposal developed?

Four main interconnector options were initially identified for EnergyConnect to achieve a new electrical transmission line between SA and the NEM. These options included a 'no-interconnector' option as well as a series of options involving new interconnectors to NSW, Queensland and Victoria. These options were investigated as part of the EnergyConnect Regulatory Investment Test for Transmission (RIT-T) assessment process undertaken by ElectraNet. The RIT-T concluded that a new 330kV interconnector between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga with an augmentation between Buronga and Red Cliffs is expected to deliver the highest net market benefits and is therefore the current preferred strategic option.

The corridor selection and refinement methodology for the proposal was based on a 'hierarchy of constraints', which was developed to inform the initial preliminary corridor alignment and to narrow the corridor. The identification of constraints was informed by analysis of extensive geospatial data, ecology and heritage surveys as well as engagement with the community and stakeholders. As a result, the corridor between the SA/NSW border and Buronga has been refined to a proposal study area, within which the proposed transmission line and associated works would be located. This proposal study area avoids key environmental constraints and has been confirmed as suitable through extensive landholder engagement. Examples include:

- locating the proposed transmission line corridor to the north of Renmark Road to minimise biodiversity, Aboriginal heritage and visual impacts. This included avoiding direct impacts on the critically endangered threatened flora species Dodonaea stenozyga and the endangered flora species Acacia acanthoclada
- avoiding areas subject to conservation agreements
- positioning a section of the transmission line corridor to avoid individuals of two threatened flora species
- locating the transmission line corridor where possible along existing property boundaries to minimise disruption to agricultural activities
- positioning the Buronga upgrade and expansion area and the temporary main construction compounds and accommodation camps in areas of existing disturbance, where possible.

Some aspects of the proposal design would continue to be refined during detailed design. This relates to:

- the final transmission line alignment and design, including the location of the transmission line structures and access tracks
- construction facilities along the transmission line corridor within the proposal study area
- the final disturbance area for the Buronga substation upgrade and expansion
- construction method and staging.

For example, there are likely to be opportunities for refinement of the transmission line tower locations during ongoing field validation of constraints, design development or as a result of government, landholder, community or other stakeholder feedback. This would also inform the final placement of access tracks and ancillary construction support facilities.

How have the community and stakeholders been involved?

Engagement activities for the proposal have been carried out since November 2018, including (but not limited to):

- stakeholder briefings including, but not limited to, with Wentworth Shire Council, NSW and Australian Government agencies, local MPs, NSW Aboriginal Land Councils and Aboriginal stakeholders
- face-to-face meetings, phone calls and direct correspondence via email with directly affected landholders, particularly during the route refinement process to provide information about into the constraints and opportunities
- print advertisements in several local newspapers to advertise the community drop-in sessions and request registration of Aboriginal stakeholders to participate in the assessment of cultural heritage
- consultation with registered Aboriginal parties in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2020* (Office of Environment and Heritage, 2010)
- holding community drop-in sessions and public events.

Consultation activities would continue as the proposal progresses, including during detailed design and construction. Further discussion of the community and stakeholder involvement for the proposal is provided in Chapter 7 of this EIS.

What is the planning approval process?

The NSW Minister for Planning and Public Spaces declared the NSW portions of EnergyConnect to be Critical State significant infrastructure (CSSI) under section 5.13 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) and by amendment to Schedule 5, clause 15 of the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). As CSSI, the proposal requires approval from the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the (NSW) EP&A Act.

A referral under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was submitted on 27 May 2020. The Australian Department of Agriculture, Water and the Environment (DAWE) determined the proposal to be a controlled action on 26 June 2020 and that it would be assessed using the bilateral assessment process. As such, the proposal also requires approval from the Australian Minister for the Environment under the EPBC Act.

Environmental assessment

How were the impacts assessed?

This EIS has been prepared in accordance with the provisions of Division 5.2, Part 5 of the EP&A Act. In particular, it addresses the environmental assessment requirements of the Secretary of the Department of Planning, Industry and Environment (DPIE) (refer to Appendix A) and the Australian Minister for the Environment under the EPBC Act. It also includes consideration of the issues raised by the community and stakeholders during the development of the proposal.

Some aspects of the proposal design would continue to be refined during detailed design as opportunities to improve the proposal design and construction methodology are further investigated. To achieve a level of flexibility for design refinement while undertaking a rigorous level of impact assessment, the approach adopted for the EIS has been to assess a 'worst case' impact. Most of the impact assessments (with the exception of biodiversity and heritage) have conservatively assumed that any area could be impacted by the proposal within the transmission line corridor, and areas identified for the Buronga substation upgrade and expansion, the main construction compounds and accommodation camps at Anabranch South and Buronga. This provides an understanding of the 'worst case' impact as only a portion would be temporarily or permanently impacted by the proposal in reality.

For biodiversity and heritage, a conservative indicative disturbance area has been assessed to provide a greater understanding of the likely magnitude of direct impacts expected from the proposal. This approach was adopted to avoid a 'worst case' approach as it would result in substantial overestimation of the likely ecological and heritage impacts (for example, assuming that the whole transmission line corridor would be cleared of vegetation). Following design refinement, if the indicative disturbance area is not consistent with what has been assessed in this EIS, and/or would impact on areas with notably different ecological or heritage value, the biodiversity and heritage impacts would be subject to additional assessments.

Some access tracks, and an additional main construction compound and accommodation camp site may be required and could be located outside the proposal study area. These sites would be selected within areas of low environmental constraint, and would be subject to additional assessments.

The final design would be reviewed for consistency with the assessment contained in this EIS, including any mitigation measures, and any conditions of approval. If design refinements are not consistent with any approval from the Minister for Planning and Public Spaces, approval would be sought from the Minister for any such modifications in accordance with the requirements of Division 5.2 of the EP&A Act.

What are the key findings of the EIS?

Table ES.1 provides a summary of the potential positive or negative impacts that may occur during construction and operation of the proposal.

Table ES.1 Summary of potential impacts of the proposal

Issue	Potential impacts
Biodiversity	The proposal has been developed to avoid and minimise impacts to biodiversity values, and further opportunities to minimise impacts would be achieved during detailed design. However, based on the conservative indicative disturbance area, the proposal would directly impact 20 native vegetation Plant Community Types (PCTs) and one endangered ecological community (EEC) listed under the (NSW) *Biodiversity Conservation Act 2016* due to the impacts on 607 hectares of native vegetation (of which 293 hectares would not be completely cleared). The clearing of native vegetation would also result in direct impacts to 59 threatened species or their habitats. Ongoing historical agricultural use (primarily grazing) and the effects of semi-regular clearing combined with this grazing (sometimes in drought conditions) has resulted in an overall landscape that while is mostly comprised of native vegetation is not high quality undisturbed native vegetation or habitat. This includes the 14 hectares of the Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions EEC that would be directly impacted by the proposal. Opportunities to further reduce the impacts to native vegetation will be considered during detailed design. This would include the selection of the final transmission tower structure locations and access tracks. Other minor impacts associated with other biodiversity impacts are expected (such as impacts to connectivity, water quality and bird strike). Indirect impacts are considered unlikely given the retention of vegetation (up to two metres in height) within the easement providing a buffer to areas subject to direct and permanent loss of native vegetation. The assessment also found that: > impacts to threatened aquatic species, ecological communities or their habitats are unlikely > impacts to groundwater dependant ecosystems are unlikely > impacts to wetlands of national or international importance are unlikely > the proposal would be unlikely to lead to a significant impact on any threatened species or their habitat, or migratory birds (and their habitat) listed under the EPBC Act. A number of mitigation measures have been proposed, and the detailed design of the proposal would seek to minimise and avoid impacts to threatened species and the EEC further. However, to offset the residual impacts to biodiversity, biodiversity offsets would be required in accordance with the Biodiversity Assessment Method, and would be met through the implementation of the following (or combination of): > the purchase and retirement of existing biodiversity credits currently available on the biodiversity credit register > establishing biodiversity stewardship site(s) on lands with like for like biodiversity values to those impacted by the proposal > making a payment into the Biodiversity Conservation Fund > alternative strategic offset outcomes.

Issue	Potential impacts
Aboriginal heritage	The proposal has the potential to directly and/or indirectly impact Aboriginal sites and Potential Archaeological Deposits (PADs) including: > three Aboriginal sites (PEC-W-74 and PEC-W-75), which are isolated finds with low scientific significance at the Anabranch South main construction compound and accommodation camp site > one PAD (PEC-PAD-27) at the Buronga substation upgrade and expansion site > up to 26 PADs, 60 Aboriginal sites (of low and moderate scientific significance) and 17 potential scarred trees within the indicative disturbance area along the transmission line corridor. Opportunities to avoid or minimise these impacts through siting of the tower and access track locations would be explored during detailed design. Where impacts cannot be avoided, a range of mitigation and management measures would be implemented in consultation with Registered Aboriginal Parties (RAPs).
Non-Aboriginal heritage	The transmission line corridor passes through the curtilage of three locally listed heritage items, being the Nulla Woolshed, the Nulla Homestead and Sturts Billabong. However, these partial impacts would not impact the significance of these heritage items, and would not directly impact the built form of the Nulla Woolshed or the Nulla Homestead, which are located over seven kilometres from the indicative disturbance area. An unlisted heritage item, being a survey tree, was found during survey work but would not be directly impacted by the indicative disturbance area. Impacts to this item would be confirmed during detailed design.
Land use and property	Construction of the proposal would require the acquisition and/or temporary leasing of land. This may temporarily disrupt agricultural land uses within and surrounding the proposal study area. However, the disruptions would generally be temporary and of a short duration due to the progressive nature of construction and minimised through appropriate mitigation measures. The acquisition of any interest in land would be acquired by private treaty or compulsory process under the *Land Acquisition (Just terms Compensation) Act* 1991. Operation of the proposal would result in permanent land use changes due to the new or modified transmission line easements, access tracks and expanded and upgraded Buronga substation. The easements may restrict certain agricultural activities and/or require different methodologies to be adopted. However, the overall impact on existing agricultural activities is expected to be minor, particularly as grazing activities would be able to continue within the easements. There are biosecurity risks that animal diseases, plant diseases, feral pests and (especially) weeds could be introduced or spread during the construction and operation of the proposal through vehicle, machinery or personnel movements. However, mitigation measures have been identified to manage these risks.

Issue	Potential impacts
Landscape character and visual amenity	While the landscape and visual study area includes landscapes of state and regional landscape sensitivity, there would be relatively low landscape impacts during construction and operation of the proposal. This is due to the relatively small area of direct impact, the relatively flat and open landscape requiring minimal landform changes, and the alignment avoiding important landscape features, such as Lake Victoria, dry relic lake beds, billabongs, and river crossings. Impacts to the landscape would be low to moderate during construction, and low during operation. Impacts to views during construction and operation would predominantly range from negligible to low, with moderate impacts to views within the vicinity of Lake Victoria due to the construction of new transmission lines and the visual sensitivity of these areas, and along Arumpo Road due to the upgrade and expansion of the Buronga substation and the scale of change. The impacts to views from private property would depend on the final distance between the transmission line and the presence of any intervening vegetation. Where residences are closer to the transmission line, the structures would be visible, and opportunities to provide screening at residences in consultation with landholders would be explored during detailed design.
Social and economic	The proposal would temporarily increase the population and change the composition of the community in the Wentworth LGA due to the incoming construction workforce. While accommodation camps would include housing and services for the workforce, the proposal would increase competition for existing services and social infrastructure, and available housing stock, in the Wentworth LGA and nearby Mildura. Changes in population can also have social impacts to local communities, including impacts to cohesion and sense of place. However, the proposal would provide opportunities for local and regional procurement of services and employment during construction, which has the ability to benefit the wider community. Strategies would be implemented to realise the local opportunities of the proposal (including opportunities with local Aboriginal communities), and to support the integration of the incoming workforce within local communities. During operation, the proposal would facilitate enhanced security and reliability of the energy supply with associated social and economic benefits to consumers at the State level across NSW, SA and Victoria, and would stimulate further investment in local economies, and in particular in the energy sector. There are a small number of landholders who may experience negative impacts to their livelihood or property value due to the proposal, or amenity impacts. TransGrid will continue to work with landholders to address these concerns, and mitigation measures have been recommended in this EIS to respond to property, land use and adverse amenity impacts.
Hydrology, flooding and water quality	During construction, the proposal has the potential to result in minor localised impacts including changes in water flows due to the temporary works changing local runoff behaviour and increased sediment load from construction area runoff. During operation, the proposal is not expected to result in notable changes to flood levels, depths or velocities. An increase in impervious surfaces at the Buronga substation may increase pollutant loads, however potential water quality impacts would be minimised by an appropriately designed drainage system.

Issue	Potential impacts
Air quality	Construction of the proposal may result in temporary minor and localised dust and gaseous emissions, and would be manageable. Air quality impacts during operation would be negligible.
Noise and vibration	All construction scenarios modelled have the potential to result in noise impacts. Site establishment, earthworks and civil construction works are predicted to generate the highest noise levels at the most affected receivers. No sensitive receivers would be highly noise affected. However, exceedances are predicted at six sensitive receivers during standard construction hours, and up to 22 sensitive receivers when works are conducted outside standard construction hours. Sensitive receivers located further than 1,430 metres from construction activities are unlikely to experience any noise impacts. The predicted exceedances are based on conservative assumptions to understand the potential 'worst case' impacts, and in reality, these 'worst case' assumptions are unlikely to occur. The typical noise levels experienced during construction are expected to be below these predicted noise levels and each receiver would only be affected for a short duration as the construction activities would be progressive along the alignment. Predicted impacts at sensitive receivers would be confirmed during detailed design, and reasonable and feasible mitigation would be implemented. There is also potential that vibration intensive equipment could be used within the minimum working distances, however, the risk of vibration impacts would be minimised through refinement of the construction methodology. As a result of construction traffic, road traffic noise levels on some roads may experience an increase of more than 2 dB (with a maximum increase of 7.1 dB on Renmark Road) due to relatively low existing traffic volumes. However, the overall road noise levels are predicted to comply with relevant criteria for all assessed roads at sensitive receivers. During operation, no sensitive receivers are expected to experience audible noise above the adopted criteria of 35 dBA from operation of the transmission lines in fair weather. However, three residential receivers would be within the 'worst-case' audible noise risk zone during wet weather conditions and are at risk of experiencing noise levels that would exceed the adopted criteria by 6 to 9 dB(A), depending on their distance. Opportunities to maximise distances to sensitive receivers would be considered during detailed design to reduce any predicted exceedances, as well as other feasible and reasonable mitigation measures. The operational noise levels associated with the Buronga substation upgrade and expansion and road traffic noise are not expected to result in noise impacts.
Traffic and access	Construction of the proposal may result in up to 250 additional light vehicle movements and 80 additional heavy vehicle movements per day on the surrounding road network (during peak construction periods). However, this is not expected to adversely impact the capacity and serviceability of the road network. The use of oversize and overmass vehicles would be planned to minimise the impact to the surrounding road network. The traffic and access impacts during operation of the proposal are expected to be negligible.

Issue	Potential impacts
Hazards and risks	Hazards and risks during construction and operation of the proposal include: > use and storage of hazardous materials and chemicals > construction or maintenance activities close to active electrical infrastructure > the risk of bushfire to or caused by the proposal > electric and magnetic fields surrounding electrical infrastructure. These risks are considered to be manageable through standard mitigation and management measures.
Soil, contamination and groundwater	The proposal may result in soil erosion or compaction from construction or maintenance activities as well as localised contamination from leaks and spills. These impacts are considered to be manageable through standard mitigation and management measures. Potential impacts to groundwater due to construction may occur where the depth of excavations for transmission towers intersect the level of groundwater, and dewatering is required. However, any dewatering would be limited to discrete locations, temporary and managed to minimise impacts to groundwater levels.
Waste management and resource use	During construction, the proposal would generate waste and require use of common resources, including about 616 megalitres of water that would be sourced from existing water infrastructure. Impacts associated with waste and resource use are considered to be manageable through standard mitigation and management measures. Minimal operational waste or resource impacts are anticipated during the operation of the proposal.
Cumulative impacts	There is the potential for cumulative impacts (such as noise and vibration and traffic) associated with EnergyConnect where there would be direct interfaces between each section of EnergyConnect, and broader regional impacts with respect to biodiversity. Interfaces of construction activities will be readily managed by the construction contractor (such as through the staging of works) and a biodiversity offsets strategy will be prepared for each NSW component of EnergyConnect where residual biodiversity impacts occur. Cumulative impacts with other major projects in the vicinity of the proposal would include cumulative traffic, and noise and vibration impacts. However, any impacts would be minor and manageable.

How would the impacts be managed?

The approach to environmental management for the proposal involves:

> TransGrid's existing ISO 14001:2015 accredited environmental management system (EMS)
> proposal design – measures to avoid and minimise impacts that have been incorporated into the corridor selection and proposal design
> mitigation measures – the measures identified to minimise the potential impacts of the proposal during construction and operation
> development of construction and operation environmental management plans and sub plans.

Justification and conclusion

The proposal is a critical component in delivering long term benefits to the SA and NSW electricity consumers, providing security to the NEM and facilitating the transition to a lower carbon emissions future.

The proposal has been designed, to the greatest extent possible, to avoid and minimise impacts, and to respond to the issues raised by the community and stakeholders. The detailed design and construction methodology for the proposal would be further developed with the objective of further avoiding and minimising potential impacts on the local and regional environment, and the local community.

Although impacts would be avoided and minimised through design, some residual impacts would remain. These would be addressed through the implementation of the proposed mitigation measures, and the potential residual impacts are considered manageable and/or would be offset.

Next steps

TransGrid is seeking approval from the NSW Minister for Planning and Public Spaces, and the Australian Minister for the Environment for the construction and operation of the proposal. Subsequent steps in the process include:

- exhibition of the Environmental Impact Statement for a minimum of 28 days and invitation for the community and stakeholders to make submissions
- consideration of submissions. Submissions received by the Secretary of the Department of Planning, Industry and Environment would be provided to TransGrid who may then be required to prepare and submit:
  - a submissions report, responding to issues raised in the submissions
  - a preferred infrastructure report and/or an amendment report, outlining any proposed changes to the proposal to minimise its environmental impacts or to deal with any other issues raised during the assessment of this application
- determination of the proposal by the NSW Minister for Planning and Public Spaces including, if approved, any conditions of approval
- determination of the proposal by the Australian Minister for the Environment including, if approved, any conditions of approval.

Consultation with the community and stakeholders would continue throughout the detailed design and construction phases.

Any person wishing to make a submission should use the online form if possible. To find the online form go to the web-page for the proposal via www.planningportal.nsw.gov.au/major-projects/projects/on-exhibition.

Part A

Introduction and need

1. Introduction

This chapter provides an overview and background to EnergyConnect, and specifically the NSW – Western Section of EnergyConnect (the proposal) .This chapter provides a summary of the proposal details, outlines the need and objectives for EnergyConnect (including the proposal) and outlines the purpose and structure of this Environmental Impact Statement (EIS).

1.1 EnergyConnect

TransGrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect aims to secure increased electricity transmission between SA, NSW and Victoria, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (NSW Department of Planning and Environment (DPE), 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

EnergyConnect comprises of several sections (shown on Figure 1-1) that would be subject to separate environmental planning approvals under the relevant jurisdictions. It includes:

- NSW sections including:
  - Western Section, which would extend from:
    - the SA/NSW border (near Chowilla in SA) to TransGrid's existing Buronga substation
    - Buronga substation to the NSW/Victoria border at Monak (near Red Cliffs in Victoria)
  - Eastern Section, which would extend from the Buronga substation to the existing Wagga Wagga 330kV substation
- a Victorian Section, which would extend from the NSW/Victoria border to Red Cliffs substation
- a SA Section, which would extend from Robertstown to the SA/NSW border.

TransGrid is now seeking planning approval for the NSW – Western Section (the proposal), which is the subject of this EIS.

TransGrid will seek separate environmental planning approvals for NSW – Eastern Section of EnergyConnect and Victorian Section. ElectraNet is responsible for obtaining environmental planning approval for the section of EnergyConnect located in SA.

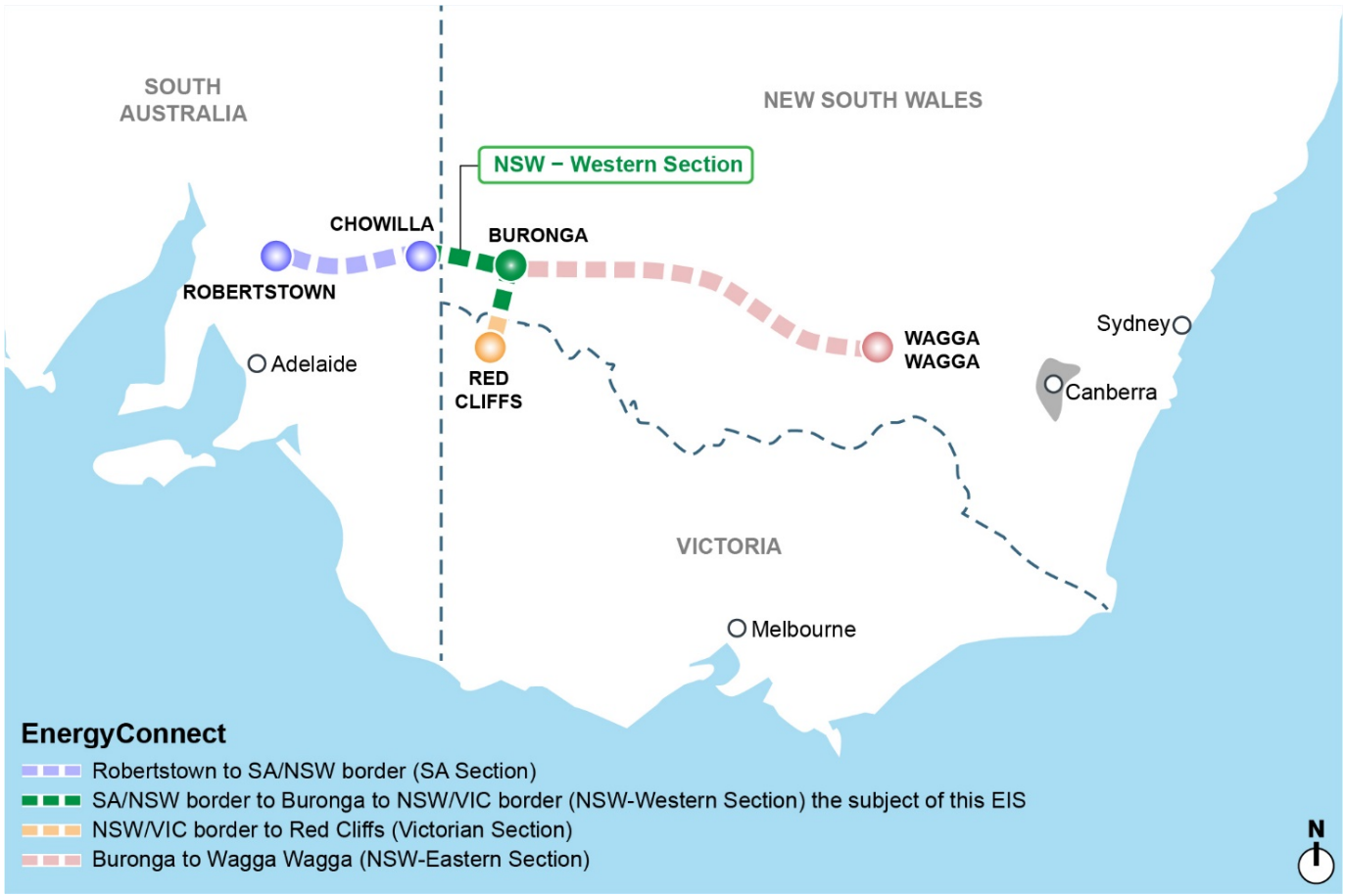


Figure 1-1 Overview of EnergyConnect

1.2 Proposal overview

1.2.1 Key features of the proposal

The key components of the proposal include:

- about 135 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the SA/NSW border near Chowilla and the existing Buronga substation
- an upgrade of the existing, 24 kilometre long 220kV single circuit transmission line between the existing Buronga substation and the NSW/Victoria border at Monak, near Red Cliffs in Victoria to a 220kV double circuit transmission line, and the decommissioning of the 220kV single circuit transmission line (known as Line 0X1)
- a significant upgrade and expansion of the existing Buronga substation to a combined operating voltage of 220kV/330kV
- new/and or upgrade of access tracks as required
- a minor realignment of the existing 0X2 220kV transmission line, in proximity to the Darling River
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure 1-2. Further detail on the key infrastructure components of the proposal and construction activities are provided in Chapter 5 and Chapter 6 respectively.

The proposal study area is located within the Wentworth Local Government Area (LGA), approximately 800 kilometres west of Sydney at its nearest extent.

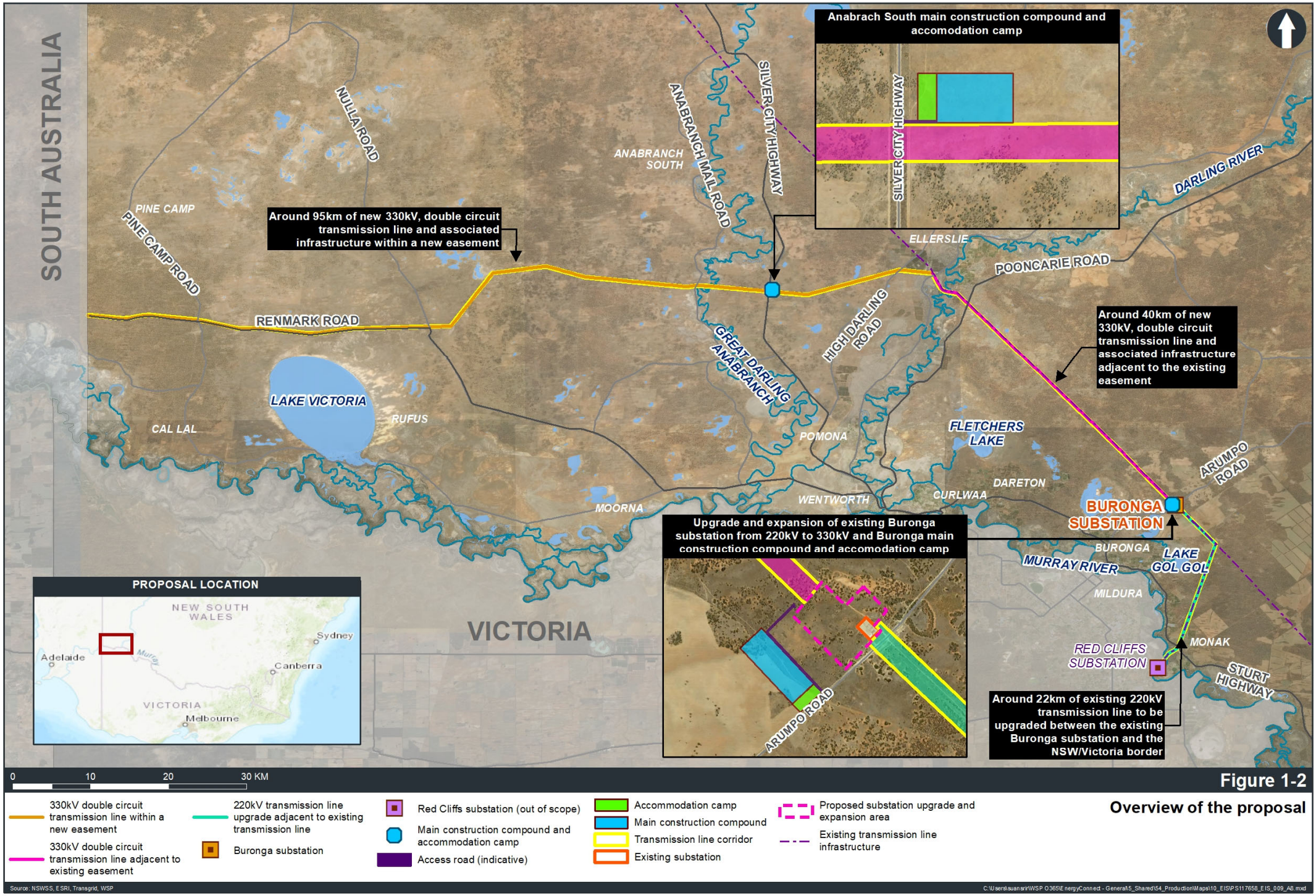


Figure 1-2

Overview of the proposal

1.2.2 Proposal objectives

The primary objective for EnergyConnect (including the proposal) is to secure increased electricity transmission between NSW, SA and Victoria of about 800 megawatts (MW) and facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources. More specifically, EnergyConnect (including the proposal) aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

1.3 The proponent

The proposal would be carried out by NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as TransGrid). TransGrid is the operator and manager of the main high voltage transmission network in NSW and the Australian Capital Territory (ACT) and is the Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.

1.4 Planning and statutory requirements

1.4.1 NSW planning requirements

The applicable planning approvals process for the proposal is summarised in Figure 1-3.

The NSW Minister for Planning and Public Spaces declared the NSW portions of EnergyConnect to be Critical State Significant Infrastructure (CSSI) under Schedule 5, clause 15 of the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). As CSSI, the proposal requires approval from the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the EP&A Act.

The Secretary's environmental assessment requirements (SEARs) for the proposal were issued on 31 July 2020 (refer to Appendix A). This EIS has been prepared to address the SEARs and the requirements of Schedule 2, Part 3 of the (NSW) Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) (refer to Appendix B).

The proposal may also require the following approval under other NSW legislation:

- a road occupancy licence under the *Roads Act 1993* where works are carried out on classified roads.

Further detail regarding on the approval requirements and statutory planning requirements is provided in Appendix C.

1.4.2 Commonwealth approval requirements

A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* was submitted on 27 May 2020. The Australian Department of Agriculture, Water and the Environment determined the proposal to be a controlled action on 26 June 2020 and will be assessed using the bilateral assessment process. The SEARs that were issued on 31 July 2020 have included the Commonwealth requirements under the bilateral assessment process.

Should the proposal be approved by the NSW Minister for Planning and Public Spaces and the Australian Minister for the Environment, the EIS (and any associated submissions report, amendment report and conditions of approval) would be used to guide the subsequent development stages of the proposal.

The proposal would be constructed and operated in accordance with the mitigation measures proposed in this EIS and any submissions report or preferred infrastructure report/amendment report, and the conditions of approval.

Further detail regarding the approval requirements and statutory planning requirements is provided in Appendix C.

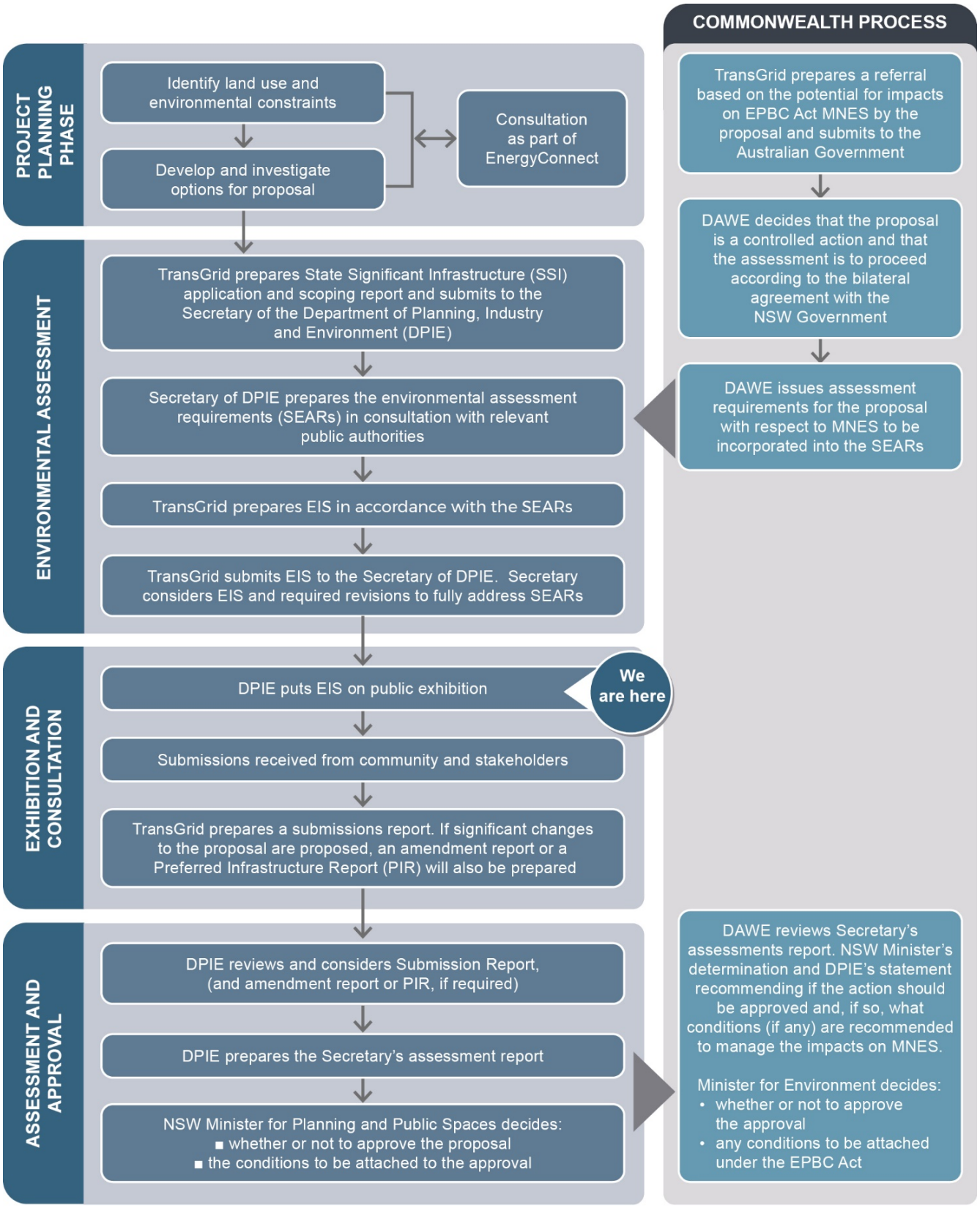


Figure 1-3 EnergyConnect planning approval process

1.5 Structure of this EIS

The main EIS (Volume 1) is structured in four main parts:

- Part A – Introduction and need:
  - an introduction to the EIS (Chapter 1)
  - an overview of the strategic context and need (Chapter 2)
- Part B – The proposal and its development:
  - the approach to design development, options assessment and corridor refinement (Chapter 3)
  - a brief overview of the proposal study area setting (Chapter 4)
  - a description of the key proposal components and operation (Chapter 5)
  - a description of the proposed construction methodology (Chapter 6)
  - a summary of the consultation that has occurred and is proposed in future project stages (Chapter 7)
- Part C - Environmental impact assessment:
  - an overview of the approach to the impact assessment undertaken for this EIS (Chapter 8)
  - the results of the assessment of the potential impacts of the proposal (Chapters 9 to 22)
- Part D – Management and conclusions:
  - an overview of the proposed environmental management approach and mitigation measures (Chapter 23)
  - justification and conclusion (Chapter 24)
  - list of references used in preparation of the EIS (Chapter 25).

Appendices to this report include:

- Appendix A – Secretary environmental assessment requirements cross-reference
- Appendix B – Environmental Planning and Assessment Regulation 2000 checklist
- Appendix C – Statutory planning assessment
- Appendix D – Consultation outcomes report
- Appendix E – Capital investment value report

Technical papers (Volume 2) include:

- Technical paper 1 – Biodiversity development assessment report
- Technical paper 2 – Non-Aboriginal and Aboriginal cultural heritage assessment
- Technical paper 3 – Agricultural land impact assessment
- Technical paper 4 – Visual and landscape character impact assessment
- Technical paper 5 – Socio-economic impact assessment
- Technical paper 6 – Hydrology, flooding and water quality
- Technical paper 7 – Air quality impact assessment
- Technical paper 8 – Noise and vibration impact assessment
- Technical paper 9 – Traffic and transport impact assessment
- Technical paper 10 – Bushfire impact assessment
- Technical paper 11 – Electric and magnetic field study
- Technical paper 12 – Phase 1 contamination assessment
- Technical paper 13 – Groundwater impact assessment.

1.6 Key report terminology

The following terms are discussed throughout this EIS and are defined as:

- **EnergyConnect:** an interconnector of about 900 kilometres between the electricity grids of SA and NSW, with an added connection to north west Victoria. In NSW, EnergyConnect comprises two sections – Western Section (the proposal the subject of this EIS) and the Eastern Section (which will be subject to separate environmental assessment)
- **the proposal:** EnergyConnect (NSW – Western Section)
- **proposal study area:** The proposal, including the transmission line corridor, Buronga substation upgrade and expansion, and the main construction compounds and accommodation camps at Buronga and Anabranch South are contained within the proposal study area (refer to Figure 1-4). The proposal study area comprises of a one kilometre wide corridor between the SA/NSW border near Chowilla and Buronga and a 200 metre wide corridor between Buronga and the NSW/Victoria border at Monak, near Red Cliffs
- **transmission line corridor**: A 200 metre corridor in which the final transmission line easement and transmission line infrastructure would be contained within (refer to Figure 1-4). Construction activities associated with the transmission line would be expected to be contained within this area. The area has been defined to provide flexibility to the detailed design of the transmission line
- **disturbance area:** the area that would be directly impacted by both construction and operation of the proposal including all proposal infrastructure elements. This area would be mostly contained within the transmission line corridor and would be defined during detailed design in consideration of avoidance and impact minimisation. An indicative disturbance area has been applied for the purposes of heritage and biodiversity assessments (refer to Figure 1-4 and Chapter 8 (Approach to impact assessment))
- **transmission line assessment corridor:** A 120 metre corridor that has been assessed for operational noise impacts (refer to Figure 1-4)
- **transmission line easement:** an area surrounding and including the transmission lines which is a legal 'right of way' and allows for ongoing access and maintenance of the lines and would be acquired from landholders. The easement width would be up to 80 metres wide for the 330kV transmission line component and 50 metres wide for the 220kV transmission line component.

A depiction of the terms associated with the transmission line component of the proposal is provided in Figure 1-4.

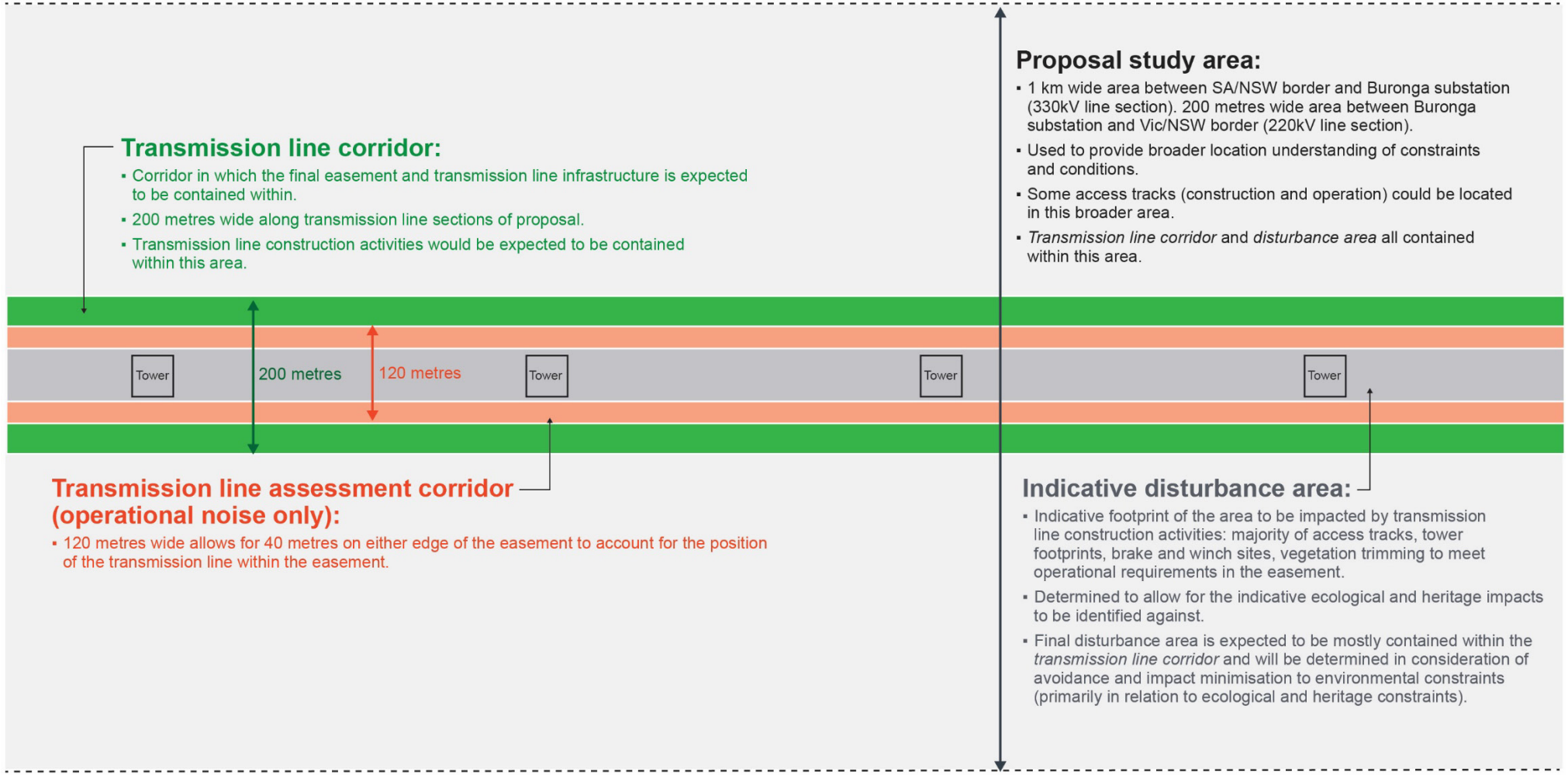


Figure 1-4 Definitions for features associated with the transmission line component of the proposal

2. Strategic context and need

This chapter considers the challenges that led to the need for EnergyConnect, which in NSW, comprises two sections – the Western Section (the proposal the subject of this EIS) and the Eastern Section (which is subject to separate environmental assessment). This chapter presents the strategic options that were considered to address these challenges, leading to the selection of the whole EnergyConnect project. It also discusses the need for and benefits of EnergyConnect. The proposal is also assessed in the context of key government strategies and policies including the *Integrated System Plan*, *NSW Transmission Infrastructure Strategy* and *State Infrastructure Strategy*.

2.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to strategic context and need, and where these requirements are addressed in this EIS are outlined in Table 2-1.

Table 2-1 Secretary's environmental assessment requirements – Strategic context and need

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include:	
	> a summary of the background to the project, including alternatives that were considered to the project	This chapter provides a summary of the background to the proposal in context of its strategic need and implications of not proceeding with the proposal. Chapter 3 (Proposal design development) provides an overview of strategic options and route development.
	> the relevant strategic context for the project, having regard to: – State legislation, policies and guidelines including current initiatives to improve energy security and reliability in the National Electricity Market	This chapter provides the strategic context of the proposal.
	– any other existing, approved or proposed projects that could result in cumulative impacts with the project.	Cumulative impacts are considered in Chapter 22 (Cumulative impacts)

2.2 The challenge

2.2.1 Need for emissions reduction

Climate change, which is linked to an increased level of greenhouse gas emissions in the atmosphere, is having worldwide impacts on society, the economy and the environment. To try and minimise the future impacts of climate change, 195 countries including Australia agreed on the United Nations Paris Agreement on climate change in December 2015 (the Paris Agreement).

This includes a global commitment to achieve net-zero greenhouse gas emissions by 2050. The Australian Government has ratified the Paris Agreement and has set interim emission reduction targets, including a commitment to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. Independently, every state and territory in Australia has set a goal or target to achieve net zero emissions by the second half of this century.

Electricity generation is Australia's largest source of emissions, accounting for 34 per cent of Australia's total annual emissions (Climate Change Authority, 2020). The National Energy Market (NEM) connects the southern and eastern states and territories in Australia and delivers around 80 per cent of Australia's electricity consumption. As such, to meet Australia's emission reduction targets, the NEM needs to significantly transition from traditional energy sources to lower emission alternatives including renewable energy (ElectraNet, 2019a).

2.2.2 Shift towards renewable energy

The NEM is currently transitioning from a system dominated by coal-fired generation to one of diverse renewable and distributed energy generation, supported by energy storage and network solutions. To date, the pace of development in new renewable and distributed energy generation has been even faster than anticipated in the *2018 Integrated System Plan* (ISP) and is predicted to continue transitioning over the next two decades (AEMO, 2020).

The *2020 Integrated System Plan* (2020 ISP) (AEMO, 2020) estimates that over 26 gigawatts of new grid-scale renewables is needed to replace the approximately 15 gigawatts, or 63 per cent, of Australia's coal-fired generation that will reach the end of its technical life and so likely retire by 2040. The retirement of coal generation is expected to be most rapid in NSW, with Mount Piper expected to be the sole remaining coal fired generator in NSW after the expected closure of the Eraring and Bayswater power stations by 2035. This has the potential to put pressure on the future supply of energy, particularly when considering that electricity consumption in NSW has increased consistently in recent years and is forecast to continue to increase over the next ten years (TransGrid, 2018). As such, the NEM needs to identify and connect to new low emission energy generation sources to continue to have enough energy to meet future demand, while meeting Australia's carbon emissions policy commitments (ElectraNet, 2019a).

The Clean Energy Council estimated that as of April 2020, there were 93 renewable energy projects in construction or due to start construction soon in Australia, which would generate around 10,999 megawatts (MW) of new renewable energy capacity (Clean Energy Council, 2020).

2.2.3 Challenges for the National Energy Market

Current interest in new energy generation projects in the NEM exceeds the existing transmission network capacity in several locations, meaning that not all projects would be viable. The existing network is estimated to have a connection capacity of 13 gigawatts in areas with favourable renewable resources, which is significantly less than the 26 gigawatts (or more) of new grid-scale renewables required by 2040 (AEMO, 2020). For example, TransGrid has identified that the existing transmission network outside the Sydney – Wollongong – Newcastle – Hunter Valley area will reach its existing capacity to connect renewable generation in 2020 (NSW Government, 2018). In addition, although South Australia (SA) has among the most abundant and high-quality renewable energy resources in Australia, total renewable energy resources in SA exceed its combined minimum demand and export capability.

In response, several Renewable Energy Zones (REZs) have been identified across the NEM (refer to Figure 2-1), which are areas of high energy resource potential where strategic transmission infrastructure upgrades can connect multiple projects at lower cost (AEMO, 2020). However, the transmission grid itself needs targeted augmentation, including strategically placed large-scale interconnectors and transmission line extensions, to balance resources and unlock REZs in new regions. Of particular importance to the proposal are the Murray River, Riverland and South West NSW REZs.

The *NSW Transmission Infrastructure Strategy* (DPE, 2018), which is discussed in more detail in Section 2.3.1, states that connection of these REZs will 'leverage massive private sector investment opportunities, boosting regional economies and building the state's resilience by ensuring there are enough new energy projects coming online to replace the retiring traditional power stations expected over the next two decades'. However, it is noted that investors in new energy projects typically will not invest unless they are sure there will be enough transmission capacity to distribute and sell their energy (NSW Government, 2018).

As described above in Section 2.2.2 above, Australia's energy markets are undergoing rapid change as the sector transitions to generating lower carbon emissions, with a greater uptake of renewable generation and emerging technologies. These changes have created several challenges, in particular to the South Australian energy market including:

- a reliance on high-cost gas plant in SA to meet peak demand
- increased variability of demand and supply due to growth of intermittent renewable generation, both at grid-scale and due to household rooftop photovoltaic (PV) cells.

