13. Landscape character and visual amenity

This chapter provides an assessment of potential landscape character and visual amenity impacts and mitigation measures to address these impacts. It summarises *Landscape and Visual Impact Assessment* (Iris, 2020) for the proposal (refer Volume 2, Technical paper 4).

13.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to landscape character and visual amenity and where these requirements are addressed in this EIS are outlined in Table 13-1.

Table 13-1 Secretary's environmental assessment requirements – landscape character and visual amenity

Ref.	Secretary's environmental assessment requirements	Where addressed
Amenity		
Key issues	The EIS must address the following matters: > an assessment of the likely visual impacts of the development on surrounding residences, scenic or significant vistas, night lighting, air traffic and road corridors in the public domain.	Landscape and visual impacts during construction are detailed in Section 13.4. Landscape and visual impacts during operation are detailed in Section 13.5.

13.2 Assessment approach

13.2.1 Legislative and policy context

The assessment considers national, state and local government policies and plans relevant to landscape and visual amenity, including:

> *Lake Victoria Cultural Landscape Management Plan of Management*, 2019 – The Lake Victoria Cultural Landscape Management Plan of Management is a plan developed by the Murray Darling Basin Authority to protect Aboriginal cultural heritage under an adaptive management framework, through scientific investigations, operational actions, on-ground works and community involvement (Murray–Darling Basin Authority, 2019)

> Far West Regional Plan 2036 – The Far West Regional Plan is NSW Government's vision for the Far West region to create a diverse economy, supported by the right infrastructure, protect an exceptional natural environment and create resilient communities

> Wentworth LEP – The purpose of the Wentworth LEP is to encourage and manage ecologically sustainable development within Wentworth. In particular, it aims to encourage the retention and enhancement of land that supports the productive agricultural activities while conserving and protecting areas of cultural heritage and environmental significance, including conservation parks, reserves and the Murray and Darling River systems

- Wentworth Shire Development Control Plan 2011 (DCP) – The Wentworth DCP supports the Wentworth LEP by providing additional objectives and controls for administering development. The DCP recognises the visual quality of the rural landscape, stating that development in rural areas should be consistent with the rural character and avoid significant environmental features, such as natural forms, remnant native vegetation, wetlands or natural watercourses and drainage
- Buronga and Gol Gol Structure Plan – The proposal is outside of the Buronga and Gol Gol structure plan area and the associated master plan area. Although the plan recognises the importance of the shire's rural 'views and vistas' in relation to the design and placement of Highway Promotional Signs, the plan does not identify any specific views, lookouts or areas containing landscape character value for protection within the Shire.

As the proposal is a declared CSSI, the Wentworth LEP and DCP do not apply and has been considered for context only.

The assessment was also prepared with reference to the following guidelines:

- Guidance Note for Landscape and Visual Assessment (Australian Institute of Landscape Architects Queensland, 2018)
- Guidance for Landscape and Visual Impact Assessment, Third Edition (Landscape Institute and Institute of Environmental Management & Assessment, 2013)
- AS/NZS 4282:2019 – Control of the obtrusive effects of outdoor lighting (Standards Australia, 2019).

13.2.2 Methodology

Landscape character and visual amenity were assessed to identify the likely impacts arising from the proposal, considering landscape character, day and night-time visual amenity, detailed below. This generally involved:

- a review of the relevant legislative and policy framework
- identifying the existing environmental conditions, supported by site visits
- assessing the impacts of the proposal during construction and operation on:
  - landscape character
  - visual impact during the daytime and night-time
  - impacts on views from private properties
- assessing potential cumulative impacts due to other projects within neighbouring areas
- identifying mitigation measures.

The operational landscape and visual impact assessment has adopted an indicative centreline for the transmission line alignment for the purposes of impact assessment. The potential landscape and visual impacts would be confirmed during detailed design to take into account any alignment shifts closer to or away from sensitive receivers.

The assessment methodology for the landscape and visual impact assessment is detailed in the following section.

Landscape impact assessment method

To assess the potential landscape character impacts, the assessment identifies the:

- existing landscape character areas of the proposal study area, by dividing the area into landscape character areas that reflect the qualities of the built, natural and cultural environment
- sensitivity of the landscape sensitivity within the proposal by considering the frequency and volume of users, as well as reflecting on the valued landscape characteristics such as rarity, tranquillity, scenic amenity and its contribution to sense of place. Landscape sensitivity levels applied in this assessment are defined in Table 13-2
- magnitude of change to the landscape character due to the proposal. This considers adverse and beneficial impacts, as well as direct impacts (e.g. the removal of vegetation) and indirect impacts (e.g. changes to the function of an area of open space). The magnitude of levels ranges from very high to negligible, and are defined in Table 13-3)
- impact to landscape character. This is determined through a risk-based matrix approach that considers the sensitivity of the specific landscapes paired with magnitude of change anticipated resulting from the proposal (refer to Table 13-4).

Table 13-2 Landscape sensitivity levels

Landscape sensitivity	Description
National	Landscape feature or place that is protected under national legislation or international policy (e.g. the Red Top Lookout at the World Heritage Listed Mungo National Park).
State	Landscape feature or place that is heavily used and/or is iconic to the state (e.g. Lake Victoria).
Regional	Landscape feature or place that is heavily used/iconic and valued by residents of a major portion of a city or a non-metropolitan region, and / or places with regionally important scenic value or to landscape features.
Local	Landscape feature that is valued and experienced by concentrations of residents and/or local recreational users, and / or places of local scenic value or local landscape features.
Neighbourhood	Places without any particular scenic value or local landscape features.

Table 13-3 Landscape magnitude of change

Magnitude of change	Description
Very high	The landscape is altered such that the proposal dominates and / or transforms its character, amenity and / or function.
High	The proposal substantially changes and / or is not compatible with the character, amenity, and function of the landscape.
Moderate	The proposal somewhat changes and / or is not compatible with the character, amenity, and function of the landscape.
Low	The proposal changes are minor and / or are compatible with the character, amenity, and function of the landscape.
Negligible	The proposal would not change the character, amenity and/ or function of the landscape.

Table 13-4 Landscape impact matrix

Magnitude of change	Sensitivity				
	National	State	Regional	Local	Neighbourhood
Very high	Very high	Very high	High	High	Moderate
High	Very high	High	High	Moderate	Low
Moderate	High	High	Moderate	Low	Negligible
Low	Moderate	Moderate	Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Daytime visual impact assessment method

An assessment of the potential visual impacts was carried out for the proposal. It considers impacts to visual amenity as experienced by people and aims to identify the range of views to the proposal study area that may be impacted. To assess the potential visual impacts, the assessment identifies the:

- existing visual catchment through an assessment of existing visual amenity conditions, supported by a digital visibility analysis and site visits
- viewpoints that have been selected to represent the range of views within the visual catchment. This included views from locations which have been identified as having increased visual sensitivity and where people are likely to congregate
- visual sensitivity of the viewpoints considering the nature and duration of views, and distance of view. This considers the sensitivity of the possible views, ranging from national to neighbourhood significance (refer to Table 13-5)
- magnitude of change on specific viewpoints from the proposal. The magnitude of levels ranges from very high to negligible, and are defined in Table 13-6)
- overall level of impact on visual amenity. This is determined through a risk-based matrix approach that considers the sensitivity of the specific visual amenity paired with magnitude of change anticipated resulting from the proposal (refer to Table 13-7).

Table 13-5 Visual sensitivity levels

Visual sensitivity	Description
National	Heavily experienced view to a national icon, views to areas with a scenic value of national importance or to landscape features of the state, and / or views from World Heritage Listed Places.
State	Heavily experienced view to a feature or landscape that is iconic to the State (e.g. Lake Victoria), or views to areas with a scenic value recognised by the State.
Regional	Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space (e.g. a view from the Darling and Murray River Junction viewing tower in Wentworth), or views to areas of regionally important scenic value or to landscape features of the region.
Local	High quality view experienced by concentrations of residents and/or local recreational users, local commercial areas and/or large numbers of road or rail users, or views to areas of local scenic value or to local landscape features.
Neighbourhood	Views where visual amenity is appreciated by a small number of residents, not particularly valued by the wider community.

Table 13-6 Visual magnitude of change

Magnitude of change	Description
Very high	The view is altered such that the proposal dominates and transforms the character of the view.
High	The proposal is visually prominent, and / or contrasts with the character of the view.
Moderate	The proposal is somewhat prominent and / or is not compatible with the character of the view.
Low	The proposal is not visually prominent and / or is visually compatible with the character of the view.
Negligible	The proposal is not visible, is not visually prominent in the view and / or is compatible with the character of the view.

Table 13-7 Visual impact matrix

Magnitude of change	Sensitivity				
	National	State	Regional	Local	Neighbourhood
Very high	Very high	Very high	High	High	Moderate
High	Very high	High	High	Moderate	Low
Moderate	High	High	Moderate	Low	Negligible
Low	Moderate	Moderate	Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Night-time visual impact assessment method

An assessment of the potential visual impacts of the proposal at night uses similar methodology to the daytime assessment. To assess the potential night-time visual impacts, the assessment identifies the night-time visual sensitivity by determining the environmental zone(s) (defined in AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting) that best describes the existing night-time visual conditions. The impact to night-time visual amenity uses a risk-based matrix approach that considerers the sensitivity of the specific night-time visual impacts, paired with magnitude of change anticipated resulting from the proposal.

Assessment of views from private properties

The assessment of visual impact on views from private residential properties is guided by the planning principles for 'view sharing' provided in the judgement of the NSW Land and Environment Court in the *Tenacity Consulting V Warringah Council* [2004], NSWLEC 140. The principles set out in the judgement can be applied to regional landscape settings in a more general way and with considerations of scenic preference appropriate for the range of landscapes available within the setting of the proposal.

For the purposes of this assessment:

- all receivers identified within the landscape and visual study area have been assessed. Where there is a group of properties in this area, a house which represents the worst-case scenario has been selected and assessed as representative of views from this group
- to determine whether view sharing is reasonable the judgement identifies a four-step assessment process, considering the views affected (desktop only) and from what part of the property the views are obtained, the extent of the impact and the opportunity to respond through detailed design
- further assessment would be required where an impact is identified that may require a mitigation response. This would include an inspection from the residence to confirm the extent of visibility, significance of any impact and the need for mitigation in consultation with the landholder.

13.3 Existing environment

13.3.1 Overview

Landscape character areas for the existing environment have been characterised as areas with similar topography, vegetation type and land use. The three landscape character types for the proposal from east to west (depicted in Figure 13-1) are:

- Murray River plain rural landscape character area
- Mallee shrubland and rural landscape
- Lake Victoria Cultural Landscape and semi-arid plains.

The visual catchment of the proposal study area varies across the study area and determined primarily by landform and vegetation cover. More significant structures, such as transmission line structures, would be visible from a broad visual catchment due to the broad open semi-arid and rural landscapes. The visual sensitivity of the proposal study area is influenced by a range of tourist routes, facilities and land uses located throughout the study area. The location of selected viewpoints is provided in Figure 13-1. In addition to these viewpoints, a view from the air is addressed for the whole proposal study area.

A number of tourist routes and places are present within the three landscape character types for the proposal, including:

- Lake Victoria
- Classic Australian Drive
- Silver City Highway
- Mallee Cliffs National Park
- Wentworth to Mungo Loop tourist route.

While the tourist routes and places exist within three landscape character types, no significant vistas or identified scenic views exist within the proposal study area. However, this assessment has considered views from scenic routes, views to landscapes with scenic value and views from road corridors. The relative scenic value of these views is considered in determining the sensitivity level of each view (as discussed in Section 13.2.2, and Sections 13.3.2 to 13.3.5).

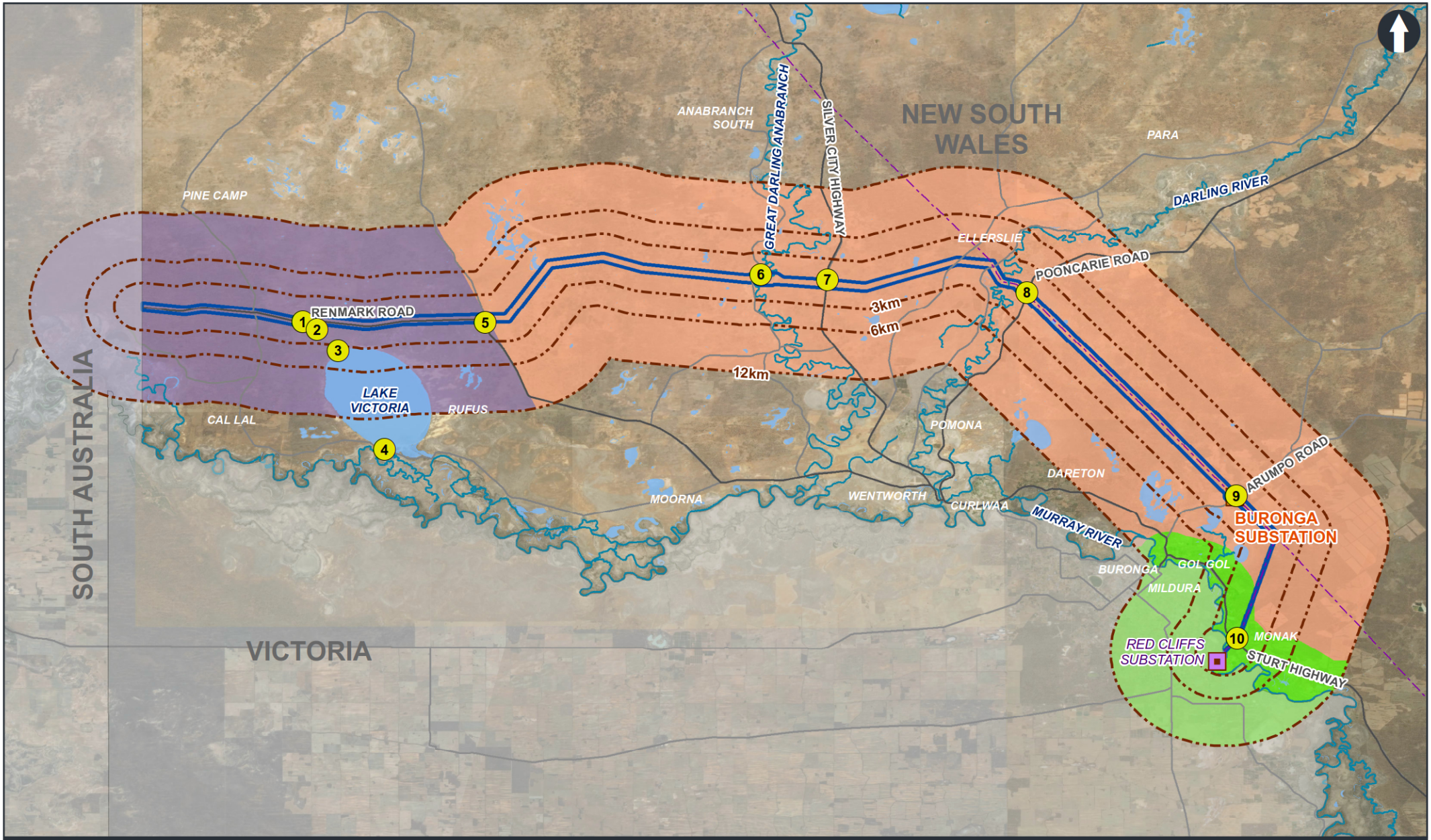


Figure 13-1

Landscape character types

13.3.2 Lake Victoria Cultural Landscape and semi-arid plains

The Lake Victoria Cultural Landscape and semi-arid plains landscape character area extends generally between the SA/NSW border and Nulla Road, north of Lake Victoria. The landscape consists of vast semi-arid plains of low elevation, with sandhills and gentle undulating sandy rises, interspersed by dense swathes of low mallee shrubland. The landscape has a remote and arid character, and includes salt pans and expanses of flat, low open shrubland.

Near Nulla Road, the landscape is open, with vegetation cleared for grazing, allowing expansive slightly elevated views, with some long-distance views to Lake Victoria. Further to the west, the landscape transitions into dense, low mallee shrubland, which encloses views.

The area is sparsely populated, including a few remote pastoral properties (including the heritage listed 'Nulla Nulla' and 'Noola' stations) with homesteads and staff cottages. There is also a small group of residential properties at Lake Victoria, associated with the management of the lake.

Renmark Road provides access to the northern camps of Lake Victoria and rural properties in this part of the proposal study area.

Renmark Road creates a northern boundary to the setting of Lake Victoria, so that areas to the north of this road contribute less to the sense of place of the lake. As such, the Lake Victoria Cultural Landscape and semi-arid plains landscape character area is of:

> state sensitivity south of Renmark Road
> regional sensitivity to the north of Renmark Road.

The visual sensitivity of the viewpoints within this landscape character unit is summarised in Table 13-8.

At night, the landscape area has limited light sources, with lighting associated with sparsely located residences, security lighting and intermittent vehicles on roads. The area is considered to have a high visual sensitivity.

Table 13-8 Lake Victoria Cultural Landscape and semi-arid plains – viewpoints

Viewpoint	Description	Sensitivity
Viewpoint 1: View east along Renmark Road	At this location, the landscape has scenic amenity value as a part of the Lake Victoria setting, and is a locally common view.	Local
Viewpoint 2: View north from track to Lake Victoria	This track is within an area with restricted public access, which is used by the local Aboriginal community to access the northern camps of Lake Victoria. This landscape has a high value to the local Aboriginal people and is associated with the visual setting of Lake Victoria. While a locally common view, this location is important to the sense of place and a part of the journey to Lake Victoria.	Regional
Viewpoint 3: View north from track near Lake Victoria		
Viewpoint 4: View north from Lake Victoria visitor lookout	Lake Victoria is a 'significant cultural landscape' in the Cultural Landscape Management Plan (Murray–Darling Basin Authority, 2019), and a landmark feature given the contrast to the surrounding semi-arid landscape.	Regional
Viewpoint 5: View north from Renmark Road, near intersection with Nulla Road	At this location, the landscape has scenic amenity value as a part of the Lake Victoria setting, and is a locally common view. The buildings associated with Nulla Nulla heritage area are at a considerable distance and are not visible.	Local

13.3.3 Mallee shrubland and rural landscape

The landscape generally consists of open, undulating rural plains with areas of native eucalyptus forest (including mallee shrubland).

In most areas thick mallee scrub has been cleared for agricultural uses, with patches of this vegetation remaining. The agricultural uses include sheep and cattle grazing. Broadacre cereal cropping, viticulture and horticulture (mainly fruit and nut trees) industries are also present in areas close to the Darling River. Agricultural infrastructure, such as sale yards, processing facilities, silos and rural retail businesses (e.g. machinery businesses) occur in the proposal study area.

There are several seasonally dry relic lake beds, such as Lake Gol Gol and Gol Gol swamp, south of the proposal study area. While not visually prominent, these form local visual features and distinctive formations in the landscape. These areas are zoned for environmental conservation and management, but do not contain recreational facilities (e.g. trails or lookouts).

Existing electricity infrastructure, including the Buronga to Broken Hill 220 kV transmission lines and substations, and several arterial roads (e.g. Sturt Highway and Silver City Highway) are also present within the proposal study area. The area is a predominately rural landscape experienced by a sparse population and relatively low use roads. Tourists to the area travel along the Wentworth to Mungo Loop tourist drive. Certain areas are zoned to preserve the aesthetic values of the landscape, and there are several river crossings which have elevated local landscape value.

The Mallee shrubland and rural landscape character area is of local sensitivity.

At night, the landscape character area has limited light sources, with lighting associated with sparsely located residences, security lighting and intermittent vehicles on roads. The area is considered to have a high visual sensitivity. The visual sensitivity of the viewpoints within this landscape character unit is summarised in Table 13-9.

Table 13-9 Mallee shrubland and rural landscape – viewpoints

Viewpoint	Description	Sensitivity
Viewpoint 6: View south from Anabranch Mail Road	This road provides local access to properties. This is a locally common landscape which would be seen for several kilometres from vehicles moving at speed.	Local
Viewpoint 7: View south from Silver City Highway	This highway does not form part of the tourist route but would attract a greater use given connectivity to other regional areas. This is a locally common landscape which would be seen for several kilometres from vehicles moving at speed.	Local
Viewpoint 8: View south from Pooncarie Road	Pooncarie Road is part of the 'Wentworth to Mungo Loop' tourist drive and also part of 'The Classic Australian Drive'. A junction of several existing transmission lines at the Ellerslie substation can be seen. This is a locally common landscape which would be seen for several kilometres from vehicles moving at speed.	Local
Viewpoint 9: View northeast from Arumpo Road	Arumpo Road serves local homesteads and properties north of Gol Gol and Buronga, and is used mainly by residents, visitors and staff at the properties and substation. This road is also part of the 'Wentworth to Mungo Loop' tourist drive. Existing power infrastructure can be seen, including the Buronga substation and transmission lines. This area is likely to undergo change with the proposal solar farm on land that is currently used for agriculture.	Local

13.3.4 Murray River plain rural landscape

This landscape is relatively flat along the Murray River, rising to a higher-level terrace back from the riparian zone and then gently undulating to the north toward mallee. The area has been extensively cleared and modified for irrigated and dryland farming purposes. The rural landscape includes a mix of cereal crops, viticulture, and horticulture such as wine and table grapes, citrus, almonds and vegetable production.

The area is settled, contains a busy highway (Sturt Highway) and large-scale power infrastructure, including 220kV transmission line corridors, extending between Buronga and Red Cliffs, crossing the Murray River at Monak (Kings Billabong Park). Other infrastructure in the area include mineral extraction facilities beside the Sturt Highway north of Monak and a higher concentration of rural structures including sheds, workshops, packing and processing facilities, supporting the surrounding agricultural uses.

The riverfront areas of the Murray River and Trentham Cliffs have amenity and scenic landscape values. This area also has views to the River Murray Reserve and Kings Billabong Park across the river in Victoria. This landscape would be appreciated by larger numbers of people travelling along the Sturt Highway including tourists and visitors to the region.

The Murray River plain rural landscape character area is of local sensitivity.

The visual sensitivity of the viewpoints within this landscape character unit is summarised in Table 13-10.

At night, the Murray River plain rural landscape has low light levels associated with rural residences and from vehicles travelling on local roads, and light spill from nearby settlements such as Buronga, Gol Gol, Red Cliffs and Mildura. Overall, this landscape has a moderate visual sensitivity at night.

Table 13-10 Murray River plain rural landscape – view points

Viewpoint	Description	Sensitivity
Viewpoint 10: View southeast from Sturt Highway	At this location, the Sturt Highway is a two-lane road providing access to/from Buronga and Mildura, and is used by high volumes of residents, visitors and freight transporters. This section of the road forms part of the 'Wentworth to Mungo Loop' tourist drive. Although this view is experienced by high number of receivers, including tourists, the presence of existing large scale power infrastructure reduces the sensitivity.	Local

13.3.5 Other viewpoints

The proposal study area is also viewed from the air. These views are seen from scenic flights from Mildura Airport, with routes extending to Lake Victoria and Mungo National Park. As these scenic flights are for tourist and recreational purposes, the views from these flights would be of regional visual sensitivity.

13.4 Potential impacts – construction

13.4.1 Landscape character impacts

The level of impact on landscape character during construction is dependent on the landscapes sensitivity and the magnitude of change that would occur as a result of the proposal.

Across all landscape character areas, construction activities would involve the temporary mobilisation of plant throughout the proposal landscape to construct the proposal and to provide ancillary infrastructure (e.g. construction compounds and access tracks). Construction activity would be most prominent around transmission line structure footings, and at the Buronga substation upgrade and expansion site. Vegetation removal would be required, which would mostly comprise of shrubs and groundcovers. Landform modification would be small and localised.

Of specific note:

- within the Lake Victoria Cultural Landscape and semi-arid plains, there would be no direct impact to areas south of Renmark Road, which are of State sensitivity
- within the Mallee shrubland and rural landscape, while a large area would be modified to construct the Buronga substation upgrade and expansion and other supporting activities, the landform modifications overall would be small and localised with no direct impact on dry relic lake beds or other important landscape features
- within the Murray River plain rural landscape, there would be no direct impacts on any important landscape feature.

Table 13-11 summarises the construction impact assessment results for landscape character.

Table 13-11 Summary of landscape impact during construction

Landscape character area	Landscape sensitivity	Magnitude of change	Landscape impact
Lake Victoria Cultural Landscape and semi-arid plains	State (south of Renmark Road)	Negligible	Negligible
	Regional (north of Renmark Road)	Moderate	Moderate
Mallee shrubland and rural landscape	Local	Moderate	Low
Murray River plain rural landscape	Local	Low	Low

13.4.2 Day-time visual amenity impacts

Construction activities that would impact visual amenity during construction are associated with vegetation removal, excavation and levelling works, the construction of the proposal infrastructure, and the presence of plant and equipment that would temporarily pass through the assessed viewpoints. This includes excavators, cranes, ground pulled draw wire or stringing drones as required to erect the transmission line structures and string wires and conductors.

At Viewpoint 9, the proposal would result in a high magnitude of change due to the construction works required for the Buronga substation upgrade and expansion, the associated transmission line construction work, and the presence of the Buronga main construction compound and accommodation camp. Elsewhere:

- where works are visible at the assessed viewpoints, construction works would contrast with the surrounding landscape resulting in a moderate magnitude of change
- as distances to construction works increase or where intervening vegetation or existing power infrastructure are present, the magnitude of the change due to construction would decrease, resulting in low to negligible magnitude of change
- when viewed from the air, construction work would be visible but would be seen in a complex landscape resulting in a low to negligible magnitude of change.

Table 13-12 summarises the construction impact assessment results for day-time visual amenity.

Table 13-12 Summary of day time visual impacts during construction

Location		Visual sensitivity	Magnitude of change	Visual impact
Lake Victoria Cultural Landscape and semi-arid plains				
1	View east from Renmark Road, to alignment crossing	Local	Moderate	Low
2	View north from track to Lake Victoria	Regional	Moderate	Moderate
3	View from track near Lake Victoria	Regional	Low	Low
4	View north from Lake Victoria visitor lookout	Regional	Negligible	Negligible
5	View north from Renmark Road, near intersection with Nulla Rd	Local	Moderate	Low
Malle scrubland and rural landscape				
6	View south from Anabranch Mail Road to alignment crossing	Neighbourhood	Moderate	Low
7	View south from Silver City Highway to alignment crossing	Local	Moderate	Low
8	View south from Pooncarie Road to alignment crossing	Local	Low	Low
9	View northeast from Arumpo Road to proposed Buronga substation upgrade and expansion site	Local	High	Moderate
Murray River plains rural landscape				
10	View southeast from Sturt Highway to alignment crossing	Local	Moderate	Low
Views from the air				
	Views from the air	Regional	Low – Negligible	Low – Negligible

13.4.3 Night-time impacts

For the three landscape character areas the following night-time visual impacts during construction where determined. Construction work would occur between 7 am to 7pm, seven days a week, and camp accommodation would be proposed to operate 24 hours, seven days a week. Other works may be required during the night time period, in limited circumstances.

Given the hours of construction, there would be negligible magnitude of change to the landscape with the exception of the Mallee shrubland and rural landscape. This landscape character area would have a moderate magnitude of change due to the lighting required at the main construction compounds and accommodation camps. This would contrast with the predominately dark landscape.

Table 13-13 summarises the construction impact assessment results for night-time visual amenity.

Table 13-13 Summary of night-time visual impacts during construction

Landscape character area	Landscape sensitivity	Magnitude of change	Landscape impact
Lake Victoria Cultural Landscape and semi-arid plains	High	Negligible	Negligible
Mallee shrubland and rural landscape	High	Moderate	Moderate
Murray River plain rural landscape	Moderate	Negligible	Negligible

13.5 Potential impacts – operation

Approaches to avoid and minimise landscape and visual impacts were considered in the selection of the proposal study area. This includes:

- minimising the number of intersections with other infrastructure, which would require the use of taller structures
- avoiding towns along the alignment by following a route which is located a distance to the north of Mildura and Wentworth
- locating the alignment to the north of Renmark Road to minimise the visibility of the proposal from Lake Victoria
- minimising intersections with existing farm infrastructure, areas of vegetation within conservation areas and cultural heritage places
- using the existing Buronga substation site for the additional substation infrastructure utilising a location which is away from residential receivers and other prominent community viewpoints.

13.5.1 Landscape character impacts

The impacts to landscape character during operation would result from the upgraded and expanded Buronga substation, and the new transmission line structures spaced throughout the proposal study area. Areas directly impacted by construction would be rehabilitated, including revegetation as appropriate. Dispersed rural activities would continue under the transmission lines. However, there would be relatively small areas of direct impact, minimal landform changes and important landscape features would be avoided. Of specific note:

- within the Lake Victoria Cultural Landscape and semi-arid plains, there would be negligible change to the landscape south of Renmark Road, which is of State sensitivity. To the north, there would be a low magnitude of change due to the presence of new power infrastructure
- within the Mallee shrubland and rural landscape, there would be a moderate change in the landscape due to the presence of new and upgraded power infrastructure
- within the Murray River plain rural landscape, the proposal would replace the existing transmission line and as such, there would be a low magnitude of change.

Table 13-4 summarises the operational impact assessment results for landscape character.

Table 13-14 Summary of landscape character impact during operation

Landscape character area	Landscape sensitivity	Magnitude of change	Landscape impact
Lake Victoria Cultural Landscape and semi-arid plains	State (south of Renmark Road)	Negligible	Negligible
	Regional (north of Renmark Road)	Low	Low
Mallee shrubland and rural landscape	Local	Moderate	Low
Murray River plain rural landscape	Local	Low	Low

13.5.2 Day-time visual amenity impacts

The operation of the proposal would result in changes in visual amenity, due to the introduction of transmission lines and associated structures into the landscape, or changes in the scale of infrastructure as a result of upgrades to existing transmission lines and the Buronga substation. The magnitude of change ranges from negligible to high, noting:

- where new transmission lines are proposed, there would be a moderate to low magnitude of change. While the new structures would rise predominately in the landscape or above the tree line, it would not dominate or change the prevailing character of the view or change the use of the land. At greater distances, the visibility and prominence of the structures would decrease
- at Viewpoint 4, at the Lake Victoria visitor lookout, the proposal would be around 16 kilometres to the north. Any structures would be imperceptible due to this distance, combined with intervening vegetation and the rising landform
- where the proposal would replace existing infrastructure, the scale of the new transmission structures would increase (around 30 per cent in scale). However, the presence of existing infrastructure would increase the capacity of the views to absorb the change, resulting in a low visual impact
- in the case of Viewpoint 9, the proposal would result in a high magnitude of change as a result of the proposed transmission lines and the Buronga substation upgrade and expansion, and the removal of screening vegetation. While these changes would be somewhat absorbed into this view due to the existing power infrastructure, the upgraded and expanded substation would dominate this view
- when viewed from the air, the proposal would create a strong linear corridor across the landscape viewed from the air, and would be more prominent within the semi-arid plains, north of Lake Victoria. While the proposal would be seen unobstructed from the air and would extend across areas of views, the proposal would not change the prevailing character of these views and would result in a low to negligible magnitude of change.

Table 13-15 summarises the construction impact assessment results for day-time visual amenity.

The photomontages in Figure 13-2 to Figure 13-6 illustrate the likely magnitude of change at select viewpoints within the proposal. The depiction of the proposal within the photomontages has assumed the maximum proposed height (80 metres for the 330kV transmission line, and 50 metres for the 220kV transmission line), the typical spacing (at around 460 metres and around 390 metres between structures for the 330kV and 220kV transmission line respectively) and one type of structure (e.g. tower). As discussed in Chapter 5, the final height, spacing and structure type would be determined during detailed design.

Table 13-15 Summary of day-time visual impacts during operation

Location		Visual sensitivity	Magnitude of change	Visual impact
Lake Victoria Cultural Landscape and semi-arid plains				
1	View east from Renmark Road, to alignment crossing	Local	Moderate	Low
2	View north from track to Lake Victoria	Regional	Moderate	Moderate
3	View from track near Lake Victoria	Regional	Low	Low
4	View north from Lake Victoria visitor lookout	Regional	Negligible	Negligible
5	View north from Renmark Road, near intersection with Nulla Road	Local	Moderate	Low
Nulla Road to Mallee				
6	View south from Anabranch Mail Road to alignment crossing	Neighbourhood	Moderate	Low
7	View south from Silver City Highway to alignment crossing	Local	Moderate	Low
8	View south from Pooncarie Road to alignment crossing	Local	Low	Low
9	View north east from Arumpo Road to proposed Buronga substation upgrade and expansion site	Local	High	Moderate
Murray River plains rural landscape				
10	View southeast from Sturt Highway to alignment crossing	Local	Moderate	Low
Views from the air				
	Views from the air	Regional	Low – Negligible	Low – Negligible

Figure 13-2 Photomontages – View north from track to Lake Victoria (Viewpoint 2)

Figure 13-3 Photomontages – View north from track near Lake Victoria (Viewpoint 3)

Figure 13-4 Photomontages – View north from Renmark Road, near intersection with Nulla Nulla Road (Viewpoint 5)

Figure 13-5 Photomontages – View north from Silver City Highway (Viewpoint 7)

Figure 13-6 Photomontages – View south east from Sturt Highway (Viewpoint 10)

13.5.3 Night-time visual amenity impacts

Night-time visual amenity impacts associated with the operation of the proposal result from the security lighting around the Buronga substation, which would result in a low magnitude of change. No lighting of transmission lines and structures is proposed.

Table 13-16 summarises the construction impact assessment results for night-time visual amenity.

Table 13-16 Summary of night-time visual impacts during operation

Landscape character area	Landscape sensitivity	Magnitude of change	Landscape impact
Lake Victoria Cultural Landscape and semi-arid plains	High	Negligible	Negligible
Mallee shrubland and rural landscape	High	Low	Low
Murray River plain rural landscape	Moderate	Negligible	Negligible

13.5.4 Impacts on views from private properties

Distances to closest private properties from the transmission line corridor range from around five kilometres to 350 metres. Impacts would depend on the distance to the transmission line corridor, as well as presence of vegetation or intervening terrain.

There are a few private properties where there is a potential visual impact, including 'Regunyah', within the Lake Victoria Cultural Landscape and semi-arid plains character area; 'Wilton' and 'Dunvegan' in the Mallee shrubland and rural landscape; and a property about 500 metres east of the proposal alignment in the vicinity of the Sturt Highway within the Arable landscapes on the Murray River plain landscape character area. In the vicinity of residences such as these, mitigation measures (such as maximising the spacing of transmission line structures, or screening) would reduce the extent of visual change and reduce the potential visual impact.

13.6 Management of impacts

13.6.1 Environmental management

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

13.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to landscape character and visual amenity are listed in Table 13-17.

Table 13-17 Mitigation measures – landscape character and visual amenity

Reference	Mitigation measure	Timing	Applicable location(s)
LV1	Opportunities for the retention and protection of existing trees within the disturbance area will be identified during detailed construction planning.	Detailed design	Whole of proposal
LV2	Temporary and permanent access will be designed to minimise vegetation removal, changes to landform, and visual impacts.	Detailed design	Whole of proposal
LV3	Proposed permanent engineering batters and water management measures will be designed to integrate with the existing landforms and natural features.	Detailed design	Whole of proposal
LV4	Lighting at construction compound and accommodation camps will be designed and operated in accordance with AS4282-2019 Control of the obtrusive effects of outdoor lighting.	Detailed design	Construction compound and accommodation camps

Reference	Mitigation measure	Timing	Applicable location(s)
LV5	Transmission line structures, where possible, are designed: > to maximise distance from private residences > to use local vegetation and landform to provide screening from residences or from the road > to be regularly spaced to reduce the potential visual impact where the proposal alignment is visible for a long duration, and in open landscapes > to be positioned alongside existing transmission line structures where they are adjacent to existing transmission lines where feasible > to avoid the location of transmission line structures on locally prominent landforms > to minimise clearing along creek lines.	Detailed design	Whole of proposal
LV6	Where the transmission line crosses a roadway, transmission line structures will be located to maximise the distance from the roadway where feasible and where it will achieve an improved visual amenity outcome.	Detailed design	Transmission line
LV7	The Tree Protection Zone (as defined in AS4970-2009 Protection of Trees on Development Sites) of retained trees within or immediately adjacent to the disturbance area will be protected through the restriction of construction activities (refer section 4.2 of AS4970-2009), to minimise the impact of the works on the long term health of these trees.	Pre-construction	Whole of proposal
LV8	Opportunities for screening vegetation to be provided on private property will be investigated where it would reduce an identified visual impact from a residence, in negotiation with the affected resident. This will be informed by further assessment to determine the extent of the impact and appropriateness of any screening vegetation, which would be maintained by the landholder.	Construction	Transmission line
LV9	Lighting at the substation will be designed and operated in accordance with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.	Operation	Buronga substation

13.6.3 Managing residual impacts or uncertainties

The landscape and visual impacts of the proposal are predominantly scored as low and negligible and, in some instances, assessed as medium. However, this assessment has been based on an indicative alignment for the transmission line, which would be subject to further refinement during detailed design. To address this uncertainty, the detailed design would be guided by the mitigation measures outlined in Section 13.6.2. These measures have been identified to ensure the final design minimises potential landscape and visual amenity impacts. Additional mitigation measures have been identified which would assist in further reducing these impacts, however, it is expected that some residual impacts would remain given the scale of some components of the proposal.

14. Social and economic

This chapter provides an assessment of potential social and economic impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Socio-economic impact assessment* (WSP, 2020c) (refer Volume 2, Technical paper 5).

14.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to social and economic impacts and where these requirements are addressed in this EIS are outlined in Table 14-1.

Table 14-1 Secretary's environmental assessment requirements – social and economic

Ref.	Secretary's environmental assessment requirements	Where addressed
Amenity		
Key issues	The EIS must address the following matters: > including an assessment of the social and economic impacts and benefits of the project (including the workers accommodation facility) for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services.	Sections 14.4, 14.5 and 14.2

14.2 Assessment Approach

14.2.1 Legislative and policy context

The Social and Economic Impact Assessment (SEIA) was guided by the following international and State guidelines for SEIA:

> The *International Association for Impact Assessment* (IAIA) defines social impact assessment as the process of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. It understands the primary purpose of social impact assessment is to bring about a more sustainable and equitable biophysical and human environment. The *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects* (IAIA, 2015) guideline is considered current global leading practice.

> The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for assessing all types of development in New South Wales. In particular, the objects of the EP&A Act include the need to promote the social and economic welfare of the community and to include social considerations in decision-making about environmental planning and assessment.

> The *Social impact assessment guideline for state significant mining, petroleum production and extractive industry development* (Department of Planning and Environment, September 2017) (the SIA guideline) has been prepared by the Department of Planning, Industry and Environment to provide a consistent framework and approach to the assessment of social impacts associated with state significant resource projects. This guideline has been applied to this proposal as it currently provides best practice guidance, framework and process for social impact assessment in NSW.

14.2.2 Methodology

The impact assessment approach used for this SEIA was guided by both international and state-level social impact assessment principles and methods as described in the IAIA and DPIE guidelines described in Section 14.2.1.

The assessment of social and economic impacts for the proposal occurred through the following key steps.

Area of influence

Socio-economic impacts relate to people, their livelihoods and their wellbeing. To define the extent of these impacts, an area of socio-economic influence (or 'area of influence') that extends beyond the proposal's direct infrastructure footprint requires defining. The area of social influence takes into account the way people organise themselves, connect with each other and move around the broader geographic area, and hence has been organised into two distinct components:

- the local area covering the Wentworth Local Government Area (LGA)
- the regional area covering the Mildura LGA and the Far West region of NSW, to encompass the main transportation corridors and infrastructure and services' hubs to and from the proposal (see Figure 14-1).

Existing conditions

The SEIA details the existing conditions of the proposal study area through review of data, legislation and targeted consultation for the proposal. The existing conditions assessment identifies community groups and individuals that have the potential to be subject to positive or negative social or economic impacts.

Defining impact pathways

The SEIA then defines potential social and economic impacts through the adaptation of the DPIE guidelines and assigning impacts into the nine distinct categories (see Table 14-2).

Table 14-2 Impact categories

Category	Description
Way of life	> how people live on a daily basis > how people work on a daily basis > how people play (recreate) and interact on a daily basis
Community	> composition and character > cohesion > functionality > sense of place
Access to and use of infrastructure, services and facilities	> public > private > not-for-profit organisations
Culture	> shared beliefs, customs, values, stories > connections to land, places and buildings > Aboriginal culture, language and connection to Country

Category	Description
Health and wellbeing	> physical health > mental health > social wellbeing
Surroundings	> access to and use of ecosystem services > public safety and security > access to and use of nature and built environment > aesthetic value and/or amenity
Personal and property rights	> economic livelihoods > personal disadvantage > civil liberties
Decision-making systems	> having a say > access to complaint, remedy and grievance mechanisms
Fears and aspirations	> future of the community

Evaluation of significance

The SEIA prescribes the potential extent of impacts by identifying:

> impact characteristics (extent, duration, severity, sensitivity)

> direct, indirect and cumulative impacts on groups and individuals

> impact phase (construction, operation)

> the level of social risk of impacts, evaluated through consequence and likelihood.

The impact characteristic, consequence and likelihood definitions and social risk matrix framework is outlined in Table 14-3 to Table 14-6. Impact characteristics and consequences are assessed within the social risk matrix framework to determine risk of level for the relevant construction and operation phases of the proposal. The assessment is completed against the impact categories detailed in Table 14-2.

Table 14-3 Impact characteristics

Characteristic	Definition
Extent	> the geographical area affected by the impact (or the number or proportion of people or population groups who are affected)
Duration	> the timeframe over which the impact occurs
Severity	> scale or degree of change from the existing condition as a result of an impact
Sensitivity	> susceptibility or vulnerability of people, receivers or receiving environments to adverse changes caused by the impact, or the importance placed on the matter being affected. Attributes of sensitivity include: conservation status; intactness; uniqueness or rarity; resilience to change and capacity to adapt; replacement potential; impacts on vulnerable people; and/or of value or importance to the community

Table 14-4 Definitions of consequence levels

Consequence level	Definition
Minimal	> no discernible positive or negative changes caused by the impact
Minor	> small change caused by the impact, generally temporary or short term in duration > impacts confined to a small number of receivers within the proposed development locality able to be mitigated such that impacts are deemed to be low
Moderate	> moderate change caused by the impact, generally temporary or short to medium term in duration > spatial extent of impacts may vary across the affected LGAs able to be mitigated or managed such that impacts are deemed to be low
Major	> large change caused by the impact, generally medium to long term in duration > spatial extent of impacts may vary across the affected LGAs, or the broader region or State > negative impacts would require extensive mitigation or consultation with affected stakeholders
Catastrophic	> very large changed caused by the impact, likely to be long-term in duration > spatial extent of impacts may vary across the affected LGAs, or the broader region or State > negative impacts would require extensive mitigation and consultation with affected stakeholders

Table 14-5 Definitions of likelihood levels

Likelihood level	Definition
Almost certain	> is expected to occur under most circumstances
Likely	> will probably occur in most circumstances
Possible	> could occur and has occurred in comparable circumstances
Unlikely	> could occur but is not expected
Rare	> could occur under only exceptional circumstances

Table 14-6 Social risk assessment framework

Likelihood		Consequence				
		1 Minimal	2 Minor	3 Moderate	4 Major	5 Catastrophic
A	Almost certain	High	High	Extreme	Extreme	Extreme
B	Likely	Moderate	High	High	Extreme	Extreme
C	Possible	Low	Moderate	High	Extreme	Extreme
D	Unlikely	Low	Low	Moderate	High	High
E	Rare	Low	Low	Moderate	High	High

Social risk rating			
Low	Moderate	High	Extreme

14.3 Existing environment

The existing environment is defined both geographically and by the existing social and economic conditions present within the area of social and economic influence. This section defines the existing towns and regions assessed and their demographic, employment and economic compositions in order to understand how the proposal would potentially impact the area of influence in a positive and negative sense.

14.3.1 Local context

The proposal study area sits within the Wentworth LGA, in an area known as the Far West Region of NSW. The local area of social influence is sparsely populated with the area predominantly used for agricultural activities.

Strategic priorities of Wentworth Shire Council focus on investment and economic growth (such as the Wentworth Aerodrome), and programs to invest in new or upgraded infrastructure to reduce reliance on Mildura (particularly in health). Wentworth Shire Council is of the view that its natural and biophysical setting makes it unique and has differing priorities in comparison to other areas of the Far West Region.

Seven key place-based communities sit within the socio-economic area of influence within NSW that form the basis of this assessment (see Figure 14-1). In order from largest to smallest population, these include:

- Buronga – Gol Gol. These are two adjacent towns that sit 11 kilometres north east of Mildura on the Murray River. The towns have a combined population of 2,735. The key employment sectors in Buronga – Gol Gol include light industry, horticulture, viticulture and grazing. Buronga – Gol Gol operates as a satellite suburb of Mildura and is growing to meet housing demand in the area.
- Wentworth. Wentworth is an historic border town located at the confluence of the Darling and Murray Rivers. Wentworth has a population of 1,221 people and the key employment sectors include Government services, education, healthcare, retail and tourism. It is a popular place for outback NSW tourism as an access point for tourists seeking to visit Lake Mungo and Mungo National Park. Almost all temporary accommodation providers are located within Wentworth.
- Dareton, Coomealla and Namatjira. Dareton, Coomealla and Namatjira are located 22 kilometres east of Wentworth and have a combined population of 618 people. The key employment sectors for the town include horticulture, government services, healthcare and education.

- Pomona. Pomona is a small town approximately 20 kilometres north of Wentworth. There are 161 people in the town and the predominant industry is horticulture. The town also contains a primary school, a boat ramp and accommodation for tourism.
- Curlwaa. Curlwaa is a small town seven kilometres east of Wentworth. There are 393 people in the town and the predominant industry is horticulture. The town has minimal services, a caravan park and a rest stop for tourists
- Ellerslie. Ellerslie is a small village of 82 people, located approximately 40 kilometres north of the town of Wentworth on the Darling River. The Ellerslie community consists of 21 families who are predominantly involved in citrus fruit production (ABS, 2016). The Palinyewah Public School is located within the village and serves the surrounding farming community.

14.3.2 Regional context

The Far West Region of NSW covers a significant portion of NSW and extends from the Queensland border to the Victorian border. The Far West Region has a diverse economy, which centres primarily around mining (predominately in Broken Hill, Cobar, Wentworth and Balranald) and agriculture, with the latter ranging from food and beverage manufacturing, broadacre cropping and grazing, and intensive agriculture and horticulture.

Immediately south of Wentworth LGA is the Mildura LGA in Victoria. Mildura LGA has a population of around 54,000 people and is the largest region of the Sunraysia irrigation district within Victoria. The city of Mildura is a strategically important regional service centre for communities across regional Victoria, south-west NSW as well as South Australia. Regional services from Mildura include transport and warehousing services for surrounding agricultural areas and the mining sector, as well as providing professional services, health services and tertiary education facilities for the broader population (Regional Development Victoria, 2020).