These challenges have led to periods of high wholesale electricity prices in SA and a reduction in the overall affordability of electricity for customers. In addition, the SA region is seen as continually vulnerable to extreme weather events and system disturbances.

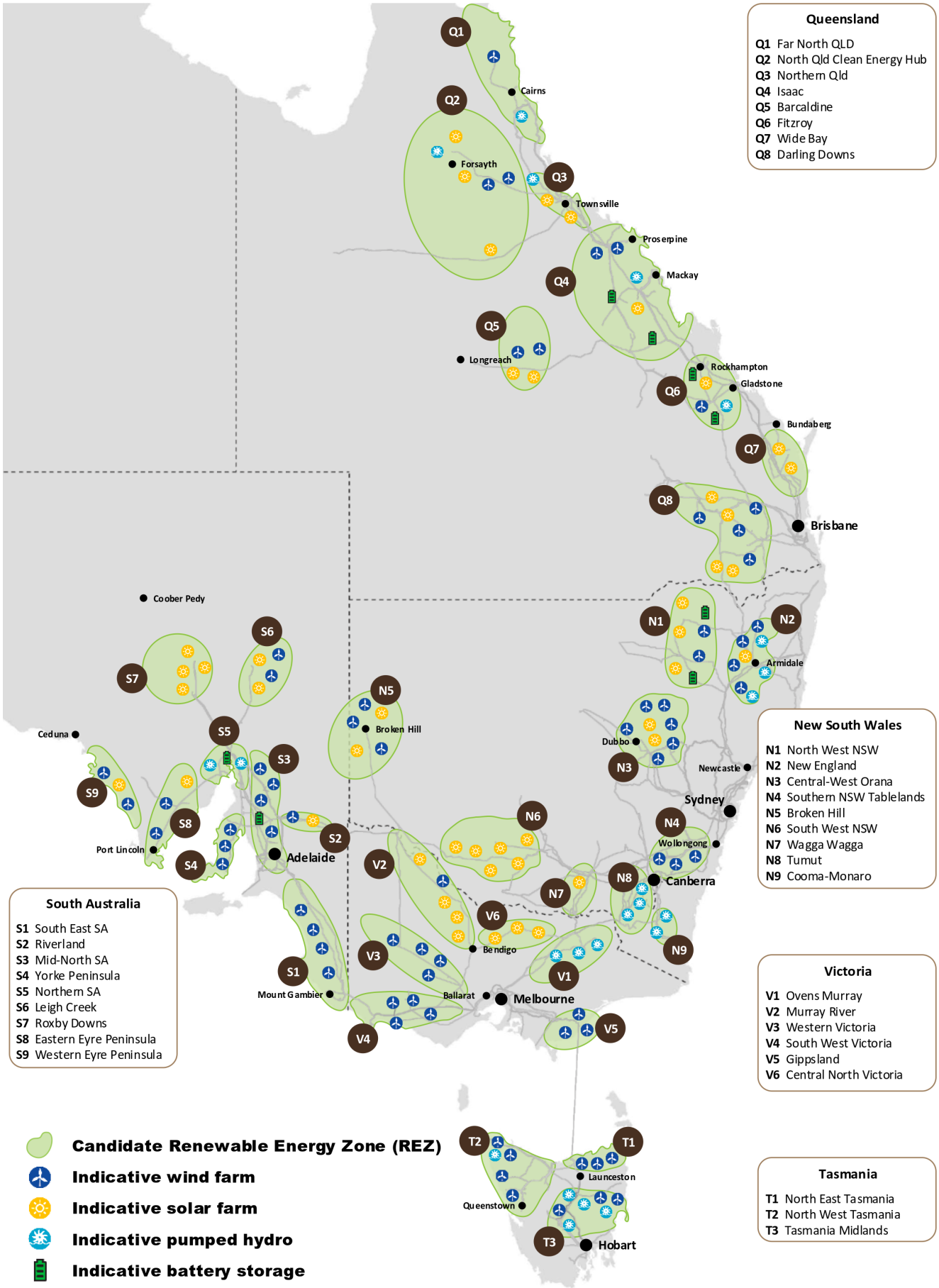


Figure 2-1 Identified potential REZs across the NEM (AEMO, 2020)

2.3 Strategic planning response

2.3.1 NSW policy context

NSW Transmission Infrastructure Strategy

The *NSW Transmission Infrastructure Strategy* (DPE, 2018) is the NSW Government's plan to unlock private sector investment in priority transmission infrastructure projects, which can deliver least-cost energy to customers through to 2040 and beyond. The Strategy forms part of the NSW Government's broader plan to make energy more affordable, secure investment in new generation sources and network infrastructure, and ensure new technologies deliver benefits for consumers. Building on existing programs to reduce household and business energy bills and secure energy supplies, the Strategy aims to:

- boost interconnection between Victoria, SA and Queensland, and unlock more power from the Snowy Hydro Scheme
- increase NSW's energy capacity by prioritising Energy Zones in the Central West, South West and New England regions of NSW, which will become a driving force to deliver affordable energy into the future
- work with other states and regulators to streamline regulation and improve conditions for investment. By increasing transmission capacity and low-cost generation, NSW will support an orderly transition of the energy sector over the next two decades.

NSW already has a substantial investment pipeline of new wind, solar, gas and generator upgrade projects that have received or are seeking planning approval, driving the energy transformation across the state. As traditional generators retire, these new projects will provide the cheapest available energy to supply households, businesses, schools and essential services. The existing network will continue to play an important role. However, it only has enough capacity to connect around one in 20 of these projects.

EnergyConnect is one of four priority transmission projects identified in the strategy to be accelerated to access existing and committed low-cost energy supplies in other regions within the NEM. These priority projects are intended to meet energy needs prior to the retirement of existing coal-fired generation in NSW.

The strategy also identifies three Energy Zones (refer to Figure 2-2), of which EnergyConnect would help transport energy from the South-West Energy Zone to major demand centres (DPE, 2018). The three Energy Zones are areas with high energy potential where planned transmission infrastructure upgrades could allow multiple generation projects to connect to the network at lower cost. AEMO forecasts these Energy Zones will provide the bulk of the state's future energy supply, with up to 17,700 megawatts of new generation projects expected to connect to the grid. This could support an average of up to 2,000 construction jobs each year and inject up to $23 billion in investment into regional NSW.

State Infrastructure Strategy 2018-2038

The *State Infrastructure Strategy 2018-2038* (Infrastructure NSW, 2018) establishes the strategic directions, projects and initiatives to meet the infrastructure needs of a growing population and a growing economy. The strategic objective for the energy sector within the strategy is to 'encourage private sector investment to deliver secure, reliable, affordable, low emissions energy supply'.

EnergyConnect is aligned with this objective as it would provide the increased transmission capacity that is required to encourage private sector investment in low emission energy generation projects within the REZs in western NSW, SA and north west Victoria.

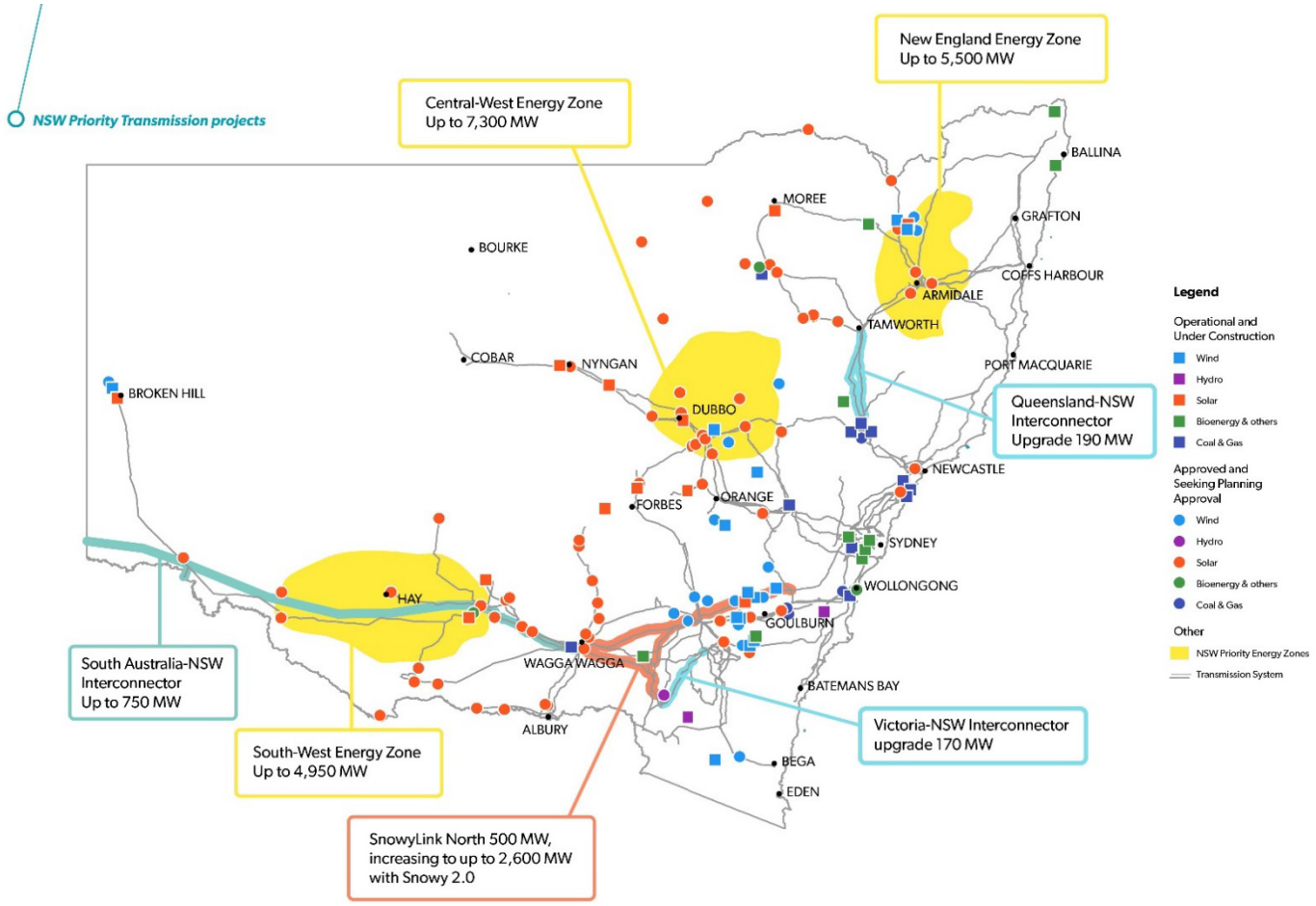


Figure 2-2 NSW Priority Transmission Projects (DPE, 2018)

NSW Climate Change Policy Framework

The NSW *Climate Change Policy Framework* (OEH, 2016) released in 2016, outlines NSW's long-term objectives to achieve net-zero emissions by 2050 and to make NSW more resilient to a changing climate. This framework guides NSW policy and programs on climate change. The framework states that NSW will be part of the global transformation of the world's energy system and that boosting energy and resource productivity can reduce the impact of rising energy prices and the cost of transition to a net-zero emissions economy. EnergyConnect is aligned with this framework, as it would provide a key piece of strategic transmission infrastructure that would enable the transition to a lower emissions economy.

2.3.2 Australian government policy context

Integrated System Plan

Responding to a recommendation in the 2018 *Independent Review into the Future Security of the NEM* (Commonwealth of Australia, 2017), the Australian Energy Market Operator (AEMO) released the first ISP in July 2018 to deliver a strategic infrastructure development plan, based on sound engineering and economics, which can facilitate an orderly energy system transition under a range of scenarios. An updated ISP (the 2020 ISP), which builds on the initial 2018 ISP, was released by AEMO in July 2020.

A new interconnector between SA and NSW (EnergyConnect) has been identified as a priority project in the 2020 ISP. This is because it is expected to deliver positive net market benefits and support the energy market transition to a lower carbon emissions future as soon as it can be built. AEMO estimates that the combined supply and network investments outlined in the 2020 ISP (such as EnergyConnect) would deliver $11 billion in net market benefits across the NEM. Moreover, the 2020 ISP confirms EnergyConnect as a 'no regret' actionable ISP project as it would 'increase transfer capacity between SA and NSW by 750 MW, to achieve fuel cost savings and unlock already stranded renewable investments' (AEMO, 2020).

EnergyConnect would also complement several additional major inter-regional interconnectors that have been identified in the 2020 ISP. Together, these interconnectors would augment the national transmission grid and address cost, security and reliability issues. These complementary projects include interconnectors between Queensland and NSW (QNI Upgrade), Victoria and NSW (VNI Upgrade) as well as the Snowy Mountains within NSW (HumeLink) to access Snowy Hydro's existing and future generation capacity. The interconnector projects proposed include a combination of 330kV and 500kV transmission systems.

Climate change policy

As discussed in Section 2.2.1, on 10 November 2016, Australia ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol, representing the Australian Government's commitment to provide action on climate change, setting interim emission reduction targets, including a commitment to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. In 2017, the Australian Government reviewed its climate change policies to ensure they remain effective in achieving Australia's 2030 target and Paris Agreement commitments. A final report was released on 19 December 2017 which generally indicated the Australian Government's policies were on course to meet Australia's international climate change commitments.

EnergyConnect is consistent with the Australian Government's climate change initiatives. It facilitates the longer-term transition across the NEM to low-emission energy sources by providing increased energy transmission capacity in strategic locations that are capable of unlocking REZs.

2.4 How the proposal would address the identified need

This proposal, which is an essential component of EnergyConnect, would enhance the energy transmission link between SA, NSW and Victorian transmission networks, joining the outreaches of the state networks at Chowilla in SA, Buronga in NSW and Red Cliffs in Victoria.

A new interconnector between SA and NSW (i.e. EnergyConnect) is needed to:

- lower dispatch costs, initially in SA, through increased access to electrical supply options across adjoining regions
- facilitate transition to a lower carbon emissions future in the NEM and promote the adoption of new technologies by improving access to high quality renewable resources across all regions of Australia
- enhance the reliability and security of electricity supply in SA and NSW, particularly as coal-fired generators begin to be retired in the near future.

By expanding, and in the case of SA and NSW establishing, power transfer capability between regions, interconnectors can enable the efficient sharing of generation resources within the NEM and can encourage more efficient investment in low-cost generation sources. This can allow overall demand and system reliability requirements to be met at the lowest cost. Allowing for a greater sharing of resources across regions would also help smooth demand and supply fluctuations, which would improve electricity security and reliability within the NEM and alleviate pressure on supply during peak demand periods.

As a result, EnergyConnect would reduce wholesale market electricity costs in SA, as soon as it can be built, by enabling electricity demand in SA to be met using low-cost generating capacity that currently exists on the east coast of Australia. This would also reduce SA's reliance on increasingly expensive gas generation, price volatility and trading risk.

In the longer term, an enhanced ability to import low-cost power from NSW, including significant high-quality renewables, provides market benefits by enabling supply in NSW to be met at a lower overall cost as existing coal-fired plants retire. This is particularly the case for the new interconnection between SA and NSW, as NSW is forecast by AEMO to experience the greatest retirement of coal plant after 2030 and would otherwise rely on higher-cost sources of generation to fill the resulting supply gap. For example, EnergyConnect is scheduled to be constructed around the time the coal-fired Liddell power station is due to retire from the market in NSW, providing timely additional transfer capacity to allow for the sharing of reserves between SA, NSW and north west Victoria (ElectraNet, 2019a).

The upgrade of the existing transmission line between Buronga and Red Cliffs would also enhance the capacity of the network to provide electricity between NSW and Victoria and enable the development of solar generation around Red Cliffs Terminal Station in the Murray River REZ. This power can then be exported to SA and NSW via EnergyConnect.

As discussed in Section 2.2.2, Australia's commitment to reduce carbon emissions has substantial implications for the future operation of the NEM. EnergyConnect would allow renewable energy trade between NSW, SA and Victoria to assist in meeting national carbon emission and renewable energy targets at lowest long-run cost. It would do so by relieving the transmission capacity constraints as required to encourage the development of large-scale renewable energy generation within the Murray River, Riverland and South West NSW REZs, which are priority areas to assist the NEM transition.

2.5 Key benefits of EnergyConnect

Economic cost-benefit analysis prepared as part of the Regulatory Investment Test for Transmission (RIT-T) process for the Australian Energy Regulator (AER) shows that EnergyConnect is expected to:

- deliver net market benefits of approximately $900 million over 21 years (in present value terms) including wholesale market fuel cost savings in excess of $100 million per year as soon as it is energised (primarily from avoided expensive gas-fired generation in SA)
- provide diverse low-cost renewable generation sources to help service NSW demand going forward, particularly as existing coal-fired generators retire
- avoid substantial capital costs associated with enabling greater integration of renewables in the NEM
- generate sufficient benefits to recover the proposal capital costs within nine years of completion
- reduce annual residential bills and small business customer bills in SA and NSW
- deliver flow on economic benefits to the wider economy totalling over $6 billion across SA and NSW (in present value terms)
- generate around 400 jobs (including around 80 regional jobs) during construction
- improve the security, reliability and resilience of the power network in SA and NSW
- improve the ability of parties to obtain hedging contracts in SA and help relieve the tight liquidity in hedging markets currently.

With regard to job creation, over the period from 2021 to 2040, it is projected that approximately 18,800 employee years of full time equivalent (FTE) direct and indirect jobs would be created by EnergyConnect (Acil Allen, 2019).

2.6 Implications of not proceeding with the proposal

This proposal, which is an essential component of EnergyConnect, would enhance the energy transmission link between the SA, NSW and Victorian transmission networks, as it would:

- complete the missing transmission link between SA and NSW
- enhance the capacity of the network to provide electricity between NSW and Victoria
- enable the development of solar generation around Red Cliffs Terminal Station, and the export of this power to SA and NSW via EnergyConnect.

Not proceeding with the proposal would reduce the security of the electricity supply in SA and NSW, particularly as coal-fired generators commence retirement. Not proceeding would discourage investment in energy generation and storage within the Murray River, Riverland and South West NSW REZs and the adoption of new renewable technologies in the future, which is required to support the delivery of commitments and policies at a State, Federal and international level.

Part B

The proposal and its development

3. Proposal design development

This chapter describes the approach to the refinement of the design for EnergyConnect (including the proposal), including the development of design criteria and principles, the approach to the design principles and issues, design options considered and assessment against a range of criteria. The proposal would be further refined and may change following consideration of submissions received from the community or stakeholders during exhibition of the EIS.

3.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to design development of the proposal and where these requirements are addressed in this EIS are outlined in Table 3-1.

Table 3-1 Secretary's environmental assessment requirements – Proposal design development

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include: > a summary of the background to the project, including alternatives that were considered to the project	This chapter provides a summary of the background to the proposal in context of its strategic need and implications of not proceeding with the proposal. Chapter 2 (Strategic context and need) provides a summary of the background to the proposal in context of its strategic need and implications of not proceeding with the proposal.

3.2 Strategic options assessment

Initial strategic connection options were identified to address the need for greater sharing of energy sources across the National Energy Market (NEM). For completeness of the options assessment process, an overview of these strategic options is provided in the following section.

3.2.1 Initial interconnector options considered

Four main interconnector options were initially identified to meet the overarching objective of securing a new electrical transmission line between SA and the NEM. These options included a predominantly SA-centric 'no-interconnector' option (consisting of both network and non-network components) as well as a series of options involving new interconnectors to NSW, Queensland and Victoria. These options were investigated as part of the EnergyConnect Regulatory Investment Test for Transmission (RIT-T) assessment process undertaken by ElectraNet and are presented in *SA Transformation RIT-T Project Assessment Conclusion Report* (ElectraNet, 2019b). The RIT-T is an economic cost benefit test that is overseen by the Australian Energy Regulator and applies to all major network investments in the NEM to enhance transparency and consistency in investment decision making.

A summary of the options considered are summarised below and shown in Figure 3-1:

> no interconnector:
  – Option A: Non-Interconnector. Consisting of a range of network support initiatives
> an interconnector to Queensland:
  – Option B: A 400kV high voltage direct current (HVDC) line between north SA and Queensland. The indicative route would be between Davenport in SA, crossing into NSW and connecting with the Queensland network at Western Downs. This path would be around 1,450 kilometres long. This option is assumed to provide 700 MW of transfer capacity

- NSW interconnector options:
  - Option C.3: A 330kV line (alternating current) between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga, plus a 220kV line between Buronga and Red Cliffs, in Victoria. The indicative route would be approximately 916 kilometres in length. This option is assumed to provide 800 MW of transfer capacity
  - Option C.3ii: A 330kV line between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga, Red Cliffs, Kerang and Darlington Point. This option is a variant of the above 330kV option that increases interconnection between Robertstown SA and Wagga Wagga in NSW via Buronga, but which is also routed via Kerang in Victoria and Darlington Point in NSW. The indicative route runs approximately 1,016 kilometres in length. This option is assumed to provide 800 MW of transfer capacity
  - Option C.3iii: A variant of Option 3, which uses a HVDC link for the Robertstown – Darlington Point portion
- an interconnector to Victoria:
  - Option D: A 275kV line from Tungkillo in SA to Horsham and Ararat in Victoria. This option uses a connection from Tungkillo to Horsham to strengthen SA's connection to the east coast by providing an increase in export and import capability. The indicative route runs approximately 510 kilometres in length. This option is assumed to provide 650 MW of transfer capacity.

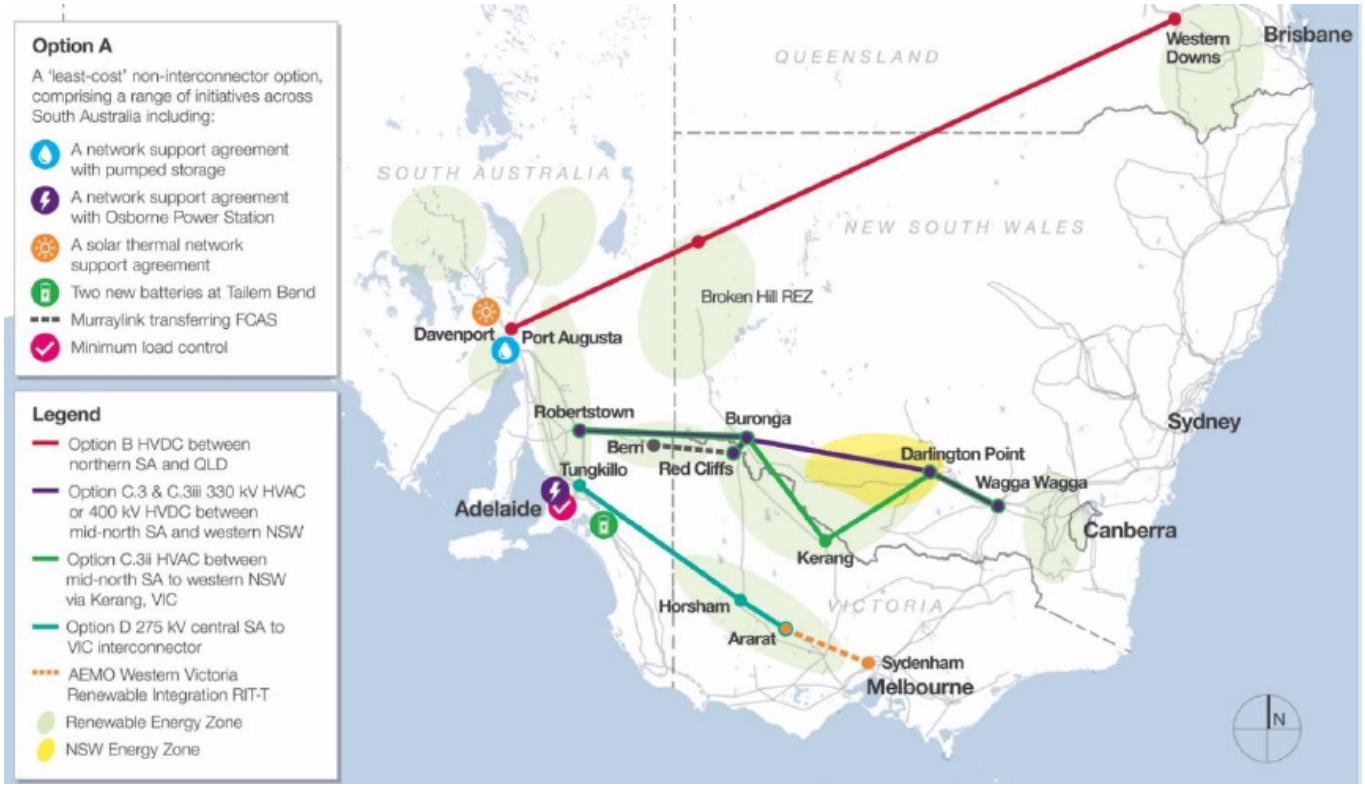


Figure 3-1 Overview of the strategic options (and variations) assessed (source: ElectraNet, 2019)

3.2.2 Evaluation of the strategic options

The four main interconnection options (and the associated sub-options in the case of the proposed NSW interconnector) were evaluated as part of the RIT-T (ElectraNet, 2019b). This evaluation included a range of considerations including:

- ability of the options to contribute to meeting the identified need
- estimating net market benefits
- scenario analysis and sensitivity testing
- consideration of cost (including consideration of capital investment value and net present value scenarios).

3.2.3 Identification of the preferred strategic option

The RIT-T concluded that of all options considered, a new 330kV interconnector between Robertstown in mid-north SA and Wagga Wagga in NSW, via Buronga and with an augmentation between Buronga and Red Cliffs (referred to as Option C.3), is expected to deliver the highest net market benefits and is therefore the current preferred strategic option.

As part of the 2020 ISP, consideration of a broader network alongside the options presented above has also been identified. Additional interconnector opportunities consisting of transmission systems with a minimum 330kV are identified, with two possible routes into NSW from Victoria (via Kerang or via Shepparton) which would interact with components of EnergyConnect (NSW – Eastern Section). The transmission system voltage configuration for Energy Connect (NSW – Eastern Section) would have a minimum 330kV and is subject to separate planning approval.

3.3 Identification and refinement of the proposal corridor

Following identification of the preferred strategic option to provide a new 330kV interconnector between Robertstown in SA and Wagga Wagga in NSW, the corridor for this interconnector was then considered. For the NSW component of the interconnector, this included:

- identification of an initial, wider proposal corridor (the preliminary alignment corridor)
- refinement of the preferred corridor.

3.3.1 Overview of the corridor assessment process

The identification of the preferred corridor for EnergyConnect between the SA/NSW border and Wagga Wagga was based on the analysis of extensive geospatial data, preliminary environmental survey and stakeholder engagement undertaken between November 2018 and February 2020. The assessment of corridor options was generally progressed as two separate sections between:

- the SA/NSW border and Buronga, including Red Cliffs (the current proposal)
- Buronga and Wagga Wagga (EnergyConnect – NSW Eastern Section – subject to separate planning approval).

An overview of the corridor selection process that was undertaken for the proposal is summarised in the following sections.

Corridor selection methodology

While the most cost-effective option for linear infrastructure projects is to take a straight-line approach from point to point, this option is not generally feasible due to a range of environmental, social, land use and engineering constraints. As such, the corridor selection assessment methodology for the proposal considered a ‘hierarchy of constraints’ which were developed to inform the preliminary alignment corridor and to allow for route narrowing and eventual selection of the preferred corridor for the proposed transmission line.

The overall methodology for the corridor selection process included consideration of a corridor that:

- minimised environmental and social impacts and maximised the use of previously disturbed areas wherever possible, including:
  - avoiding areas of particular environmental sensitivity where obtaining planning approvals and access were considered unlikely
  - maximising distances to dwellings, inhabited areas and other sensitive land uses
  - preferencing areas of existing disturbance (e.g. transmission line or utility easements, roads, tracks, fence lines and cadastral boundaries) and targeting narrow crossing points of waterways and flood out areas (and their associated riparian habitats e.g. around the Darling River and Great Darling Anabranch)

- enabled the use of current and available technology for transmission line construction
- enabled the transmission line to be accessed and maintained safely
- was broadly acceptable to landholders and key stakeholders
- provided a cost effective and best value for money option.

The identification of constraints used to consider potential options was also informed by engagement with the community and the incorporation of their feedback. This included:

- engagement with local and regional communities
- targeted engagement with key stakeholders including local government, State and Commonwealth government agencies, landholders, Traditional Owner groups and other directly affected parties.

An overview of the corridor selection process used for the proposal is summarised in Figure 3-2.

Hierarchy of constraints and opportunities

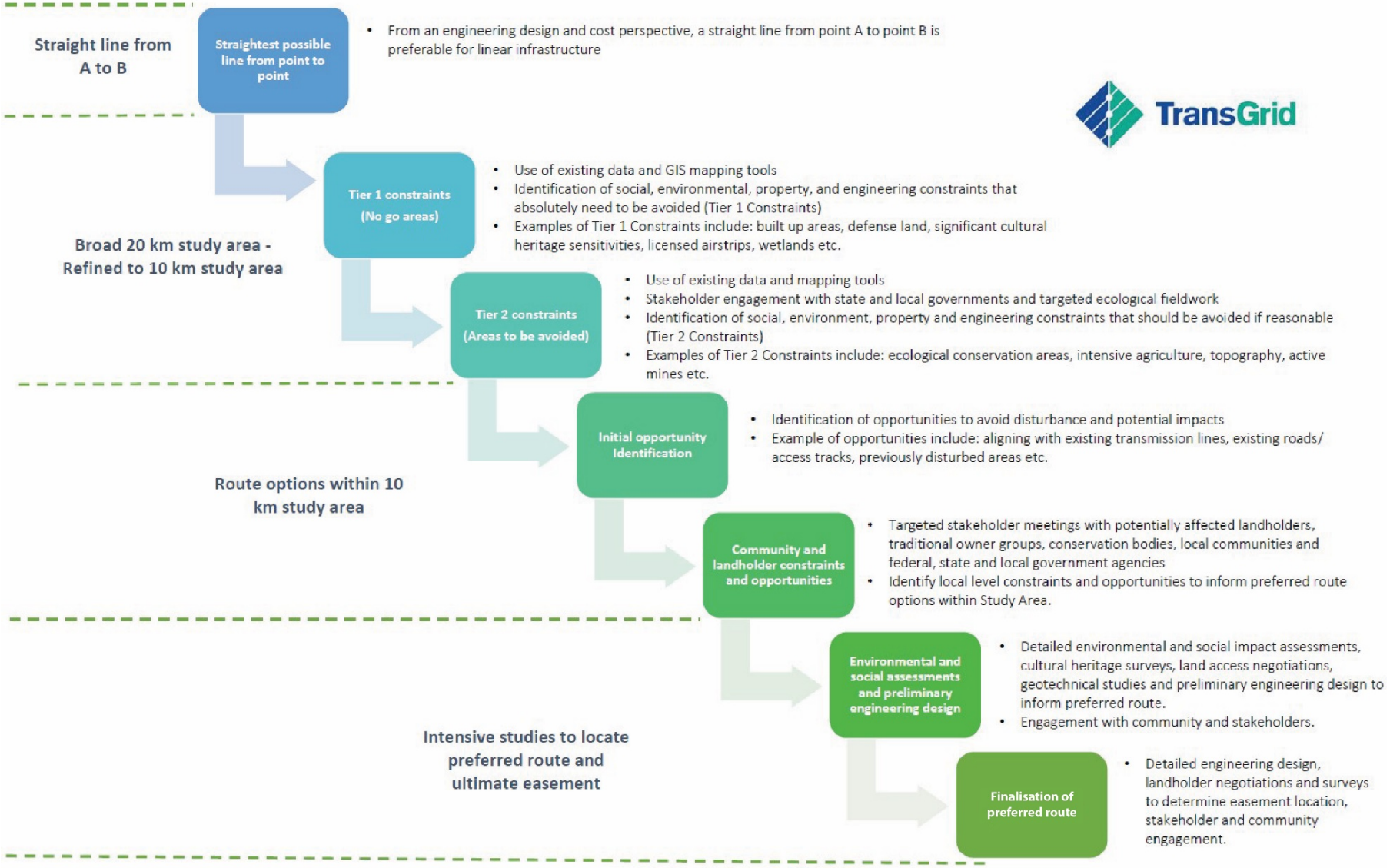
A range of primary constraints and opportunities were identified and considered during the identification of the preliminary alignment corridor, and the eventual selection of the refined preferred corridor. These were categorised into the following hierarchy:

- No-Go (Tier 1 constraints): Areas where the proposal cannot be located including
  - Ramsar Wetlands
  - World Heritage Properties
  - Defence Land and other relevant exclusion zones
  - built up areas (townships and residential zoning)
  - licenced Airstrips / certified aerodromes
- Avoid (Tier 2 constraints): Areas that are to be avoided wherever possible including:
  - ecological constraints such as:
    - National Parks, ecological conservation areas (including flora reserves, state conservation areas, Biodiversity Stewardship Sites, Biobanks; wilderness protection areas)
    - EPBC Threatened ecological communities
    - serious and irreversible impacts (SAII) ecological communities and species
    - other Important Wetlands and Water sources for migratory birds protected by international agreements
  - heritage conservation areas
  - land uses including:
    - Commonwealth Land
    - exclusive Native Title Determination sites
    - freehold land granted under NSW Aboriginal Land Rights Act.
    - intensive agricultural activities and horticultural use
    - active mining
  - areas with engineering and constructability challenges
- Minimise (Tier 3 constraints): Areas where impacts should be minimised and mitigated including
  - ecological constraints such as:
    - threatened species (flora/fauna) – other non-SAII threatened flora fauna records
    - large, contiguous/intact areas of moderate or better-quality woodland vegetation
    - threatened ecological communities listed under the (NSW) *Biodiversity Conservation Act 2016* (BC Act) (non-SAII)
    - key fish habitat
    - riparian corridors within two kilometres of existing alignment for additional context

- heritage constraints such as:
  - known/recorded sites and places of aboriginal and non-aboriginal heritage significance
  - areas of Aboriginal cultural significance (ceremonial sites, etc)
  - sites on the Aboriginal heritage information management system (AHIMS) and recorded conservation sites
  - State heritage items
- main channels of rivers and tributaries
- flood-prone land
- homesteads/dwellings/structures (including agricultural structures)

> Opportunities: Areas that improve/benefit the proposal outcomes including:

- areas of existing and permanent disturbance (e.g. existing roads and tracks, utility easements, fence lines, cadastral boundaries, biosphere, degraded grazing lands)
- existing crossings/access (including bridges) across or narrow sections of the permanent/semi-permanent watercourses.



Source: TransGrid

Figure 3-2 Overview of the corridor selection process

3.3.2 Identification of a preliminary alignment corridor

For the preliminary alignment corridor, existing start and end points were already established due to the nature of the connection (i.e. the need to connect with the identified connection point at the SA border and the need to connect with the existing Buronga substation and the Red Cliffs substation).

Using existing, publicly available datasets for the tiered constraints and opportunities listed in Section 3.3.1, together with the feedback received from early stakeholder engagement activities, a single 10 kilometre option wide study area was defined between the SA/NSW border and Buronga substation and onwards to Red Cliffs substation.

This corridor was identified as it did not intersect any known Tier 1 constraints (in particular Lake Victoria) and substantially avoided interaction with Tier 2 constraints as far as possible (such as the identified areas of intensive agricultural land within the vicinity of Ellerslie), as shown in Figure 3-3.

The primary opportunities that influenced the preliminary alignment corridor between the SA/NSW border and Buronga substation included:

- the existing TransGrid 0X2 220kV transmission line running north west from the Buronga substation towards Broken Hill
- the existing Buronga 220kV substation
- the Renmark-Wentworth Road towards the western extent of the corridor
- various minor roads, tracks, fence lines and cadastral boundaries trending east/west through the corridor alignment
- the existing TransGrid X5/3 220kV transmission line running south west from the Buronga substation towards Red Cliffs.

These existing features offered various opportunities for the co-location of transmission infrastructure (in particular from the point where the existing TransGrid 0X2 220kV line crosses Low Darling Road near the suburb of Ellerslie) and offered some reduction in the extent of impacts arising from transmission line construction and operational maintenance.

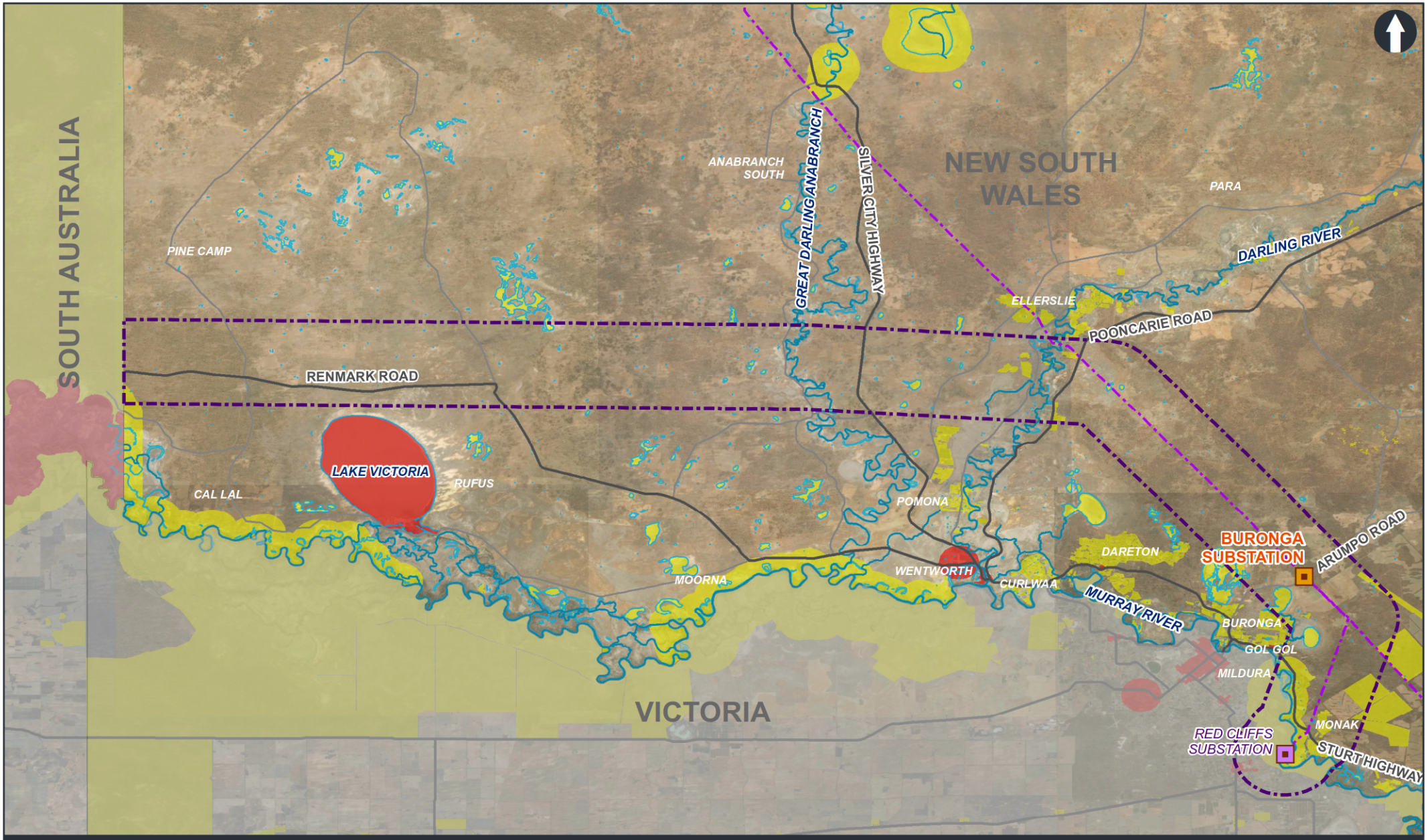


Figure 3-3

EnergyConnect preliminary alignment corridor

- SA/NSW border to Buronga - 10km corridor (the preliminary alignment corridor)
- Buronga substation
- Red Cliffs substation (out of scope)
- Existing transmission line infrastructure
- Tier 1 constraint areas
- Tier 2 constraint areas

Source: NSWSS, ESRI, Transgrid, WSP

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3.3.3 Preferred corridor identification and refinement

Following identification of the preliminary alignment corridor, the corridor was refined to develop a narrower preferred corridor (also referred to as the proposal study area). This refinement process involved:

- further consideration of key environmental constraints and opportunities at a local level, including some field-based survey work to validate assumptions made around the extent and quality of key biodiversity features
- commencement of direct engagement with potentially affected stakeholders and landholders between the SA/NSW border and Buronga to:
  - collect feedback on the methodology used to identify the preliminary alignment corridor including the selection criteria and tiered constraints/opportunities (landscape level)
  - collect additional information on constraints and opportunities (at a local property level)
  - seek preferences as to where new transmission infrastructure may be located.

The preferred corridor (the proposal study area) is shown in Figure 3-4.

SA/NSW border to Buronga substation section

As a result of the above process, the preliminary alignment corridor between the SA/NSW border and Buronga was refined to a generally one kilometre preferred corridor (the proposal study area). This corridor was developed in order to avoid key environmental constraints and has been confirmed as suitable through extensive landholder engagement. This included:

- the co-location of the new transmission line infrastructure with existing infrastructure, where possible, such as:
  - Renmark Road
  - the existing Broken Hill to Buronga 220kV electrical infrastructure. In particular, the preferred corridor would cross the Darling River in the same locality
- use of various minor roads, tracks, fence lines and cadastral boundaries, and areas of degraded vegetation, where possible
- positioning of the corridor to cross narrower sections of waterways and their associated flood zones.

The preferred corridor (the proposal study area) included a wider crossing at the Great Darling Anabranch to enable further engineering and environmental investigation of the preferred crossing location.

Buronga substation to NSW/Victorian border section

Due to the limited nature of alternative feasible options (other than to provide a parallel easement), the corridor between Buronga and the border of NSW/Victoria at Monak, near Red Cliffs was refined to a 200 metre wide corridor for the majority of this section. This corridor follows the existing TransGrid X5/3 220kV transmission line which runs south west from the Buronga substation towards Red Cliffs substation.

Two options within this corridor were considered, being a new single circuit 220kV transmission line that would run parallel with the existing easement, or an upgrade to a double circuit 220kV transmission line (and removal of the existing single circuit 220kV transmission line). The upgrade to a double circuit 200kV transmission line was selected as the preferred option as it would:

- minimise the impacts to property and land use, as the total area subject to easements would be reduced
- minimise ongoing costs associated with maintaining separate lines and easements.

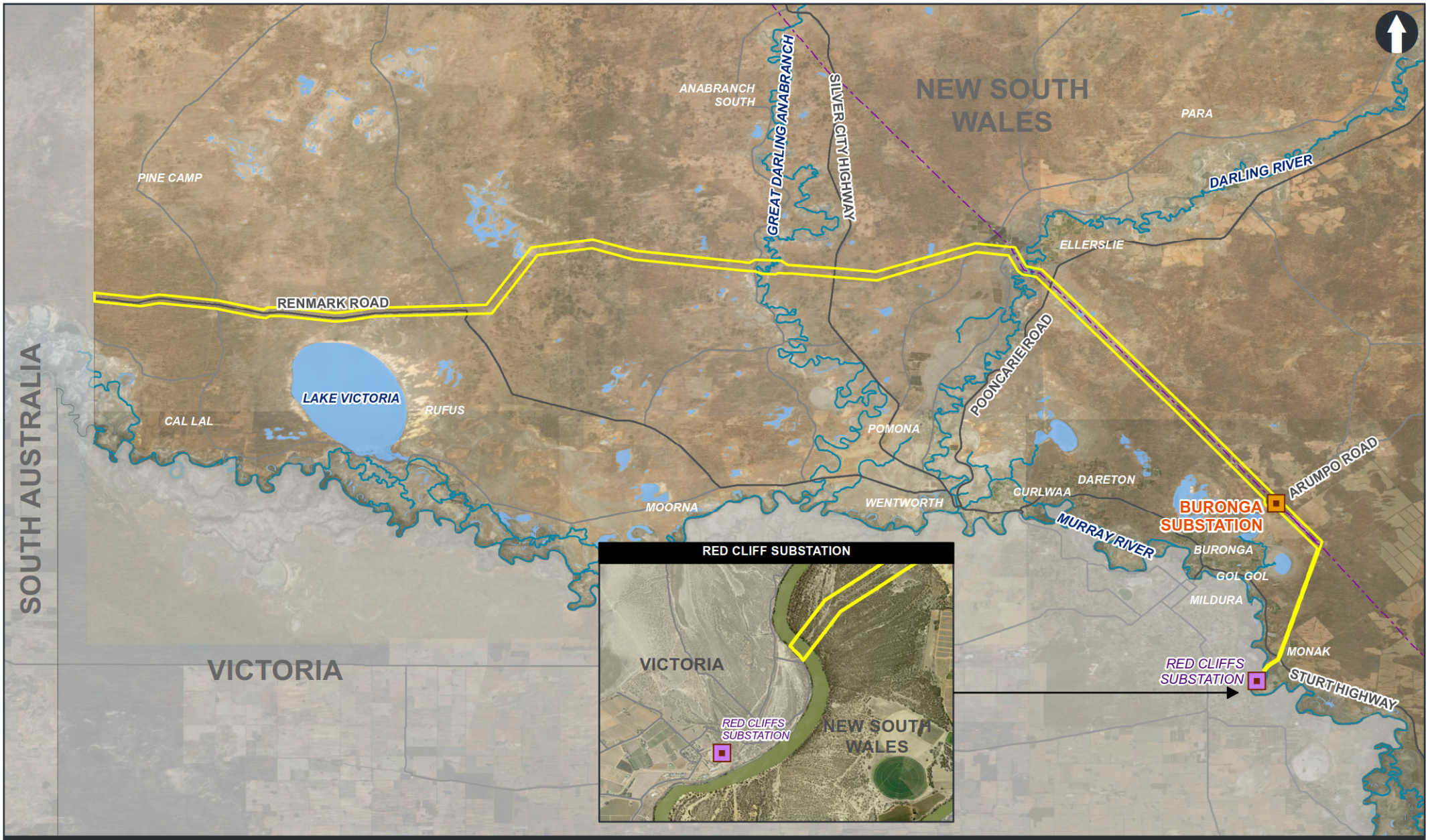

Figure 3-4

Preferred corridor alignment – SA/NSW border to Buronga and NSW/Victorian border

3.3.4 Further corridor refinements

Following the identification of the preferred corridor (the proposal study area), further refinements have been identified to identify the proposed transmission line corridor as described in Chapter 5 (Proposal infrastructure and operation). This work was supported by:

- detailed environmental and other site investigations
- stakeholder engagement with landholders.

Based on this work, the following refinements were made to further avoid and minimise environmental and social impacts by:

- locating the transmission line corridor to the northern side of Renmark Road to:
  - avoid impacts on the critically endangered threatened flora species *Dodonaea stenozyga* and the endangered flora species *Acacia acanthoclada*
  - avoid direct impacts and minimise indirect visual impacts on Lake Victoria, an area of Aboriginal cultural significance that has numerous known Aboriginal heritage sites
- locating the transmission line corridor on the southern boundary of Nulla Station to avoid high biodiversity value areas that contain a population of the endangered flora species *Austrostipa nullanulla*, including areas protected under conservation agreements
- positioning the transmission line corridor to avoid impacts on individuals of the endangered flora species *Leptorhynchos watzia* and vulnerable flora species *Atriplex infrequens*
- locating the transmission line corridor where possible along existing property boundaries to minimise disruption to agricultural activities.

3.3.5 Buronga substation

The existing Buronga 220kV substation is located at 993 Arumpo Road, Buronga. The site is the existing marshalling point for TransGrid transmission lines and provides ancillary services for operation and maintenance activities.