SOUTH AUSTRALIA
NEW SOUTH WALES
WENTWORTH LGA
POONCARIE
ANABRANCH SOUTH
PARA
PINE CAMP
ELLERSLIE
CAL LAL
RUFUS
POMONA
BURONGA SUBSTATION
DARETON
MOORNA
WENTWORTH
BURONGA
GOL GOL
MILDURA
MONAK
RED CLIFFS SUBSTATION
ADELAIDE 395km
SYDNEY 1016km
VICTORIA
MELBOURNE 542km
BENANEE
MILDURA LGA
QUEENSLAND
SOUTH AUSTRALIA
NEW SOUTH WALES
WENTWORTH LGA
MILDURA LGA
VICTORIA
0 10 20 30 KM
Figure 14-1
Buronga substation and main construction compound and camp accommodation site location
Anabranch South main construction compound and camp accommodation site
Namatjira Aboriginal Settlement
Local Government Area
Proposal study area
Medical facility
Far West Region
Existing transmission line infrastructure
Airport
Socio-economic study area
Source: NSWSS, ESRI, Transgrid, WSP
C:\Users\Emily.Mitchell\WSP O365\EnergyConnect - General\5_Shared\54_Production\Maps\10_EIS\PS117658_EIS_039_A1.mxd

14.3.3 Social context

Local

Community profile and social characteristics

At the local level, the Wentworth LGA has:

- low population levels (6,794) and low population growth over the past five years, with a higher than average percentage of people that identify as Aboriginal when compared to the NSW average
- the majority of residents live a rural lifestyle, within 10 to 30 minutes of the community services, infrastructure and amenities available in nearby towns
- an ageing population, with the proportion of the working age group being less than the NSW average but with a somewhat stable population growth in the younger age groups (0 – 14 years)
- a higher percentage of the population is born in Australia when compared to the NSW average, and has a significantly smaller proportion of households who speak a language other than English
- limited diversity in housing types, with the majority of the housing stock comprising of detached housing but with somewhat low occupancy rates of the available privately-owned properties when compared to the NSW average. The median weekly rental payments are significantly lower than the NSW average
- unemployment rates are slightly lower than the NSW average however the median weekly household income is lower than the NSW average, and the proportion of population that earn below the minimum wage is higher than the NSW average
- a higher percentage of volunteer participation when compared to the state average, indicating that the residents are more likely to be engaged in their local community. However, it is recognised that low levels of community cohesion were reported by Wentworth Shire Council in 2020 when engaging with the Dareton community to gather insights on community capital, sense of belonging and social cohesion and wellbeing of that community
- there are varying levels of social advantage and disadvantage across the LGA, when considering access to material and social resources, and their ability to participate in society. In particular, there are a number of localised socio-economic issues specific to Dareton, including high unemployment (often above 80 per cent), low community cohesion, poor health status, high rates of social housing, high crime rates and household overcrowding.

Social infrastructure

District and local social infrastructure, including educational facilities, open spaces, recreational facilities, aged care facilities, community, childcare and medical services, are located across the local area of social influence. In some instances, towns provide a certain function specifically:

- Wentworth serves as the key administration centre for the LGA, and contains a number of key community facilities and services (e.g. library, town hall, visitor information centre), the Wentworth District Hospital and regional ambulance base, short-term accommodations and retail centre.
- Dareton/Coomealla functions as the operational base for many council-wide community services and facilities, and contains a number of local infrastructure as well as community-based organisations and groups. This includes the Far West Health Centre, Coomealla Health Aboriginal Corporation, regional headquarters of NSW Rural Fire Service and NSW Police, Department of Communities and Justice, education facility (high school and TAFE), youth centre, community hall and other community services.

Community values

Values that are highly important to the community within the LGA:

- rural and semi-rural lifestyle
- surrounding natural environment – including its position of the Murray and Darling Rivers and proximity to the Mungo National Park located within the Willandra Lakes Regional World Heritage Area
- heritage – the area's connection to Aboriginal and European history
- tourism – based on its heritage values, natural environment and as the gateway to the outback
- community spirit and pride – including its community connectedness and community events.

Regional

At a regional level:

- The Far West Region:
  - has a relatively small population despite covering 40 per cent of NSW and has the highest percentage of Aboriginal people in comparison to other regions in NSW (NSW Government, 2020). The region's population aged above 65 years is estimated to increase by more than a third to approximately 11,950 people by 2036
  - has high levels of Drive-in Drive-out (DIDO) workers due to the prevalence of the mining sector across the region. Within the Wentworth and Mildura LGAs, this transient workforce is associated with seasonal horticulture and recent solar energy projects
  - population is expected to change over the next twenty years, due to industry and economic growth that would incentivise new population groups to relocate into the region (DPC, 2020)
- The Mildura LGA has a population of around 54,000 people (as of 2016), of which 60 per cent reside in the city of Mildura. The LGA is also characterised as having:
  - stable population growth, but an ageing population
  - similar characteristics to the Wentworth LGA with respect to housing diversity, occupancy and median weekly rental payments, median weekly household income as well as cultural background
  - unemployment rates are slightly higher than the Victorian average, and a slightly higher percentage of volunteer participation in comparison to the Victorian average
  - hosted numerous temporary workforces in recent years, giving the Mildura residential population as well as service providers a familiarity with the dynamics of transient populations associated with a range of industries including solar, mining, aviation and agriculture
  - limited temporary accommodation given demands driven by agricultural and construction workforces.

As identified earlier, Mildura services the surrounding area, including areas of NSW. It is a regional centre that contains a range of district and local infrastructure ranging retail, medical, recreational, transport and educational services. This includes the Mildura airport, university campuses and numerous medical facilities including three hospitals.

14.3.4 Economic context

The Gross Regional Output for the Wentworth LGA in 2016 was $854 million (Wentworth Shire Council, 2017), with the top three industry sectors of agriculture, mining and manufacturing contributing to a combined $441 million (or 51.7 per cent) of the Gross Regional Output for the area. Tourism accounted for $54.93 million (or 6.4 per cent) of Gross Regional Output in 2016.

Of the population that work within Wentworth LGA, the top industry of employment in the 2016 census was grape growing, generating 142 local jobs and accounting for 5.3 per cent of the labour force. Following this industry, the other top industries for employment in the LGA included citrus fruit growing (3.8 per cent), sheep farming (3.2 per cent), primary education (3 per cent) and retail (supermarket and grocery stores) (2.5 per cent).

People living in both Buronga and Mildura routinely travel across the state borders as part of their everyday activities to access employment, goods and services. Around 40 per cent (1,105 people) of workers who reside in the Wentworth LGA travel to work in Mildura each day (Western Murray Regional Economic Development Strategy 2018-2022).

The Mildura Rural City Council estimates that the economy supports approximately 22,368 jobs, representing 88.74 per cent of the 25,205 people working in the Mildura-Wentworth region, which it has estimated as representing around 0.7 of the NSW labour force and around 0.8 of Victorian labour force Mildura City Council, 2020).

14.4 Potential impacts – construction

Socio-economic impacts have been assessed against the impact categories defined in Table 14-2. The potential positive and negative socio-economic impacts prior to mitigation are described in the following sections. Measures to mitigate negative impacts or to enhance positive impacts are discussed in Section 14.6.

14.4.1 Way of life

Way of life is a broad category of social impact, defined as how people live, work, recreate and interact with each other on a daily basis. With respect to the proposal:

- there is limited availability of short-term accommodation and rental housing in the Wentworth and Mildura LGA, and the proposal may increase competition to available housing stock, and affordability. While the provision of accommodation camps for its workers would reduce the potential for impacts, it would not entirely remove demand on local accommodation
- opportunities for local and regional procurement of services and employment during construction would be created. Within the region, there are high levels of unemployment within certain communities and limited employment opportunities, particularly for the skilled workforce. Further, the COVID-19 pandemic has placed further pressure on employment opportunities within the region, primarily in the retail sector within local towns. Community and stakeholder engagement for the proposal has identified the need to support initiatives to upskill local residents so that future opportunities are available to local communities. Further, TransGrid's policies which require local and regional procurement of goods and services, and the implementation of plans to facilitate local industry participation and Aboriginal workforce participation during construction, would mitigate these impacts (refer to Section 14.6). Local employment strategies have been effective for environmental investigation works and surveys works completed for the proposal
- the experience of other infrastructure projects suggests that projects, such as the proposal, may result in increased prices for goods and services due to increased demand, and conversely, decrease in prices at the completion of construction. This may increase costs for some existing residents during construction. However, goods and services in the order of $18 million per year may be able to be provided by the region

- construction employment opportunities would exist over the duration of construction, and construction would also generate indirect employment opportunities. At the conclusion of construction, these jobs or demand on services would no longer be required, which may have impacts on the local community and employment opportunities. The proposal would however support further investment in the renewable energy sector within the region and would facilitate future employment opportunities
- the departure of the workforce following construction may fragment social ties or connections that may form between the workforce and local residents over the course of construction. However, this may be a minor impact experienced by relatively few individuals given the provision of accommodation camps.

Table 14-7 Way of life – construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
An increase in competition for temporary accommodation or rental housing may result in unavailability of accommodation for certain user groups.	Minor	Possible	Moderate
Construction activities including the operation of the accommodation camps would provide local employment opportunities for job seekers and would increase the commercial activity for local service providers and contractors. Procurement of local contracting services and businesses would increase local spending power of business owners and their families, bringing about increased social and economic capital in local communities.	Minor	Possible	Moderate (positive)
The completion of construction would see the conclusion of certain casual, full-time and contracted employment positions, which may cause a spike in localised unemployment, placing potential strain on social services and decrease in community social and economic capital.	Minor	Possible	Moderate
The decrease in business revenue following completion of construction may reduce local economic activity.	Minor	Possible	Moderate
Increased demand for goods and services may result in certain products or services becoming difficult to access for some residents due to increased costs, while reduction in demand (and cost) following construction may have a commercial impact to local businesses and service providers.	Minor	Possible	Moderate
Social ties or interpersonal connections formed during construction may experience fragmentation as construction works conclude. The accommodation camps and facilities provided may result in this being experienced by a small number of individuals.	Minor	Unlikely	Low

14.4.2 Community

Community impacts refer to aspects of population composition, cohesion, character, function and sense of place. It is recognised that this category of impact involves a level of uncertainty because socio-economic environments and the processes that affect them are constantly changing and can vary from place to place and over time. With respect to the proposal:

- the proposal would cause an increase in the population of the Wentworth LGA of up to six per cent within a one year period due to the incoming construction workforce. Localised population changes and implications on the socio-economic area of influence are largely centred around where the incoming workforce would be residing, working, visiting and recreating. The construction workforce would diversify the composition of the community, which could impact a community's sense of place but which can also improve social and human capital within the community
- an influx in predominately international or interstate male and single workers has the potential to disrupt existing social norms and localised gender relations, which may disproportionately impact certain groups within local communities. However, the establishment of workforce accommodation camps at a distance from residential populations would decrease the likelihood of this being experienced. Furthermore, the incoming workforce are perceived as providing opportunities for the local economy. Both councils indicate that the workforce would be generally welcomed and would form a key part of the social fabric
- grants and funding opportunities can provide benefit to local communities. The TransGrid's Community Partnerships Program (CPP) provides funding to initiatives that will have a tangible and lasting impact on local communities, and will continue to apply in areas surrounding EnergyConnect. Initiatives delivered by the proposal or through the CPP (such as prioritising strategic partnerships with local Aboriginal communities) has the potential for a lasting positive legacy within local communities
- outcomes from consultation with local Aboriginal representative groups indicate that the proposal could improve collaboration and interactions between community groups
- an unfair distribution of local benefit, even if perceived, related to compensation for land access or acquisition, may brew resentment and cause fragmentation between individuals within a community. This issue has been understood to have been experienced on other energy infrastructure projects. The potential for this impact would depend on individual circumstances, and may result in decreased trust and cohesion between neighbouring landholders.

Table 14-8 Community – construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
The sudden increase to the residential population would change the composition of the community and has the potential to change the character of the community.	Minor	Possible	Moderate
The change in resident population would diversify existing community composition, bringing new and skilled people of working age into the town which can improve social and human capital within the community.	Moderate	Likely	High (positive)
Recipients of CPP grants would increase in revenue and service delivery capacity to improve community cohesion and community development outcomes	Moderate	Likely	High (positive)
A perceived unfair distribution of local benefit, especially compensation may decrease trust and cohesion between neighbouring landholders.	Minor	Possible	Moderate

14.4.3 Access to and use of infrastructure, services and facilities

Access to and use of infrastructure covers a broad array of infrastructure, services and facilities provided by local, state and federal governments, as well as by for-profit and not-for-profit organisations. With respect to the proposal:

- the incoming population may increase competition for access to social infrastructure in the area of socio-economic influence, including health facilities, recreational facilities, emergency services and air and road transport
- facilities would be provided within accommodation camps, including recreational facilities as well as emergency response and first aid facilities. While this would reduce demand, it is anticipated that the construction workers would likely access local infrastructure, services and facilities but the extent of use would subject to a number of factors, including worker schedules and workforce requirements. Wentworth Shire Council is in support of the proposal making use of local services and suppliers as a means to integrate with the local towns and communities, and to deliver local economic benefits
- while first aid facilities within the accommodation camps would reduce some demand on health services, construction workers would likely still require access to existing health facilities in the Wentworth and Mildura LGAs. Given the current strains on health infrastructure and services in both LGAs, the proposal workforce would likely heighten this pressure
- it is anticipated that the construction workforce would be on Fly in Fly out (FIFO) or Drive in Drive out (DIDO) rosters for the duration of their employment term. Subject to any COVID-19 health order restrictions, the proposal area has access to Mildura Airport for commercial flight services and the Wentworth aerodrome for private or chartered aircraft services. If contractors plan to utilise existing commercial flight services into Mildura for the incoming construction workforce, this may impact upon air transport access for existing residents of Mildura city and other flight users across the Wentworth LGA. Depending on frequency of flights and number of flights induced by the proposal, this could either improve supply of services or alternatively, place potential demand pressures on existing services. Further, it is acknowledged that COVID-19 has substantially altered the aviation industry and frequency of services in 2020, and use of public or private services would need to be considered during detailed construction planning within this context
- construction-related traffic may impact road conditions and increase traffic on local or major roads.

Table 14-9 Access to and use of infrastructure, services and facilities – construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
An increase in competition for local recreational facilities may reduce ability to access for certain resident groups.	Minor	Unlikely	Low
An increase in competition for local healthcare facilities and services may reduce ability to access for certain resident groups.	Moderate	Possible	High
An increase in competition for local emergency services may reduce ability to access for certain resident groups.	Moderate	Possible	High
An increase in demand for flight services may place further strain on Mildura Airport's COVID-19 associated pressures, which may reduce ability for other users to access air transport.	Moderate	Unlikely	Moderate

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
An increase in air traffic at local airports or aerodromes caused by FIFO workforce may improve connectivity to the region for all users (based on pre-COVID-19 frequency of services).	Moderate	Unlikely	Moderate (positive)
Increased heavy vehicles and other proposal-related traffic may decrease local communities' ability to access and efficiently use road networks, and decrease safety on roads.	Minor	Unlikely	Low

14.4.4 Culture

Culture refers to a community's or peoples' shared beliefs, customs, values, stories and language or dialect. Potential social impacts on culture for the proposal relate to:

- Aboriginal heritage sites have high cultural value to local Aboriginal communities. The existing community places weight and significance on the cultural heritage finds, as well as other Aboriginal cultural values that may be non-tangible. Technical paper 2 identifies that the disturbance to or loss of Aboriginal cultural heritage values would be a direct impact of the proposal, and that 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
- Lake Victoria and its surrounds has cultural heritage significance. The proposal has been designed to be located to the north of Renmark Road to minimise any indirect impacts on this place of cultural value. However, changes to the landscape due to the construction of the proposal may also alter cultural or community connections to land, sites or places of value
- community groups who have connection to certain attributes of the natural environment may experience to changes to how they interact or engage with their culture. Aboriginal communities and intergenerational farming families who have an attachment to land and places in the proposal area would be groups most likely to experience these effects.

Table 14-10 Culture – construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Built infrastructure changes to landscape and effect on culturally significant sites or natural values may reduce community connection to cultural land, places and customs.	Minor	Unlikely	Low
Perceived detrimental effect to traditional lands of Barkandji People and Native Title holders through construction of built infrastructure.	Minor	Unlikely	Low
Damage to sites of Aboriginal cultural value may reduce community connection to cultural land, places and customs for Aboriginal communities.	Minor	Possible	Moderate

14.4.5 Health and wellbeing

Health is defined as a state of complete physical, mental and social wellbeing. Social impact has the potential to result in poor health outcomes if it causes affected individuals or groups significant stress and anxiety. The proposal has the potential to affect levels of stress for some individuals and groups. The following social groups are considered to potentially experience impacts to their health and wellbeing:

- FIFO workers have a high risk of experiencing impacts to health and wellbeing due to social isolation from existing social networks and the remote work environment. Adverse impacts to mental and physical health and wellbeing can lead to community and family fragmentation, an increase in antisocial behaviour and substance abuse and decreased mental health outcomes. Access to recreational facilities while off-shift would be key to the extent of this impact
- incoming construction workforces may cause a perceived public safety risk in nearby townships, depending on the nature of facilities provided in the accommodation camps and the frequency of interaction works have the local community. Conversely, broader communities in the Mildura and Wentworth LGAs would likely welcome temporary workforce populations. With consideration of the proposed locations of these camps, this impact is considered minor.

Table 14-11 Health and wellbeing construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Decrease in worker health and wellbeing due to social isolation from families and existing personal networks.	Moderate	Likely	High
Decrease in sense of public safety due to anti-social behaviour in townships nearby accommodation camps.	Minor	Possible	Moderate

14.4.6 Surroundings

Surroundings refers to access to and use of ecosystem services, public safety, access to and use of nature and the built environment, and aesthetic value and/or amenity. With respect to the proposal:

- there is the potential to generate amenity impacts during construction, including noise, vibration, light spill, dust generation and reduced air quality (if not properly mitigated). Local communities and existing user groups would be sensitive to changes to the amenity of the surrounding environment, and impacts of the proposal may lead to irritation or how people experience or conduct day-to-day activities.

Table 14-12 Surroundings – construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Amenity impacts including noise, vibration, light spill, dust generation and reduced air quality may cause irritation or result in changes in day-to-day activities.	Minor	Possible	Moderate

14.4.7 Personal and property rights

Personal and property rights refer to whether someone's economic livelihoods are affected and whether they experience personal disadvantage. With respect to the proposal:

- acquisition for the proposal would be carried out in accordance with TransGrid's Landholder and Easement Compensation Guidelines, and legislative requirements. This will include compensation for impacts to landholdings due to the creation of easements for the proposal
- 25 to 30 landholders livelihoods would be directly affected due to construction activities by displacing land currently under agricultural production. The potential impact of disruption to agricultural enterprises caused by the proposal is relatively low (refer to Chapter 12 (Land use and property). There may be economic advantages impact for landholders because of land access, compensation or leasing arrangements
- the value of properties would be affected by the transmission lines during both construction and long-term into the operations of the proposal. TransGrid has been working with landholders to determine the transmission line corridor, and to resolve, where possible, solutions to minimise impacts on property and land uses. However, individuals may perceive devaluation of their properties beyond the compensation provided through the land acquisition process, which this may reduce personal assets or financial stability
- the proposal would not substantially restrict movements of landholders, noting that some movements may be affected temporarily for a short duration. Access through properties to access construction areas that extend beyond future easements would be agreed with landholders.

Table 14-13 Personal and property rights – construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Financial compensation would strengthen economic livelihood for recipients.	Minor	Possible	Moderate (positive)
Land devaluation may be perceived as being greater than the compensation received for the construction of transmission line infrastructure.	Minor	Possible	Moderate
Acquisition of or restricted access to productive land may weaken landholder's economic livelihoods.	Minor	Possible	Moderate
Biosecurity risks to land and property may economically disadvantage landholders affected by proposal infrastructure.	Minor	Unlikely	Low

14.4.8 Decision making system

Decision making systems refers to the extent to which people believe they can have their say in decisions that affect their lives, and are aware of and have access to complaint, remedy and grievance mechanisms. A large Native Title determination exists in the area of socio-economic influence. While the proposal does not directly intersect or affect the determined land, this determination carries substantial socio-political value for Traditional Owners. There may be perceptions of reduced decision making ability and perceived (or real) ability to control activities, such as any permanent infrastructure constructed on the land. The level of establishment of strong working relationships with Traditional Owners and their representative bodies may assist in understanding any such concerns as well as enabling different parties to cooperate in forming shared priorities for the proposal's construction activities.

With respect to land acquisition and/or leasing arrangements, it is possible that some landholders may feel they have little agency in the land acquisition process, and have no means to veto development in or near their land. Following completion of construction, landholders may experience a sense of access and control on matters or activities taking place around them or on their land.

Table 14-14 Decision making system – construction

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Traditional Owners may feel that they have limited agency in built infrastructure changes to traditional lands and do not have means to the veto development.	Minor	Unlikely	Low
Some landholders may feel that they have little to no agency in the land acquisition process and do not have means to veto the development.	Minor	Possible	Moderate
Landholders may experience a sense of returned access and control on matters or activities taking place around them or on their land as well as an increased sense of certainty and confidence on managing their land and properties.	Minor	Possible	Moderate (positive)

14.5 Potential impacts – operation

14.5.1 Health and wellbeing

The proposal has the potential to cause concerns relating to:

- electric and magnetic fields (EMF) from transmission lines in proximity to residential dwellings, acknowledging that EMFs directly under the proposed transmission lines are below the public exposure reference limit (refer to Section 19.5.3 for further detail)
- changes to bushfire risk due to the proposal, acknowledging that the bushfire risk from the transmission lines infrastructure to the surrounding environment would be moderate and that bushfire risk management strategies would be implemented during operation.

Table 14-15 Health and wellbeing – operation

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Community anxiety and stress related to perceived EMF or bushfire risk generated from the proposal.	Minimal	Possible	Low

14.5.2 Surroundings

The proposal has the potential to impact access to and use of ecosystem services, public safety, nature, built environments and aesthetic value and/or amenity with respect to the below:

- the proposal would require the clearing of native vegetation and habitat due to the land required for construction, and for ongoing operations, which could impact the aesthetic value and amenity of the area. The proposal has been designed to avoid impacts, where possible. However some impacts would remain and offsetting for these impacts is required
- the proposal would introduce new built elements into the landscape, and landholders have raised concerns with the impact to the visual amenity from residential dwellings and from vantage points, such as rivers and lakes
- there would be no impact to the use of or access to the natural environment due to the proposal, however physical changes to the landscape may reduce value placed on attributes of the natural environment by local communities

Table 14-16 Surroundings – operation

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Changes to the landscape may reduce the values placed on attributes of the natural environment by local communities	Minor	Unlikely	Low

14.5.3 Personal and property rights

Easements would restrict certain land use activities that could impact personal or public safety or affect the operation of the transmission system, and permanent access tracks would be required for the proposal. As discussed in Section 14.4.7, compensation would be paid for the acquisition of any interest in land required for the proposal. The devaluation of land or properties may be perceived by some landholders as greater than the compensation to be received, and devaluation of properties over time could reduce assets and/or financial stability. However, the financial significance of the impact is unknown and would be only understood on a case-by-case basis.

During operations, TransGrid personnel, as per programs for the operation and maintenance of the network, would require occasional access to directly affected properties to conduct routine maintenance and monitoring. Outside of these infrequent requirements and excluding the permanently acquired corridor of land based on TransGrid's easement safety requirements, access to properties for landholders and landholders, and use of the land, will be returned.

Table 14-17 Personal and property rights – operation

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Land devaluation may be perceived as being greater than the compensation received for the construction of transmission line infrastructure.	Minor	Possible	Moderate
Acquisition of or restricted access to productive land may weaken landholder's economic livelihoods.	Minor	Possible	Moderate

14.5.4 Decision making system

The impacts to decision making systems during operation are considered in Section 14.4.8.

14.5.5 Fears and aspirations

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. Benefits of the overall proposal may include:

- improvement of security and continuity of energy supply to NSW during periods of maximum demand
- reduce reliance of high cost gas plants in SA
- unlock renewable generation development and allow greater market access
- creation of additional capacity in a heightened period with energy security being a critical issue for NSW and Australia
- opportunities for local construction employment and additional spend to boost local business.

Improvements in infrastructure activated by the proposal would stimulate further investment in local economies, and in particular in the energy sector. This would bring long-term economic benefit to the broader regional population, who will experience over time, new industries establishing and former industries being re-boosted, both of which would bring about an incoming residential population, likely to be felt mostly in the major regional centres such as Mildura.

Table 14-18 Fears and aspirations operation impacts

Impact pathway	Consequence	Likelihood	Impact (pre mitigation)
Improvements in energy infrastructure would stimulate investment in local and regional economies, generating a positive sense for the future within the community.	Moderate	Likely	High (positive)

14.6 Management of impacts

14.6.1 Environmental management

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

Environmental management to reduce the effect on socio-economic impacts would be implemented throughout the design, procurement, construction and operation stages. For the purpose of the EIS, the mitigations have been grouped into the construction and operation stages, as these are the stages whereby potential impacts would transpire.

14.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential social and economic impacts are listed in Table 14-19.

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 9 (Biodiversity) with respect to mitigating, managing and offsetting impacts to biodiversity values
- Chapter 10 (Aboriginal heritage) with respect to the next stages of engagement with RAPs as well as requirements to mitigate and manage impacts on Aboriginal heritage
- Chapter 12 (Land use and property) with respect to mitigating and managing impacts to property and land use
- Chapter 13 (Landscape character and visual amenity) with respect to visual impacts, including views from private property
- Chapter 19 (Hazards and risk) with respect to EMF, bushfire and biosecurity risks management.

Table 14-19 Mitigation measures – social and economic

Reference	Mitigation measure	Timing	Applicable location(s)
SE1	A Community and Stakeholder Engagement Plan will be implemented. This will include: > Targeted stakeholder consultation with Local Government, chamber of commerce, Traditional Owners, landholders, emergency services and service providers to ensure plans for the proposal are integrated with local needs and priorities and proactively respond to community or stakeholder concerns including those of neighbouring or nearby landholders > Continuation of a consistent, open and transparent land acquisition process, giving due consideration of the interests or needs of directly affected landholders in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016 (where applicable) > Culturally appropriate ceremonies of recognition aligned with proposal activities and key milestones, in alignment with the TransGrid Reconciliation Action Plan.	Detailed design and construction	All locations
SE2	A Local Business and Employment Strategy will be implemented to guide local opportunities during construction, and where possible, align with existing plans and strategies of Wentworth Shire Council and Mildura Rural City Council, and TransGrid's Reconciliation Action Plan. The initiatives will be prepared in consultation with Wentworth Shire Council, Mildura Rural City Council and key community stakeholders and organisations in the region. The strategy will consider local market conditions and capacity, and will include initiatives for: > local supplier and labour procurement targets > Aboriginal workforce and business participation > training and upskilling programs for local labour force > programs to inform local businesses of contracting opportunities and requirements > consideration of use of available local infrastructure and services for construction activities such as the Wentworth Aerodrome, where feasible transitioning the local workforce following the completion of construction.	Detailed design and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
SE3	A Community Benefit Plan will be implemented to guide opportunities to deliver benefits to local communities during and following construction. The plan will be prepared in consultation with Wentworth Shire Council, Mildura Rural City Council and key community stakeholders and organisations in the region, and will align with TransGrid's Community Partnerships Program. The plan will include (but is not limited to): > initiatives to create positive social contributions in local communities and to respond to community priorities and needs > initiatives for Aboriginal heritage impacts of the proposal to be managed in partnership with local Aboriginal organisations > exploring opportunities to repurpose temporary infrastructure to address local infrastructure needs.	Detailed design and construction	All locations
SE4	A Workforce Management Plan will be implemented to provide construction workforce support services to promote health and wellbeing and to manage positive social integration with existing communities. The plan will be prepared in consultation with Wentworth Shire Council, Mildura Rural City Council and social infrastructure service providers near accommodation camps so that the needs of the construction workforce are coordinated to minimise pressure on existing health services and social infrastructure.	Detailed design and construction	All locations

14.6.3 Managing residual impacts or uncertainties

Adoption of mitigation measures would result in residual socio-economic (negative) impacts being predominately low, and no greater than moderate. Where positive socio-economic impact can be enhanced, there is potential for extreme benefit for individuals and communities. Key mitigations to reduce or enhance socio-economic impacts revolve around the procurement policies and considered engagement with communities to enable inclusion, upskilling and support throughout the proposal stages.

15. Hydrology, flooding and water quality

This chapter provides an assessment of potential hydrology, flooding and water quality impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Hydrology and flooding impact assessment* (WSP, 2020c) (refer Volume 2, Technical paper 6).

15.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to hydrology, flooding and water quality and where these requirements are addressed in this EIS are outlined in Table 15-1.

Table 15-1 Secretary's environmental assessment requirements – Hydrology, flooding and water quality

Ref.	Secretary's environmental assessment requirements	Where addressed
Water		
Key issues	The EIS must address the following matters: > an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Murray River, the Darling, Great Darling Anabranch and Lake Victoria, having regard to NSW Water Quality Objectives.	Section 15.4 and Section 15.5.
	> details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation.	Section 15.4.4 and Section 15.5.4
	> an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the NSW Aquifer Interference Policy and relevant Water Sharing Plans.	Chapter 20 and Technical paper 13
	> an assessment of the potential flooding impacts and risks of the project.	Section 15.4.1 and Section 15.5.1

15.2 Assessment approach

15.2.1 Legislation and policy context

The assessment was completed with consideration of relevant Australian and state legislation which includes the *Water Management Act 2000* (WM Act) and *Protection of the Environment Operations Act 1997* (POEO Act).

Policies and guidelines that are also relevant to the assessment include:

> National Water Quality Management Strategy (ANZECC / ARMCANZ 2018)
> Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
> NSW Water Quality and River Flow Objectives (Office of Environment and Heritage, 2006)
> Murray–Darling Basin Plan (MDBA, 2012)
> Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia, Handbook 7 (AIDR, 2017)

- Floodplain Risk Management Guide, Incorporating 2016 Australian Rainfall and Runoff in studies (OEH, 2019)
- NSW Floodplain Development Manual and Flood prone land policy (DIPNR, 2005);
- Wentworth Shire Local Flood Plan (SES, 2018)
- Guidelines for controlled activities on waterfront land (DPI, 2012)
- Guidelines for developments adjoining land and water (OEH, 2013b)
- Managing Urban Stormwater – Soils and Constructio[n,] 4th Edition (Landcom, 2004).

15.2.2 Methodology

The study area for the assessment included the wider catchment areas of the Lower Murray River downstream of the Hume Dam, Darling River and Darling Anabranch and all minor watercourses within these catchments in the proposal study area.

The approach for this assessment included the following key tasks:

- a desktop review of publicly available resources and identification of sensitive receiving environments
- a qualitative assessment of flooding impacts (discussed further in this section) to identify risks to the proposal as well as potential impacts to flood behaviour and risk due to the proposal. This includes a review of flood modelling prepared for the Darling River and Darling Anabranch (BECA, 2020)
- an assessment of potential impacts to water quality, including:
  - review of historical water quality assessments and baseline data to determine existing conditions relevant to water quality
  - comparison of the established baseline data to relevant water quality objectives
  - a qualitative assessment of the potential impacts to water quality from the proposal, including potential residual impacts post-mitigation and the likely performance against the water quality objectives.
- an assessment of geomorphology, including review of the existing geomorphic condition of waterways, with reference to the NSW River Styles mapping (DPI, 2019), and qualitative assessment of potential changes in surface water flows and impacts to geomorphology from the proposal
- an assessment of potential impacts to water supply and water resources, including:
  - background review of existing relevant water sharing plans, and existing water supply, use and storage within the water quality and flooding study area
  - identification of existing environmental water requirements in the vicinity of the transmission line corridor
  - review of indicative demand for water from construction and operation of the proposal
  - qualitative assessment of potential impacts to water availability for the construction and operation of the proposal
- identification of relevant mitigation measures.

The assessment of hydrology, flooding and water quality has considered all water catchments that could be potentially impacted by the proposal. A catchment is defined as the area that drains directly to a stream or body of water and includes areas upstream and downstream of the proposal.

Detailed discussion of the methodology for the hydrology and flooding assessment is provided in Chapter 3 of the Hydrology and flooding impact assessment (refer to Volume 2, Technical paper 6).

15.3 Existing environment

15.3.1 Climate, rainfall and topography

The proposal is located within a semi-arid region of NSW, with temperatures regularly exceeding 33 degrees Celsius (°C) during the summer months. A review of data from weather stations within or close to the proposal study area indicates relatively low average annual rainfalls of about 259 – 271 millimetres in the region. Rainfall is generally evenly averaged over the year with higher peak rainfall values recorded from November to April.

A mean daily evaporation average of 5.6 millimetres was identified, with a peak of 10.0 millimetres in January falling to 1.8 millimetres in June.

The topography of the study area is predominantly flat, with gentle slope towards the major watercourses of the Darling River and the Darling Anabranch and then to the south to the Murray River. The catchment has a very shallow grade with an average grade from four to six centimetres per kilometre in the Darling River catchment. The elevation across the proposal study ranges from 35 to 80 mAHD.

Due to the low average rainfall values and relatively low gradient of the topography, generally limited surface water run-off is generated from the catchment.

Climate change projections indicate an increase in mean annual rainfall will impact the overall water availability, however higher projected temperatures also indicate higher rates of evaporation. The projected higher temperatures are predicted to result in increased rainfall intensities, which will change the behaviour of floods. However, it is not likely to have a significant impact on the duration of flood events across the proposal study area.

15.3.2 Catchments and watercourses

The proposal is located within the Lower Murray-Darling catchment, which is a sub-catchment of the Murray-Darling Basin.

The Lower Murray-Darling catchment encompasses an area of approximately 6.3 million hectares and wholly or partially includes the LGA's of Wentworth, Broken Hill, Balranald, and Central Darling. There are three major rivers within the Lower Murray-Darling catchment that are located in the proposal study area, including the Murray River, Darling River, and the Great Darling Anabranch (and associated lakes). The proposal study area intersects the Murray River upstream of its confluence with the Darling River and Darling Anabranch. Surface water also discharges to the Murray River via Lake Victoria at the western extent of the proposal study area. Lake Victoria is located about three kilometres south of the proposal study area.

These water bodies form three distinct catchments; Lake Victoria, the Darling River and Darling Anabranch which eventually discharge to the Murray River. A third catchment area at the eastern extent of the proposal discharges directly to the Murray River.

Other watercourses intersecting the proposal study area are limited to unnamed ephemeral creeks and drainage lines.

Surface water features and catchments relevant to the proposal are shown in Figure 15-1.

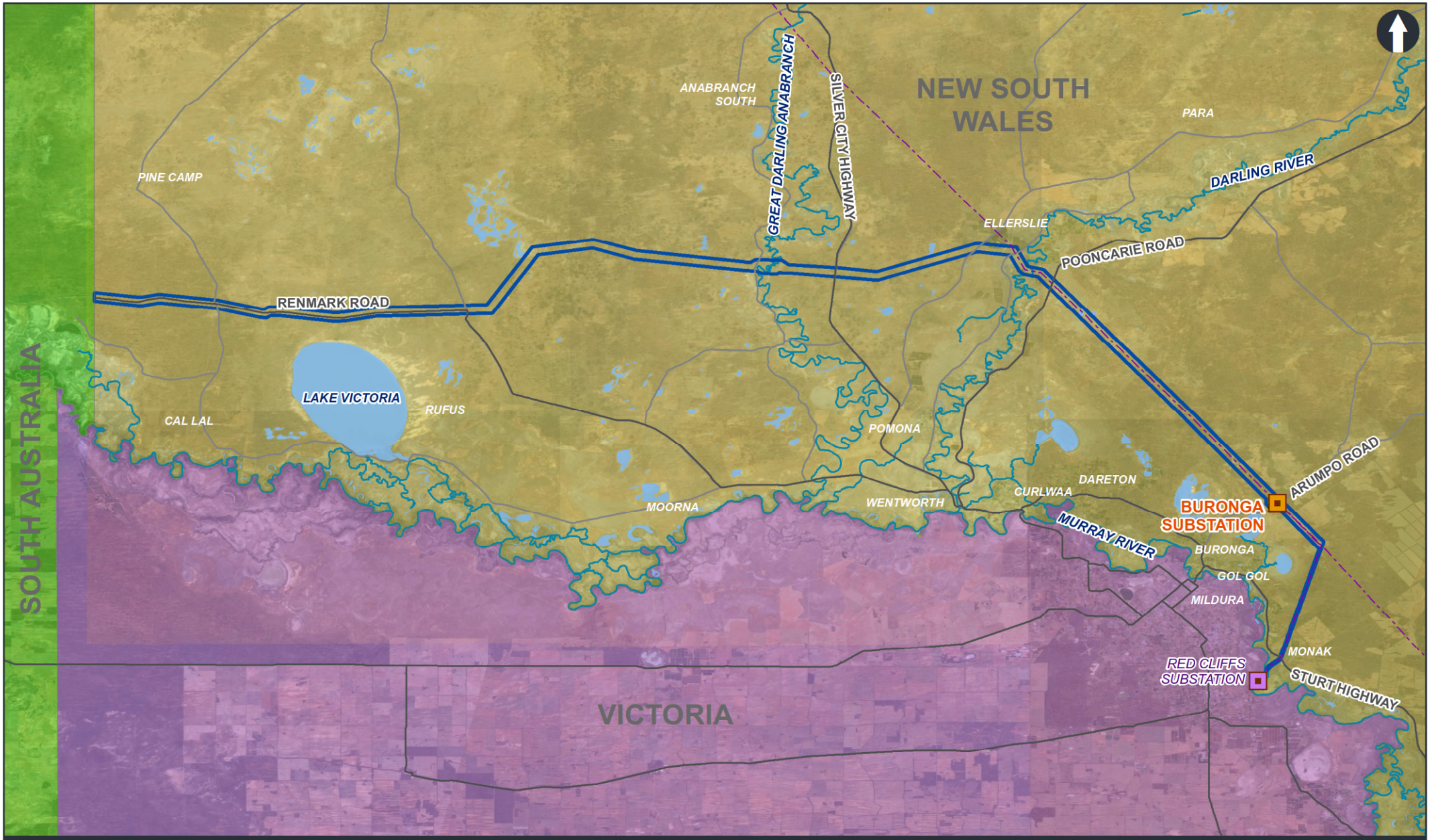


Figure 15-1

Surface water features and catchments

15.3.3 Sensitive receiving environments

Sensitive receivers relevant to the proposal include the major watercourses, as well as Lake Victoria, the Gol Gol Swamp and Gol Gol Lake located about 1.5 kilometres north-east of the proposal study area.

No high priority Groundwater Dependent Ecosystems (GDEs) were documented in either of the previous groundwater related water sharing plans that were superseded on 1 July 2020. Publicly available location (GIS) data, including information on high priority GDEs, is currently unavailable for the new water sharing plans that were enacted on 1 July 2020. A review of the National Groundwater Information System (BOM 2020b) identified six GDEs high potential for groundwater interaction within the proposal study area (refer to Chapter 20 for further discussion).

15.3.4 Flooding

As a result of the generally flat topography, the extent and flow of historical flood patterns at major watercourses has varied.

While a number of historical flood events of the Darling River have been recorded, these are not considered to be indicative of current flood behaviour due to more modification to the naturally occurring chain of lakes near Menindee by the NSW Government in 1968. This work was completed to manage flooding and improve water storage capacity for farming, recreation, mining, and domestic water supply. Consequently, the flows through the lower Darling River and the Darling Anabranch are highly regulated and significantly reduced as a result of water taken from the upper catchments of the Barwon–Darling river system.

Flood data for the Murray River, including flows within Lake Victoria are largely historic due to much of the flow being regulated. Significant flooding depth is not anticipated for the Murray River, however flood extents up to four kilometres in width have been identified, with the Sturt Highway forming the limit of the flood extent within NSW.

Flood modelling completed by BECA (2020) estimated a flood extent for the one per cent annual exceedance probability (AEP) event up to four kilometres and 18 kilometres wide at the Darling Anabranch and Darling River respectively. During floods, depths in the main river channels were estimated to be up to six metres and up to two metres across the floodplains for the proposal study area.

Flooding within the proposal study area is shown in Figure 15-2.

The Wentworth Shire Local Flood Plan (SES 2018) outlines flood emergency measures, including response operations and the coordination of immediate recovery measures from flooding within the Wentworth Shire LGA. The plan identifies Low Darling Road as being affected by floods but does not identify where or to what extent. No other roads in the proposal study area are listed. The plan indicates that the Silver City Highway to Broken Hill and Silver City Highway to Mildura remain open during major floods. The plan does not list any flood evacuation routes but it can be assumed the Silver City Highway could serve as an evacuation route based on previous flood events.

15.3.5 Geomorphology

The proposal study area intersects a number of minor unnamed watercourses and overland flow paths. Many of these watercourses are first order streams (meaning there are no other streams flowing into it) and their size, shape and location is dependent on regular rainfall events. As such their geomorphological condition has not been considered further.

Table 15-2 outlines the geomorphology of the three major watercourses within the proposal study area, including classifications from NSW River Styles Mapping (DPI, 2019). There are also many second order streams that have not been officially identified. Second order streams are dependent on the first order streams for surface flows.

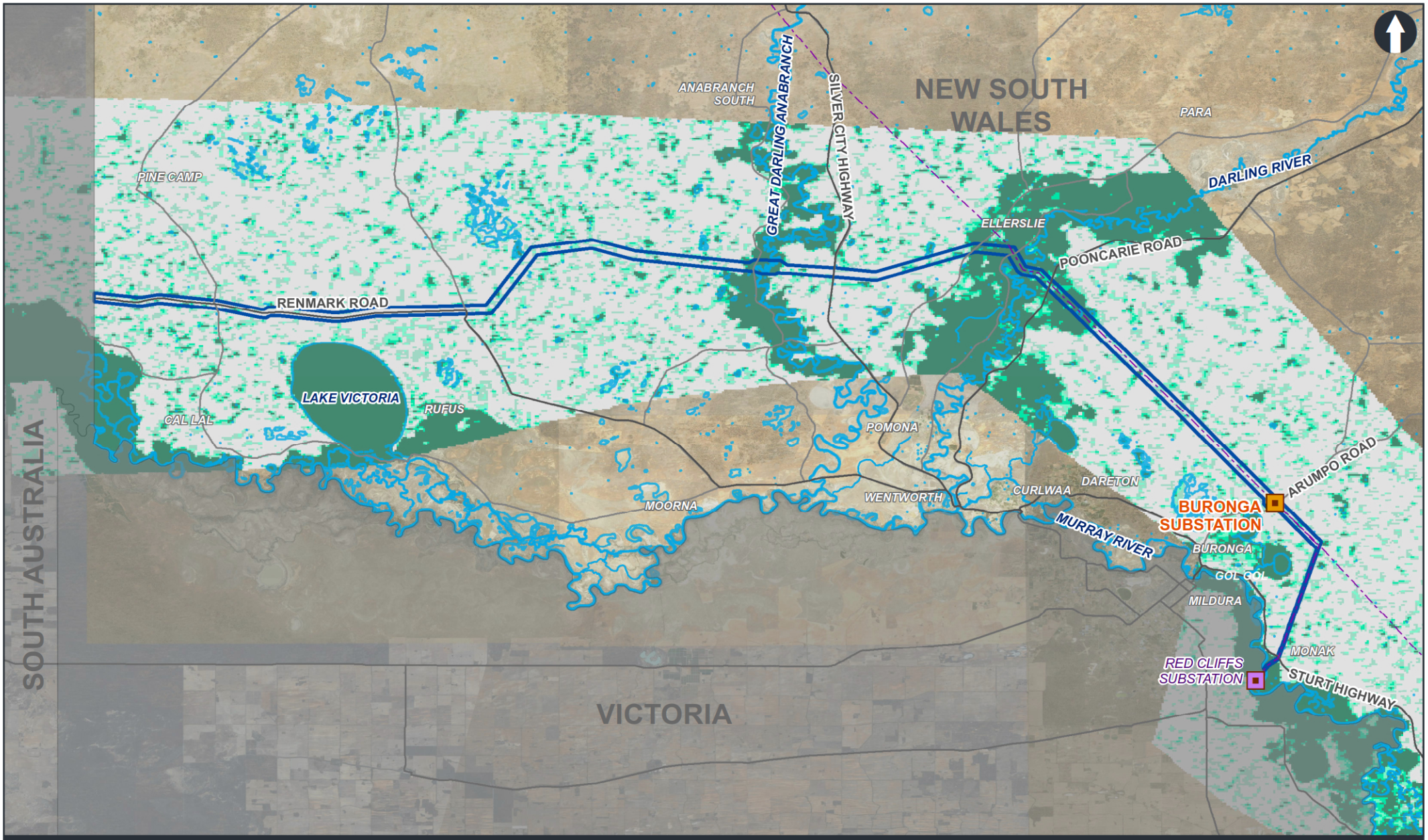


Figure 15-2

Flooding in the proposal study area

The geomorphic condition affects the aquatic biodiversity and physical habitats available in streams. The riverine channel and bank shape and riparian vegetation is used to assess the local aquatic habitat and its potential to support aquatic biota. These physical features and stream order form the basis of the NSW River Styles Mapping. Rivers that lack regular flow and riparian vegetation (including first and second order streams or overland flow paths) would be in a poor geomorphic condition (no fixed channel shape or size) and have high fragility because of the significant potential to change with each flow event. Recovery potential indicates the capacity of a river to return to good condition or to a realistic rehabilitated condition.

Table 15-2 Geomorphology of major watercourses within the proposal study area

Watercourse	Stream order	NSW River Style	Existing condition	Recovery potential	Description
Darling River	Unconfirmed (due to numerous tributaries)	Meandering and fine grained with anabranches	Moderate condition High fragility	High	The Darling River can be described as a series of connected pools along many sections. It is laterally unconfined which is evident from the significant meandering channel and many billabongs and dry anabranches.
Great Darling Anabranch	Unconfirmed (due to numerous tributaries)	Meandering and fine grained with anabranches	Moderate condition High fragility	High	The Great Darling Anabranch is laterally unconfined and meanders significantly at the proposal crossing but it described as being in good geomorphic condition.
Murray River	Unconfirmed (due to numerous tributaries)	Meandering and fine grained with anabranches	Moderate condition High fragility	High	The Murray River has a permanent channel with flows controlled by releases from Hume Dam. It has riparian vegetation along it banks away from the towns.

15.3.6 Water quality

Water quality within the catchment is known to be impacted by existing land uses, particularly agricultural activities. Surface water run-off from agricultural areas such as those that dominate the proposal study area is commonly identified as a diffuse source of high levels of nutrients, with this run-off being captured in major watercourses resulting in degradation of water quality.

The existing water quality for the Murray-Darling Basin has been periodically monitored and assessed as part of a range of management plans and other documents, including:

- State of the Catchment (Office of Environment and Heritage, 2010)
- National Water Quality Assessment (Sinclair Knight Merz, 2011)
- State of the Environment (NSW EPA, 2018)
- Darling Water Resource Plan (Department of Primary Industries (DPI), 2018b)
- Basin Plan Annual Report 2018-2019 (MDBA, 2020).

Parameters monitored to assess water quality include nutrients (nitrogen and phosphorus), pH, turbidity and dissolved oxygen. These results are compared to trigger values (ANZECC, 2000), to provide a rating based on the frequency and level of samples exceeding the trigger values.

The State of the Catchment (OEH, 2010), and National Water Quality Assessment (Sinclair Knight Merz , 2011) identified that levels of phosphorus and turbidity often exceeded the trigger values.

The 2018 State of the Environment Report (NSW EPA, 2018) scored the Darling River as poor (corresponding to 50-75 per cent exceedance rate for samples collected) but the Murray River as good (corresponding to 25-50 per cent exceedance rate for samples collected). The 2018 Darling Water Resource Plan (MDBA, 2018) again scored the water quality of the Darling River as poor. The Basin Plan Annual Report 2018-2019 (MDBA, 2020) indicated that poor water quality was likely due to low flows and less flushing.

Based on a review of available data, existing water quality within the proposal study area predominantly exceeds the water quality trigger values outlined in the basin plan for nutrients (nitrogen and phosphorus), pH, turbidity and dissolved oxygen.

15.3.7 Water supply and water resources

The draft water sharing plan for the NSW Murray and Lower Darling Regulated Rivers Water Sources 2020 regulates water within the Lower Darling River, Darling Anabranch and the Murray River from Hume Dam to the SA Border.

The plan includes a range of objectives for the water source, including the categories of environmental, economic, Aboriginal cultural as well as social and cultural water demands.

Environmental water is a large component of water allocation, including licenced water and other water to be used for environmental purposes.

Licenced water entitlements include high security licences as well as general and supplementary categories. Actual water allocations are reviewed periodically, and proportioned based on priority, with high security licences given first priority. As at July 2020, the volumes of allocations for high security licences are as follows:

- domestic and stock access licences:
  - 17,102 megalitres per year in the Murray Water Source
  - 1,370 megalitres per year in the Lower Darling Water Source
- Local Water Utility access licences:
  - 38,217 megalitres per year in the Murray Water Source
  - 10,135 megalitres per year in the Lower Darling Water Source
- other high security access licences in the Murray River source:
  - 0 megalitres per year for subcategory Aboriginal cultural
  - 47 megalitres per year for subcategory Community and education
  - 0 megalitres per year for subcategory Environmental
  - 1 megalitres per year for subcategory Research
  - 3,195 megalitres per year for subcategory Town water supply.

DPIE Water provide water allocation statements which announce allocations in line with the Water Sharing Plan for New South Wales Murray and Lower Darling Regulated Rivers Water Sources.

15.4 Potential impacts – construction

15.4.1 Flooding

Impacts to flooding from construction of the proposal are anticipated to be limited to temporary and localised impacts due to the progressive nature of the construction activities. Potential impacts would also be limited to periods of flooding, which have a low likelihood of occurring during construction on flood prone areas.

Most construction activities would occur in areas not prone to flooding, including the Buronga substation upgrade and expansion site. Activities such as the construction of access tracks would require limited diversion of surface water runoff, and may result in new flow paths forming. Access tracks across major watercourse are not proposed, however minor watercourse crossings may be required. Given the relatively flat topography, these minor watercourse crossings are not anticipated to significantly impact flood levels, depths or velocities across the floodplains, but may have minor localised impacts.

Construction activities within flood prone areas associated with major watercourses would include earthworks required for the transmission line structures as well as access tracks and other ancillary sites. Temporary redistribution of flood flows may result and have impacts on other nearby infrastructure, including buildings and other structures, however further assessment during detailed design of the proposal would be undertaken and appropriate mitigation implemented to prevent significant impacts occurring. This would include specific measures to be implemented during construction in advance of a predicted flood.

Whilst there is also potential for temporary impacts to flood level, depths and velocities around ancillary areas, including large stockpiles, these would be able to be minimised through locating these types of construction facilities outside of flood prone areas.

No impacts to properties or infrastructure outside the proposal study area, or floodplain storage areas are anticipated during construction of the proposal.

Whilst a number of roads within Wentworth Shire Council local government area are known to be affected by flooding, the proposal is not anticipated to change the extent or severity of these impacts. Mitigation would be implemented to manage potential impacts in the event of a flood emergency.

15.4.2 Geomorphology

The proposal includes crossings of three major watercourses, including the Murray River, Darling River and Darling Anabranch. To minimise impacts, transmission line structures would be constructed at least 50 metres from the edge of these watercourses. No temporary crossings of major watercourses would be constructed as part of the proposal.

Notwithstanding, the proposal has the potential to result in localised impacts to geomorphology, including:

- changes in low flow channel shape due to temporary works changing local runoff behaviour
- increased sediment load from runoff from construction areas.

As the proposal does not include construction within the main channel of these watercourses (by at least 50 metres), geomorphological impacts would only be expected to occur during flood events where construction is located on flood prone land. However, these impacts would be minor and limited to during a flood event. Further planning during detailed design would consider specific mitigation to prevent significant impacts to geomorphology occurring.

The high fragility of minor waterways and low recovery potential mean there could be permanent changes to the local overland flow paths. These changes would have to be discussed with landholders and managed during construction.

15.4.3 Water quality

Construction of the proposal has the potential to result in water quality impacts of the waterways within the disturbance area and areas downstream. Construction activities, including earthworks, vegetation removal, stockpiling, and accidental spills, have the potential to result in mobilisation of pollutants into surrounding waterways. Notwithstanding, potential impacts to water quality are anticipated to be limited to temporary and localised impacts due to the progressive nature of the construction activities.

The types of water pollutants and indicative sources which may be mobilised during construction of the proposal include:

- sediment from soil excavation and stockpiling, or mobilisation of sediment from areas containing exposed soils within the disturbance footprint, including access tracks and site compounds
- stored fuels, hydrocarbons and other contaminants from refuelling and maintenance of equipment and construction machinery from leaks or spills and runoff to the surrounding environment
- concrete slurry and wastewater from concrete batching plants from leaks or spills and runoff to the surrounding environment
- potential contaminants from disturbance of contamination from previous land uses (refer to Chapter 20)
- general waste types generated by construction, which may be mobilised during construction if not adequately contained.

Sediments, contaminants and other wastes may be mobilised through a range of processes, including surface water runoff during rainfall or flooding events, periods of high winds as well as directly from construction activities such as runoff from leaks and spills, and use of a water cart for dust suppression.

Existing water quality within the proposal study area is identified to be degraded, however the construction of the proposal may further degrade water quality if not appropriately managed. The likelihood and magnitude of risks would vary depending on the stage of construction, the area of disturbance and presence of high rainfall or wind weather events.

Impacts to water quality would be greatest when construction is located near sensitive receiving environments such as the major watercourses discussed above, or when impacts are likely to occur such as during periods of rainfall. The proposal study area has relatively low annual rainfall and is generally located in areas greater than 200 metres from a watercourse, which would be considered to have a lower risk of impacts to water quality. Further the topography of the proposal study area is generally flat, with surface water runoff likely to spread slowly and be easily managed. Notwithstanding, areas of greater sensitivity occur, including near major watercourses. When working within sensitive receiving environments, including the floodplains of the Murray River, Darling River, and the Great Darling Anabranch, potential water quality impacts from the construction of the proposal would be short-term and limited in extent as construction progresses.

The risk of impacts to water quality is considered to be low, and the types of impacts would be typical of most construction projects, and readily managed through the implementation of industry standard mitigation measures.

A soil and water management sub-plan (SWMP) would be prepared for the proposal and include the mitigation measures detailed in Section 15.6.2 to manage potential impacts to water quality. Mitigation measures would include specific measures to be implemented when working in sensitive areas.

With the implementation of mitigation measures, there are not anticipated to be any significant impacts to water quality during construction of the proposal, and the proposal would achieve the identified water quality objectives.

15.4.4 Water supply and water resources

Preliminary estimates indicate that up to 616 megalitres (ML) of water would be required for construction of the proposal, including:

- dust suppression: required at approximately four concurrent work sites, with weekly suppression via water and water reduction polymers
- concrete batching (assuming concrete line structure foundations are adopted): 200 cubic metres of concrete for each of the approximate 330 transmission line structures, plus concrete for the Buronga substation upgrade, totalling 100,000 cubic metres of concrete
- construction camps: 200 litres of water per person per day for 400 construction personnel for about 550 days.

The above estimates would be further reviewed and confirmed by TransGrid and the construction contractor.

Water supply for construction of the proposal would be sourced from the existing water market, Council facilities or accessed via existing, licensed water extraction infrastructure only. No additional water take (or reduction in environmental water) would be required.

Wastewater would be generated from staff facilities and construction activities, including effluent from construction camps (onsite toilets and facilities). All wastewater would be collected via tanker trucks and disposed of at licensed disposal locations in accordance with the NSW EPA waste classification guidelines.

15.5 Potential impacts – operation

15.5.1 Flooding

Following completion of construction, the transmission line structures would be located on either side of major watercourses with no instream infrastructure or vehicle crossings required. Some transmission line structures and footings would be required within flood prone areas, however the transmission line structure above the footing would consist of largely open space with connections to the footing. Therefore, it is not anticipated that there would be significant impacts to flood behaviour from the presence of this infrastructure such as changes to flood levels, depths, or velocities.

Permanent access tracks are not expected to impact flood behaviour, where they are located away from overland flow paths.

The Buronga substation (including the upgrade and expansion) is not located on food prone land.

Permanent vehicle crossings may be needed at minor watercourses. The presence of infrastructure at these locations may result in minor increases in flood levels during rainfall events, however any change in flood levels would be localised and not impact on regional flood extents.

The proposal is not predicted to have an impact on the flood affectation of structures (including buildings) and infrastructure (including roads) located near the proposal study area. As such there is not expected to be any change to use of the roads during a flood emergency or existing flood emergency management arrangements.

15.5.2 Geomorphology

Transmission line structures located within the flood prone areas may have minor, localised geomorphological impacts to the existing waterways during flood events due to disruption of flow paths upstream and downstream. Where transmission line structures are located out of the flood prone area, there would not be any geomorphological impacts.

15.5.3 Water quality

Potential impacts to water quality from operation of the proposal are predominantly limited to new impervious surfaces to be constructed, which may increase pollutant loads.

A drainage system would be installed at the Buronga substation to collect and discharge surface and subsoil water. The drainage system would also separately drain oil and oil contaminated water to appropriate containment structures in accordance with regulatory requirements prior to collection and disposal to a licensed receiving facility. Storage of significant quantities of chemicals within the substation is not proposed, and spill kits would be kept on site in the event of minor spills and leaks.

Surface runoff within the switchyard would be intercepted by roadside kerb and guttering, drainage swales and subsoil drains. All associated pits and pipes would discharge to the environment using appropriate dispersion structures or a drainage system.

There would be some potential for minor impacts to water quality as a result of spills or litter generated from operation and maintenance activities along the transmission lines and at transmission line structures near waterways. However, these impacts would be localised and manageable.

15.5.4 Water supply and water resources

Water would be required during operation for maintenance activities and the operation of the Buronga substation. It is anticipated that up to 20,000 litres of water would be required per year for operation of the proposal. Water would be sourced from the local water authority and rainwater tanks at the substation.

15.6 Management of impacts

15.6.1 Environmental management

Environment management plans

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

During construction of the proposal, a range of measures would be specified in the soil and water management sub-plan prepared as part of the Construction Environmental Management Plan. These measures are based on industry best practice to minimise potential impacts on watercourses.

The sub-plan will set out measures to mitigate and manage impacts on soil and water, including water quality and potential contaminated soils. It will include (as a minimum):

- measures to minimise impacts to soil and water, and to maintain water quality of surrounding surface watercourses. This includes details of erosion and sediment controls, diversion of runoff around disturbed areas and stockpiles, salinity and acid sulfate soils control measures, as well as minimising areas of disturbance and progressive rehabilitation of disturbed areas
- stockpile management procedures, including procedures to segregate wastes and contaminated soil
- materials tracking and record keeping
- an unexpected finds protocol for contaminated materials (e.g. soils, building materials and water) and acid sulfate soils
- measures for the storage of chemicals and other hazardous materials
- spill management procedures
- measures to minimise water use during construction
- a flood emergency management procedure which will provide a series of activities that need to take place should a flood event occur. These activities would focus on the flood emergency and then during the recovery period to assist with starting work again as soon as possible after the flood event.

15.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to hydrology, flooding and water quality are listed in Table 15-3.

Table 15-3 Mitigation measures – hydrology, flooding and water quality mitigation measures

Reference	Mitigation measure	Timing	Applicable location(s)
HF1	The proposal will be designed, where feasible and reasonable, to mitigate potential alterations to local runoff conditions due to permanent operational infrastructure.	Detailed design	All locations
HF2	Detailed construction planning would consider flood risk at construction areas. This will include identification of measures to not worsen flood impacts downstream and on other property and infrastructure during construction up to and including the 1% AEP flood event, and review of site layout and staging of construction works to avoid or minimise obstruction of overland flow paths and to limit the extent of flow diversion required. Procedures as detailed in the flood emergency management procedures will be implemented in response to flood events, including the evacuation of personnel.	Pre-construction and construction	Transmission line and construction sites within flood prone land
HF3	A water quality monitoring program will be implemented to establish baseline water quality conditions in the Darling River, Darling Anabranch and Murray River prior to construction, and to observe any changes in water quality that may be attributable to the proposal during construction. The frequency, location and duration of sampling will be detailed in the monitoring program, but will include: > at least two monitoring locations located downstream and upstream of the proposal on the Darling River, Darling Anabranch and, Murray River > monitoring for total dissolved solids, total suspended solids, total nitrogen and total phosphorus. Sampling will commence at least 6 months prior to the commencement of construction at each respective location, and then monthly during construction until completion of rehabilitation works.	Pre-construction and construction	Transmission line - Darling River, Darling Anabranch, and Murray River

Reference	Mitigation measure	Timing	Applicable location(s)
HF4	Water supply options and management will be undertaken in accordance with agreements between the construction contractor and Wentworth Shire Council.	Construction	All locations
HF5	Erosion and sediment measures will be implemented in accordance with the principles and requirements in: > Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004), and Volumes 2A and 2C (NSW Department of Environment, Climate Change and Water 2008), commonly referred to as the 'Blue Book' > Best Practice Erosion and Sediment Control (IESCA – 2008) > Transgrid's HSE Guideline. Additionally, any water collected from construction areas would be appropriately treated and discharged to avoid any potential contamination.	Construction	All locations
HF6	Maintenance works in the vicinity of waterways will be conducted in accordance with the Transgrid's HSE Guideline.	Operation	Transmission line

15.6.3 Managing residual impacts or uncertainties

With the implementation of the mitigation measures detailed above, no significant residual impacts or uncertainties for hydrology, flooding and water quality are anticipated for the proposal.

16. Air quality

This chapter provides a summary of the assessment of potential air quality impacts of the proposal and identifies mitigation measures to address these impacts, as provided in the *Air quality impact assessment* (WSP, 2020d) (refer to Volume 2, Technical paper 7).

16.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to air quality and where these requirements are addressed in this EIS are outlined in Table 16-1.

Table 16-1 Secretary's environmental assessment requirements – air quality

Ref.	Secretary's environmental assessment requirements	Where addressed
Air quality		
Key issues	The EIS must address the following matters: > an assessment of the air quality impacts of the project.	Construction air quality impacts are addressed in Section 16.4. Operational air quality impacts are addressed in Section 16.5.

16.2 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

16.2.1 Legislative and policy context

Air quality impacts resulting from the generation of dust and gaseous emissions were qualitatively assessed for the construction and operation phases of the proposal in Technical paper 7 (*Air Quality Impact Assessment*) in line with the:

> National Environment Protection Council (NEPC) established ambient air quality standards and goals in the *National Environment Protection (Ambient Air Quality) Measure* (NEPC, 2016)

> *Protection of the Environment Operation Act* 1997 (POEO). The POEO Act provides the legislative framework for the protection and enhancement of air quality in NSW. Its primary objectives are to reduce risks to harmless levels through pollution prevention, cleaner production, application of waste management hierarchy, continual environmental improvement and environmental monitoring

> (NSW) Environment Protection Authority (EPA) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2016)

> Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014).

16.2.2 Methodology

Construction

The NSW legislation relevant to air quality focusses on the assessment of emission source proposals, as opposed to proposals that only create potential air quality emissions during construction. The NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2016) definitions for sensitive receivers are utilised for this proposal, however the dust emissions associated with the construction of the proposal were assessed in accordance with the *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014) which is considered more appropriate for this proposal. The IAQM assessment approach is an evaluation of the risk of dust impacts during construction that considers the potential magnitude of dust emissions based on activity type (e.g. earthworks) and the sensitivity of the surrounding environment within proximity to the activity. This method results in a risk rating for each type of construction activity without mitigation. This risk rating is then used to determine what mitigation and management measures are required to effectively manage these risks.

The air quality assessment undertaken for the construction phase adopted the following approach:

- a desktop review of the existing environment conditions including local topography, climate and existing ambient air quality
- identifying any sensitive receivers within 350 meters of the proposal study area of the transmission lines, 500 metres of the Buronga substation and the main construction compound and camp sites
- a qualitative assessment of potential dust impacts associated with the proposal using the risk-based assessment in accordance with the IAQM guidance
- a qualitative assessment of gaseous emissions generated from vehicles and fugitive sources
- consideration of cumulative impacts to potential regional air quality impacts combined with other projects
- identifying mitigation measures for the construction of the proposal.

Operation

Gaseous emissions due to vehicle fuel combustion and wheel-generated dust on unpaved roads have the potential to be generated during routine inspection, maintenance or emergency. A qualitative assessment based on the likely frequency of these events were detailed in Technical paper 7 (*Air Quality Impact Assessment*).

Mitigation measures during the operation of the proposal have been provided.

16.3 Existing environment

The proposal study area typically traverses areas of rural land, and land that has been developed primarily for agricultural uses including sheep grazing for wool and meat, cattle grazing and cereal cropping. Other land uses within and surrounding the proposal study area include farm buildings and infrastructure, roads and road reserves, broad acre rural residential development, drainage channels for irrigation and existing transmission line easements.

There are no major population and service centres located within the proposal study area. Various towns including Wentworth, Dareton, Buronga, Mildura, Gol Gol, 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. While large areas have been cleared and disturbed for the identified agricultural activities, the proposal study area also contains several areas of remnant vegetation as well as two key waterway crossings at the Darling River and the Great Darling Anabranch.

Land uses in the proposal study area are discussed further in Chapter 12.

16.3.1 Topography

The overall terrain is relatively flat across the proposal study area with elevations typically ranging from between around 35 metres and 80 metres (refer to Chapter 20 for further detail).

16.3.2 Climate and meteorology

The Bureau of Meteorology (BoM) collects meteorological data at Automatic Weather Station (AWS) across Australia and can be used for determining climate statistics over a long period. Meteorological conditions are important for determining the direction and rate at which emissions from a source disperses.

Climate data was reviewed from the following AWS in proximity to the proposal study area:

- Mildura Airport AWS is located 21 kilometres to the southwest of Buronga substation and 16 kilometres to the west of the closest transmission line
- Lake Victoria Storage AWS is approximately 15 kilometres to the south of the closest transmission line.

The climate statistics data recorded by BoM at the Mildura Airport AWS and Lake Victoria Storage AWS are presented in Table 4-2 and Table 4-3 respectively of Technical paper 7.

Detailed wind condition data was only available from the Mildura Airport AWS within the proposal study area. The wind roses presented in Figure 4-2 of Technical paper 7 present the frequency, seasonal and annual strength and direction of wind over the past five years at the station. The wind roses indicate that the typical winds at Mildura Airport AWS are most frequently from a southerly direction and moderately from the west and north north-east across five years with a calm wind frequency of 2.71 per cent.

16.3.3 Ambient air quality

Existing emission sources

The proposal study area consists predominantly of rural land uses with few industrial facilities or residences. The main existing emissions consist of wind-blown dust from bare land and traffic using the unsealed road network.

A National Pollutant Inventory (NPI) database review was conducted to identify existing emission sources in the vicinity of the proposal study area. Two facilities located in Buronga reported their emissions to the NPI for the 2018/2019 reporting period. However, these two facilities are approximately nine kilometres south west of the transmission line and Buronga substation. Given the distance to these facilities, the ground level air quality concentrations contributed to by the sources at the proposal study area are negligible after dispersion.

Background air quality

The NSW Government monitors air quality across NSW. Buronga station is the only monitoring station within the proposal study area and monitors for particulate matter (dust). For the purpose of the impact assessment, the PM_{10} data (particulate matter with diameter less than 10 microns) collected at this station was considered indicative of particulate matter concentrations in a rural area due to the coarseness at which the data was collected. Under recommendation by the EPA data was not compared against the Air NEPM standards. These results suggest that over five years, exceedances of PM_{10} occurred around 8.2 per cent of the time. These exceedances could be due to a range of events including dust storms, bushfire smoke, fog or other dust events in the region.

16.3.4 Sensitive receivers

A sensitive receiver for the purposes of this assessment is a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area, and considers the location of any known or likely future sensitive receiver.

Assessment of potential sensitive receivers were identified within:

> 350 metres of the transmission line corridor sections of the proposal study area (refer to Figure 16-1)
> 500 metres of the Buronga substation, main construction compounds and accommodation camp sites.

These receiver distances are presented in Table 16-2. No sensitive receivers are within 500 metres of the Buronga substation, main construction compounds and accommodation camp sites.

Table 16-2 Identified sensitive receivers

Receiver ID	Type	Suburb[1]	Distance from the transmission line corridor or construction works
R1489	Residential	Wentworth-1	Around 200 metres
R2023	Residential	Wentworth-1	Around 260 metres
R2022	Residential	Wentworth-2	Around 100 metres

Note 1: Suburb-number means the sensitive receivers located in the same suburb but may be affected by different structure construction sites

Section 16.3 describes the existing environment as primarily consisting of rural land and land that has been developed for agricultural uses with some broad acre rural residential development around the towns of Buronga and Wentworth. The sensitive receivers identified through Technical paper 7 and detailed in Table 16-2 are rural homesteads associated with the predominant agricultural land uses.

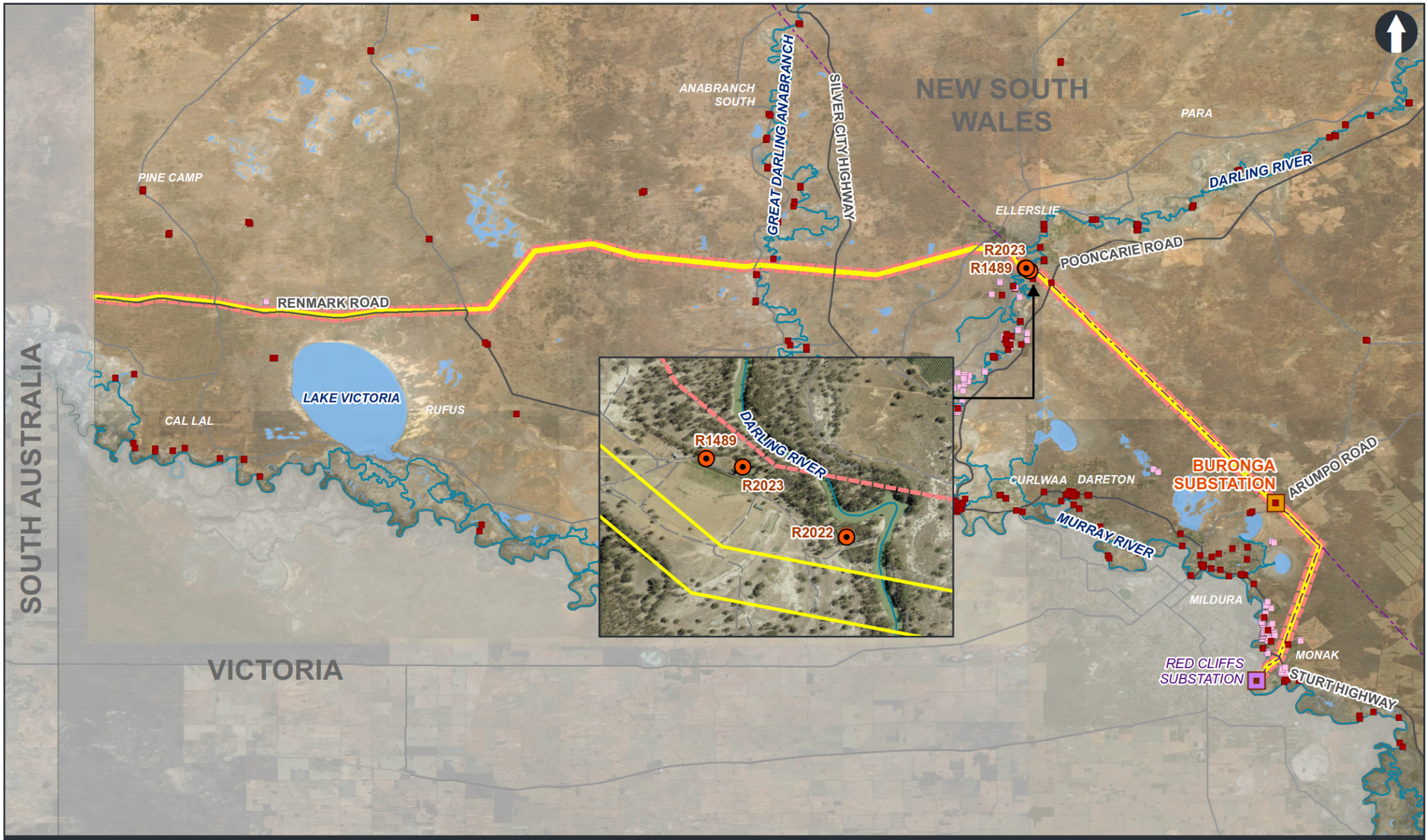


Figure 16-1

Transmission line corridor
- Air quality sensitive receiver locations

16.4 Potential impacts – construction

16.4.1 Overview

Construction of the proposal would broadly involve the following key activities that would impact air quality, without mitigation:

- earthworks
- main construction works
- movement of heavy vehicles.

These key activities may result in:

- dust emissions from earthworks and egress
- gaseous emissions including:
  - combustion and pollutant emissions from construction vehicles and plant exhaust
  - fugitive emissions from construction compounds.

The construction methodology including the plant and equipment (as presented in Chapter 6) is indicative and would be confirmed during detailed design.

16.4.2 Dust

Dust impacts depend on the quantity and drift potential of the particles in the atmosphere. Larger particles (the larger particle fractions of total suspended particulates (TSP)) settle out closer to the source due to their larger mass. The deposition of the particles can cause nuisance and aesthetic impacts on the receiving environment. Finer particles (PM_{10} and $PM_{2.5}$) remain entrained longer and therefore dispersed at greater distances from the source. The fine nature of these particles also has the potential for human health impacts if not adequately controlled.

While dust generation would typically be localised during the majority of the construction activities, the following activities have the potential to generate dust:

- vegetation clearing and grubbing
- installation of new temporary and permanent construction tracks
- earthworks such as creation of substation footings or excavation for tower structures
- civil works at the Buronga substation site
- dirt, mud or other materials tracked onto a paved public roadway by a vehicle leaving a construction site (generally referred to as egress)
- potential dust emission sources at the main construction compound and accommodation camp sites including:
  - the operation of concrete batching plant(s)
  - vehicle movements on unsealed roads/surfaces
  - wind erosion of unsealed surfaces
  - materials drop off and loading at the laydown area.
- plant, equipment and activities likely to generate dust include:
- use of earth working plant including excavators, bulldozers and front-end loaders
- heavy vehicles dumping soil and aggregate
- scraper/graders
- wheel generated dust from vehicle movements on unsealed surfaces.

Predicted impact from dust emissions

Using the risk based assessment described in Section 16.2.2, the potential dust emission magnitude for earthworks, construction works and egress activities were evaluated.

For proposal components that are further than 350 metres or 500 metres (in the case of the Buronga substation upgrade and expansion site) to sensitive receivers, level of risk to dust impacts are considered to be negligible and any effects would not be of significance.

However, three sensitive receivers were identified as potentially being affected dust during the construction of transmission line structure sites being:

> Wentworth-1 site: two receivers within 200 metres and 260 metres from the transmission line corridor
> Wentworth-2 site: one receiver at around 100 metres from the transmission line corridor.

The assessment of air quality impacts at these identified sensitive receivers found that the impacts to sensitive receivers would be negligible (refer Section 5.2 of Technical paper 7). Any impacts would be temporary and of relatively short duration, and standard mitigation measures would be employed to manage these risks.

16.4.3 Gaseous emissions

Gaseous emissions such as Carbon Monoxide (CO), oxides of Nitrogen (NO_x), Sulphur Dioxide (SO_2), Volatile Organic Compounds (VOCs) and Polycyclic Aromatic Hydrocarbons (PAHs) would be generated from vehicles and fugitive sources during the construction phase.

Vehicle emissions

Diesel fuel combustion from vehicle movements and on-site plant and machinery operation would generate CO, NO_x, SO_2 and trace amounts of non-combustible hydrocarbons (i.e. VOCs and PAHs). The emission rates and potential impact on surrounding areas would depend on the number and power output of the combustion engines, the quality of fuel used, the condition of the engines and the intensity of use.

During construction, equipment and material would be transported to each tower site along the corridor, the Buronga substation or the main construction compound and camp sites.

Fuel combustion emissions from plant and equipment along the transmission line easement would be intermittent and transient. Given the anticipated duration of works at any given location, the likely numbers of emission sources, and scheduling of activities (i.e. not all machinery would be operating in the same location simultaneously), gaseous emissions are not anticipated to significantly influence local air quality.

Fugitive emissions

Petroleum, diesel, liquefied natural gas and mineral petroleum based oils stored in the storage and laydown areas at the main construction compound and camp sites have the potential to generate fugitive emissions. These emissions are expected to be minor and readily dispersed within the sites. With appropriate handling and storage, air quality impacts from these fugitive sources would be negligible.

Emissions would be able to be adequately managed through the implementation of the mitigation measures identified in Section 16.6.2.

16.5 Potential impacts – operation

During normal operations, no air emissions would be generated from the operation of transmission lines or the Buronga substation.

During routine inspection, maintenance or emergency works, light vehicles or light aircraft would be used to transport personnel to sections along the transmission line easement. This would generate emissions as a result of fuel combustion and dust generation from light vehicles travelling on unsealed roads. The routine inspections, maintenance and emergency works would be infrequent, and the number of vehicles required during these events would be small. Therefore, the gaseous and dust emissions during operation would be negligible, and the impacts on surrounding areas would be not of significance.

16.6 Management of impacts

16.6.1 Environmental management

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

Impacts to air quality are primarily expected during construction of the proposal. Standard mitigation measures would manage impacts to acceptable levels, which would be detailed in an air quality management sub-plan (AQMP), which would stipulate processes and procedures for dust and gaseous emission management, monitoring, reporting and communications, including:

- measures to minimise the potential for dust emissions, including dust suppression
- air quality monitoring requirements and compliance management. This includes monitoring of meteorological conditions in order to implement appropriate responses to changing weather conditions, and regular visual inspections.

16.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to air quality are listed in Table 16-3.

Table 16-3 Mitigation measures – Air quality

Reference	Mitigation measure	Timing	Applicable location(s)
AQ1	Construction air quality management measures will be detailed in the Air Quality Management Plan and implemented during construction to minimise particulate and gaseous emissions as far as possible. Measures will include (but not limited to): > use of water sprays or dust suppression surfactants as required for dust suppression > adjusting the intensity of activities based on observed dust levels and weather forecasts > minimising the amount of materials stockpiled and position stockpiles away from surrounding receivers > vehicle movements to be strictly limited to designated entry/exit routes and parking areas, and measures to minimise the tracking of material onto paved roads > covering of loads > stabilising disturbed areas as soon as practicable, including new access routes > minimising the extent of disturbance as far as practicable regularly conducting visual inspections of dust emissions and applying additional controls as required.	Construction	All locations
AQ2	Ensure that all vehicles and machinery are fitted with appropriate emission control equipment and maintained in a proper and efficient manner.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
AQ3	Measures will be implemented at concrete batching plants to minimise emissions to air as far as possible and will be regularly inspected with additional controls implemented as required. Measures to minimise emissions to air may include: > all aggregate and sand will be stored appropriately in storage bins or bays to minimise dust generation, and material will not exceed the height of the bay > cement silos and hoppers will be fitted with dust filters > all inspection points and hatches will be fully sealed > all dry raw materials to be transferred into the bowl of an agitator via front end loaders by maintaining adequate moisture levels and/or an enclosed conveyor > the cement silo will be fitted with fitted with emergency pressure alert and automatic cut off overfill protection > transfer of cement from storage to batching will occur via sealed steel augers > regularly inspect dust emissions and apply additional controls as required.	Construction	Concrete batching plant(s)

16.6.3 Managing residual impacts or uncertainties

The risks of dust impacts from earthworks, construction and egress activities associated with the transmission lines are negligible or low prior to mitigation. With further specific mitigation measures in place, the residual dust impacts would not be of significance.

Gaseous emissions generated from vehicles and fugitive sources during construction would be minimised with mitigation measures in place and air quality impacts would not be of significance.

17. Noise and vibration

This chapter provides an assessment of potential noise and vibration impacts of the proposal and identifies mitigation measures to address these impacts. It summarises the *Noise and Vibration Impact Assessment* (WSP, 2020e) (refer Volume 2, Technical paper 8).

17.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to noise and vibration and where these requirements are addressed in this EIS are outlined in Table 17-1.

Table 17-1 Secretary's environmental assessment requirements – noise and vibration

Ref.	Secretary's environmental assessment requirements	Where addressed
Amenity		
Key issues	The EIS must address the following matters: > an assessment of the construction, operational and road noise and vibration impacts of the project.	Construction noise and vibration is addressed in Section 17.4. Operational noise is addressed in Section 17.5.

17.2 Assessment approach

17.2.1 Legislative and policy context

Potential noise and vibration impacts resulting from construction of the proposal were assessed in line with the following legislation and key strategic and policy guidelines:

> *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009), which contains procedures for determining project specific Noise Management Levels (NMLs) that are based on the existing background noise surrounding the proposal. Sensitive receivers are considered likely to be affected by construction noise where a relevant NML is predicted to be exceeded. The NMLs adopted for the noise assessment of the proposal are used as the criteria (see Section 17.2.3)

> *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime, 2016), which has been used to provide additional guidance for the application of the requirements of the ICNG, including recommendations for noise management measures if the NMLs are predicted to be exceeded

> *NSW Road Noise Policy* (RNP) (DECCW, 2011), which provides a method for assessing construction traffic impacts on public roads and has been used in the construction traffic noise assessment (see Section 17.2.4)

> *Assessing Vibration: A Technical Guideline* (AVTG) (DEC, 2006), which is used to assess human comfort vibration impacts on sensitive receivers and has been used in the construction vibration assessment (see Section 17.2.3)

> *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* (BS7385) (BSI, 1993), which has been used to assess vibration impacts (structural damage) on non-heritage sensitive structures (see Section 17.2.3)

> *DIN 4150-3 Structural vibration Part 3: Effects of vibration on structures* (DIN 4150-3:1999-02), which has been used to assess vibration impacts on heritage sensitive structures (see Section 17.2.3)

- Technical Basis for Guidelines to Minimise Annoyance Due to Blast Overpressure and Ground Vibration (ANZECC, 1990)
- Australian Standard (AS) 2187.2 Explosives – Storage , Transport and use Part 2: Use of Explosives (AS 2187.2).

Potential noise and vibration impacts resulting from operation of the proposal were assessed in accordance with the following key strategic and policy guidelines:

- *Noise Policy for Industry* (NPfI) (EPA, 2017), which provides a framework and criteria for the consistent assessment of the impact and control of noise from industrial developments. It includes a method for assessing sleep disturbance and maximum noise level for industrial noise sources, which has been used in the selection of noise management levels and criteria for the operational noise assessment (see Section 17.5.1)
- *NSW Road Noise Policy* (RNP) (DECCW, 2011), which provides a method for assessing traffic impacts on public roads, which has been used in the operational traffic noise assessment (see Section 17.5.2).

17.2.2 Methodology

The methodology adopted for the noise and vibration assessment included:

- identifying potential sensitive receivers within and surrounding the proposal study area (see Section 17.3.2)
- identifying existing noise levels in the area by undertaking noise monitoring and measurements, including:
  - long term (unattended) noise monitoring between 26 May and 10 June 2020
  - short term (attended) noise monitoring
  - measuring the sound pressure levels at various distances from the Buronga substation
  - measuring temperature and humidity to identify the likelihood of weather conditions that may influence noise levels experienced
- establishing noise and vibration criteria to provide a basis for assessing the potential for impacts (refer to Sections 17.2.3 and 17.2.4)
- assessing the construction noise and vibration impacts of the proposal based on several representative construction scenarios (see 207717.2.3) and conservative assumptions to provide flexibility, including that:
  - for the transmission line corridor, construction activities could be located anywhere within the transmission line corridor
  - all construction equipment could be operational at the same time
- considering requirements for potential future assessment of blasting for construction of the proposal (if required)
- assessing the operational noise and vibration of the proposal. This included:
  - a model of the Buronga substation upgrade and expansion using SoundPLAN 8 modelling software
  - assessing the proposed transmission lines based on audible noise risk scenarios, which assumed that they could be located anywhere within the proposal study area to allow for design refinement
  - assessing the potential cumulative impacts in accordance with the NPfI
- assessing the road traffic noise impacts of the proposal based on estimations of traffic volumes and haulage routes of the proposal during construction and operation, and assessment of increases with existing and predicted future traffic volumes
- identifying mitigation and management measures to minimise potential impacts.

A detailed description of the assessment methodology is provided in Chapter 3 of Technical paper 8.

17.2.3 Construction noise and vibration assessment approach

Construction noise impact assessment scenarios

Several representative scenarios have been developed based on an indicative construction methodology to assess the likely airborne noise impacts from the various construction stages of the proposal.

The quantities and types of plant and equipment that have been assumed to be operating during each scenario is outlined in Appendix B-1 in Technical report 8.

In general, the transmission line construction scenarios are progressive (would move along the alignment and would not impact the same receivers for the full duration of the scenario). The Buronga substation upgrade and expansion, and the main construction compound and accommodation camps would be in a fixed location and may impact the same receivers for the duration of the scenario. These scenarios represent the 'worst-case', as it is assumed that several items of construction equipment would be in use at the same time at the closest point to each receiver. In reality, it is anticipated that the worst-case noise levels would only last for short periods of time during the construction duration, and there would be periods when no (or limited) noisy construction activities occur.

Construction hours

Construction of the proposal would generally be carried out between 7 am and 7 pm Monday to Sunday (referred to as the base construction hours). Standard construction hours are defined as Monday to Friday between 7 am and 6 pm, and Saturday between 8 am and 1 pm, with no work on Sundays or public holidays. As such, construction scenarios have been assessed for potential noise impacts within and outside standard working hours.

Accommodation camp facilities would be operational 24 hours a day, Monday to Sunday.

A range of activities may be required outside of the base construction hours. An out of hours work protocol will be developed to ensure that noise impacts are adequately managed where works are in the vicinity of sensitive receivers and where exceedances are predicted. The out of hours work protocol is discussed in Section 17.6.

Construction noise management levels

Table 17-2 outlines the construction NMLs applicable to residential receivers. These levels developed for the proposal using the existing background noise levels in accordance with the ICNG. In addition, residential receivers are considered highly noise affected and may have a strong reaction to noise if the noise levels experienced at the receiver are above 75 $L_{eq\ 15\ min}$ dBA.

Table 17-2 NMLs for residential receivers

Noise management levels, $L_{EQ\ 15\ MIN}$ DBA			
Standard construction working hours [1]	**Out of hours work (OOHW) periods [2]**		
Day	**Day**	**Evening**	**Night**
45	40	35	35

(1) Standard construction hours are defined as Monday – Friday: 7 am – 6 pm, Saturday: 8 am – 1 pm with no work on Sundays or public holidays

(2) Out of hours work time periods are defined as:
Day: 7 am to 8 am Saturday, 1 pm to 6 pm Saturday and 8 am to 6 pm on Sunday and public holidays
Evening: 6 pm to 10 pm Monday to Sunday
Night: 10 pm to 7 am Monday to Saturday, 10 pm to 8 am Sunday

The noise management levels adopted for non-residential receiver types within and surrounding the proposal study area are as follows:

- Educational facilities – 45 $L_{eq\ 15\ min}$ dBA (for internal noise levels)
- Industrial facilities – 75 $L_{eq\ 15\ min}$ dBA (for external noise levels).

Noise management levels are not mandatory limits. However, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable mitigation measures to minimise noise emissions are to be investigated and applied.

Construction vibration criteria

Table 17-3 outlines the minimum working distances for typical items of vibration intensive equipment to minimise potential for vibration related impacts.

Where vibration intensive equipment such as vibratory rollers, hydraulic hammers, bored piling rigs or jackhammers are used at a greater distance from sensitive receivers than the specified minimum working distance, there is negligible risk of structural damage or impacts on human comfort. Where recommended minimum working distances are not met, more detailed consideration of potential vibration impacts and the construction approach would occur during detailed design.

Table 17-3 Minimum working distances for vibration intensive plant

Equipment	Rating/Description	Minimum working distance (m)		
		Human response (DEC, 2006)	Cosmetic damage to non-heritage structures (BSI, 1993)	Damage to heritage structures (DIN 4150-3:1999-02)
Vibratory roller	<50 kN (typically 1-2 t)	15 to 20	5	11
	<100 kN (typically 2-4 t)	20	6	13
	<200 kN (typically 4-6 t)	40	12	15
	<300 kN (typically 7-13 t)	100	15	30
	>300 kN (typically 13-18 t)	100	20	40
	>300 kN (> 18 t)	100	25	50
Small hydraulic hammer	300 kg – 5 to 12 t excavator	7	2	5
Medium hydraulic hammer	900 kg – 12 to 18t excavator	23	7	15
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	73	22	44
Vibratory pile driver	Sheet piles	20	2 to 20	5
Pile boring	≤800 mm	n/a	2	5
Jackhammer	Hand held	Avoid contact with structure	1	3

Construction blasting

Table 17-4 outlines the maximum levels and blast overpressure and ground vibration criteria to maintain the amenity of residential receivers from *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) and *AS 2187.2 Explosives – Storage, Transport and use Part 2: Use of Explosives.*

The guidelines also provide a long-term goal of two millimetres per second for peak particle vibration velocity.

The criteria for amenity is more conservative than that required for the protection of structures, however for structures which may be particularly susceptible to ground vibration, AS 2187.2 1893 recommends a criterion of five millimetres per second peak particle velocity.

Where blasting is to occur in the vicinity of heritage structures, relevant ground vibration criteria would be adopted based on German Standard DIN 4150-3 for vibration (refer to the discussion on construction vibration criteria above).

Table 17-4 Vibration and air blasé criteria (ANZECC, 1990)

Measure	Unit	Criterion for 95% of blasts	Criteria for 100% of blasts
Vibration	mm/s PPV1	5	10
Air blast (peak)	dBL	115	120

(1) Millimetres per second peak particle velocity

Construction traffic noise criteria

The potential impacts from construction traffic when travelling on public roads are assessed under the RNP. An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than two dB due to construction traffic. Where this is considered likely, further assessment is required using the relevant road traffic noise criteria in Table 17-5, and mitigation options should be investigated.

Table 17-5 Road traffic noise criteria for receivers on existing roads affected by the additional traffic from land use developments (DECCW, 2011)

Road type	External road traffic noise criteria[1]	
	Day 7 am – 10 pm	Night 10 pm – 7 am
Freeway/arterial/sub-arterial roads	60 dB $L_{Aeq\ 15hr}$	55 dB $L_{Aeq\ 9hr}$
Local roads	55 dB $L_{Aeq\ 1hr}$	50 dB $L_{Aeq\ 1hr}$

(1) Façade corrected noise levels.

17.2.4 Operational noise assessment approach

Project noise trigger levels

Table 17-6 outlines the project noise trigger levels (PNTLs) determined for the proposal in accordance with the NPfI, taking into account the project intrusiveness and project amenity noise levels (refer to Section 6.1.1.3 of Technical paper 8 for more information).

Table 17-6 Summary of Project Noise Trigger Levels for the proposal (EPA, 2017)

Receiver location	Assessment/ receiver type	Project noise trigger levels dBA $L_{eq,15\ min}$		
		Day[1]	Evening[1]	Night[1]
All residences	Intrusiveness	40	35	35
	Amenity	48	43	38
	PNTL – Residential	40	35	35

(1) Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and public holidays; Evening: the period from 6 pm to 10 pm; Night: the remaining periods.

Operational traffic noise

As per construction traffic noise, the potential impacts from traffic associated with operation of the proposal are assessed under the RNP. An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2 dB due to construction traffic. Where this is considered likely, further assessment is required using the following relevant road traffic noise criteria in Table 17-7, and mitigation options should be investigated.

Table 17-7 Road traffic noise criteria for receivers on existing roads affected by the additional traffic from land use developments (DECCW, 2011)

Road type	External road traffic noise criteria[1]	
	Day 7 am – 10 pm	Night 10 pm – 7 am
Freeway/arterial/sub-arterial roads	60 dB $L_{Aeq\ 15hr}$	55 dB $L_{Aeq\ 9hr}$
Local roads	55 dB $L_{Aeq\ 1hr}$	50 dB $L_{Aeq\ 1hr}$

(1) Façade corrected noise levels

17.3 Existing environment

17.3.1 Existing noise levels

Existing noise levels within and surrounding the proposal study area are influenced by the surrounding agricultural and rural residential land uses as well as local traffic and the operation of the existing Buronga substation.

Table 17-8 provides the noise levels that were measured during the unattended noise monitoring between 26 May and 10 June 2020 at 694 Arumpo Road, Wentworth NSW (referred to as noise monitoring location NM1). This noise monitoring location was selected as it was considered to be representative of the existing background noise levels that would be experienced across the proposal study area.

Table 17-8 Unattended noise measurement results at NM1

Measured Noise Level (dBA)					
Rating background level (RBL) dBA			Ambient noise level $L_{eq,15,min}$		
Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
35 (24)[2]	30 (21)[2]	30 (22)[2]	45	39	34

(1) Time periods defined as – Day: 7 am to 6 pm Monday to Saturday, 8 am to 6 pm Sunday; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am Monday to Saturday, 10 pm to 8 am Sunday

(2) Where background levels are below the minimum assumed RBLs outlined in the NPfI, they have been adjusted to 35 dBA during the day period, and 30 dBA during the evening and night periods in accordance with the NPfI

During the attended noise monitoring near the proposal study area, the main noise sources observed included birds, motor vehicles, dogs barking and light wind, which is typical of rural and natural sounds and is expected to be generally consistent across the proposal study area. The noise levels observed were generally consistent with the findings of the unattended noise monitoring. Further information on the monitoring results is available in Section 4.4 of Technical paper 8.

17.3.2 Sensitive receivers

Locations that may be occupied by people and are potentially sensitive to noise and vibration are referred to as sensitive receivers. There are 24 sensitive receivers that have been identified within 1.7 kilometres of the proposal study area (refer to Table 4.1 in Technical paper 8), which includes:

- 17 residential dwellings
- three industrial facilities
- two education facilities
- one community facility
- one utility facility (Ellerslie substation).

Four of these receivers, including three residential dwellings and one utility facility (Ellerslie substation), are located within the proposal study area.

The locations of the sensitive receivers with respect to the proposal study area and the noise monitoring locations are shown on Figure 17-1.

Three non-Aboriginal heritage sites that have curtilages partially located within the proposal study area (refer to Section 11.3) have also been considered as potential vibration sensitive receivers as vibration can affect sensitive structures or buildings.