Given the advantage of expanding the existing substation and the absence of constraints immediately surrounding the existing substation, no alternative locations for the proposed expanded substation have been considered. However, the position of the upgrade and expansion has been located in areas of existing disturbance, where possible.

3.3.6 Main construction compounds and accommodation camps

In addition to the transmission line corridor, a number of main construction compounds and accommodation camps would be required along the corridor to support construction.

The primary objective for locating these sites was to minimise environmental and community impacts, while addressing landholder requirements and being suitably located at key strategic locations to support construction activities across the transmission line corridor.

Key factors applied to the identification of potential main construction compounds and accommodation camps included:

- being in areas which have previously been disturbed, or would already require disturbance as part of the construction of the proposal
- no impacts to threatened species (or their habitats) or threatened ecological communities (within the meaning of the *Biodiversity Conservation Act 2016* or the *Environmental Protection and Biodiversity Conservation Act 1999*)
- being located on sites of identified lower ecological and heritage value
- being located an appropriate distance from watercourses (i.e. locations greater than 200 metres away)

- being located an appropriate distance from sensitive receivers to minimise potential impacts (i.e. enabling adequate separate from residential buildings) with consideration of matters such as compliance with the *Interim Construction Noise Guideline* (DECCW, 2009), traffic and access impacts, dust impacts, and visual (including light spill) impacts
- sites being of relatively level ground to minimise earthwork requirements and offsite drainage risks
- of minimal environmental impact with respect to flooding
- proximity to key construction activities to minimise durations of travel for workforce and transport of materials and equipment
- easily accessible for heavy vehicle construction traffic (including deliveries).

Details of the Anabranch South and Buronga main construction compounds and accommodation camps are provided in Section 6.7.1. These sites have been identified applying these factors, and have been located in areas of existing disturbance (where possible) and avoid areas that contain high biodiversity and heritage values. Where the identified main construction compounds and accommodation camps could not meet the criteria listed above, additional specific mitigation measures were identified to manage impacts associated with their use.

As discussed in Section 6.7.1, these factors would be considered when identifying an additional third main construction compounds and accommodation camp.

4. Proposal setting

This chapter describes the location and setting of the proposal to provide context to the proposal description in Chapter 5 (Proposal infrastructure and operation). It summarises the key environmental features and the broader setting for the confirmed proposal study area (which was defined through the corridor development process described in Chapter 3 (Proposal design development).

4.1 Location

The proposal study area is located in western NSW within the Wentworth LGA, approximately 800 kilometres south-west of Sydney at its nearest extent. The proposal study area is about 160 kilometres in length, from the SA/NSW border where the proposal would transfer from ElectraNet to TransGrid, through to the Buronga substation and onwards to the NSW/Victoria border.

There are no major population and service centres located within the proposal study area. Various towns including Wentworth, Dareton, Buronga, Mildura, Gol, Monak and Red Cliffs are within the vicinity of the proposal study area.

From the SA border, the proposal study area initially runs parallel to the Renmark Road for about 36 kilometres to a point where Renmark Road travels south. From this point, the proposal study area continues in an initially north eastern direction crossing Nulla Road, before continuing east towards Ellerslie, crossing roadways such as the Silver City Highway, High Darling Road and Low Darling Road. Three key waterways are present within this section of the proposal study area; the Darling River, the Great Darling Anabranch and the Murray River. Lake Victoria is also located about three kilometres to the south of the proposal study area and Renmark Road at its nearest point.

From the crossing point with Low Darling Road, the proposal study area turns south-east to run parallel (for approximately 40 kilometres) to the existing TransGrid ‘Line 0X2’ 220kV transmission line that connects Broken Hill to the Buronga substation. This section of the proposal study area crosses several roadways including Pooncarie Road, Arumpo Road and several other local roads and tracks.

At this point, the proposal study area covers the existing Buronga substation. The Buronga substation is an existing 220kV substation operated by TransGrid, which is located north east of the main town of Buronga at 993 Arumpo Road, Wentworth NSW. The existing substation covers an area of approximately 2.14 hectares and is surrounded by grazing property.

From the Buronga substation, the proposal study area generally turns south, running parallel to the existing X5/3 and 0X1 transmission lines for about 6.5 kilometres before 0X1 diverges towards the NSW/Victoria border at Monak. One major road crossing then occurs within this section of the proposal study area at the Sturt Highway.

Photographs generally showing the existing land uses and environment within and surrounding the proposal study area, are provided as Photo 4-1 to Photo 4-7.

Photo 4-1 Photograph of Renmark Road looking west towards the SA/NSW border

Photo 4-2 Photograph of Nulla Road where the proposal study area crosses (left to right), looking north

Photo 4-3 Photograph of vegetation within the proposal study area immediately east of Nulla Road

Photo 4-4 Photograph of the Darling River within the proposal study area showing existing transmission lines ('Line 0X2')

Photo 4-5 Photograph of the proposal study area at the Darling River showing the River Red Gum community on the river bank

Photo 4-6 Photograph of the existing Buronga substation and surrounding environment

Photo 4-7 Photograph showing the Sturt Highway with the existing 'Line 0X1' transmission line in the background, looking south towards Monak

4.2 Future setting

As discussed in Section 2.2.3, several REZs have been identified across the National Energy Market (NEM). In the vicinity of EnergyConnect (including the proposal) are the Murray River, Riverland and South West NSW REZs (refer to Figure 4-1).

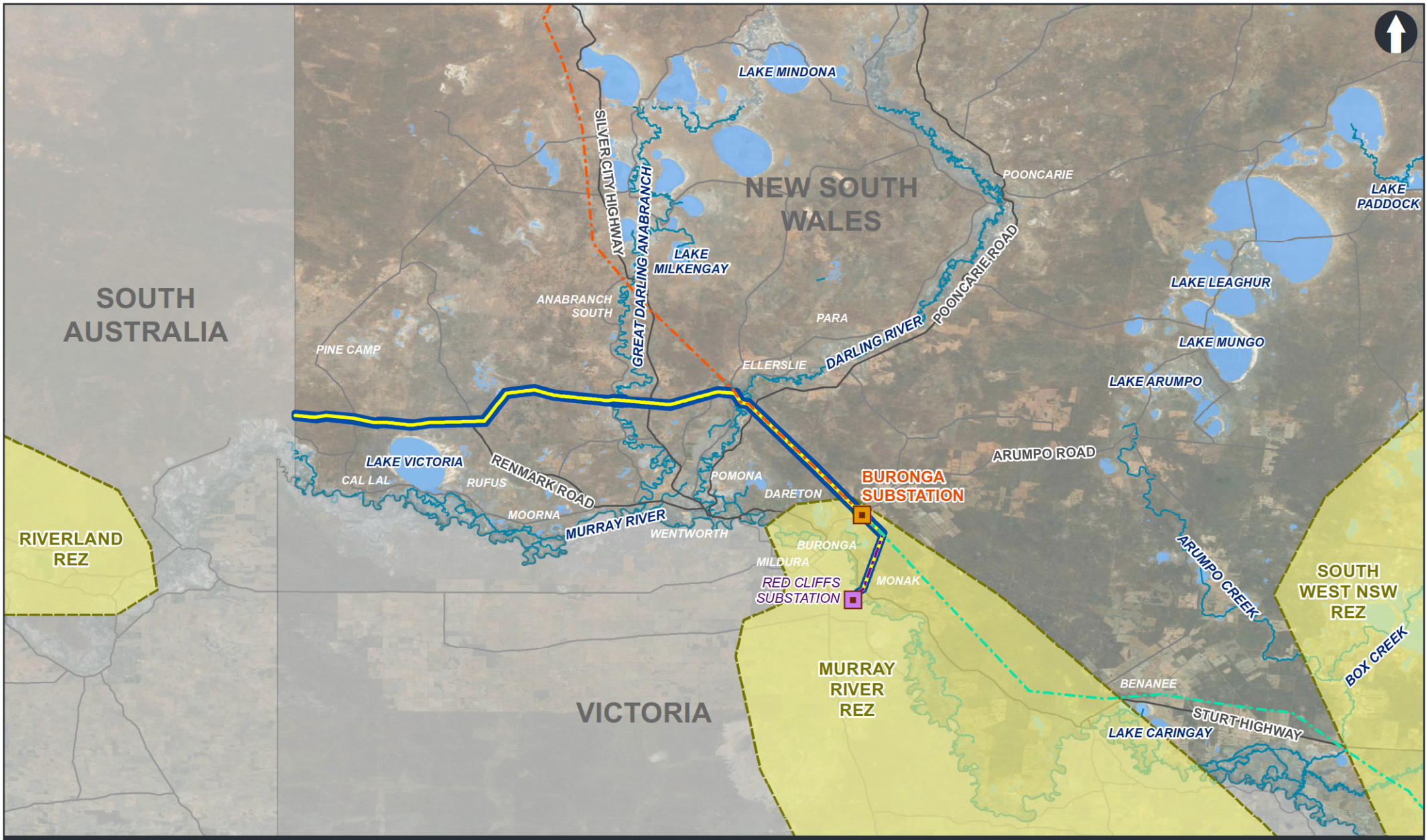

Figure 4-1

Identified REZ along the alignment and within the surrounding areas

5. Proposal infrastructure and operation

This chapter provides a description of the key elements of the proposal, including the proposed transmission lines and works associated with the upgrade and expansion of the Buronga substation. This chapter also outlines how the proposal would operate and be maintained. A description of how the proposal would be constructed is provided in Chapter 6 (Proposal construction).

The description of the proposal components presented in this chapter are indicative and based on the current level of design. Some detailed elements of the proposal would continue to be refined as part of the ongoing design development process. For this EIS, a proposed study area has been defined within which the proposal would be constructed and operated.

The final design would be reviewed for consistency with the assessment contained in this EIS, including relevant mitigation measures and any future conditions of approval.

5.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to description of the proposal and where these requirements are addressed in this EIS are outlined in Table 5-1.

Table 5-1 Secretary's environmental assessment requirements – Proposal infrastructure and operation

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include:	
	> a full description of the project, accompanied by suitable maps and plans, including the:	This chapter provides an operational description of the proposal, and is supported by Figure 5-1 to Figure 5-8. A description of construction activities is provided in Chapter 6 (Proposal construction).
	– disturbance area	The disturbance area is described in Section 6.5.
	– physical layout of the project over time, including sections of key components	The transmission line corridor is shown in Figure 5-1 and Figure 5-2, with typical arrangement of each structure in Figure 5-3 and Figure 5-5. The Buronga substation upgrade and expansion is shown in Figure 5-6 to Figure 5-8.
	– key uses and activities to be carried out on site;	This chapter provides a description of the key uses and activities to be carried out. A description of construction activities is provided in Chapter 6 (Proposal construction).

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
	– likely timing of the project including any stages, the key phases within each stage (site preparation, construction, commissioning, operation, decommissioning and rehabilitation) and the sequencing of these stages and phases;	Refer to Chapter 6 (Proposal construction).

5.2 Proposal overview

An overview of the key components of the proposal is provided below and shown on Figure 5-1. Section 5.3 provides a greater level of details about each of the key components of the proposal and Section 5.4 provides the operational and maintenance aspects of the proposal.

The key components of the proposal include:

> about 135 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the SA/NSW border near Chowilla and the existing Buronga substation

> an upgrade of the existing, 24 kilometre long 220kV single circuit transmission line between the existing Buronga substation and the NSW/Victoria border at Monak, near Red Cliffs in Victoria to a 220kV double circuit transmission line, and the decommissioning of the 220kV single circuit transmission line (known as Line 0X1)

> a significant upgrade and expansion of the existing Buronga substation to a combined operating voltage of 220kV/330kV

> a minor realignment of the existing 0X2 220kV transmission line, in proximity to the Darling River

> new/and or upgrade of access tracks as required.

The final alignment and easement of the transmission line would be confirmed during detailed design and would be located within the transmission line corridor as shown in Figure 5-1.

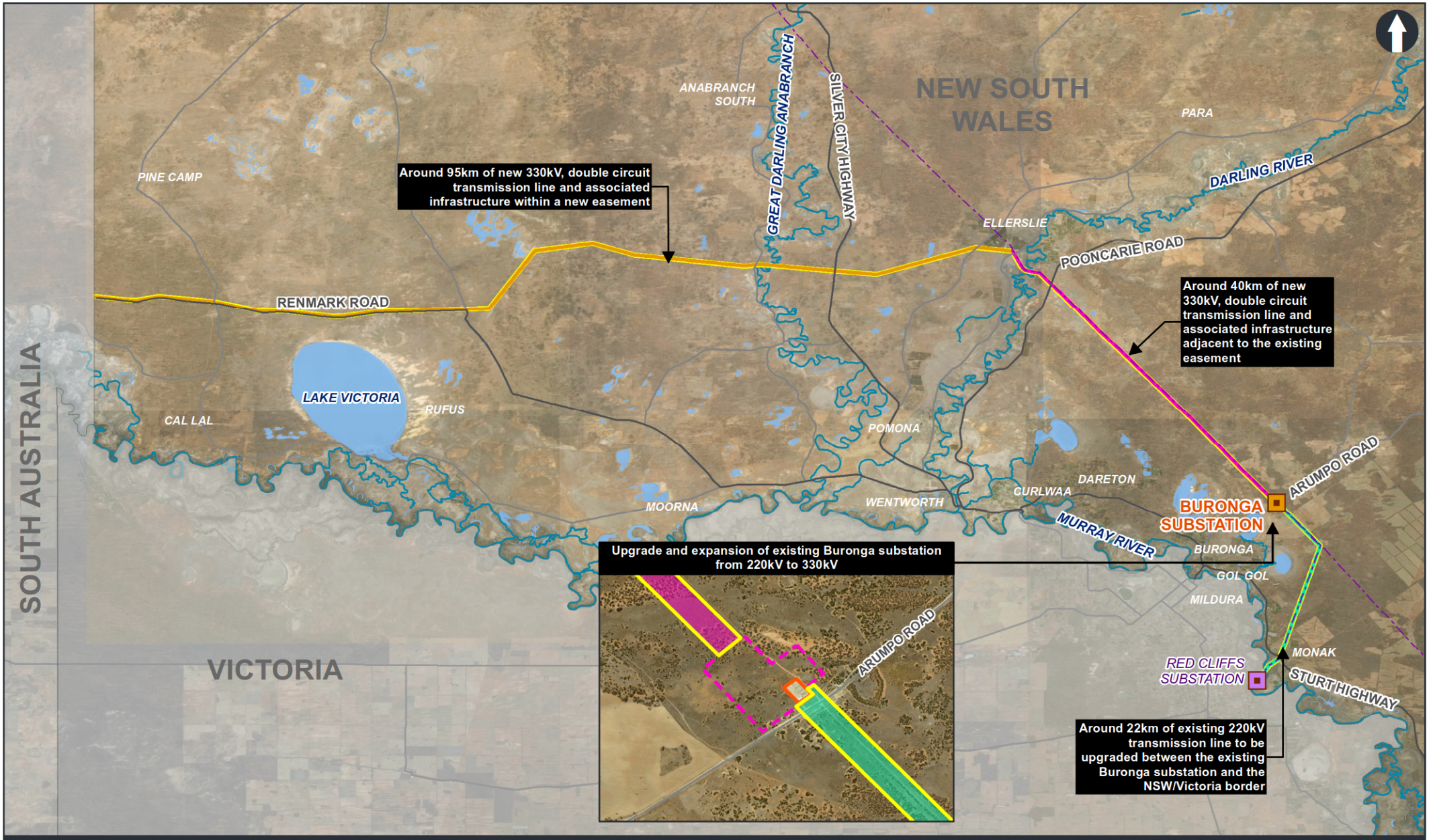

Figure 5-1

Key proposal features

5.3 Components of the proposal

5.3.1 Transmission line between SA/NSW border to Buronga substation

This component of the proposal comprises of a new double circuit 330kV transmission line from the SA/NSW border in the vicinity of Chowilla eastwards towards the existing 220kV Buronga substation. The nominal distance of this line would be about 135 kilometres.

From the SA border, the transmission line would run parallel to Renmark Road for about 37 kilometres. The transmission line would be located on the north of Renmark Road from the NSW border to the point at which it crosses over Nulla Road.

East of Nulla Road, the alignment would travel in north east direction for about 10 kilometres, before heading in an easterly direction, crossing over the Darling Anabranch, Darling River, Silver City Highway and various other roads, before intersecting with the existing TransGrid 0X2 220kV transmission line. This section would extend for about 48 kilometres.

From this point, the alignment would turn southeast and be located parallel to the existing TransGrid 0X2 220kV transmission line to connect with the Buronga substation. This section of the alignment would consist of around 40 kilometres of parallel transmission line.

The final alignment of the transmission line within the transmission line corridor would be confirmed during detailed design with a view to further minimising environmental impacts, wherever practicable. An overview of the proposed transmission line from the SA/NSW border to the Buronga substation is shown in Figure 5-2a to Figure 5-2c.

Figure 5-2a

Proposed transmission line corridor

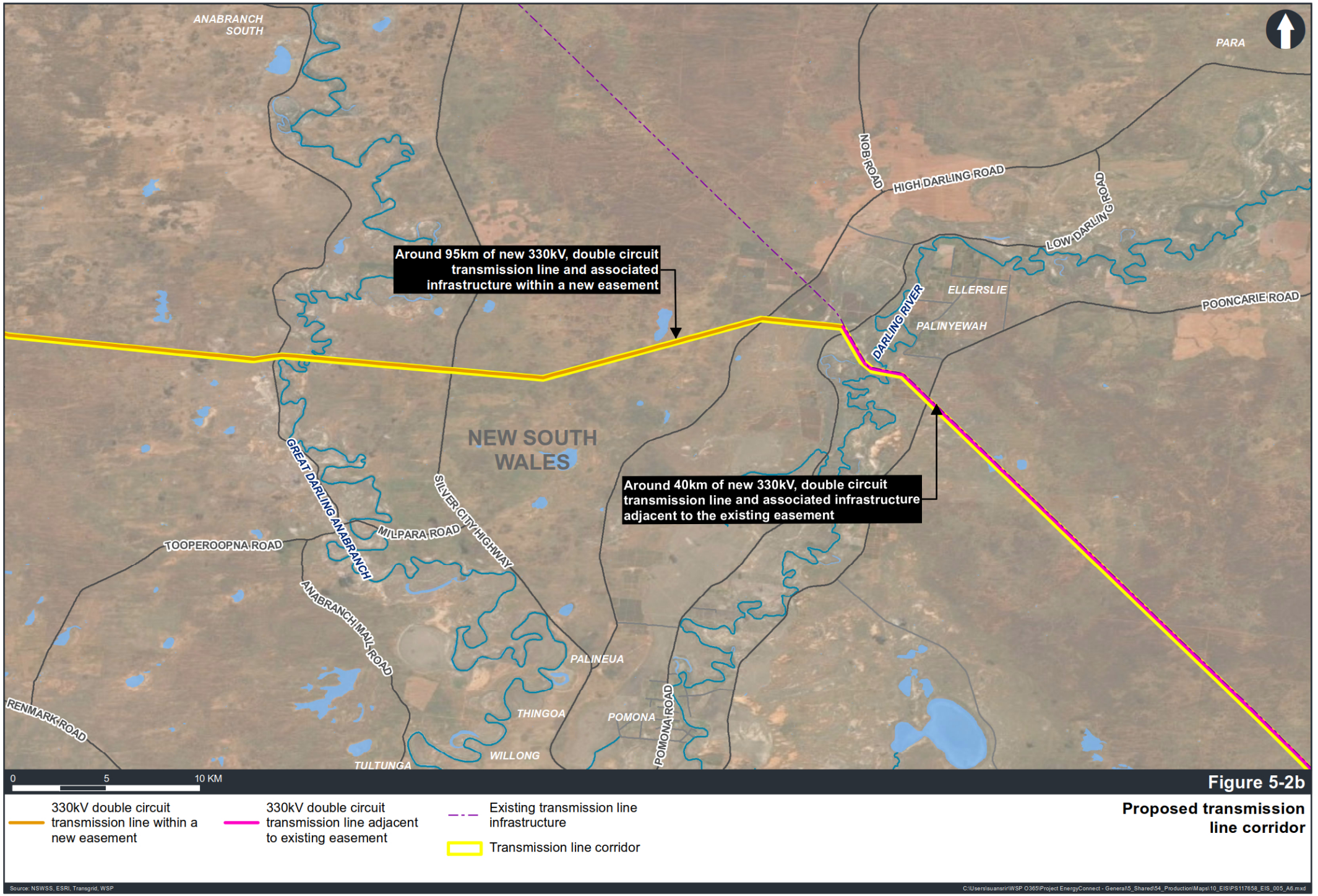

Figure 5-2b

Proposed transmission line corridor

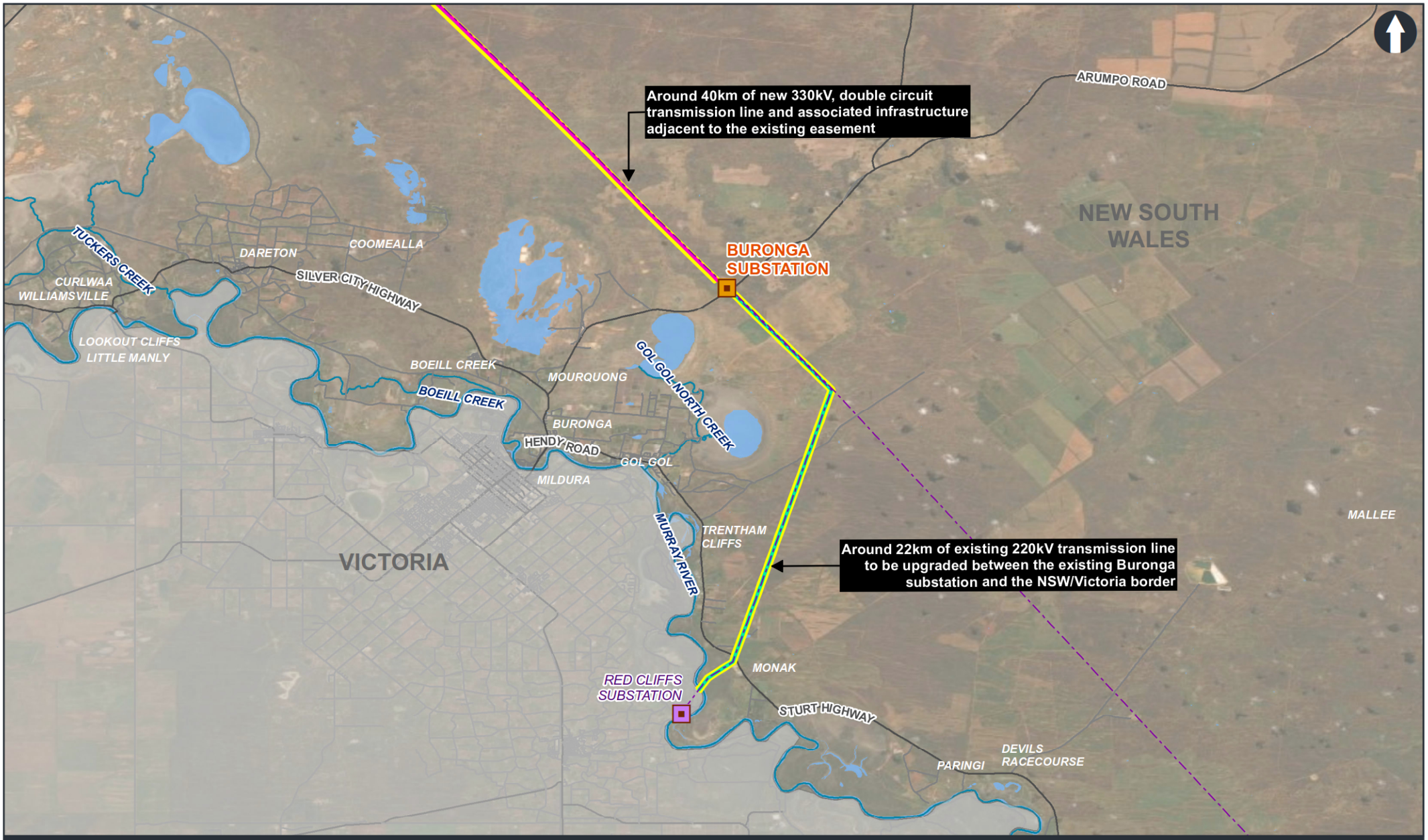

Figure 5-2c

Proposed transmission line corridor

Transmission line structures

The transmission line would be supported on a series of transmission line towers. These would be typically spaced between 450 and 600 metres apart, however shorter distances may be required in limited circumstances. The number and exact type of towers required would be confirmed during detailed design.

The tower types for this section would consist of:

- suspension towers, comprised of:
  - a guyed steel tower – consisting of a thinner tower design with guy wires and ground anchors attached to provide stability. Typical height between around 50 and 70 metres.
  - a free standing tower – which typically has a wider base but does not require other supporting infrastructure. Typical height between around 40 and 60 metres
- strain towers – which consist of a wider base and are self supporting. This type of structure is used for the first and last structure of the transmission line, at road or river crossings, and where there is a change in direction. This type of structure can also be used for structural reasons to break up long runs of suspension towers.

Depending on local circumstances, the tower heights for both forms of towers could be up to 80 metres (refer to Figure 5-3).

The final location and specification of each tower would be dependent on a range of factors such as distance between each tower, local geotechnical conditions, local environmental constraints (for example the need to avoid specific areas of biodiversity). The type and arrangement of the towers would be refined during detailed design.

For simplicity, all structures along this corridor are referred to as transmission line structures within this EIS.

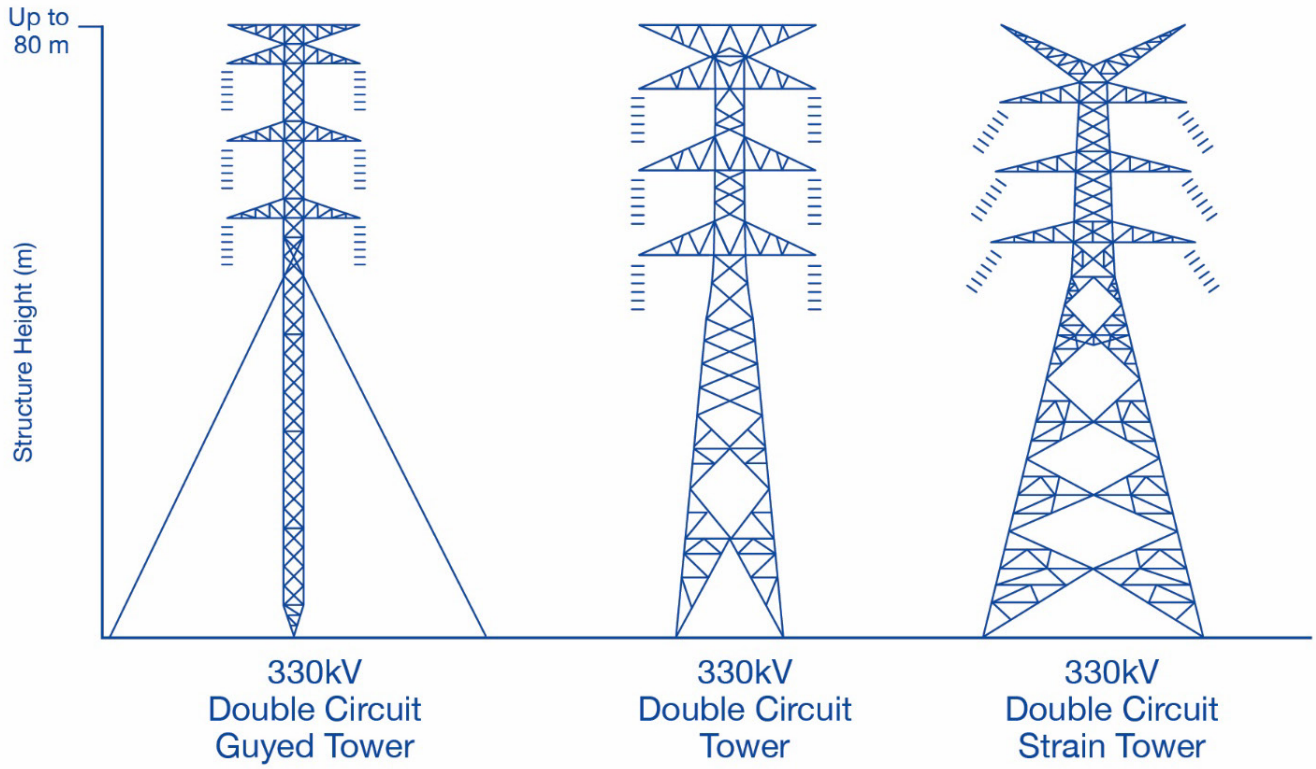

Figure not to scale. Typical widths only, may vary on a case by case basis.

Figure 5-3 Proposed concept design for the transmission line towers on the 330kV line

Transmission line access

Land access protocols would be established with each landholder during the acquisition of property or easement interests including access requirements where necessary. Access to the proposed easement for construction and operational purposes would preferentially use existing public and private roads and tracks although some new access may be required to provide appropriate access to construction areas and may be retained for operational purposes in limited circumstances.

Realignment of the existing 220kV transmission line

A short section of the existing Broken Hill to Buronga 220kV transmission line (Line 0X2) in proximity to the Darling River would be realigned to accommodate the new 330kV transmission line (refer to Figure 5-4). This would be for around 700 metres in length and require two new monopole structures to replace one existing tower structure. The new monopoles would be around 41 metres in height. The redundant tower would be decommissioned and removed from the easement.

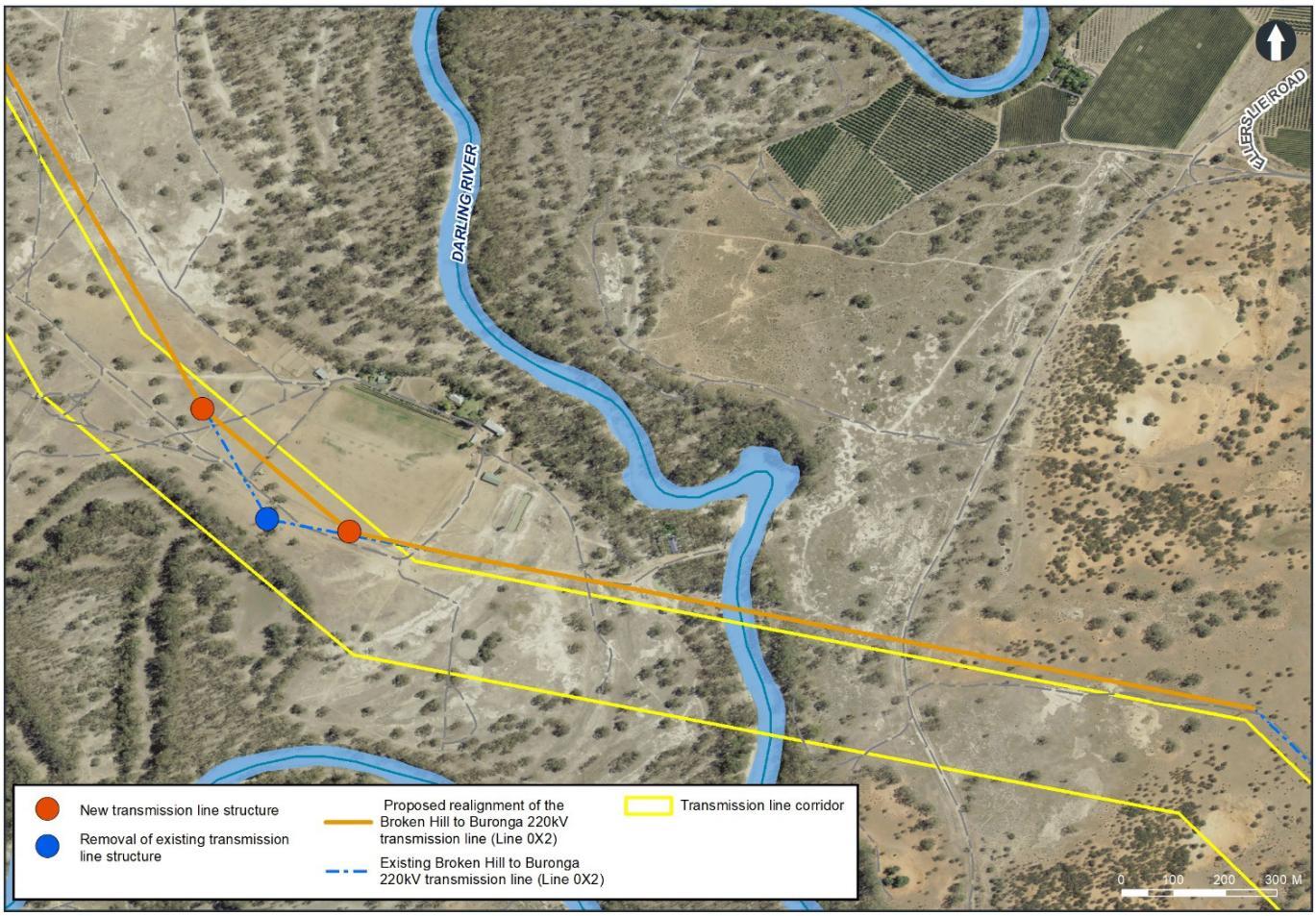

Figure 5-4 Proposed realignment of the Broken Hill to Buronga 220kV transmission line (Line 0X2)

5.3.2 Transmission line between Buronga substation and NSW/Victoria border

This component of the proposal comprises the upgrade of the existing TransGrid 220kV single circuit transmission line between Buronga substation and the NSW/Victoria border (known as Line 0X1) to a 220kV double circuit transmission line.

From the Buronga substation, the new transmission line would run parallel to the existing 'Line X5/3' 220kV transmission line for around 6.5 kilometres. It would then turn generally south west running parallel to the existing Line 0X1 for a further 16 kilometres before reaching the NSW/Victoria border, near Monak, at the Murray River (which comprises the end of the NSW proposal component). The current design runs parallel to the eastern side of the existing line.

The final alignment of the transmission line along this section would be determined during detailed design with consideration of limitations relating to working safely near the existing line and further minimising environmental impacts, wherever practicable.

An overview of the proposed transmission line from the Buronga substation to the NSW/Victoria border at Monak is shown in Figure 5-2c.

Transmission line structures

The transmission line would be supported on a series of transmission line towers or poles. These would be typically spaced about 400 metres apart however shorter distances may be required in limited circumstances. The final number and type of structures required would be determined during detailed design.

The transmission line structure type for this section would consist of:

- suspension structures, consisting of
  - a pole structure
  - a self-supporting tower
- strain poles. This type of structure is used for the first and last structure of the transmission line, at road or river crossings, and where there is a change in direction. This type of structure is also used for structural reasons to break up long runs of suspension structures. Two pole structures may be required at some locations.

The structures (regardless of design) would be between around 30 and up to 50 metres in height depending on local circumstances such as topography etc (refer to Figure 5-5). The final location and height, depending on a range of factors such as distance between each structure, local ground and topography conditions and the need to minimise environmental and land use impacts. The type and arrangement of the structures would be refined during detailed design.

For simplicity, all structures along this corridor are referred to as transmission line structures within this EIS.

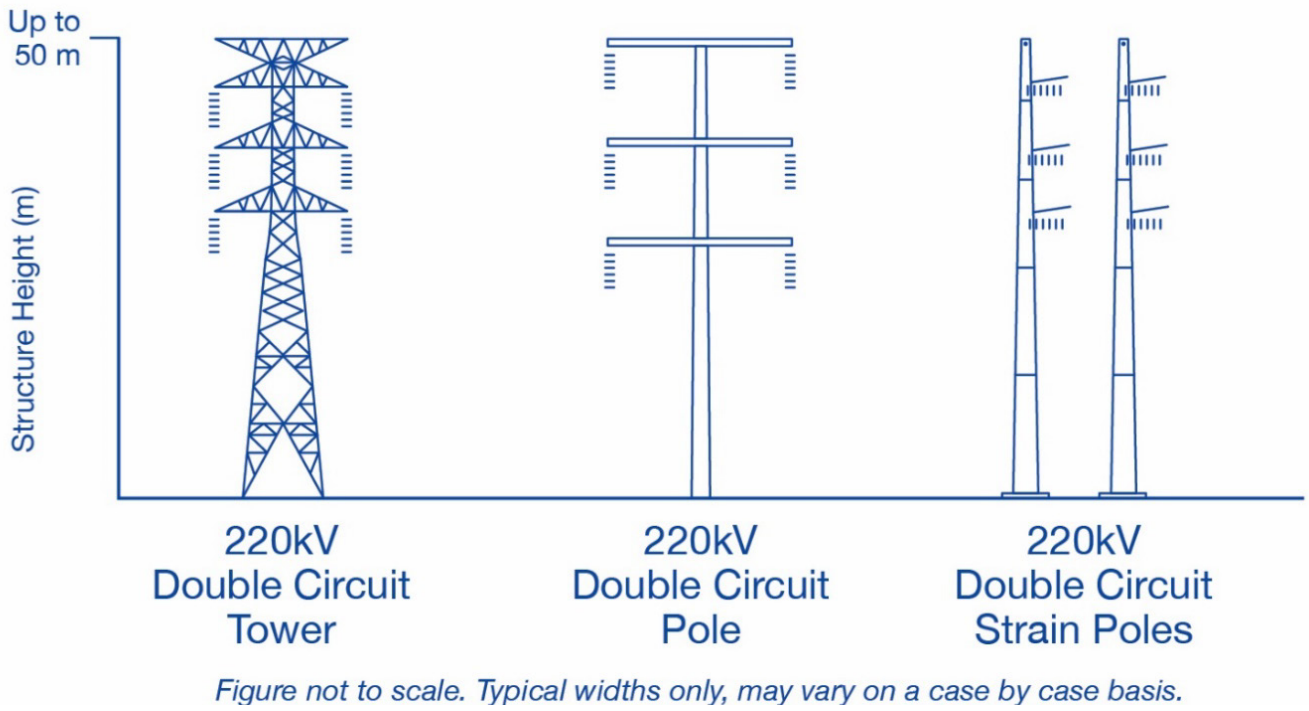

Figure 5-5 Proposed concept design for the transmission line structures on the 220kV line

Transmission line access

Where possible, existing access track(s) associated with the existing single circuit 220kV transmission line would be utilised to access the upgraded double circuit 220kV line. Should it not be feasible to retain the existing access track(s) due to the final location of the new double circuit transmission line, the access track used for construction of the transmission line may be retained for access during operation.

Decommissioning of the existing transmission line

Once the new double circuit 220kV line is operational, the existing 220kV single circuit transmission line (Line 0X1), including all existing towers, fittings and conductors, would be decommissioned and removed from the easement.

5.3.3 Upgrade and expansion of Buronga substation

Built form and layout

The proposal would include a significant upgrade and expansion of the existing Buronga 220kV substation to a combined operating voltage of 220kV/330kV, which would continue to service existing 220kV connections to Broken Hill, Red Cliffs and Balranald while also servicing the new 330kV connections to SA and eastwards towards Wagga Wagga. This would require the construction of a new 330kV component for the substation (the expanded substation site). The new 330kV component would be connected to the north western side of the existing 220kV substation site (refer to Figure 5-6). The maximum additional area required for the upgrade and expansion of the Buronga substation would be around 530 metres by 630 metres (a total additional area of around approximately 33.5 hectares). The final area required would be confirmed during detailed design.

The expanded substation site consists of three main areas:

- new 220kV switchyard – to enable connection and operation of the upgraded 220kV transmission line to Red Cliffs substation
- northern expansion area – to enable connection and operation of the new transmission line between Buronga substation and the SA/NSW border (the 330kV transmission line described in section 5.3.1)
- southern expansion area – to enable connection and operation of the new transmission line between Buronga substation and Wagga Wagga and transformation to 220kV.

The typical infrastructure and equipment that would be installed within the expanded substation site would include:

- up to five new phase shifting transformers
- a range of supporting 330kV and 220kV electrical components including overhead conductors busbars and gantries
- new 220kV and 330kV circuit breaker equipment
- shunt reactors
- two 50 mega volt ampere (MVA) capacitor banks
- three 200MVA 330kV/220kV/11kV transformer units (within the southern expansion area)
- two 100 megavar (MVAr) synchronous condensers.

Other key features of the expanded substation would include:

- construction of up to two secondary system control buildings to accommodate protection for new switchgear and fixed portions of secondary system (such as fire protection, security system, air conditioning etc.) and 125V direct current (DC) and 50V DC battery system
- control and protection systems (including relays, metering, disturbance recorder, etc.)
- 125V DC and 400V DC electrical distribution system
- lightning mast(s)
- oil containment system (including bunding and containment tank)
- new or upgraded communications network infrastructure including:
  - optical ground wire to be established within the substation
  - provision of a microwave link
  - two optical multiplexer network systems.

The maximum height of the new equipment would be around 65 metres.

Minor connection works between the existing substation and the expanded substation may also be required. These connections would be expected to occur within the operating footprint of the existing substation.

All key substation equipment (such as the transmission gantries, transformers, etc.) within the expanded substation site would be fixed to either a driven steel pile or reinforced concrete footing. The new transformers within the expanded substation site would be bunded and incorporate a flame trap and drainage point in the event of an emergency. The hardstand areas of the expanded substation site would be designed to drain to a reinforced concrete spill oil containment tank.

Figure 5-6 to Figure 5-8 show the layout and elevations of the proposed new substation infrastructure, which are indicative only and would be subject to detailed design.

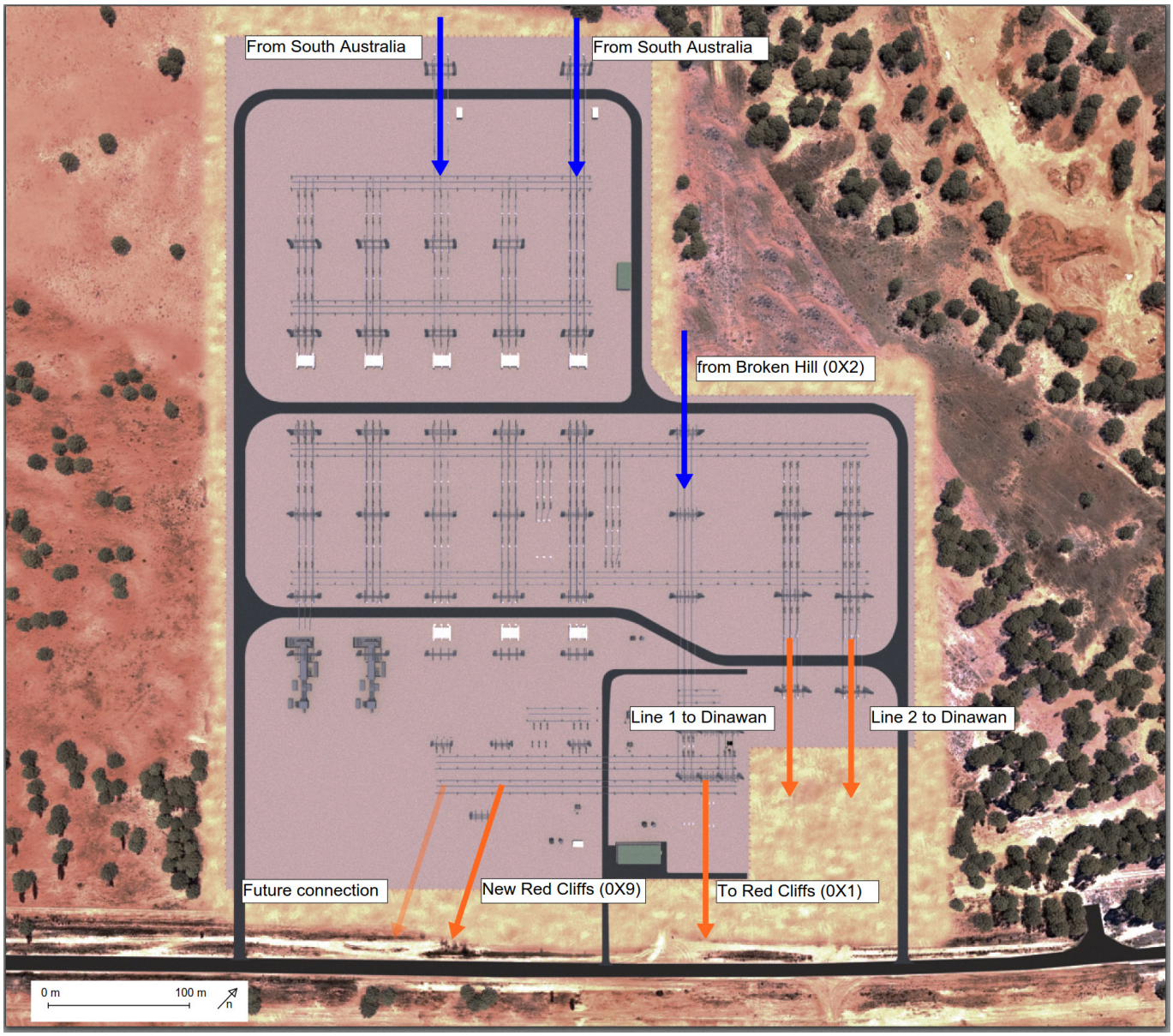

Figure 5-6 Arrangement of the proposed substation layout (indicative)

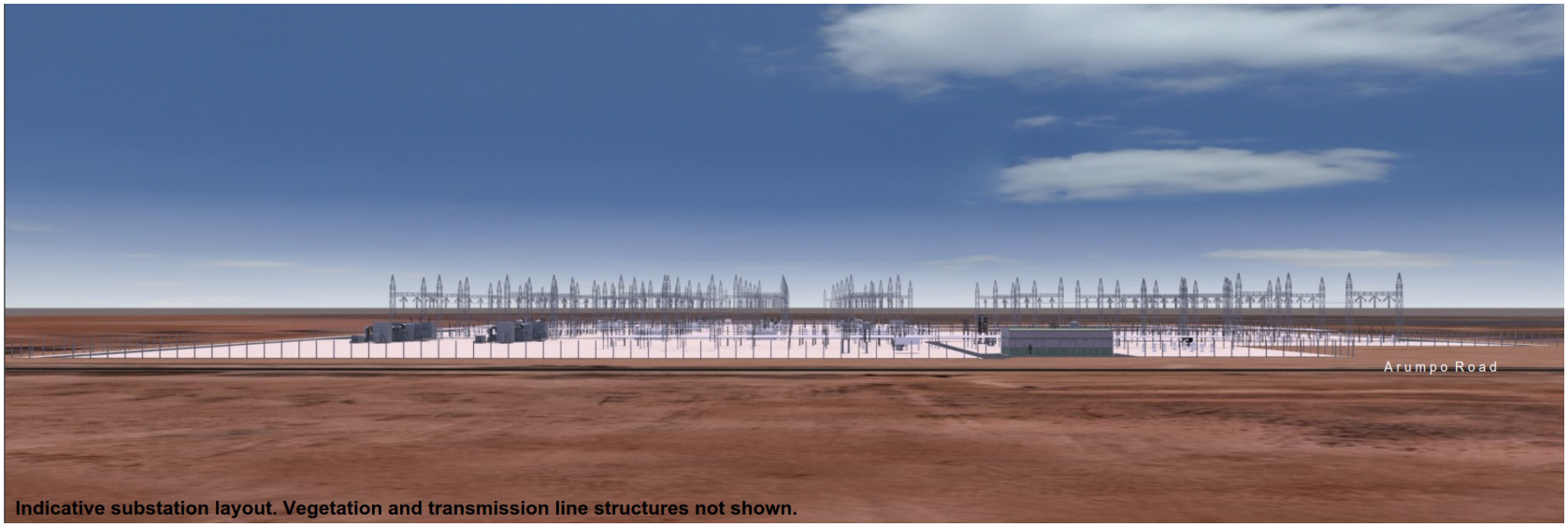

Figure 5-7 Indicative elevation of the proposed substation, facing Arumpo Road (south-east elevation)

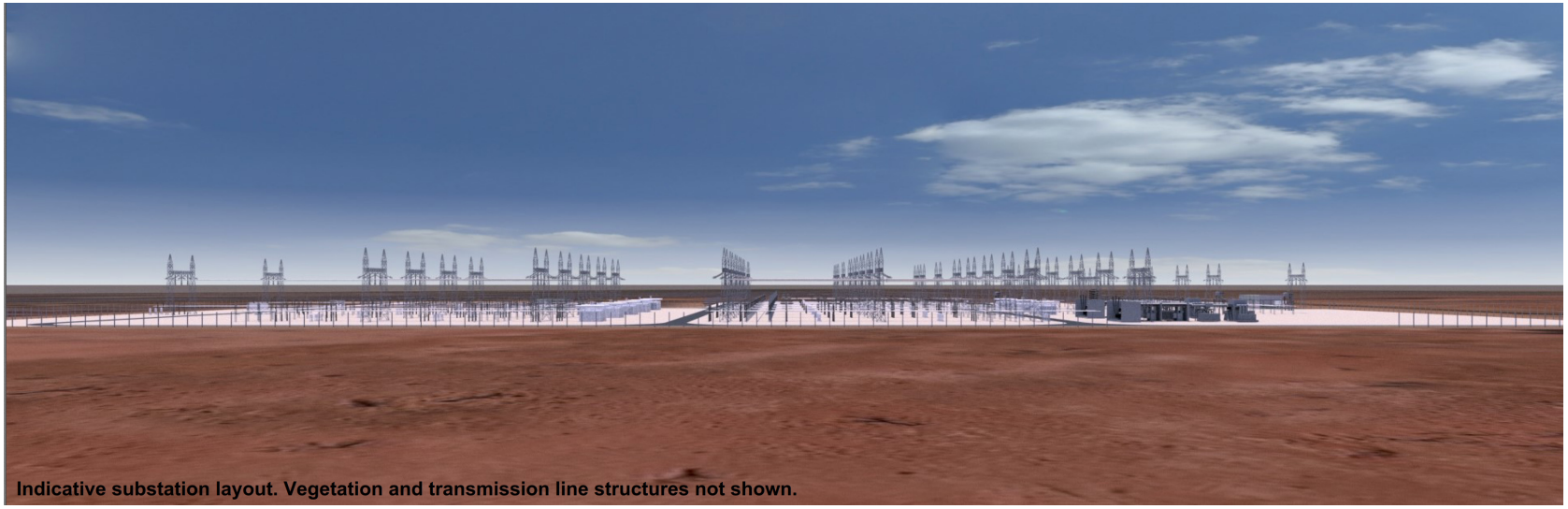

Figure 5-8 Indicative elevation of the proposed substation, with Arumpo Road located to the left of the image (south-west elevation)

Safety and security

Three metre high security fencing would be installed on all sides of the switchyard and would be compliant with current TransGrid standards for substation fencing. The security fence would be comprised of a galvanised steel (or similar) material. Two motorised sliding gates would also be installed to provide an overall opening of around seven metres at the main entrance point to the site.