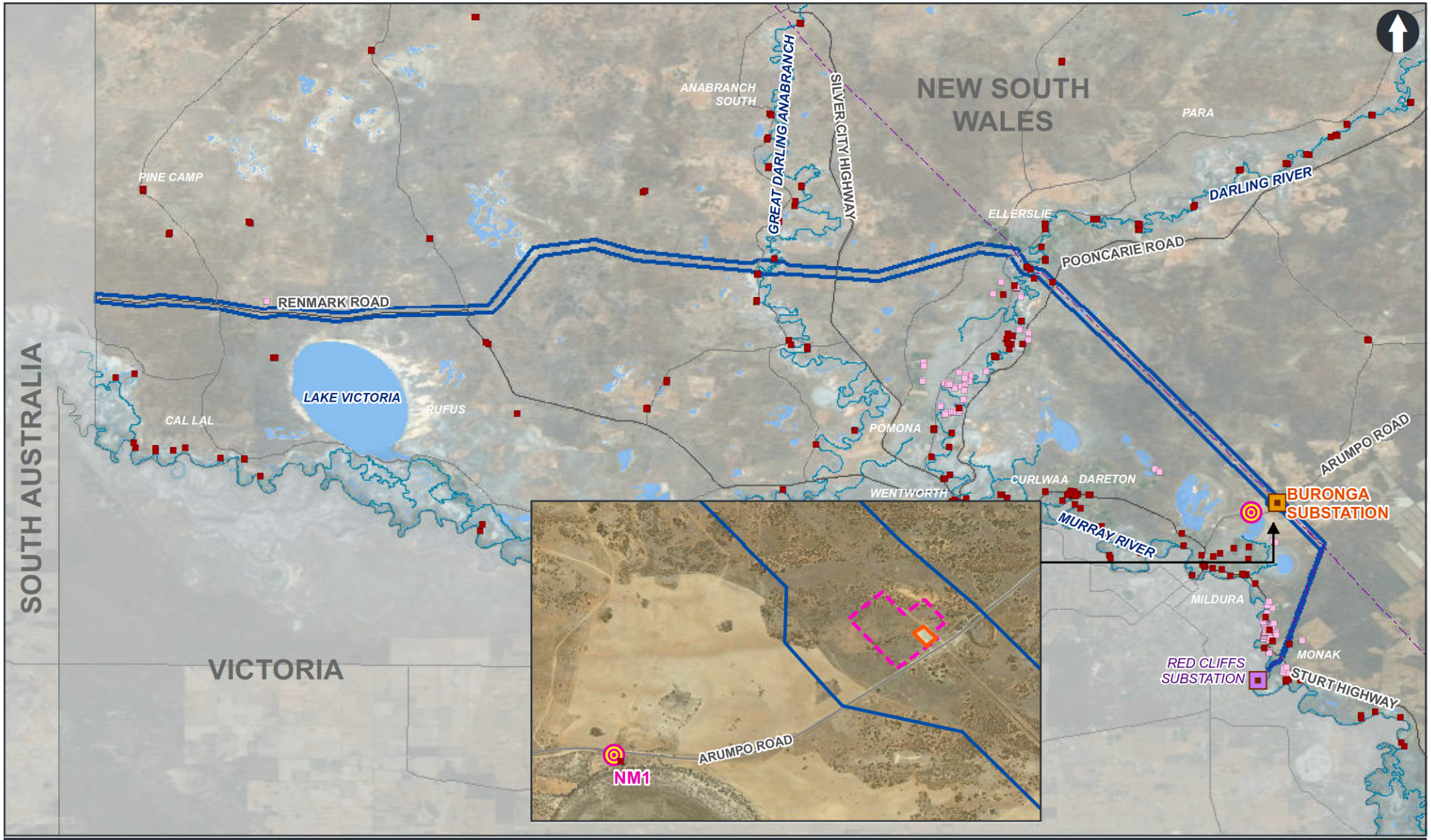


Figure 17-1

Location of sensitive receivers and noise monitoring locations

17.4 Potential impacts – construction

17.4.1 Construction noise

Transmission line construction works

The results of the assessment confirmed distances from the transmission line construction works that would be required to achieve compliance with relevant noise limits (refer to Table 17-2) during and outside standard construction hours for each scenario. The results also confirmed the distances at which noise level exceedances would be clearly audible, moderately intrusive, highly intrusive or result in receivers that would be highly affected for each construction scenario.

Figure 17-2 shows the sensitive receivers within and surrounding the transmission line corridor with respect to a maximum buffer distance, which indicates which receivers are likely to be impacted from noise generated by different scenarios associated with construction of the transmission line when works are in the vicinity.

The results show that:

- all construction scenarios modelled have the potential to result in noise impacts to sensitive receivers
- sensitive receivers beyond 1,430 metres from the transmission line corridor are unlikely to experience noise impacts due to construction
- exceedances of noise management levels would depend on the activity, with site establishment, earthworks and civil construction works, and decommissioning scenarios generating the highest noise levels. Exceedances would be up to 26dB(A) above the noise management level at the nearest sensitive receiver during standard construction hours, and up to 36dB(A) during these works outside standard construction hours
- for other activities, construction noise would be up to 20dB(A) during standard construction hours at the closest residential receiver, and up to 28dB(A) above noise management levels for works outside standard construction hours
- the impacted receivers would predominately be located in proximity to the transmission line corridor where it passes across the Great Darling Anabranch and the Darling River, and in areas in proximity to the Murray River with:
  - up to six sensitive receivers exceeding noise management levels during daytime standard construction hours
  - up to eight sensitive receivers exceeding noise management levels during daytime works outside standard construction hours
  - up to seven sensitive receivers exceeding noise management levels for the majority of scenarios during the evening and night time period, except for two scenarios (establishment, and earthworks and civil construction) in which up to 22 sensitive receivers would exceed noise management levels
- no sensitive receivers would be highly noise affected
- construction of the proposal is unlikely to result in sleep disturbance, as the proposed construction working hours (7 am to 7 pm, Monday to Sunday) only extend into the shoulder periods of the evening and night time period.

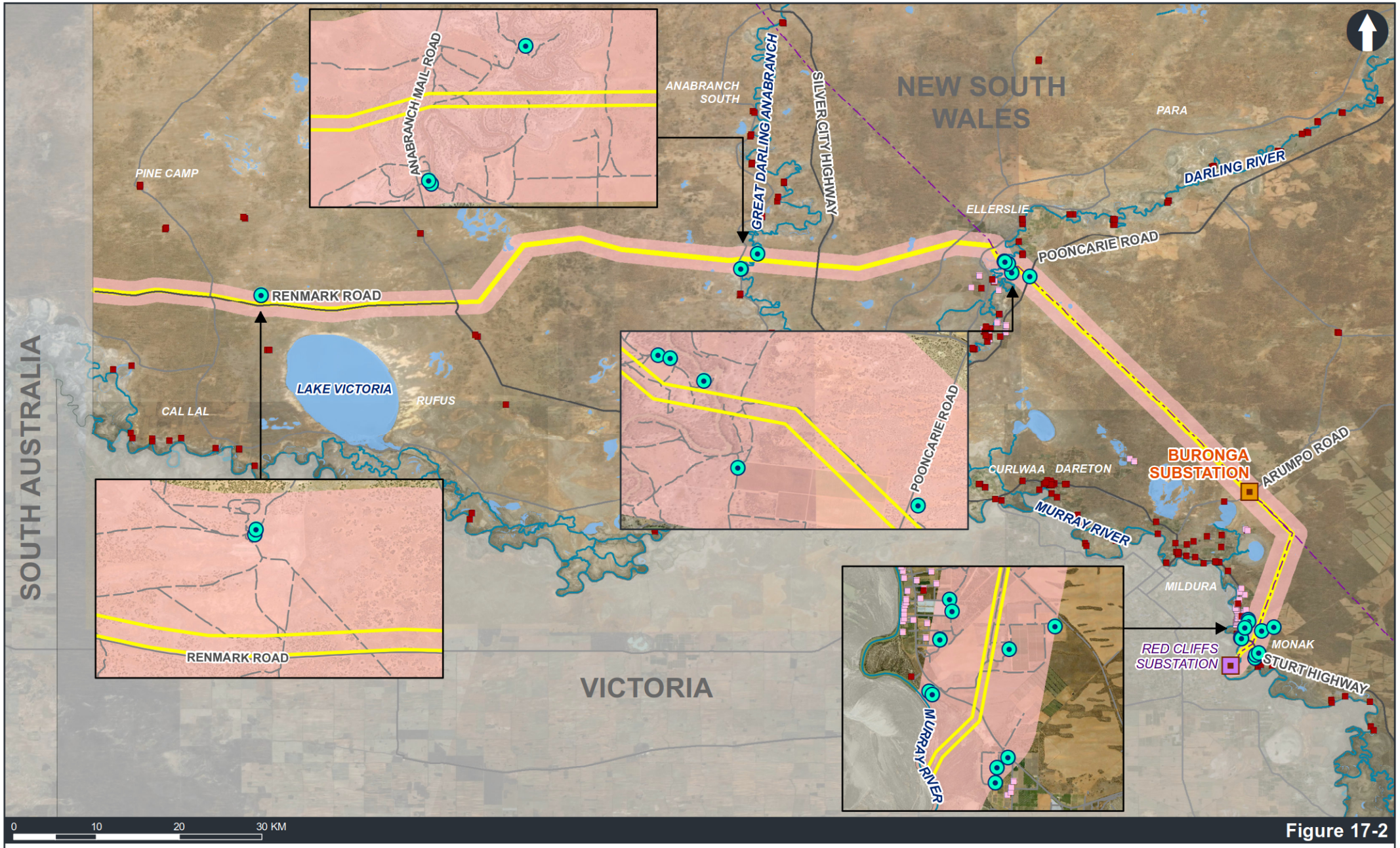


Figure 17-2

Sensitive receivers likely to be affected by construction of the transmission lines

As discussed in Section 17.4.1, the noise scenarios were based on conservative assumptions to understand the potential 'worst case' impacts including assuming that several items of construction equipment would be in use at the same time at the closest point to each receiver, and does not take into account screening of activities (such as by terrain) or mitigation measures. In reality, these 'worst case' assumptions are unlikely to occur. The typical noise levels experienced during construction would be below these predicted noise levels and each receiver would only be affected for a short duration as the construction activities would be intermittent with periods of no activity between key construction activities (refer to Section 6.3).

Predicted impacts at sensitive receivers would be confirmed during detailed design, and reasonable and feasible mitigation would be implemented where exceedances of NMLs are predicted, including an out of hours work protocol (refer to Section 17.6).

Temporary batching plants with the transmission line corridor

The location of temporary batching plants would be confirmed during detailed design. Use of temporary batching plants would include similar equipment as the construction compounds, and based on continuous operation of this equipment, temporary batching plants should be established at least 460 metres from the nearest sensitive receivers to ensure compliance with the most stringent NML.

Buronga substation upgrade and expansion

The nearest receiver to the Buronga substation is located approximately two kilometres from the boundary of the Buronga substation upgrade and expansion site. The construction equipment and phases for these works are similar to those for the construction of the transmission line, and therefore similar compliance distances can be assumed. The maximum identified compliance distance for all work stages as part of the transmission line construction was calculated at 1,430 metres, which was predicted for the earthworks and civil construction scenario when works are completed outside standard construction hours. As the nearest residence is located beyond this compliance distance, no sensitive receivers are expected to be impacted by noise generated during construction of the Buronga substation upgrade and expansion.

Main construction compounds and accommodation camps

The nearest receiver to either the Buronga and Anabranch South main construction compounds and accommodation camps are located approximately 1.8 kilometres from the main construction compound and camp sites. Based on the distances to sensitive receivers, no receivers are predicted to be adversely impacted by construction or use of these sites during and outside standard construction hours.

Concurrent construction activities

There is the potential for concurrent construction activities occurring in proximity to sensitive receivers as a result of the construction of the transmission line, substation and the two main construction compounds. Based on the results of the above assessment, and considering the proximity of the nearest receivers to Buronga substation and main construction compound and accommodation camp sites, the risk of notable construction impacts at the nearest receivers would be low, with concurrent noise levels anticipated to be below relevant construction NMLs.

17.4.2 Construction vibration

As the construction activities could occur anywhere within the transmission line corridor, there is the potential that vibration intensive equipment could be used within the minimum working distances for cosmetic damage, human response and heritage sensitivity (outlined in Table 17-3). The potential for vibration impacts at these receivers would be minimised through refinement of the construction methodology, such as the selection of alternative equipment if works need to occur within minimum working distances. No vibration impacts are expected for receivers outside of the transmission line corridor as they would be located beyond the minimum working distances for potential vibration impacts, with the exception of the Ellerslie and Buronga substations. At these locations, human comfort criteria may be exceeded. However, given the likely presence and roles of most staff at these sites, human comfort impacts are expected to be minor.

No vibration related impacts are anticipated as a result of construction works at the Buronga substation due to the nearest external sensitive receiver being located approximately two kilometres away.

17.4.3 Blasting

Blasting may be required at the Buronga substation but would be confirmed during detailed design (refer to Section 6.6.5). Further assessment would be required, including:

- proposed blast methodology, charge, delay interval and spacing
- calculated vibration and overpressure
- distance limits for specific Maximum Interval Charge (MIC).

Based on the outcomes of this assessment, management and mitigation may be required at the nearest affected sensitive receivers.

A Blast Management Strategy would be prepared in accordance with AS 2187.2 Explosives – Storage, Transport and use Part 2: Use of Explosives. This strategy would be developed to demonstrate that blasting and associated activities would not generate unacceptable noise and vibration impacts at residences or other sensitive receivers.

17.4.4 Construction road traffic noise

The key roads and the prospective haulage routes in the traffic and transport study area are discussed Section 18.3 and include national and state roads (Silver City Highway through Buronga, the Sturt Highway from Buronga to Wagga Wagga) and regional roads including Arumpo Road, Renmark Road and Pooncarie Road/Wentworth Street. Construction of the proposal is expected to generate a peak of 250 light vehicle movements and 80 heavy vehicle movements per day on these roads, which has the potential to result in road traffic noise impacts at the nearest sensitive receivers.

Table 17-9 outlines the results of the construction traffic noise assessment for the proposal. The results indicate that road traffic noise levels may increase due to construction of the proposal but are predicted to comply with relevant RNP noise criteria at all assessed roads.

As a result of construction traffic, some roads would experience road traffic noise level increases of more than 2dB due to the relatively large increases in vehicle volumes on the roads (due to low existing vehicle volumes). This includes Arumpo Road, Renmark Road and the section of the Silver City Highway between Broken Hill to Perry Street. However, the overall noise levels predicted would still be below the applicable external road traffic noise criteria of 60dBA (refer to Table 17-5), and mitigation options would not be required.

Given the large existing number of vehicles on the Silver City Highway and Sturt Highway (both designated NSW Heavy Vehicle routes), the additional construction traffic along these roads is not expected to increase road traffic noise levels by more than 2dB.

Table 17-9 Predicted road traffic noise levels and impacts

Road name and location	Existing vehicle volume (veh/day)[1]	Distance to nearest sensitive receiver (m)	Predicted existing noise level of traffic (dBA)	Predicted noise level with construction traffic (dBA)	Increase in noise level (dB)
Silver City Highway (B79). Ellerslie – between Broken Hill and Wentworth (from Broken Hill to Perry Street in Wentworth)	358	1000	29	32	2.9
Silver City Highway (B79). Wentworth Town Centre (from Perry Street in Wentworth to Delta Road in Wentworth)	2,559	100	47	48	0.5
Silver City Highway (B79). Mourquong – between Dareton and Buronga (from Fletchers Lake Road to Corbett Avenue)	2,228	100	50	50	0.7
Silver City Highway (B79). within Buronga Town Centre (from Corbett Avenue to Sturt Highway)	5,478	20	59	59	0.2
Sturt Highway (A20) George Chaffey Bridge – between Mildura and Silver City Highway, Buronga	10,593	20	64	64	0.1
Sturt Highway (A20) within Buronga (between Silver City Highway and Knights Road in Gol Gol)	2,730 (eastbound only)	20	56	56	0.5
Arumpo Road (north of Mourquong Road, Mourquong)	327	100	41	44	2.6
Renmark Road	<50	800	24	31	7.1

17.5 Potential impacts – operation

17.5.1 Operational noise assessment results

Predicted noise impacts from the transmission lines

The proposed new high voltage transmission lines may generate audible noise during operation associated with accumulation of pollution and water droplets on the conductor surface of the transmission lines, which can result in corona discharge noise. This corona discharge noise is more prominent during rain, mist or fog and often sounds like a 'crackling noise'.

To assess the potential risk of impact from the noise generated by the transmission lines, an audible risk assessment was completed for the proposal by BECA, the *Project EnergyConnect Audible Noise and Radio Frequency Interference Study* (BECA, 2020b).

Table 17-10 outlines the audible risk zones that were calculated for the proposed 330kV transmission line from the SA/NSW border to the Buronga substation as well as the number of sensitive receivers that have been identified within each. Figure 17-3 depicts the location of the sensitive receivers within the audible risk zone.

The audible risk zones were calculated for three scenarios by determining the distance from an indicative transmission line beyond which the most stringent project noise trigger level of 35dBA would be met at surrounding receivers. As the exact transmission line alignment is yet to be determined, the 'worst-case' number of potential sensitive receivers within each audible noise risk zone was calculated by assuming the closest location of the transmission line would be 40 metres from the boundary of the transmission line corridor for sensitive receivers (to account for the easement).

The results show that in fair weather conditions, no sensitive receivers are expected to experience audible noise above the adopted criteria. However, three residential receivers would be within the 'worst-case' audible noise risk zone during wet weather conditions and are therefore at risk of experiencing noise levels that would exceed the adopted criteria by up to 9 dB at one sensitive receiver, and up to 6 dB at two sensitive receivers. These wet weather conditions are predicted to occur for up to 30 per cent of the days in the year based on historical meteorological data (with one day per year with mist). Noting that these conditions can occur for only short durations on these days. During heavier rain events, the noise generated by the rain itself would be substantial and would potentially mask any noise from operation of the transmission line. Noise disturbance under such circumstances is therefore likely to be low risk.

Table 17-10 Audible risk zones surrounding the proposed 330 kV transmission line

Scenario	Audible noise risk zone distance from 330 kV transmission line (m)	Number of sensitive receivers within the audible noise risk zone
Wet weather conditions with an indicative 'base case' concept tower design	442	3
Wet weather conditions with a 1% increase in surface voltage gradient to account for a slightly more compact tower design	548	3
Fair weather conditions with an indicative 'base case' concept tower design	<40 (i.e. within the easement)	0

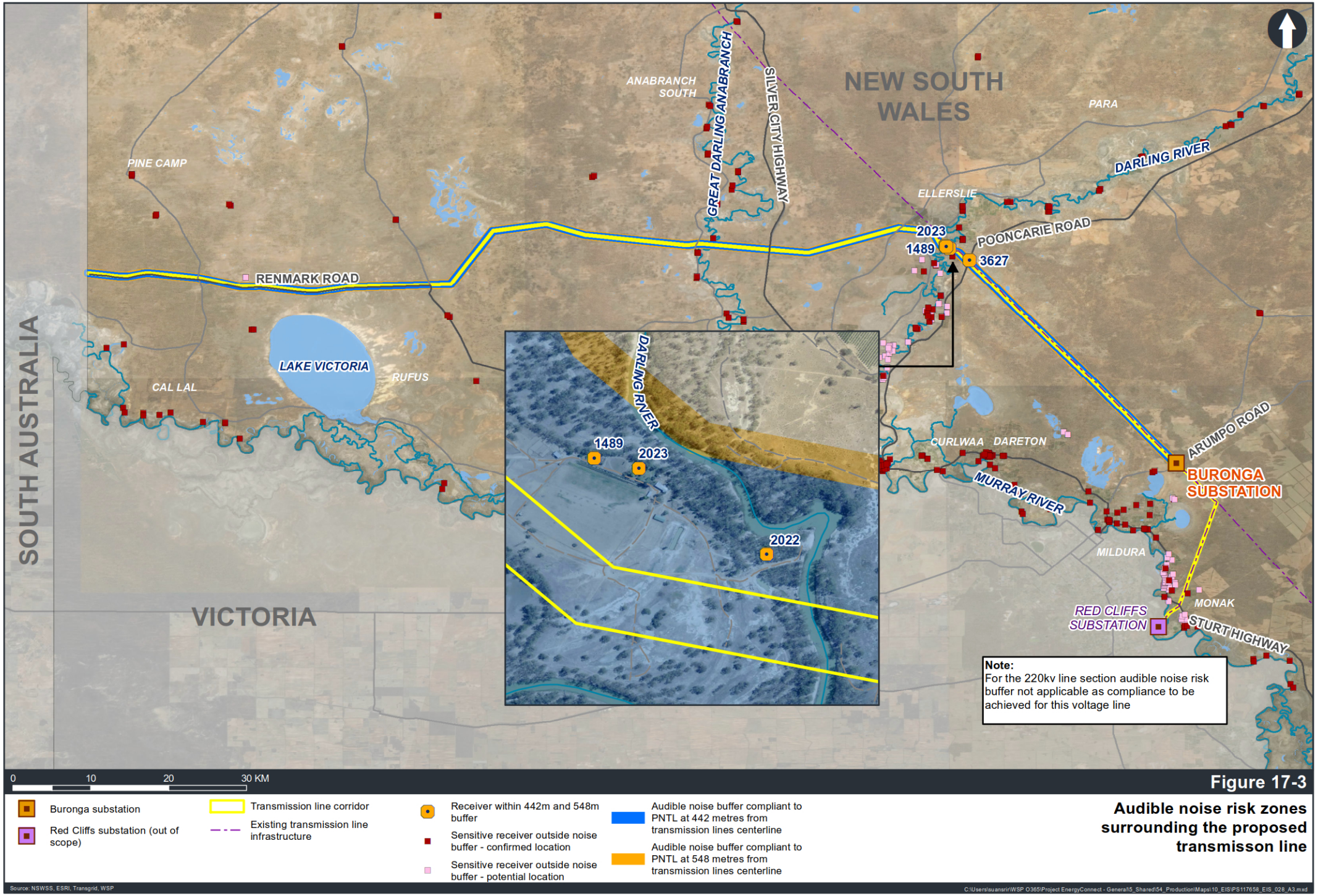


Figure 17-3

Audible noise risk zones surrounding the proposed transmisson line

Noise modelling by BECA (2020b) also considered potential cumulative noise impacts associated with the sections of the proposed 330kV transmission line that would run close and parallel to existing 220kV transmission lines. The results showed that the existing 220kV transmission lines are expected to have a significantly lower noise impact than the proposed 330kV transmission lines and would therefore have negligible contribution to any cumulative operational noise impact.

To minimise potential noise impacts, the number of sensitive receivers within the audible noise risk zones would be minimised during design refinement by locating the final 330kV transmission line alignment as far away from sensitive receivers as possible.

The BECA study identified that the 220kV transmission line between the Buronga substation and the NSW/Victorian border is expected to result in a sound pressure level of less than 35dBA directly below the line. This noise level complies with the most stringent project noise trigger levels of 35dBA and therefore further consideration of audible risk zones was not undertaken.

Predicted noise impacts from the Buronga substation upgrade and expansion

The additional equipment proposed at the Buronga substation as part of the upgrade and expansion would generate noise during operation, including the proposed transformers, reactors, capacitor banks, generators, heating, ventilation and air conditioning (refer to Section 6.1.2 of Technical paper 8 for further detail). The substation would also house circuit breakers, which when triggered would emit a short-term impulsive noise. Noise levels at the nearest four receivers to the Buronga substation (as shown on Figure 17-4 and Figure 17-5) were predicted to assess the predicted change in noise levels, including potential short-term maximum noise events.

These results show that under all scenarios, the operational noise levels associated with the Buronga substation upgrade and expansion are predicted to comply with the relevant project noise trigger levels, and therefore no additional mitigation measures would be required. It is noted that these results are conservative, as the model assumes that all equipment at the substation would operate at the same time, whereas in reality, some equipment may not be required at all times due to the load on the electricity network.

17.5.2 Vibration

Operation of the proposal is not anticipated to result in any impacts from vibration.

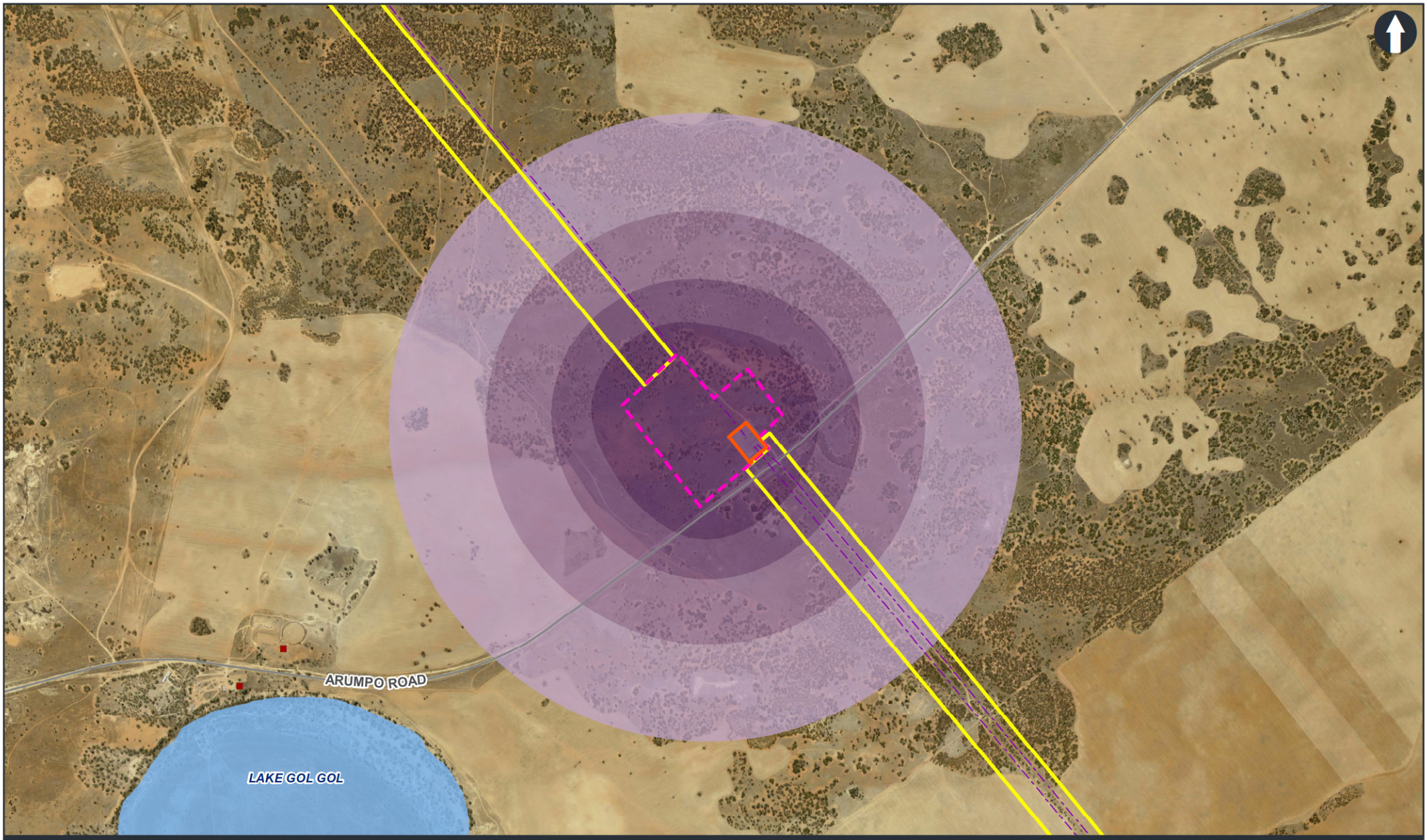


Figure 17-4

Operational noise levels (daytime) - Buronga substation upgrade and expansion

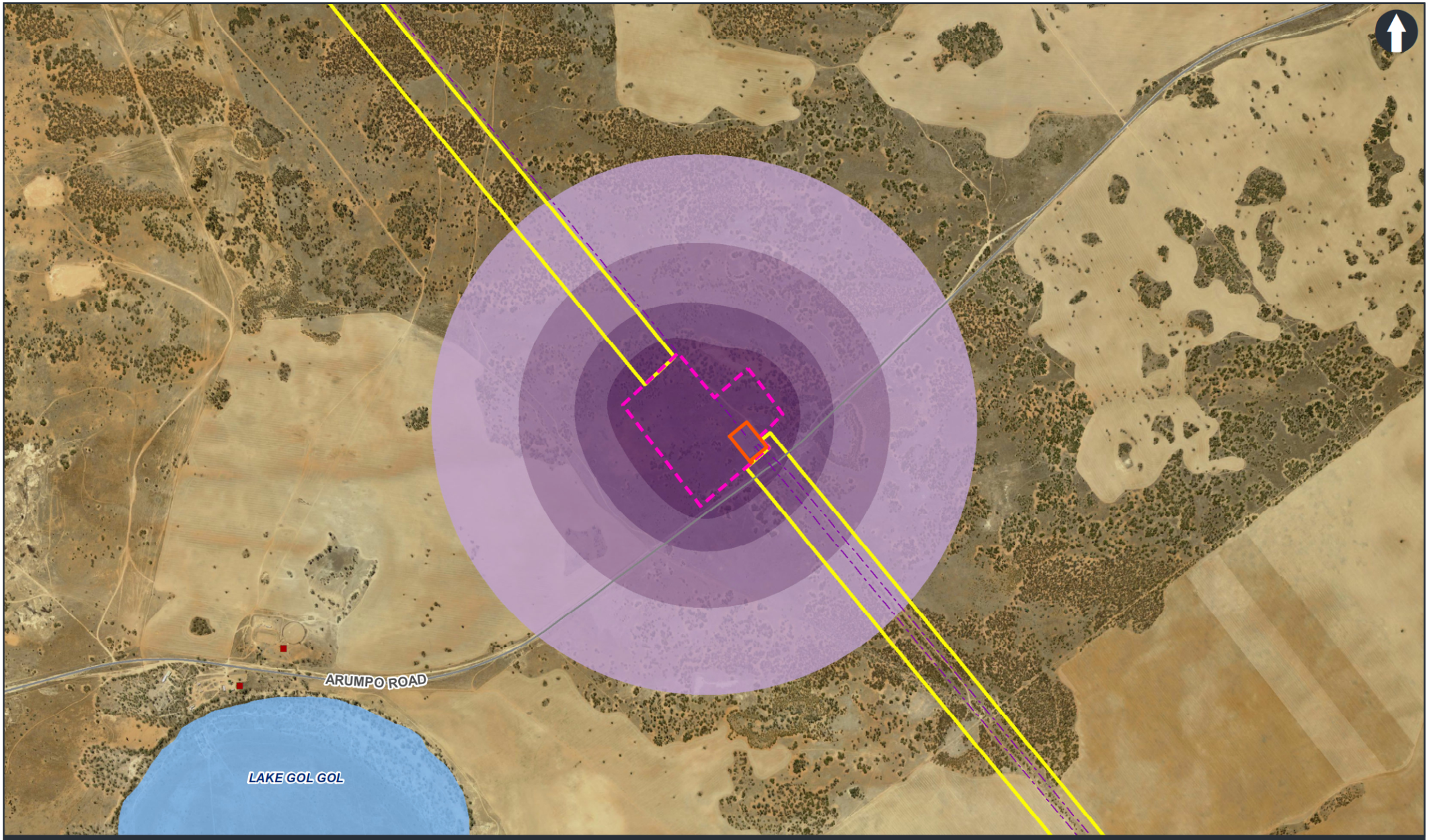


Figure 17-5

Operational noise levels (night time) - Buronga substation upgrade and expansion

17.5.3 Operational road traffic noise

As discussed in Technical paper 9, the operation and maintenance of the Buronga substation and the transmission lines are conservatively estimated to generate up to 100 vehicle movements per day, which would mainly comprise of light vehicle movements from maintenance staff. This scenario is unlikely to be realised, given the infrequent nature of the access required for routine maintenance.

To achieve a 2 dB increase in road traffic noise, the existing traffic volumes on the affected roads would need to be increased by over 60 per cent. Given the low number of vehicle movements per day expected to be generated by operation of the proposal compared to existing road volumes, road traffic noise increases from operation of the proposal would be negligible.

17.6 Management of impacts

17.6.1 Environmental management

Environmental management plans

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

For construction, this would include a detailed construction noise and vibration management plan (CNVMP) which would be based on the final construction methodology and construction footprint including the confirmed schedule and locations of construction activities as well as equipment types and numbers. The approach to mitigation would be in accordance with the recommendations in the ICNG.

17.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to noise and vibration are presented in Table 17-11.

Table 17-11 Mitigation measures – noise and vibration

Reference	Mitigation measure	Timing	Applicable location(s)
NV1	An Operational Noise Review will be prepared to confirm the predicted noise impacts from the proposal (based on the final detailed design) and refine the operational mitigation measures that will be implemented so operational noise impacts complies with the project noise trigger levels, where feasible and reasonable.	Detailed design	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
NV2	Where exceedances of the project specific trigger noise levels are predicted, feasible and reasonable operational noise and vibration mitigation measures will be further investigated during detailed design, in consultation with the affected receivers. This may include (in order of priority): > land use planning and provision of appropriate buffer distances to increase the distance between the final transmission line alignment and the surrounding sensitive receivers and ultimately minimise the number of sensitive receivers within the audible risk noise zones > noise control at the noise source > noise control along the noise transfer path, such as noise barriers > noise control at the receiver, such as 'at property' treatment to upgrade aspects of the dwellings including the façade or ventilation systems.	Detailed design	Transmission line (330 kV only)
NV3	Construction methodologies and measures that minimise noise and vibration levels during construction will be investigated during detailed design and implemented where feasible and reasonable. This will be supported through the completion of additional assessments (where impacts to sensitive receivers could occur) based on the final construction methodology. This will: > consider the proposed layouts of work areas or construction compounds > the noise and vibration generating activities that will take place > assess the predicted noise and vibration levels against the relevant management levels > incorporate feasible and reasonable mitigation and management measures in accordance with the ICNG.	Detailed design and construction	All locations
NV4	Further engagement and consultation with affected receivers will be carried out to understand their preferences for mitigation and management measures where exceedances of noise management levels are predicted. Based on this consultation, appropriate mitigation and management options will be considered and implemented where feasible and reasonable to minimise the impacts.	Detailed design and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
NV5	A CNVMP would be prepared by the construction contractor prior to construction works and would (as a minimum): > examine feasible and reasonable noise mitigation where management levels are exceeded > examine feasible and reasonable noise measures to manage traffic noise impacts on public roads where exceedances above 2 dB are identified > develop associated noise and vibration monitoring programs, as required > develop proactive and reactive strategies for dealing with any noise complaints > outline community consultation measures including notification requirements. This CNVMP would be implemented for the duration of construction.	Detailed design and construction	All locations
NV6	An out of hours works (OOHW) protocol will be implemented and will include: > details of what works are required outside standard construction hours > noise management safeguards and other reasonable and feasible mitigation measures, including respite periods and duration respite where works are within the identified affectation distances for sensitive receivers leading to NML exceedances for sensitive receivers > community consultation procedures, including letterbox drops, notification protocols, and site contact information for the works > complaints handling procedures.	Detailed design and construction	All locations
NV7	Where noise intensive equipment is to be used near sensitive receivers, the works will be scheduled for standard construction hours, where possible.	Construction	All locations
NV8	Where works are required within the minimum working distances for vibration: > different construction methods with lower source vibration levels will be investigated and implemented, where feasible > attended vibration measurements will be undertaken at the start of the works to determine actual vibration levels at the structure. Works will cease if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
NV9	Temporary batching plants along the transmission line corridor will be positioned to ensure compliance with NMLs at the nearest sensitive receivers.	Construction	Transmission line
NV10	If blasting is required, a blasting vibration and overpressure assessment will be completed to demonstrate that blasting and associated activities will not exceed noise and vibration limits at residences or other sensitive receivers. Based on outcomes of this assessment, a blast management strategy will be implemented that details how blasting will be carried out in a manner that complies with relevant noise and vibration limits, and notification requirements with landholders.	Construction	Blasting

17.6.3 Managing residual impacts or uncertainties

The ICNG acknowledges that construction noise impacts cannot always be avoided where construction activities are required near sensitive receivers. The final construction strategy for the proposal would aim to minimise construction noise and vibration impacts through refinement of the methodology and construction locations, where possible. It should also be prepared in consultation with the community to take into account the communities' willingness to tolerate the level of construction noise predicted and preferences for strategies such as respite periods. The noise and vibration during construction would be managed through implementation of a CNVMP. Monitoring would be carried out at some stages during construction to confirm the effectiveness of the noise and vibration mitigation measures implemented and determine whether any adjustment to the mitigation measures would be required to manage residual impacts.

In accordance with NPfI, a residual noise impact is defined as '*receivers with exceedances of the project noise trigger levels under the best-achievable acoustic outcome from a development*'. Residual noise impacts are identified after all source and pathway feasible and reasonable noise mitigation measures (in accordance with the meaning of these terms as outlined in Section 1.4 of the ICNG) have been considered, which would occur during detailed design. Following design refinement, if sensitive receivers are still identified to be located within the audible noise risk zones surrounding the proposed 330 kV transmission line, feasible and reasonable mitigation options would be identified in accordance with the ICNG to manage the residual risk. An Operational Noise Review would be prepared to confirm the noise impacts from the proposal (based on the final detailed design) and define the operational mitigation measures that would be implemented. This would ensure that the operational mitigation measures would be suitable to effectively control operational noise impacts.

18. Traffic and access

This chapter provides an assessment of potential traffic and access impacts of the proposal and identified mitigation measures to address these impacts. It summarises *Traffic and Transport Impact Assessment* (WSP, 2020f) (refer Volume 2, Technical paper 9).

18.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to traffic and access and where these requirements are addressed in this EIS are outlined in Table 18-1.

Table 18-1 Secretary's environmental assessment requirements – traffic and access

Ref.	Secretary's environmental assessment requirements	Where addressed
Transport		
Key issues	The EIS must address the following matters:	
	> an assessment of the transport impacts of the project on the capacity, condition, safety and efficiency of the local and State road network	Impacts during construction are addressed in Section 18.4 Impacts during operation are addressed in Section 18.5
	> details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road network.	Maintenance activities are described in Section 5.4 and addressed in Section 18.5 with respect to impacts on the road network.

18.2 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

18.2.1 Legislative and policy context

Traffic and access impacts resulting from the proposal were assessed in line with the following legislation and key strategic and policy guidelines:

> *Roads Act 1993* – The Act aims to establish the rights of members of the public to pass along public roads, rights of persons who own land adjoining a public road to have access to the public road, and to establish the procedures for the opening and closing of a public road. This proposal is consistent with this legislation, ensuring that the appropriate processes and measures are in place to manage the impacts to users of the public roads, landholders and the opening/closing of public roads

> *NSW Road Rules, 2014 – The NSW Road Rules 2014* are a framework for safe and efficient movement of traffic on NSW roads. The proposal would support the objectives of the NSW Road Rules by ensuring mitigation recommendations are aligned with these rules

- *Traffic Control at Work Sites – Technical Manual 2018* (RMS, 2018) – The aim of this manual is to protect the safety for all transport mode users (vehicles, pedestrians, cyclists etc.) travelling around or passing through work sites. This guide refers to Australian Standards 1742 (*Manual of uniform traffic control devices*) (Australian Standards, 2009) and 1743 (*Road signs – specifications*) (Australian Standards, 2018) to have consistent application with the Australian Standards. Temporary works on public roads detailed in Technical paper 9 consider the practices detailed in this guideline
- *NSW Heavy Vehicle Access Policy Framework 2018* (TfNSW, 2018) – which provide a framework for heavy vehicle access in NSW for both state and local council roads. As part of the proposal, heavy vehicles would be required to carry freight, including construction materials, to locations within the proposal study area. This framework provides a platform to consider areas of priority such as safety and the capacity of road infrastructure (including roads and bridges), particularly for higher density loads such as construction material, is the limitation on the movement of vehicles operating at Higher Mass Limits
- *Towards Zero – Safe System 2016* (NSW Government, 2016) – a framework by the NSW Government that is central to moving. The mitigation measures detailed in Section 18.2 consider the principles of Safe System approach that would provide a safe temporary road environment.

18.2.2 Methodology

The methodology adopted for the traffic and transport assessment included:

- undertaking a desktop assessment to identify, describe and qualitatively assess the existing conditions of the study area, including road regulations (speed zone, heavy vehicle restrictions, over mass and oversize vehicles access), crash history, traffic volumes, active transport, and public transport
- review of the proposed construction and operational vehicular access to construction areas
- a qualitative impact assessment of the traffic and access impacts during construction. This included:
  - a road network capacity assessment to assess the impact of construction traffic movements on the surrounding road network
  - a review of the proposed haulage access requirements
  - assessment of the potential impacts to existing public and active transport provisions
- examining the operational traffic and transport impacts, such as impact on the road network due to maintenance vehicle movements, emergency vehicle access, and requirements of access by large vehicles
- identifying mitigation measures to minimise as far as practicable the impacts of the proposal.

18.3 Existing environment

18.3.1 Existing road network

The existing road network within the Wentworth LGA consists of a combination of national, state, regional and local roads. The key roads within the proposal study area are shown on Figure 18-1 and include:

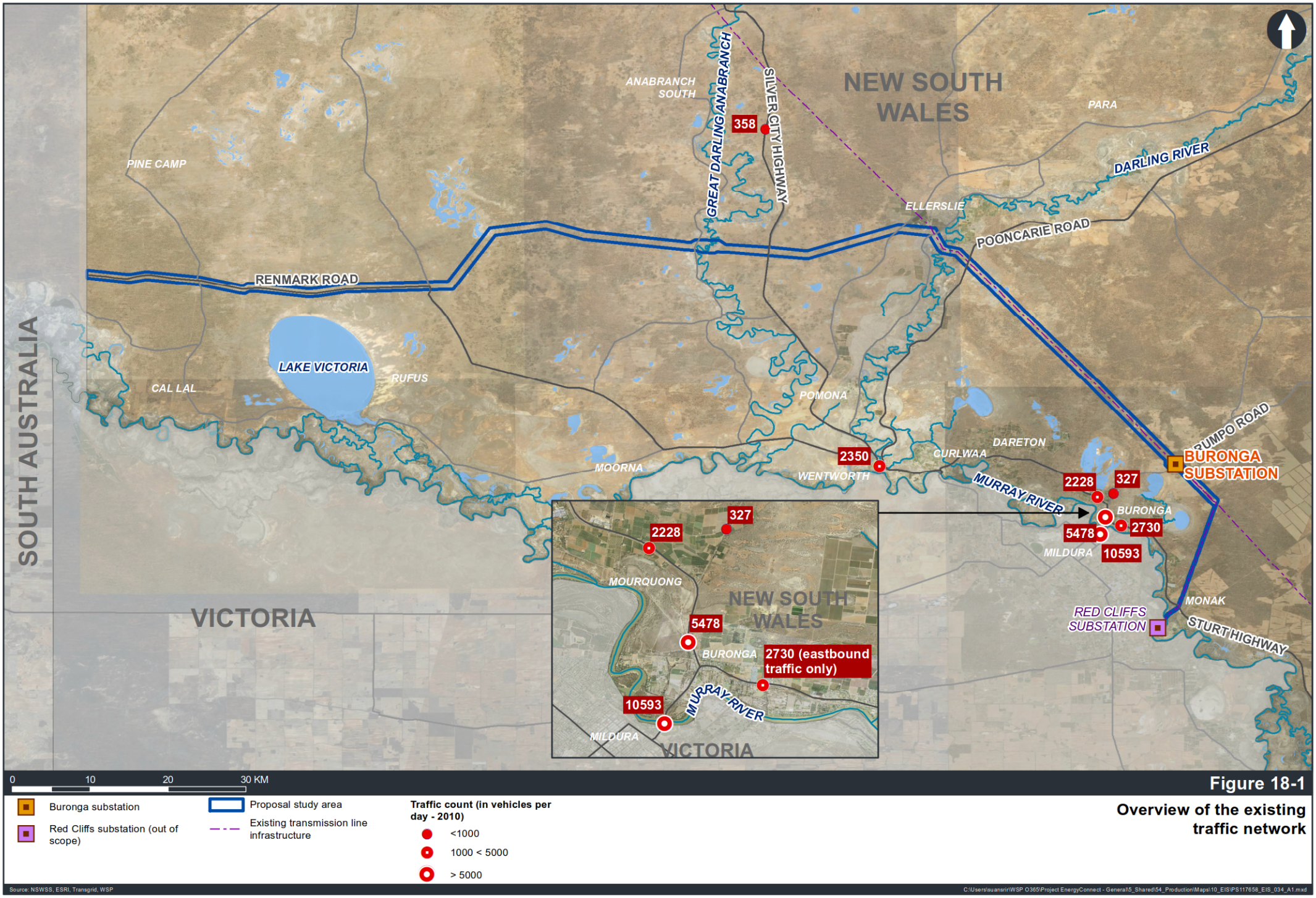
- *Sturt Highway (A20):* A major east-west highway that connects Buronga to Wagga Wagga. The Sturt Highway is sealed with two lanes (one lane in each direction). Sturt Highway has a general speed limit of 100 kilometres per hour and 60 kilometres per hour in town centres such as Gol Gol
- *Silver City Highway (B79):* A state road that connects Buronga to the Queensland Border, via Wentworth and Broken Hill. Silver City Highway is sealed with two lanes (one lane in each direction). It has a general speed limit of 100 kilometres per hour (110 kilometres per hour north of Wentworth) and 60 kilometres per hour in larger town centres such as Buronga and Dareton. It has a dedicated cycling facility (one lane in each direction) and a dedicated pedestrian footpath only on the west side on George Chaffey Bridge between Mildura and Buronga

- *Arumpo Road:* This is sealed regional road with unsealed road shoulders that connects traffic from Silver City Highway and Sturt Highway to Lake Mungo. There is a speed limit of 80 kilometres per hour and one lane in each direction
- *Renmark Road:* This is a partially sealed regional road that connects the South Australian border directly with Silver City Highway. This road is sealed from Silver City Highway for approximately 18 kilometres with unsealed road shoulders, where the rest of the road to the South Australian border is unsealed. There is a posted speed limit of 100 kilometres per hour with one lane in each direction
- *Pooncarie Road/Wentworth Street:* This is a sealed regional road that connects the town of Wentworth to the village of Pooncarie. This road is sealed between Wentworth and Pooncarie, with a posted speed limit of 80 kilometres per hour and one lane in each direction.

In addition, a number of local roads, would be included within the proposal study area and would be required to be accessed as part of the construction of the proposal. These roads include:

- Fletchers Lake Road
- Low Darling Road
- Pomona Road
- High Darling Road
- Rufus River Road
- Pine Camp Road
- Nulla Road
- Anabranch Mail Road.

Further detailed description of the existing road network and key roads is detailed in Section 4.1 of Technical paper 9.


SOUTH AUSTRALIA
VICTORIA
NEW SOUTH WALES
PINE CAMP
ANABRANCH SOUTH
GREAT DARLING ANABRANCH
SILVER CITY HIGHWAY
358
PARA
DARLING RIVER
ELLERSLIE
POONCARIE ROAD
RENMARK ROAD
LAKE VICTORIA
CAL LAL
RUFUS
POMONA
DARETON
CURLWAA
MOORNA
WENTWORTH
2350
MURRAY RIVER
2228
327
BURONGA
2730
5478
MILDURA
10593
BURONGA SUBSTATION
RUMPO ROAD
MONAK
RED CLIFFS SUBSTATION
STURT HIGHWAY
MOURQUONG
2730 (eastbound traffic only)
0
10
20
30 KM
Figure 18-1
Overview of the existing traffic network
Buronga substation
Red Cliffs substation (out of scope)
Proposal study area
Existing transmission line infrastructure
Traffic count (in vehicles per day - 2010)
<1000
1000 < 5000
> 5000
Source: NSWSS, ESRI, Transgrid, WSP
C:\Users\suansri\WSP O365\Project EnergyConnect - General\5_Shared\54_Production\Maps\10_EIS\PS117658_EIS_034_A1.mxd

18.3.2 Traffic volumes

The traffic volumes recorded outside of the major townships within the study area are typically low. The two key highways along the prospective haulage routes (i.e. Sturt Highway and Silver City Highway (between Wentworth and Buronga)) have a bi-directional traffic volume of over 2,500 vehicles per day.