To comply with TransGrid's safety requirements, additional security measures which would be incorporated across and around the substation site. This would include:

- security cameras within the substation upgrade and expansion site
- safety and public information signage on both the substation and incoming and outgoing transmission line towers connections to ensure public safety
- an asset protection zone (APZ) – consisting of an area maintained to be cleared of all trees and vegetation which may affect the substation during a bushfire in accordance with TransGrid design and safety standards.

Lighting

Operational lighting would be required for the operation of the substation for site security and for the safety of operational personnel operating and maintaining the substation equipment. Operation of the substation lighting would be from dusk until dawn, seven days a week. The external lighting would be installed to maintain an even distribution across the site, typically located on poles around four metres in height. The final lighting design would minimise light spill to areas beyond the substation boundary including potential impacts on passing traffic along Arumpo Road and local fauna.

Access and parking

The existing entry point from Arumpo Road would be maintained for external access to the existing 220kV substation. Two new entry and exit roads would be provided to provide vehicular access from Arumpo Road to the expanded substation site. The access driveway would be designed to allow access for employees undertaking maintenance operations and would also be suitable to allow longer vehicles as required (such as equipment replacement). The new access points would also be designed to ensure that it meets relevant NSW road design and council guidelines, including required sight-lines along Arumpo Road.

Additional parking for a small number of heavy vehicle and maintenance crew vehicles would be provided within the site boundary near the new control room buildings. Additional parking bays would be used by occasional maintenance and operational crew visiting the site. An internal perimeter road would be constructed as shown in Figure 5-6.

Water supply

Water would be required for maintenance activities and the operation of the Buronga substation. This would require an additional 20,000 litres of water per year compared to the existing requirements and would be sourced from Wentworth Shire Council and rainwater tanks at the substation.

Stormwater and drainage

An on-site stormwater drainage system would be installed to capture and discharge stormwater collected from within the expanded substation site during operation.

Runoff from outside the expanded substation site would be intercepted and diverted around the site by new drainage infrastructure. The drains would be designed for rainfall corresponding to an annual exceedance probability (AEP) of around 0.02 exceedances per year (equivalent to around a one in 50-year average exceedance). The runoff would be diverted to natural watercourses using appropriate dispersion/dissipation structures or drainage systems.

Within the expanded substation site, the stormwater drainage system would be designed for a rainfall corresponding to an AEP of 0.11 per year (equivalent to around a one in 10-year average exceedance). This system would include a series of surface drains which would interconnect with a grid of stormwater pits within the expanded substation site.

The new substation would also be designed to have an impervious surface and an oil containment system would be installed (separate to the stormwater drainage collection system to prevent cross-contamination). The oil containment system would be designed in accordance with TransGrid's substation oil containment design procedure which defines TransGrid's approach to meeting the requirements of the *Protection of the Environment Operations Act 1997*.

Landscaping

Landscaping or visual screening of the substation site is not proposed.

5.4 Operation and maintenance

The expanded substation and transmission lines would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required).

Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment
- general building, asset protection zone and general landscaping maintenance
- fire detection system inspection and maintenance
- fence repair
- stormwater and drainage infrastructure maintenance.

5.4.1 Transmission line maintenance

Regular maintenance activities would be required for the transmission lines during its operation. Likely maintenance activities would include:

- regular inspection and maintenance of transmission lines, towers and poles including:
  - an annual fly over as part of seasonal bushfire prevention surveys
  - routine infrastructure inspection on a six-yearly cycle for self-supporting towers and three-yearly cycle for guyed towers. This would typically involve two to three maintenance crew driving a light vehicle from public roads to the easement utilising access tracks, then along the easement inspecting each transmission line tower in turn. Towers would be inspected both from the ground and by personnel climbing the tower
  - routine / planned line maintenance using a light vehicle(s), an elevated work platform and a medium sized truck with up to around five to ten personnel to rectify any defects found from routine inspections. Generally, this would occur within the same three to six-year maintenance cycles as the routine infrastructure inspection
- ad hoc fault and emergency fly over(s) to assess infrastructure condition should an unplanned outage occur (for example through a weather event or other failure of infrastructure). This maintenance would occur as required. The amount of maintenance and/or crew required for repair of any damaged infrastructure would depend on the extent of repairs required
- vegetation removal required to maintain appropriate clearances between ground vegetation and transmission lines (refer to Figure 5-9 and Figure 5-10)
- vegetation below transmission lines would require ongoing maintenance throughout the operation to ensure electrical safety clearances and protection zones are maintained. The required clearance of vegetation within the corridor would be undertaken in accordance with TransGrid maintenance guides.

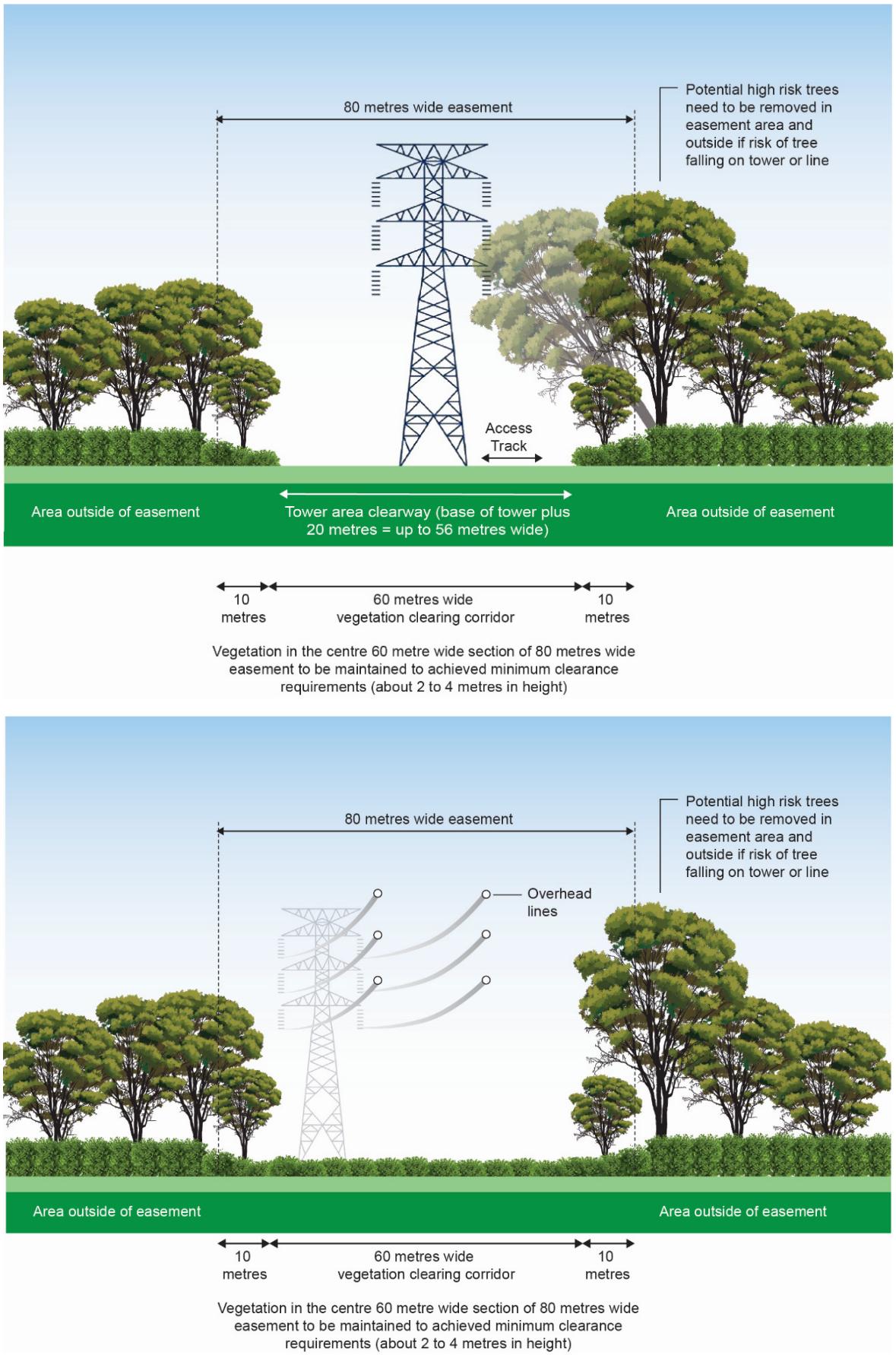

Figure 5-9 Elevation of the indicative proposed vegetation clearing requirements within the 330kV transmission line at tower locations (top) and mid easement between towers (bottom)

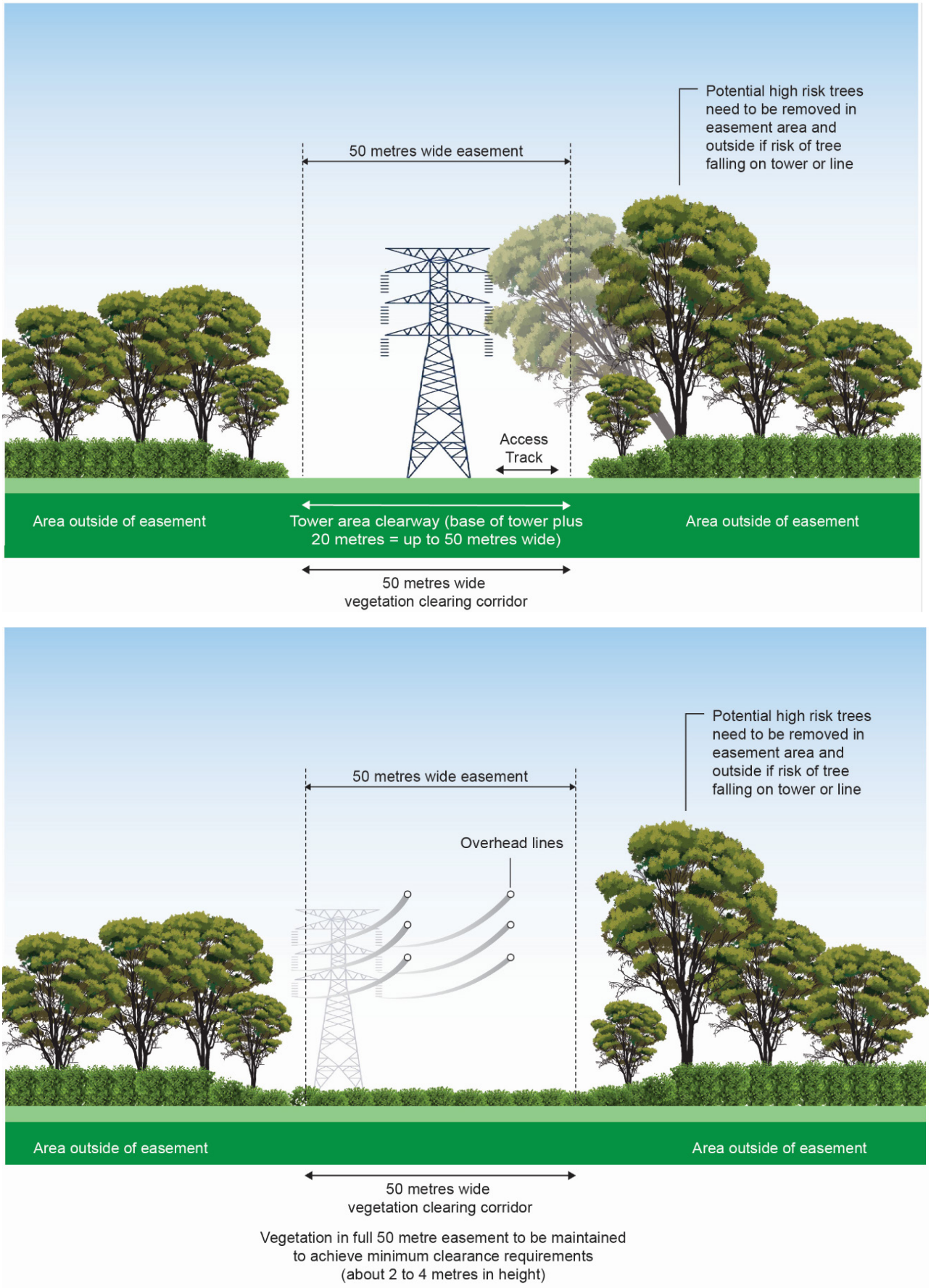

Figure 5-10 Elevation of the indicative proposed vegetation clearing requirements within the 220kV transmission line at tower locations (top) and mid easement between towers (bottom)

5.4.2 Buronga substation operation and maintenance

The substation would not accommodate full-time staff or contractors. Maintenance at the expanded substation site would typically include ad-hoc attendance (up to three times a week) of one or two switching operators to undertake planned and unplanned switching of equipment. It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the works required). Any waste generated during operation would be minimal and disposed of on an 'as need' basis by the attending maintenance personnel.

Additional maintenance activities at the expanded substation site would typically include:

- routine substation infrastructure inspection (such as transformers and other electrical plant and equipment) throughout the year by around two to three personnel
- routine / planned substation maintenance of equipment, property and switchyard areas on a scheduled basis. This would typically be monthly and undertaken by around three to five maintenance personnel
- ad hoc fault and emergency works for repair of any damaged infrastructure (for example through a weather event or other failure of infrastructure). This maintenance would occur as required. The amount of maintenance and/or crew required to access for repair of any damaged infrastructure would depend on the extent of repairs required.

Equipment for the substation is expected to have a service life of around 50 years. Maintenance would be regularly undertaken for the different infrastructure components and plant items such as transformers. These components would be replaced/refurbished towards the end of their serviceable life, allowing the service life of the substation to be extended.

5.5 Land acquisition, easements and operational access

5.5.1 Freehold land acquisition

The land required for the proposed substation upgrade and expansion (inclusive of asset protection zones) has been acquired adjacent to the existing Buronga substation and comprises of part of the following parcels:

- Lot 2 DP 1195524
- Lot 1 DP 1174934.

5.5.2 Easements

TransGrid is continuing to work with relevant landholders to create the new transmission line easements. Typical easement requirements for the proposal are further discussed in the following section.

All acquisitions of privately owned land would be carried out in consultation with the landholders through the private treaty process or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016.

The acquisition of Crown Land would be undertaken in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991, Crown Lands Management Act 2016* and the *Crown Land Legislation Amendment Act 2017.*

330kV transmission line easement between SA/NSW border and Buronga substation

The final alignment of the transmission line between the SA and NSW border and Buronga substation would be located within an easement up to 80 metres wide. This easement would provide a right of access to construct, maintain and operate the transmission line and other operational assets associated with the line (such as the transmission line structures and conductors). The easement would also ensure safe electrical clearances during the operation of the lines.

An adjusted easement would also be required for the realigned section of Broken Hill to Buronga 220kV transmission line near the Darling River. Sections of the previous easement no longer required would be returned to the landholder.

220kV transmission line easement between Buronga substation and NSW/Victoria border

The existing transmission line is located within a 50-metre-wide easement. The existing easement is expected to be widened by up to 25 metres to allow for the new transmission line to be positioned beside the existing line, resulting in an easement of 75 metres in width until the existing line is decommissioned and removed. Once the existing line has been removed, the easement would be reduced to 50 metres with part of the existing easement area returned to the landholder.

As with the existing easement, the new easement would continue to provide a right of access to construct, maintain and operate this section of the transmission line and other operational assets associated with the line (such as the transmission line towers and conductors). The easement would also ensure safe electrical clearances during the operation of the lines.

For the section of transmission line that would run parallel to the existing 0X5/3 and 0X1 transmission lines, this easement would be widened to the south of the existing easement. Where the transmission line diverges towards the NSW/Victoria, it is anticipated that the easement would be widened to the east of the existing easement for the existing 0X1 line. The final easement for the transmission line along this section would be determined during detailed design.

5.5.3 Operational access requirements

Access to the proposed easement for operational purposes would preferentially use existing public and private roads and tracks, although access tracks created for construction may be retained during operation of the proposal to provide safe access (refer to Section 6.6.3). Access easements may be required to provide TransGrid with access from the nearest public road to the easement. These access easements would be negotiated with landholders as necessary. TransGrid may install locked and signed access gates to enable access to the easement should a landholder not have a suitable existing gate nearby.

6. Proposal construction

This chapter describes the likely key construction works for the proposal and describes the indicative construction staging, strategy and program.

The construction approach and methodology presented in this chapter is indicative and would continue to be refined as the design and construction planning progresses. A final construction methodology and program would be developed by the nominated construction contractor. This would be reviewed for consistency with the assessment contained in this EIS, including relevant mitigation measures and any future conditions of approval.

Any material changes to the construction methodology which could result in additional environmental impacts to those assessed in this EIS would be the subject of additional environmental assessment or consistency review, as relevant.

6.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to the description of the proposal and where these requirements are addressed in this EIS are outlined in Table 6-1.

Table 6-1 Secretary's environmental assessment requirements – Proposal construction

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include:	
	> a full description of the project, accompanied by suitable maps and plans, including the:	This chapter provides a description of the construction activities and sites associated with the proposal and is supported by figures. A description of operational component of the proposal is provided in Chapter 5 (Proposal infrastructure and operation).
	– disturbance area	The disturbance area is described in Section 6.5.
	– physical layout of the project over time, including sections of key components	Refer to Section 6.6.5 with respect to the Buronga substation upgrade and expansion. Figure 6-4a to Figure 6-4c) provides the location of the proposal and key supporting main construction sites and accommodation camps.
	– key uses and activities to be carried out on site; -	This chapter provides a description of the key uses and activities to be carried out during construction. A description of operational activities is provided in Chapter 5 (Proposal infrastructure and operation).

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
	– likely timing of the project including any stages, the key phases within each stage (site preparation, construction, commissioning, operation, decommissioning and rehabilitation) and the sequencing of these stages and phases;	This chapter provides the program and describes these phases of construction (refer to Section 6.3 to Section 6.6.7.

6.2 Construction overview

Key construction works for the proposal would typically include (but not be limited to):

- site establishment works and vegetation clearance (refer to Section 6.6.2)
- construction of access tracks (refer to Section 6.6.3)
- construction of the proposed transmission lines (refer to Section 6.6.4)
- construction of the Buronga substation upgrade and expansion (refer to Section 6.6.5)
- commissioning of the proposal (refer to Section 6.6.6)
- demobilisation and remediation of areas disturbed by construction activities (refer to Section 6.6.7)
- ancillary works to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps) (refer to Section 6.7).

An overview of the key construction features of proposal is provided in Figure 6-1.

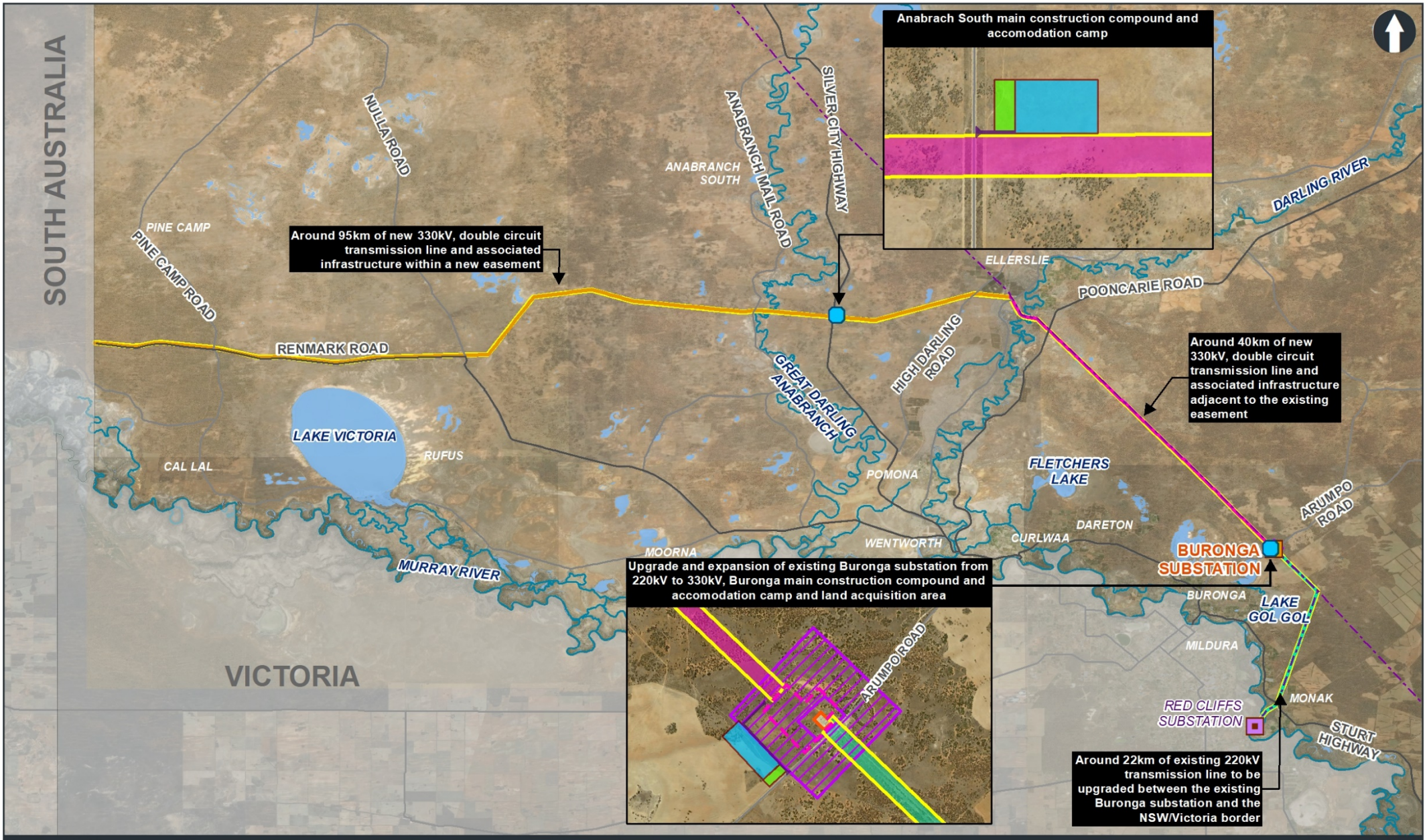

Figure 6-1

Key construction features

330kV double circuit transmission line within a new easement

330kV double circuit transmission line adjacent to existing easement

220kV transmission line upgrade adjacent to existing transmission line

Buronga substation

Red Cliffs substation (out of scope)

Main construction compound and accommodation camp

Access road (indicative)

Accommodation camp

Main construction compound

Transmission line corridor

Existing substation

Proposed substation upgrade and expansion area

Freehold land acquisition (substation)

Existing transmission line infrastructure

Source: NSWSS, ESRI, Transgrid, WSP

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6.3 Indicative construction program

Construction of the proposal would commence in mid-2021, subject to NSW Government and Commonwealth planning approvals.

The construction of the transmission lines would take approximately 18 months while the Buronga substation upgrade and expansion would be delivered in two components. The substation would be initially operational by the end of 2022, and fully operational by mid-2023.

Site decommissioning and remediation is expected to extend approximately one year beyond the commissioning (operational) phases, with estimated completion in mid-2024.

Figure 6-2 presents an indicative program for the proposal (following planning approval). The indicative staging strategy for construction is discussed in Section 6.4.

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration for each phase of construction as expressed in Figure 6-2.

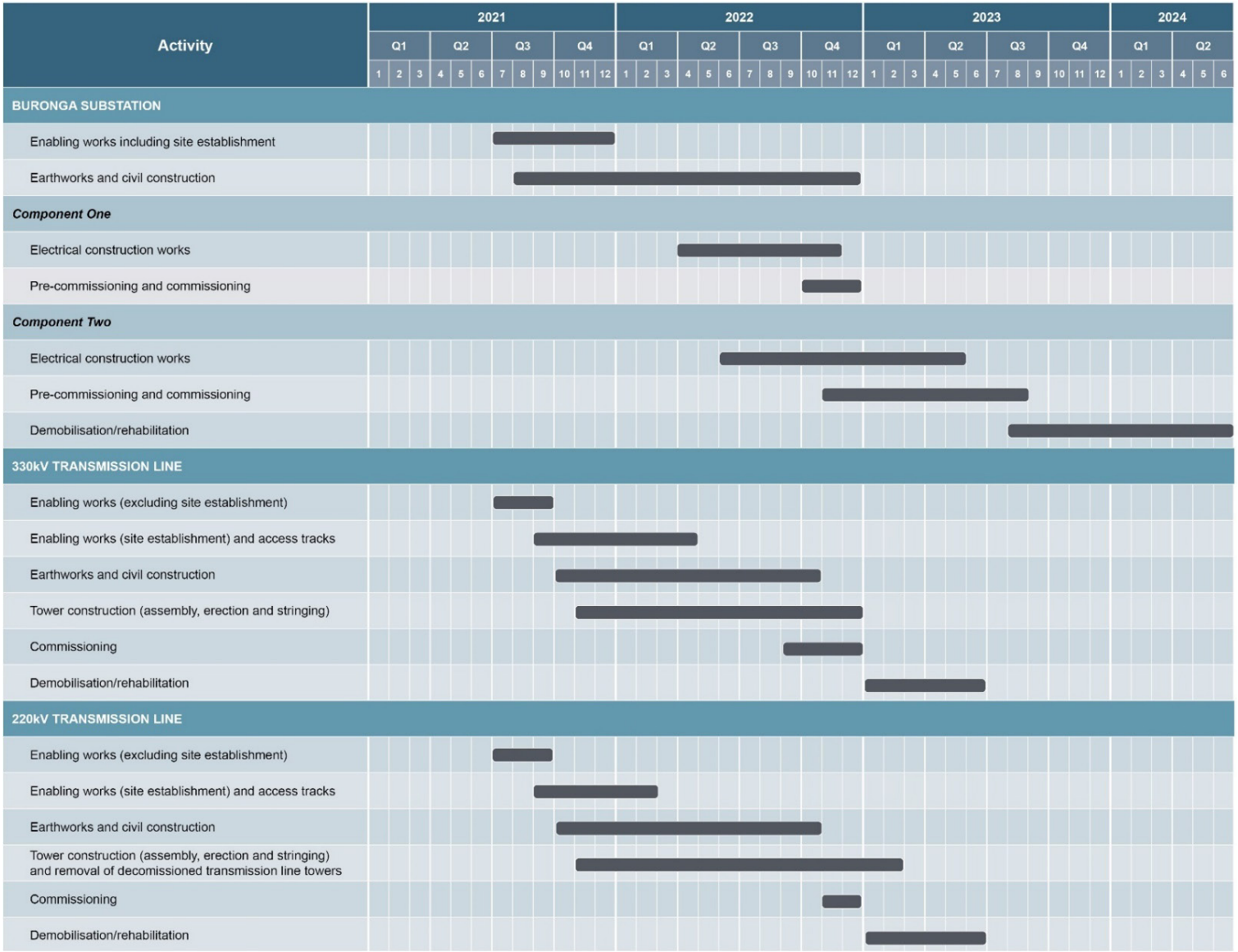

Figure 6-2 Indicative construction program

Figure 6-3 presents an indicative duration of construction activities associated with the transmission line structures. These durations could vary, and breaks between activities may be shorter which may lead to longer inactive periods in subsequent stages of construction at an individual transmission line structure. Durations of any particular construction activity, and respite periods, can vary for a number of reasons including (but not limited to), resource and engineering constraints, works sequencing and location.

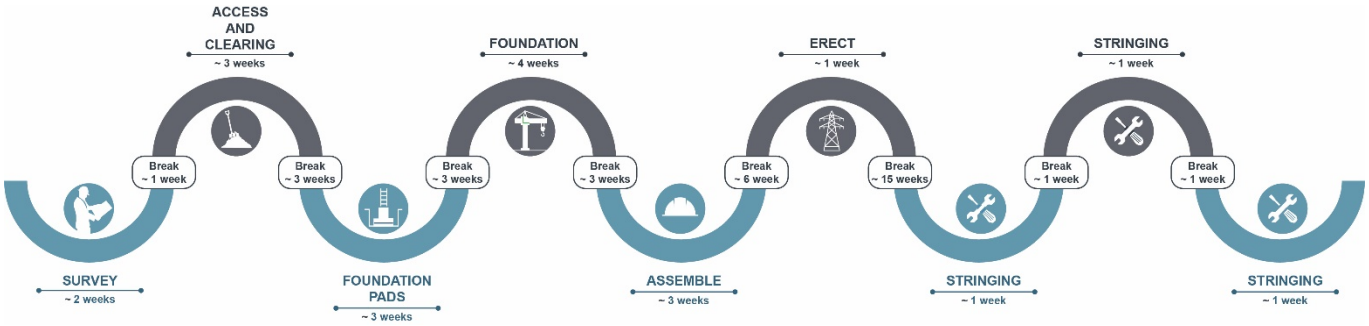

Figure 6-3 Indicative duration of construction activities at transmission line structures

6.4 Construction staging

The construction of the proposal is expected to require staging of certain elements. Staging is proposed to enable the commencement of some activities, such as enabling works or low impact activities, in advance of the final design and construction methodology being finalised by the construction contractor. Construction environmental management documentation required for each stage of works would be prepared and implemented.

It is expected that the proposal would be staged as follows:

> enabling works as follows
  - site establishment and operation of the main construction compound and camp sites at Anabranch South and Buronga
  - site establishment and bulk earthworks at the Buronga substation upgrade and expansion site
  - biodiversity and heritage investigations
  - any other activities described in Section 6.6.1 that are of low impact (refer to Section 23.1).

> all other works, such as:
  - establishment of access tracks and construction sites not identified as enabling works
  - construction and commissioning of the new or upgraded transmission lines, including site establishment, vegetation clearance, civil construction works, tower erection and conductor stringing
  - decommissioning of redundant 220kV transmission line structures
  - construction and commissioning of the Buronga substation upgrade and expansion (excluding activities identified as enabling works). This would be delivered as two components:
    - component 1 – upgrade and expansion work required to enable the proposed connection and operation of the transmission lines between SA/NSW border and Buronga substation, and Buronga substation and the NSW/Victorian border
    - component 2 – upgrade and expansion work required to facilitate the future connection and operation of the proposed transmission lines between Buronga substation and Wagga Wagga substation.

The final staging arrangement would be confirmed during detailed design.

6.5 Disturbance area

The disturbance area for the proposal would encompass all construction activities and components of the proposal (including access tracks). The permanent works footprint and easements would be within the disturbance area.

For the transmission line component of the proposal, the disturbance area would encompass all disturbance required for the construction of the transmission line and any ancillary infrastructure. This disturbance area would be largely located within the transmission line corridor, with the exception of some access tracks. In these instances, access tracks would be located within the proposal study area.

The proposal study area and transmission line corridor is shown in Figure 6-4a to Figure 6-4c, as well as the disturbance area for the Buronga substation upgrade and expansion and the two main construction compounds and accommodation camps at Anabranch South and Buronga. The final disturbance area would be confirmed during detailed design with consideration to the mitigation measures established for the proposal.

For the purposes of this EIS and as discussed further in Chapter 8 (Approach to impact assessment):

- the majority of the impact assessments have assumed disturbance across the transmission line corridor, and the areas required for Buronga substation upgrade and expansion, the main construction compounds and accommodation camps at Anabranch South and Buronga
- for biodiversity and heritage assessments, an indicative disturbance area for the transmission line component (and ancillary construction works) has been assumed.

There may also be the requirement for an additional main construction compound and accommodation camp site beyond those identified in the Figure 6-3, as well as refinements to the location of the Anabranch South main construction compound and accommodation camp site. These sites may be outside the proposal study area and the selection criteria for these possible refinements are is discussed further in Section 6.7.1.

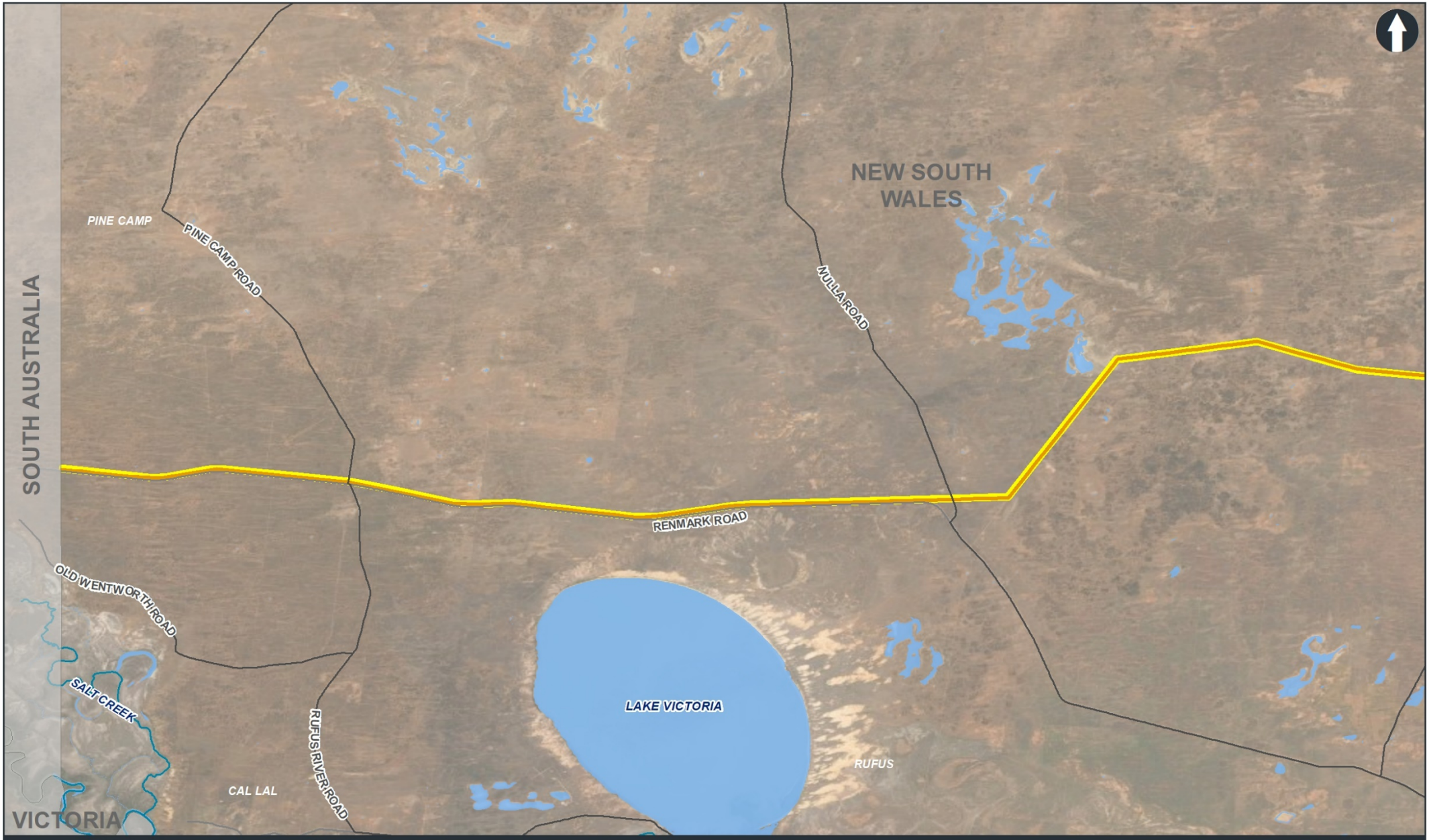

Figure 6-4a

Construction overview

330kV double circuit transmission line within a new easement

Transmission line corridor

Source: NSWSS, ESRI, Transgrid, WSP

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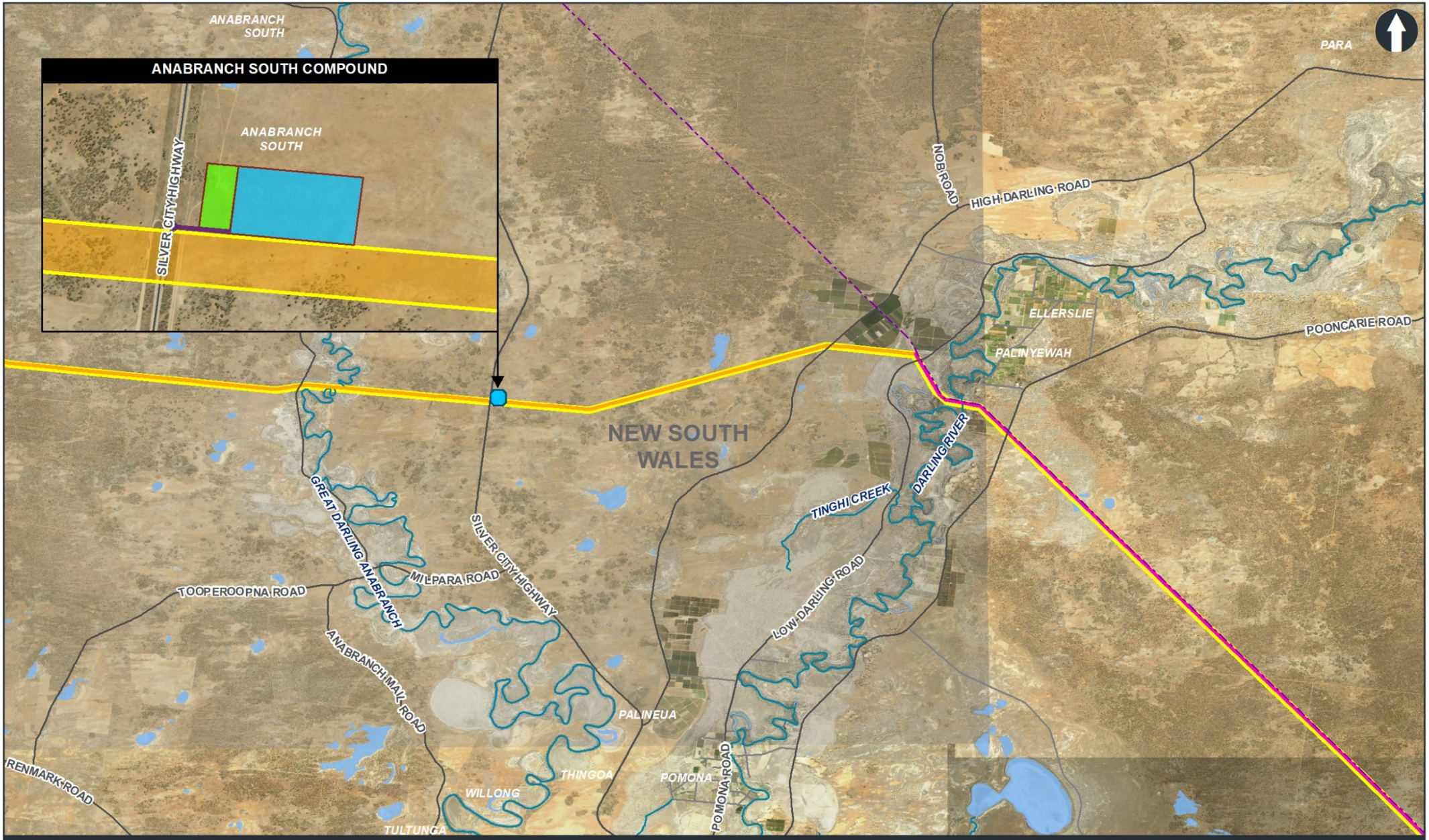
ANABRANCH SOUTH COMPOUND
ANABRANCH SOUTH
SILVER CITY HIGHWAY
ANABRANCH SOUTH
PARA
NOB ROAD
HIGH DARLING ROAD
ELLERSLIE
PALINYEWAH
POONCARIE ROAD
NEW SOUTH WALES
DARLING RIVER
TINGHI CREEK
GREAT DARLING ANABRANCH
SILVER CITY HIGHWAY
MILPARA ROAD
TOOPEROOPNA ROAD
LOW DARLING ROAD
ANABRANCH MAIL ROAD
PALINEUA
RENMARK ROAD
THINGOA
POMONA
POMONA ROAD
WILLONG
TULTUNGA
0
5
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Figure 6-4b
Construction overview
Transmission line corridor
330kV double circuit transmission line within a new easement
330kV double circuit transmission line adjacent to existing easement
Existing transmission line infrastructure
Main construction compound and accommodation camp
Access road (indicative)
Accommodation camp
Main construction compound
Source: NSWSS, ESRI, Transgrid, WSP
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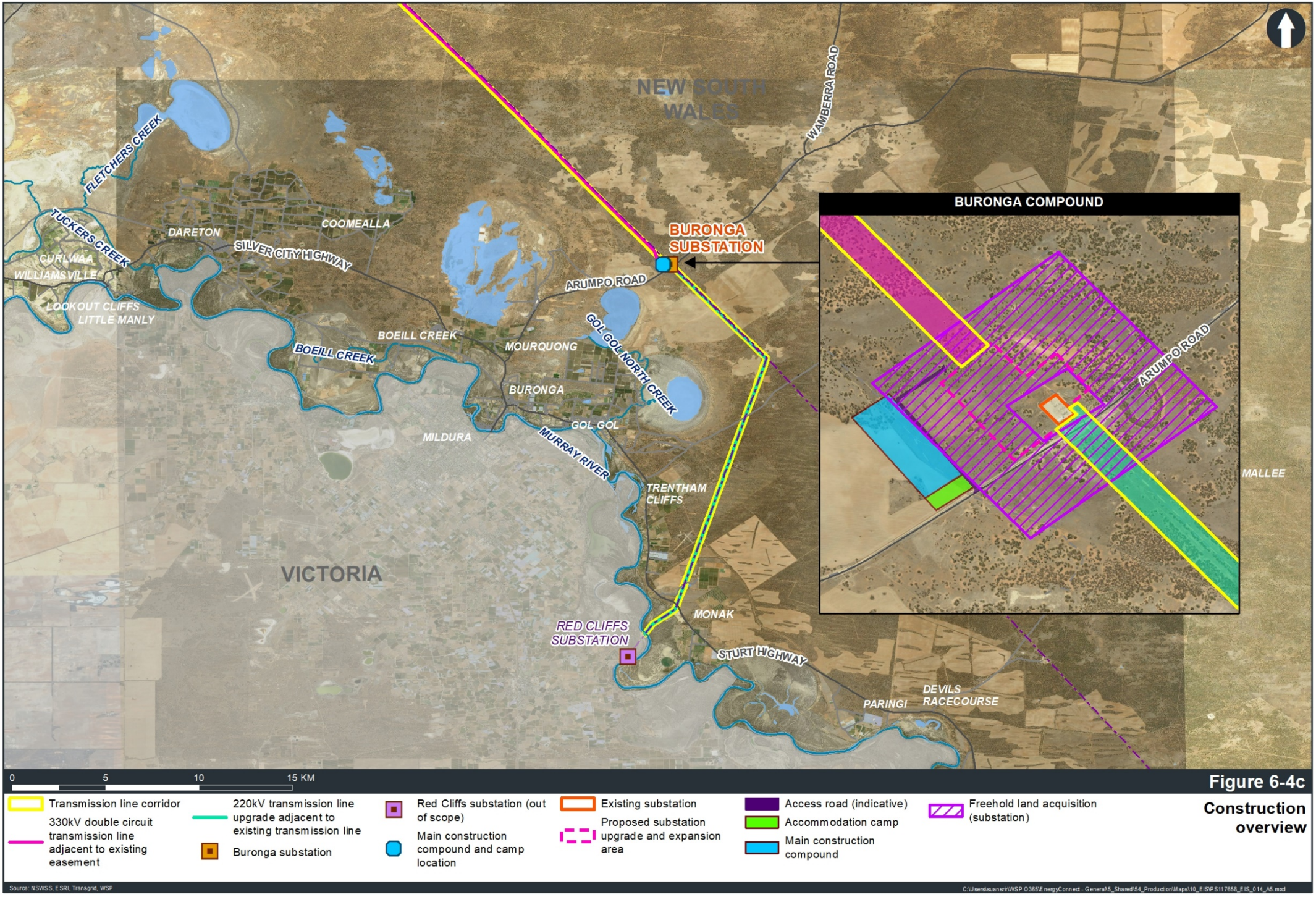


Figure 6-4c

Construction overview

6.6 Construction methodology

6.6.1 Enabling works

Enabling works are activities that would typically be carried out before the start of substantial construction in order to make ready the key construction sites and to manage specific features or issues of the proposal.

Enabling works are expected to include:

- site establishment and operation of the main construction compound and camp sites at Anabranch South and Buronga (refer to Section 6.7.1)
- site establishment and bulk earthworks at the Buronga substation upgrade and expansion site (refer to Section 6.6.5)
- biodiversity and heritage investigations, including protection, salvage and recordings
- utility adjustments and protection (refer to Section 6.6.2)
- property adjustment work, including adjustments to property fencing (Section 6.6.2)
- access tracks (refer to Section 6.6.3) including adjustment to regional and state roads at main construction compound and accommodation camp locations
- additional geotechnical and contamination investigations and remediation if identified as required
- other survey work, such as road dilapidation surveys, and surveys of the general alignment and existing utilities.

These works are described further in the relevant sections of this chapter.

Some of these work are proposed to take place prior to the approval of the main works construction environmental management plan (refer to Section 6.4).

6.6.2 Site establishment

At the commencement of construction, the main activities which would be undertaken would include:

- clearing and removal of top soils and vegetation. Top soil would be stockpiled on site
- establishing construction compounds, batching plants, camp sites and ancillary facilities, including offices, amenities, workshops and internal roads
- connections to utilities (water and power) to main construction compounds and camp sites, where possible
- establishing vehicle access and egress points including adjustment of state and regional roads to ensure safe vehicle movements at relevant locations such as accommodation camps
- establishing truck wheel wash or rumble grids
- establishing hardstand areas for storage, laydown and carparking
- establishing fencing around the perimeter of the construction area, where required
- installing temporary fencing and security measures as well as any necessary construction environmental management measures such as erosion and sediment controls

Further discussion on some components of site establishment are discussed below.

Vegetation clearance

In general, vegetation within the construction disturbance area (including scrub, undergrowth and ground vegetation) would be removed. Where logs and tree hollows that could provide fauna habitat are identified, these would be relocated to adjacent woodland where feasible.

The exception would be along the transmission line corridor. For this area, the disturbance area and vegetation clearance requirements would be confirmed during detailed design and would be informed by:

- future operational requirements (refer to Figure 5-9 and Figure 5-10) as set by *Vegetation Clearance Requirements at Maximum Line Operating Conditions* (TransGrid, 2003) (the Vegetation Clearance Requirements)
- clearing around each transmission tower construction pad of around 60 metres by 80 metres to provide clear access to the tower during construction
- clearing for access tracks and ancillary construction activities.

Gates and fences

Installation or adjustment of gates and fences would be required at some locations along the alignment to enable access from the nearest roadway to construction areas. These would be constructed in consultation with the relevant council and/or affected landholder.

Where the transmission line crosses or closely runs parallels to a metallic fence, an earthing or isolation section would be installed.

Service relocations and/or protection works

The existing alignment of the 0X2 220kV Broken Hill transmission line would require relocation at two locations. This would comprise of:

- a permanent relocation of the existing transmission line in the vicinity of the Darling River (refer to Section 5.3.1). This would require the construction of two new monopoles, and the stringing of conductors/earthwires between the existing and new structures. The redundant tower would be decommissioned
- a temporary relocation of a section of the existing transmission line that currently passes through the existing Buronga substation. This would be temporarily relocated around 200 metres to the east of its current alignment (along the eastern boundary of the existing substation site). Once the construction works to upgrade the substation are completed, the alignment of the 220kV Broken Hill line would be restored in a location generally consistent with the original line location.

Based on known utility information, works would also be required to convert overhead distribution powerlines up to and including 66kV to underground cables for the entire width of the transmission line easement.

Potential impacts to other existing services and utilities would be confirmed during detailed design and any proposed relocation and/or protection works would be determined in consultation with the relevant asset owners.

6.6.3 Establishment of access tracks

The establishment of access tracks would include:

- construction of access tracks to accommodate safe access of construction machinery and materials to each transmission line tower site and the expanded substation site
- construction of temporary watercourse crossings (discussed further in Section 6.6).

Each of these elements are described in greater detail below.

Construction access tracks

Access to each tower would be required during construction, and may be retained for operational purposes. Access tracks would be required to be traversable by a range of vehicles. Access tracks would fall into two broad groups:

- un-improved access tracks
- constructed access tracks.

Where access tracks extend beyond the transmission line easement, the location of the access tracks would be agreed with the landholder and subject to separate agreements. For permanent access tracks beyond the transmission line easement, an access easement may be required and negotiated with the landholder.

Un-improved access tracks

Un-improved access tracks would provide access to work sites by using existing roads or tracks, or driving on existing soil or ground surface with minimal or no prior preparation. Existing roads, tracks and other existing disturbed areas would be used wherever possible in order to minimise vegetation clearing requirements.

Where access is across open spaces, particularly in cultivated areas, pasture improved grazing land or native grasslands, care would be exercised to ensure that minimum damage is caused to the surface by confining movement, as far as possible, to one route.

Constructed access tracks

Constructed access tracks would be required in areas where there are no existing roads or tracks, or where terrain conditions prevent continuous access along the line easement between road crossings. In these situations, 'off easement' access may be required and suitable access tracks would be constructed.

All new access tracks would be around six metres wide and would generally follow the natural contour of the land as far as practicable to minimise the amount of cut and fill and soil disturbance. Access tracks would also include drainage control features such as table drains or cross banks to minimise erosion.

In the case of cultivated land, it may be necessary to route access tracks along fence lines or otherwise in accordance with landholder requirements. Track construction would be carried out so as to cause minimum disturbance to soil and vegetation both on and adjacent to the track, including restricting the use of bulldozers where practical.

Access tracks would be constructed in accordance with the following guidelines:

- *Guidelines for the Planning, Construction and Maintenance of Tracks* (Department of Land & Water Conservation, 1994)
- *Managing Urban Stormwater: Soils and Construction – Volume 2C Unsealed Roads* (Department of Environment and Climate Change, 2008).

Where tracks are, or are required to be, located in areas which are not suitable for use by vehicles and plant following adverse weather conditions, the area would be temporarily by-passed (i.e. alternative access paths would be identified).

Access tracks would be designed and formed such that the track is suitable for use by vehicles during subsequent use as part of future maintenance access (i.e. suitable for use by long wheel-base 4WD vehicles).

6.6.4 Transmission line construction

Main works associated with the construction of the transmission lines would include (but not be limited to):

- earthworks and footing construction including:
  - earthworks and establishment of construction pads for each transmission line tower
  - construction of footings and foundation works for the new transmission line towers including either concrete or steel piles (driven and/or screw), boring and/or excavation, steel fabrication works and concrete pours
- construction of transmission line towers
- erection of the transmission line towers
- stringing of the conductors and overhead earth wires and optical ground wire
- installation of earthing conductors
- earthing of fences and gates (as required).

The typical methodology for the construction of the transmission lines would be similar for both the new 330kV line and the upgraded 220kV line. Further detail of these key tasks is provided below.

Earthworks and transmission tower footing construction

Excavation works at each tower site would be required for the installation of foundations, levelling around the individual tower foundations, drainage and grading or preparation for construction at the tower site. Excavations would typically be up to five metres in depth. Where groundwater is shallow, alternative construction methodologies and designs would be implemented (such as boring) to limit interaction with groundwater.

Typical transmission line tower piling depth would be generally up to 25 metres below ground level and would depend on ground conditions (e.g. greater piling depths would be required where soft soil types are present).

The foundation type would also vary and (subject to detailed design) would consist of either:

- bored pile (reinforced concrete)
- driven or screw pile (concrete or steel)
- helical screw anchor, or cast in-situ reinforced concrete.

If groundwater is encountered or the excavations are filled by rainwater, the excavation would be dewatered and appropriately managed.

Bench sites (stepped ground excavation) may be required to provide a level platform for equipment setup, the erection of the tower and other construction activities. Benching would be constructed by use of earthing equipment such as graders and excavators.

Excavated material would be stockpiled to be used for backfill around the transmission line tower foundations and embankment filling at the tower site from which it was excavated. Top soil would be kept separate from the excavated material to allow for placement at ground level during backfilling. Any excess excavated material would be spread evenly around the site after completion of the foundation backfilling (if suitable) or removed from the site and disposed of in accordance with the appropriate waste classification.

Construction of transmission line towers

The transmission line towers would typically be erected by assembling in sections on the ground and hoisting or lifting successive sections into place using cranes. Alternatively, towers may be erected in place on the footings by installing individual members. These towers would include infrastructure such as step bolts, climbing attachment plates, ladders, platforms, climbing barriers, identification plates, warning plates, other fixtures and fittings for the attachment of earthwires and insulators.

Following erection and securing of the tower, the transmission line would be strung by either a ground pulled draw wire (with brake/winch sites) or a line stringing drone.

The area required for the construction of each tower would require access for tower assembly and stringing works. Where a transmission tower is proposed to allow for a direction change of the transmission line, a larger area would be required (to allow for brake and winching sites). At a typical site, this would include a temporary area of up around 60 metres by 80 metres at each transmission line tower location.

Transmission line watercourse crossings

The proposed transmission line would require three major watercourse crossings. These crossings are proposed at:

- the Great Darling Anabranch, Wentworth NSW
- Darling River, Ellerslie NSW
- Murray River, Monak NSW / Red Cliffs Victoria.

Generally, the design of the transmission line would include a transmission line structure on either side of each major river crossing. A drone would then be used to take a lead wire over the river to allow cables to then be pulled and strung tower to tower.

It is not envisaged that any access tracks or bridges would be required for these particular crossings due to the design and proposed construction method of the transmission line at these locations (refer to Section 6.6.4 for details). There would likely be some temporary works at the transmission line structure on each side of the crossing to allow for the construction of the transmission line structure, however it is likely that these would be between at least 50 metres from the river bank (subject to detailed design) and with appropriate environmental controls (such as erosion and sediment controls).

Where alternative access routes are impractical, a number of local waterway crossings and causeways would be required at other smaller waterway locations along the length of the proposal. Where required, bed-level fords (i.e. construction of a good footing where a river or stream may be crossed) or causeways may be required to be constructed to provide temporary access. Where these crossings are required, they would typically be constructed using the following typical methodology:

- removing all loose material from the watercourse at the point to be crossed, forming a depression with firm base and sides
- the depression would then be filled with graded layers of rock. The rock layers would be placed so as to produce an interlocked bed of rock, sloped and dished, to allow water to drain freely through and flow over the causeway (minimum thickness of around 450 millimetres but not higher than the bed of the watercourse).

All watercourse crossing would be designed and installed in accordance with relevant Department of Primary Industries (DPI) guidelines for waterway crossings including:

- *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI, 2004a)
- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (DPI, 2004b)
- *Water Guidelines for Controlled Activities on Waterfront Land* (DPI, 2012a).

If required as part of a water crossing, culverts may also be installed in accordance with required standards (such as AS/NZS 4058 *Precast concrete pipes (pressure and non-pressure)*).

6.6.5 Buronga substation upgrade and expansion

As described in Section 5.3.3, the existing Buronga 220kV substation would be upgraded and expanded to add a new 330kV substation on the land parcel adjacent to the existing 220kV substation. The construction methodology for the proposed expansion of the Buronga substation would consist of the following key activities:

- site establishment, including vegetation removal and establishment of temporary construction site office and amenities within the expanded substation site
- bulk earthworks to form the substation pad including placement of around 350,000 cubic metres of rock/gravel/soil to allow for the construction of the substation pad, and the temporary stockpiling of existing soil that does not meet engineering requirements for the substation pad
- excavation and preparation of the site for concrete foundations
- installation of reinforced concrete and piled foundations for the electrical equipment
- excavation and installation of electrical equipment conduits, trenches and general site drainage works
- construction of two to three new ancillary and equipment control buildings
- erection of galvanised steel towers to support electrical equipment, using cranes
- installation of electrical equipment on foundations
- installation of site wiring and electrical control equipment within the control buildings.
- erection of the expanded substation site boundary security fence, including site access gates
- surfacing and stabilising works for access, dust and vegetation suppression and drainage.

Site establishment and bulk earthworks would be carried out as enabling works.

Blasting may be required, depending on geotechnical conditions. This would be confirmed during detailed design and would be subject to further assessment.

6.6.6 Pre-commissioning and commissioning phases

Pre-commissioning activities would form part of the final construction and installation works and would incorporate all tests and checks to confirm that construction quality assurance documentation, inspection and test plans, checklists and associated activities have been completed for each individual component of plant. This would be to ensure that it has been supplied and installed in accordance with the design and statutory standards and is safe to proceed to commissioning.

The key pre-commissioning and commissioning activities which would be undertaken would include:

- testing and commissioning of the new substation equipment
- point to point testing of the new transmission lines and substation connections
- earthing testing
- high voltage testing
- high voltage equipment operational checks
- testing of the installed protection, metering, control, and communication systems
- cut over (energisation) of electricity between the existing and new transmission lines (where required, such as the section south of the Buronga substation).

Once all high voltage and low voltage testing is completed, the electrical protection systems have been set and all quality assurance documentation has been completed, commissioning would proceed.

The key activities involved in the main commissioning process would include:

- transmission line cut in and connection to the electrical network
- protection, control, and metering checks
- high voltage equipment operation and energisation
- audible noise, thermographic imaging and electric and magnetic field (EMF) testing.

The new substation components would be commissioned and integrated with any necessary TransGrid external facilities.

6.6.7 Demobilisation

Decommissioning of existing infrastructure

Once the new double circuit 220kV line between Buronga substation and Red Cliffs substation is constructed and operational, the existing 220kV single circuit transmission line (Line 0X1), including all existing structures and conductors, would be decommissioned and removed from the easement. A single 220kV transmission structure would also be removed on the Broken Hill to Buronga substation (Line 0X2).

The methodology for the removal of the existing 220kV single circuit infrastructure would typically consist of the following key activities:

- disconnection and removal of the existing transmission lines
- dismantling of transmission line towers and removal from site (including removal of foundations to one metre below ground)
- remediation of access tracks (where no longer required for access to the new double circuit line). This would include remediation of an area around 30 metres in all directions from the existing tower, with access to these sites for remediation provided along the existing access tracks to the (decommissioned) tower locations
- handover of excess land (resulting from adjusted easement) back to landholder.

Site rehabilitation and landscaping

Site rehabilitation would be carried out progressively along sections of the transmission line and at tower and pole installation sites as well as the expanded substation site. This phase would occur following the completion of construction and involve the removal of all materials not required during the operation of the substation and/or transmission lines. This phase would include the removal/remediation of the construction compounds and camp sites, removal of any site buildings and temporary environmental controls. Rehabilitation of access roads or tracks would also be undertaken where they are not required for further construction activities.

These areas would be restored back to their previous natural conditions as far as possible.

Works may also be undertaken to restore:

- irrigation and water infrastructure facilities to pre-existing conditions before arrival on site
- natural drainage in areas where temporary facilities were provided
- fences, gates, etc., which may have been damaged during construction.

Installation of the permanent TransGrid property boundary fence surrounding the expanded substation site would also likely occur during this phase.

6.7 Construction facilities

6.7.1 Main construction compound and accommodation camp sites

The main construction compound and accommodation camp sites would be in place throughout the period of construction of the proposal.

Each main construction compound and camp site would accommodate a range of facilities including:

- staging and laydown facilities
- concrete batching plants
- workforce accommodation camp areas

- demountable offices for up to around 50 workers
- construction support facilities including vehicle and equipment storage, maintenance sheds, chemical/ fuel stores and potential stockpile areas.
- parking for up to around 190 light vehicles, 45 heavy vehicles and five 20-seat buses.

The workforce camp area would accommodate between 100 to 200 workers. The camp accommodation would include accommodation facilities, food and catering facilities, fitness and recreational facilities (such as indoor and outdoor recreational spaces, gymnasium areas), first aid facilities and telecommunication services for personal use.

The main construction compound and accommodation camp sites would range in size from around 150 metres by 200 metres (around 30 hectares) to up to around 250 metres by 300 metres (around 75 hectares). Within each site, the size of laydown areas could be up to 150 metres by 150 metres (up to 22.5 hectares).

Upon completion of works, the construction compound and accommodation camp sites would be cleared of any temporary infrastructure and equipment, and rehabilitated in line with Section 6.6.6.

Up to three construction compound and camp sites would be required during the construction of the proposal.

Anabranch South

The Anabranch South main construction compound and accommodation camp site would be located on the Silver City Highway and would provide primary support for the construction of the western end of the 330kV transmission line. An indicative location for the site is shown on Figure 6-4b. The final location would be determined in consultation with the landholder and would be subject to the criteria identified in Section 3.3.6.

Should the final location reflect the indicative location, the site would be established as part of enabling works.

Buronga

The Buronga main construction compound and accommodation camp site would be located in the vicinity of the Buronga substation (refer to Figure 6-4c), and would be established as part of enabling works. It would provide primary support for the construction of the eastern end of the 330kV transmission line, the 220kV transmission line and the Buronga substation upgrade and expansion.

Wentworth (and surrounds)

A third site may be required to provide primary support for the construction of the central section of the 330kV transmission line. The location of this site, if required, is subject to further investigation, but would be located in general proximity to Wentworth and its surrounds.

The location of the site would be selected to minimise potential environmental impacts (applying the below factors) and would be subject to landholder agreement.

The following factors, in general order of priority, would be considered when selecting the additional site:

- being in areas which have previously been disturbed, or would already require disturbance as part of the construction of the proposal
- no impacts to threatened species (or their habitats) or threatened ecological communities (within the meaning of the *Biodiversity Conservation Act 2016* or the *Environmental Protection and Biodiversity Conservation Act 1999*)
- being located on sites of identified lower ecological and heritage value
- located an appropriate distance from watercourses (i.e. locations greater than 200 metres away)
- located an appropriate distance from sensitive receivers to minimise potential impacts (i.e. enabling adequate separate from residential buildings) with consideration of matters such as compliance with the *Interim Construction Noise Guideline* (DECCW, 2009), traffic and access impacts, dust impacts, and visual (including light spill) impacts

- sites being of relatively level ground to minimise earthwork requirements and offsite drainage risks
- of minimal environmental impact with respect to flooding
- proximity to key construction activities to minimise durations of travel for workforce and transport of materials and equipment
- easily accessible for heavy vehicle construction traffic (including deliveries).

The selected site would subject to additional environmental assessment or consistency review, as relevant. If the location is confirmed prior to any planning approvals, this site would be established as part of the enabling works identified in Section 6.6.1.

6.7.2 Other ancillary facilities and the transmission line construction corridor

A number of minor staging, storage and laydown ancillary areas would be required along the proposal study area for the temporary storage of materials, plant and equipment required to construct the various elements of the proposal (in particular transmission line structures). Some temporary mobile batching plant locations may also need to be established to enable for easily access to concrete at the more western end of the proposal, and would be located at least 500 metres away from any residential dwelling. Upon completion of works, these ancillary sites would be cleared of any temporary infrastructure and equipment, and rehabilitated in line with Section 6.6.6. These sites would be in place for shorter periods at locations suitable to support the construction works as they move along the alignment.

6.8 Plant and equipment

An indicative list of construction plant and equipment likely to be required for the key construction elements is provided below. Not all the equipment identified below would be required for all phases of construction.

- air compressor
- backhoe
- bob cat
- CAT 140M grader
- cranes (ranging from 50 to 300 tonnes)
- concrete agitator
- concrete pump
- crawler crane with grab attachments
- D6 dozer
- D10 dozer
- drones
- dumper trucks
- elevated working platforms
- excavators (ranging from five to 45 tonnes)
- excavator(s) with hammer
- franna cranes (ranging from 12 to 25 tonnes)
- flatbed Hi-Ab trucks
- generators
- graders
- mulchers
- piling rig(s)
- pneumatic jackhammers
- rigid tippers
- rollers (ranging from 10 to 15 tonnes)
- scrapers
- semi-trailers
- stringing winches
- tilt tray trucks
- transport trucks
- trenchers
- watercarts.

6.9 Resources and materials

6.9.1 Excavation volumes

As described in Section 6.4, excavation works would be required within the disturbance area for activities such as transmission line structure construction, preparation of the expanded substation site to provide a level surface, to create the required trenches for drainage, earthing, and electrical conduits and to construct access tracks.

Spoil from the excavations associated with the transmission line may be reused on site wherever possible, however in some instances spoil would be removed from site and disposed of at an appropriately licenced facility. Any such on site re-use would be within the disturbance area, and would not substantially alter landform or drainage in the vicinity of the transmission line structures. Excavation works would be carried out using earth moving equipment such as excavators, dozers, piling rigs and rock breakers.

Based on the current design of the proposal, the anticipated excavation volumes for the proposal are shown in Table 6-2.

Table 6-2 Indicative earthwork volumes

Approximate volume of material to be excavated	Approximate volume of material required for fill	Earthwork balance	Typical depth
Buronga substation upgrade and expansion site			
Bulk earthworks to remove sand/soils unsuitable for compaction as part of construction of the expanded substation pad 250,000 to 350,000 cubic metres	Imported quarry products/ fill suitable for compaction 250,000 to 350,000 cubic metres	Landscaping, drainage, crushed rock topping Approximately 25,000 cubic metres	Typical depth two metres (majority) to six metres (low spots in land parcel to be filled)
330kV transmission line – SA/NSW border to Buronga substation			
Excavation for tower foundations 54,000 cubic metres	Reinforced concrete would be used to fill the excavations	Nil	15 to 20 metres
220kV transmission line – Buronga substation to NSW/Victoria border			
Excavation for tower foundations 12,000 cubic metres	Reinforced concrete would be used to fill the excavations	Nil	15 to 20 metres

Where required, imported quarry products would likely be sourced locally and be transported by road to the expanded substation or transmission line sites. Opportunities to win material within or in proximity to the proposal is being investigated, and would be subject to additional environmental assessment and approvals (as required).

As identified in Section 6.6.2, in order to reduce potential earthwork requirements, top soils would be stockpiled within the construction disturbance area and reused for re-establishing grasses and other vegetation in areas proposed to be rehabilitated. Where excavated spoil is determined not to be appropriate for reuse on site, it may be necessary to import additional material to site to make up any identified deficit. Where this is required, this would be sourced locally.

There would also be a requirement to maintain safe working clearances under the existing transmission lines where the proposal would be located in or adjacent to existing lines or the Buronga substation. Accordingly, excavation works would generally commence where clearances from natural ground level to the above transmission lines exceed the safe working requirements. Benching and spoil removal would progress using rock breakers, excavators and trucks. This methodology would ensure that safe clearances are maintained and excavation works can proceed without the requirement to disconnect electrical transmission along these lines during construction.

6.9.2 Water supply

Water would be required during construction for:

- dust suppression on substation construction sites and line tower construction sites, and on access tracks through the use of a water spray attached to a tanker vehicle (including the possible use of water reduction polymers)
- concrete batching activities for use when mixing with cement, aggregates and water for transmission line towers and substation foundations
- wetting backfill material (if it is too dry for effective compaction)
- general worker facilities at the main construction compound and camp sites.

It is estimated that about 616 megalitres of water would be required for construction, comprising:

- 428 megalitres for dust suppression
- 91 megalitres for earthworks compaction
- 11 megalitres for concrete batching activities (potable water)
- four megalitres for vehicle washdown facilities
- 82 megalitres for camp sites (potable water).

Water would be supplied for the proposal from existing regulated sources. Water would be purchased from the existing water market within the region or from local council facilities. Access to these sources would occur through the use of existing, licensed water extraction infrastructure only.

TransGrid has commenced discussions with Wentworth Shire Council to access the required volume of potable water for the proposal from existing council facilities. For non-potable water supply, commercial discussions with potential suppliers to secure non-potable water has commenced and is ongoing.

Water storage tanks would be provided, where required, along the transmission line corridor to manage demand requirements. Wastewater would be collected via tanker trucks and disposed of at approved disposal locations in accordance with the NSW Environment Protection Authority (EPA) waste classification guidelines (NSW EPA, 2014).

6.9.3 Hazardous materials and chemicals

During construction, various hazardous materials and chemicals would likely be required to be used and/or stored on site. Hazardous materials and chemicals would typically include (but not limited to):

- acetylene, Oxygen, Liquid Petroleum Gas
- adhesives, glues, epoxies, etc.
- concrete and other mortar products
- contact cleaners
- cold-galvanising spray
- fuels, oils and lubricants (such as diesel, unleaded petrol, thinners, etc.)
- paints and other paint markers.

6.9.4 Other resources and materials

A range of other materials and resources would also be required during the construction of the proposal. Key additional materials and resources would include:

- 12,000 tonnes of steel for transmission line towers
- around 1,600 kilometres of conductor cables
- 3,400 tonnes of aluminium and 50 tonnes of copper for transmission lines
- up to 15,000 cubic metres of concrete for substation works and up to around 11,200 cubic metres of concrete for transmission tower footings.

6.10 Workforce and working hours

6.10.1 Construction workforce

The construction workforce would vary depending on the stage of construction and associated activities. During peak construction activities, the proposal is expected to employ around 400 full time equivalent workers. Table 6-3 provides an overview of the anticipated construction workforce for each stage of construction.

Table 6-3 Anticipated construction workforce

Phase	Anticipated workforce (approx.)
Buronga substation upgrade and expansion works	
Site and compound establishment and vegetation clearance	10 to 20
Substation access road	20
Civil construction works	80 to 100
Electrical construction works	80 to 100
Pre-commissioning and commissioning	20 to 30
Site clean-up and landscaping	20 to 30
Transmission line works	
Site establishment, environmental controls and vegetation clearance	8 to 12
Establishment of access tracks to towers for construction of towers	8 to 12
Tower foundation installation	40 to 50
Erection of towers	40 to 50
Stringing of conductors	40 to 50
Testing and commissioning	20

6.10.2 Construction work hours

Construction work would be carried out seven days per week between 7:00 am and 7:00 pm. The main construction compounds would also operate during these hours.

The accommodation camp facilities would be operational 24 hours a day, seven days a week.

Extended construction hours are proposed given the distance to sensitive receivers for the majority of the proposal study area, and the shift arrangements of the workforce given the remote nature of the proposal. Extended working hours would also achieve reductions in the overall duration of construction.

Where the extended hours are proposed for activities in proximity to sensitive receivers, additional measures would be implemented where works would potentially exceed noise management levels through an out of hours work protocol.

Out of hours works

A series of works outside the proposed construction hours for the proposal are anticipated including (but not limited to) the following:

- transmission line construction where this would occur as a crossing of a main road or railway. These locations are expected to have restricted construction hours requiring some night works for activities such as conductor stringing over the crossing(s)
- works where Road Occupancy Licenses (or similar) are required
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- substation assembly (oil filling of the transformers)
- connection of the new 330kV substation to the existing 220kV substation which is likely to require longer working hours
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages
- situations where agreement is reached with affected receivers.

During detailed design, a program would be determined to identify the required night work periods (including dates and durations).

Except for emergencies, construction works would be carried out in accordance with the out of hours work protocol and would not take place outside construction hours without prior notification in line with that protocol.

6.11 Construction parking, access and vehicle movements

Construction vehicle movements would comprise vehicles transporting compound and camp infrastructure, equipment and plant, materials, spoil and waste, as well as mini-buses and light vehicles associated with construction workers travelling to and from construction areas. Non-standard or oversized loads would also be required for the substation upgrade and expansion works (such as delivery of transformer units) and transportation of transmission line tower materials.

Indicative daily vehicle movements for the proposal are outlined in Table 6-4. These vehicle movements are based on the expected typical and peak construction period for the proposal. The vehicle movements stated in Table 6-4 would be confirmed during detailed design.

Table 6-4 Indicative vehicle movements

Vehicle type	Phase	Indicative total vehicle movements during construction (average)[1, 2]
Buronga substation upgrade and expansion site		
Light vehicles	Indicative daily movements (typical day)	50
Light vehicles	Maximum daily movements (critical/peak construction period)	100
Heavy vehicles	Indicative daily movements (typical day)	15
Heavy vehicles	Maximum daily movements (critical/peak construction period)	80
Transmission line works		
Light vehicles	Indicative daily movements (typical day)	67
Light vehicles	Maximum daily movements (critical/peak construction period)	150
Heavy vehicles	Indicative daily movements (typical day)	15
Heavy vehicles	Maximum daily movements (critical/peak construction period)	30

Note:

1. Indicative daily movements based on current program of works. This is an average and there would be days of increased peak activities which may impact these average/indicative numbers.

2. Vehicle movements are each way (i.e. a heavy/light vehicle arriving and leaving a site within a day counts as two movements).

Construction vehicle traffic would be greatest during the main earthworks and civil construction activities.

Most of the light vehicle movements associated with the construction works would generally be limited to construction staff travelling to and from individual sites for work from the worker accommodation sites.

Standard traffic management measures would be employed to minimise short-term traffic impacts expected during construction. These measures would be identified in the construction traffic management plan for the site.

In general, vehicle movements would be scheduled outside peak periods wherever possible. However, there would be a need for some vehicle movements during these periods. Worker vehicle movements would also be required during both the morning and afternoon peak hour periods.

6.11.1 Construction haulage routes

Routes for the movement of construction equipment and materials (local haulage routes)

Construction heavy vehicle movements would be required along the length of the proposal study area. Where feasible, this would be undertaken within the proposal study area, to minimise impacts on the public road network. However, use of public roads would also be required.

Local haulage routes would predominantly use the Sturt Highway, Silver City Highway, Renmark Road, Arumpo Road and then local roads. Given the limited number of route options within the proposal study area, these routes would be used by both general construction traffic and for heavy vehicle haulage routes.

Specifically, indicative local haulage routes would include the following:

- for the Buronga substation to the 330kV transmission line work site areas in the west via Wentworth, vehicles would travel along Arumpo Road and Silver City Highway (B79) to Wentworth, before turning onto Renmark Road and travelling towards the western worksite areas
- for the Buronga substation to 220kV transmission line work sites (near Monak), vehicles would travel from Arumpo Road onto Silver City Highway (B79) and to the Sturt Highway (A20), exiting at the transmission line worksite areas.

The routes have been developed to minimise impacts on local roads as far as possible, while providing the most direct route to the road network and meeting specific road requirements (such as specified routes for heavy vehicles). These preliminary haulage routes would be reviewed during detailed design and confirmed following appointment of the construction contractor.

The local haulage routes along the proposal alignment are shown on Figure 6-5.

Main interstate / long distance haulage routes (oversize vehicle movements)

The shipping port locations which would receive each of the deliveries of the proposal equipment are not confirmed at this stage in the process. Locations being considered include Sydney (Port Botany), Wollongong (Port Kembla), Adelaide (Port of Adelaide) and Melbourne (Port of Melbourne). The final haulage routes from each of these locations would be determined by the appointed contractor and they would need to accord with the heavy vehicle haulage guidelines in each of the respective states.

Haulage routes from port facilities would be expected to include:

- Port Botany – travel from Sydney to Buronga via Wagga Wagga along the Hume Highway (M31) and Sturt Highway (A20), before reaching Arumpo Road to access the Buronga substation site.
- Port Kembla – travel from Wollongong to Buronga via Wagga Wagga along the Hume Highway (M31) and Sturt Highway (A20), before reaching Arumpo Road to access the Buronga substation site
- Port of Adelaide – travel from Adelaide to Buronga via Broken Hill along Silver City Highway (B79), before reaching Arumpo Road to access the Buronga substation site.
- Port of Melbourne – travel from Melbourne to Buronga via Mildura along Calder Highway (A79) and Benetook Avenue (C255) on the Victorian side, before crossing the Murray River along George Chaffey Bridge on Sturt Highway (A20) and reaching Arumpo Road to access the Buronga substation site.

The four main interstate / long distance haulage routes proposed for the proposal are shown on Figure 6-6.

6.11.2 Construction worker parking

Construction worker parking would primarily be provided within the main construction compound and camp sites as described in Section 6.7.

For the construction works at the Buronga substation, it is expected that relevant workers would be typically based within the accommodation camp at this work site or travel to the site locally from the surrounding towns such as Buronga, Gol Gol or Mildura and park within the Buronga main construction compound.

For the transmission line alignments, given the transient nature of these construction works, and potentially long distances, it is expected that workers would typically be transported by bus to site from their relevant accommodation camp. Where other vehicles are used to access these sites, parking spaces for construction personnel would generally be within 30 metres on each tower location site.

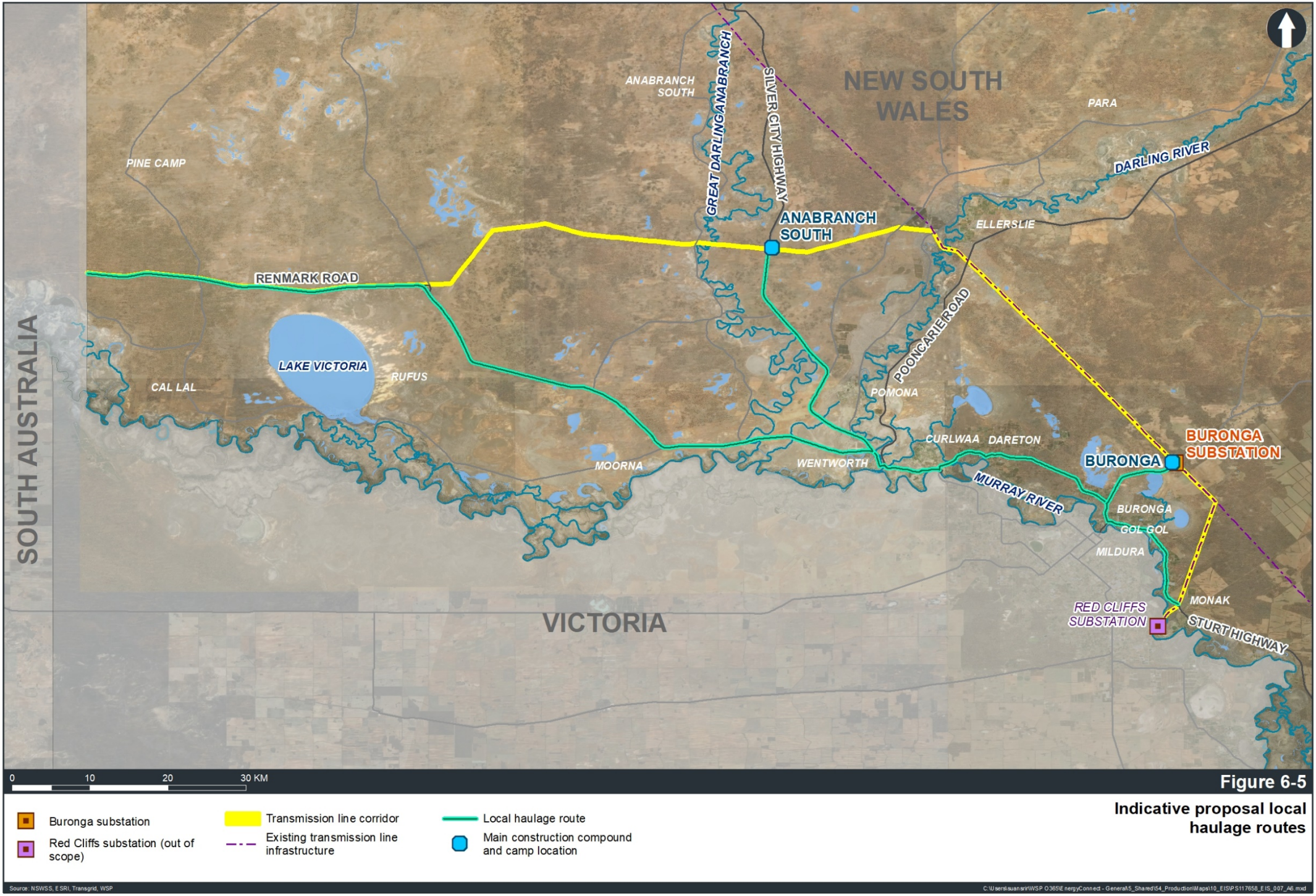


Figure 6-5

Indicative proposal local haulage routes

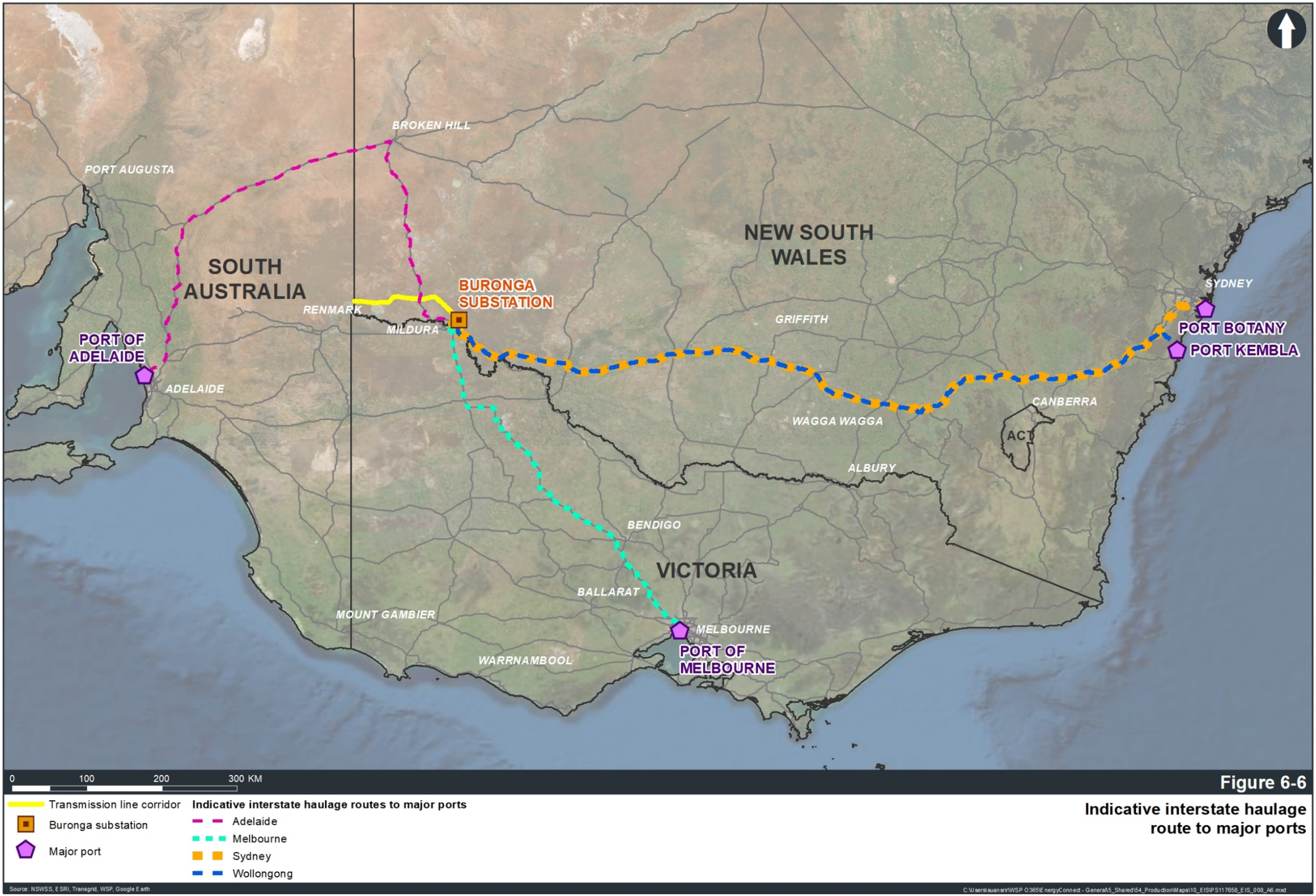


Figure 6-6

Indicative interstate haulage route to major ports

7. Stakeholder and community consultation

This chapter summarises the stakeholder and community consultation activities that have been previously undertaken and that are planned for EnergyConnect (including the proposal). It includes details of consultation methods and a list of the stakeholders and government agencies consulted.

The chapter also provides an overview of the key issues raised by stakeholders and the community and where relevant, how these concerns have been addressed through the design of the proposal and/or through the EIS process. Further details of community and stakeholder consultation, issues raised and supporting documents are provided in Appendix D – *Consultation outcomes report*.

7.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to consultation and where these requirements are addressed in this EIS are outlined in Table 7-1.

Table 7-1 Secretary's environmental assessment requirements – consultation

Ref.	Secretary's environmental assessment requirements	Where addressed in the EIS
General requirements	The EIS must include: > a description of the engagement that was carried out during the preparation of the EIS, the key issues raised during this engagement and the proposed engagement strategy for the project if it is approved	This chapter provides a description of the engagement that was carried out during the preparation of the EIS, including a summary of the key issues raised.
Consultation	During the preparation of the EIS, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups, affected landowners, Native Title holders, exploration licence holders, quarry operators and mineral title holders.	This chapter provides a description of the engagement undertaken with relevant stakeholders throughout the development of the proposal and preparation of the EIS.

7.2 Consultation strategy

7.2.1 Consultation approach and objectives

TransGrid is committed to an engagement process that is proactive, transparent and represents a genuine desire to work with our stakeholders. TransGrid recognises that a two-way feedback process is the key to understanding the needs and views of stakeholders and communities who are directly and indirectly affected by its operations. Throughout the development of the proposal, TransGrid has and will continue to engage with affected and interested parties so that project planning is informed by input from stakeholders and communities in line with both regulatory requirements and TransGrid internal policies and standards.

A Community and Stakeholder Engagement Plan (CSEP) was developed in broad alignment with the *Draft Environmental Impact Assessment Guidance Series*: *Community Guide to EIA* (DPE, 2017a) to establish an appropriate framework for EnergyConnect (including the proposal).

For alignment with leading practice, in addition to the *Draft Environmental Impact Assessment Guidance Series,* a range of TransGrid and industry standards and guidelines for community and stakeholder engagement were also considered including:

- Stakeholder Engagement Charter (TransGrid, 2015)
- Landholder Easement and Compensation Guide (TransGrid, 2019)
- *Quality Assurance Standard* (International Association for Public Participation, 2015)
- *Community Engagement Guidelines* (Clean Energy Council, 2018).

The objectives of the stakeholder and community consultation activities for the proposal are to:

- undertake a structured, transparent and meaningful approach to working with stakeholders who are directly and indirectly affected by the proposal
- provide tailored engagement and communications for different stakeholder needs and expectations
- enable stakeholder participation in the route selection process in a manner that is clear and transparent and ensures stakeholders understand how their feedback will be used or will influence the process
- provide stakeholders with opportunities to participate, with sufficient and timely information to enable informed engagement and information on how their feedback has been used in the decision-making process.

7.2.2 Stakeholder identification

Table 7-2 provides a list of key stakeholder groups that have been/will be engaged throughout the development of EnergyConnect and the proposal more specifically.

Table 7-2 Key stakeholder groups for the proposal

Stakeholder Group	Stakeholders
Government – Political representatives	> NSW Premier, the Hon Gladys Berejiklian MP > NSW Minister for Energy and Environment, the Hon Matthew Kean MP > SA Premier, the Hon Steven Marshall MP > SA Minister for Energy and Mining, the Hon Dan van Holst Pellekaan MP > Commonwealth Minister for Energy and Emissions Reduction, the Hon Angus Taylor MP.
Energy Regulator / Operator	> Australian Energy Market Operator (AEMO) > Australian Energy Regulator > Australian Energy Market Commission > Energy Security Board.
Federal Member	> Member for Farrer, The Hon Sussan Ley MP.
State Member	> Member for Murray, Helen Dalton MP
Local government – Elected officials/ Executive staff	> Wentworth Shire Council (the local government for the proposal study area) > Additional local governments within the larger EnergyConnect project area including: – Balranald Shire Council – Edward River Council – Hay Shire Council

Stakeholder Group	Stakeholders
Local government – Elected officials/ Executive staff (cont.)	– Lockhart Shire Council – Murray River Council – Murrumbidgee Council – Federation Council – Narrandera Shire Council – Wagga Wagga City Council.
Government – Departmental	> Australian Government Department of Agriculture, Water and the Environment (DAWE) > Australian Government Department of Education, Skills & Employment > Australian Government Department of Industry, Innovation & Science > NSW Department of Planning, Industry and Environment (DPIE) and its divisions NSW Crown Lands, NSW Environment, Energy and Science (previously referred to as Office of Environment and Heritage (OEH)) and NSW National Parks & Wildlife Services > NSW Department of Premier and Cabinet > NSW Department of Regional NSW including its divisions of Forestry Corporation NSW and NSW Local Land Services > NSW Transport for NSW, specifically its division Property Acquisition NSW > NSW Department of Customer Service (DCS), and its division SafeWork NSW > the Victorian Department of Environment, Land, Water and Planning (DELWP) > Parks Victoria.
Directly impacted landholders (in corridor)	> Landholders (owners, occupiers, lease and other interest holders in the corridor).
Traditional Owners and other Aboriginal groups	> NSW Aboriginal Land Council > NTSCORP > National Indigenous Australians Agency (NIAA) > Aboriginal Affairs, Broken Hill > NSW Indigenous Chamber of Commerce > Barkandji Traditional Owners (Native Title Group) > Barkindji Maraura Elders Council > Barkindji Maraura Elders Environment Team (BMEET) > Ta-Ru Board of Management / Maraura Barkintji Traditional Owners > Lake Victoria Advisory Committee > Muragadi > Murra Bidgee Mullangari > Dareton Local Aboriginal Land Council > Balranald Local Aboriginal Land Council > Hay Local Aboriginal Land Council > Griffith Local Aboriginal Land Council

Stakeholder Group	Stakeholders
Traditional Owners and other Aboriginal groups (cont.)	> Deniliquin Local Aboriginal Land Council > Narrandera Local Aboriginal Land Council > Wagga Wagga Local Aboriginal Land Council > Other individuals, which are Registered Aboriginal Parties for the proposal.
Local land users	> Local land users e.g. irrigators, farmers within Wentworth Shire Council or surrounding LGAs not considered directly impacted or adjacent landholders.
Local community	> Local communities within Council areas.
Local suppliers	> Local suppliers within the Riverina.
Other suppliers	> NSW and Australian suppliers.
Industry groups	> NSW Farmers Association > Regional Development Australia > Industry Capability Network > Energy Consumers Australia > Energy Users Association of Australia > Primary Producers SA > AI Group > Public Interest Advocacy Centre > Business SA > Relentless Resources > Morello Earthmoving.
Service providers / utilities	> AAPT > AARNet > APA Group Networks > APT Management Services > AusNet Transmission Group > Essential Energy > Mildura Rural City Council > Murraylink Transmission Co > Nextgen > Optus > Powercor – Mildura > Riverina Water County Council > SA Water > Telstra.
Interest groups	> Local progress associations, issue-specific interest groups.
Media	> Local, State and National print, radio and television including: Sunraysia Daily, The Mildura Weekly, ABC Radio Mildura-Swan Hill.
General public	> General members of the public who may take an interest in EnergyConnect (including the proposal).

7.3 Consultation undertaken prior to and during the preparation of the EIS

A wide-ranging engagement program was developed prior to and during preparation of the EIS to consider the range of stakeholders who may be potentially impacted by or interested in EnergyConnect and the proposal. This included providing opportunities for general stakeholder participation as well as more targeted consultation with government agencies and Aboriginal group representatives.

7.3.1 Opportunities for stakeholder participation

Since November 2018, over 890 stakeholder and community engagement activities have been undertaken for the proposal. Table 7-3 outlines the activities undertaken and the stakeholder group involved.

Table 7-3 Engagement activities

Activity/consultation method	Summary
Telephone	Over 330 telephone calls (41 incoming and 291 outgoing) have been made engaging stakeholders on the proposal. In addition, a dedicated toll-free telephone number (1800 49 06 66) has been created to receive and respond to enquiries from the community and interested stakeholders.
Email	Over 320 emails (65 incoming and 261 outgoing) have been made engaging stakeholders on the proposal. In addition, a dedicated email address (pec@transgrid.com.au) has been created to receive and respond to enquiries from the community and interested stakeholders.
EnergyConnect website	The EnergyConnect website (transgrid.com.au/EnergyConnect) provides information on the proposal background and need, proposal milestones and timelines and links to get involved. During route selection, information and opportunities have been provided to enable stakeholder participation in the route selection process, including an interactive map.
Online interactive map	A digital engagement tool that allows stakeholders to provide comments on opportunities and constraints for the proposed route across a number of topics (environment, social, existing and future land use, visual amenity etc). This is a transparent tool that displays the comments provided.
Stakeholder briefings	Forty-four briefings and presentations have been conducted with relevant local councils and key industry stakeholders. The briefings have included presentations and discussions on the need for EnergyConnect, any upcoming planning issues that all parties should be aware of, how stakeholders would like to be engaged, and any other topics of interest. Workshops have also been held with councils to secure their feedback into the route selection process.
One-on-one meetings with landholders	Eighty face to face meetings occurred with 50 potentially affected landholders within the proposal study area from the SA/NSW border to Buronga through to Monak. These meetings focused on securing landholder input into the route selection process and understanding their properties current or future land use and their views regarding potential constraints and opportunities. This feedback was captured on holding maps and recorded in TransGrid's stakeholder management system.