Higher traffic volumes are evident near major townships due to day-to-day activities. George Chaffey Bridge on the Sturt Highway, between Mildura and Buronga experiences significantly higher volumes of traffic, with over 10,500 vehicles per day. Similarly, Silver City Highway in Buronga Town Centre record over 5,000 vehicles per day.

Other key regional roads include:

> Arumpo Road with just over 300 vehicles per day in either direction
> Renmark Road with the daily traffic volume recording no more than 50 vehicles per day.

The traffic volumes and their relationship with the haulage routes for the proposal (refer to Section 6.11) are summarised in Table 4.1 and Figure 4.2 of Technical Paper 9.

18.3.3 Road network performance

The peak hourly volumes and capacity for roads within the proposal study area have been calculated using the *Austroads Guide to Traffic Management Part 3 – Transport Study and Analysis Methods* and are presented in Table 18-2.

Table 18-2 Road network performance summary

Road name and location	Daily traffic volume (vehicles per day)	Peak hourly traffic estimates	Number of lanes in each direction	Capacity (vehicles per hour)	Volume to capacity (%)	Level of service
Silver City Highway (B79)						
Ellerslie - between Broken Hill and Wentworth (from Broken Hill to Perry Street in Wentworth)	358	35 vehicles per hour	1	3,600 (in both directions)	1.0%	A
Wentworth Town Centre (from Perry Street in Wentworth to Delta Road in Wentworth)	2,559	255 vehicles per hour	1	2,000 (in both directions)	12.8%	A
Mourqu–ng - between Dareton and Buronga (from Fletchers Lake Road to Corbett Avenue)	2,228	N/A	1	3,600 (in both directions)	6.2%	A
Within Buronga Town Centre (from Corbett Avenue to Sturt Highway)	5,478	N/A	1	2,000 (in both directions)	27.4%	B

Road name and location	Daily traffic volume (vehicles per day)	Peak hourly traffic estimates	Number of lanes in each direction	Capacity (vehicles per hour)	Volume to capacity (%)	Level of service
Sturt Highway (A20)						
George Chaffey Bridge - between Mildura and Silver City Highway, Buronga	10,593	1,059 vehicles per hour (estimate)	1	3,600 (in both directions)	29.4%	B
Within Buronga (between Silver City Highway and Knights Road in Gol Gol)	2,730 eastbound only	273 vehicles per hour in eastbound direction (estimate)	1 (eastbound only)	500 (in eastbound direction)	54.6%	C
Arumpo Road						
Arumpo Road	327	32 in both directions (estimate)	1	3,600 (in both directions)	0.9%	A

18.3.4 Heavy vehicle route restrictions

The classified roads within the study area (i.e. Silver City Highway and Sturt Highway) currently permit access by restricted access vehicles, oversized and overmass vehicles, and road trains (except for Type 2 A-triple).

The unclassified regional roads (including Renmark Road, Arumpo Road and Pooncarie Road) currently permit access by restricted access vehicles and road trains (except for AB-triple and Type 2 A-triple). Oversized and overmass vehicles are not permitted without prior approval.

The majority of local roads within the proposal study area typically only allow access of up to the largest general vehicle type (i.e. a semi-trailer).

The heavy vehicle restrictions on the prospective haulage route from Melbourne, Sydney and Adelaide (refer to Section 6.11) are shown on Figure 18-2. Further details of the heavy vehicle route restrictions by heavy vehicle type is provided in Table 4.3 of Technical paper 9.

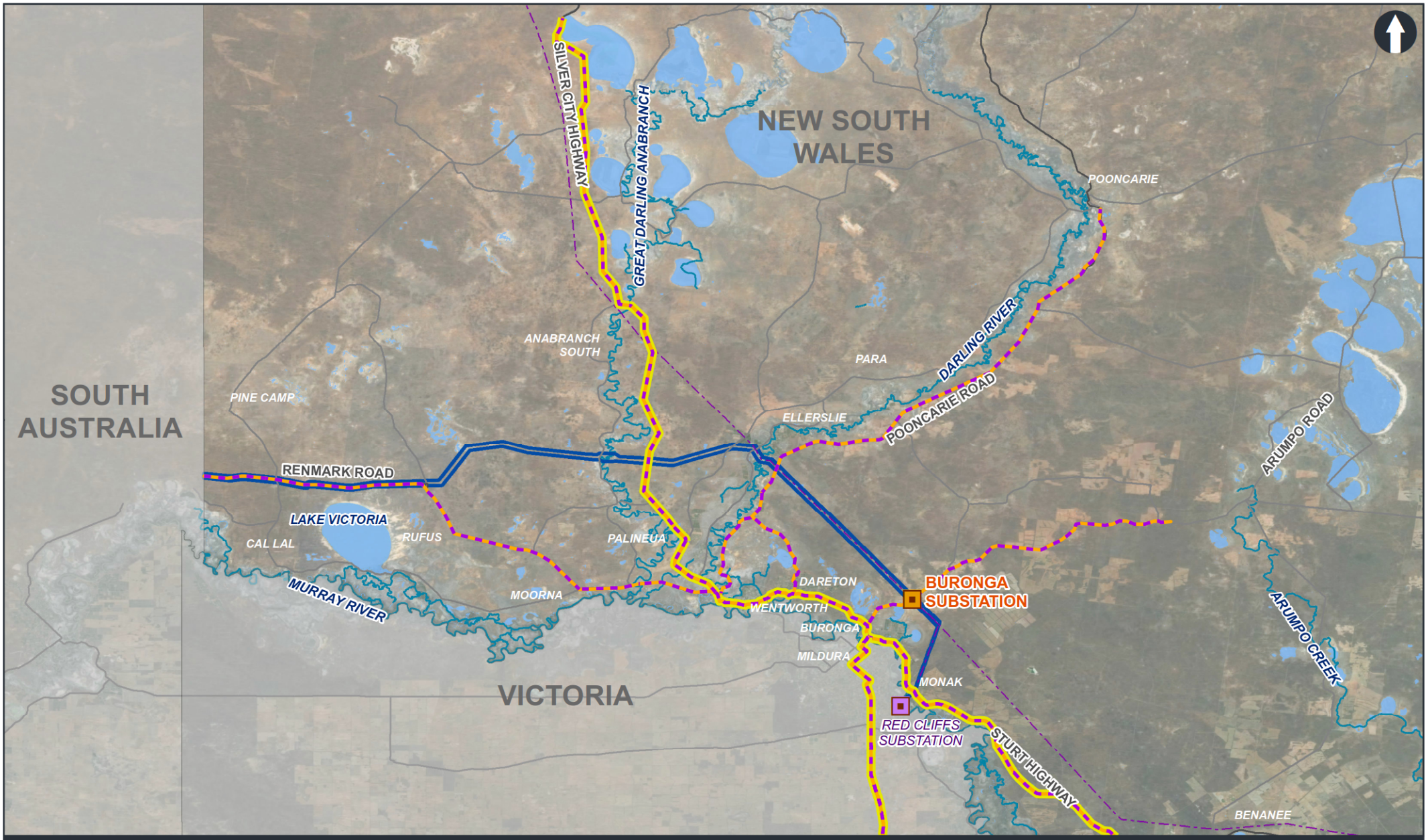


Figure 18-2

Overview of heavy vehicle restrictions

18.3.5 Public transport

Buses provide the primary public transport service in the Wentworth LGA. The bus routes within the Wentworth LGA on the NSW side are operated by Buslink and the bus routes within the city of Mildura on the Victoria side are operated by Public Transport Victoria, where the key bus corridors and the bus routes are as follows:

- Buslink routes along Sturt Highway in NSW (routes 950, 951, 953, 954, 955, 956) and Buslink routes along Silver City Highway in NSW (routes 950, 951, 955, 956). The section of Sturt Highway (including George Chaffey Bridge) between Mildura and Buronga serves all the Buslink services entering NSW, all of which originate from Mildura, with a peak of three buses per hour in each of the weekday AM and PM period direction. The frequency of the remaining services provides either no or between one to two peak services only.
- Public Transport Victoria routes along Calder Highway/Fifteenth Street (in Mildura) in Victoria (routes 100, 200) and along Benetook Avenue (in Mildura) in Victoria (route 400). Calder Highway/Fifteenth Street experiences a peak of 11 and nine buses per hour in the weekday morning and afternoon period directions respectively, connecting Red Cliffs to the city of Mildura
- Benetook Avenue in the city of Mildura carries the 400 bus route. It experiences two buses per hour in each of the weekday morning and afternoon period direction, providing a loop service for the south-eastern section of the city of Mildura.

18.4 Potential impacts – construction

18.4.1 Impact on road network

Capacity

The increase of light vehicles movements by a peak of 250 movements per day and heavy vehicle movements by a peak of 80 movements per day (or to up to an increase of around 1.65 per cent) from current traffic volume would not be expected to adversely impact the capacity and serviceability of the road network and at intersections. Heavy vehicle traffic movements would also be distributed throughout the day to minimise their impact on town centres' peak traffic activities.

Table 18-3 summarises the impact on the capacity on the existing road network including the additional traffic movements proposed as part of the proposal.

Additionally, surrounding roads which do not form part of the haulage route may experience higher traffic movements due to the overall temporary increase in population of the town with additional 400 people workforce proposed. The traffic impacts are likely to be limited, given the workforce would travel on fixed routes to get to/from the sites, and during certain hours of the day, within the proposed work hours.

Table 18-3 Impact of additional construction traffic on road network performance

Road name and location	Existing daily traffic volume (vehicles per day)	Initial volume/ capacity (%)	Initial level of service	With additional construction traffic volumes (vehicles per day)	Resulting volume/ capacity	Level of service
Silver City Highway (B79)						
Ellerslie – between Broken Hill and Wentworth (from Broken Hill to Perry Street in Wentworth)	358	1.0%	A	688	1.91%	A
Wentworth Town Centre (from Perry Street in Wentworth to Delta Road in Wentworth)	2,559	12.8%	A	2,889	14.45%	A
Mourquong – between Dareton and Buronga (from Fletchers Lake Road to Corbett Avenue)	2,228	6.2%	A	2,558	7.11%	A
Within Buronga Town Centre (from Corbett Avenue to Sturt Highway)	5,478	27.4%	B	5,808	29.04%	B
Sturt Highway (A20)						
George Chaffey Bridge – between Mildura and Silver City Highway, Buronga	10,593	29.4%	B	10,923	30.34%	B
Within Buronga (between Silver City Highway and Knights Road in Gol Gol)	2,730 eastbound only	54.6%	C	3,060	61.2%	D
Arumpo Road						
Arumpo Road	327	0.9%	A	657	1.83%	A

Oversize and overmass vehicle access

Haulage routes for oversize and overmass vehicle deliveries for the proposal have been selected so that road or bridge widening or strengthening to support these types of vehicles is not required.

The proposed haulage routes considered from Sydney, Port Kembla, Adelaide and Melbourne are discussed in Chapter 6. For most part, the haulage route would travel through the classified roads (Silver City Highway and Sturt Highway), which currently permit access by restricted access vehicles, road trains (except for Type 2 A-triple) and oversize and overmass vehicles. The unclassified regional roads currently permit access by restricted access vehicles, and road trains (except for AB-triple and Type 2 A-triple). Oversize and overmass vehicles are not permitted without prior approval. This would include Renmark Road, Arumpo Road and Pooncarie Road which would be required to access the Buronga substation upgrade and expansion site as well as site access points along the transmission line corridor.

The transport of oversize and overmass vehicles would be planned to minimise the impact to the surrounding road network and community with consideration of vehicle characteristics, areas or routes, pilot and escort requirements and travel restrictions on the road network.

The specific details of vehicle types and route options would be confirmed during detailed construction planning and a permit to operate oversize and overmass vehicles on the road network would be the obtained by the construction contractor from the National Heavy Vehicle Regulator, where required. Permits would be required if the oversize and overmass vehicle combination does not comply with a mass, dimension or operating requirements set out in a gazette notice.

The use of pilots and escort vehicles would also be required. In NSW, this is carried out by the NSW Police.

Submission of a transport management plan to comprehensively document the ‘High Risk’ oversize and overmass movements to Transport for NSW would also be required to obtain approval prior to these movements occurring.

Construction site access points

At main construction compound and camp site locations (Anabranch South, Buronga and, if required, Wentworth), acceleration and deceleration lanes may be required to allow heavy vehicles to safely enter and exit the road network, and to minimise operational interruption to the road network. The design of these access provisions would be carried prior to the commencement of construction, and would consider the speed limit and traffic volumes of these roads, as well as the intended use of the access.

Road condition

Construction heavy vehicle movements are likely to have moderate impact to the condition of the existing road network. The construction contractor would be required to undertake pre-condition surveys to record the pavement condition along the haulage routes. This would be undertaken to understand the existing condition of the road pavement along the haulage routes. Following completion of construction works (and as needed through the construction period to maintain safe road conditions) the roads would be repaired to address pavement failures resulting from the increased construction and haulage activities from the proposal.

18.4.2 Impacts from temporary access tracks

The construction of the transmission lines would require temporary access tracks to be created where existing tracks to reach a construction site do not currently exist. Any required temporary access tracks would be established by the construction contractor, and removed after the construction phase is finished, unless these are required for permanent access.

The use of temporary access tracks would provide a positive impact as it would ensure direct accesses to proposed work areas are established. This is particularly beneficial to manage the traffic movements and would enable:

- appropriate wayfinding for haulage drivers and workers to the site
- appropriate temporary road and intersection design which is safe, appropriately delineated and suitable for all-weather conditions to accommodate the different types of construction vehicles
- a consolidation of accesses to different sites which would minimise disturbance to the surrounding environment, including the abutting roads.

18.4.3 Impacts on active transport

The majority of the proposal construction works would be undertaken without extensive interaction with the active transport facilities on the road network. Where interaction is proposed to occur, the existing active transport infrastructure including footpaths, bicycle paths, shared paths and on-road shoulders would be retained wherever possible. Where disruption to the facilities is required, a detour of the route would be planned accordingly.

George Chaffey Bridge (between Mildura and Buronga) which is part of the Sturt Highway, is the only section of road in the study area which has been identified with dedicated cycling and pedestrian facilities (painted cycling lanes on both sides and a pedestrian footpath on the western side of the bridge). The increase in heavy vehicle movement and construction phase traffic is expected to have a negligible impact on active transport movement at this location.

18.4.4 Impacts on public transport

The construction of the proposal is not envisaged to require road closures to affect the existing public transport routes. However, should a full or partial road closure be required, the construction contractors would liaise with the relevant public transport service providers, local council and Transport for NSW accordingly.

Some limited and occasional delays to some routes may be experienced if they coincide with peak heavy vehicle movement periods.

18.4.5 Impacts on road safety

The haulage route to the main construction compounds, or elsewhere along the transmission line corridor from either Sydney, Melbourne or Adelaide shipping ports would each require extensive travel time and the issue of travel fatigue may be present for drivers undertaking the haulage activities. As such, effective fatigue management must be implemented for drivers.

The road network carries low traffic volumes and is found to operate efficiently with a good level of service. An increase in heavy vehicle movements due to construction would typically result in an increase of one to two per cent, and a maximum of seven per cent in daily traffic volumes. This increase can be readily accommodated on the road network, and would not exacerbate safety issues on the road network.

The increase of heavy vehicle activities, including oversize and overmass vehicles to transfer materials and construction plant and equipment may also have some impact on the pavement condition along the haulage route. The haulage routes to major ports have been selected based on the suitability of these roads to carry heavy vehicles, in particular, oversized and overmass vehicles. As such, it is considered that the safety impact due to increased heavy vehicle movements is minor.

18.4.6 Impacts to property access

There is expected to be minimal impacts to property access due to the rural nature of the proposal, however some properties along the proposed 220kV transmission line near Monak may be affected for short periods. Elsewhere, in some limited circumstances, short-term restrictions for a particular property may need to be imposed, with prior consultation with the affected party.

In all instances, access to properties for residents would be maintained throughout the construction phase.

18.5 Potential impacts – operation

18.5.1 Impact on the road network

Traffic generation by the proposal during the maintenance phase would be minimal and infrequent. Depending on the activity, around 10 – 20 staff would be required to travel to and from the Buronga substation and/or the transmission line. A conservative daily peak of 50 light vehicle trips (or 100 movements) has been assessed which assumes that key maintenance activities are carried out concurrently. However, it is expected that daily movements would be substantially lower on any typical day and would range from 10 to 20 movements. Based on the worst case volumes, the impacts to the local road network is minimal.

18.5.2 Impacts of permanent access tracks

Permanent access tracks may be constructed to support ongoing maintenance operations . However, impacts would be minimal due to the low volume of vehicles generated over this phase.

Access to the proposed easement for operational purposes would preferentially use existing public and private roads and tracks. 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.

18.5.3 Impacts on active transport

The additional light vehicle traffic generated over the operational and maintenance phase of the proposal is expected to have a negligible impact on the existing active transport network.

18.5.4 Impacts on public transport

The additional light vehicle traffic generated over the operational and maintenance phase of the proposal is expected to have a negligible impact on the existing public transport network.

18.5.5 Impacts on road safety

Due to the low magnitude, the additional light vehicle traffic generated over the operational and maintenance phase of the proposal is expected to have a negligible impact on road safety for the existing road network.

18.5.6 Impacts to property access

Access to properties for residents is expected to be maintained throughout the operational and maintenance phase. Should there be a requirement for a short-term restriction for a particular property, prior consultation with the affected party would be undertaken by TransGrid.

18.6 Management of impacts

18.6.1 Environmental management

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

For construction, this would include a detailed construction traffic management plan (CTMP) which would be based on the final construction methodology. The sub-plan will be prepared in consultation with Wentworth Shire Council to identify the key management and response strategies to potential delays and disruptions that may arise due to the proposal. It will include (as a minimum):

- measures to minimise disruption to pedestrians, cyclists and motorists
- management of safe vehicle access/egress from construction compounds and other construction work areas
- measures to manage oversize and overmass vehicle movements during construction, which will consider activities of adjoining land uses and safety of the public, such as entering urban areas from rural highways
- management of long-distance travel through driver fatigue management measures
- measures to ensure safe access to existing properties during construction, or provision of suitable alternatives.

18.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to traffic and access are presented in Table 18-4.

Table 18-4 Mitigation measures – Traffic and access

Reference	Mitigation measure	Timing	Applicable location(s)
TA1	Site access / egress points will be designed to minimise conflicts with vehicle movements on the road network and in accordance with relevant safety requirements. This may include the provision of acceleration and deceleration lanes at accommodation camp locations. Any designs will be in accordance with the Traffic Control at Worksites, Austroads Guide to Road Design and Austroads Guide to Traffic Management, and approved by the relevant road authority.	Detailed design	All roads that intersect with the transmission line corridor or are on haulage routes.
TA2	Road pre-condition surveys on construction haulage routes will be carried out prior to the commencement of construction in consultation with relevant councils and road owners. This will include identification of existing conditions and mechanisms to repair damage to the road network caused by construction vehicles associated with the proposal.	Pre-construction and construction	All roads that intersect with the transmission line corridor or are on haulage routes.
TA3	The community will be notified in advance of proposed road network changes through appropriate forms of communication.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
TA4	Road Occupancy Licence(s) will be sought (as required) for any road closures (full or partial) prior to any such closure. The timing of any closures will be carried out to minimise impacts to the road network.	Construction	All roads that intersect with the transmission line corridor or are on haulage routes.
TA5	Permits from the National Heavy Vehicle Regulator (NHVR) will be obtained where required to provide oversized and overmass vehicles access during construction. Permit applications will be supported by a Vehicle Movement Plan (VMP), prepared to indicate the proposed heavy vehicle route(s). The Vehicle Movement Plan will consider activities of adjoining land uses and safety of the public, particularly when entering urban areas from rural highways.	Construction	All roads that intersect with the transmission line corridor or are on haulage routes.
TA6	Construction access/egress, and construction movements, will be managed to ensure pedestrian and cyclist safety.	Construction	Sturt Highway (George Chaffey Bridge)
TA7	Adjustments to haulage routes in response to road closures by Wentworth Shire Council (e.g. during wet weather conditions or during other maintenance or other upgrade activities) will be identified in consultation with Wentworth Shire Council and affected residents, and suitable management measures identified and implemented.	Construction	Local roads within the study area
TA8	Access to properties for emergency vehicles would be provided at all times.	Construction	All locations
TA9	Access to properties will be maintained or alternative arrangements agreed in consultation with landholders.	Construction	All locations
TA10	Following completion of construction, condition surveys will be carried out. Any damage as a result of construction vehicles would be repaired following the completion of construction (and as needed through the construction period to maintain safe road conditions).	Construction	All roads that intersect with the transmission line corridor or are on haulage routes.

18.6.3 Managing residual impacts or uncertainties

Through the implementation of the standard mitigations detailed in Table 18-4, residual impacts resulting from the identified transport and access impacts are anticipated to be appropriately managed without any residual impacts or uncertainties.

19. Hazards and risks

This chapter provides an assessment of potential hazard and risk impacts of the proposal, and includes mitigation measures to address these potential hazards. This chapter summarises information in *Bushfire Impact Assessment* (ABPP, 2020) (refer Volume 2, Technical paper 10) and *Electric field and electromagnetic field study* (BECA, 2020c) (refer to Volume 2, Technical paper 11).

19.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to hazards and risks and where these requirements are addressed in this EIS are outlined in Table 19-1.

Table 19-1 Secretary's environmental assessment requirements – hazards and risks

Ref.	Secretary's environmental assessment requirements	Where addressed
Hazards		
Key issues	The EIS must address the following matters:	
	> an assessment of potential hazards and risks *associated* with electric and magnetic fields (EMF) having regard to the latest advice of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)	Impacts during operation are addressed in Section 19.5.
	> an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, and the handling and use of any dangerous goods	Impacts during construction are addressed in Section 19.4. Impacts during operation are addressed in Section 19.5.

19.2 Assessment approach

19.2.1 Legislative and policy context

The assessment of general hazards and risks focused on the potential to adversely affect human health and the quality of the surrounding environment, land uses and communities, as well as construction workers and ongoing maintenance personnel. This included consideration of the following relevant legislation guidelines and/or standards:

> (NSW) *Work, Health and Safety Act 2011* and (NSW) Work Health and Safety and Regulation *2011* which provides work health and safety regulations for the management of contaminated waste such as asbestos as well as consideration of health and safety hazards to on-site workers associated with normal construction operations

> *Electricity Supply (Safety and Network Management) Regulation 2014* which requires network operators to take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe and to implement safety management systems. This covers the safety of the network, people (worker and the general public), property and the environment

- *Hazardous and Offensive Development Application Guidelines*: Applying SEPP 33 (Department of Planning, 2011) (Applying SEPP 33) – presents a systematic approach to planning and assessing proposals for potentially hazardous and offensive development for the purpose of industry or storage
- *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover, 2005) – provides practical guidance and advice on how to comply with regulations
- (NSW) *Dangerous Goods (Road and Rail Transport) Act 2008* and (NSW) Dangerous Goods (Road and Rail Transport) Regulation 2014 – to regulate the transport of dangerous goods by road and rail in order to promote public safety and protect property and the environment
- *Australian Code for the Transport of Dangerous Goods by Road and Rail (Edition 7.6)* (National Transport Commission, 2018) – sets out the requirements for transporting dangerous goods by road or rail
- *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1–Hz - 100 kHz)* 2010, International Commission on Non-Ionizing Radiation Protection (ICNIRP) – the recommended guidelines from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- Various TransGrid systems, policies and guidelines to manage hazards and risks in all stages of the delivery and implementation of its projects, including Transmission Line Design Manual – Major New Build, Power System Safety Rules (2017) and Public Electrical Safety Awareness Plan
- *Rural Fires Act 1997* which outlines the operational role of the NSW Rural Fire Service, their functions and their powers in relation to protecting the people, infrastructure and natural environment of NSW from fire related threats
- *Planning for Bushfire Protection – 2019* (NSW Rural Fire Service, 2019) that provides and explains the legal requirements, framework and protection measures needed for all types of development on bushfire prone land in NSW.
- *National Electricity Network Safety Code* (Energy Networks Australia, 2019) which, among other things, provides information on safety clearances from overhead transmission lines.

19.2.2 Methodology

General hazards and risk

A desktop assessment was undertaken to determine the potential general hazards and risk associated with the proposal. The qualitative assessment was used to identify construction and operational activities that may have the potential to cause risks to public health and safety.

Other work, health and safety hazards are not specifically considered in this EIS. These issues would be addressed by the relevant construction contractor in accordance with relevant guidelines and legislative requirements. This includes TransGrid's Power System Safety Rules (TransGrid, 2017).

Electric and magnetic fields and radio frequency interference

To assess the impacts of the proposal on EMF and radio frequency interference, the assessment predicts:

- the levels of EMF exposure to determine performance against recognised public exposure guidelines (also known as basic restrictions) for transmission lines, as they relate to typical (and worst case) operations using SESEnviroPlus. These levels are predicted at one metre above the normal standing position of the public, and at the minimum ground clearance of the circuit
- the Radio Frequency Interference (RFI) performance of the proposal at 0.5 MHz for each transmission line using SESEnviro Ver 16.1 for the specified line voltages and TransGrid's standard low-EMF double circuit phase arrangement.

As discussed in Section 2.3 of Technical paper 11, the EMF design criteria for the proposal has considered national and international guidelines. The exposure guidelines for the proposal are summarised in Table 19-2 and detailed in the following paragraph.

Table 19-2 EMF exposure guidelines for the general public

Field			Unit of measurement	Level
Basic restriction	Central nervous system tissues of the head	volts per metre	0.02 V/m	
	All tissue in the head and body	volts per metre	0.4 V/m	
Reference level		Electric field	kilovolts per metre	5 kV/m
		Magnetic field	microtesla	200 µT

The Australian Radiation Protection and Nuclear Safety Agency, an Australian government agency that is charged with the responsibility for protecting health and safety of people and the environment from EMF, recommends the use of the exposure guidelines provided by the ICNIRP and IEEE.

The limiting thresholds for the general public set by the ICNIRP guideline are widely accepted as providing complete protection against all known adverse health effects of electric and magnetic fields (BECA, 2020c). These basic restrictions apply to both adults and children and are independent of duration.

The ICNIRP Guideline sets “Basic Restrictions”, expressed in terms of field levels within the human body. As these levels can only be assessed by sophisticated computer modelling of the body, ICNIRP also sets “Reference Levels”, expressed in terms of kV/m and microtesla for electric and magnetic fields respectively. These levels are conservatively set such that, provided they are met, the Basic Restrictions will also be met without the need for more comprehensive analysis. While the magnetic fields from high voltage transmission lines are normally well below the ICNIRP Reference Level, the electric fields may not be. Accordingly, TransGrid has commissioned a specialist consultant to undertake the sophisticated analysis required to assess compliance with the Basic Restrictions. Based on this analysis, TransGrid has established that for large transmission lines, an electric field of 7.8 kV/m will comfortably comply with the ICNIRP basic restriction.

The magnetic field exposure reference level of 200 microtesla (µT) is set by the ICNIRP guideline.

For the assessment, the following scenarios have been assessed:

> time weighted average loading which represents a typical daily average load and with both circuits in service
> contingency scenario, which represents one line in service with a higher current with a minimum ground clearance sag. This scenario would only occur for short periods on rare occasions.

Bushfire

Bushfire risk is defined as the chance of a bushfire occurring that will have harmful consequences to human communities and the environment, using a range of bushfire related diagnostics detailed within Technical paper 10.

Bushfire risk has two elements:

> likelihood – the chance of a bushfire occurring and
> consequence – the impact of a bushfire when it occurs.

The evaluation of bushfire risk to or from the proposal are detailed in Sections 19.4.3 and 19.5.5.

19.3 Existing environment

There are inherent hazards or risks in the existing environment relevant to the proposal study area including:

- periods of extreme weather (primarily temperature related)
- road traffic incidents/risk of road traffic events which have the potential to cause injury
- electricity, given the presence of existing power lines within the proposal study area
- bushfire.

With regard to bushfire risk, the proposal study area traverses two main types of landscapes:

- grassland and crops, which represents the majority of the proposal study area. Unmanaged grassland and cured (dry) crops would present a high to very high fuel hazard rating
- mallee Woodlands, which also encompasses Low Open Chenopod shrub land (including areas which have been heavily grazed) and degraded to highly degraded low open chenopod of Black-bush. The fuel hazard of these areas would depend on the type of vegetation, its level of management and/or time that has lapsed since the most recent modification (e.g. fire or grazing). A review of the vegetation in and adjoining the proposal study area has determined that the Mallee Woodland, when not managed could have been a high and extreme fuel hazard

Further detail of the potential bushfire fuel hazards within the proposal study area is provided in Section 4.3.5 of Technical paper 10.

19.4 Potential impacts – construction

During construction, potential hazards and risks to the surrounding community or environment may be associated with:

- the on-site storage, handling and transport of dangerous and hazardous goods, contaminated soil and hazardous waste
- potential interaction with existing utilities
- potential bushfire risks
- changes to emergency egress and excavation routes.

These are described further in the following sections.

19.4.1 Dangerous goods and hazardous materials

During construction, various hazardous materials and chemicals would be required to be used and/or stored on site. Typically, hazardous materials and chemicals which would be utilised during construction would include (but not limited to):

- acetylene
- 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.

The main construction compounds and other ancillary construction sites would be planned so that hazardous materials are stored appropriately and at a suitable distance from sensitive receivers, in accordance with the thresholds established under Applying SEPP 33 guidelines. Establishing suitable buffer distances to sensitive receivers is expected to be achieved, given the nature of the proposed study area. However, in the event that minimum distances cannot be achieved (e.g. due to land constraints, or a requirement to store volumes of hazardous materials in excess of storage thresholds), a risk management strategy would be developed as required to confirm that the proposal would not have a significant off-site risk.

Environmental hazards and risks associated with the on-site storage and use of chemicals, fuels and materials would be managed through standard mitigation measures that would be developed as part of the construction environmental management plan. Storage of dangerous goods and hazardous substances would be in accordance with the supplier's instructions, and would comply with applicable legislation, guidelines and Australian Standards. This includes the (NSW) *Work Health and Safety Act 2011*, the (NSW) Work Health and Safety Regulation 2017 and the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005).

Dangerous goods would be transported to and from the proposal study area in accordance with the (NSW) *Dangerous Goods (Road and Rail Transport) Act 2008* and (NSW) Dangerous Goods (Road and Rail Transport) Regulation 2014, and extended routes would avoid areas (such as road tunnels) prohibited by NSW Road Rule 300-2 (carriage of dangerous goods in prohibited areas), and the equivalent legislation of SA and Victoria.

The proposal may also require the handling and transport of contaminated soil, hazardous waste and asbestos waste. The handling and transport of contaminated soils, hazardous waste and asbestos waste would be adequately managed by the measures identified in:

- Chapter 20 (Soils, contamination and groundwater)
- Chapter 21 (Waste management and resource use).

19.4.2 Impacts to utilities

The proposal requires adjustment and/or upgrades to existing electrical infrastructure, and in certain cases, the decommissioning of existing infrastructure, which could pose hazards to the general community if not properly managed.

Construction methodologies for construction activities that interact directly with electrical infrastructure or are in close proximity to active electrical infrastructure would be developed to comply with relevant legislative requirements, as well as TransGrid robust systems, guidelines and procedures. This includes:

- Electricity Supply (Safety and Network Management) Regulation 2014
- TransGrid's Electrical Network Safety Management System
- TransGrid's Public Electrical Safety Awareness Plan.

The need to adjust or relocate utilities during construction is minimal, and limited to electricity infrastructure. The relocation and/or protection of utilities would occur prior to the commencement of construction to avoid impacts. Otherwise relocation and protection would occur during construction. Consultation with utility infrastructure providers would continue during the design and construction of the proposal to mitigate the risk of unplanned and unexpected disturbance of utilities. In rare circumstances, the relocation of utilities may result in short term outages of some utilities to surrounding areas.

19.4.3 Bushfire impacts

During construction the bushfire ignition risk associated with the proposal, by definition, would generally only exist in those areas that are capable of supporting a bushfire. In general the risk of bushfire impact on the proposal study area during construction would be between high and extreme and would be dependent on factors such as fuel loads, weather and the scale (size) of fires which may occur.

There would be a threat to construction personnel from fast moving bushfire events which may impact large lengths of the proposal study area.

The potential sources of ignition of bushfires resulting from the construction of the proposal include:

- construction equipment including bulldozers, excavators and cranes – The use of heavy construction equipment including bulldozers and excavators for building roads, excavating pads and drilling bore holes would have the potential to create situations where these activities can give off sparks when steel blades encounter rock, resulting in a high level of risk of ignition of vegetation. This risk can occur over a wider area from the machine operational area
- motor vehicles – Motor vehicle exhaust systems are known to ignite grassland vegetation. Diesel powered trucks with pollution control devices in the exhaust system would have the potential to emit burning diesel particles which ignite grassland vegetation and forest ground fuels, resulting in a high level of risk of ignition of vegetation. There is also risks associated with collision of a vehicle with a power pole or infrastructure that can result in either a spark, arc from a power supply or fire from spilt fuel being ignited
- vegetation removal including mulching – The use of specialised slashers, mulching machines and bulldozers used for clearing vegetation would have the potential to create high risk situations where blades come into contact with rock outcrops. Where this occurs, there is the potential to result in sparks that may ignite surrounding materials. Mulch storage may also present a bushfire risk if a large volume of material is stored in a large pile for an extended period of time. The ability of mulch to self-combust, the production of methane (includes the potential for explosion) under favourable conditions and the potential for arson attack all contribute to the potential bushfire risk associated with storing mulch. Mulch may be used as a landscaping material or it may be generated during the proposals construction phase when removing and chipping of existing vegetation along the route
- hot works – Hot works undertaken such as welding, grinding, drilling can produce sparks which have the capacity to spread for some distance on the wind, resulting in an extreme level of risk of ignition of cured (dry) vegetation
- electrical faults in equipment – Electrical faults, including faulty power leads and generators also create a high level of risk of ignition of vegetation
- chemical fires – The inappropriate storage of incompatible or flammable chemicals have the potential to cause a chemical fire or explosion. The failure to clean up a flammable chemical spill or address leaking containers can also lead to a fire
- activities at the main construction compounds and accommodation camps, such as external cooking, electrical faults and inappropriate discarding lit cigarettes
- human activity/arson – A malicious act (e.g. arson) can occur where-ever human activity occurs and can result in high risk to the proposal and the operators of the equipment. Other potential causes of ignition are the inappropriate actions of individuals such as discarding lit cigarettes, matches or hot metal into a general waste bins etc.

19.4.4 Impacts to emergency vehicles egress and evacuation

There may be temporary detours that may be required during construction. However, these would be of short-duration. There is not anticipated to be any substantial change to emergency vehicle access. Construction areas would be arranged so that emergency vehicles access and evacuation routes are maintained, and if required, made available for emergency vehicle passage if required. Consultation would be carried out with emergency service providers in relation to changed traffic conditions and/or access points to the proposal study area.

19.5 Potential impacts – operation

During operation, potential hazards and risks to the surrounding community or environment may be associated with:

- the on-site storage, handling and transport of dangerous and hazardous goods
- potential interaction with new or upgraded infrastructure
- EMF
- potential bushfire risks.

These are described further in the following sections.

19.5.1 Dangerous goods and hazardous materials

During operation of the proposal, limited hazardous materials and chemicals would be required to be maintained on site. Potential materials which would be required are summarised below:

- insulating oil
- weed control chemicals
- unleaded fuel.

The materials and chemicals would only be required in small amounts and below the thresholds in Applying SEPP 33. Additional small quantities of other materials may be required on-site from time to time to support occasional maintenance activities.

Further, the substation would include a separate drainage system to capture oil spills. In such an event, the spill would be contained, pumped and disposed of at a licensed facility.

Managed in accordance with the measures in Section 19.6, these materials would not pose a substantial risk to the general public during operation of the proposal.

19.5.2 Integration with new or upgraded infrastructure

The proposal would introduce new hazards to the general community as a consequence of building new or upgraded electrical infrastructure along the proposal study area. As discussed in Sections 19.2 and 19.4.2, TransGrid have a number of safety systems, policies and guidelines that are implemented across its network to ensure the hazards to the general public are managed and comply with legislative requirements. This includes specific guidance to people that work and live along transmission line easements on what activities can occur, or what activities are prohibited or restricted (refer to Chapter 12).

19.5.3 Electric and magnetic fields

EMF exist wherever electricity is generated, transmitted or distributed in power lines or cables, or used in electrical appliances. Electrical systems used for the transmission of electricity in Australia operate at a frequency of 50 Hertz (Hz) and typically give rise to extremely low frequency (ELF) EMF in their vicinity.

ELF EMF induce internal electric fields and currents in the body. If the external fields are strong enough, these induced electric fields can interfere with the body's nervous system causing nerve and muscle stimulation and changes in nerve cell excitability in the central nervous system.

The proposal study area and surrounding environment currently contains a series of EMF generating electrical equipment including the existing TransGrid transmissions lines and the existing Buronga substation. As referenced in Section 19.2.2, ARPANSA are the Australian authority charged with the responsibility for protecting health and safety of people and the environment from EMF through the adoption of ICNIRP and IEEE exposure guidelines. Compliance with exposure guidelines and basic restrictions, ensures adequate protection to effects of exposure. TransGrid's *Transmission Line Design Manual – Major New Build* has been developed to guide compliance with ICNIRP basic restrictions through design of new transmission lines. The guidelines require compliance against the worst-case scenarios (peak maximum voltage at lowest ground clearance for the transmission line).

The new and upgraded infrastructure that will be delivered as part of this proposal would be designed to meet EMF exposure guidelines set out in Table 19-2 and worst case scenarios within TransGrid's *Transmission Line Design Manual – Major New Build*.

Transmission lines

EMF reduce rapidly with distance from their source. Electric fields are shielded by most objects, including trees, buildings and human skin. Unlike electric fields, magnetic fields cannot easily be shielded and pass through most materials.

The current carried by a transmission line directly influences the magnetic field. It also indirectly influences the electric field levels experienced below the line. The current has a heating effect on the conductors so that increasing current increases the conductor sag. Weather conditions such as air temperature, solar radiation, and wind speed also affect line sag. As line sag increases, the electric and magnetic fields experienced below the lines at ground level also increase.

The proposal study area and surrounding environment currently contains a series of EMF generating electrical equipment including the existing TransGrid transmissions lines and the existing Buronga substation.

The new or upgraded infrastructure that would be delivered as part of this proposal would be designed to meet EMF exposure guidelines set in Table 19-2.

The assessment (as presented in Technical paper 11) found that:

- the magnetic field levels directly under the proposed line are within the ICNIRP general public exposure reference level of 200 μT in all cases, including during the contingency case of one circuit in service with increased loads
- the electric field levels directly under the proposed transmission lines are below 7.8 kV/m which has been shown to satisfy the ICNIRP Basic Restriction of 0.02k/V, in all cases, based on the minimum ground clearance for the proposed lines. The majority of the line is well above this clearance. The minimum ground clearance only applies when the line is running at its maximum rating, which occurs in the contingency case in hot weather conditions only.

The edge of easement EMF maximums calculated for transmission lines based on the concept design, substation landing spans and parallel transmission lines are provided in Table 19-3 to Table 19-5. The results in Table 19-5 provides a cumulative assessment where existing or future transmission lines run parallel to the proposed transmission line.

Table 19-3 Maximum calculated EMF at edge of easement

Transmission line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic field density (mG[1])	Electric field strength (kV/m)	Magnetic field density (mG[1])
330kV	0.19	35	0.07	6.50
220kV	0.08	97	0.09	17

1. 1 microtesla (μT) equals 10 milligauss (mG). The magnetic field exposure reference level of 200μT equates to 2,000mG

Table 19-4 Maximum calculated EMF at edge of easement for landing span

Transmission line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic field density (mG[1])	Electric field strength (kV/m)	Magnetic field density (mG[1])
330kV	0.21	36	1.75	44
220kV	0.09	97	0.07	17

1 1 microtesla (μT) equals 10 milligauss (mG). The magnetic field exposure reference level of 200μT equates to 2,000mG

Table 19-5 Maximum calculated EMF at edge of easement – parallel lines

Transmission line	Maximum contingency circuit loading		Time weighted average circuit loading	
	Electric field strength (kV/m)	Magnetic field density (mG[1])	Electric field strength (kV/m)	Magnetic field density (mG[1])
Proposed 330kV parallel with Line 0X2	0.35	40	0.44	31
Proposed 220kV parallel with existing Line X5/3 and future NSW – Eastern Section (330kV)[2]	0.44	97	0.40	41

1. 1 microtesla (μT) equals 10 milligauss (mG). The magnetic field exposure reference level of 200μT equates to 2,000mG
2. The proposed 330kV line that forms part of the future NSW – Eastern Section of EnergyConnect

Buronga substation upgrade and expansion

The electrical equipment associated with the upgraded and expanded substation would be contained in metal safety enclosures, which would also serve to shield the public and operators from both alternating current (AC) and direct current (DC) electric fields associated with the electrical equipment. Accordingly, both the alternating and static electric field contribution from the upgraded and expanded substation would be negligible inside and outside the substation.

The alternating field levels to which people may be exposed would be greatest in the localised areas within the substation near the transformer tails, the High Voltage AC switchgear and at cable risers where cables run vertically up from below ground level. These localised field levels decrease very quickly at small distances from the cables and equipment. EMF studies on similarly configured substations have concluded that the magnetic field levels are well below the general public guidelines in areas outside the metal safety

enclosures. As such, it is not expected that the upgraded and expanded substation would result in any potential health risks for future adjacent residents located on the neighbouring blocks.

The security system for the site, including switchyard fencing and closure of gates, would be extended to ensure access restrictions to the facility by the general public are maintained.

19.5.4 Radio frequency interference

Limits for electric and magnetic interference (radio disturbance) from the proposal are established in AS2344 in the frequency band 0.15 MHz to 3000 MHz. A satisfactory level of radio reception, as defined by the International Telecommunication Union (ITU), can be expected for broadcast, navigation, safety-of-life and other radio communication services in areas where the emissions from the line are below these limits.

19.5.5 Bushfire impacts

Hazards related to the operational phase would typically be grouped in to impact to infrastructure from bushfires, and impact of bushfires occurring from infrastructure operation. These impacts are summarised below.

Bushfire risk to the proposed transmission lines during operation

There is a high probability that the proposed transmission lines could be impacted by a bush/grass fire when ignition occurs in any unmanaged vegetation during periods of high fire danger, when excessive dry (cured) fuel is available and weather conditions result in high temperatures, low humidity and strong winds travelling across the landscape from the northwest, west and southwest direction.

The risk to the transmission lines under these conditions would be dependent on the scale (size) of the fire. Without mitigation, the potential risk from large scale fire events would be high to extreme. The residual risk of bushfire on the transmission lines and their supporting structures (with the mitigation proposed in Section 19.6) is considered to be moderate.

Bushfire risk created by the proposed transmission lines during operation

The distribution of electricity via high voltage transmission lines and associated equipment has the potential to cause ignition of bushfire fuels, either within or adjoining the transmission line easement. Ignition sources which could be attributable to high voltage transmission lines and associated equipment include:

- trees or tree branches falling/touching conductors and bird strikes
- equipment malfunction – transmission line failure including damage caused by high winds, lightning strike or mechanical damage (i.e. aircraft strike)
- wind causing transmission lines to contact each other
- arc to ground and arc between conductors caused by Ionise particles in dense bushfire smoke
- heat causing power lines to sag and connect with the ground/vegetation/structures
- lightning strikes
- human error – faulty installation
- failure of power line including breakage of wires, poles, cross arms, insulators and associated equipment
- pole-top fires caused by dust build up on insulators, causing arcing from the conductor to the tower/cross arm
- electrically induced fire – current or voltage transfer due to fault and failure of the earthing system at transmission line structures.

The incidence of these ignition sources from transmission lines supported on high towers which are maintained clear of trees and combustible materials would however be rare. However, an ignition occurs during prolonged drought conditions when combustible fuels are available, the risk of ignition would be high, necessitating monitoring and rapid response to any incident/emergency that is likely to cause line failure.

The bushfire risk from the transmission lines infrastructure to the surrounding environment would therefore be moderate.

Bushfire risk to the Buronga substation during operation

The expanded substation is located to the northeast of the Buronga township and is adjoined to all aspects by vacant land with open woodland vegetation. The minimum Asset Protection Zone to the existing facility is 11 metres with a bushfire buffer zone of three metres around the perimeter fence of the switchyard and a minimum eight metre safety clearance to active network equipment. These protection measures would be maintained in the design of the substation upgrade and expansion.

With the planned protection measures in place the potential bushfire risk to the substation is considered to be low to moderate.

Bushfire risk from the Buronga substation during operation

The generation and distribution of electricity has the potential to cause fire ignition within the Buronga substation. Ignition sources would include:

- equipment malfunction – transformer explosion; burn out of motors/fans; wiring failure
- human error.

The incidence of equipment malfunction would be rare but may include

- transformers having the potential to explode and have the potential to spread molten metal and burning oil for some distance from the transformer
- fans and motors failing with the potential impact restricted to localised sparks and in some cases, the shedding of hot/molten metal
- overhead wiring failure which would be uncommon and is usually the result of physical damage from lightning strikes or sparks given off during light rain, as a result of dust build up on the insulators over extended dry periods.

Whilst these occurrences may generate a potential ignition source, it is the human error factor that would cause the greatest level of risk of ignition to the surrounding bushfire prone vegetation.

The bushfire risk from the operation of the substation is considered to be low to moderate.

19.5.6 Impacts to emergency vehicles egress and evacuation

The operation of the proposal would not have impacts on emergency vehicle egress or evacuation routes.

19.6 Management of impacts

19.6.1 Environmental management

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

Hazards and risks would be managed in accordance with TransGrid's Electricity Network Safety Management system, policies and guidelines. This would seek to avoid, to the greatest extent possible, risks to public safety and achieve the desired outcomes in relation to the hazards identified in this chapter.

A bushfire risk management sub-plan would be prepared for construction of the proposal, including:

- protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone (Bushfire Emergency and Evacuation Plan (BEEP)
- protocols for the management of bushfire risk and fuel management during construction. This will include restriction and/or prevent of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high', and as directed by relevant state authorities
- training to inform construction workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.

The CEMP would also include strategies and measures for:

- management of hazardous materials and dangerous goods
- management of other hazards and risks to the general public and the environment.

19.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to hazards and risk are presented in Table 19-6.