Activity/consultation method	Summary
Meetings with government agencies	Engagement with key government agencies was ongoing during EIS development, including 30 meetings held with 37 stakeholder representing: > Environment, Energy and Science (EES) Group within DPIE (previously referred to as Office of Environment and Heritage (OEH)) for biodiversity and Aboriginal heritage matters > Department of Premier and Cabinet (formerly Heritage office in OEH) for all heritage matters > NSW Crown Lands for matters related to Crown Lands > DPIE for matters related to the NSW planning approvals process, biodiversity, Aboriginal heritage and property easements > DAWE for matters related to the Commonwealth planning approvals process > Department of Regional NSW for matters relating to regional engagement (Local Land Services), State Forests (Forestry Corporation NSW) and project spatial data (Regional NSW). > Parks Victoria and Victorian Department of Environment, Land, Water and Planning for matters relating to Victorian planning requirements > Australian Government Department of Education, Skills and Employment for matters relating to skills and employment.
Media and advertisements	A radio broadcast was used to promote the project and the information sessions at Buronga and Wentworth in an interview on Monday 6 May 2019 with ABC Mildura-Swan Hill. Print advertisements were placed for: > community information sessions held in Buronga and Wentworth in May 2019 (advertised in the Sunraysia Daily and Mildura Weekly in late April / early May 2019) > community information session scheduled in Buronga on 28 March 2020 and (advertised in the New South Western Standard Newsletter on 17 March 2020). A subsequent advertisement was placed on 24 March 2020 to advise of the cancellation of this session in response to COVID-19
	> community Partnership Program, promoting the opportunity for local community groups to seek funding for local projects and was advertised in the Sunraysia Daily in April 2020 > Aboriginal consultation opportunities were advertised in the Koori Mail, Weekly Times and Mildura Weekly in April 2020 > notification of the EIS being placed on public exhibition and the upcoming exhibition period community information sessions to be held in Buronga and Wentworth (advertised in the Sunraysia Daily, New South Wales Standard Bulletin and Mildura Weekly in October 2020).

Activity/consultation method	Summary
Factsheets	Five (5) factsheets have been specifically developed for EnergyConnect, which have been utilised at community drop-in sessions and are available online. The development of these factsheets supplements existing TransGrid factsheets and align with the current stage of the proposal and address frequent stakeholder queries. > *EnergyConnect (general information):* explains EnergyConnect (including the proposal) and context. The focus is to provide stakeholders with a general understanding of the proposal along with the potential benefits, a visual of the proposed route and how stakeholders could participate in EnergyConnect. > *Route selection:* illustrates the route selection methodology with background information on EnergyConnect. It explains regional constraints and opportunities, route refinement investigation and local considerations being taken into account in defining the route. > *Land access:* provides an overview of preliminary field studies and the process undertaken to access private property. It explains the types of activities proposed and TransGrid's commitment to working with landowners to minimise the impact of these activities. > *Ecology surveys:* illustrates the process undertaken to identify existing animal and plant species within the local area and what landholders can expect from this process. It outlines how the ecology assessments are done and the focus of the surveys whether it be flora, fauna or aquatic. > *Geotechnical investigations:* outlines the process undertaken to understand local ground conditions and what landholders can expect from this process. It provides an overview of what geotechnical investigations are and illustrates examples of some that may be conducted on site including borehole drilling and Cone Penetration Tests. As the proposal progresses, additional factsheets will be developed.
Community drop-in sessions	Community information sessions have been held to provide information regarding EnergyConnect in: > Wentworth, NSW on 7 May 2019 > Buronga, NSW on 8 May 2019. An additional information session was scheduled for Buronga, NSW on 28 March 2020, however was later postponed in response to COVID-19. It is anticipated that additional information sessions will be conducted as part of the EIS exhibition process.
Social media	TransGrid's Facebook page has shared various updates in relation to the proposal. This includes advertising community drop-in sessions and online resources and participation options. The focus of the posts has been to increase general awareness of the proposal and opportunities for stakeholders to participate. TransGrid's Facebook page is https://www.facebook.com/TransGrid/?ref=br_rs In addition to this, community focussed social media pages have promoted engagement activities, including information sessions, and engagement channels, like the website, community information line and email address.

Activity/consultation method	Summary
Community hubs	A digital display was set up at the Midway Centre at Buronga to introduce EnergyConnect and encourage interested parties to visit the interactive feedback tool to find out more and provide their feedback.

7.3.2 Engagement with Aboriginal representatives

As part of the development of the proposal, consultation has been undertaken with representatives of the Aboriginal community in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2020* (Office of Environment and Heritage, 2020). As part of this process, Aboriginal knowledge holders were invited to be 'Registered Aboriginal Parties' (RAPs), which were provided the opportunity to take part in cultural surveys of the proposal study area and provide input into the methodology and preparation of the cultural heritage assessment for the proposal.

TransGrid will continue to consult with the Aboriginal community throughout the proposal, including (but not limited to) if any Aboriginal objects are unexpectedly found during construction.

7.3.3 Summary of issues raised

A summary of the key issues raised during consultation that are relevant to the EIS is provided in Table 7-4.

Table 7-4 Summary of issues raised relevant to the EIS

Theme	Feedback received	Issued raised by	Where addressed in the EIS
Aboriginal heritage	The project represents a positive opportunity to work with Indigenous groups to identify, protect and promote Aboriginal Heritage and assist with upskilling younger peoples.	Aboriginal Group	Chapter 10 (Aboriginal heritage). The proposal would also be subject to Aboriginal and Torres Strait Islander engagement and participation policy (TransGrid, 2020).
Biosecurity	Importance of weed hygiene and biosecurity measures	Multiple	Chapter 12 (Property and landuse)
Consultation	Importance of landholder and community consultation	Landholders	This chapter
Dust	Dust generated by traffic movement and construction activity has potential to spoil livestock feed	Landholders	Chapter 16 (Air quality)
Easement compensation	Use of land value and other factors in determining compensation	Landholders	Chapter 12 (Property and landuse)
Electric and magnetic frequency	The effect of EMF on people, food production and local wetlands in the region	Community	Chapter 19 (Hazards and risk)
	Potential interference with UHF radios and other communications devices	Landholders	Chapter 19 (Hazards and risk)

Theme	Feedback received	Issued raised by	Where addressed in the EIS
Employment	Local business or employment opportunities	Local businesses	Chapter 14 (Social and economic)
Environment	Mature trees, particularly along riverfront, and other riparian vegetation significant to ecosystem	Landholders	Chapter 9 (Biodiversity)
	Significant areas of native Mallee woodland	Landholders	Chapter 9 (Biodiversity)
	Locations of modified pastoral leases and conservation areas to protect flora and fauna	Community	Chapter 9 (Biodiversity)
	Offsetting environmental impacts	Government	Chapter 9 (Biodiversity)
Land use	Potential impact to current and future land use for agricultural operations, infrastructure and sub-division	Landholders	Chapter 12 (Property and landuse)
	Opportunity for co-existence between proposal and agricultural operation	Landholders	Chapter 12 (Property and landuse)
	Existence of small airstrips used for light aircraft movement	Landholders	Chapter 12 (Property and landuse) and Chapter 19 (Hazards and risk)
Property access	Certain areas may become inaccessible after rainfall (local flooding and mud conditions)	Landholders	Chapter 12 (Property and landuse)
Proposed alignment	Proximity to farm infrastructure, agricultural equipment, communications equipment and access gates	Landholders	Chapter 12 (Property and landuse)
	Capitalise on use of existing tracks and disturbed areas of property	Landholders	Chapter 12 (Property and landuse)
	Proximity to dwellings	Landholders	Chapter 12 (Property and landuse)
Remediation	Roads and council assets requiring remediation or improvement works necessary for construction loads	Council	Chapter 18 (Traffic and access)
	Property is reinstated after construction is complete	Landholders	Chapter 12 (Property and landuse)
Tourism	Visual presence of transmission line and impact to future tourism opportunities (e.g. river based & eco-tourism)	Community	Chapter 14 (Social and economic)

Theme	Feedback received	Issued raised by	Where addressed in the EIS
Visual amenity	Potential impact of the proposed transmission line on the visual amenity at Lake Victoria and its surrounds	Community Interest Group	Chapter 13 (Landscape character and visual amenity)
	Potential impact of the proposed transmission towers on the visual amenity and would affect local areas, including Kings Billabong Park	Community Members	Chapter 13 (Landscape character and visual amenity)
	Maintaining visual amenity from dwellings	Landholders	Chapter 13 (Landscape character and visual amenity)
Water	Sustainable management of water during construction in areas where water can be scarce	Council	Chapter 15 (Hydrology, flooding and water quality) and Chapter 21 (Waste management and resource use)

7.4 Public exhibition of the EIS

During the public exhibition period, the community and other stakeholders will be able to review the EIS and make a written submission to the DPIE for consideration in its assessment of the project.

During this time, TransGrid would undertake further consultation with the community and stakeholders using several of the consultation methods implemented prior to and during preparation of the EIS, including those summarised in the sections below. This would allow the community and other stakeholders to be informed about the proposal and the opportunity to provide a submission.

7.4.1 Display of the EIS

Electronic copies of the EIS will be available to be viewed:

- on the DPIE Major Projects website (www.majorprojects.planning.nsw.gov.au)
- on the EnergyConnect website (transgrid.com.au/energyconnect).

7.4.2 Interactive EIS map

An interactive EIS map is available through the EnergyConnect website (transgrid.com.au/energyconnect). This provides an online tool to explore the key outcomes of the EIS through interactive mapping and provides another way to view the EIS.

7.4.3 Project notifications and updates

To promote the EIS exhibition, TransGrid will continue to inform stakeholders through a variety of engagement tools, either in person or via digital platforms, including:

- stakeholder briefings
- community information sessions
- EnergyConnect webpage
- traditional media and advertisements
- social media.

Separate notifications would also be provided to directly affected landholders via email, informing them of the public exhibition process and providing details of the EnergyConnect telephone number (1800 49 06 66) and EnergyConnect website (transgrid.com.au/energyconnect) to find out more information.

7.4.4 Consideration of community feedback

At the completion of the display period the DPIE will provide TransGrid with a copy of all submissions and a summary of issues raised. A submissions report will be prepared responding to the issues raised and will be made available for viewing on the DPIE website. If changes to the project need to be made, a preferred infrastructure report (or an amendment report) would also be prepared.

7.5 Consultation during delivery of the proposal

Consultation with the community and key stakeholders would be ongoing in the lead up to and during construction of the proposal. The consultation activities would aim to provide:

- the community and stakeholders with a high level of awareness of all processes and activities associated with construction of the proposal
- accurate and accessible information and a timely response to issues and concerns raised by the community
- opportunities for feedback and input.

The EnergyConnect phone number and email address would continue to be available during construction. Targeted consultation methods, such as letters, notifications, signage and face-to-face communications, would also continue to occur. The TransGrid website and social media platforms would also include updates on the progress of the proposal.

The construction contractor engaged to construct the proposal would be required to prepare and implement a community communications strategy and complaints management procedure during construction to manage communications with the community and any community concerns or feedback. This strategy and procedure would be approved by TransGrid prior to construction commencing.

Part C

Environmental impact assessment

8. Approach to impact assessment

8.1 Overview

As discussed in Chapter 5 (Proposal infrastructure and operation) and Chapter 6 (Proposal construction), some aspects of the proposal design would continue to be refined during detailed design as opportunities to improve the proposal design and construction methodology are further investigated. Opportunities for refinement relate to:

- the location of the transmission line alignment, and micro-sitting of the transmission line structures connecting with the Buronga substation upgrade and expansion area
- construction facilities along the transmission line alignment within the proposal study area.

For example, there are likely to be opportunities for refinement of the transmission line structure locations during ongoing field validation of constraints, design development or as a result of government, landholder, community or other stakeholder feedback. This would also inform the final placement of access tracks and ancillary construction support facilities along the transmission line corridor.

The final design and construction methodology would be reviewed for consistency with the assessment contained in this EIS, and would be guided by:

- the hierarchy of constraints to avoid and/or minimise impacts (refer to Section 3.3)
- the mitigation measures identified in this assessment (refer to Section 23.1).

8.1.1 Assessment approach

To achieve a level of flexibility while undertaking a rigorous level of impact assessment, the approach adopted for this EIS has been to assess a 'worst case' impact. Most of the impact assessments (with the exception of biodiversity and heritage) have conservatively assumed that any area could be impacted by the proposal within the transmission line corridor, and areas identified for Buronga substation upgrade and expansion, the main construction compounds and accommodation camps at Anabranch South and Buronga. This provides an understanding of the 'worst case' impact as only a portion would be temporarily or permanently impacted by the proposal in reality.

Some access tracks may be required outside of the transmission line corridor, but would be located within the proposal study area. The locations of the additional access tracks would be selected in consultation with landholders and to avoid environmental impacts wherever possible, and would be subject to additional assessments and approvals (where required).

Biodiversity and heritage

For biodiversity and heritage, a conservative indicative disturbance area has been assessed to provide a greater understanding of the likely magnitude of direct impacts expected from the proposal. This approach was adopted to avoid a 'worst case' approach that would result in substantial overestimation of the likely biodiversity and heritage impacts (for example, assuming the whole of the transmission line corridor would be cleared of vegetation).

The indicative disturbance area comprises varying degrees of physical disturbance along the transmission line alignment to reflect construction and operational requirements – specifically:

- disturbance area A – this is the area where ground disturbance would be required. It refers to an area around transmission towers and between transmission towers in which all vegetation would be removed during construction and subject to ongoing maintenance during operation (i.e. removal to ground level) for operational and safety requirements (including bushfire)
- disturbance area B – this is the area where ground disturbance would not be required except in limited circumstances. It refers to an area between transmission towers in which trimming of vegetation above about two metres in height would be required to meet the vegetation clearance heights.

Figure 8-1 provides an overview of the key assumptions associated with the indicative disturbance area in a typical transmission line section.

The indicative disturbance area for these impact assessments also includes areas identified for Buronga substation upgrade and expansion and the main construction compounds and accommodation camps at Anabranch South and Buronga. These are contained within disturbance area A.

Following design refinement, if the indicative disturbance area is not consistent with what has been assessed in this EIS, and/or would impact on areas with notably different biodiversity or heritage value, the biodiversity and heritage assessments would be revised accordingly.

8.1.2 Additional main construction compounds and accommodation camp sites

As discussed in 6.7.1, additional main construction compounds and accommodation camp sites may be required and could be located outside the proposal study area. These sites would be selected using the selection criteria outlined in Section 3.3.6 to target areas of low environmental constraint. These sites would be identified once the property requirements have been determined by the construction contractor.

These sites would be subject of additional environmental assessment for consistency review, as relevant, once the property requirements and construction disturbance area are confirmed.

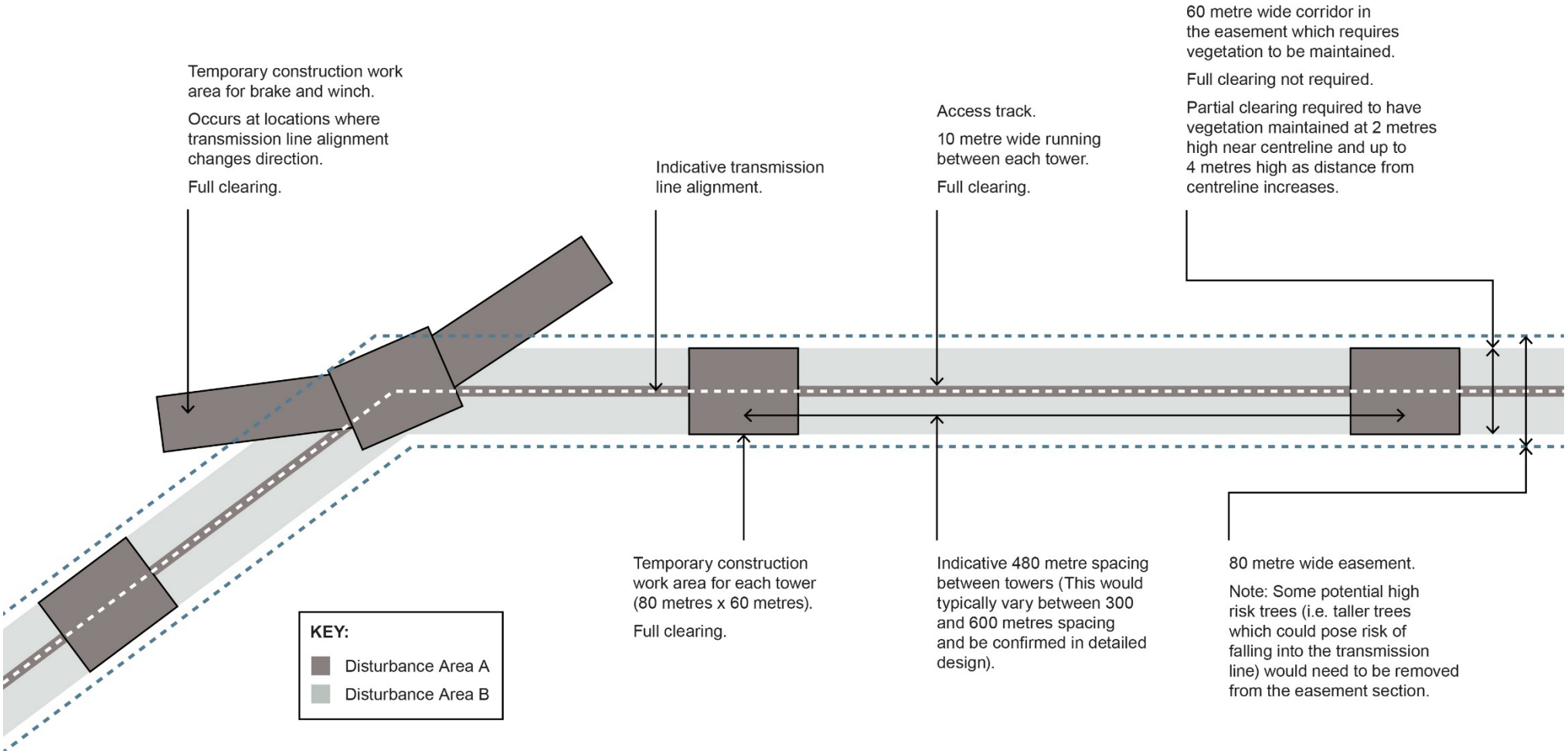


Figure 8-1 Indicative disturbance area definition for a typical transmission line section

9. Biodiversity

This chapter provides an assessment of potential biodiversity impacts of the proposal, identifies mitigation measures to address these impacts and the requirements to offset these impacts. This summarises the *Biodiversity Development Assessment Report* (BDAR) (WSP, 2020a) (refer Volume 2, Technical paper 1).

9.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to biodiversity and where these requirements are addressed in this EIS are outlined in Table 9-1.

Table 9-1 Secretary's environmental assessment requirements – biodiversity

Ref.	Secretary's environmental assessment requirements	Where addressed
Biodiversity		
Key issues	The EIS must address the following matters:	
	> an assessment of the biodiversity impacts of the project in accordance with the *NSW Biodiversity Conservation Act 2016* (BC Act), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR)	The chapter provides a summary of the BDAR (referred to as Technical paper 1) which has been prepared in accordance with the BC Act and BAM.
	> the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM	The proposal has applied the avoid, minimise and offset principles as outlined in Chapter 4 of the EIS and Technical paper 1 (the BDAR).
	> an assessment of the impacts of the project on aquatic ecology including impacts on key fish habitat and threatened species of fish.	Section 9.4.1 provides the assessment outcomes for impacts on aquatic habitat, which have been largely avoided.

On 25 June 2020, the delegate for the Federal Minister determined that the proposal was a controlled action under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in respect to impacts on EPBC Act listed threatened species and communities. It was also determined that the proposal (being the controlled action) would be assessed in accordance with the bilateral assessment agreement (refer to Section 1.4.2 for further detail).

Appendix A of the SEARs outlines the matters which must be addressed under the EPBC Act and Regulations. Appendix A of the SEARs requires an assessment of protected matters relating to listed threatened species and communities, and lists species that must be considered in the EIS and Technical paper 1 which the Australian Department of Agriculture, Water and the Environment considers (based on the information provided in the referral documentation):

> would likely be significantly impacted by the proposal, being the endangered Black-eared Miner (*Manorina melanotis*); or
> has the possibility of being significantly impacted by the proposal (19 threatened species or ecological communities), which requires further investigation.

Appendix A of the EIS outlines these requirements and where these requirements have been addressed in the EIS and Technical paper 1. Matters of National Environmental Significance are summarised in Section 9.3 and 9.4 of this EIS, with further detail provided in Section 7, Section 9.9 and Appendix E of Technical paper 1.

9.2 Assessment approach

9.2.1 Legislative and policy context

Potential biodiversity impacts resulting from the proposal were assessed in line with the following legislation (including associated guidelines):

- EPBC Act (Commonwealth), that provides protection for matters of national environmental significance including listed threatened species and ecological communities, listed migratory species and wetlands of international importance
- BC Act which outlines the framework for assessment, and offsetting, of biodiversity impacts in NSW. The BAM (Office of Environment and Heritage (OEH), 2017) is established under section 6.7 of the BC Act. The purpose of the BAM is to assess impacts on threatened species and threatened ecological communities, and their habitats, and the impact on biodiversity values, where required under the BC Act. The BC Act also introduced the Biodiversity Offsets Scheme (BOS), which has been addressed as part of the proposal
- *Biosecurity Act 2015* (BS Act), that provides for risk based management of biosecurity in NSW through prevention, elimination and minimisation of biosecurity risks. This assessment considers the presence of priority weeds and any control measures to minimise any risks
- *Fisheries Management Act 1994* (FM Act) regulates protection of fish and aquatic habitats in NSW, and applies to waterways within the proposal study area. Although certain provisions of the Act do not apply to CSSI (section 201, 205 and 219 of that Act), this assessment does consider potential impacts to threatened aquatic entities listed under the Act as required by the SEARs
- *Local Land Services Act 2013* (LLS Act). This Act excludes clearing of native vegetation and loss of habitat on category 1 - exempt land (previously cleared, contains low conservation value grasslands, contains regrowth vegetation or is identified as exempt land) from the BAM assessment. Some category 1 lands have been identified as part of the proposal.

Importantly, as noted in Section 9.1, on 25 June 2020, a delegate of the Federal Minister for the Department of Agriculture, Water and the Environment (DAWE) determined that the proposal was a controlled action under section 75 of the EPBC Act. The EPBC Act controlling provisions for the proposal are listed threatened species and communities (section 18 and 18A). The proposal will be assessed in accordance with the bilateral assessment agreement Amending Agreement No. 1, and as such, is required to be assessed in the manner specified in Schedule 1 to that Agreement, including, addressing the matters outlined in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations). This means that Commonwealth and State matters are both addressed in this EIS and separate reporting for Commonwealth and State matters is not required.

9.2.2 Methodology

The methodology adopted for the assessment is detailed in Technical paper 1, and was supported by:

- a desktop assessment, including a review of relevant databases, vegetation maps, aerial photography, published literature and species expert assessments, to identify threatened species, populations, communities and their habitats with a likelihood of occurrence in areas that may be impacted by the proposal. This included searches of PlantNet, Bionet Atlas of NSW Wildlife, EPBC Act Protected Matters Search Tool, Threatened biodiversity profile search and the Threatened aquatic fauna database. The database searches were carried out for an area of 10 kilometres around the proposal study area

- field surveys across late 2018, 2019 and 2020 within the proposal study area, including vegetation integrity plots, targeted flora and fauna surveys, fauna habitat assessments, diurnal bird surveys, fauna trapping and anabat surveys. Field survey techniques that were used were in general accordance with the NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004), NSW Guide to Surveying Threatened Plants (Office of Environment and Heritage, 2016) and Surveying threatened plants and their habitats; NSW guide for the BAM (Department of Planning, Industry and Environment, 2020) and relevant Commonwealth guidelines. The 2020 field survey guidelines published by DPIE were released during this projects survey period and were not strictly adopted for the survey method. The adopted systematic parallel transect method applied as the survey method was considered more suitable for the extensive linear nature of the proposal than a systematic plot-based approach (identified by the new guidelines) for the following reasons:
  - it more comprehensively sampled the indicative disturbance area within each sample section and
  - the relatively homogeneous nature of the PCT and condition for large sections provides relatively consistent habitat potential .

As discussed in Chapter 8 (Approach to impact assessment), the assessment has considered an indicative disturbance area within the proposal study area to provide a conservative assessment. The final alignment and easement of the transmission line would be confirmed during detailed design and would be located within the transmission line corridor. Therefore, there will be a degree of flexibility in determining the final location within the transmission line corridor area.

For impacts that could not be avoided, the assessment has considered:

- impacts due to the removal of native vegetation and habitat, including direct and indirect impacts on native vegetation and threatened flora
- the potential for serious and irreversible impacts on identified threatened species and ecological communities
- the prescribed impacts on biodiversity impacts under the BAM
- the potential for impacts on threatened species, ecological communities or their habitats listed under the FM Act and EPBC Act
- the potential for impacts to Groundwater Dependant Ecosystems (GDEs)
- the requirement for any offsets where impacts cannot be avoided or managed through mitigation measures, with offset obligations calculated using the Biodiversity Assessment Method Calculator (BAM-C).

9.3 Existing environment

9.3.1 Landscape context

The landscape features outlined below were used to inform the assessment of habitat suitability of the proposal study area for threatened species and the potential movement of species across the landscape.

The proposal study area occurs within three broad IBRA bioregions in western NSW that are comprised of four IBRA subregions, being:

- Murray Darling Depression region
  - South Olary Plain subregion
- Darling Riverine Plains region
  - Great Darling Anabranch subregion
  - Pooncarie – Darling subregion
- Riverine region
  - Robinvale Plain subregion.

Key landscape features of the proposal study area and surrounds include:

- The Great Darling Anabranch, Darling River, Murray River and a number of unnamed creeks occur in the proposal study area.
- No important wetlands were recorded within the proposal study area. However, local wetlands in the form of unnamed salt (playa) lakes occur within the western sections of the proposal study area, which form part of the broader Nulla Bulla saline discharge complex.
- There are large areas of connected native vegetation within the proposal study area, which connect to other key landscape features beyond the proposal study area, such as Lake Victoria, or conservation areas in eastern SA (e.g. Chowillla Regional Reserve to the west, or Mallee Cliffs National Park, Southern Mallee conservation areas to the east). Fringing vegetation along rivers, such as the Great Darling Anabranch, Darling and Murray Rivers, also provide connectivity within the broader landscape.
- Gypsum soils, which are preferentially favoured by rare gypsum obligate species such as *Austrostipa nullanulla* (Endangered) and the highly restricted *Elacanthus glaber* and *Roepera compressa*, were observed in a restricted area on the eastern edge of the Nulla Station within the proposal study area and adjoining lands.
- No legislated areas of outstanding biodiversity values have been declared within the proposal study area.
- The landscape is generally well connected in terms of habitat connectivity, being a mostly naturally vegetated open isolated part of NSW, albeit subjected to ongoing grazing and agricultural clearing impacts.

9.3.2 Native and exotic vegetation

The proposal study area predominately comprises of native vegetation, with limited scattered areas considered to be cleared of native vegetation (for the purposes of LLS Act), and therefore being excluded from the BAM. Large areas within the proposal study area are used for grazing, but comprise of derived native vegetation that exceeds 50 per cent native cover. As such, these areas have been assessed as native vegetation, along with other sensitive regulated land (such as land covered by Property Vegetation Plans).

Broadly, the proposal study area has been subject to ongoing historical agricultural use, primarily for grazing. Much of the remaining mallee areas are comprised of younger whipstick mallee that has regrown following previous clearing for agriculture. The effects of semi-regular clearing combined with grazing (sometimes in drought conditions) has resulted in an overall landscape that while mostly comprised of native vegetation is not high quality undisturbed native vegetation or habitat.

Twenty plant community types (PCTs) were identified in the proposal study area. Two of these PCTs (PCT19 and PCT21) meet the criteria of one threatened ecological community, being Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions (Sandhill Pine Woodland). This community is listed as an endangered ecological community (EEC) under the BC Act. The PCTs found within the proposal study area do not correspond to any EPBC Act listed threatened ecological communities.

Further detail on the native vegetation is presented in Technical paper 1. A full set of detailed PCT maps within the proposal study area refer to Appendix A-4 of Technical paper 1.

Two of the exotic flora species recorded within the proposal study area during field surveys were *Lycium ferocissimum* (African boxthorn) and *Opuntia* species (Prickly pear – Opuntia). These weeds are listed under the BC Act as priority weeds for the Western region (Department of Planning, Industry and Environment, 2020) and Weeds of National Significance (WONS) (Australian Weeds Committee, 2020). A number of other weeds were recorded during field surveys, including as *Asphodelus fistulosus* (Onion Weed), *Emex australis* (Spiny Emex), *Marrubium vulgare* (Horehound), *Nicotiana glauca* (Tree Tobacco), *Onopordum acaulon* (Stemless Thistle), *Tribulus terrestris* (Cat-head) and *Xanthium occidentale* (Noogoora Burr).

9.3.3 Habitat types

The four main habitat types, or habitat stratification units are:

- Riverine
- Arid Woodland/Shrublands
- Chenopod Shrublands
- Wetlands.

The Riverine habitat type is broadly associated with riverine environments. These are dominated by Black Box and River Red Gum woodlands and forests. The vast majority of this fauna habitat stratification unit occurs in association with the Great Darling Anabranch, the Darling River and the Murray River. It is highly modified, mostly consisting of a tree canopy layer with generally a highly disturbed understorey and groundcover, owing to the historical agricultural and grazing use for over 140 years. The association with the permanent or semi-permanent rivers still lends this stratification unit regional importance as it is a habitat that provides water within an arid or semi-arid landscape. Tree hollows occur within older River Red Gums and Black Box and these are an important nesting resource for species such as parrots, microchiropteran bats, arboreal fauna and reptiles.

The Arid Woodland Shrublands are broadly associated with arid interior areas. This habitat stratification unit mostly occurs in the western part of the proposal study area to the SA/NSW border. It is dominated primarily by mostly whipstick (young) Mallee, with older bull Mallee occurring adjacent to the SA/NSW border. The Mallee is dominated by spinifex or chenopod understorey. Typically it is highly or partially modified as a result of agricultural and grazing use, which relies on maximum grazing especially in dry times. Due to its disturbed condition, while it still provides habitats for those fauna that primarily rely on tree canopies, those species that require complex shrub layer and groundcovers are less likely to be present. Tree hollows generally do not occur within this fauna stratification unit at a high density, even in the older Mallee areas as Mallee generally needs to be very old to form hollows.

The Chenopod Shrublands occur in the arid and semi-arid interior parts of the proposal study area. They do not contain a dense or dominant tree canopy but are dominated by dense shrubs such as Black Bluebush, Pearl Bluebush and saltbush. Like the other fauna habitat stratification units, these have generally also been impacted by agriculture and grazing, though the presence of some dense areas of shrublands means that native fauna species still persists throughout this unit.

The wetland habitat stratification unit is very small, occupying only 0.33 hectares in total within the indicative disturbance area. These are located in lower lying areas near the riverine areas and tend to be dominated by Lignum shrubs and be ephemerally wet in nature. These areas can be important within the arid and semi-arid region by providing a water source and in particularly providing habitat for amphibians in wet times.

9.3.4 Threatened flora species

Field surveys carried out for the proposal identified five threatened flora species within the proposal study area. These are:

- *Acacia acanthoclada* (Harrow Wattle) listed as endangered under the BC Act
- *Atriplex infrequens* (A saltbush) listed as vulnerable under the BC Act and EPBC Act
- *Austrostipa nullanulla* (A spear-grass) listed as endangered under the BC Act
- *Dodonaea stenozyga* (Desert Hopbush) listed as critically endangered under the BC Act
- *Santalum murrayanum* (Bitter Quandong) listed as endangered under the BC Act.

9.3.5 Threatened fauna species

Field surveys carried out for the proposal identified one threatened fauna species within the proposal study area that requires species credit offsets, being *Polytelis anthopeplus monarchoides* Regent Parrot (eastern subspecies), listed as endangered under the BC Act and vulnerable under the EPBC Act.

Fifty-five threatened fauna species were identified as having a potential for occurrence within the indicative disturbance area given the presence of suitable habitat and are classified as ecosystem credit species. Of these, five threatened fauna were recorded that potentially could have required species credits if evidence of breeding was noted within the indicative disturbance area. However due to no evidence of breeding of these species, they are classified as ecosystem credit species. These species are:

- *Hamirostra melanosternon* (Black-breasted Buzzard), listed as vulnerable under the BC Act
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle), listed as vulnerable under the BC Act
- *Hieraaetus morphnoides* (Little Eagle), listed as vulnerable under the BC Act
- *Lophochroa leadbeateri* (Major Mitchell's Cockatoo), listed as vulnerable under the BC Act
- *Lophoictinia isura* (Square-tailed Kite), listed as vulnerable under the BC Act.

Of these ecosystem credit species, 23 species were recorded within or adjacent to the proposal study area.

9.3.6 Migratory species

Twenty-six migratory species are considered to have a moderate likelihood of occurrences within, or adjacent to, the proposal study area, and an additional nine marine bird species may occur in habitats on occasion within the proposal study area. Three migratory and/or marine bird species listed were recorded within the proposal study area during field survey, being the White-bellied Sea Eagle, Rainbow Bee-eater and Great Egret. An additional seven migratory species were recorded outside the proposal study area in local or regional wetlands and therefore could move through the proposal study area at times:

- Sharp-tailed Sandpiper (Chowilla regional reserve)
- Pectoral Sandpiper (Chowilla regional reserve)
- Red-necked Stint (Chowilla regional reserve)
- Greater Sand Plover (Chowilla regional reserve)
- Black-winged Stilt (Chowilla regional reserve)
- Caspian Tern (Recorded in local riparian and wetland habitats)
- Red-necked Avocet (Chowilla regional reserve).

9.3.7 Aquatic species

Within the proposal study area, threatened aquatic habitat occurs in the form of fresh and saline wetlands, rivers and creeks that contain mapped key fish habitats (Strahler 4th and 5th order streams) and other open water bodies such as agricultural dams, irrigation canals, road table drains and low depressions that periodically pond water. Areas of mapped key fish habitat have been considered to provide moderate likelihood of occurrence for the following threatened species:

- Darling River Snail (*Notopala sublineata*) listed as critically endangered under the FM Act
- Eel-tailed Catfish (*Tandanus tandanus*) listed as endangered under the FM Act
- Hanley's River Snail (*Notopala hanleyi*) listed as critically endangered under the FM Act
- Murray Crayfish (*Euastacus armatus*) listed as vulnerable under the FM Act
- Murray Hardyhead (*Craterocephalus fluviatilis*) listed as critically endangered under the FM Act and vulnerable under the EPBC Act
- Silver Perch (*Bidyanus bidyanus*) listed as vulnerable under the FM Act, and Critically endangered under the EPBC Act.

Two EECs listed under the FM Act have potential to occur within the proposal study area:

- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River Lowland
- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Murray River Lowland.

9.3.8 Groundwater dependent ecosystems

At the time of writing, no public information on the location of high priority GDEs was available for water sharing plans that are applicable to groundwater sources within the proposal study area. No high priority GDEs were documented in historical water sharing plans that were superseded on 1 July 2020.

A search of the National Groundwater Information System (NGIS) (BOM, 2020) identified six GDEs with high potential for groundwater interaction within the proposal study area.

The six GDEs with high potential for groundwater interaction are in proximity to the Darling River, Great Darling Anabranch and Murray River based on National Groundwater Information System (NGIS) (BOM, 2020). Two additional GDEs with high potential for groundwater interaction were identified by the Bureau of Meteorology Groundwater Dependent Ecosystems Atlas:

- two non-connected populations of Mallee (vegetation) that occur northeast of Lake Victoria; one at the edge of the proposal study area and the other within the proposal study area and extending approximately five kilometres to the northwest
- an additional grouping of Mallee and *Eucalyptus largiflorens* occur proximal to the townships of Buronga and Wentworth, approximately one kilometre from the proposal study area.

9.3.9 Wetlands of national and international importance

Seven nationally important wetlands are located within 25 kilometres of the proposal study area and are located in SA and Victoria.

Three wetlands of international importance were identified by database searches:

- Riverland – in Chowchilla Game Reserve in SA and is located three kilometres to the south west of the SA/NSW border at its most western extent of the proposal study area, located in South Australia
- Banrock station wetland complex – located 40 to 50 kilometres downstream of the proposal study area
- The Coorong, and Lakes Alexandra and Albert Wetland, located 150 to 200 kilometres downstream of the proposal study area.

The Riverland site would be the only wetland of international importance of concern to the proposal, but it would not be directly impacted. The mitigation measures would ensure that no indirect downstream impacts would occur.

9.4 Potential impacts – construction

This section presents the potential impacts of the proposal on biodiversity during construction which have not been avoided through design development to date. Impacts that have been avoided through design are detailed in Chapter 4 of the EIS and Section 8 of Technical paper 1.

The main impacts on biodiversity during construction would be:

- direct impacts:
  - clearing of native vegetation
  - removal of threatened species and/or their habitat
- indirect impacts.

9.4.1 Direct impacts

Direct impacts to native vegetation

Around 607 hectares of native vegetation, consisting of 20 PCTs, would be directly impacted by the proposal, based on the indicative disturbance area. Around 293 hectares of the 607 hectares would not be completely modified within the easement due to growth under two metres being retained (being vegetation within disturbance area B).

Of the 607 hectares, 14 hectares also comprises the Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions EEC, which is listed under the BC Act.

As outlined previously, this native vegetation has been subject to ongoing historical agricultural use, primarily for grazing and the effects of semi-regular clearing combined with this grazing (sometimes in drought conditions) has resulted in an overall landscape that while is mostly comprised of native vegetation is not high quality undisturbed native vegetation or habitat. This includes the Sandhill Pine Woodland EEC, all of which occurs in zones identified as “modified” vegetation.

As discussed in Section 9.2.2, the assessment considers the indicative disturbance area, which is a conservative estimate of the area subject to direct impacts. Opportunities to further reduce the impacts to native vegetation will be considered during detailed design. This would include the selection of the final transmission tower structure locations and access tracks.

Direct impacts to threatened flora species

Four threatened flora species would be directly impacted by the proposal, as detailed in Table 9-2.

For EPBC listed flora species, of which *Atriplex infrequens* is the single flora species, the direct impacts would be unlikely to have a significant impact on the species as described in Technical paper 1.

Table 9-2 Direct impacts on threatened flora species (species credit species) due to the clearing

Species name	Common name	BC Act[1]	EPBC Act[2]	Direct impact (area / individuals)
Acacia acanthoclada	Harrow Wattle	E	-	0.01 ha
Atriplex infrequens	A saltbush	V	V	0.26 ha
Austrostipa nullanulla	A spear-grass	E	-	2.18 ha
Santalum murrayanum	Bitter Quandong	E	-	18 individuals

(1) V = vulnerable, E = endangered, CE = critically Endangered under the BC Act

(2) V = vulnerable, E = endangered under the EPBC Act.

Direct impacts to threatened fauna species

Direct clearing impacts on threatened species listed under the BC Act and EPBC Act within the indicative disturbance area are presented in Table 9-3.

All other recorded threatened fauna are ecosystem credit species who are assumed to be present (and/or were recorded) and impacted. These impacts are offset via the requirement for ecosystem credits for PCT impacts and these are not included in the below table.

For EPBC listed fauna species, the direct impacts would be unlikely to have a significant impact on the species as described in Technical paper 1. Impact to these species’ habitats will be offset on a like for like basis as required in the bilateral assessment agreement.

Table 9-3 Direct impacts on threatened fauna species (species credit species) due to the clearing

Scientific name	Common name	BC Act[1]	EPBC Act	Impact (hectares)
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	E	V	6.91

(1) V = vulnerable, E = endangered, CE = critically endangered under the BC Act

(2) V = vulnerable, E = endangered, CE = critically endangered under the EPBC Act.

9.4.2 Indirect impacts

The assessment of indirect impacts has been prepared in accordance with section 9.1.4 of the BAM. Indirect impacts have been considered in terms of the nature, extent and duration of impacts on native vegetation, threatened ecological communities and threatened species habitats likely to be affected and is presented in Table 9-4.

Table 9-4 Summary of indirect impacts during construction

Indirect impact	Discussion	Consequence
Inadvertent impacts on adjacent habitat or vegetation	Disturbance of soils and construction activities has the potential to result in sedimentation and erosion and mobilisation of contaminants, which could impact adjoining native vegetation and aquatic habitats, if not properly managed, particularly where works are in proximity to rivers, creek lines and Key Fish Habitats. These impacts have the potential to reduce the viability of habitat for aquatic and semi aquatic species temporarily. Any impacts would be of short term duration. The proposal would minimise impacts to these sensitive environmental receivers by targeting narrow crossing points of the Great Darling Anabranch, Darling River and Murray River. The mobilisation of sediments would be contained within the disturbance area as sediment containment measures would be implemented as part of mitigation measures (refer to Section 9.6).	Low
Reduced viability of adjacent habitat due to edge effects	Fragmentation would be minimised where possible by utilising existing easements and areas of prior disturbance. Removal of vegetation would have a long term impact however, vegetation to be retained with the transmission line corridor would provide a buffer to areas that would be directly impacted by clearing (disturbance area A). Impacts at the Buronga substation and main construction compounds and accommodation camps would be comparatively minor at a local and regional scale.	Negligible

Indirect impact	Discussion	Consequence
Reduced viability of adjacent habitat due to noise, dust or light spill	Noise, dust and light spill during construction would be short term and would unlikely have long term adverse impacts on the viability of adjacent habitats, as: > Noise impacts would be short-term and would be mostly limited to day time periods. > Increases in localised dust levels are unlikely to be at levels that would adversely impact adjacent habitats, or differ to dust generated by agricultural activities. > Light spill is not expected to be to an extent that would impact the viability of adjacent habitats.	Negligible
Transport of weeds and pathogens from the site to adjacent vegetation	Any potential impacts would be long term, as it would lead to a reduction in vegetation integrity. However, biosecurity measures would be implemented to ensure risks are managed.	Negligible
Increased risk of starvation, exposure and loss of shade or shelter	Displacement of fauna species during clearing is considered relatively low due to the modified vegetation structure, and of short term duration. Increased risk due to starvation, exposure and loss of shade and shelter is considered low given the linear nature of the proposal and mostly highly mobile nature of most potential resident fauna species. Any impacts would be of short term duration.	Negligible
Loss of breeding habitats	The loss of breeding habitat such as hollow-bearing trees, old growth bull mallee lignotubers, *Triodia* grass clumps and fallen timber would be long term and has the potential to affect native animals. The loss of habitat would be limited to the indicative disturbance area.	Low
Trampling of threatened flora species	Impacts could occur in areas not directly impacted by clearing, if not properly managed, and would be of short term duration. Mitigation measures, such as through the delineation of no-go areas, would manage this risk.	Low
Increased risk of fire	Construction works may increase bushfire risk, if not properly managed. However, a Bushfire Risk Management Sub-Plan will be implemented to ensue any bushfire risk is managed during construction.	Low

9.4.3 Prescribed biodiversity impacts

An assessment of prescribed biodiversity impacts was prepared in accordance with section 9.2 of the BAM and is presented in Section 9.3 of Technical paper 1. Prescribed impacts are those impacts not easily quantified in terms of direct clearing or impact to native vegetation or habitat.

The assessment found that all prescribed biodiversity impacts would be minor or low-level with minor impacts to:

- the habitat of threatened species or ecological communities, with respect to the impact to gypsum soils and *Austrostipa nullanulla* that are preferentially favoured by rare gypsum obligate species such as *Austrostipa nullanulla* (Endangered) and the highly restricted species *Elacanthus glaber* and *Roepera compressa.* The majority of this area of geological significance would be avoided, with around 2.18 hectares directly impacted by the proposal. The minor impact to gypsum soils, and *Austrostipa nullanulla*, would be permanent but would not be significant with the implementation further mitigation measures. Residual impacts would be appropriately offset
- connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range, and movement of threatened species that maintains their life cycle. The removal of vegetation would impact connectivity and movements in the long term, however, the impacts would be minor given the existing disturbed corridors would be used, the corridor would remain permeable, and impacts would reduce over time. Mitigation measures to minimise bird strike will also be implemented.

9.4.4 Serious and irreversible impacts

The proposal has been identified to impact on one entity currently listed as serious and irreversible impacts (SAIIs) in the Threatened Biodiversity Data Collection (EES, 2020). This SAII entity is *Austrostipa nullanulla* as further outlined in Table 9-5. The proposal would provide biodiversity offsets, in the form of species credit species, for the impacts to this species. The vast majority of the *Austrostipa nullanulla* recorded, and its habitat, would not be impacted by the proposal and the proposal has been designed to maximise avoidance of this species. The proposal is not expected to have a substantial impact on this species.

An additional recorded SAII threatened flora species, being *Dodonaea stenozyga* (Desert Hopbush), was recorded within the proposal study area and was within the original alignment corridor; however, impacts to this species have been avoided by locating the transmission line corridor to the northern side of Renmark Road. The Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions EEC within the indicative disturbance area is not considered as a SAII entity.

Further detail is provided in Table 9.16 of Technical paper 1.

Table 9-5 SAII entities recorded within the indicative disturbance area

SAII entity	BC Act	Threshold	Impact (ha)	Consideration
Austrostipa nullanulla (A Spear Grass)	E	Not listed	2.18	> The local population has over 200,000 individuals, with a restricted distribution on Nulla Station. A large proportion of the local population has been protected under conservation agreements. > The proposal avoids impacts to the areas subject to conservation agreements. Further refinement to the disturbance area during detailed design would further minimise impacts to this species.

SAII entity	BC Act	Threshold	Impact (ha)	Consideration
Austrostipa nullanulla (A Spear Grass) (cont.)				> The direct impact to habitat occurs on the south-east extent of the population and is unlikely to fragment or isolate the existing population to an extent that would adversely impact the ecology of the population, or life cycle, genetic diversity or long-term evolutionary development of the species. > Biosecurity management measures would be implemented to manage risk of any invasive flora during construction.

9.4.5 Key threatening processes

Consideration of key threatening processes (KTP) applicable to the proposal are considered in Table 9-6.