Table 19-6 Mitigation measures – hazards and risk

Reference	Mitigation measure	Timing	Applicable location(s)
HR1	The proposal will be designed and constructed in accordance with the Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz) (International Commission on Non-Ionizing Radiation Protection (ICNIRP), 2010).	Detailed design	All locations
HR2	A minimum 50m wide managed Asset Protection Zone will be provided to the hazard perimeter of the construction equipment and buildings. This zone will be regularly maintained to provide a maximum grass height of 100mm -150mm during the prescribed Bushfire Danger Period and when the grassland fuel reaches 70 per cent cured. Grass inside the main construction compounds and accommodation camp sites will be regularly maintained to a maximum height of 75mm.	Detailed design and construction	Main construction compounds and accommodation camps
HR3	Buildings within the construction compound and camp site will be constructed to comply with Section 3 and Section 5 (BAL 12.5) of A.S. 3959 – 2018 –'Construction of Buildings in Bushfire Prone Areas'. The sub-floor space of each building will be enclosed with stainless steel flymesh securely fixed to the external wall/s and buried into the ground. All joints will be overlapped and sealed.	Detailed design and construction	Main construction compounds and accommodation camps

Reference	Mitigation measure	Timing	Applicable location(s)
HR4	Water for fire-fighting operations will be confirmed during detailed design with consideration to occupancy density and site layout. This will include onsite static water supply and fire-fighting hose reels. All weather access having a minimum width of 4 metres will be provided to the static water supply tanks.	Detailed design and construction	Main construction compounds and accommodation camps
HR5	Consultation with emergency services, including the Rural Fire Service and Fire and Rescue NSW will be undertaken during detailed design to ensure emergency access provisions are provided during operation.	Detailed design	All locations
HR6	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on the site plans.	Construction	All locations
HR7	Dangerous goods and hazardous substances will be transported in accordance with relevant legislation and codes, including the Dangerous Goods (Road and Rail Transport) Act 2008, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2007).	Construction	All locations
HR8	Appropriate spill containment equipment will be provided and located at strategic, accessible locations.	Construction	All locations
HR9	Security measures will be implemented to minimise the risk of arson within and adjoining construction areas. The location of appropriate security measures will be determined using a risk based approach.	Construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
HR10	All chemicals or other hazardous substances at the Buronga substation will be stored in bunded and weatherproof facilities away from drainage lines, and in accordance with supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of the bunded area will be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on the site plans.	Operation	Buronga substation
HR11	Emergency spill procedures will be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities in accordance with the Transgrid's HSE Guideline. Environmental spill kits will be provided at strategic, accessible locations, and staff will be trained in spill response procedures.	Operation	All locations
HR12	The proposal would be designed, operated and maintained in accordance with TransGrid's Bushfire Risk Management Plan. This includes reduction in fuel loads, management of asset protection zones and inspections of infrastructure.	Operation	All locations
HR13	The Buronga substation Emergency Response Manual will be updated to include the new proposed design and required revised emergency response procedures.	Operation	Buronga substation

19.6.3 Managing residual impacts or uncertainties

Through the implementation of the standard mitigations detailed in Section 19.6, residual impacts resulting from the identified hazard and risk would be appropriately managed.

With respect to EMF, TransGrid adopts a precautionary approach to the management of EMF by:

- taking EMF into account in the design and location of new facilities, such as this proposal
- closely monitoring ongoing research and reviews by scientific panels and international policy developments
- regularly reviewing TransGrid's policies and practices in light of the latest scientific information
- measuring field strengths in and around TransGrid installations and other places where appropriate
- providing up-to-date information to interested parties on request.

20. Soils, contamination and groundwater

This chapter provides an assessment of potential soils, contamination and groundwater impacts of the proposal and identifies measures to address these impacts. This chapter summarises information in *Contamination impact assessment* (WSP, 2020g) (refer Volume 2, Technical paper 12) and *Groundwater impact assessment* (WSP, 2020h) (refer Volume 2, Technical paper 13).

20.1 Environmental assessment requirements

20.1.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to soils and contamination and where these requirements are addressed in this EIS are outlined in Table 20-1.

Table 20-1 Secretary's environmental assessment requirements – soils and contamination

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;	Issues relevant to soils and land capability are discussed in Section 20.3.3, 20.4.1 and 20.5.1.
	> an assessment of the risk of soil contamination and disturbance of land associated with naturally occurring asbestos in the vicinity of the site; and	Issues relevant to contamination risk are discussed in Sections 20.3.4 and 20.4.2.
	> assessment of impact of the project on any Crown lands and travelling stock reserves.	Refer to Chapter 12
Water		
Key issues	The EIS must address the following matters	
	> an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Murray River, the Darling, Great Darling Anabranch and Lake Victoria, having regard to NSW Water Quality Objectives;	Refer to Chapter 15
	> details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation;	Issues relevant to groundwater are discussed in Sections 20.3.5, 20.4.3 and 20.5.3. Issues relevant to surface water are discussed in Chapter 15.

Ref.	Secretary's environmental assessment requirements	Where addressed
	> an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the *NSW Aquifer Interference Policy* and relevant Water Sharing Plans; and	These matters are discussed in Section 20.4.3
	> an assessment of the potential flooding impacts and risks of the project.	Refer to Chapter 15

20.2 Assessment Approach

20.2.1 Legislation and policies

There is no legislation specifically relevant to the assessment of soils. Notwithstanding the assessment was completed with consideration of the following guidelines:

> *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries) (DECC, 2008)
> NSW EES guidance on urban and regional salinity
> *Landslide risk management guidelines* (Australian Geomechanics Society, 2007)
> Soil and Landscape Issues in Environmental Impact Assessment (DLWC, 2000).
> Acid Sulfate Soil Manual (ASSMAC, 1998).

Legislation relevant to the assessment of contamination includes the *Contaminated Land Management Act 1997* (CLM Act), State Environmental Planning Policy 55 – Remediation of Land (SEPP 55) and the *National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013* (NEPM, 2013). Other relevant guidelines which informed the assessment included:

> Managing Land Contamination Planning Guidelines SEPP 55 – Remediation of Land (DUAP and NSW EPA, 1998)
> Guidelines for the NSW Site Auditor Scheme (2nd edition) (DEC 2006b)
> Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (NSW EPA, 2015)
> Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme (3rd edition) (NSW EPA 2017b)
> Guidelines for Consultants Reporting on Contaminated Sites (OEH, 2011).
> Managing Asbestos in or on Soil (SafeWork NSW, 2014)
> Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (WA Department of Health, 2009)
> PFAS National Environmental Management Plan (PFAS NEMP) (HEPA, 2020).

Legislation relevant to the regulation of groundwater includes the (Commonwealth) *Water Act 2007*, (NSW) *Water Act 1912* and the(NSW) *Water Management Act 2000*. In addition to this legislation, the assessment was completed with reference to the following guidelines and policies:

- *Murray–Darling Basin Plan* (the Basin Plan) (Murray-Darling Basin Authority, 2012)
- Relevant Water Sharing Plans established under the Water Management Act 2000, including:
  - Lower Murray – Darling Unregulated River Water Sources 2011
  - NSW Murray and Lower Darling Regulated Rivers Water Sources 2016
  - Darling Alluvial Groundwater Sources 2020
  - NSW Murray Darling Basin Porous Rock Groundwater Sources 2020
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 revision (ANZG, 2018)
- NSW Aquifer Interference Policy (DPI, 2012)
- NSW Groundwater Quality Protection Policy (DPIE, 1997a)
- NSW Groundwater Dependent Ecosystems Policy (DLWC, 2002)
- NSW Groundwater Quantity Management Policy (DPIE, 1997b).

20.2.2 Methodology

Soils and contamination

The study area for this assessment included the proposal study area, unless otherwise defined below.

The assessment methodology for the soil and contamination impact assessment involved:

- reviewing desktop information to describe the existing environment, including:
  - historical aerial photographs
  - Australian Soil Resource Information System (maintained by the Commonwealth Scientific and Industrial Research Organisation (CSIRO))
  - eSPADE geology and soil landscape mapping
  - acid sulfate soils risk mapping
  - naturally occurring asbestos risk mapping
  - maps published by the Geological Survey of NSW and Australian Soils Resource Information System (ASRIS)
- completing searches of relevant public databases to identify registered sites or areas which may contain contamination. This included the NSW EPA Contaminated Sites Register, a list of sites which have been notified to the EPA, environmental protection licences held under the POEO Act, the NSW EPA PFAS investigation program, the Australian Department of Defence database for unexploded ordnance, and the NSW Department of Primary Industries register of cattle dip sites, and the NSW Government database of former gasworks sites
- a review of previous geotechnical and contamination investigations to determine areas of potential contamination concern
- identifying potential impacts to soil which may occur during construction and operation of the proposal
- an assessment of potential risks from contamination during construction and operation of the proposal, including completion of a risk assessment for contamination based on potential activities which may disturb contamination (or result in contamination), and potential risk from pathways to sensitive receivers.
- identifying mitigation measures.

Further detail on the assessment of contamination is provided in the contamination impact assessment (refer Volume 2, Technical paper 12).

Groundwater

The assessment methodology for the groundwater impact assessment involved:

- a desktop review of publicly available databases relevant to climate, soils, geology and hydrogeology, including the National Groundwater Information system (BOM, 2020) to identify registered groundwater bores and groundwater dependent ecosystems (GDEs)
- a review of previous geotechnical investigations completed for the proposal
- a qualitative assessment of the potential groundwater impacts from the proposal
- identifying mitigation measures to manage the potential impacts identified.

Further detail on the assessment of groundwater is provided in the Groundwater impact assessment (refer Volume 2, Technical paper 13).

Aquifer interference

Potential groundwater impacts were assessed with reference to the minimal impact considerations for highly productive groundwater sources for coastal sand water sources in the NSW Aquifer Interference Policy.

The following groundwater source categories, and minimum impact criteria, are relevant to the proposal:

- highly productive (high yields and electrical conductivity of 500 microsiemens per centimetre) groundwater source, including the following minimum impact criteria:
  - water table – Less than or equal to 10 per cent cumulative variation in the water table at a distance of 40 metres from any high priority groundwater dependant ecosystem or high priority culturally significant site.
  - water table – A maximum two metre water table decline at any water supply work
  - water pressure – A cumulative pressure head decline of not more than forty percent of the “post-water sharing plan” pressure head above the base of the water source to a maximum of a 2 metres decline, at any water supply work.
  - water quality – Any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond a distance of 40 metres from the activity
- less productive (porous rock and not highly connected to surface water sources), including the following minimum impact criteria:
  - water table – Less than or equal to 10 per cent cumulative variation in the water table at a distance of 40 metres from any high priority groundwater dependant ecosystem or high priority culturally significant site.
  - water table – A maximum two metre water table decline at any water supply work
  - water pressure – A pressure head decline of not more than two metres at any water supply work
  - water quality – Any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond a distance of 40 metres from the activity
  - water quality – No increase of more than one per cent per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity.

20.3 Existing environment

20.3.1 Topography

The topography of the proposal study area is generally flat, with gentle slopes towards major watercourses including the Darling River, Darling Anabranch and the Murray River. The elevation of the proposal study area ranges between 35 and 80 metres Australian Height Datum (mAHD).

20.3.2 Geology

The geology underlying the proposal study area includes the Woorinen Formation, Blanchetown Clay, Yamba Formation and Coonambidgal Formation, collectively from 10 metres to approximately 30 metres below ground level. The Shepparton Formation may exist within the eastern portion of the groundwater study area. These formations include aeolian (meaning deposited by wind) sediments and alluvial (meaning deposited by water) sediments in areas close to watercourses. Alluvial soils extend across the entirety of the large flood plains associated with major watercourses within the proposal study area. Deeper geological formations underlying the proposal study area include:

- Loxton-Parilla Sands, underlying the above formations, with anticipated thickness of 40 to 60 metres
- Bookpurnong Beds, possible Gera Clay and Winnambool Formation, of 10 to 40 metres thickness
- the Murray Group with considerable thickness, potentially in excess of 100 metres
- the Ettrick Formation and Renmark group are likely to occur at depth and to a considerable thickness.

20.3.3 Soils

There are no published soil landscape maps for the proposal study area, however other published mapping showing soil types indicates that soils are predominantly Quaternary-aged sediments deposited in alluvial flood plains and dunes, which occur along the length of the proposal study area. The predominant soil types include sand and clay or a mixture of the two. Geotechnical investigations completed for the proposal identified that soils associated with the Woorinen Formation typically comprise large proportions of very stiff to hard (calcareous) clays and dense to very dense sands. Soils with high erodibility were identified in samples collected.

Saline soils

The majority of the proposal study area is mapped as having low salinity potential, with no mapped areas of high salinity occurring. However, investigations completed for the proposal indicate there is variability in salinity levels, with some soil results indicating moderate to very saline conditions.

Acid sulfate soils

Acid sulfate soils (ASS) (including potential acid sulfate soils (PASS)) are naturally occurring soils containing iron sulphides. On exposure to air, such as during excavation or other mechanisms of disturbance, these iron sulfides oxidise and create sulfuric acid, which can impact the surrounding environment. This increase in acidity can also result in the mobilisation of aluminium, iron and manganese from the soils. Published acid sulfate soils mapping indicates there is a low risk of these soils occurring across the proposal study area, with the potential exception of low lying areas surrounding lakes and river beds, which are mapped as potentially containing acid sulfate soils.

Naturally occurring asbestos

Naturally occurring asbestos refers to the mineral component found in certain types of soils and rocks. There are no mapped areas indicating naturally occurring asbestos minerals may be present within the proposal study area.

20.3.4 Contamination

Searches of the NSW EPA contaminated land database (NSW EPA, 2020) and sites notified to the NSW EPA did not identify any sites regulated under the CLM Act within a one kilometre range of the proposal study area.

The majority of the proposal study area is utilised for agriculture, including land for livestock grazing and cropping. These broad areas are sparsely intersected by infrastructure including roads and electrical easements.

A review of previous investigations completed within the proposal study area did not confirm the presence of any areas with significant contamination. However, a number of areas of potential contamination were identified. The areas of potential contamination identified through review of previous investigations, and additional areas identified through further review of aerial photographs of the proposal study area are summarised in Table 20-2 and shown in Figure 20-1.

Table 20-2 Potential areas of contamination

Area of potential contamination	Location relevant to the proposal footprint	Activity and potential contamination
Buronga substation	Within the proposal study area	Spills from maintenance activities on-site, leaks of transformer oils. Potential contaminants including hydrocarbons and poly chlorinated biphenyls (PCBs).
Ellerslie substation (off Pooncarie Road)	Within the proposal study area	Spills from maintenance activities on-site, leaks of transformer oils. Potential contaminants including hydrocarbons and poly chlorinated biphenyls (PCBs).
Existing transmission line infrastructure	Within the proposal study area	Spills from maintenance activities on-site. Potential contaminants including hydrocarbons.
Built-up areas and residences	Within the proposal study area	Uncontrolled filling and historical buildings and other structures. Potential contaminants including hydrocarbons, pesticides, heavy metals and asbestos.
Cleared improved agricultural land (including cropping and irrigated land)	Within the proposal study area	Chemical spraying, use of heavy machinery. Potential contaminants including pesticides, and heavy metals.
Farm dams	Within the proposal study area	Uncontrolled filling. Potential contaminants including hydrocarbons, pesticides, heavy metals and asbestos.
Potential quarry	Within the proposal study area	Areas of potential contaminated sediment build-up. Potential contaminants including hydrocarbons, pesticides, heavy metals and asbestos.

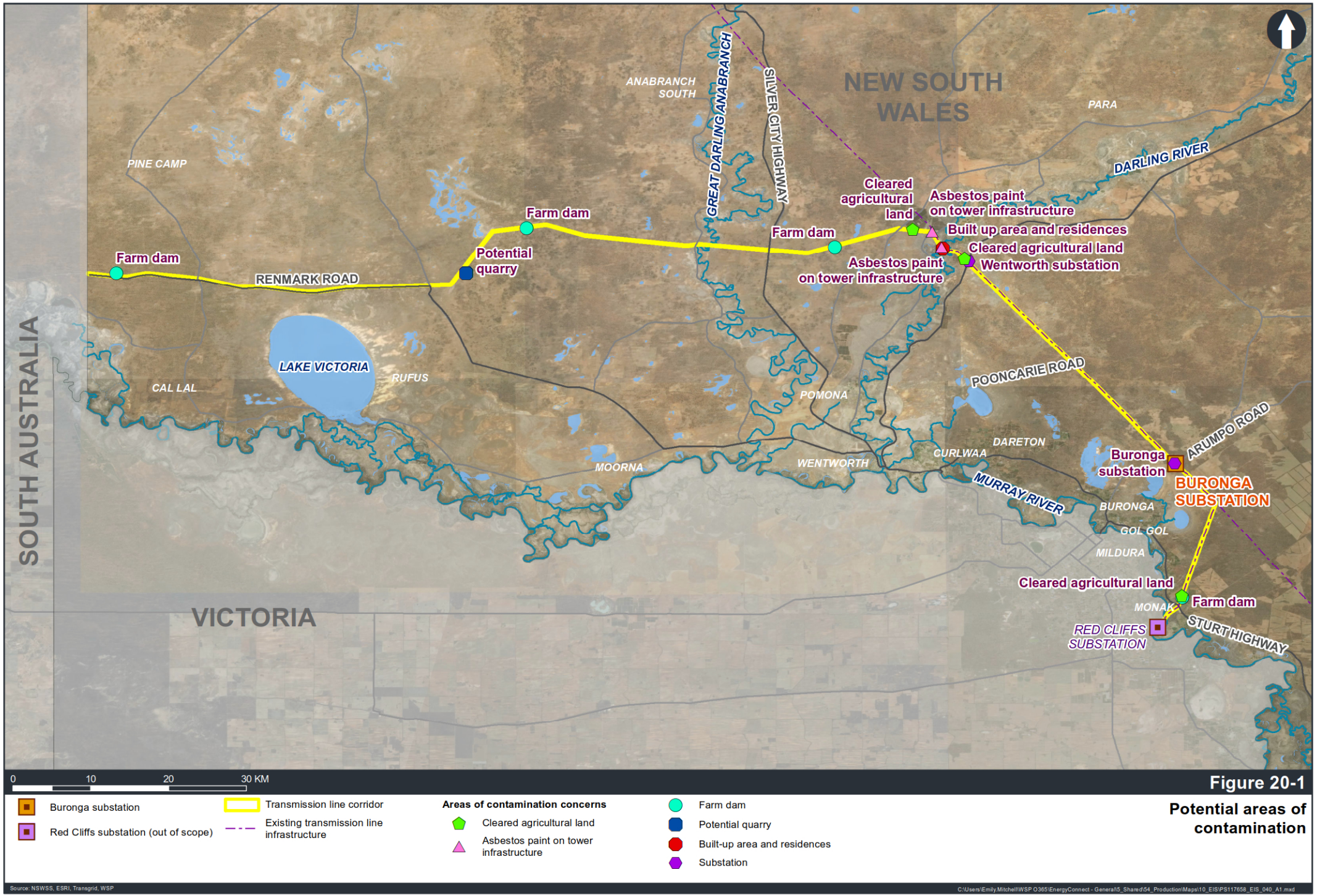


Figure 20-1

Potential areas of contamination

20.3.5 Groundwater

Regulated groundwater sources

Groundwater sources within the proposal study area are regulated by three water sharing plans, including:

- NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020 (Kanmantoo Fold Belt Murray-Darling Basin Groundwater Source)
- Darling Alluvial Groundwater Sources – including unconfined aquifers with high connectivity to the Darling River
- NSW Murray Darling Porous Rock Groundwater Sources – including remaining unconfined, semiconfined and confined aquifers. These groundwater sources are categorised as less productive porous rock and not highly connected to surface water sources.

Further discussion on the aquifers occurring within the proposal study area is provided below.

Groundwater regulated by the NSW Murray Darling Basin Porous Rock Groundwater Sources 2020 is located at significant depth, is not anticipated to be intersected by the proposal and therefore has not been discussed further.

Data for the latest water sharing plans have not been publicly released. However, it is expected that the updated water sharing plans would contain negligible alterations to their geographical extent and any adjustments between the depicted water sharing plan boundaries would be minor in relation to the proposal.

Hydrogeology

The proposal study area is located within the Lower Murray-Darling catchment, a sub-catchment of the Murray-Darling catchment, with surface water discharging to the Murray River, Darling River, and the Great Darling Anabranch (and associated lakes), and Lake Victoria (refer to Chapter 15 for further detail).

The hydrogeology of the proposal study area is complex. A review of the National Groundwater Information System (NGIS) (BOM, 2020) identified a number of systems within the proposal study area. The NGIS classifies these systems into four types based on depth: upper, middle-upper, middle-lower and lower.

A summary of aquifer classifications, hydrogeological unit and type, depth and flow direction is provided in Table 20-3. The majority of the upper aquifers, excluding the Loxton-Parilla Sands, would occur in discreet areas, and have limited connectivity to the regional groundwater regime. A simplified hydrogeological conceptual model showing the hydrogeological units is presented in Figure 20-2 (Viezzoli, Auken and Munday, 2009).

Table 20-3 Hydrogeological units identified within the proposal study area

NGIS Aquifer classification	Hydrogeological unit	Hydrogeological type	Indicative depth (metres below ground level)	Flow
Upper	Quaternary sediments	Perched, unconsolidated aquifer	Up to 30 metres	With surface topography
Upper	Coonambidgal Formation	Unconsolidated aquifer	Up to 30 metres	
Upper	Shepparton and Yamba Formations	Aquitard	Up to 30 metres	
Upper	Blanchetown Clay	Aquitard	Up to 30 metres	
Upper	Loxton-Parilla Sands	Typically an unconfined aquifer, however likely to be semi-confined in the proposal study area	Generally in excess of 20 metres	Generally west
Middle – upper	Bookpurnong Formation	Aquitard	In excess of 60 metres	Generally west to south-west
Middle – upper	Winnambool Formation	Aquitard		
Middle – upper	Murray Group Limestones	Confined aquifer	In excess of 100 metres	
Middle – lower	Ettrick Formation	Aquitard		
Lower	Renmark Group	Confined aquifer	Considerable depth below formations above	

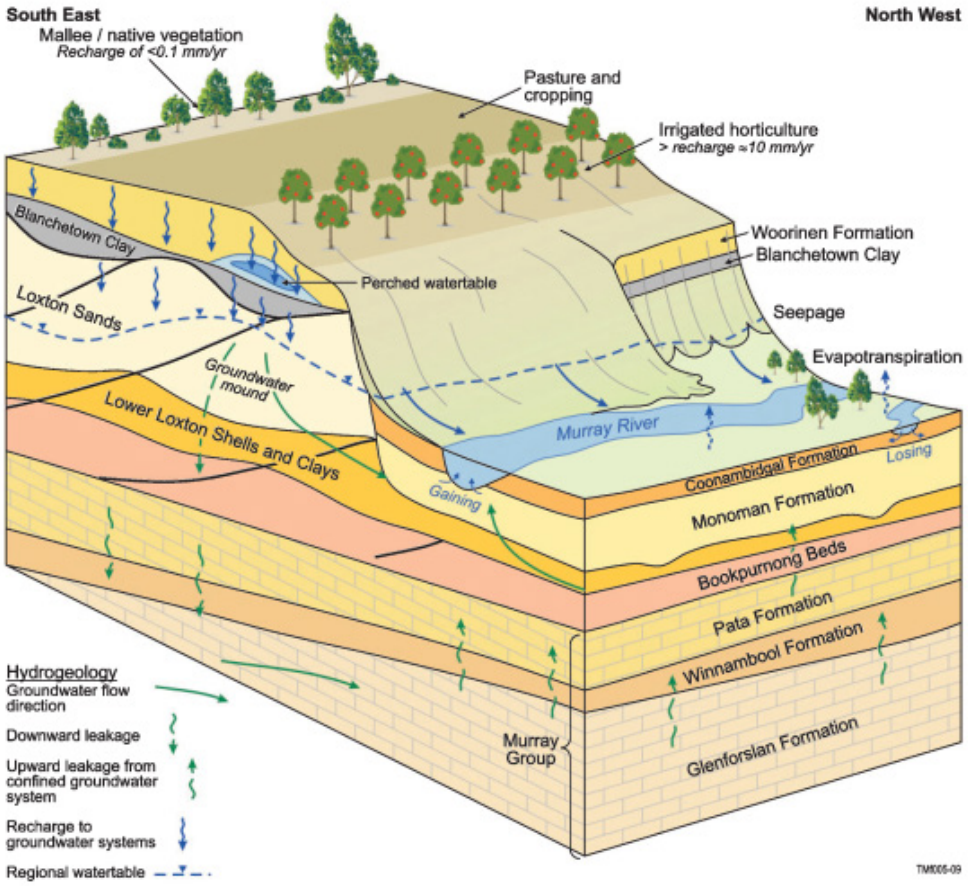


Figure 20-2 Simplified hydrogeological conceptual model (Viezzoli, Auken and Munday, 2009)

Groundwater depth and connectivity

Local groundwater levels vary due to influences from surface water features, climatic conditions and localised geological controls, such as topography and the presence of perched shallow aquitards.

Geotechnical investigations completed for the proposal identified water levels ranging from 2.8 to 12.5 metres below ground level. This water level is inferred to be associated with upper aquifers, including:

- unconfined perched aquifers
- unconfined alluvial aquifers, within a few kilometres of major surface water bodies.

It is possible that the Loxton-Parilla Sands aquifer was intersected due to the field investigation being taken in areas of lower elevation, however this was unable to be confirmed.

A review of registered groundwater bores with recorded groundwater levels identified seven bores with a measured groundwater level within five metres below ground levels in the vicinity of the Darling River, Great Darling Anabranch and Murray River.

Anticipated groundwater depth across the proposal study area is as follows:

- within the majority of the proposal study area, groundwater levels are anticipated to be between 20 to 30 metres below ground level and associated within the Loxton-Parilla Sands aquifer.
- near Lake Victoria:
  - shallow groundwater (less than two metres below ground level) is anticipated approximately 1.25 kilometres to the northwest, up to seven and a half kilometres to the east and five kilometres to the south and south east from the top of bank due to low elevations
  - to the north, within the proposal study area, groundwater is generally greater than 15 metres below ground level

- groundwater is approximately 2.5 to five metres below ground surface within 500 metres of the Great Darling Anabranch and generally five to 10 metres below the ground surface within its floodplain, up to 1.2 kilometres away from the river
- groundwater is generally deeper than 5 metres below ground surface within the Darling River floodplain
- groundwater is approximately 2.5 to five metres below ground surface within the Murray River floodplain. Shallower groundwater levels may occur at closer distances to the river
- groundwater is generally anticipated to be within five metres below ground level in areas within 500 metres of the Great Darling Anabranch, Darling River floodplain, and Murray River floodplain.

Surface water and groundwater connectivity is generally limited across the proposal study area, with the exception of two areas including:

- a freshwater lens which extends approximately 500 metres from the Darling River into the associated alluvial sediments, where it is highly connected and recharged primarily by the Darling River
- groundwater surrounding Lake Victoria, particularly the shallow unconfined aquifers, which consistently show strong groundwater level and water quality relationships to the surface water level in Lake Victoria
- the Murray River, which receives groundwater from the Loxton-Parilla Sands.

Groundwater quality

The assessment of contamination has not identified any potentially contaminated groundwater within the proposal study area.

The salinity of aquifers within the proposal study area varies depending on the hydrogeological unit the aquifer is contained within. In general salinity levels are as follows:

- unconfined aquifers within 500 metres from fresh surface water – water quality ranges from fresh to brackish in salinity (up to 3,000 microsiemens per centimetre)
- perched aquifers – salinity levels vary, but are generally expected to be high
- unconfined aquifers – generally saline to hypersaline with salinity levels between 30,000 and 150,000 microsiemens per centimetre.

Sensitive receivers

Registered groundwater bores

Searches of registered groundwater bores within two kilometres of the proposal study area identified 53 registered bores. Seven of these bores were registered for a purpose other than monitoring. From these seven bores, two were registered as household water supply, one for irrigation and the remaining four were listed as unknown purpose. The bores listed with unknown purpose are documented as part of the Lake Victoria groundwater monitoring network (MDBA, 2019), and therefore do not classify as a sensitive user.

Two registered bores were located within the proposal study area, GW600452 (monitoring bore) and GW088454 (part of the Lake Victoria groundwater monitoring network).

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. A summary of the GDEs is provided in Table 20-4. The location of the high potential GDEs are shown Figure 20-3a to Figure 20-3c.

One RAMSAR wetland, the Riverland wetland, is located about 3.5 kilometres southwest of the proposal study area (within South Australia (SA)). No other RAMSAR wetlands are located within 25 kilometres of the proposal study area.

Table 20-4 Relevant groundwater dependent ecosystems recorded on the National Groundwater Information System

GDE Type	Name	Coverage (hectares)
Terrestrial (aquatic)	Darling River	-
Terrestrial (aquatic)	Murray River	-
Subterranean (vegetation)	Eucalyptus Camaldulensis	6571
Subterranean (vegetation)	Eucalyptus Largiforens	7127
Subterranean (vegetation)	Grassy Riverine Forest	<1
Subterranean (vegetation)	Mallee	7584[1]

Other sensitive receivers

Lake Victoria is a key water resource storage of the Murray-Darling Basin. Groundwater surrounding Lake Victoria, particularly the shallow unconfined aquifers, shows a strong correlation in groundwater levels and water quality with the surface water within Lake Victoria.

Major watercourses, including the Darling River, Darling Anabranch and Murray River are also sensitive receivers requiring consideration.

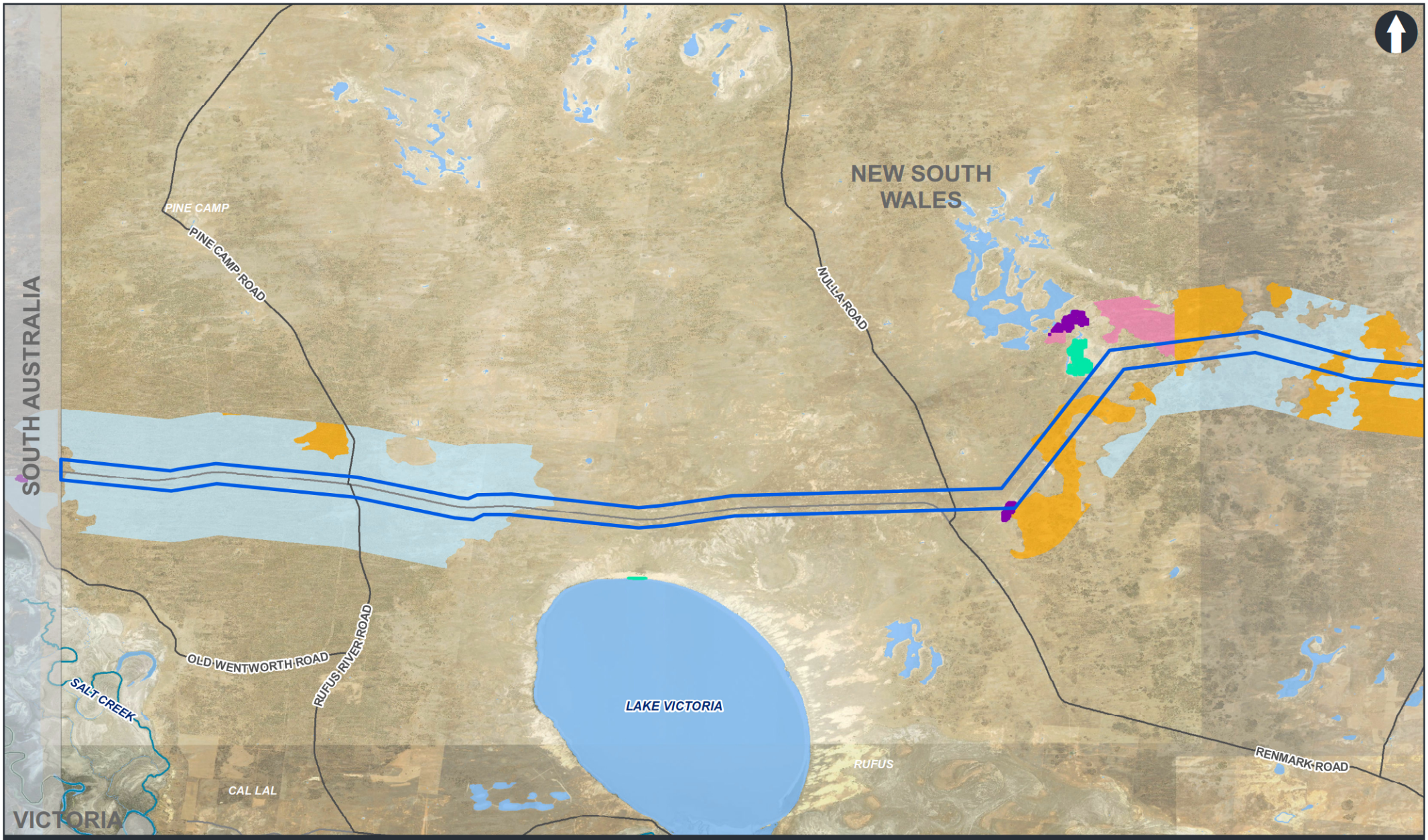


Figure 20-3a

Groundwater dependent ecosystems relevant to the proposal

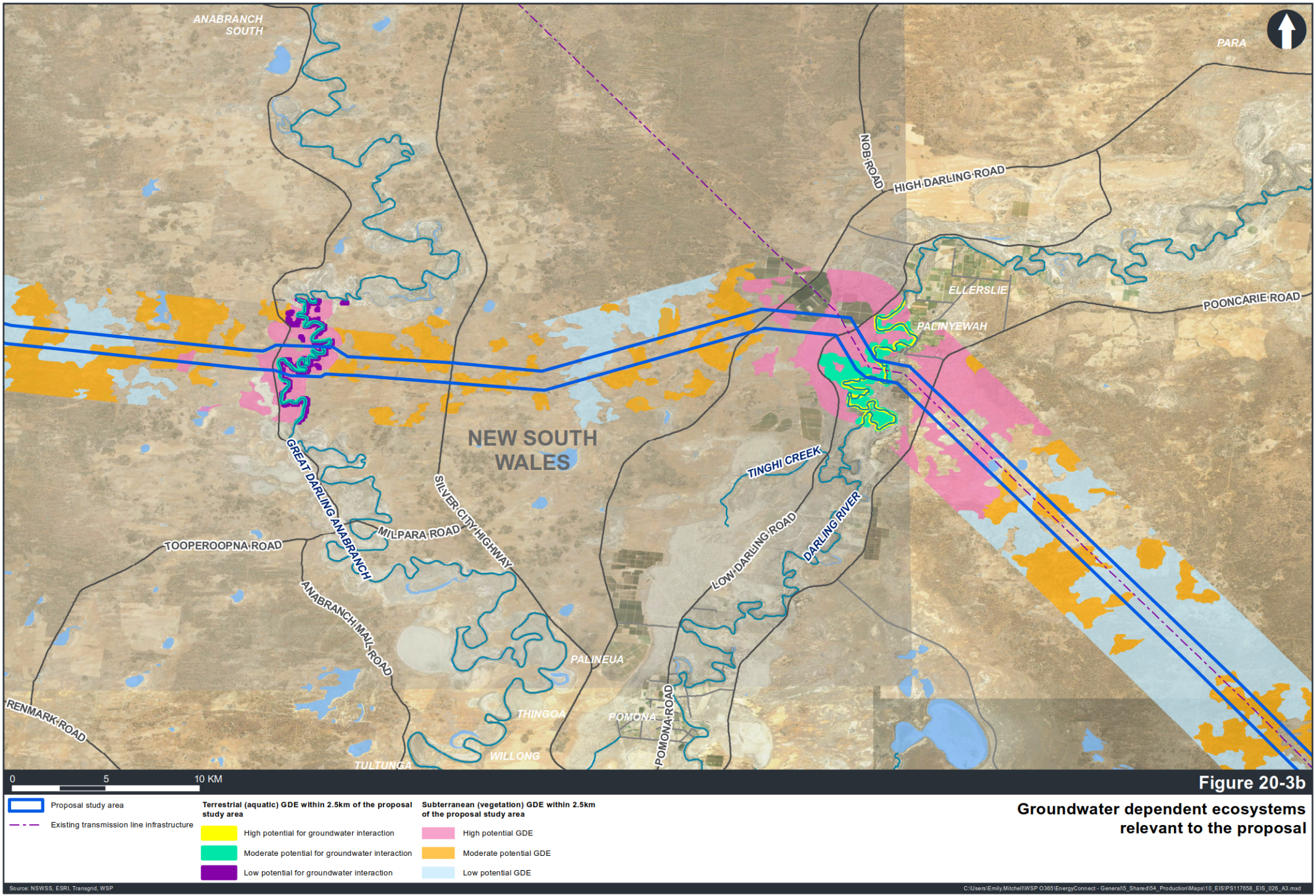
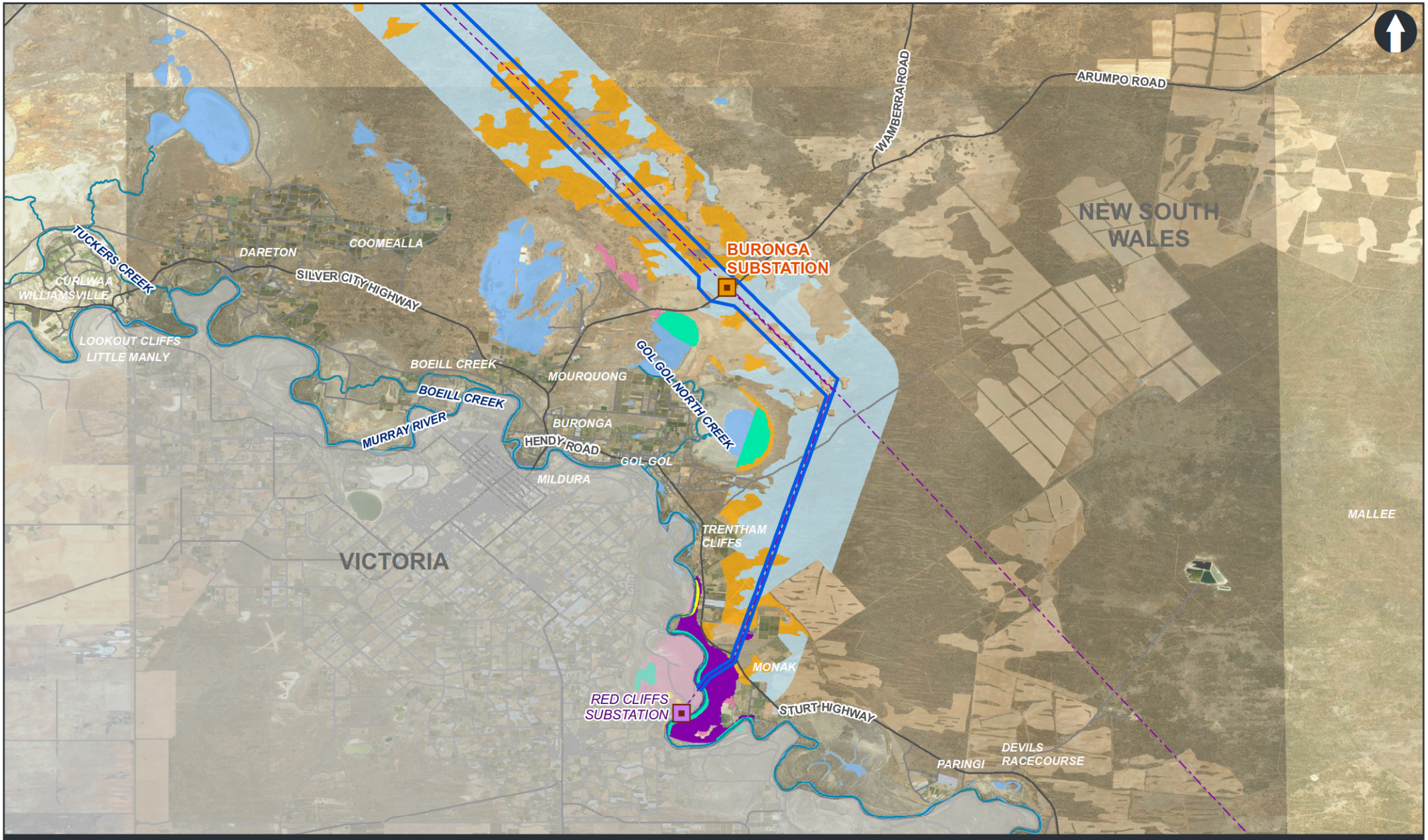


Figure 20-3b

Groundwater dependent ecosystems relevant to the proposal


ARUMPO ROAD
WAMBERRA ROAD
NEW SOUTH WALES
BURONGA SUBSTATION
TUCKERS CREEK
DARETON
COOMEALLA
SILVER CITY HIGHWAY
CURLWAA
WILLIAMSVILLE
LOOKOUT CLIFFS
LITTLE MANLY
BOEILL CREEK
MOURQUONG
GOL GOL NORTH CREEK
BOEILL CREEK
MURRAY RIVER
BURONGA
HENDY ROAD
GOL GOL
MILDURA
TRENTHAM CLIFFS
VICTORIA
MALLEE
MONAK
RED CLIFFS SUBSTATION
STURT HIGHWAY
PARINGI
DEVILS RACECOURSE
0
5
10 KM
Figure 20-3c
Buronga substation
Red Cliffs substation (out of scope)
Proposal study area
Existing transmission line infrastructure
Terrestrial (aquatic) GDE within 2.5km of the proposal study area
High potential for groundwater interaction
Moderate potential for groundwater interaction
Low potential for groundwater interaction
Subterranean (vegetation) GDE within 2.5km of the proposal study area
High potential GDE
Moderate potential GDE
Low potential GDE
Groundwater dependent ecosystems relevant to the proposal
Source: NSWSS, ESRI, Transgrid, WSP
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20.4 Potential impacts – construction

20.4.1 Soils

Soil erosion and land capability

Construction of the proposal has the potential to result in soil erosion and impacts to land capability in the absence of adequate management measures. Key construction activities that present a risk to soils include excavation and other earth moving activities, vegetation removal and the movement of vehicles, plant and equipment within unsealed areas. The potential impact of these activities may include:

> erosion of exposed soils and stockpiled materials
> dust generation from
> increased sediment loads entering the surrounding waterways
> compaction of soils leading to impacts on drainage.

The potential for these impacts would vary depending on the activity undertaken and the type of soil within the work areas. The highest potential for soil erosion during construction would be associated with the disturbance of soils on slopes, or soils with high erodibility potential.

Soil samples collected from the proposal study area had high soil erodibility, being indicative of the type of soils across the majority of the proposal study area. Whilst most of the proposal study area is flat or gently sloping, a greater risk of erosion be in areas with significant slope such as the banks of major watercourses including the Darling River, Darling Anabranch and Murray River. Erosion of soils may also occur via wind and surface water flows over disturbed areas, including the flat and gentle sloping topography. This would mostly occur during periods of severe weather. If unmanaged, the proposal could result in localised erosion and sedimentation around areas of disturbance, loss of topsoil and potential impacts to land capability. However, these impacts would be readily manageable through standard mitigation measures. These measures are detailed in Section 20.6.

Disturbed areas would be progressively rehabilitated as construction work progresses to minimise the duration of disturbance. Land would be reinstated to pre-existing conditions or other condition as agreed with the landholder. No long-term impacts to soils or the land capability of these areas are anticipated.

Acid sulfate soils

The majority of the proposal study area is identified as having a low risk of acid sulfate soils. Areas surrounding lakes and river beds are identified as potentially containing acid sulfate soils.

If acid sulfate soils are encountered, it would be managed in accordance with the Acid Sulfate Soil Manual (Stone, Y, Ahern C R, and Blunden B, 1998) The manual identifies procedures for the investigation, handling, treatment and management of such soils. If encountered and exposed by construction excavation without proper management, it could result in damage to surrounding vegetation and receiving aquatic environments due to the release of sulfuric acid generated from oxidised acid sulfate soils. The presence of acid sulfate soils would be confirmed prior to the commencement of construction.

Salinity

Potential impacts from salinity can occur due to disruption of the water table (i.e. when saline groundwater rises and deposits salts in upper soil layers). Disruption can result from vegetation removal, physical barriers, or the reuse of saline soils generated by the proposal.

As discussed in Section 20.4.3, the proposal is not anticipated to result in changes to the water table and as such impacts due to altered groundwater levels are not anticipated.

Existing saline soils may be encountered during construction. These soils would be managed in discreet areas and would not be moved to areas of low salinity.

Construction within areas of moderate to high-risk saline soils would be managed in accordance with the Salinity Training Handbook (DPI, 2014).

Naturally occurring asbestos

No areas of known or expected naturally occurring asbestos has been identified within the proposal study area. No impacts from naturally occurring asbestos are anticipated from construction of the proposal.

20.4.2 Contamination

Impacts from encountering contamination

Potential impacts from contamination include the risk of encountering existing contamination and spreading it to other areas during earthworks and other construction activities, resulting in exposure to human or environmental receptors.

Whilst areas known to be contaminated have not been identified, the assessment has identified areas of potential contamination. Construction activities potentially impacting these sites includes vegetation removal, excavation of soils, piling and dewatering activities. Consideration of these areas, the contamination potentially present, and an evaluation of risk from the proposal is summarised in Table 20-5.

Contaminated soils not previously identified as areas of potential concern could also be encountered during construction work. However, an unexpected contamination finds protocol would be developed as part of the construction environmental management plan (CEMP).

Table 20-5 Potential areas of contamination and assessed risk of encountering contamination during construction

Potential areas of contamination	Potential source of contamination	Potential for encountering contamination	Preliminary risk evaluation
Buronga substation	Spills from maintenance activities on-site and leaks	Medium potential for contaminants to be present Low potential for groundwater contamination	Low
Ellerslie substation (off Pooncarie Road)	Spills from maintenance activities on-site and leaks	Medium potential for contaminants to be present Low potential for groundwater contamination	Low (no disturbance proposed)
Existing transmission line infrastructure	Spills from maintenance activities on site	Low potential for contaminants to be present Low potential for groundwater contamination	Low
Built-up areas and residences	Historical uncontrolled earthworks and building structures previously demolished/ degraded	Low potential for contaminants to be present Low potential for groundwater contamination	Low
Cleared agricultural land	Historical use of pesticides, and defoliants, large scale land use and the use of heavy machinery	Medium potential for agricultural contaminants to be present in soil Low likelihood for groundwater contamination	Medium risk for soil Low risk for groundwater

Potential areas of contamination	Potential source of contamination	Potential for encountering contamination	Preliminary risk evaluation
Farm dams	Areas of potential contaminant sediment build-up	Medium potential for contaminant build-up within the dam sediments; however, it is unlikely that the dam sediments or water would be disturbed during construction	Low
Potential quarry	Areas of potential fill	Low potential for contaminants to be present Low potential for groundwater contamination	Medium risk for soil Low – medium risk for groundwater

Impacts from contamination from the proposal

The proposal has the potential to result in contamination from construction activities. Predominantly this includes accidental leaks and spills from the storage of fuels and chemicals and refuelling and other maintenance activities undertaken on plant and equipment.

The proposal includes construction support facilities including vehicle and equipment storage, maintenance sheds, chemical/ fuel stores and potential stockpile areas. Fuels and other chemicals would be appropriately stored according to Australian standards. Whilst the potential for spills or leaks cannot be discounted, these impacts would be localised and able to be managed and rectified to prevent significant impacts to sensitive receivers.

20.4.3 Groundwater

Groundwater levels

Potential impacts to groundwater levels can occur where drawdown (or extraction of groundwater) is required, potentially lowering the level of the surrounding groundwater table. Other potential impacts may include groundwater mounding (localised increase in groundwater levels), or a reduction in groundwater recharge from surface infiltration due to an increase in impervious surfaces.