Table 9-6 Key Threatening processes

Key Threatening Process	Relevance	Consideration
Clearing of native vegetation	High	The proposal would result in the clearing of native vegetation and contribute to this key threatening process. However it is unlikely to significantly exacerbate this key threatening process as approaches to further minimise and avoid clearing would be considered during detailed design, and mitigation measures to address impacts of clearing and indirect impacts would be implemented.
Infection of native plants by *Phytophthora cinnamomi*	Low	While native vegetation would be removed, biosecurity measures would be implemented to manage these risks.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis		
Invasion and establishment of exotic vines and scramblers		
Invasion of native plant communities by exotic perennial grasses		
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants		

Key Threatening Process	Relevance	Consideration
Loss of hollow-bearing trees	High	The proposal would contribute to this key threatening process as the loss of breeding habitat such as hollow-bearing trees, old growth bull mallee lignotubers, *Triodia* grass clumps and dead fallen timber has the potential to impact species that rely on these features (such as hollow-nesting and canopy-nesting birds, hollow-bearing bats, reptiles and arboreal mammals). Approaches to further minimise these impacts would be considered during detailed design, however, complete avoidance of these impacts is unlikely. As such additional mitigation measures would be implemented (including nest box replacement). With these measures in place, the proposal is unlikely to significantly exacerbate this key threatening process.
Removal of dead wood and dead trees		

9.4.6 Assessment of impacts of groundwater dependent ecosystems

No high priority GDEs were identified within the recently superseded water sharing plans for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011 and Lower Murray Darling Unregulated and Alluvial Water Sources 2011. Subsurface impacts to groundwater are expected to be comparatively negligible. No substantive impacts to GDE's are anticipated.

9.4.7 Impacts on aquatic species and habitat

Impacts from the proposal on aquatic habitats, particularly mapped key fish habitats (Strahler 4/5th Order streams) are considered likely to be negligible. Avoiding and minimising impacts on aquatic habitats would be a priority of detailed design and any residual indirect impacts would be subject to appropriate project specific mitigation measures.

The proposal would not have a direct impact on the fish and aquatic invertebrates that form part of the two EECs located within the indicative disturbance area – the Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River Lowland EEC and Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Murray River Lowland EEC. However, limited disturbance to riparian vegetation would be required where vegetation must be removed to meet operational requirements for the proposed transmission line, with all shrub and ground stratum vegetation retained in-situ. Further, transmission line structures would be located around 50 to 100 metres from the waterways to avoid impact to riparian areas. As these impacts would be minor, and water quality impacts during construction would be managed, the proposal would not have a significant impact on the EECs.

Further, the proposal is not considered likely to significantly impact any EPBC Act listed threatened fish species. The Silver Perch, Murray Hardyhead and Murray Cod have been assumed to occur within suitable waterway habitats within the proposal study area due to mapped habitat, waterway classification for fish passage, and/or Key Fish Habitat mapping. However, the waterways would be spanned by the transmission lines, structures would not be built within the riparian zone, and appropriate buffers would be placed around the structures to ensure indirect impacts do not occur.

9.4.8 Migratory species

While some migratory or marine bird species are likely to use the proposal study area and locality, no important habitats for EPBC listed migratory species are located in the proposal study area, including nationally or internationally important habitats for migratory wetlands species as defined by the *EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Department of the Environment, 2015a). Further:

- no important habitats for the Fork-tailed Swift or the White-throated Needletail are located in the proposal study area as outlined in the *Draft Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015b)
- no nationally significant proportion of a listed migratory bird population would not be supported by the habitats in the proposal study area
- the proposal would not substantially modify, destroy or isolate an area of important habitat for any EPBC Act listed migratory species
- construction of the proposal would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

9.4.9 Wetlands of national and international importance

The Riverland RAMSAR wetland complex in the Chowchilla Game Reserve is located around three kilometres to the south west of the SA/NSW state border and the Banrock station wetland complex is located 40 to 50 kilometres downstream of the proposal study area. These wetlands would not be directly or indirectly impacted by the proposal.

9.5 Potential impacts – operational

The proposal would have limited ongoing biodiversity impacts once operational. The key potential operational impacts are the following:

- ongoing regular access requirements for maintenance of the infrastructure – impacts of infrastructure maintenance are expected to be negligible as access would occur via access tracks
- ongoing vegetation maintenance to ensure that TransGrid maintenance procedures and the required bushfire protection aspects are implemented. The impacts of this activity have been factored into the construction assessment through the predicted impacts to vegetation integrity. Existing procedures would ensure retained biodiversity values are adequately protected during maintenance activities
- increased potential for bird collision – impacts are expected to be low, with the proposed transmission lines likely to be below flight paths for a majority of species. Mitigation measures are detailed in Section 9.6.1 to ensure the likely impacts are minimised.
- impacts of electric and magnetic fields (EMF) to local fauna populations. However, as outlined in Technical paper 11, most studies indicate that EMF exposure of birds generally changes (but not always consistently in effect or direction) their behaviour, reproductive success, growth and development, physiology and endocrinology, and oxidative stress under EMF conditions.

9.6 Management of impacts

9.6.1 Environmental management

The environmental management approach and framework has been developed to be consistent with the regulatory requirements for management of biodiversity impacts, identified as likely to be encountered during the construction and operational phases of the proposal. Further details on the environmental management approach for the proposal are provided in Chapter 23 (Environmental Management).

For construction, a Biodiversity Management Sub-Plan (BMP) would set out measures to minimise and manage impacts on biodiversity. It will include (as a minimum):

- measures to minimise impacts to biodiversity, including measures to reduce disturbance to sensitive flora and fauna
- procedures for clearing of vegetation, including pre-clearing inspections and procedures for the relocation of flora and fauna
- procedures for the demarcation and protection of retained vegetation, including vegetation adjacent to construction areas
- weed management
- rehabilitation strategies including progressive rehabilitation, and measures for the management and maintenance of rehabilitated areas (including duration)
- procedures for unexpected EECs or threatened flora and fauna during construction, including stop work procedures
- monitoring requirements and compliance management.

9.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to biodiversity are listed in Table 9-7.

Additional mitigation measures, as identified in other chapters of the EIS, would also be relevant to the management of potential impacts to biodiversity. This includes:

- Chapter 12 (Land use and property) with respect to biosecurity risks
- Chapter 15 (Hydrology, flooding and water quality) with respect to water quality
- Chapter 20 (Soils, contamination and groundwater) with respect to soil and erosion impacts, and groundwater management.

Table 9-7 Mitigation measures – biodiversity

Reference	Mitigation measure	Timing	Applicable location(s)
B1	The final disturbance area will seek to avoid the clearing of native vegetation and habitats as far as practicable. In particular threatened species recorded and their habitat, including *Acacia acanthoclada*, *Atriplex infrequens*, *Austrostipa nullanulla*, *Dodonaea stenozyga* and *Santalum murrayanum*	Detailed design	All locations
B2	Where vegetation disturbance activities are required in areas that have not been previously subject to biodiversity survey, additional survey will be carried out prior to works occurring in any such areas and to inform detailed design. These surveys will be carried out by a suitably qualified ecologist.	Detailed design	All locations
B3	Opportunities to locate site offices, compounds and ancillary facilities in areas of limited biodiversity value (e.g. cleared land or areas of native vegetation with vegetation integrity scores of less than 17) will be prioritised during detailed design.	Detailed design	All locations
B5	Existing tracks and clearings will be used, where possible, to avoid the construction of new tracks. Where this is not possible, the design will seek to minimise impacts to native vegetation as a priority.	Detailed design	Transmission line corridor
B6	Transmission line structures will be located at to minimise impact to vegetated riparian zones.	Detailed design	Transmission line within the riparian zone of Great Darling Anabranch, Darling River and/or Murray River
B7	Conductor line-marking techniques will be implemented during detailed design to minimise bird strike.	Detailed design	Transmission line – within one kilometre of wetland / riverine habitats (i.e. Great Darling Anabranch, Darling River and Murray River)
B8	Pre-clearing surveys will be completed prior to construction by a suitability qualified ecologist.	Pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
B9	Nest boxes will be provided to minimise habitat loss to hollow-bearing fauna in accordance with a Nest Box Strategy. The strategy will include the following requirements: > hollow-bearing trees will be marked/tagged and mapped in a pre-clearing survey > the size, type, number and location of nest boxes required will be based on the results of the pre-clearing survey > 70 per cent of nest boxes will be installed about one month prior to any hollow-bearing vegetation removal, with all nest boxes to be installed within six months from the date of commencement of clearing.	Pre-construction	All locations where hollow bearing trees are being removed.
B10	Biodiversity exclusion zones for retained vegetation, including identified threatened flora populations that have a high susceptibility to trampling and compaction, will be clearly identified by a suitably qualified ecologist prior to the commencement of construction.	Pre-construction	All locations
B11	Construction workforce will be supplied with sensitive area maps (showing clearing boundaries and exclusion zones), including updates as required.	Construction	All locations
B12	The predicted clearing of native vegetation by the proposal will be monitored against the recorded clearing to inform any final biodiversity offset requirements within the biodiversity offset package.	Construction	All locations
B13	Shrub or ground stratum native vegetation within vegetated riparian zones (within the definition of Water Management Act 2000) of the Great Darling Anabranch, Darling River and/or Murray River (and other defined riparian areas) will not be removed, with vegetation clearing limited to the tree stratum only, with trunk bases being retained in-situ.	Construction	Transmission line within the riparian zone of Great Darling Anabranch, Darling River and/or Murray River
B14	Activities within vegetated riparian zones will be managed to minimise impacts to aquatic environments. Riparian areas subject to disturbance will be progressively stabilised and rehabilitated.	Construction	Transmission line within the riparian zone of Great Darling Anabranch, Darling River and/or Murray River

Reference	Mitigation measure	Timing	Applicable location(s)
B15	A species unexpected finds protocol will be implemented if threatened ecological communities, flora and fauna species, not assessed in the biodiversity assessment, are identified in the disturbance area.	Construction	All locations

9.6.3 Biodiversity offset credit report

Chapter 12 of Technical paper 1 (Biodiversity assessment report) addresses Section 11 of the BAM and provides information on the application of the no net loss standard and the proposal's biodiversity offset obligations. Credit calculations were quantified using the BAM-C Version 1.2.7.2.

The proposal offset obligation for the indicative disturbance area has been calculated to require the following biodiversity credits:

- 8,845 ecosystem credits
- 254 species credit.

The biodiversity offset strategy comprises four options of:

- purchasing and retirement of existing biodiversity credits currently available on the biodiversity credit register
- establishing a biodiversity stewardship site(s) on lands with like for like biodiversity values to those impacted by the proposal
- making a payment into the Biodiversity Conservation Fund
- alternative strategic offset outcomes.

The final obligation would be confirmed as the design of the proposal is further refined and the disturbance area is confirmed (as discussed below).

9.6.4 Managing residual impacts and uncertainties

The biodiversity assessment is based on an indicative disturbance area to develop an understanding of the likely magnitude of potential impacts from the proposal and retain flexibility during design refinement (refer to Chapter 8). During design refinement, the final location of transmission line structures and construction facilities (including access tracks) would be located with the aim to further avoid or minimise impacts on native vegetation, where possible.

Further biodiversity investigations may be undertaken once the final disturbance impact area is determined. Following further surveys (if required) and design refinement, the potential for impacts on biodiversity would be confirmed.

10. Aboriginal heritage

This chapter provides an assessment of potential Aboriginal heritage impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Non-Aboriginal and Aboriginal Cultural Heritage Assessment Report* (Navin Officer, 2020a) (refer Volume 2, Technical paper 2).

10.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to Aboriginal heritage and where these requirements are addressed in this EIS are outlined in Table 10-1.

Table 10-1 Secretary's environmental assessment requirements – Aboriginal heritage

Ref.	Secretary's environmental assessment requirements	Where addressed
Heritage		
Key issues	The EIS must address the following matters: > an assessment of the Aboriginal and historic heritage (cultural and archaeological) impacts of the project	Sections 10.4 and 10.5 provide an assessment of Aboriginal heritage impacts.
	> adequate consultation with the local Aboriginal community and other relevant stakeholders, having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010).	Chapter 7 and Section 10.2.2 outline the consultation undertaken with the local Aboriginal community and other relevant stakeholders.

10.2 Assessment approach

10.2.1 Legislative and policy context

Potential Aboriginal heritage impacts resulting from the proposal were assessed in line with the following legislation and key guidelines:

> Australian International Council on Monuments and Sites *Charter for Places of Cultural Significance* (also known as the Burra Charter; Australian ICOMOS, 2013), which defines cultural significance as 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations' and provides relevant criteria to assess cultural significance

> Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH, 2010), which outlines a process for effective consultation with Aboriginal peoples, and stipulates that where relevant, consultation must be conducted with Native title holders or registered native title claimants in accordance with the *Native Title Act 1994*

> *National Parks and Wildlife Act 1974,* which provides protection for Aboriginal cultural heritage in NSW, including Aboriginal objects and declared Aboriginal places, and establishes the requirement to notify the DPIE if any previously unrecorded Aboriginal object is identified. As the proposal has been declared as Critical State significant infrastructure in accordance with the EP&A Act, section 90 of the *National Parks and Wildlife Act 1974*, which outlines the requirements for Aboriginal heritage impact permits, does not apply (refer to Section 5.23 of the EP&A Act)

> *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which provides protection for matters of national environmental significance and recognises the role of indigenous people and their knowledge

- *Native Title Act 1994*, which was introduced to work in conjunction with the *Commonwealth Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act. The proposal study area intersects with the Barkandji Traditional Owners #8 (Part A) native title area (determined). Barkandji Traditional Owners have been included in consultation and archaeological survey for the proposal
- *Aboriginal Land Rights Act 1983,* which establishes the local Aboriginal land councils (LALCs) to protect and promote awareness of the culture and heritage of Aboriginal persons in the council's area. This Act also establishes a mechanism for LALCs to claim Crown lands that are not lawfully needed for an essential public purpose. No claimable Crown lands have been identified that would be affected by the proposal.
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (DECCW, 2011), which provides guidance on the process to follow when investigating and assessing whether Aboriginal cultural heritage values and objects are present and the harm a proposed activity may cause to them. It also includes the requirements for an Aboriginal cultural heritage assessment report
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (NSW DECCW 2010b), which specifies minimum standards for archaeological investigation undertaken in NSW.

10.2.2 Methodology

Overview

The study area for the assessment of Aboriginal heritage included:

- a heritage study corridor used for searches of relevant databases, including a 10 kilometre buffer on the centreline of the proposal study area
- a heritage survey area for the completion of a walkover (discussed further below), which was centred on the indicative disturbance area (refer to Chapter 8 for definition of the indicative disturbance area).

The methodology adopted for the Aboriginal heritage assessment included the following key tasks:

- reviewing the legislative and policy context including relevant guidelines and procedures for assessing Aboriginal heritage impacts
- reviewing existing data to identify known Aboriginal sites, including the Aboriginal Heritage Information Management System (AHIMS) database (NSW Heritage), Atlas of Aboriginal Places (NSW Heritage) and archaeological reports
- consulting with registered Aboriginal parties (RAPs) at various stages in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010) (refer to Chapter 7)
- undertaking a field survey between 22 June and 3 July 2020, the methodology for the survey is discussed further in the following section
- developing a predictive model based on known regional and local site patterns within a broader 10 kilometre wide corridor centred on the proposal study area (referred to as the heritage study corridor)
- assessing potential direct and indirect impacts on Aboriginal heritage within the indicative disturbance area (refer to Chapter 8)
- identifying mitigation and management measures to minimise the potential impacts identified.

Field survey methodology

The field survey comprised a walkover within the heritage survey area, which generally comprised of a 100 metre wide area with some broader sections where construction facilities or design refinements were likely to occur.

The aims of the survey were to:

- identify any archaeological sites and areas of potential archaeological deposit (PADs) not previously recorded
- assess all areas of identified archaeological sensitivity
- locate, inspect and assess the condition of known Aboriginal sites recorded on the AHIMS database.

The survey was conducted by three survey teams, with each team consisting of two archaeologists from Navin Officer Heritage Consultants and two to three RAP representatives. The RAP representatives were encouraged to communicate knowledge regarding the cultural heritage values of the proposal study area, archaeological and cultural sites, and the overall landscape.

Field surveys were also completed as part of geotechnical investigations for the proposal, and the results of these surveys have been incorporated into the assessment.

10.3 Existing environment

10.3.1 Aboriginal heritage context

The oldest archaeological evidence of Aboriginal occupation near the proposal study area is from Lake Victoria, dating back 21,000 years. The oldest evidence of regional occupation dates back to at least 45,000 years ago (Balme and Hope 1990).

The proposal study area is within the lands of the Barkindji and Maraura people. The Aboriginal people living along the Darling River are the Barkindji, named after the Darling River, which they refer to as the Barka (Hardy 1976). The local Barkindji form substantial communities at Wentworth, Dareton and Buronga. The Maraura people were located along the Murray River between Wentworth and Paringa, associated with the area around Lake Victoria.

10.3.2 Recorded Aboriginal sites and archaeology

A search of Aboriginal objects, sites and places registered on AHIMS identified:

- 289 sites within the broader heritage study corridor
- 43 sites within the proposal study area, none of these sites were located in the section of the proposal study area between Buronga and the NSW/Victorian border at Monak
- six sites within the heritage survey area, including one modified/scarred tree site (39-6-0029), four artefact sites (39-6-0023, 39-6-0030, 39-6-0026, and 46-3-0086) and one combined modified/scarred tree and artefact site (39-6-0022).

In addition to previously recorded sites, 131 previously unrecorded Aboriginal site features were recorded during the field surveys, including:

- 34 stone artefact scatters
- 30 scarred trees
- 29 isolated finds
- 19 sites with a combination of multiple site types
- 12 hearths
- six shell middens
- one post contact artefact scatter (glass).

Three shell middens and two sites with both shell middens and artefacts were also recorded outside of the heritage survey area during preliminary geotechnical investigations for the proposal. Figure 10-1 depicts the locations of previously and newly recorded Aboriginal heritage sites.

Areas where the potential for subsurface archaeological material is considered to be moderate or high are defined as potential archaeological deposits (PADs). In total, 28 PADs were identified within the heritage survey area. Refer to Sections 7.2 and 7.3 in Technical paper 2 for more information on the sites and PADs recorded within the heritage survey area.

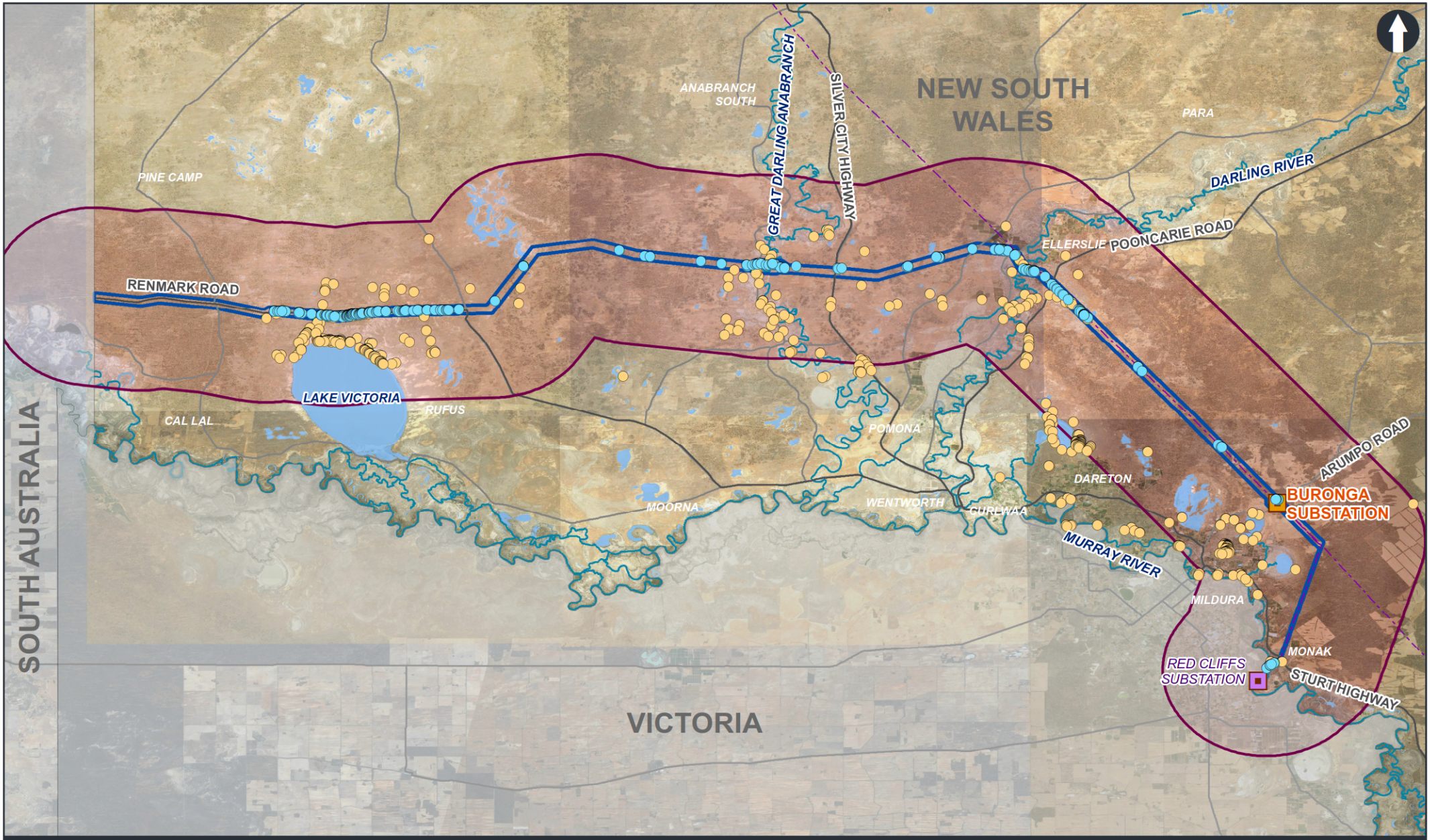


Figure 10-1

Previously recorded and newly identified Aboriginal sites

10.3.3 Aboriginal site patterns

Overall, the most common Aboriginal site type present in the proposal study area and broader heritage study corridor is open artefact scatters, which are associated with hunting or gathering activities, domestic camps or the manufacture and maintenance of stone tools. Other site types that may occur within the proposal study area are isolated finds, modified/scarred trees, hearths, mound sites, freshwater middens and burials.

The biggest predictor for Aboriginal sites within the proposal survey area is proximity to water, which is shown by the high number of sites recorded near Lake Victoria, the Darling River, the Great Darling Anabranch River and the Murray River.

The highest density and variety of sites within the proposal study area are located on an undulating sandplain ridge north of Lake Victoria. While this area is now dry, in the past this area would have featured several shallow interconnected lakes and would have been a focus of Aboriginal occupation. The high number of grindstones at these sites suggests that seed grinding was a focus at this location, and the larger grindstones (weighing between five to 10 kilograms) would have likely remained in place between visits.

The main channel of the Great Darling Anabranch River is currently dry, with artefact scatters and freshwater shell midden common along the banks. The low sand dunes along the flood channel banks are likely to contain significant archaeological deposits, as shown by the high densities of hearths identified at the claypan exposures.

The most common site types along the Darling River and its floodplains were hearths and low-density artefact scatters. This area also has high subsurface archaeological potential as the ground was poorly visible in areas due to mature vegetation and silt deposits. For example, one location on an elevated bank on the western side of the river had over 50 hearths, which were only made visible by previous disturbance from a large grader.

The floodplains and banks of the Murray River had lower ground exposure and visibility; however, sites were identified including scarred trees.

10.3.4 Assessment of significance

An assessment of significance for the recorded Aboriginal sites was undertaken in accordance with the criteria of the Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Australia ICOMOS Burra Charter, 2013a). This assessment of significance considers the historic value, scientific (archaeological value), aesthetic value and the social (cultural) value of a place.

Historic value

No information has been provided to date by Aboriginal stakeholders to suggest the proposal study area is historically important in terms of persons, events, phases or activities in the Aboriginal community.

Scientific (archaeological) value

In general, moderate (local) scientific significance has been attributed to all surface sites that are associated with areas of moderate to high or, high potential for subsurface archaeological deposits as well as scarred trees assessed as either of possible or probable Aboriginal origin. Low scientific significance has been attributed to all surface sites that have been identified as either highly disturbed (relative to the surrounding landscape) or, have been assessed as having low or low to moderate subsurface archaeological potential. PADs that are not associated with surface artefacts cannot be assessed at this stage, as further subsurface archaeological testing is required before their archaeological significance can be determined.

Refer to Section 9.1 of Technical paper 2 for an overview of the scientific significance of each Aboriginal site recorded during field surveys for the proposal.

Aesthetic value

Culturally significant places near the proposal study area such as Lake Victoria are of high aesthetic value to the local Aboriginal community and any development in the area should consider such vistas.

To date, RAPs have not identified any cultural landscape values/aesthetic values of in the proposal area.

Social (cultural) value

All archaeological objects and sites have cultural value for present-day Aboriginal people, as they were created by ancestral Aboriginal people and provide tangible evidence of past occupation of the landscape. All sites have cultural significance to present-day Aboriginal groups as manifestations of their ancestors' past occupation of the landscape.

10.4 Potential impacts – construction

10.4.1 Aboriginal sites and archaeology

Impacts on known and previously unrecorded Aboriginal items can occur through the following processes:

- direct harm or disturbance through surface disturbance, vegetation clearance and ground excavation:
  - to all surface and/or subsurface features at a site resulting in a total loss of heritage value
  - to some surface and/or subsurface features at a site resulting in a partial loss of heritage value
- indirect harm or disturbance through changes to the site environment (such as increased erosion risk), which may or may not result in loss of heritage value at a site.

As discussed in Chapter 8, direct impacts from the proposal have been categorised as:

- direct impacts from activities requiring ground disturbance, such as transmission line structures, Buronga Substation (and asset protection zone), construction work areas, vegetation clearing and establishment of access tracks (referred to as disturbance area A)
- potential direct impacts due to trimming vegetation down to two metres in height within the transmission line corridor (referred to as disturbance area B). These works have the potential to impact scarred trees and other site types, depending on the extent of required vegetation clearing.

The potential for direct impacts to Aboriginal heritage from construction of the proposal has been determined by assessing the location of Aboriginal sites and PADs against an indicative disturbance area including nominal locations for the transmission line structures.

Indirect impacts, depending on the site type, site context, and its archaeological and cultural significance, may not result in a loss of heritage value. Indirect impacts may occur to areas beyond the indicative disturbance area, however, the impact would be dependent on several factors, including aerial extent of the site, depth of deposits, and the works being conducted adjacent to these areas. For this reason, the number of sites that may be potentially indirectly impacted have not been quantified and would need to be managed during construction. Construction planning and management for the proposal will ensure that indirect impacts that could potentially result in a loss of heritage values due to physical disturbance will not occur (including physical disturbance from surface water drainage or other mechanism).

Use of the Anabranch South main construction compound and accommodation camp site has the potential to directly impact three Aboriginal sites (PEC-W-74, PEC-W-75 and PEC-W-76), which are isolated finds located within the indicative compound site boundary. These two sites have been assessed as having low scientific significance. If direct impacts cannot be avoided through refinement of the construction layout, the impact on Aboriginal values would be minimised through implementation of mitigation measures such as surface artefact collection (refer to Table 10-3).

Construction of the Buronga substation upgrade and expansion has the potential to directly impact on PAD (PEC-PAD-27). Further testing would be undertaken to confirm the subsurface archaeological potential within this PAD so to enable avoidance of direct impacts on Aboriginal sites through design refinement, where possible.

Table 10-2 summarises the direct and potential direct impacts to recorded Aboriginal heritage sites during construction of the transmission line and associated components, based on the indicative disturbance area and nominal structure locations. However, the number of sites likely to be impacted would be confirmed during detailed design, including opportunities to avoid or minimise impacts (refer to Section 10.2).

Impacts to a number of these sites also include impacts to 26 PADs. The significance of the PADs would be confirmed via further investigation prior to the commencement of construction in these areas.

Further information on the potential impacts to Aboriginal heritage is provided in Chapter 10 of Technical paper 2.

Table 10-2 Summary of potential Aboriginal heritage impacts within the indicative disturbance area

Site features and significance	Impact type			Total number of sites potentially impacted
	Direct (disturbance area A)	Potential direct (Disturbance area B)	Direct/ Potential direct[1]	
Artefact				
Low scientific significance	6	6	1	13
Moderate scientific significance	10	11	5	26
Hearth				
Low scientific significance	1	2	-	3
Moderate scientific significance	1	3	-	4
Hearth, Artefact				
Moderate scientific significance	2	-	2	4
Midden				
Low scientific significance	1	2	1	4
Midden, Artefact				
Low scientific significance	-	-	1	1
Moderate scientific significance	-	1	3	4
Midden, Hearth, Artefact				
Moderate scientific significance	-	1	-	1
Scarred tree				
Potential scarred trees	3	14[2]	-	17
Total	**23**	**39**	**13**	**77**

Note:

1. Direct / Potential direct relates to sites that extend across disturbance area A and B.
2. For scarred trees, impacts in disturbance area B would be considered direct.

10.4.2 Aboriginal cultural values

All Aboriginal sites within the heritage study area are of cultural significance to the local Aboriginal community. Also, independent of archaeological sites and objects within the survey area, the landscape, native flora, and fauna of the proposal are of high cultural significance.

10.5 Potential impacts – operation

Operation of the proposal is not anticipated to result in direct impacts to known or previously unrecorded Aboriginal sites. Whilst some disturbance may be required as part of routine maintenance and repair activities, these activities would be contained within areas previously disturbed during construction. Recorded sites remaining after the construction period would be mapped and potential impacts avoided.

Indirect impacts from the presence of infrastructure, including visual impacts, would continue during operation of the proposal. An indirect impact would include a low to moderate visual impact to the culturally sensitive area near Lake Victoria.

It is unlikely that direct harm or disturbance to any known Aboriginal sites remaining within the transmission line easement would occur as a result of maintenance activities, as these sites would be mapped and mitigation measures would be implemented to protect them from accidental harm (refer to Section 10.6).

10.6 Management of impacts

10.6.1 Environmental management

Environmental management for the proposal would be carried out in accordance with the approach detailed in Chapter 23 (Environmental management).

For construction, this would include a detailed construction heritage management sub-plan. This would be based on the final construction methodology, and would:

- detail appropriate heritage mitigation measures, including identification, protection and/or management of heritage items/sites within or adjacent to construction areas (including additional investigations, recordings, or measures to protect items/sites that would not be directly impacted in the vicinity of construction works)
- procedures for carrying out salvage or excavation of heritage items/sites (as relevant) prior to works commencing that would affect the heritage item
- procedures for unexpected finds, including procedures for dealing with human remains
- heritage monitoring and compliance management requirements
- induction requirements for construction personnel.

10.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to Aboriginal heritage are listed in Table 10-3.

Table 10-3 Mitigation measures – Aboriginal heritage

Reference	Mitigation measure	Timing	Applicable location(s)
AH1	The final disturbance footprint will be designed to avoid impacts to Aboriginal sites as far as practical. Avoidance of sites of moderate or higher archaeological significance will be prioritised.	Detailed design	All locations
AH2	Aboriginal stakeholder consultation will be carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a). Registered Aboriginal Parties (RAPs) will be active participants in all proposed mitigation measures for Aboriginal heritage, including site inspections and test excavations, with further cultural information to be gathered during consultation undertaken in association with these activities. All addendum reports to the ACHAR will be provided to RAPs for comment and input.	Detailed design and pre-construction	All locations
AH3	A survey will be carried out with Registered Aboriginal Party representatives where ground or vegetation disturbance activities are required in all locations outside of the previously surveyed 100m heritage survey area, prior to works occurring in any such areas. These surveys will be carried out in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (2010) and will be reported on in addendum reports to the ACHAR. Reports will be provided to RAPs for comment and to DPIE. If these sites are identified as having moderate or high scientific significance, impacts will be avoided where possible. If impact avoidance is not possible then recommendations included in the addendum reports to the ACHAR (including requirements for further investigation) will be implemented prior to any construction potentially impacting these sites.	Detailed design and pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
AH4	Prior to the commencement of construction that would impact areas of moderate and high archaeological significance and/or archaeological subsurface potential (e.g. PADs), test excavation will be carried out in these areas to determine the presence or absence of subsurface archaeological deposits, where direct impacts are anticipated based on the detailed design. The test excavation works will be carried out in accordance with a methodology presented to RAPs. The results of the test excavation will be reported on in addendum reports to the ACHAR. Reports will be provided to RAPs for comment and to DPIE.	Detailed design and pre-construction	PEC-W-6, PEC-W-11, PEC-W-12, PEC-W-15, PEC-W-17, PEC-W-18, PEC-W-27, PEC-W-31, PEC-W-36, PEC-W-37, PEC-W-45, PEC-W-47, PEC-W-50, PEC-W-51, PEC-W-55, PEC-W-63, PEC-W-100, PEC-W-102, PEC-G-7 PEC-PAD1 through PEC-PAD14, PEC-PAD-16 through PEC-PAD26, and PEC-PAD-28
AH5	All scarred trees identified during archaeological survey will be assessed by a qualified arborist to determine tree age and likely cause of the scarring in order to confirm the scientific significance prior to any impact to the scarred trees. Impacts to all scarred trees (including those of cultural significance) will be avoided where possible through design or construction methodology and must only be removed for permanent infrastructure and/or to meet Vegetation Clearance Requirements at Maximum Line Operating Conditions (TransGrid, 2003). If any scarred tree cannot be avoided, the tree will be subject to 3D scanning, followed by salvage of the scarred trunk. The results of this assessment will be reported on in addendum reports. Reports will be provided to RAPs for comment and to DPIE.	Detailed design and construction	PEC-W-57, PEC-W-67, PEC-W-80, PEC-W-85, PEC-W-86, PEC-W-88, PEC-W-90, PEC-W-91, PEC-W-99, PEC-W-104, PEC-W-105, PEC-W-106, PEC-W-107, PEC-W-108, PEC-W-109, PEC-W-110, PEC-W-111, PEC-W-112, PEC-W-113, PEC-W-115, PEC-W-118, PEC-W-121, PEC-W-122, PEC-W-127, PEC-W-128, PEC-W-130

Reference	Mitigation measure	Timing	Applicable location(s)
AH6	All portions of artefact scatters that are to be directly impacted will require surface collection prior to construction commencement in those areas. Additionally, based on the outcomes of the test excavation, items or PADs will be subject to surface collection or salvage prior to the commencement of construction in those areas.	Detailed design	Surface collection (artefact scatters impacted by disturbance Area A) PEC-W-6, PEC-W-7, PEC-W-11, PEC-W-12, PEC-W-15, PEC-W-17, PEC-W-18, PEC-W-27, PEC-W-31, PEC-W-35, PEC-W-36, PEC-W-37, PEC-W-45, PEC-W-47, PEC-W-50, PEC-W-51, PEC-W-55, PEC-W-63, PEC-W-74, PEC-W-75, PEC-W-100, PEC-W-102, PEC-W-114, PEC-W-119, PEC-G-7, 39-6-0030
AH7	Aboriginal heritage exclusion zones will be established to protect sites that would remain in-situ throughout construction. Suitable controls will be identified in the heritage management sub-plan, which may include site fencing and sediment control. Aboriginal heritage zones will be demarcated by a suitably qualified archaeologist in consultation with the RAPs	Pre-construction	PEC-W-1, PEC-W-4, PEC-W-5, PEC-W-6, PEC-W-7, PEC-W-1 0, PEC-W-12, PEC-W-23, PEC-W-27, PEC-W-29, PEC-W-30, PEC-W-35, PEC-W-36, PEC-W-37, PEC-W-38, PEC-W-45, PEC-W-46, PEC-W-47, PEC-W-48, PEC-W-49, PEC-W-52, PEC-W-53, PEC-W-54, PEC-W-60, PEC-W-61, PEC-W-62, PEC-W-66, PEC-W-66, PEC-W-78, PEC-W-81, PEC-W-82, PEC-W-100, PEC-W-101, PEC-W-102, 46-3-0086
AH8	Construction planning and management will ensure that indirect impacts that could potentially result in a loss of heritage values due to physical disturbance will not occur (including physical disturbance from surface water drainage or other mechanism).	Construction	All locations
AH9	Cultural and historic heritage awareness training will be carried out for all personnel working on the proposal	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
AH10	If at any time during construction, any items of potential Aboriginal archaeological or cultural heritage significance, or human remains are discovered, they will be managed in accordance with the Aboriginal heritage unexpected finds protocol.	Construction	All locations
AH11	A temporary repository of any retrieved archaeological material and Aboriginal objects will be appropriately secured and under the care of the archaeological consultant. The strategy for the long term conservation of salvaged or collected Aboriginal objects will be determined in consultation with Registered Aboriginal Parties.	Construction	As relevant
AH12	Sites that would remain in-situ within the transmission line easement will be mapped and recorded within GIS systems managed by TransGrid to ensure inadvertent impacts do not occur during maintenance activities.	Operation	Transmission line

10.6.3 Managing residual impacts or uncertainties

The Aboriginal heritage assessment is based on an indicative disturbance area to develop an understanding of the magnitude of potential impacts from the proposal and retain flexibility during design refinement (refer to Chapter 8). During design refinement, the locations of recorded Aboriginal sites and PADs will be used to inform the final location of transmission line structures and construction facilities, with an aim to:

- protect, conserve and/or manage the heritage significance of Aboriginal objects and places to ensure the proposal does not diminish the story and cultural understanding of Aboriginal people in New South Wales
- avoid or minimise impacts on areas of archaeological potential and scientific significance, where feasible and reasonable. Where this is not possible areas of moderate or high archaeological potential and significance are prioritised for avoidance or impact minimisation.

Further archaeological investigation such as subsurface testing may be undertaken once the final impact area is determined, to confirm the potential for impacts on Aboriginal sites. Following further archaeological investigation and design refinement, the potential for direct impacts on known Aboriginal heritage sites would be confirmed.

Where known Aboriginal sites would be located close to construction or maintenance activities for the proposal, mitigation measures to protect the sites from accidental impacts would be implemented such as clear mapping of sites on construction plans and use of high visibility fencing to mark exclusion zones.

Where direct impacts to sites cannot be avoided during design refinement, mitigation measures would be implemented to minimise the potential impacts on Aboriginal heritage, such as surface salvage of artefacts or a program of salvage excavations in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010).

11. Non-Aboriginal heritage

This chapter provides a summary of the assessment of potential non-Aboriginal (historic) heritage impacts of the proposal, and identifies mitigation measures to address these impacts. This chapter summarises relevant sections of the *Non-Aboriginal and Aboriginal Cultural Heritage Assessment Report,* which has been prepared by Navin Officer Heritage Consultants (Navin Officer, 2020a) (refer Volume 2, Technical paper 2).

11.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to non-Aboriginal heritage and where these requirements are addressed in this EIS are outlined in Table 11-1.

Table 11-1 Secretary's environmental assessment requirements – non-Aboriginal heritage

Ref.	Secretary's environmental assessment requirements	Where addressed
Heritage		
Key issues	The EIS must address the following matters: > an assessment of the Aboriginal and historic heritage (cultural and archaeological) impacts of the project.	Sections 11.4 and 11.5 provide an assessment of non-Aboriginal (historic) heritage impacts. Assessment of Aboriginal heritage is included in Chapter 10.

11.2 Assessment approach

11.2.1 Legislative and policy context

The *Heritage Act 1977* (Heritage Act) provides for the protection of heritage items within NSW and establishes the State Heritage Register and associated heritage assessment criteria for assessing State or local heritage significance. The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also provides for the protection of heritage items of national significance, or matters of national environmental significance (MNES).

The assessment of potential impacts to non-Aboriginal heritage was completed with consideration to the following guidelines:

> Assessing Heritage Significance (OEH, 2015)
> Australia ICOMOS Charter for the Conservation of Places of Significance, (Burra Charter 2013)
> Assessing Significance for Historical Archaeological Sites and 'Relics' (NSW Department of Planning (Heritage Branch, 2009)
> Altering Heritage Assets (Heritage Council, undated)
> Australian International Council on Monuments and Sites Charter for Places of Cultural Significance (also known as the Burra Charter; Australian ICOMOS, 2013), which defines cultural significance as 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations' and provides relevant criteria to assess cultural significance.

11.2.2 Methodology

The study area for the assessment of non-Aboriginal heritage included:

- A heritage study corridor used for searches of relevant databases, including a 10 kilometre buffer on the centreline of the proposal study area (refer to Chapter 8)
- A heritage survey area centred on the indicative disturbance area (refer to Chapter 8)

The methodology for the assessment of non-Aboriginal heritage included the following key tasks:

- reviewing the legislation and policy context relevant to assessing non-Aboriginal heritage
- reviewing relevant historical information including regional and local histories, heritage studies and theses, historical maps to understand the historical (non-Aboriginal) heritage context
- undertaking desktop searches of relevant heritage registers and schedules including:
  - World Heritage List
  - National Heritage List (Department of Environment and Energy)
  - Commonwealth Heritage List (Department of Environment and Energy)
  - State Heritage Register (NSW Heritage Branch, Office of Environment and Heritage)
  - Section 170 Heritage and Conservation Registers
  - Wentworth LEP
- undertaking a field survey between 22 June and 3 July 2020 to validate the results of the desktop assessment and identify any potential areas of archaeological sensitivity
- assessing potential direct and indirect impacts to non-Aboriginal heritage based on the indicative disturbance area (refer to Chapter 8)
- recommending mitigation and management measures to minimise the potential impacts identified.

Further discussion of the methodology for the non-Aboriginal heritage assessment is provided in Technical paper 2.

11.3 Existing environment

11.3.1 Historic (non-Aboriginal) heritage context

The Darling River and Murray River were first mapped by explorers around the 1830s. This led to development of overland trails linking NSW with the new colony of SA and the introduction of cattle to the region in 1838. Between April 1838 and April 1841, numerous parties travelled the western central Murray route, bringing with them sheep and cattle as well as horses, bullocks, drays and goods into Aboriginal territories, leading to conflicts in the area. Pastoral leases were granted from 1847 onwards. The settlers of the region were subject to periods of boom and bust associated with drought, flood, land degradation caused by hard-hoofed stock, as well as land clearing and rabbit infestations. The introduction of paddle steamers in 1853 made remote places along the Murray more accessible and enabled more diversified industries and employment in the region, leading to the establishment of Wentworth. The establishment of artesian bores by the 1880s enabled irrigation of land, and subsequently the subdivision of larger properties and the introduction of higher value horticulture to the region.

11.3.2 Listed heritage items

Three heritage listed items of local significance were identified with curtilages that are located partially within the proposal study area (refer to Table 11-2 and Figure 11-2). An additional four heritage listed sites of local significance have curtilages that are located entirely or partially within the heritage study corridor, but outside the proposal study area (refer to Figure 11-2).

These sites, which are listed on the Wentworth Local Environmental Plan 2011 (Wentworth LEP), are:

- Anabranch Hall (I1)
- Hazeldell Homestead (I28)
- Noola Homestead (I75)
- Provincial Border Obelisk (I95).

Given the distance to the proposal study area, these heritage items are not considered further.

No items of State, Commonwealth or World Heritage significance were identified.

Table 11-2 Heritage listed items within the proposal study area

Item name	Listing	Category	Location relevant to the proposal study area	Summary of heritage significance
Nulla Nulla Woolshed	Wentworth LEP 2011 (I81)	Woolshed (Built)	Partially within	A large modern shearing shed with sawtooth roof, representative of the pastoral industry modernisation, and associated with Lake Victoria. The woolshed is the primary item of heritage significance, however yards, and shearers quarters are also referenced. Further, the item is identified as having aesthetic significance due to its setting in 'an almost featureless landscape'. The item is of local significance. The location of the woolshed is shown in Figure 11-2.
Nulla Nulla Homestead	Wentworth LEP 2011 (I82)	Homestead (Built)	Partially within	A rare elevated homestead representative of management changes in the pastoral industry in the twentieth century. The heritage listing is associated with the main homestead and other buildings. The item is of local significance. The location of the homestead is shown in Figure 11-2.

Item name	Listing	Category	Location relevant to the proposal study area	Summary of heritage significance
Sturts Billabong	Wentworth LEP 2011 (I27)	Historic landscape	Partially within	Described as an area of aesthetic significance as a quiet stretch of water off the Darling River with majestic river red gum trees. It has historical significance because of its association with Captain Sturt on his exploration in 1829. The riparian zone along the outer edge of Sturts Billabong, which includes the mature River Redgums, have been identified as the natural landscape that contributes to the significance of the heritage item (refer to Figure 11-2). The item is of local significance.

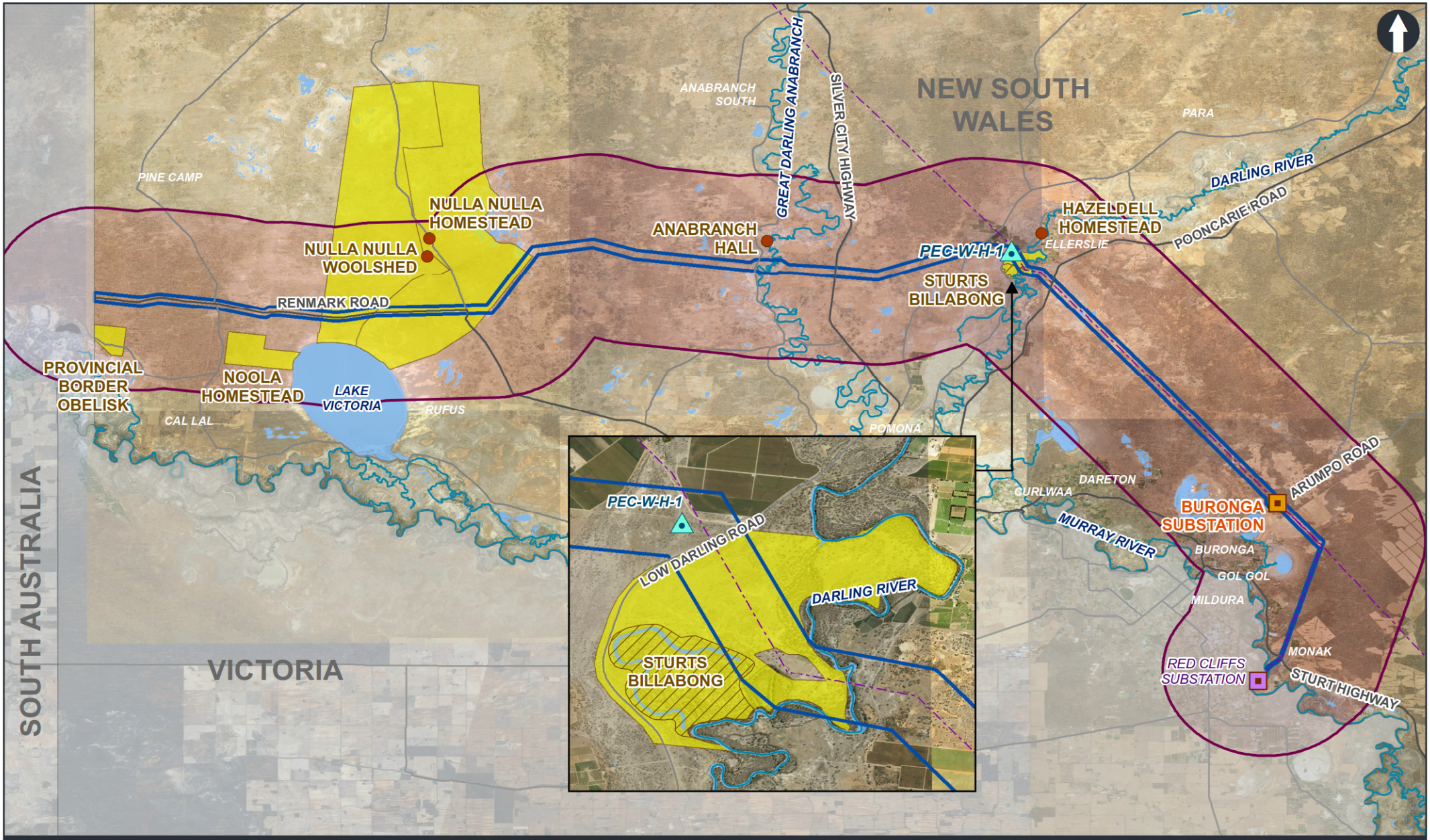
11.3.3 Previously unrecorded heritage

In addition to the listed heritage items identified, one previously unrecorded site was identified during the field survey comprising a historic survey marker tree (identified in the assessment as PEC-W-H-1). The item is located near the bend in the proposal study area, where it turns from running east to south-east, about 1.5 kilometres west of the Darling River (refer to Figure 11-1).