Potential impacts to groundwater levels due to construction may occur where the depth of excavations for transmission line structures intersect the level of groundwater, and dewatering is required. The majority of excavations required for the proposal would be to a maximum depth of two metres. These include excavations associated with the foundation of light structures, such as access tracks, construction camps or pad footings. Groundwater is generally unlikely to be intercepted at these depths, with the exception of:

- about 2.5 to five metres below ground surface within 500 metres of the Great Darling Anabranch and generally five to 10 metres below the ground surface within its floodplain, up to 1.2 kilometres away from the river
- deeper than five metres below ground surface within the Darling River floodplain.
- about 2.5 to five metres below ground surface within the Murray River floodplain (within the groundwater study area). Note this is based on limited information at greater than 500 metres from the Murray River and thus shallower groundwater levels may occur at closer distances to the river.

However, the likelihood that groundwater may be intercepted would be dependent on a range of factors, including rainfall in the period prior to construction.

Where groundwater may be encountered, a design and construction methodology will be adopted in order to avoid groundwater inflows. This would include the adoption of alternative footing designs (such as boring), if required.

If unexpected groundwater inflows are encountered and dewatering is required during construction of the proposal, it would be limited to discreet locations and likely from perched, non-permanent and localised groundwater that is not connected regionally. The size, depth and duration of the excavation would be limited as far as practicable, reducing the potential impact of the proposal on sensitive receptors due to decreasing groundwater levels resulting as part of the construction phase of the proposal.

Whilst excavations to deeper depths (between 15 and 25 metres below ground level) would also be required for the installation of piles, the piling method used during construction would not require dewatering, and no impacts to groundwater levels are anticipated.

Earthworks associated with the Buronga substation are not anticipated to intersect groundwater.

The proposal includes a relatively small compaction footprint, and small magnitude (shallow depth of compaction), as such significant impacts from groundwater mounding, changes to groundwater flow, or localised increases in groundwater levels are not anticipated for the proposal.

Water supply for construction is to be sourced from existing infrastructure and within existing water allocations, licencing and approvals.

Groundwater quality

Potential impacts to groundwater quality from construction activities may include:

- disturbance of previously unidentified contamination in groundwater
- contamination of groundwater from leaks or spills of fuels, oils and other chemicals used during construction
- increases in salinity due to rises in groundwater levels
- removal of saline groundwater (dewatering) and discharge.

Potential impacts from contamination are discussed in Section 20.4.2 and the potential for impacts to groundwater are considered to be low and easily managed.

The proposal is not anticipated to result in increased groundwater levels, and therefore impacts from increases in salinity are not anticipated.

If saline groundwater is encountered during construction potential impacts may include discharge to the surrounding environment and impacts to sensitive receivers. However, management measures would be included in the CEMP for the proposal to manage any impacts.

Sensitive receivers

The proposal is not anticipated to impact registered groundwater bores due to changes in groundwater levels or quality.

Registered bores exist within the transmission line corridor and/or proposal study area. These include GW088454-nested, GW087531 and GW600452). These bores may be damaged or require removal for construction of the proposal. This includes indirect impacts due to vibration.

No high priority GDEs were identified in water sharing plans relevant to the proposal study area at the time of writing, however further review of the Darling Alluvial Groundwater Sources 2020 and NSW Murray Darling Basin Porous Rock Groundwater Sources 2020 water sharing plans would be required pending release of mapping for these plans. High potential GDEs are located within the floodplains of the Great Darling Anabranch, Darling River and Murray River and approximately three kilometres east of the Darling River floodplain. As discussed above, potential risks associated with impacts to groundwater levels and/or quality from the proposal are low. As such, no significant impact to GDEs are anticipated from the proposal.

The nearest RAMSAR wetland (Riverland wetland) is located about 3.5 kilometres form the proposal study area. Given the distance to this site (and other RAMSAR sites beyond), no impacts from the proposal are anticipated.

Potential groundwater mounding in areas near surface water features connected to groundwater systems, including the Darling River and Lake Victoria, may result in saline groundwater intrusion and impacts to surface water quality. However, as discussed above, impacts from groundwater mounding are not anticipated for the proposal.

Aquifer interference policy

There are currently no requirements for aquifer interference approvals under the *Water Management Act 2000*. However, the aquifer interference policy is used to guide proponents and DPIE in assessing aquifer interference activities.

An assessment of the proposals impacts on aquifers and GDEs in regard to the minimal impact considerations of the NSW Aquifer Interference Policy was undertaken for groundwater source categories of:

- highly productive groundwater sources, in which the groundwater source has total dissolved solids of less than 1,500 mg/L and contains water supply works that can yield water at a rate greater than five litres per second
- less productive groundwater sources failing to meet the highly productive criteria and are either alluvial, porous rock or fractured rock.

A summary of the assessment against these groundwater sources is provided in Table 20-6.

Table 20-6 Consideration of aquifer interference

Impact	Minimum impact consideration (highly productive and less productive groundwater sources)
Water table	There is a low risk of the proposal causing change to the groundwater table. Any potential change would be minimal due to the expected groundwater depth and selection of appropriate construction methodologies. No groundwater take is anticipated for construction or operation of the proposal.
Water pressure	Pressure heads are not anticipated to be lowered (or raised) due to the expected depth of the confined aquifers in the groundwater study area and selection of appropriate construction methodologies. No groundwater take is anticipated for construction or operation of the proposal.
Water quality	Any potential impact to groundwater is not expected to result in significant change in water quality that results in lowering the beneficial use category beyond 40 metres from the activity.

The assessment concluded the predicted impacts would comply with the Level 1 minimal impact considerations and thus impacts water table, water pressure and water quality would be considered as acceptable (refer to Section 7.1 of Volume 2, Technical paper 13 for the full assessment).

20.5 Potential impacts – operation

20.5.1 Soils

The potential for erosion of soils may be present around infrastructure, particularly around footings for transmission line structures and permanent access tracks located within the floodplain, where erosion and scour from water flow during flood events or high winds is more likely to occur. However, these impacts are anticipated to be minor as the proposal would be designed to manage water flows and the effects of winds, including scour protection (where required). Any areas of erosion would be minor and easily rectified.

Maintenance and repair activities would require use of vehicles on unsealed roads, as well as small scale excavation and ground disturbance. These activities have the potential to result in minor short-term impacts to soils from erosion and sedimentation. However, these impacts would be managed by implementing TransGrid's existing environmental management procedures.

20.5.2 Contamination

Operation of the proposal would not require disturbance to additional areas, as such the potential for exposure to previously unidentified areas of contamination is considered to be negligible.

There would be a minor risk of contamination during operation of the proposal from accidental spillage of petroleum, chemicals or other hazardous materials as a result of leakage or vehicle accidents, which could result in pollution of the surrounding environment. Given the minor volume and low risk of occurrence, these risks would be easily managed through standard controls.

Further, as discussed in Section 5.3.3, all key substation equipment (such as the transmission gantries and transformers) within the expanded substation would be fixed to a 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. This would reduce the risk of contamination. Incident response procedures would be also developed to manage spills.

20.5.3 Groundwater

Groundwater levels and flow

No significant excavations or cuttings would permanently intersect groundwater and no groundwater take is required during the operation of the proposal.

Infrastructure pads and other sites may have the potential to result in localised groundwater mounding resulting from compaction of the aquifers. However, areas of compaction are limited in size, and not considered likely to result in impacts from groundwater mounding or impacts to the flow of groundwater.

In the long-term, compaction from infrastructure pads, or piles intersecting groundwater may present potential risk of disrupting groundwater flows, causing groundwater levels to increase on the up gradient side (relative to groundwater flow direction) and decrease down gradient causing a 'groundwater shadow'. However, the potential impact from infrastructure associated with the proposal is considered minor and not likely to impact to groundwater flow.

Increases in impervious layers can reduce infiltration of rainfall and surface water. However, the proposed impervious areas are small relative to the local catchment area and the net impact on regional recharge and groundwater levels is low.

Groundwater quality

The operational activities that may impact water quality include maintenance activities along the transmission lines and at transmission line structures. However, these potential impacts would be minor and localised, and with operational procedures and safeguards, the residual likelihood of impacts would be low.

Increased runoff from new impervious surfaces resulting in the mobilisation of underlying salts and migration of contaminants to aquifers may occur. However, the overall increase in impervious surfaces is minor, and provided adequate drainage systems are implemented to collect and discharge surface waters appropriately, the potential risk to groundwater quality is low.

The proposal would be constructed of material of suitable durability to withstand potential corrosion from saline groundwater which may be present.

Sensitive receivers

No impacts to registered groundwater bores, or GDEs are anticipated during operation of the proposal.

Whilst the potential impact to surface water features and their associated groundwater aquifer could cause potential impact during the operation of the proposal, the overall risk is considered to be low.

20.6 Management of impacts

20.6.1 Environmental management

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

Measures and procedures to address potential impacts to impacts to soil, contamination and groundwater would be specified in a soil and water management sub-plan. The sub-plan will set out measures to mitigate and manage impacts on soil and water, including water quality and potentially contaminated soils (refer to Chapter 15 for further discussion).

20.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to soil, contamination and groundwater are listed in Table 20-7.

Table 20-7 Mitigation measures – soils, contamination and groundwater

Reference	Mitigation measure	Timing	Applicable location(s)
SCG1	Locations of transmission line structure foundations, and ancillary construction sites will be positioned to avoid disturbance to any known farm dams where practicable.	Detailed design and pre-construction	Transmission line
SCG2	Existing areas of waterlogging and poor drainage will be avoided, where possible, with regard to both access tracks and permanent structures.	Detailed design	Locations mapped as moderate to high-risk salinity
SCG3	Construction materials will be selected to withstand high saline soil and groundwater environment (where applicable).	Detailed design and pre-construction	Locations mapped as moderate to high-risk salinity
SCG4	A review of additional geotechnical and hydrogeology data, and any publicly available mapping of high priority GDEs as documented in the latest relevant water sharing plan, will be carried out to confirm the groundwater conditions and to: > determine if any additional mitigation measures are required to limit groundwater inflows, or impacts to groundwater dependant ecosystems (GDEs) > confirm no or minimal impact to groundwater sources as per the minimal impact criteria listed within the Aquifer Interference Policy.	Detailed design and pre-construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
SCG5	Disturbance to areas of medium risk of contamination will be avoided or minimised where practicable during construction. This includes the position of foundations for transmission line structures and ancillary construction sites. Areas of medium risk of contamination that will be disturbed by construction activities will be further investigated including completion of a site inspection. Where considered to be required, a Phase 2 investigation will be completed in accordance with NEPM 2013. Mitigation measures identified through further investigation will be implemented.	Detailed design and pre-construction	All locations
SCG6	To limit the potential for groundwater inflows, the construction methodology for transmission line structure foundations will ensure that excavations will not occur within 40 metres of the Darling River, Great Darling Anabranch or Murray River. Where groundwater may be encountered, alternative design and construction methodology will be adopted in order to avoid groundwater inflows. The depth of groundwater at transmission line structure locations will be confirmed prior to commencement of construction.	Detailed design and pre-construction	All locations
SCG7	Direct impacts to registered bores GW088454 (nested), GW087531 and GW600452 will be avoided, where possible. If the bores are: > not required to be removed during construction, then they will be clearly demarcated with a 5x5 metre construction exclusion zone > are to be removed during construction or unavoidably damaged, then make good provisions would apply in consultation with the registered bore owner.	Pre-construction and construction	Transmission line - Registered bores GW088454 (nested), GW087531 and GW600452
SCG8	Prior to ground disturbance in areas of potential acid sulfate soil occurrence (e.g. in low lying areas surrounding former or current lakes and river beds), testing would be carried out to determine the presence of actual and/or potential acid sulfate soils. If acid sulfate soils are encountered, they will be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC, 1998) and TransGrid's HSE Guideline.	Pre-construction and construction	All locations

Reference	Mitigation measure	Timing	Applicable location(s)
SCG9	Prior to ground disturbance, a visual inspection would be undertaken for the presence of saline soils. Areas of known or suspected salinity will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with Book 4 Dryland Salinity: Productive use of Saline Land and Water (NSW DECC 2008) to prevent impacts from salinity. Erosion controls will be implemented in accordance with Blue Book (Landcom, 2004).	Pre-construction and construction	All locations
SCG10	Earthworks and construction activities that result in compaction of soils will be limited where possible in areas within 40 metres of the Darling River, Murray River and Great Darling Anabranch to prevent potential impacts to groundwater.	Pre-construction and construction	Transmission line – locations adjacent to the Darling River, Murray River and Great Darling Anabranch
SCG11	A bore condition assessment is to be conducted prior and post construction on GW088454 (nested), GW087531 and GW600452 where required to identify any adverse impact to the bores integrity that may have resulted during construction. If impacts are identified, repair or replacement of the bore will be undertaken in discussion with the registered owner.	Pre-construction and construction	Registered bores GW088454 (nested), GW087531 and GW600452
SCG12	Construction materials, spoil and waste will be suitably stored to minimise the potential for soil, groundwater or water quality impacts.	Construction	All locations
SCG13	The discovery of previously unidentified contaminated material will be managed in accordance with a contamination unexpected finds procedure.	Construction	All locations

20.6.3 Managing residual impacts or uncertainties

With the implementation of the mitigation measures detailed above, no significant residual impacts for soils, contamination and groundwater are anticipated for the proposal. The assessment includes a level of uncertainty and the potential for previously unidentified impacts such as contamination may occur. These impacts would be able to be managed appropriately through the mitigation measures detailed above.

21. Waste management and resource use

This chapter provides a summary of the assessment of potential waste management and resource use impacts of the proposal and identifies measures to address these matters.

21.1 Environmental assessment requirements

The Secretary's environmental assessment requirements relating to waste management and resource use and where these requirements are addressed in this EIS are outlined in Table 21-1.

Table 21-1 Secretary's environmental assessment requirements – waste management and resource use

Ref.	Secretary's environmental assessment requirements	Where addressed
Land		
Key issues	The EIS must address the following matters: > identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.	Waste management during construction is addressed in Section 21.3. Waste management during operation is addressed in Section 21.4.

21.2 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

21.2.1 Legislative and policy guideline context

The main legislation relevant to the management of waste are the *Protection of the Environment Operations Act 1997* (POEO Act), the Protection of the Environment Operations (Waste) Regulation 2014 (the Waste Regulation) made under the POEO Act, and the *Waste Avoidance and Resource Recovery Act 2007* (WARR Act). The POEO Act establishes the procedures for environmental control, and for issuing environmental protection licences regarding matters such as waste, air, water and noise.

The Waste Regulation controls matters such as the obligations of consignors (producers and agents), transporters and receivers of waste in relation to waste transport licensing and tracking requirements.

The WARR Act aims to ensure that waste management options are considered against the following waste management hierarchy:

1. avoidance of unnecessary resource consumption
2. resource recovery (including reuse, reprocessing, recycling and energy recovery)
3. disposal.

Waste classification

The classifications that apply to waste in NSW and the descriptions of each are provided by the POEO Act, the Waste Regulation and supporting guidelines, including the *Waste Classification Guidelines* (NSW EPA, 2014). Many waste types are pre-classified under the POEO Act and do not require testing. However, if a waste is not pre-classified, it may need to be tested to determine its classification.

21.2.2 Methodology

The assessment involved:

- reviewing the regulatory framework for waste management
- identifying potential waste generating activities
- identifying the likely classification of waste generated by the proposal in accordance with relevant legislation and guidelines
- estimating quantities of waste, where feasible
- identifying available waste management options
- identifying waste management measures for construction and operation.

The waste types and quantities of waste detailed in the EIS are indicative and have been identified for the purpose of determining potential waste impacts and waste management options. Although the quantities of waste actually generated by the proposal may differ from the estimates made, the identified waste management options are variable and would be appropriate to the final waste quantities.

Typical management measures, in line with State regulatory frameworks have also been proposed to appropriately manage potential waste and resource use impacts.

21.3 Potential impacts – construction

21.3.1 Waste sources

The anticipated waste streams generated during construction would include:

- green waste generated during vegetation removal for the transmission line easement (around 100,000 cubic metres)
- excess spoil from excavation works including:
  - spoil from excavation(s) of tower (around 66,000 cubic metres)
  - spoil from excavation at the Buronga substation (around 250,000 to 350,000 cubic metres)
  - spoil from access tracks (around 10,000 cubic metres)
- steel and other metals associated with the removal or redundant equipment including dismantled transmission line structures including around:
  - 1,050 tonnes steel
  - 10,500 cubic metres of concrete and reinforcing steel
  - 140 tonne aluminium/steel conductors
  - 2,500 glass and porcelain insulators
  - seven tonnes of redundant line hardware
- empty overhead optical ground wire (OPGW) drums
- general construction waste such as off-cuts, packaging and excess construction material (such as concrete, timber, plastic and metal) (around 200 tonnes)
- waste oils, greases and lubricants from maintenance of construction plant and equipment
- domestic waste from site personnel including food scraps, glass and plastic bottles, paper and plastic containers (around 200 tonnes).

21.3.2 Resource use

Materials selection and use

The proposal would require a wide range of materials during construction. Typical construction materials including steel, transmission line cable, concrete, plastics, paints and timber. Key materials and resources would include:

> 12,000 tonnes of steel for transmission line structures
> 3,400 tonnes of aluminium and 50 tonnes of copper for transmission lines
> up to 15,000 cubic metres of concrete for substation and transmission tower footings.

The majority of materials required for construction are considered common construction materials. The highest value materials used in the proposal would include large amounts of copper used in the transmission line cabling and transformers housed in the substation. This metal is considered relatively abundant, with the proposal not likely to impact on its availability.

Opportunities to utilise recycled materials in the proposal would be explored during the subsequent phases of the proposal design and construction.

Energy and fuel use

Construction of the proposal would require the use of energy and fuels to power plant, equipment and transport vehicles. Fuels would likely include non-renewable sources such as petroleum, diesel, natural gas and liquefied natural gas.

Electricity needs on site would likely be provided by connection of the construction site offices to the local power grid. A generator would be used where it is not possible to obtain power from the local grid.

Water

As described in Section 6.9.2, water would be required during construction for:

> dust suppression on substation construction sites and line structure construction sites, and on access tracks through the use of a water spray attached to a tanker vehicle (including the use of water reduction polymers)
> concrete batching activities for use when mixing with cement, aggregates and water for transmission line structures 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 mega litres of water would be required for construction, comprising:

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

Wastewater would be collected via tanker trucks and disposed of at approved disposal locations in accordance with the NSW EPA waste classification guidelines.

Water would be supplied to the required areas either via water tanker vehicle deliveries or connections to a local town water main (in line with the relevant council and utility provider approval processes). It is estimated that water tanker deliveries would require up to around 15 20-tonne trucks per day during the peak construction period to maintain appropriate water supplies to the relevant construction work front, compound or camp site as required. Discussions have commenced with Wentworth Shire Council and other providers for the supply of potable and non-potable water.

Waste handling and management

Relevant legislation and policies outline the requirements which would be adopted for construction waste management. The proposed waste handling and management measures for construction waste streams are provided in Table 21-2.

Stockpile management would be in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004). The size of stockpiles would be determined by material quantity requirements, space availability, stockpile stability and safety.

Table 21-2 Management of construction waste

Waste type	Management
Spoil from excavated materials	Excavated materials would be reused on site where practicable. Where excavated materials cannot be reused (on site or in other projects off site) or reinstated, it would be classified and taken off site to a waste management facility that is lawfully permitted to accept that type of waste for reuse, recycling or disposal.
Contaminated spoil or soils	In situ testing of soils in areas of potential contamination concern would be undertaken to determine the appropriate waste classification. Further details regarding management of any contaminated soils is provided in Chapter 20.
General construction waste	General construction waste would be managed in accordance with the waste hierarchy. Waste would be segregated and stockpiled on site, with materials such as concrete, timber, plastic, and metals separated for reuse or recycling. Electrical waste would be stored for collection by an authorised contractor for recycling off site, where feasible, or disposal at an appropriately licenced facility. All construction waste would be classified in accordance with the *Waste Classification Guidelines* and directed to a waste management facility that is lawfully permitted to accept that type of waste or reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption.
Liquid waste	Sewage and grey water from construction compounds and camp sites would be disposed of in sewers or transported to an appropriately licenced liquid waste treatment facility.
Adhesives, lubricants, waste fuels and oils, engine coolant	Waste from construction vehicle and plant maintenance activities would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal. Where feasible, containers holding oil, grease and lubricants would be washed prior to disposal or stored separately for disposal as hazardous waste. Waste oil and oil filters would be stored in recycling bins and collected by an authorised contractor and recycled off site, where feasible.
Office waste including kitchen waste, paper, cardboard, plastics, glass	Waste containing food would be stored appropriately (covered), and regularly removed from site for disposal to reduce the likelihood of attracting pests and vermin (including birds). Recyclable materials such as paper, cardboard, plastics, glass, ferrous, and non-ferrous containers would be stored at recycling bins for collection by an authorised contractor and recycled off site. Where recycling is not feasible, waste would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal at a licenced waste facility.

Waste type	Management
Green waste	As far as practicable, green waste would be chipped, mulched and reused for vegetation management or dust suppression on site, reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption or collected by an authorised contractor and recycled off site. Noxious weeds would be disposed of in accordance with relevant guidelines/ requirements.
Top soil	As far as practicable and subject to suitability, topsoil would be reused in rehabilitation/reinstatement work or reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption.

Off-site recycling and disposal locations

General waste and recycling would be disposed of off-site would be sent to be to local council recycling/transfer centres at Wentworth in NSW and Mildura in Victoria.

Any additional metals such as steel or aluminium (either from redundant infrastructure or waste from new structures) would also be recycled.

21.4 Potential impacts – operation

Minimal operational waste or resource impacts are anticipated during the operation of the proposal. The wastes generated during operation of the proposal would be related to the following:

- periodic maintenance activities which would have the potential to generate some materials where elements of the proposal are required to be replaced or serviced
- general waste generated by maintenance personnel
- vegetation management activities (which would typically be limited to maintenance of vegetation clearances limits along the proposal easement).

No regular waste collection service would be required for the proposal. Waste would be removed from site as required by maintenance personnel. Similarly, no regular/ongoing use of resource use are anticipated during operation of the proposal.

Resource use during operation would include:

- water for onsite staff facilities (toilet and wash basin facilities) and fire-fighting (if required)
- electricity for Buronga substation operation and minimal lighting.

21.5 Management of impacts

21.5.1 Environmental management

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

Potential impacts to waste and resource use would be managed throughout each phase of the proposal. As part the design and procurement stage, design optimisation and sustainable procurement elements would be incorporated where practicable, to reduce material inputs and enable reduced energy and fuel inputs throughout the construction phase. A waste management sub-plan would be prepared for the proposal, including (but not limited to):

- targets for the recovery, recycling and re-use of construction waste
- procedures for the assessment, classification, management and disposal of waste
- waste tracking and compliance management.

21.5.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to waste and resource use are listed in Table 21-3.

Table 21-3 Mitigation measures – waste and resource use

Reference	Mitigation measure	Timing	Applicable location(s)
WM1	The proposal will aim to achieve a contractor ISCA rating of at least 60 / Excellent.	Detailed design and construction	All locations
WM2	Measures to minimise excess spoil generation will be investigated at detailed design. This would include a focus on optimising the design to minimise spoil volumes and the reuse of material on-site.	Detailed design	All locations
WM3	Opportunities to re-use or recycle construction and demolition waste would be investigated during detailed design.	Detailed design	All locations
WM4	All waste will be assessed, classified, managed and disposed of in accordance with the Waste Classification Guidelines (NSW EPA, 2014).	Construction	All locations
WM5	Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities.	Construction	All locations
WM6	All waste generated and surplus spoil to be removed from the construction of the proposal will be transported to appropriately licenced waste disposal or transfer facilities.	Construction	All locations
WM7	Waste during operations would be managed in accordance with TransGrid's existing Environmental Management System and processes for the identification, classification, handling and management of waste.	Operation	All locations
WM8	All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	Operation	All locations

21.5.3 Managing residual impacts or uncertainties

Through the implementation of the standard mitigations detailed in Table 21-3, residual impacts resulting from waste and resource use are anticipated to be appropriately managed.

22. Cumulative impacts

This chapter provides an assessment of the potential cumulative impacts. It describes other projects in the proposal study area and identifies where there is the potential for cumulative impacts to occur.

22.1 Assessment approach

When a project is assessed in isolation, the environmental impacts and benefits may not be considered large. However, when combined with other projects, the resultant cumulative effects may result in a greater extent, magnitude or duration of impact. Identifying the potential for cumulative impacts assists in guiding the development of appropriate mitigation measures.

The identification of proposed developments assessed as part of this cumulative impact assessment was based on a number of criteria including the:

- proximity of the project to the proposal
- likelihood of the project being constructed during a similar time as the proposal
- size of the project and the potential to result in substantial changes to identified key issues (such as traffic, noise and vibration, air quality, etc.) or substantial changes to the existing land use of the area
- likelihood of the project being constructed given its pre-approval status and support from relevant government planning strategies and local environmental plans.

Projects with the potential for cumulative impacts with the proposal were identified through a review of publicly available information and environmental impact assessments from the following databases:

- NSW Major Projects website (NSW Government Department of Planning, Industry and Environment (DPIE), searched June 2020)
- Wentworth Shire Council website (Wentworth Shire Council, searched June 2020)
- Australian Government EPBC Public notices list (Department of Environment and Energy, searched June 2020).

The cumulative assessment undertaken has been predominantly qualitative, due to information available at the time of the assessment.

Projects in addition to EnergyConnect that are considered to have the potential for cumulative impact with the proposal are listed in Table 22-1 and shown in Figure 22-1.

Table 22-1 Projects with the potential for cumulative impacts

Project / *proponent*	Details	Status (as of September 2020)	Construction timeframe (indicative)	Nearest proposal location
Buronga Solar Farm Renew Estate	The proposal consists of the development of a 400 megawatt (MW) solar farm with energy storage and associated infrastructure.	An EIS is currently being prepared for the proposal.	The construction schedule for the proposal is identified as being about approximately 18 to 24 months from site establishment to completion (noting commencement subject to approval from DPIE) (Renew Estate, 2018).	The proposed solar farm would be located immediately adjacent to the proposal (eastern side).
Copi Mineral Sand Mine Relentless Resources Limited	The proposal consists of the development of an open cut mineral sands mine and associated infrastructure to extract and process up to 1.5 million tonnes per annum for up to 6 years, transporting the heavy mineral concentrate via road for off-site processing; and progressively rehabilitating the site.	An EIS is currently being prepared for the proposal.	The construction schedule for the proposal is identified as being about approximately 12 months from site establishment to completion (noting commencement subject to approval from DPIE) (R.W. Corkery & Co. Pty Limited, 2018).	The proposed mine would be located around 25 kilometres to the north of the proposal.
Buronga – Gol Gol residential expansion Wentworth Shire Council	The Buronga and Gol Gol communities are considered to be the growth area of the Wentworth Shire with new subdivisions proposed to provide approximately 500 new large residential housing allotments. The proposed expansion of residential subdivisions in the Buronga and Gol Gol area is identified in the *2017-2027 Community Strategic Plan* (Wentworth Shire Council, 2017) with areas identified as urban release areas on the Wentworth LEP 2011.	No timeframe on proposed development of the urban release areas has been identified at this time.	No timeframe on proposed development of the urban release areas has been identified at this time.	Within the township of Buronga and Gol Gol about seven to eight kilometres west of the proposal.

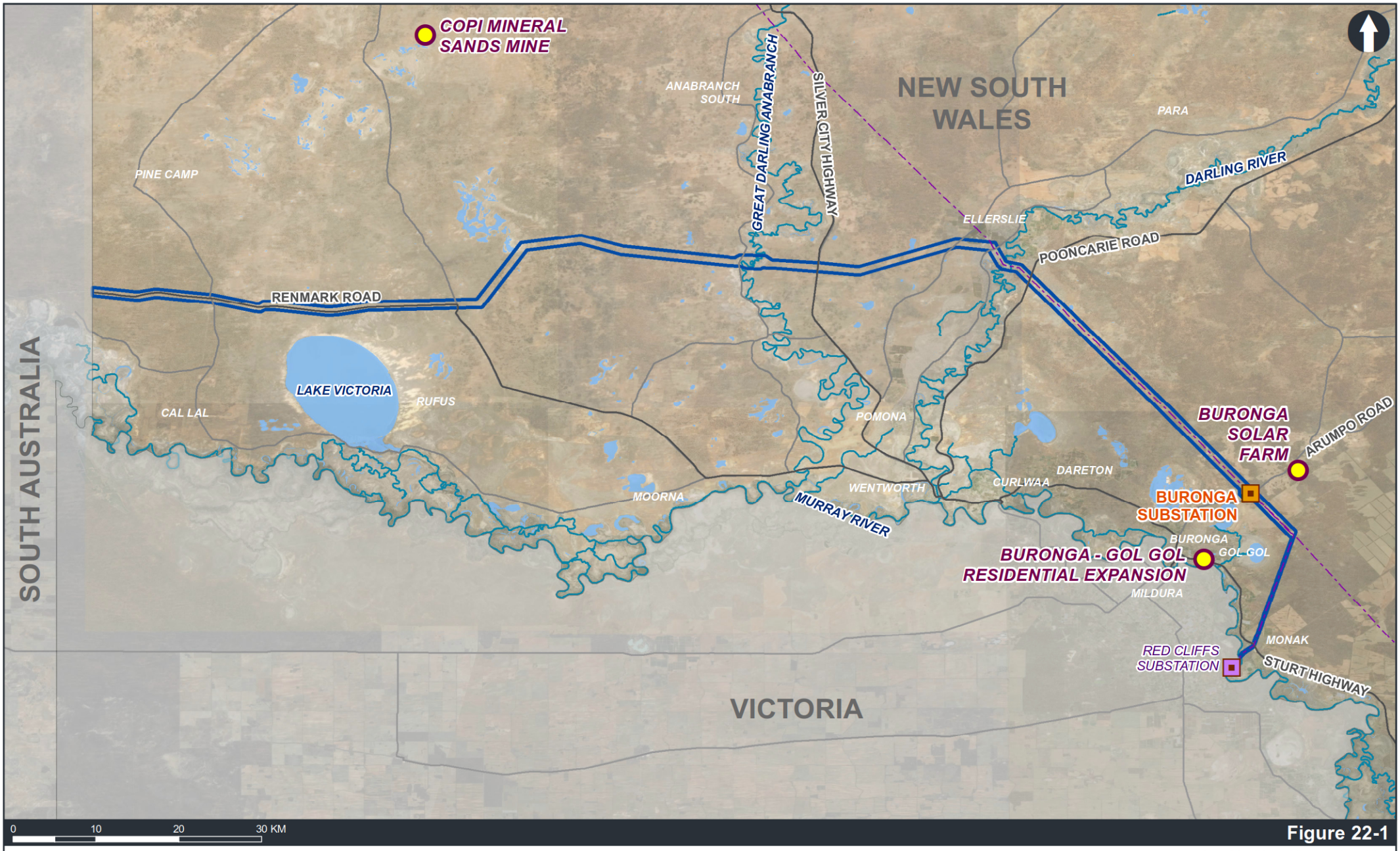

Figure 22-1

Projects with potential cumulative impacts

22.2 Cumulative impacts

This section provides an overview of the cumulative impacts that may occur during the construction and operation of the proposal and other major developments.

Of the projects listed in Table 22-1 the Buronga Solar Farm is the only major project that is considered to potentially result in cumulative impacts due to the proximity of each project and potential overlap of construction periods. This project is discussed in further detail below. The remaining projects are considered to be sufficient distance from the proposal (Copi Mineral Sand Mine) or not sufficiently progressed enough (proposed subdivision expansion at Buronga) to result in material cumulative impacts to the proposal.

22.2.1 EnergyConnect

The proposal forms part of a broader project and would share a direct interface at each connection point with the South Australian section, Victorian Section and the NSW-Eastern Section. These other proposals are currently within the early stages of development and environmental assessment.

Key cumulative impacts could arise at these direct interfaces, and would be associated with potential impacts to:

- amenity due to construction activities, such as construction noise emissions and dust emissions
- traffic impacts, in the event that common haulage routes are used
- visual amenity and landscape impacts due to construction activities, or construction of new or modified permanent infrastructure
- land use and property impacts, due to temporary changes to land uses or restrictions to activities due to the creation of new easements
- Aboriginal heritage
- socio-economic impacts
- biodiversity impacts.

The potential for cumulative impacts would depend on the staging, location and timing of construction activity, the opportunities to avoid and minimise impacts through design and construction methodologies, and proximity to sensitive receivers. However, construction impacts would be readily managed by the contractor through staging of works to minimise interruption and impacts to sensitive receivers. The potential for cumulative impacts would be considered further in subsequent environmental impact assessments.

Cumulative impacts pertaining to loss of biodiversity however has the potential to extend beyond the construction of the proposal, through the loss of habitat and vegetation. To manage the cumulative biodiversity impacts of EnergyConnect, the options development for EnergyConnect has considered routes to avoid and minimise impacts to biodiversity, and opportunities will continue to be explored during further proposal development and based on further field investigations. In addition to environmentally sensitive design responses, biodiversity offsets will be provided for the proposal, and would be expected for the NSW-Eastern and Victorian Sections of EnergyConnect, to address cumulative biodiversity impacts where removal of habitat and vegetation is unavoidable. These measures when combined will ensure that net increase in conservation and protection of impacted species and Plant Community Types.

22.2.2 Buronga Solar Farm

Potential cumulative impacts (where these have been identified) that may arise as a result of both projects are summarised in Table 22-2. Key issues where no cumulative impacts are expected have been excluded, or cumulative impacts are expected to be negligible. Further discussion of cumulative impacts (including justification of no cumulative impacts where relevant) is provided in the associated technical paper(s).

Table 22-2 Summary of cumulative impact – the proposal and Buronga Solar Farm

Environmental aspect/impact	Potential cumulative impact
Biodiversity	**Construction –** During construction, it is likely that approximately 500 hectares of mostly Chenopod Sandplain Mallee Woodland would be impacted, with the remainder of the site previously already cleared for agriculture / dryland cropping. While the connection of this project to the Buronga substation is adjacent to the proposal, most of the impacts are located over one kilometre to the north. There would be a cumulative impact on Chenopod Sandplain Mallee Woodland, although this is a relatively common vegetation type and habitat in the locality and region. Both would implement biodiversity offset strategies which are likely to result in a net increase of protection and conservation of such vegetation and habitat in the locality and region. Therefore, the cumulative impacts from the proposal on the biodiversity of the region are assessed as low. **Operation –** No additional impact.
Aboriginal heritage	**Construction –** Five Aboriginal sites are located within the development area for the Buronga Solar Farm, which would potentially be impacted by the project. Due to the linear nature of the proposal and impacts being spread across the landscape, cumulative impacts in association with the Buronga Solar Farm are likely to be partial as opposed to total, resulting retention and preservation of potential archaeological deposits and sites. Therefore, the cumulative impacts from the proposal on the Aboriginal heritage of the region are assessed as low. **Operation –** No additional impact.
Land use and property	**Construction –** The proposal may contribute to a cumulative loss of land available for agricultural uses in the region as a result of the Buronga Solar Farm, which would comprise development of a 400 megawatt solar farm on approximately 1,200 hectares of land, which is currently used for cropping and grazing The majority of this land is Land and Soil Capability (LSC) class 5 land of moderate–low capability, with a small portion of class 7 land of very low capability. However, during operation, groundcover vegetation would be maintained under the arrays and is intended to be managed by sheep grazing where possible, but cropping will cease. **Operation –** There would be changes to land uses, however, any cumulative impacts are unlikely to be significant.

Environmental aspect/impact	Potential cumulative impact
Landscape character and visual amenity	**Construction –** The Buronga Solar Farm would have a cumulative impact from both a landscape character and visual amenity perspective with the proposal. As both the proposal and solar farm project would result in a contiguous landform change and various extents of vegetation removal, the cumulative impact would be evident. However, the relative lack in elevation paired with the compatibility of the existing substation and transmission line infrastructure do mean that there is capacity for the existing environment to absorb impacts of the proposal and solar farm project due to the fragmented nature of the existing rural landscape. **Operation –** The solar farm would have a cumulative landscape character and visual amenity impact in conjunction with the proposal. However the fragmented nature of the existing rural landscape does provide some capacity for absorption of these impacts by the existing environment.
Social and economic	**Construction** – in the event of concurrent construction activities, cumulative impacts could result in the following areas: > increased construction traffic has the potential to lead to road safety concerns for local residents > incoming workforces place pressures on existing services and rental market that affects rental prices for local residents > demand for local labour force drives up labour costs for local industries. **Operation** – No additional impact
Noise and vibration	**Construction** – Cumulative impacts associated with the construction of the proposal and any simultaneous construction from the Buronga Solar Farm are anticipated to be low risk due to the distance to the nearest sensitive receiver. As the proposal is closer to sensitive receivers, cumulative impacts would be minor and mask noise levels from works at greater distance. **Operation** – The proposal has the potential to result in cumulative noise impacts with the proposed Buronga Solar Farm, which would be located next to the Buronga substation and involve operation of noise generating equipment including electrical transformers, inverters, solar panel sun tracking mechanism, and service vehicles. However, given the proposed solar farm would be less noise generating than the Buronga substation, and the noise generated by the upgraded and expanded Buronga substation during operation is predicted to be well below the adopted project noise trigger values, the potential for cumulative noise impacts can be considered as low risk.
Traffic and access	**Construction** – The construction works associated with the development of the Buronga Solar Farm would be expected to result in increased construction vehicles which may result in some additional cumulative traffic impacts, should the construction timing of these two projects overlap with the proposal. Co-ordination of traffic management arrangements between major construction projects will occur in consultation with the relevant road authorities (Transport for NSW and local councils) and/or other proponents (as relevant). This will consider any potential conflicts in relation to deliveries and identified haulage routes during the program. **Operation** – No additional impact.

22.2.3 Copi Mineral Sands mine

Cumulative impacts for the proposal and the Copi Mineral Sands mine during construction and operation are summarised in Table 22-3.

Potential cumulative impacts (where these have been identified) that may arise as a result of both projects are summarised in Table 22-4. Key issues where no cumulative impacts are expected have been excluded. Further discussion of cumulative impacts (including justification of no cumulative impacts where relevant) is provided in the associated technical paper(s).

Table 22-3 Summary of cumulative impact – the proposal and Copi Mineral Sands mine

Environmental aspect/impact	Potential cumulative impact
Biodiversity	**Construction** – Ecological surveys completed to date for the Copi Mineral Sands mine project indicate the presence of the endangered *Austrostipa nullanulla*, a native grass species listed as endangered in the NSW Biodiversity Conservation Act 2016 (BC Act). Surveys also identified the Endangered Ecological Community, *Halosarcia lylei* low open shrubland. Threatened or migratory species recorded included Little Eagle, Rainbow Bee-eater (migratory), Redthroat, Hooded Robin, Little Pied Bat and Inland Forest Bat. All of these species except the EEC have also been recorded for the proposal. This project is located approximately 25 kilometres from the proposal and while broad-scale regional impact may be cumulative, they are well dispersed in the landscape and unlikely to be significant in a cumulative sense in terms of biodiversity. **Operation** – No additional impact.
Aboriginal heritage	**Construction** – Preliminary reporting from the Copi Mineral Sands Mine EIS details a low likelihood of archaeological material within the landscape proposed for development. Due to the linear nature of the proposal and impacts being spread across the landscape, cumulative impacts in association with the Copi Mineral Sands Mine are likely to be partial as opposed to total, resulting retention and preservation of potential archaeological deposits and sites. Therefore, the cumulative impacts from the proposal on the Aboriginal heritage of the region are assessed as low. **Operation** – No additional impact.
Land use and property	**Construction** – The proposal may contribute to a cumulative loss of land available for agricultural uses in the region as a result of the Copi Mineral Sands mine, which would comprise two open cuts covering approximately 143 hectares, an infrastructure area covering approximately five hectares and a new 31 kilometre access road, which would generally be located on Land and Soil Capability (LSC) class 8 land of extremely low capability, with a small section of class 4 land of moderate capability, all of which is used for low-intensity grazing (R.W. Corkery & Co. Pty. Limited, 2018). **Operation –** No additional impact.

Environmental aspect/impact	Potential cumulative impact
Social and economic	**Construction** – If concurrent development of the proposal and Copi Mineral Sands Mine occurs, cumulative impacts could result in the following areas: > increased construction traffic has the potential to lead to road safety concerns for local residents > incoming workforces place pressures on existing services and rental market that affects rental prices for local residents > demand for local labour force drives up labour costs for local industries. **Operation** – No additional impact.
Hydrology, flooding and water quality	**Construction** – No cumulative impacts from flood risk, geomorphology or water quality are anticipated. Cumulative impacts on water supply and demand may occur from the Copi Mineral Sands Mine during construction if water management strategies are not developed. **Operation** – No additional impact.

22.2.4 Buronga – Gol Gol residential expansion

Potential cumulative impacts (where these have been identified) that may arise as a result of both projects are summarised in Table 22-4. Key issues where no cumulative impacts are expected have been excluded. Further discussion of cumulative impacts (including justification of no cumulative impacts where relevant) is provided in the associated technical paper(s).

Table 22-4 Summary of cumulative impact – the proposal and Buronga – Gol Gol residential expansion

Environmental aspect/impact	Potential cumulative impact
Biodiversity	**Construction** – The Buronga – Gol Gol residential expansion, which would comprise a 240 hectare urban release area on land that is largely currently used for irrigated horticulture has negligible potential for cumulative impacts to biodiversity. **Operation** – No additional impact.
Aboriginal heritage	**Construction** – The proposed land subject to the Buronga-Gol Gol residential expansion sits between 400-1,500 metres from the banks of the Murray River. Aboriginal heritage within this area is predicted to be of moderate to high archaeological sensitivity. Due to the linear nature of the proposal and impacts being spread across the landscape, cumulative impacts in association with the Buronga-Gol Gol residential expansion are likely to be partial as opposed to total, resulting retention and preservation of potential archaeological deposits and sites. Therefore, the cumulative impacts from the proposal on the Aboriginal heritage of the region are assessed as low. **Operation** – No additional impact.

Environmental aspect/impact	Potential cumulative impact
Land use and property	**Construction** – The proposal may contribute to a cumulative loss of land available for agricultural uses in the region as a result of the Buronga – Gol Gol residential expansion, which would comprise a 240 hectare urban release area on land that is largely currently used for irrigated horticulture has the potential for cumulative impacts with the proposal. However, given the individual impacts on regional agriculture of the Buronga – Gol Gol residential expansion is expected to be relatively minor, the cumulative impact is also expected to be minor as the total area affected would be small relative to the total extent of agriculture in the in the Wentworth-Balranald and Wentworth-Buronga statistical areas, and would be mostly limited to extensive grazing and dryland cropping land uses. **Operation** – No additional impact.
Social and economic	**Construction** – If concurrent development of the proposal and Buronga-Gol Gol residential expansion occurs, cumulative impacts could result in the following areas: > increased construction traffic has the potential to lead to road safety concerns for local residents > incoming workforces place pressures on existing services and rental market that affects rental prices for local residents > demand for local labour force drives up labour costs for local industries. **Operation** – No additional impact.
Hydrology, flooding and water quality	**Construction** – No cumulative impacts from flood risk, geomorphology or water quality are anticipated. Cumulative impacts on water supply and demand may occur from the Buronga – Gol Gol residential development during construction if water management strategies are not developed. **Operation** – No additional impact.

22.3 Management of impacts

22.3.1 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential cumulative impacts are listed in Table 22-5.

Table 22-5 Mitigation measures – Cumulative impacts

Reference	Mitigation measure	Timing	Applicable location(s)
CI1	Co-ordination of traffic management arrangements between major construction projects will occur in consultation with the relevant road authorities (Transport for NSW and local councils) and/or other proponents as relevant. This will consider any potential conflicts in relation to deliveries and identified haulage routes during the program.	Construction	Silver City Highway and Arumpo Road

Part D

Management and conclusions

23. Environmental management

This chapter describes the environmental management approach for the proposal during construction and operation, identifies the process for inspections, monitoring, auditing and reporting of environmental compliance. The chapter also includes a compilation of the mitigation measures listed throughout the EIS, as well as how sustainability will be considered during design, construction and operational phases of the proposal.

23.1 Approach to environmental management

23.1.1 Overall approach

The approach to environmental management for the proposal would be consistent with:

- the Environmental management system (EMS) of the construction contractor and TransGrid during construction and operation respectively, which are accredited under ISO 14001:2015
- proposal design – measures to avoid and minimise impacts that have been incorporated into the corridor selection and proposal design
- construction and operation environmental management, as described in sections 23.1.2 and 23.1.3. This will be consistent with TransGrid's *HSE Handbook* (TransGrid, 2020), which provides the minimum environmental controls for all construction and maintenance works on the TransGrid network.
- mitigation measures – the measures are identified as an outcome of the environmental impact assessment (refer to Section 23.1.4).

TransGrid's existing ISO 14001:2015 accredited EMS provides a structured approach to environmental management for the proposal. The EMS includes procedures, training, records, inspections, objectives and policies to guide compliance with environmental laws, regulations and corporate policies while managing potential environmental impacts.

23.1.2 Construction environmental management approach

The construction environmental management approach would be staged to allow for tailoring to address specific impacts during the enabling works and main construction works associated with the proposal (refer to Figure 23-1). An overarching community and stakeholder engagement plan would be implemented to manage community and stakeholder engagement during all phases of construction.

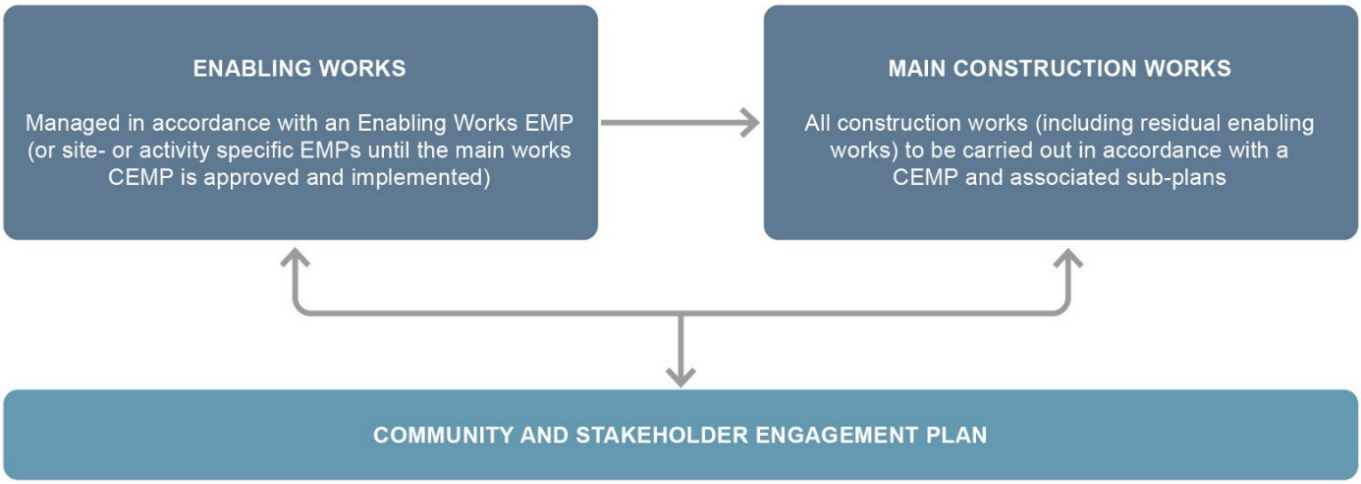

Figure 23-1 Approach to construction environmental management

Enabling works

An Environmental Management Plan (EMP) would be prepared for enabling works (as either site specific or activity specific EMPs) and would be the primary management plan for enabling works prior to the finalisation and approval of the main works CEMP. Following approval of the main works CEMP, all works would then be undertaken in accordance with the CEMP. Enabling works comprise of:

- 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. Low impact would consist of works that:
  - would have minimal amenity impacts to surrounding residences, such as noise, traffic and access, dust, and visual (including light spill) impacts
  - would have minimal environmental impact with respect to waste management, soil, water and flooding
  - would be located on sites of identified low ecological and heritage value
  - would have no impacts to threatened species (or their habitats) or threatened ecological communities (within the meaning of the *Biodiversity Conservation Act 2016* or the *Environment Protection and Biodiversity Conservation Act 1999*)
  - standard mitigation measures can be used to manage the impacts.