This tree contains a marking of European origin in the form of an arrow (refer to Figure 11-1), which may have been used as a reference point marker for a feature survey.

Figure 11-1 Photos of heritage survey marker tree (PEC-W-H-1)

An assessment of the significance of this item was completed in accordance with the Assessing Heritage Significance (OEH, 2015) guidelines and determined to achieve the criteria for local significance due to its increasingly rare occurrence and being uncommon within the landscape.



Source: NSWSS, ESRI, Transgrid, WSP

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Figure 11-1

Location of listed and previously unrecorded heritage items relevant to the proposal study area

11.3.4 Archaeology

Based on the review of the historical context of the study area, potential archaeology may occur associated with:

- graves
- fence lines
- evidence of historical agricultural and industrial processing or extractive sites
- remains of former dwellings including homesteads, houses and huts
- historical roads
- other transport and access routes, such as bridle paths, stock routes of varying forms and ages
- other structures of historical interest and potential heritage significance.

No previously unrecorded archaeology was identified during the field survey, and the potential for archaeology is considered to be low to nil. The archaeological survey area included the indicative disturbance footprint defined in Chapter 8. Further survey would be required to determine the likelihood of occurrence and significance of archaeology in areas outside of the survey area.

11.4 Potential impacts – construction

11.4.1 Listed and previously unrecorded heritage items

Impacts to recorded heritage items from construction of the proposal can include direct (disturbance) and indirect impacts. Direct impacts generally result from changes to site environment, including vegetation removal, excavation or impacts from vibration caused by construction plant and equipment, which can result in a loss of heritage value.

Indirect impacts may occur where views to and from significant sites are altered, resulting in a loss of the heritage value of the site.

A summary of the listed and previously unrecorded heritage items identified above, and the potential direct and indirect impacts from the proposal is outlined in Table 11-3, including the presence of transmission line structures.

Table 11-3 Impact assessment of non-Aboriginal heritage items

Site Name	Item ID	Significance	Potential impacts
Nulla Nulla Woolshed	I81	Local	The proposal would not directly impact the woolshed, which is located about 6.2 kilometres north of the indicative disturbance are. The landscape is largely open, with low vegetation. The distance and gentle changes in landform over this area would result in the transmission line and structures being absorbed into the far background of views from the woolshed. As such, there would be no appreciable change to the views from the woolshed. The proposal is not anticipated to impact the significance of the item from direct or indirect (visual) impacts.

Site Name	Item ID	Significance	Potential impacts
Nulla Nulla Homestead	I82	Local	The proposal would not directly impact the homestead or other buildings. As above, the transmission line and structures would be absorbed into the far background of views from the site and is not anticipated to impact the significance of the item from direct or indirect (visual) impacts.
PEC-W-H-1 (survey marker tree)	Previously unrecorded	Local	This item is located within 10 metres of the indicative disturbance area. However, with the implemented of mitigation measures to protect the item, no impacts to its significance are anticipated.
Sturts Billabong	I27	Local	The transmission line corridor passes through the central portion of the curtilage. The natural landscape of Sturts Billabong is in the south western portion of the curtilage. The proposal would not directly impact any features (landscape or mature trees) of significance to this item, including River Redgums. While the new transmission structure would be easily visible from Sturts Billabong, the visual impact is considered low given the presence of existing transmission lines within the existing easement. The proposal is not considered to impact the significance of this heritage item.

11.4.2 Archaeology

Non-Aboriginal heritage archaeology was not identified within the archaeological survey area, and the potential for archaeology is considered to be low to nil. Mitigation measures will be implemented to manage unexpected finds for the proposal.

Should the disturbance footprint of the proposal extend beyond the archaeological survey area, further assessment will be required to determine the likelihood of occurrence and significance of potential archaeology, and impacts from the proposal.

11.5 Potential impacts – operation

The indirect (visual) impacts of the proposal due to the presence of transmission line structures has been considered in Table 11-3. Maintenance activities required for operation of the proposal would not result in disturbance of additional areas. As such, no additional direct impacts to non-Aboriginal heritage would occur during operation of the proposal.

11.6 Management of impacts

11.6.1 Environmental management

Environmental management for the proposal would be carried out in accordance with the approach detailed in Chapter 23 (Environmental management).

For construction, this would include a detailed construction heritage management sub-plan. This would be based on the final construction methodology, and would:

- detail appropriate heritage mitigation measures, including identification, protection and/or management of heritage items/sites within or adjacent to construction areas (including additional investigations, recordings, or measures to protect items/sites that would not be directly impacted in the vicinity of construction works)
- procedures for unexpected finds, including procedures for dealing with human remains
- heritage monitoring and compliance management requirements
- induction requirements for construction personnel.

11.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to non-Aboriginal heritage are listed in Table 11-4.

Table 11-4 Mitigation measures – Non-Aboriginal heritage

Reference	Mitigation measure	Timing	Applicable location(s)
NAH1	A non-Aboriginal heritage exclusion zone will be established for site PEC-W-H-1 (Survey Marker Tree). The site will be fenced during construction and vegetation clearance for the proposal, to avoid inadvertent impacts during works. If impacts cannot be avoided, then the tree should be archivally recorded and research undertaken to confirm the nature and history of the item prior to impact occurring.	Detailed design and pre-construction	Transmission line.
NAH2	Should the disturbance area for the proposal extend beyond the survey area, further assessment by an archaeologist will be carried to determine the likelihood of occurrence and significance of potential archaeology and impacts from the proposal (including built heritage) prior to the commencement of construction in these areas. The results of this assessment will be reported on in addendum reports for non-Aboriginal heritage. Reports will be provided to DPIE.	Detailed design and pre-construction	Transmission line.
NAH3	If at any time during construction, any items of potential non-Aboriginal archaeological significance, or human remains are discovered, they will be managed in accordance with the non-Aboriginal unexpected finds protocol.	Construction	All locations.

11.6.3 Managing residual impacts or uncertainties

Following the implementation of mitigation measures, further impacts to heritage items identified in this assessment are not anticipated.

Whilst the assessment concluded there is a low risk for impacts to archaeology, some potential for this to be encountered during construction of the proposal would remain. In these instances, the process of mitigation outlined in the mitigation above would be implemented for the proposal to prevent residual impacts occurring.

The non-Aboriginal heritage assessment is based on several assumptions to develop an understanding of potential impacts to non-Aboriginal heritage and retain flexibility during design refinement. This includes consideration of the indicative disturbance area described in Chapter 8. During design refinement, the final location of transmission line structures and construction facilities would be determined with the aim to avoid or minimise impacts on all areas of non-Aboriginal heritage significance, where feasible and reasonable. Where this is not possible areas of moderate or high significance will be prioritised for avoidance or impact minimisation. Where impacts are not avoided, further assessment by an archaeologist will be carried out to determine the likelihood of occurrence and significance of potential impacts from the proposal in an addendum non-Aboriginal heritage assessment.

12. Land use and property

This chapter considers the potential land use and property implications of the proposal, and identifies mitigation measures to address these impacts. This chapter summarises the *Agricultural impact assessment* which has been prepared by Tremain Ivey Advisory (Tremain Ivey Advisory, 2020) (refer Volume 2, Technical paper 3).

12.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to land use and property and where these requirements are addressed in this EIS are outlined in Table 12-1.

Table 12-1 Secretary's environmental assessment requirements – land use and property

Ref.	Secretary's environmental assessment requirements	Where addressed
Land		
Key issues	The EIS must address the following matters:	
	> an assessment of impacts of the project on soils and land capability of the site and surrounds	Section 12.3.4 discusses the land capability of the site and surroundings. Chapter 20 provides a further assessment of impacts of the proposal on soils.
	> assessment of impact of the project on any Crown lands and travelling stock reserves.	Sections 12.3.3, 12.4.1 and 12.5.1 discuss the impact of the project on any Crown lands and travelling stock reserves.

12.2 Assessment approach

12.2.1 Legislative and policy context

Potential land use and property impacts resulting from the proposal, including potential agricultural impacts, were assessed in line with the following legislation and key guidelines:

> *Crown Lands Management Act 2016* and the *Crown Land Legislation Amendment Act 2017*, which sets out the requirements for ownership, use and management of Crown Land. This includes the permissions and authorisations needed when planning the development of activities on Crown Land as well as the process for the acquisition of Crown Land

> *Lands Acquisition (Just Terms Compensation) Act 1991*, which provides a mechanism for the compulsory acquisition of land and the payment of compensation on just terms, in line with market value for the acquisition of land. The Act encourages the acquisition of land by agreement rather than compulsory processes

- *Biosecurity Act 2015*, which provides a framework for the prevention, elimination and minimisation of biosecurity risks on public and private land and establishes that all people have a general biosecurity duty. The NSW Department of Primary Industries (DPI) holds the primary responsibility for management of biosecurity under this Act
- *Soil Conservation Act 1938*, which makes provisions for the conservation of soil resources and farm water resources, enables areas to be designated as 'areas of erosion hazard' and allows the Soil Conservation Commissioner to issue notices aimed at preventing soil erosion or land degradation
- *Local Land Services Act 2013*, which establishes regional Local Land Services (LLS) who are responsible for the integrated management of local land services including agricultural production, biosecurity, travelling stock reserves (TSRs) and other related aspects
- State Environmental Planning Policy (Primary Production and Rural Development) 2019 (Rural SEPP), which aims to reduce land use conflicts and sterilisation of rural land, identifies State significant agricultural land and encourages sustainable agriculture
- Wentworth LEP, which provides land zoning and local development controls for Wentworth LGA. However, as the proposal is subject to assessment under Division 5.2 of the EP&A Act, the proposal is not subject to environmental planning instruments such as the LEP or the Rural SEPP
- Other policies and guidelines that provide more specific guidance including:
  - NSW Invasive Species Plan 2018-2021 (DPI, 2018a)
  - Western Regional Strategic Weed Management Plan 2017-2022 (Western LLS, 2017)
  - Western Regional Strategic Pest Animal Management Plan 2018-2023 (Western LLS, 2018)
  - Far West Regional Plan 2036 (DPE, 2017)
  - Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land (OEH, 2013).

12.2.2 Methodology

The methodology adopted for the land use and property assessment included:

- reviewing the legislation and policy context for assessing land use and property impacts
- identifying and mapping existing land uses within the study area based on a desktop review of spatial data, aerial photography, land use zoning maps and other available information
- analysing and describing the existing environment including:
  - geographical factors such as climate, topography and soils that influence land use within the proposal study area
  - measures such as land and soil capability, land use and value of production, that can help evaluate the nature and productivity of agricultural enterprises in the proposal study area, which is the dominant land use
- consulting with relevant stakeholders and landholders including:
  - landholder consultations and property inspections at three representative properties on 22 and 23 July 2020 to understand landholder's perspectives of the potential impacts of the proposal on agricultural land uses
  - consulting with biosecurity officers from Wentworth Shire Council and Western LLS to understand potential biosecurity risks within and surrounding the proposal study area
  - general consultation with potentially affected landholders to encourage feedback on potential land use and property impacts (refer to Chapter 7)
- assessing land use and property impacts, with a specific focus on agricultural land uses
- recommending mitigation and management measures to minimise the potential impacts identified.

12.3 Existing environment

12.3.1 Existing land uses and zoning

The proposal study area is mainly zoned RU1 Primary Production under the Wentworth LEP, except for two small areas zoned E2 Environmental Conservation near the Darling River and one very small area zoned E2 Environmental Conservation near the Murray River. Most of the land zoned for primary production within the proposal study area is Crown Land held under Western Lands Leases, granted under the *Crown Land Management Act 2016* (formerly the Western Lands Act 1901), with only a small area under freehold.

There are no major population and service centres located within the proposal study area. Various towns including Wentworth, Dareton, Buronga, Gol Gol, Mildura, Monak and Red Cliffs are situated along the Darling and Murray Rivers to the south of the proposal study area near the NSW/Victorian border.

Land use within and surrounding the proposal study area is mainly for agricultural purposes (over 97 per cent of the proposal study area), which is dominated by sheep grazing for wool and meat and cattle grazing. There are also some relatively small areas with a recent history of dryland cereal cropping and improved pastures at the south-eastern end of the proposal study area near Buronga and some irrigated grape vines near the Darling River and Murray River.

Other land uses within and surrounding the proposal study area include farm buildings and infrastructure, roads including a section of Renmark Road, broad acre rural residential development and key waterways including the Darling River, Great Darling Anabranch and Murray River. The existing Buronga substation and 220kV Broken Hill to Buronga and 220kV Buronga to Red Cliffs transmission lines also are located within sections of the proposal study area (refer to Section 4.1 for more information and photographs showing the existing land uses).

The proposal study area falls within areas of the Barkandji Native Title Group traditional lands (refer to Sections 10.3 and 14.3 for more information).

Existing land uses within the proposal study area are summarised in Table 12-2 and shown on Figure 12-1.

The proposal study area contains no National Parks, state forests, aerodromes, defence or Commonwealth lands. The closest aerodromes are at Wentworth (around 24 kilometres from the proposal study area, at its closest point) and Mildura (around 16 kilometres from the proposal study area). A limited number of private and active airstrips for agricultural activities are present within or in proximity to the proposal study area.

The periphery of mining operations (with licences for exploration) EL 8500 (gypsum), ELA 6062 (mineral sands) and quarry operations north of Monak all intersect the proposal study area.

Table 12-2 Summary of land use in the proposal study area

Land Use[1]	Area (ha)[2]	Proportion of the proposal study area (%)[2]
Grazing native vegetation	13,000	89%
Grazing modified pastures	498	3%
Cropping	648	4%
Irrigated land	132	1%
Residential and farm infrastructure	39	<1%
Transport and communication	84	1%
Lake	17	<1%
River	85	1%
Marsh/wetland	35	<1%
Other	12	<1%
Total	**14,550**	**100%**

1) Source (OEH, 2013)

2) Hectares and percentages have been rounded

12.3.2 Far West Regional Plan 2037

The Far West Regional Plan 2037 (DPIE, 2017) sets out the NSW Government's vision, goals and land use priorities over the next 20 years for the Far West region of NSW. The plan identifies a number of directions to achieve the goal in diversifying the economy with the efficient use of infrastructure and infrastructure networks. This includes:

- protecting productive agricultural land and planning for greater land use compatibility
- diversifying energy supply through renewable energy production. This includes actions to identify areas and project sites with renewable energy potential, and infrastructure corridors with access to the electricity network to inform land use planning. The Far West Region has capacity for high renewable energy generation, which is consistent with the NSW Government's *Renewable Energy Action Plan* (2013) and the Renewable Energy Zones (REZ) identified in the AEMO's 2020 ISP (refer to Chapter 2)
- promoting tourism opportunities in the region.

The Far West Regional Plan also recognises the southern area of the Far West Region for its diverse agriculture and landscapes, its natural features and association with the Murray and Darling Rivers. The protection of the environmental assets of the region is identified as a key priority within the Far West Regional Plan, including existing conservation areas, river systems, lagoons, native vegetation of high conservation value.

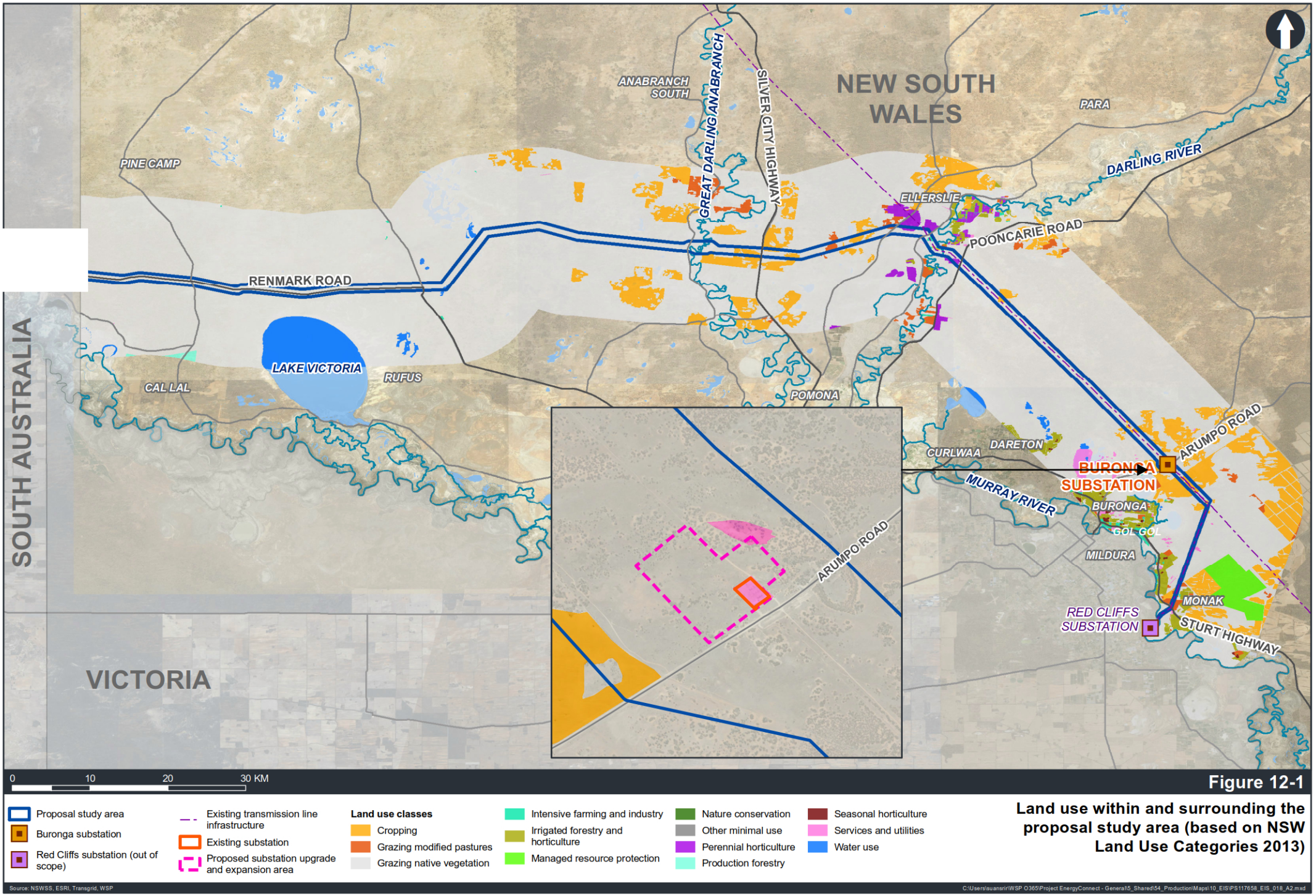

Figure 12-1

Land use within and surrounding the proposal study area (based on NSW Land Use Categories 2013)

12.3.3 Land ownership and property information

The underlying land tenure within the proposal study area is mostly Crown Land perpetual leasehold (Figure 12-2). Areas of freehold land are evident along the Darling River where smaller, lifestyle blocks area more frequent, however, some additional landholdings have recently been transferred to private ownership.

The predominant land use across the region is dryland grazing with areas of irrigated horticulture generally associated with the key river systems such as the Darling and Murray Rivers. These areas on the margins of the river systems also contain smaller rural residential blocks.

The average agricultural establishment in the Wentworth LGA is approximately 8,100 hectares in size, although there are some smaller horticultural and cropping holdings near the Murray River (ABS, 2017).

The grazing industry often uses a network of Crown reserves called travelling stock reserves. These are reserved under the *Local Land Services Act 2013* for moving or grazing stock on foot around NSW. Livestock can also be moved along public roads subject to permit from the LLS. There are no travelling stock reserves or roads identified as part of a 'livestock highway' within the proposal study area. The closest travelling stock reserves are:

- 'Gol Gol Well' located about 2.5 kilometres south-west of the proposal study area on Arumpo Road
- 'Tapio' located about 14 kilometres north-east of the proposal study area on Arumpo Road.

Figure 12-2

Crown land within and surrounding the proposal study area

12.3.4 Geographical factors influencing land use

Topography

The proposal study area is mostly comprised of relatively flat dune fields and sand plains at an elevation between approximately 35 and 80 metres above Australian Height Datum (mAHD), with some areas of alluvial plains near the Darling River, Murray River and Great Darling Anabranch.

Climate

The proposal study area typically experiences between 260 to 290 millimetres of rain each year, with generally less rain in summer and early autumn. Historical data shows that the average maximum monthly temperature within the proposal study area reaches a high of 32.3°C in January and a low of 15.4°C in July. The proposal study area experiences on average 12.3 days per year with a minimum temperature under 2°C, which is generally regarded as the temperature at which frost will occur and is most likely to occur between May and September. Due to the typically high temperatures, high evaporation and low rainfall within the proposal study area, the growing season is variable but short in duration.

OEH (2014) reported that the Far West Region of NSW is projected to experience the following due to climate change:

- increased temperatures of about 0.5°C to 1.0°C in the near future (2020-2039) and 1.5°C to 2.0°C in the far future (2060-2079) with more high temperature days and less risk of frost
- less rainfall in spring and winter, but more rainfall in summer and spring
- increased risk of extreme weather including heatwaves, flooding and a longer fire season.

These factors are likely to lead to higher evapotranspiration, shorter growing seasons and a greater potential for heat and moisture stress on crops, pasture and animals within the proposal study area in the future.

Soil, water and vegetation

The soils within the proposal study area are generally classified as having low to moderately low inherent fertility and low water holding capacity, except for the areas near major waterways, which are generally classified as having moderate inherent soil fertility (OEH, 2017). Figure 12-3 shows the inherent soil fertility across the proposal study area.

Water used for agriculture is mainly sourced from the Murray River, Darling River and Darling Anabranch or earthen farm dams that capture and store local runoff. The water is mainly for stock and domestic use with some small areas of irrigation. Surface water is reticulated on some grazing properties using a system of pumps, pipes, tanks and livestock troughs. Groundwater in the area generally has high salinity levels making the water suitable only for stock use.

As discussed in Chapter 9 (Biodiversity), the proposal study area is dominated by native vegetation and large areas are used for grazing. The main exceptions are some irrigated agriculture near the Darling River and some other modified vegetation types including dryland cropping around Buronga and the Murray River.

Sections 9.3, 15.3 and 20.3 provide more information on the types of vegetation, water sources and soil characteristics within the proposal study area, respectively.

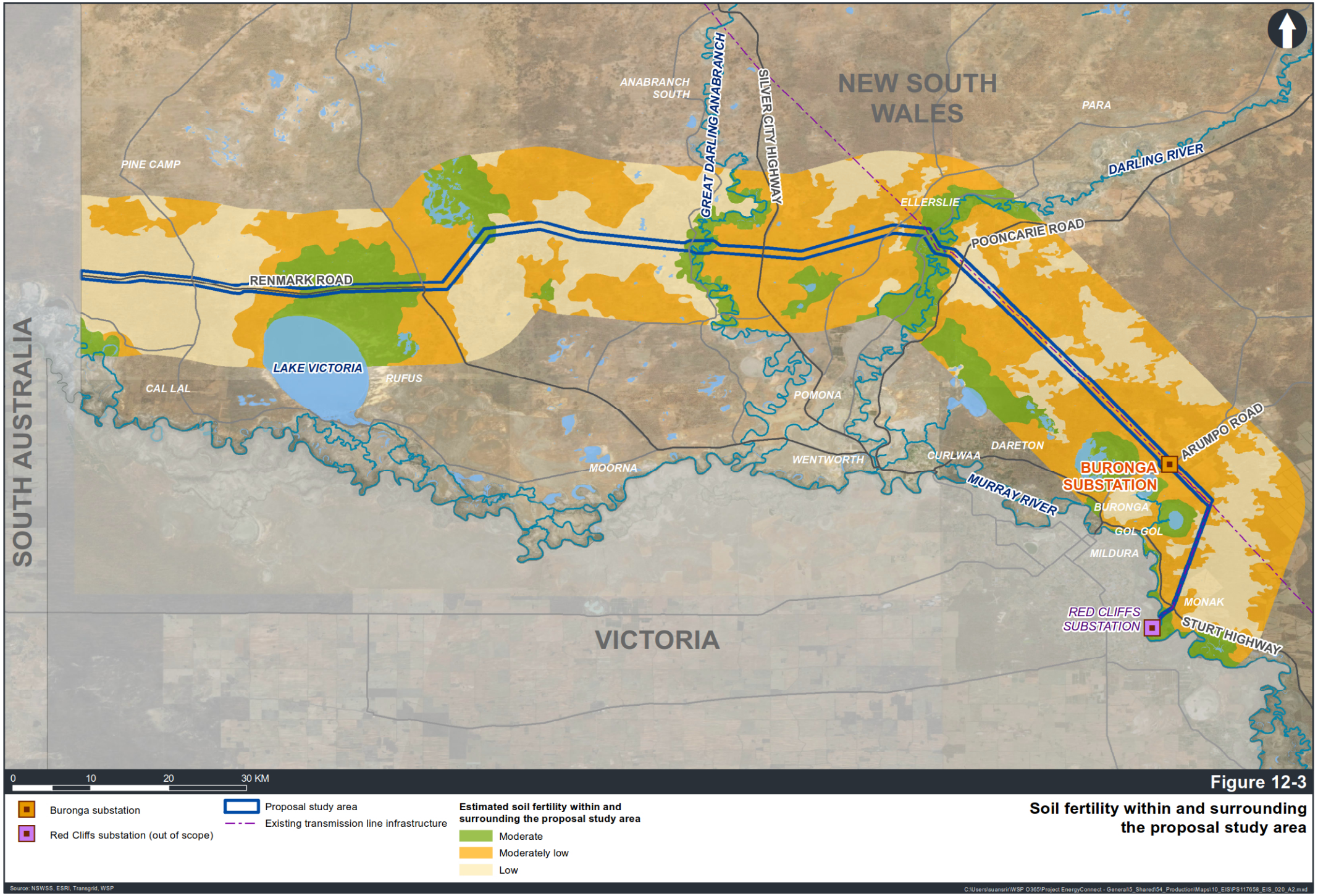

Figure 12-3

Soil fertility within and surrounding the proposal study area

12.3.5 Land and soil capability

Land and Soil Capability (LSC) is based on an assessment of the biophysical characteristics of the land, the extent to which this will limit a particular type of land use and the current technology that is available for the management of the land. LSC Class 1 represents land capable of sustaining most intensive land uses including those that are often associated with regular soil cultivation, whereas Class 8 represents land that can only sustain very low intensity land uses to minimise land and environmental degradation.

The highest capability land within the proposal study area is Class 4 capability land (moderate capability land), which is located around the Darling and Murray Rivers and is associated with the alluvial soils that can support cropping and horticultural land uses.

Land mapped as LSC class 5 (moderate-low capability land) is prevalent in the eastern and central sections of the proposal study area near the Darling Anabranch, Wentworth and Buronga, while most of the remainder of the land within the proposal study area consists of Classes 6 and 7 (low to very low capability land).

Refer to Section 4.3 of Technical paper 3 for more information.

12.3.6 Biosecurity risk

The Far West region of NSW has the potential to effectively manage biosecurity risks due to its separation from major populations and intensive agricultural industries as well as its semi-arid climate, which is challenging for exotic animals and plants to survive (DPE, 2017b). As such, the region has relatively few examples of widespread introduced species of weeds.

However, there are several species of weeds that are likely to be located in the vicinity of the proposal study area including (refer to Section 4.1.9 of Technical paper 3 for further detail):

- six species of weeds recorded during property inspections under the *Biosecurity Act 2015* (DPI, 2020)
- a likely occurrence of six noxious weeds, declared under the former *Noxious Weeds Act 1993*
- 11 species that are identified as regional priority weeds on the *Western Regional Strategic Weed Management Plan 2017 – 2022* (Western LLS, 2017)
- one state priority weed – Bitou bush (*Chrysanthemoides monilifera*)
- four weeds that were specifically mentioned as problematic weeds by landholders and the Wentworth Shire Council biosecurity officer: Khaki weed, caltrops, thornapple and onionweed
- Noogoora burr and Bathurst burr, which can be a problem in irrigation fields and contaminate wool.

During consultation, local landholders and the Western LLS biosecurity officer identified rabbits, foxes, kangaroos, goats, wild dogs and pigs as the main vertebrate pests in the vicinity of the proposal study area. These pest animals can cause damage to primary production, natural environments and cultural assets. Common carp is also present throughout all major river systems in the Western LLS region (Western LLS, 2018). Plague locusts can also cause problems in favourable seasons.

Some species (such as goats and pigs) pose significant biosecurity, economic and social threats to agricultural land uses in the proposal study area as they can harbour and transmit both endemic and exotic diseases (Western LLS, 2017). The prevalence of sheep footrot and bovine Johnes disease within and surrounding the proposal study area is considered to be low in recent years and unlikely to readily spread.

Horticultural enterprises within and surrounding the proposal study area are particularly susceptible to plant diseases and pests. Parts of the proposal study area are located in quarantine zones including the:

- Greater Sunraysia Pest Free Area, which is aimed at preventing the entry of the Queensland fruit fly by banning certain fruit and vegetables from entering the area
- Phylloxera Exclusion Zone, which bans taking grapevines, cuttings or budwood into this zone
- Potato Biosecurity Zone, which bans the movement of plants belonging to the *Solanaceae* family and associated matter into this zone.

The NSW Rice Pest and Disease Exclusion Zone also lies to the east of the proposal study area and bans the entry of rice plants or grain such as paddy rice or brown rice.

12.4 Potential impacts – construction

12.4.1 Property impacts

The proposal would require the acquisition and/or temporary leasing of land within the proposal study area (refer to Section 6.7). This may require TransGrid to secure:

- temporary leases of freehold land for temporary access and construction
- temporary leases for affected sections of Crown Land (Western Land Leases) in accordance with the *Crown Lands Management Act 2016* for access and construction
- an easement for the transmission line. Easements would restrict certain activities on the land for ongoing maintenance and operation of the electricity network, including any permanent access tracks. Acquisition to create easements would be carried out under private treaty arrangements (including options) or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*
- land acquisition for the Buronga substation expansion and upgrade.

As described in Section 5.4, an area of around 25 hectares has been permanently acquired for the upgrade and expansion of the Buronga substation. The remainder of property requirements would be facilitated by leases for temporary works or sites, and the creation of easements for the transmission line. No residential dwellings would be subject to acquisition for the proposal, however there may be impacts on other infrastructure (such as agricultural sheds, fencing and gates).

The final extent of property acquisition or creation of easements, and associated mechanisms, would be refined and confirmed during detailed design in consultation with landholders.

Figure 12-4 shows the location of the transmission line corridor with respect to the surrounding property holdings. The transmission line corridor has been located, through discussions with landholders, to minimise impacts to property, to ensure that land uses remain viable and access is retained. The guiding principle to minimise the potential for property impacts located along the transmission line corridor was to locate the final transmission line easement parallel with existing transmission lines or road corridors or along property boundaries, where possible.

Impacts due to the acquisition of easements, for instance reduction in production capacity due to the restriction on farming activities, would be subject to compensation negotiated through the acquisition process. Any adjustments to fences, dams, access tracks or other property infrastructure that would be required for the proposal would be undertaken in consultation with the landholder and at no cost to the landholder.

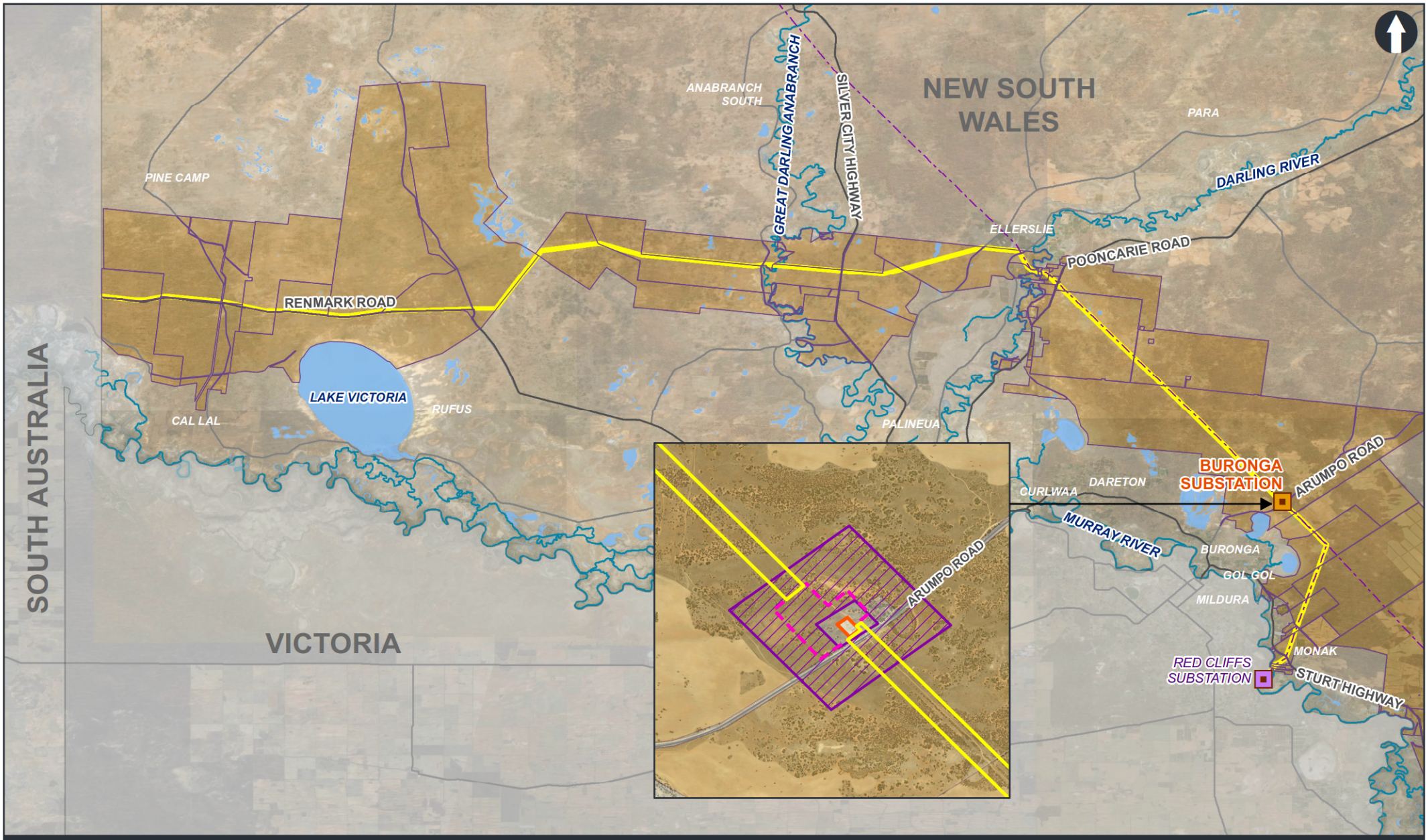

Figure 12-4

The proposal with respect to property holdings

All acquisitions of privately owned land would be carried out in consultation with the landholders through the private treaty process or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016. The acquisition of Crown Land would be undertaken in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991, Crown Lands Management Act 2016* and the *Crown Land Legislation Amendment Act 2017.*

Areas within the construction footprint that are not required for operation of the proposal, including any temporary access tracks or construction compounds, would be rehabilitated at the completion of construction to a similar condition as the existing land. Easements would be created throughout the construction period, with all easements being in place prior to completion of construction.

12.4.2 Land use changes

Land use and productivity loss and restrictions

Construction activities may result in temporary land use changes to accommodate construction facilities (refer to Section 6.7). Temporary land use changes are most likely to impact existing agricultural enterprises within the proposal study area.

These land use changes are likely to disrupt agricultural activities through:

- temporary access restrictions, which may require landholders to access sections of their properties via alternative routes
- noise created by the construction activities, which may be an issue during calving and lambing as livestock
- damage to existing fences or stock water pipelines, or gates accidentally left open leading to loss of livestock during construction
- potential indirect impacts to water sources such as farm dams (discussed further in Section 15.4).

Land use changes due to construction of the proposal are more likely to negatively impact areas used for cropping and horticulture within the proposal study area (refer to Figure 12-1) due to their higher intensity land use. However, the restrictions during construction of the proposal would generally be, of a short duration due to the progressive nature of construction, in a limited location and would be minimised through appropriate mitigation measures (refer to Section 12.6.2). These mitigation measures would include establishment of alternate access routes in consultation with landholders, such as temporary access tracks where required.

The agricultural productivity of the proposal study area is relatively low compared to other areas in NSW, largely due to low rainfall, high temperatures and low to moderate fertility soils (refer to Section 12.3.3). This is reflected in the relatively low value of agricultural production on a per hectare basis as well as the small proportions of the proposal study area being used for higher value cropping and improved pastures. As such, the overall impact on agricultural productivity within and surrounding the proposal study area from construction of the proposal is expected to be negligible.

Moreover, the proposal study area would cover a small fraction (about 0.6 percent) of the agricultural land in the Wentworth LGA, and therefore the impacts of the proposal on the overall agricultural activities in the region would be minimal. Additionally, given the relatively small size of the disturbance area compared to the large average size of the agricultural properties, construction activities are not likely to cause significant loss, fragmentation or alienation of agricultural land or significant disruptions to agricultural operations.

The proposal would not impact any travelling stock reserves. Direct impacts to private airstrips have been avoided through the selection of the transmission line corridor, and consultation with these landholders have advised that the proposal would not impact their use of these private facilities.

Upon completion of construction, the construction facilities and temporary access tracks would be removed and any land that is not required for operation within the construction footprint would be rehabilitated and returned to the relevant landholder to minimise loss in land use or viability.

Mining operations

The periphery of the two mining operations and the Monak quarry all intersect the transmission line corridor. For areas subject to exploration licences, consultation with these operators have advised that the proposal is unlikely to impact their activities. In the case of the quarry, the existing transmission line passes to the immediate west of the quarry. The final transmission line infrastructure for the proposal would be placed to avoid direct impacts on the quarry.

Biosecurity risks

There are risks that animal diseases, plant diseases, feral pests and (especially) weeds could be introduced or spread during the construction of the proposal through vehicle, machinery or construction personnel movements. Biosecurity matter could also be spread by soil erosion and water runoff associated with construction works.

Risk of weed spread

The risk of weed spread is generally highest during the earthworks phase of construction, due to the high frequency of vehicle movements and disturbance of ground cover and soil, which could lead to weed growth. Some species of weeds are readily spread by vehicles, machinery and human activity, including cactuses, spiny burrgrass, khaki weed, Noogoora burr and Bathurst burr.

A biosecurity incident has the potential to impact surrounding agricultural enterprises due to the costs of monitoring pests, weeds or diseases and implementing control measures as well as the reduced income caused by loss of livestock, crop or pasture production and lower produce quality.

To minimise the risk of biosecurity incidents occurring due to construction, mitigation measures would be implemented to avoid the spread of weeds. In addition, the proposal study area lies within the biosecurity zones for alligator weed, bitou bush and water hyacinth (as per the *Biosecurity Regulation 2017*), which means that the local control authority would need to be notified of a new infestation of the weeds as well as action undertaken by the contractor to eradicate, destroy or suppress the weeds.

Risk of livestock disease

There is the potential for livestock diseases to be spread during construction of the proposal including:

- ovine footrot, which is an important risk despite its low current prevalence due to the relative ease of its spread and economic consequences due to impacts to stock health, productivity and value, as well as disease control costs
- ovine Johne's disease, which can result in significant economic losses due to sheep deaths, lost meat production, fewer lambs and less wool
- sheep lice, which can cause significant losses in sheep enterprises due to treatment costs, reduced wool growth and lower meat production.

Under the *Biosecurity Act 2015*, ovine footrot and ovine Johne's disease are notifiable diseases.

However, considering the low density livestock and low prevalence of disease in the area, the overall risk of spreading these livestock diseases during construction is low.

Risk of other pest or disease spread

The most significant livestock pests in the vicinity of the proposal study area are pigs, foxes and rabbits, which may result in economic impacts on livestock and crop enterprises due to lamb predation, fence damage or consumption of pasture and crops. However, construction activities are unlikely to significantly change the number or movement patterns of these pests.

Horticultural enterprises may be impacted if construction activities were to result in inappropriate plant material or soil being brought into the proposal study area via vehicle, construction personnel or water movements. For example, the avocado orchards near the proposal study area may be susceptible to phytophthora root rot. This risk for horticultural enterprises will be minimised through implementation of mitigation measures to prevent the spread of pests or disease within the construction footprint. It is noted that these plant diseases or pests are not considered to be an issue for grazing enterprises in the region.

12.5 Potential impacts – operation

12.5.1 Property impacts

New or modified easements would be created for the proposal. Easements would restrict activities along the transmission line (refer to Section 12.5.2), and provide 'right of way' for TransGrid to operate and maintain the infrastructure.

Land access would preferentially rely on use of existing access gates, driveways, access tracks or as otherwise agreed (e.g. driving over paddocks when agricultural cropping is not a constraint).

Permitted activities within easements would depend on the nature or scale of the activity, as well as proximity to the transmission line and structures. All activities, except for cropping and grazing activities, are not allowed within the defined exclusion zones, unless otherwise agreed to by TransGrid.

12.5.2 Land use changes

Land use and productivity loss and restrictions

Operation of the proposal would result in a permanent change in land use from agricultural to electrical infrastructure where permanent infrastructure is located along the transmission line (e.g. tower structures and permanent access tracks) and at the expanded and upgraded Buronga substation.

The land within an easement, and immediately next to the proposal could continue to be used for grazing. However the proposal has the potential to reduce the land available within the proposal study area for cropping and horticultural land uses. These land uses comprise a small portion of the proposal study area (approximately eight per cent) and the area of land affected would be minimised where possible through design refinement.

There would be several movement and activity restrictions for surrounding agricultural activities as:

- the method and/or area for certain cropping and horticultural activities (including cultivation, crop establishment, spraying travel patterns and use of wide farming equipment) may need to be adjusted to avoid the transmission line structures and easement, which may reduce efficiency
- equipment within the transmission line easements would be restricted to a height of 4.3 metres to minimise the risk of collision or close approach with the transmission lines, which would prevent use of certain equipment within the easement such as large grain harvesters and grain augurs, which can typically extend up to five metres
- aerial activities, such as aerial spreading/spraying of fertilisers and use of drones for mustering or monitoring crops, would not be allowed within 60 metres of the transmission lines to minimise risk of collisions
- sheep and cattle may be disturbed by noise generated during operation or maintenance activities
- the transmission lines and high voltage equipment may cause interference with surrounding radiocommunication equipment used, which is most likely to occur during rain and is likely to only affect one rural building beyond the easement (refer to BECA 2020 and Section 19.5.4)
- sections of existing fences and gates may need to be realigned.

The overall impact on existing agricultural activities is expected to be relatively minor as:

- cropping and horticultural land uses only represent a small proportion of the proposal study area and no transmission line structures would be located on existing horticultural land
- the proposed transmission line easement for the 220kV line from the Buronga substation to NSW/Victorian border would be the same width and parallel to the existing easement, and the land within the existing easement would be returned to the relevant landholder, which would offset any land use losses
- the existing dryland cropping land uses are mainly located within the section between the existing Buronga substation and NSW/Victoria border, which is subject to an existing transmission line easement
- few aerial agricultural activities are expected to occur within the proposal study area
- any affected fences or gates would be realigned and/or reinstated in accordance with agreement with landholder, relevant guidelines and standards.

Operation of the proposal will not impact any travelling stock routes.

Biosecurity risks

Movement of vehicles and equipment associated with maintenance and operation of the proposal may introduce or spread animal diseases, plant diseases, feral pests and weeds within the proposal study area. The potential impacts of this would be similar in nature to the construction phase (refer to Section 12.4.2), however the risk would be lower due to less frequent vehicle and equipment movements and infrequent ground disturbance. Regardless, the proposal would require ongoing weed control around and underneath transmission line structures during operation as part of regular maintenance activities in accordance with landholder agreements.

12.6 Management of impacts

12.6.1 Environmental management

Environmental management for the proposal will be carried out in accordance with the approach detailed in Chapter 23 (Environmental management).

12.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to land use and property are listed in Table 12-3.

Table 12-3 Mitigation measures – land use and property

Reference	Mitigation measure	Timing	Applicable location(s)
LP1	During detailed design, access tracks (temporary and permanent) will be determined in consultation with landholders and to minimise impacts to agricultural activities to the greatest extent possible. Where permanent tracks are required, a single access track will be designed to serve both temporary and permanent purposes, where possible.	Detailed design	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
LP2	Transmission line structures (and associated permanent structures or construction compounds) will be located where possible to avoid or minimise impacts, or as agreed with the affected landholder, on: > cropping and irrigated horticultural land > areas used for set up and pack up of agricultural equipment, entry points and turning areas > radiocommunication sensitive areas > drainage catchments for farm dams > locations of high biosecurity risk.	Detailed design	All locations
LP3	Final transmission line easement will be located parallel with existing transmission lines or road corridors or along property boundaries, where possible, to reduce potential fragmentation of properties and disturbance to existing land uses.	Detailed design	All locations
LP4	To minimise disruption to agricultural activities: > landholders will be consulted regarding any required adjustments to property infrastructure (fences, access tracks, etc) and the proposed timing and location of construction works, especially where some restriction on vehicular or stock movements will be necessary. Appropriate arrangements will be negotiated with the affected parties and in place prior to any such disruption > property infrastructure (such as gates) will be managed in accordance with landholder requirements and any damage caused by construction will be repaired promptly > use of existing roads, tracks and other existing disturbed areas will be prioritised > where access is required across open spaces, care will be exercised to ensure that minimum damage is caused to the surface by confining vehicular or plant movement, as far as possible, to one route.	Pre-construction and construction	All locations
LP5	Disturbed areas will be stabilised and appropriately rehabilitated as soon as feasible and reasonable following the completion of construction. This will be carried out in consultation with the relevant landholder.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
LP6	Procedures will be implemented so that potential impacts or conflicts between livestock and construction activities are appropriately managed. Procedures will be developed in consultation with effected landholders will include management of: > Noise intensive activities during sensitive periods within the livestock production cycle (such as lambing and calving) > Vehicle movements and other activities within the vicinity of livestock > Movement of stock away from potential stressors created by construction activities.	Construction	Transmission line
LP7	Biosecurity controls will be implemented during construction to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls will include (but not limited to): > inspections and cleaning of vehicles, machinery, and personnel equipment prior to movement on and off the construction work areas or between properties > minimising movements across adjoining farmland including trip numbers and locations > additional measures where localised areas of high biosecurity risks have been identified. The effectiveness of these controls will be regularly monitored.	Construction	All locations
LP8	Where present, weeds will be managed in consultation with Western LLS, Wentworth Shire Council and NSW Department of Primary Industries.	Construction	All locations
LP9	In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority will be notified as per *Biosecurity Act 2015* and Biosecurity Regulation 2017.	Construction	All locations
LP10	Fencing and access arrangements along the transmission line easement, such as locked gates, will be determined in consultation with landholders.	Operation	Transmission line
LP11	Biosecurity controls will be implemented during operation to minimise the risk of off-site transport or spread of disease, pests or weeds during maintenance activities.	Operation	All locations
LP12	Where present, weeds will be managed in accordance with the *Biosecurity Act 2015*.	Operation	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
LP13	Management of access including opening and closing of gates and monitoring of fencing will be done in accordance with landholder requirements. Any damage caused by maintenance activities will be repaired promptly.	Operation	All locations

12.6.3 Managing residual impacts or uncertainties

The final transmission line easement, permanent infrastructure locations and extent of property acquisition will be refined and confirmed during detailed design in consultation with landholders. Residual impacts will be refined following detailed design and application of mitigations.