The EMPs would guide the approach to environmental management during the enabling works. The enabling works EMP(s) would:

- detail key project information relevant to the enabling works being undertaken
- provide reference to all relevant statutory and other obligations, including consents, licences, approvals and voluntary agreements applicable to the proposal
- detail key environmental risk issues and the specific mitigation measures that would apply to the enabling works as identified in the EIS, and with consideration of TransGrid's *HSE Handbook* (TransGrid, 2020). This would include but is not limited to:
  - location of environmentally sensitive areas (e.g. threatened species, critical habitat, contaminated areas, heritage zones)
  - vegetation and trees to be protected or removed, with any actions required prior to felling
  - location of known heritage (Aboriginal or non-Aboriginal) items
  - soil and water management
  - air quality mitigation
  - traffic and access arrangements
  - noise and vibration management
  - waste management
- show (using a graphical tool) where environmental controls will be located and how they will be used
- detail processes for managing incidents and non-compliance (including corrective and preventative actions)
- document processes for environmental monitoring and inspections, and compliance monitoring
- provide procedures for complaints handling and ongoing communication with the community
- identify roles and responsibilities for all personnel and contractors, and site inductions.

The enabling works CEMP(s) would be regularly reviewed, in response to changes such as activities and environmental conditions, to ensure ongoing environmental management.

Main construction works

Developed prior to commencement of the main construction works, the CEMP would include:

- a description of construction contractor's environmental policy and objectives for construction
- a description of the activities to be undertaken during construction
- reference to all relevant statutory and other obligations, including consents, licences, approvals and voluntary agreements required
- environmental targets and measurable performance indicators which compliance would be monitored against
- roles and responsibilities for all personnel and contractors to be employed on site with regards to the planning, implementation, maintenance and monitoring of environmental controls
- specific mitigation measures and controls that would be applied to avoid and minimise environmental impacts
- required sub-plans (as detailed later in this section), which clearly set out the objectives of the sub-plan, relevant conditions of approval and mitigation measures
- processes for managing non-compliance (including corrective and preventative actions)
- procedures for complaints handling and ongoing communication with the community
- inspection, monitoring and auditing requirements, including procedures for regular environmental inspections and monitoring, auditing and review of the performance of environmental controls, and compliance tracking and reporting
- incident and contingency management requirements
- procedures for the control of environmental records
- induction and training requirements for all personnel and contractors.

The CEMP would be adaptive, establishing a continuous cycle of monitoring, assessment, investigation and corrective actions. This process would be used to continuously evaluate and monitor the effectiveness of the environmental management measures proposed in this EIS and identify the corrective actions to be carried out should such measures be identified as being ineffective.

A compliance tracking and reporting program would be developed as part of the CEMP and implemented by the construction contractor. It would aim to monitor compliance with this EIS, relevant conditions of approval, licences and permits.

Compliance monitoring would be undertaken in the form of audits, including site audits undertaken by TransGrid. Frequency and reporting parameters would be identified in the CEMP.

Outline of sub-plans

Table 23-1 outlines the sub-plans that would be contained within the CEMP. Sub-plans may be replaced by a procedure where appropriate (i.e. when considering the scale and scope of the works), or merged with another sub-plan to streamline the CEMP. The conditions of approval for the proposal may require different and/or additional matters to be addressed in the CEMP or sub-plans.

Table 23-1 Outline of CEMP sub-plans

Sub-plan	Purpose and requirement
Biodiversity	The sub-plan will 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) > protocols for unexpected EECs or threatened flora and fauna during construction, including stop work procedures > monitoring requirements and compliance management
Heritage	The sub-plan will set out the measures to manage impacts on any impacts on heritage items/sites. It will include (as a minimum): > 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 > induction requirements for construction personnel.
Noise and vibration	The sub-plan will identify procedures and measures that will be implemented to mitigate and manage construction noise and vibration impacts at sensitive receivers. It will include but is not limited to: > examine feasible and reasonable noise mitigation where management levels are exceeded > examine feasible and reasonable noise measures to manage traffic noise impacts on public roads where exceedances above 2 dB are identified > develop associated noise and vibration monitoring programs, as required > develop proactive and reactive strategies for dealing with any noise complaints > outline community consultation measures including notification requirements > include an out of hours works protocol.

Sub-plan	Purpose and requirement
Air quality	The sub-plan will include measures to control dust and other emissions during construction. It will include (as a minimum): > measures to minimise the potential for dust emissions, including dust suppression > air quality monitoring requirements and compliance management. This includes monitoring of meteorological conditions in order to implement appropriate responses to changing weather conditions, and regular visual inspections.
Soil and water	The sub-plan will set out measures to mitigate and manage impacts on soil and water, including water quality and potential contaminated soils. It will include (as a minimum): > measures to minimise impacts to soil and water, and to maintain water quality of surrounding surface watercourses. This includes details of erosion and sediment controls, diversion of runoff around disturbed areas and stockpiles, salinity and acid sulfate soils control measures, as well as minimising areas of disturbance and progressive rehabilitation of disturbed areas > stockpile management procedures, including procedures to segregate wastes and contaminated soil > materials tracking and record keeping > unexpected finds protocols for contaminated materials (e.g. soils, building materials and water) and acid sulfate soils > storage of chemicals and other hazardous materials > spill management procedures > measures to minimise water use during construction > a flood emergency management procedure which will provide a series of activities that need to take place should a flood event occur. These activities would focus on the flood emergency and then during the recovery period to assist with starting work again as soon as possible after the flood event.
Traffic and transport	The sub-plan will be prepared in consultation with Wentworth Shire Council to identify the key management and response strategies to potential delays and disruptions that may arise due to the proposal. It will include (as a minimum): > measures to minimise disruption to pedestrians, cyclists and motorists > management of safe vehicle access/egress from construction compounds and other construction work areas > measures to manage oversize and overmass vehicle movements during construction, which will consider activities of adjoining land uses and safety of the public, such as entering urban areas from rural highways > management of long-distance travel through driver fatigue management measures > measures to ensure safe access to existing properties during construction, or provision of suitable alternatives.

Sub-plan	Purpose and requirement
Bushfire risk management	The sub-plan will be prepared by a suitably qualified professional and will include (but not limited to): > protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone (Bushfire Emergency and Evacuation Plan (BEEP) > protocols for the management of bushfire risk and fuel management during construction. This will include restriction and/or prevent of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high', and as directed by relevant state authorities > training to inform construction workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.
Waste management	The sub-plan will set out waste management strategies that will be implemented in accordance with the waste management hierarchy of avoid, minimise, re-use and dispose. The plan will include but is not limited to: > targets for the recovery, recycling and re-use of construction waste > procedures for the assessment, classification, management and disposal of waste > waste tracking and compliance management.

Community and stakeholder engagement plan

A community and stakeholder engagement plan (CSEP) would be prepared prior to commencement of the enabling works. The plan would be developed in consultation with Wentworth Shire Council. The plan would aim to detail the approach to communication between TransGrid, the construction contractor, the community and government authorities. The community and stakeholder engagement plan would:

> identify people, organisations and government authorities to be consulted during the works
> set out procedures and mechanisms for the regular distribution of accessible information to keep the community and stakeholders informed of the proposal
> set out the procedures and mechanisms for consulting with relevant councils and government authorities including procedures for nil responses
> describe the method for advertising the telephone line and email address for enquiries relating to the proposal
> set out procedures and mechanisms for response to enquiries and feedback
> include a complaints management system which outlines parameters for recording information on all complaints received during the main construction work
> set out procedures and mechanisms to resolve any issues and disputes that might arise in relation to environmental and stakeholder management associated with the proposal.

23.1.3 Operational environmental management approach

The operation of the proposal would be managed through the practices, procedures and processes within TransGrid's EMS, Environmental Assessment Framework (EAF), Environmental checklists, as well as its *HSE Handbook* and *Complaints Handling Policy* (TransGrid, November 2019).

Details of the environmental constraints identified as part of this EIS, that are relevant to the ongoing operation and maintenance of the asset, would be included in the appropriate TransGrid Geographical Information Systems (GIS). Due diligence environmental checks, including environmental information generated from GIS where relevant, would be undertaken before any maintenance works are carried out.

23.1.4 Summary of mitigation measures

Table 23-2 provides a compilation of the measures proposed to mitigate and manage the potential impacts of the proposal, as detailed in Part C. The measures listed may be revised in response to submissions raised during public exhibition of the EIS or any design changes made following exhibition. The final list of mitigation measures would be provided in the submissions report and/or amendment report/preferred infrastructure report.

If the proposal is approved, the proposal would be undertaken in accordance with the conditions of approval and the final list of mitigation measures.

Table 23-2 Compilation of mitigation measures

Reference	Mitigation measures	Timing	Application location(s)
Biodiversity			
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

Reference	Mitigation measures	Timing	Application location(s)
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
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

Reference	Mitigation measures	Timing	Application location(s)
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
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
Aboriginal heritage			
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

Reference	Mitigation measures	Timing	Application location(s)
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
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

Reference	Mitigation measures	Timing	Application location(s)
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
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

Reference	Mitigation measures	Timing	Application location(s)
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-10, 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
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

Reference	Mitigation measures	Timing	Application location(s)
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
Non-Aboriginal heritage			
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
Land use and property			
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 measures	Timing	Application 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 measures	Timing	Application 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 measures	Timing	Application 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
Landscape and visual amenity			
LV1	Opportunities for the retention and protection of existing trees within the disturbance area will be identified during detailed construction planning.	Detailed design	Whole of proposal
LV2	Temporary and permanent access will be designed to minimise vegetation removal, changes to landform, and visual impacts.	Detailed design	Whole of proposal
LV3	Proposed permanent engineering batters and water management measures will be designed to integrate with the existing landforms and natural features.	Detailed design	Whole of proposal
LV4	Lighting at construction compound and accommodation camps will be designed and operated in accordance with AS4282-2019 Control of the obtrusive effects of outdoor lighting.	Detailed design	Construction compound and accommodation camps
LV5	Transmission line structures, where possible, are designed: > to maximise distance from private residences > to use local vegetation and landform to provide screening from residences or from the road > to be regularly spaced to reduce the potential visual impact where the proposal alignment is visible for a long duration, and in open landscapes > to be positioned alongside existing transmission line structures where they are adjacent to existing transmission lines where feasible > to avoid the location of transmission line structures on locally prominent landforms > to minimise clearing along creeklines.	Detailed design	Whole of proposal
LV6	Where the transmission line crosses a roadway, transmission line structures will be located to maximise the distance from the roadway where feasible and where it will achieve an improved visual amenity outcome.	Detailed design	Transmission line

Reference	Mitigation measures	Timing	Application location(s)
LV7	The Tree Protection Zone (as defined in AS4970-2009 Protection of Trees on Development Sites) of retained trees within or immediately adjacent to the disturbance area will be protected through the restriction of construction activities (refer section 4.2 of AS4970-2009), to minimise the impact of the works on the long term health of these trees.	Pre-construction	Whole of proposal
LV8	Opportunities for screening vegetation to be provided on private property will be investigated where it would reduce an identified visual impact from a residence, in negotiation with the affected resident. This will be informed by further assessment to determine the extent of the impact and appropriateness of any screening vegetation, which would be maintained by the landholder.	Construction	Transmission line
LV9	Lighting at the substation will be designed and operated in accordance with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.	Operation	Buronga substation
Social and economic			
SE1	A Community and Stakeholder Engagement Plan will be implemented. This will include: > targeted stakeholder consultation with Local Government, chamber of commerce, Traditional Owners, landholders, emergency services and service providers to ensure plans for the proposal are integrated with local needs and priorities and proactively respond to community or stakeholder concerns including those of neighbouring or nearby landholders	Detailed design and construction	All locations
	> continuation of a consistent, open and transparent land acquisition process, giving due consideration of the interests or needs of directly affected landholders in accordance with the requirements of the Land Acquisition (Just Terms Compensation) Act 1991 and the supporting NSW Government Land Acquisition Reform 2016 (where applicable) > culturally appropriate ceremonies of recognition aligned with proposal activities and key milestones, in alignment with the TransGrid Reconciliation Action Plan.		

Reference	Mitigation measures	Timing	Application location(s)
SE2	A Local Business and Employment Strategy will be implemented to guide local opportunities during construction, and where possible, align with existing plans and strategies of Wentworth Shire Council and Mildura Rural City Council, and TransGrid's Reconciliation Action Plan. The initiatives will be prepared in consultation with Wentworth Shire Council, Mildura Rural City Council and key community stakeholders and organisations in the region. The strategy will consider local market conditions and capacity, and will include initiatives for: > local supplier and labour procurement targets > Aboriginal workforce and business participation > training and upskilling programs for local labour force > programs to inform local businesses of contracting opportunities and requirements > consideration of use of available local infrastructure and services for construction activities such as the Wentworth Aerodrome, where feasible > transitioning the local workforce following the completion of construction.	Detailed design and construction	All locations
SE3	A Community Benefit Plan will be implemented to guide opportunities to deliver benefits to local communities during and following construction. The plan will be prepared in consultation with Wentworth Shire Council, Mildura Rural City Council and key community stakeholders and organisations in the region, and will align with TransGrid's Community Partnerships Program. The plan will include (but is not limited to): > initiatives to create positive social contributions in local communities and to respond to community priorities and needs > initiatives for Aboriginal heritage impacts of the proposal to be managed in partnership with local Aboriginal organisations > exploring opportunities to repurpose temporary infrastructure to address local infrastructure needs.	Detailed design and construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
SE4	A Workforce Management Plan will be implemented to provide construction workforce support services to promote health and wellbeing and to manage positive social integration with existing communities. The plan will be prepared in consultation with Wentworth Shire Council, Mildura Rural City Council and social infrastructure service providers near accommodation camps so that the needs of the construction workforce are coordinated to minimise pressure on existing health services and social infrastructure.	Detailed design and construction	All locations
Hydrology, flooding and water quality			
HF1	The proposal will be designed, where feasible and reasonable, to mitigate potential alterations to local runoff conditions due to permanent operational infrastructure.	Detailed design	All locations
HF2	Detailed construction planning would consider flood risk at construction areas. This will include identification of measures to not worsen flood impacts downstream and on other property and infrastructure during construction up to and including the 1% AEP flood event, and review of site layout and staging of construction works to avoid or minimise obstruction of overland flow paths and to limit the extent of flow diversion required. Procedures as detailed in the flood emergency management procedures will be implemented in response to flood events, including the evacuation of personnel.	Pre-construction and construction	Transmission line and construction sites within flood prone land

Reference	Mitigation measures	Timing	Application location(s)
HF3	A water quality monitoring program will be implemented to establish baseline water quality conditions in the Darling River, Darling Anabranch and Murray River prior to construction, and to observe any changes in water quality that may be attributable to the proposal during construction. The frequency, location and duration of sampling will be detailed in the monitoring program, but will include: > at least two monitoring locations located downstream and upstream of the proposal on the Darling River, Darling Anabranch and, Murray River > monitoring for total dissolved solids, total suspended solids, total nitrogen and total phosphorus. Sampling will commence at least 6 months prior to the commencement of construction at each respective location, and then monthly during construction until completion of rehabilitation works.	Pre-construction and construction	Transmission line - Darling River, Darling Anabranch, and Murray River
HF4	Water supply options and management will be undertaken in accordance with agreements between the construction contractor and Wentworth Shire Council.	Construction	All locations
HF5	Erosion and sediment measures will be implemented in accordance with the principles and requirements in: > *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom 2004), and *Volumes 2A and 2C* (NSW Department of Environment, Climate Change and Water 2008), commonly referred to as the 'Blue Book' > *Best Practice Erosion and Sediment Control* (IESCA – 2008) > TransGrid's *HSE Guideline.* Additionally, any water collected from construction areas would be appropriately treated and discharged to avoid any potential contamination.	Construction	All locations
HF6	Maintenance works in the vicinity of waterways will be conducted in accordance with the TransGrid's HSE Guideline.	Operation	Transmission line

Reference	Mitigation measures	Timing	Application location(s)
Air quality			
AQ1	Construction air quality management measures will be detailed in the Air Quality Management Plan and implemented during construction to minimise particulate and gaseous emissions as far as possible. Measures will include (but not limited to): > use of water sprays or dust suppression surfactants as required for dust suppression > adjusting the intensity of activities based on observed dust levels and weather forecasts > minimising the amount of materials stockpiled and position stockpiles away from surrounding receivers > vehicle movements to be strictly limited to designated entry/exit routes and parking areas, and measures to minimise the tracking of material onto paved roads > covering of loads > stabilising disturbed areas as soon as practicable, including new access routes > minimising the extent of disturbance as far as practicable > regularly conducting visual inspections of dust emissions and applying additional controls as required.	Construction	All locations
AQ2	Ensure that all vehicles and machinery are fitted with appropriate emission control equipment and maintained in a proper and efficient manner.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
AQ3	Measures will be implemented at concrete batching plants to minimise emissions to air as far as possible and will be regularly inspected with additional controls implemented as required. Measures to minimise emissions to air may include: > all aggregate and sand will be stored appropriately in storage bins or bays to minimise dust generation, and material will not exceed the height of the bay > cement silos and hoppers will be fitted with dust filters > all inspection points and hatches will be fully sealed > all dry raw materials to be transferred into the bowl of an agitator via front end loaders by maintaining adequate moisture levels and/or an enclosed conveyor > the cement silo will be fitted with fitted with emergency pressure alert and automatic cut off overfill protection > transfer of cement from storage to batching will occur via sealed steel augers > regularly inspect dust emissions and apply additional controls as required.	Construction	Concrete batching plant(s)
Noise and vibration			
NV1	An Operational Noise Review will be prepared to confirm the predicted noise impacts from the proposal (based on the final detailed design) and refine the operational mitigation measures that will be implemented so operational noise impacts complies with the project noise trigger levels, where feasible and reasonable.	Detailed design	All locations

Reference	Mitigation measures	Timing	Application location(s)
NV2	Where exceedances of the project specific trigger noise levels are predicted, feasible and reasonable operational noise and vibration mitigation measures will be further investigated during detailed design, in consultation with the affected receivers. This may include (in order of priority): > land use planning and provision of appropriate buffer distances to increase the distance between the final transmission line alignment and the surrounding sensitive receivers and ultimately minimise the number of sensitive receivers within the audible risk noise zones > noise control at the noise source > noise control along the noise transfer path, such as noise barriers. > noise control at the receiver, such as 'at property' treatment to upgrade aspects of the dwellings including the façade or ventilation systems.	Detailed design	Transmission line (330kV only)
NV3	Construction methodologies and measures that minimise noise and vibration levels during construction will be investigated during detailed design and implemented where feasible and reasonable. This will be supported through the completion of additional assessments (where impacts to sensitive receivers could occur) based on the final construction methodology. This will: > consider the proposed layouts of work areas or construction compounds > the noise and vibration generating activities that will take place > assess the predicted noise and vibration levels against the relevant management levels. > incorporate feasible and reasonable mitigation and management measures in accordance with the ICNG.	Detailed design and construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
NV4	Further engagement and consultation with affected receivers will be carried out to understand their preferences for mitigation and management measures where exceedances of noise management levels are predicted. Based on this consultation, appropriate mitigation and management options will be considered and implemented where feasible and reasonable to minimise the impacts.	Detailed design and construction	All locations
NV5	A CNVMP would be prepared by the construction contractor prior to construction works and would (as a minimum): > examine feasible and reasonable noise mitigation where management levels are exceeded > examine feasible and reasonable noise measures to manage traffic noise impacts on public roads where exceedances above 2 dB are identified > develop associated noise and vibration monitoring programs, as required > develop proactive and reactive strategies for dealing with any noise complaints > outline community consultation measures including notification requirements. This CNVMP would be implemented for the duration of construction.	Detailed design and construction	All locations
NV6	An out of hours works (OOHW) protocol will be implemented and will include: > details of what works are required outside standard construction hours > noise management safeguards and other reasonable and feasible mitigation measures, including respite periods and duration respite where works are within the identified affectation distances for sensitive receivers leading to NML exceedances for sensitive receivers > community consultation procedures, including letterbox drops, notification protocols, and site contact information for the works > complaints handling procedures.	Detailed design and construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
NV7	Where noise intensive equipment is to be used near sensitive receivers, the works will be scheduled for standard construction hours, where possible.	Construction	All locations
NV8	Where works are required within the minimum working distances for vibration: > different construction methods with lower source vibration levels will be investigated and implemented, where feasible > attended vibration measurements will be undertaken at the start of the works to determine actual vibration levels at the structure. Works will cease if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Construction	All locations
NV9	Temporary batching plants along the transmission line corridor will be positioned to ensure compliance with NMLs at the nearest sensitive receivers.	Construction	Transmission line
NV10	If blasting is required, a blasting vibration and overpressure assessment will be completed to demonstrate that blasting and associated activities will not exceed noise and vibration limits at residences or other sensitive receivers. Based on outcomes of this assessment, a blast management strategy will be implemented that details how blasting will be carried out in a manner that complies with relevant noise and vibration limits, and notification requirements with landholders.	Construction	Blasting
Traffic			
TA1	Site access / egress points will be designed to minimise conflicts with vehicle movements on the road network and in accordance with relevant safety requirements. This may include the provision of acceleration and deceleration lanes at accommodation camp locations. Any designs will be in accordance with the Traffic Control at Worksites, Austroads Guide to Road Design and Austroads Guide to Traffic Management, and approved by the relevant road authority.	Detailed design	All roads that intersect with the transmission line corridor or are on haulage routes

Reference	Mitigation measures	Timing	Application location(s)
TA2	Road pre-condition surveys on construction haulage routes will be carried out prior to the commencement of construction in consultation with relevant councils and road owners. This will include identification of existing conditions and mechanisms to repair damage to the road network caused by construction vehicles associated with the proposal.	Pre-construction and construction	All roads that intersect with the transmission line corridor or are on haulage routes
TA3	The community will be notified in advance of proposed road network changes through appropriate forms of communication.	Construction	All locations
TA4	Road Occupancy Licence(s) will be sought (as required) for any road closures (full or partial) prior to any such closure. The timing of any closures will be carried out to minimise impacts to the road network.	Construction	All roads that intersect with the transmission line corridor or are on haulage routes
TA5	Permits from the National Heavy Vehicle Regulator (NHVR) will be obtained where required to provide oversized and overmass vehicles access during construction. Permit applications will be supported by a Vehicle Movement Plan (VMP), prepared to indicate the proposed heavy vehicle route(s). The Vehicle Movement Plan will consider activities of adjoining land uses and safety of the public, particularly when entering urban areas from rural highways.	Construction	All roads that intersect with the transmission line corridor or are on haulage routes
TA6	Construction access/egress, and construction movements, will be managed to ensure pedestrian and cyclist safety.	Construction	Sturt Highway (George Chaffey Bridge)
TA7	Adjustments to haulage routes in response to road closures by Wentworth Shire Council (e.g. during wet weather conditions or during other maintenance or other upgrade activities) will be identified in consultation with Wentworth Shire Council and affected residents, and suitable management measures identified and implemented.	Construction	Local roads within the study area
TA8	Access to properties for emergency vehicles would be provided at all times.	Construction	All locations
TA9	Access to properties will be maintained or alternative arrangements agreed in consultation with landholders.	Construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
TA10	Following completion of construction, condition surveys will be carried out. Any damage as a result of construction vehicles would be repaired following the completion of construction (and as needed through the construction period to maintain safe road conditions).	Construction	All roads that intersect with the transmission line corridor or are on haulage routes
Hazards and risk			
HR1	The proposal will be designed and constructed in accordance with the Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz) (International Commission on Non-Ionizing Radiation Protection (ICNIRP), 2010).	Detailed design	All locations
HR2	A minimum 50m wide managed Asset Protection Zone will be provided to the hazard perimeter of the construction equipment and buildings. This zone will be regularly maintained to provide a maximum grass height of 100mm -150mm during the prescribed Bushfire Danger Period and when the grassland fuel reaches 70 per cent cured. Grass inside the main construction compounds and accommodation camp sites will be regularly maintained to a maximum height of 75mm.	Detailed design and construction	Main construction compounds and accommodation camps
HR3	Buildings within the construction compound and camp site will be constructed to comply with Section 3 and Section 5 (BAL 12.5) of A.S. 3959 – 2018 –'Construction of Buildings in Bushfire Prone Areas'. The sub-floor space of each building will be enclosed with stainless steel flymesh securely fixed to the external wall/s and buried into the ground. All joints will be overlapped and sealed.	Detailed design and construction	Main construction compounds and accommodation camps
HR4	Water for fire-fighting operations will be confirmed during detailed design with consideration to occupancy density and site layout. This will include onsite static water supply and fire-fighting hose reels. All weather access having a minimum width of 4 metres will be provided to the static water supply tanks.	Detailed design and construction	Main construction compounds and accommodation camps
HR5	Consultation with emergency services, including the Rural Fire Service and Fire and Rescue NSW will be undertaken during detailed design to ensure emergency access provisions are provided during operation.	Detailed design	All locations

Reference	Mitigation measures	Timing	Application location(s)
HR6	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on the site plans.	Construction	All locations
HR7	Dangerous goods and hazardous substances will be transported in accordance with relevant legislation and codes, including the Dangerous Goods (Road and Rail Transport) Act 2008, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2007).	Construction	All locations
HR8	Appropriate spill containment equipment will be provided and located at strategic, accessible locations.	Construction	All locations
HR9	Security measures will be implemented to minimise the risk of arson within and adjoining construction areas. The location of appropriate security measures will be determined using a risk based approach.	Construction	All locations
HR10	All chemicals or other hazardous substances at the Buronga substation will be stored in bunded and weatherproof facilities away from drainage lines, and in accordance with supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of the bunded area will be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on the site plans.	Operation	Buronga substation
HR11	Emergency spill procedures will be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities in accordance with the TransGrid's HSE Guideline. Environmental spill kits will be provided at strategic, accessible locations, and staff will be trained in spill response procedures.	Operation	All locations

Reference	Mitigation measures	Timing	Application location(s)
HR12	The proposal would be designed, operated and maintained in accordance with TransGrid's Bushfire Risk Management Plan. This includes reduction in fuel loads, management of asset protection zones and inspections of infrastructure.	Operation	All locations
HR13	The Buronga substation Emergency Response Manual will be updated to include the new proposed design and required revised emergency response procedures.	Operation	Buronga substation
Soils, contamination and groundwater			
SCG1	Locations of transmission line structure foundations, and ancillary construction sites will be positioned to avoid disturbance to any known farm dams where practicable.	Detailed design and pre-construction	Transmission line
SCG2	Existing areas of waterlogging and poor drainage will be avoided, where possible, with regard to both access tracks and permanent structures.	Detailed design	Locations mapped as moderate to high-risk salinity
SCG3	Construction materials will be selected to withstand high saline soil and groundwater environment (where applicable).	Detailed design and pre-construction	Locations mapped as moderate to high-risk salinity
SCG4	A review of additional geotechnical and hydrogeology data, and any publicly available mapping of high priority GDEs as documented in the latest relevant water sharing plan, will be carried out to confirm the groundwater conditions and to: > determine if any additional mitigation measures are required to limit groundwater inflows, or impacts to groundwater dependant ecosystems (GDEs) > confirm no or minimal impact to groundwater sources as per the minimal impact criteria listed within the Aquifer Interference Policy.	Detailed design and pre-construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
SCG5	Disturbance to areas of medium risk of contamination will be avoided or minimised where practicable during construction. This includes the position of foundations for transmission line structures and ancillary construction sites. Areas of medium risk of contamination that will be disturbed by construction activities will be further investigated including completion of a site inspection. Where considered to be required, a Phase 2 investigation will be completed in accordance with NEPM 2013. Mitigation measures identified through further investigation will be implemented.	Detailed design and pre-construction	All locations
SCG6	To limit the potential for groundwater inflows, the construction methodology for transmission line structure foundations will ensure that excavations will not occur within 40 metres of the Darling River, Great Darling Anabranch or Murray River. Where groundwater may be encountered, alternative design and construction methodology will be adopted in order to avoid groundwater inflows. The depth of groundwater at transmission line structure locations will be confirmed prior to commencement of construction.	Detailed design and pre-construction	All locations
SCG7	Direct impacts to registered bores GW088454 (nested), GW087531 and GW600452 will be avoided, where possible. If the bores are: > not required to be removed during construction, then they will be clearly demarcated with a 5x5 metre construction exclusion zone > are to be removed during construction or unavoidably damaged, then make good provisions would apply in consultation with the registered bore owner.	Pre-construction and construction	Transmission line - Registered bores GW088454 (nested), GW087531 and GW600452
SCG8	Prior to ground disturbance in areas of potential acid sulfate soil occurrence (e.g. in low lying areas surrounding former or current lakes and river beds), testing would be carried out to determine the presence of actual and/or potential acid sulfate soils. If acid sulfate soils are encountered, they will be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC, 1998) and TransGrid's HSE Guideline.	Pre-construction and construction	All locations

Reference	Mitigation measures	Timing	Application location(s)
SCG9	Prior to ground disturbance, a visual inspection would be undertaken for the presence of saline soils. Areas of known or suspected salinity will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with Book 4 Dryland Salinity: Productive use of Saline Land and Water (NSW DECC 2008) to prevent impacts from salinity. Erosion controls will be implemented in accordance with Blue Book (Landcom, 2004).	Pre-construction and construction	All locations
SCG10	Earthworks and construction activities that result in compaction of soils will be limited where possible in areas within 40 metres of the Darling River, Murray River and Great Darling Anabranch to prevent potential impacts to groundwater.	Pre-construction and construction	Transmission line – locations adjacent to the Darling River, Murray River and Great Darling Anabranch
SCG11	A bore condition assessment is to be conducted prior and post construction on GW088454 (nested), GW087531 and GW600452 where required to identify any adverse impact to the bores integrity that may have resulted during construction. If impacts are identified, repair or replacement of the bore will be undertaken in discussion with the registered owner.	Pre-construction and construction	Registered bores GW088454 (nested), GW087531 and GW600452
SCG12	Construction materials, spoil and waste will be suitably stored to minimise the potential for soil, groundwater or water quality impacts.	Construction	All locations
SCG13	The discovery of previously unidentified contaminated material will be managed in accordance with a contamination unexpected finds procedure.	Construction	All locations
Waste management and resources			
WM1	The proposal will aim to achieve a contractor ISCA rating of at least 60 / Excellent.	Detailed design and construction	All locations
WM2	Measures to minimise excess spoil generation will be investigated at detailed design. This would include a focus on optimising the design to minimise spoil volumes and the reuse of material on-site.	Detailed design	All locations
WM3	Opportunities to re-use or recycle construction and demolition waste would be investigated during detailed design.	Detailed design	All locations

Reference	Mitigation measures	Timing	Application location(s)
WM4	All waste will be assessed, classified, managed and disposed of in accordance with the Waste Classification Guidelines (NSW EPA, 2014).	Construction	All locations
WM5	Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities.	Construction	All locations
WM6	All waste generated and surplus spoil to be removed from the construction of the proposal will be transported to appropriately licenced waste disposal or transfer facilities.	Construction	All locations
WM7	Waste during operations would be managed in accordance with TransGrid's existing Environmental Management System and processes for the identification, classification, handling and management of waste.	Operation	All locations
WM8	All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	Operation	All locations
Cumulative impacts			
CI1	Co-ordination of traffic management arrangements between major construction projects will occur in consultation with the relevant road authorities (Transport for NSW and local councils) and/or other proponents as relevant. This will consider any potential conflicts in relation to deliveries and identified haulage routes during the program.	Construction	Silver City Highway and Arumpo Road

23.1.5 Uncertainties and resolution

The proposal as presented in this EIS is conceptual in the sense that a corridor for the proposal has been selected and assessed and final location within the corridor will be subject to further detailed design. As outlined in Chapter 5 (Proposal infrastructure and operation) and Chapter 6 (Proposal construction), the proposal study area and transmission line corridor have been developed to avoid and minimise environmental impacts, while providing flexibility in the detailed design of the proposal and the final construction methodology. As detailed in the EIS, aspects of the proposal that may be subject to further refinement include:

- the final transmission line alignment and design, including the specific location, height and type of transmission line structures, location of access tracks and associated extent of the disturbance area
- the final disturbance area for the Buronga substation upgrade and expansion
- final locations and layouts of the main construction compound and accommodation camp sites, including a potential additional third site in Wentworth (or its surrounds)
- construction method and staging.

These refinements may require further field investigations, such as biodiversity and heritage. Refinements to optimise the design outcomes and construction method would be carried out to:

- further avoid or minimise environmental impacts. This includes approaches to avoid or minimise native vegetation clearing, impacts to areas of biodiversity value, and areas of moderate to high Aboriginal archaeological potential
- reduce impacts on the community during construction and/or operation
- reduce the duration of construction
- improve the operation of the proposal without increasing the potential environmental impacts.

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.

23.2 Sustainability

The Infrastructure Sustainability Council of Australia's (ISCA) Infrastructure Sustainability (IS) rating scheme is an industry-compiled, voluntary sustainability performance rating scheme that evaluates planning, design, construction and operation of a project. The IS scheme drives improved sustainability outcomes for infrastructure and includes Planning, Design, As Built and Operation rating tools. Figure 23-2 shows the assessment tools (rating products).

The proposal, coupled with the EnergyConnect (NSW – Eastern Section), would aim to achieve an overall IS As built' rating of at least 60 / Excellent under the IS Version 1.2 assessment process.

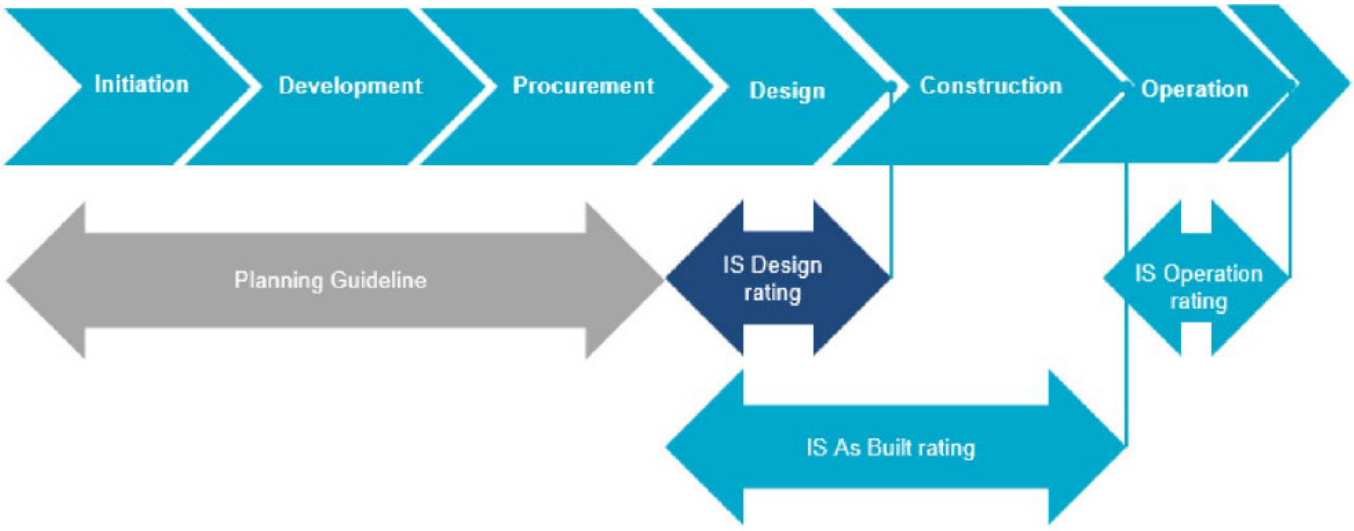

Figure 23-2 ISCA assessment tools across the proposal life cycle (ISCA, 2018)

24. Justification and conclusion

This chapter provides the justification and conclusion to the EIS, and an evaluation of the proposal against the principles of ecological sustainable development and the objects of the EP&A Act.

24.1 Proposal justification

Electricity transmission infrastructure improvement is viewed as the critical link to realising the potential of the renewable energy market and providing energy security futures for the National Electricity Market (NEM) as traditional coal fired power stations are retired. The primary objective for the proposal is to secure increased electricity transmission capacity between South Australia (SA), NSW and Victoria by 800 megawatts (MW) and facilitate the longer-term transition of the energy sector across the 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.

The proposal would have benefits that would be realised across the eastern and southern states of Australia, providing the missing link between the SA and NSW transmission networks and improving the current link to Victoria.

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 enable the efficient sharing of generation resources between regions in the NEM and can encourage more efficient investment in low-cost generation sources, allowing 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.

EnergyConnect would reduce wholesale market electricity costs in SA, 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, EnergyConnect would facilitate an enhanced ability to import low-cost power from NSW, including significant high-quality renewables, providing market benefits by enabling supply in NSW to be met at a lower overall cost as existing coal-fired plant retires.

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 Renewable Energy Zone (REZ). This power can then be exported to SA and NSW via EnergyConnect.

As discussed in Section 2.2.1, 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.

The environmental impacts of the proposal have been assessed, including impacts to biodiversity, Aboriginal and non-Aboriginal heritage, land use and property, landscape character and visual amenity, social and economic, noise and vibration, traffic and access, hazards and risk, soils, contamination and groundwater. The EIS identifies that the proposal would have both potential positive and negative impacts. In particular, the assessment identified that:

- while the proposal has been refined to avoid and minimise impacts on biodiversity, there would be direct impacts to a number of threatened species, and one endangered ecological community (EEC) due to the removal of native vegetation listed under the BC Act. The proposal would also impact EPBC listed species (or their habitat). However, the proposal would unlikely lead to a significant impact on any threatened species or their habitat, or migratory birds (and their habitat) listed under the EPBC Act
- around 26 Potential Archaeological Deposits (PADs), 60 Aboriginal sites (comprising of low and moderate scientific significance), and 17 scarred trees have the potential to be impacted by the proposal, however impacts to Lake Victoria, an area of cultural significance, has been avoided through the selection of the proposed transmission line corridor. Further opportunities to minimise these impacts would be investigated during detailed design
- impacts to listed non-Aboriginal heritage sites would be limited and these impacts would not impact the significance of these sites.

The majority of impacts would occur during construction of the proposal, however some impacts would occur during operation, such as impacts to landscape character and visual amenity. However, these impacts in most instances are considered to be low or moderate, and approaches have been proposed to manage these impacts during detailed design.

A suite of mitigation measures (compiled in Sections 23.1.4) have been identified to guide detailed design, and to manage the construction and operational phases of the proposal. These seek to further avoid and minimise, where possible, the environmental, social and economic impacts of the proposal.

24.2 Ecologically sustainable development

The EP&A Act adopts the definition of ecologically sustainable development contained in the *Protection of the Environment Administration Act 1991*. An assessment of the proposal against the principles of ecologically sustainable development as per clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 is provided below.

Precautionary principle

A range of environmental investigations, as described in Part C of the EIS, have been undertaken during the development of the proposal and the environmental assessment process, to ensure that potential impacts are understood with a high degree of certainty. The assessments undertaken are consistent with accepted scientific and assessment methodologies and have taken into account relevant statutory and agency requirements. The assessments have applied a conservative approach with regard to construction and operational arrangements, and the modelling used. The assessments indicate that there would be no threat of serious or irreversible damage to the environment.

The proposal has evolved to avoid impacts where possible and to reflect the findings of the studies undertaken. Where components of the proposal are subject to detailed design, a worst case impact assessment has been carried out, and a number of environmental mitigation measures have been proposed to further avoid and minimise risks to the environment. No safeguards have been postponed as a result of lack of scientific certainty.

Intergenerational equity

The proposal would provide a more secure electricity supply in the near-term and would facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources, benefiting current and future generations. It would increase economic activity, regional job opportunities and assist in unlocking 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.

The EIS identifies that the proposal has some degree of environmental, social and economic impacts. This includes the removal of native vegetation. A range of mitigation measures have been proposed to further reduce these impacts on the surrounding environment and community. This includes initiatives to deliver benefits to local communities including employment opportunities.

Conservation of biological diversity and ecological integrity

The development and assessment of the proposal has been carried out with the aim of identifying, avoiding, minimising and mitigating impacts to biological diversity and ecological integrity. This has been informed by field investigations.

Where potential impacts cannot be avoided, mitigation measures would be implemented to reduce the impact as far as possible, including further avoidance of high value areas. An offsets strategy has also been developed to compensate for the potential threatened species impacted by the proposal.

Improved valuation and pricing of environmental impacts

The design development and construction planning for the proposal has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process. In addition, the assessment has identified the environmental and other consequences of the proposal, as well as environmental mitigation measures where appropriate to manage potential impacts. If approved, the construction and operation of the proposal would be in accordance with relevant legislation, the conditions of approval and environmental management plans for construction and operation. These requirements would result in an economic cost to the proponent. The application of the environmental mitigation measures would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

The proposal has been developed with an objective of minimising potential impacts on the surrounding environment and would continue to do so during detailed design and delivery. This demonstrates TransGrid's commitment to recognition of the value of protecting environmental resources.

24.3 Objects of the EP&A Act

Table 24-1 summarises the consideration of the proposal against the objects of the EP&A Act.

Table 24-1 Objects of the EP&A Act

Object	Consideration
(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The proposal has considered impacts to the community during design development, and socio-economic impacts of the proposal have been assessed (refer to Chapter 14 (Social and economic)). As discussed in Chapter 3 (Proposal design development), the selection of the preferred corridor aimed to minimise impacts on a range of environmental and land use constraints, and to avoid ecological and culturally sensitive areas. Mitigation measures as summarised in Chapter 23 (Environmental management) would seek to further avoid and minimise environmental social and economic impacts of the proposal.
(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	The principles of ESD have been considered in the planning and development of the proposal as discussed in Section 24.2.
(c) to promote the orderly and economic use and development of land,	The proposal would promote the orderly and economic use and development of land by improving the security of electricity transmission between NSW and SA in the near term and facilitating the longer-term transition to low emission energy generation sources. The proposal would upgrade and extend the existing Buronga substation, and where possible, would use or run adjacent to existing easements, which has minimised impacts on land use and development of land. Where existing easements cannot be used or modified for the proposal, new easements would be created which would assist in promoting the orderly development of land. Mitigation measures have been identified that will further minimise impacts to land uses along the transmission line alignment.
(d) to promote the delivery and maintenance of affordable housing,	The proposal would not impact on the delivery and maintenance of affordable housing.

Object	Consideration
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The selection of the preferred corridor for the proposal considered a range of constraints to avoid and/or minimise the impacts on the environment (refer to Chapter 3 (Proposal design development)), with a particular focus on the avoidance of tier 1 constraints. These included a range of ecological factors such as National parks, ecological conservation areas, and wetlands. The impacts on biodiversity has been assessed in the EIS (refer to Chapter 9 (Biodiversity) and the corresponding Technical paper 1 – Biodiversity development assessment report) in accordance with the Biodiversity Assessment Method. The assessment found that while the proposal has been refined to avoid and minimise impacts to biodiversity values, direct impacts to 59 threatened species or their habitats and one EEC listed under the BC Act would remain. These impacts are mostly attributed to the clearing of threatened flora species within the disturbance footprint of about 607 hectares, 293 hectares of which would not be completely cleared within the easement due to growth under two metres being retained. Only 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 Australian Department of Agriculture, Water and the Environment determined the proposal to be a controlled action under the EPBC Act. The assessment on the relevant Matters of National Environmental Significance found that 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. During detailed design, opportunities to further avoid or minimise impacts will be investigated. This would prioritise the avoidance of areas of high and medium value. Further mitigation measures have also been identified to manage any such impacts, and an offsets strategy will be implemented to address the residual impacts of the proposal on biodiversity.
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The impacts on Aboriginal and non-Aboriginal heritage has been assessed in the EIS (refer to Chapter 10 (Aboriginal heritage) and Chapter 11 (Non-Aboriginal heritage), and the corresponding Technical paper 2). The proposal would avoid direct impacts on built components of listed non-Aboriginal heritage items, and would avoid direct impacts on Lake Victoria, a culturally significant area for the Aboriginal community. However, the proposal, based on the indicative disturbance area, has the potential to directly impact 60 Aboriginal sites (comprising of low and moderate scientific significance), 17 scarred trees and 26 PADs, which include items of moderate and low scientific significance. 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).

Object	Consideration
(g) to promote good design and amenity of the built environment,	There would be impacts on the amenity of the built environment as a result of construction and/or operational impacts, including noise, air (dust) and visual amenity. These impacts would be addressed through the mitigation measures summarised in Chapter 23 (Environmental management). Permanent infrastructure would be designed and operated in accordance with TransGrid's public safety and technical requirements.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The health and safety of workers and occupants of the Buronga substation would be managed in accordance with TransGrid's existing management systems. No other buildings are proposed as part of this proposal.
(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	TransGrid is seeking approval for the proposal under Division 5.2, Part 5 of the EP&A Act. Consultation completed to date is outlined in Chapter 7 (Stakeholder and community consultation), which has included engagement with local governments, State agencies and elected government officials.
(j) to provide increased opportunity for community participation in environmental planning and assessment.	Community and stakeholder consultation has been carried out through all phases of proposal development to date, and will be ongoing during the next phase of design and delivery. Consultation completed to date is outlined in Chapter 7 (Stakeholder and community consultation). The EIS will be placed on public display by DPIE, in which stakeholders and the community will be able to review the EIS and provide submissions on the proposal. Submissions will be responded to by TransGrid within the submissions report. This process provides further opportunity for community participation in the planning and assessment process for this proposal.

24.4 Conclusion

This proposal is an essential component of EnergyConnect, which would enhance the energy transmission link between 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.

EnergyConnect would provide for greater electricity transmission and energy security between the states and facilitate the incorporation of low carbon energy generation into the NEM. This would facilitate lower energy costs for consumers.

Not proceeding with the proposal would reduce the security of the electricity supply in SA and NSW, particularly as coal-fired generators commence retirement. It would also discourage investment in energy generation and storage within REZs the Murray River, Riverland and South West NSW REZs. The provision of appropriate infrastructure to these zones is required to allow 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.

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.

Assessments have been based on the current indicative design and construction methodology for the proposal, and some uncertainties remain. At this stage of assessment, a reasonable worst case assessment has been carried out which indicates that no unacceptable impacts are anticipated, and that despite efforts to avoid and minimise impacts 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.

Overall, the proposal is a critical component in delivering long term benefits to SA and NSW electricity consumers, providing security to the NEM and facilitating the transition to a lower carbon emissions future. On balancing the strategic need and benefits of the proposal with the residual impacts, the proposal is justified.

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