

Mid North SA Renewable Energy Zone

Preparatory Activities – Final Report

30 JUNE 2023

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Revision Record					
Date	Version	Description	Author	Checked By	Approved By
31/3/2023	1.0	Draft report	B. Parker S. Haynes	B. Harrison	
30/6/2023	2.0	Final report	B. Parker	B. Harrison S. Haynes H. Klingenberg M. Bails	B. Harrison

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1 Introduction, context and background

AEMO's 2022 Integrated System Plan (ISP) identified that the Mid North SA Renewable Energy Zone (REZ) has high quality wind and solar resources. Existing transmission infrastructure that traverses the Mid North SA REZ also provides connectivity to the Adelaide Metropolitan load centre for the North SA REZ, Leigh Creek REZ, Roxby Downs REZ, Eastern Eyre Peninsula REZ, and Western Eyre Peninsula REZ.

AEMO's 2022 ISP identified that expansion of the Mid North SA REZ is required in the late 2020s in the *Hydrogen Superpower* scenario and in the early 2030s in the *Step Change* scenario, to facilitate the connection of generation within these REZs. Consequently, the 2022 ISP required ElectraNet to undertake Preparatory Activities, which will inform development of AEMO's 2024 ISP.

This final report provides AEMO with the outcome of the Preparatory Activities that ElectraNet has undertaken for this potential ISP project.

1.1 The Mid North region

The South Australian transmission network is one of the most extensive regional transmission systems in Australia, extending across some 200,000 square kilometres of the State. This network consists of transmission lines operating at 132,000 Volts (132 kV) and 275,000 Volts (275 kV), which are supported by both lattice towers and large stobie poles. It connects the major South Australian load centres with various sources of generation.

The Mid North region lies between Davenport (near Port Augusta, at the northern end of Spencer Gulf) and the Adelaide metropolitan region (Figure 1). Four 275 kV transmission lines traverse the region from north to south, providing strong connectivity between the north of South Australia and the Adelaide metropolitan region. The 275 kV transmission lines overlay and connect to a meshed 132 kV regional transmission network that provides supply and connection for customers in the Mid North. Many existing generators are connected to the 132 kV and 275 kV networks in the Mid North.

Construction of Project EnergyConnect is underway, which will deliver a new HVAC 330 kV interconnector between Robertstown in the Mid North of South Australia and Wagga Wagga in New South Wales. Project EnergyConnect remains on track to be completed in two stages:

- the completion of construction, energisation and commissioning from Robertstown in South Australia to Buronga in New South Wales, with inter-network testing and release of initial transfer capability up to 150 MW by July 2024
- the completion of the second section, from Buronga to Wagga Wagga in New South Wales, energisation and commissioning in late 2024, with inter-network testing and release of transfer capacity up to 800 MW over 12-18 months, subject to market demand.

Opportunities to accelerate inter-network testing timeframes are under active consideration for this project of national significance.

Current load, generator and battery energy storage system (BESS) connection enquiries and applications indicate continued strong interest in new connections across the Mid North, with very strong interest in new connections to Robertstown and Bunday.

There is also strong connections interest on the Eyre Peninsula, which depends on flows through the Mid North region for connectivity to the Adelaide metropolitan load centre and in future to Project EnergyConnect.

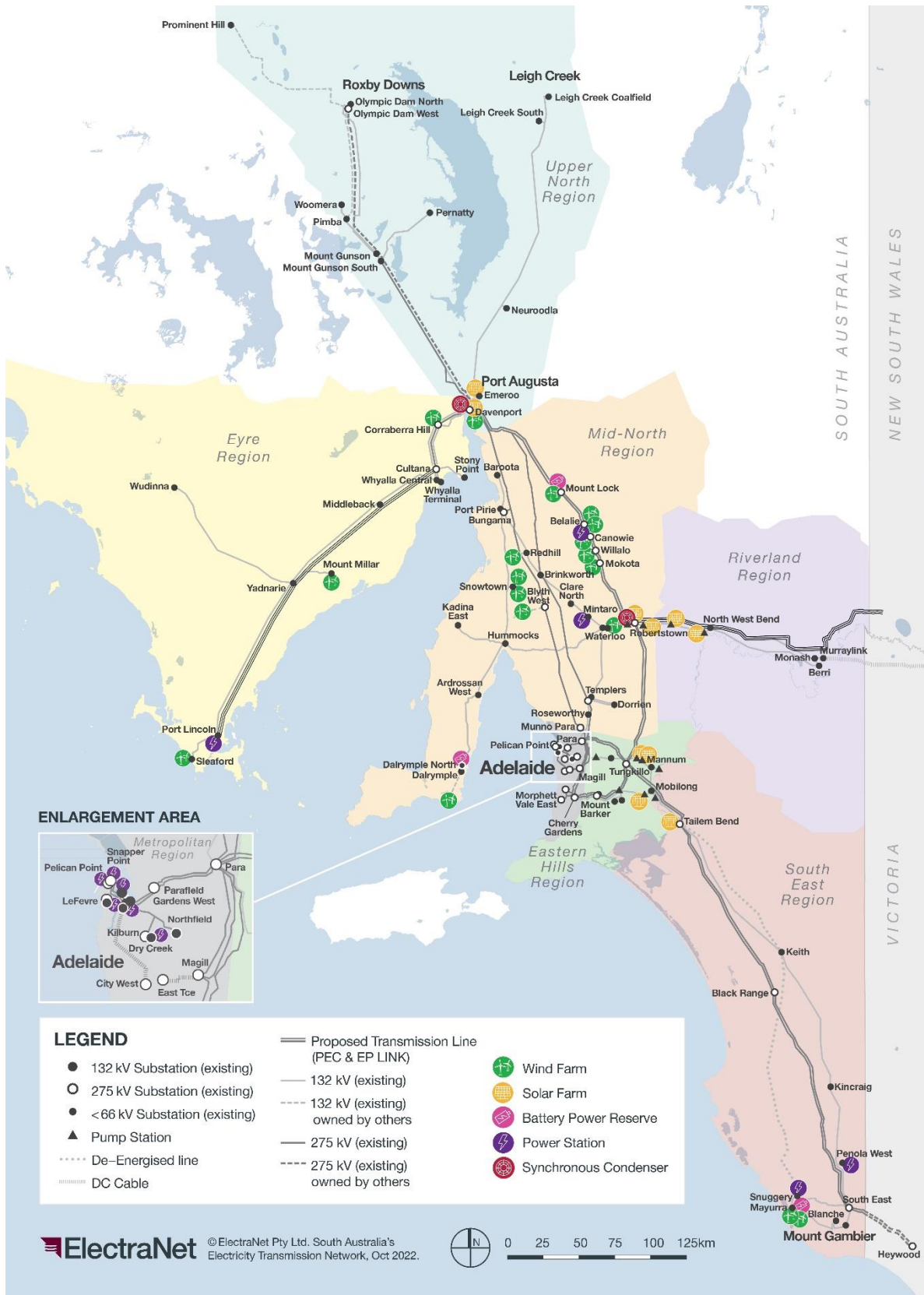


Figure 1 South Australia's electricity transmission system, showing the Mid North region

2 Preliminary engineering design

The preliminary engineering design is to construct:

- new double-circuit, twin-conductor 275 kV lines from Robertstown in South Australia’s Mid North to Para in the Adelaide metropolitan region
- new double-circuit, single-conductor 275 kV lines from Brinkworth in South Australia’s Mid North to cut into the existing Bungama – Blyth West 275 kV line, creating a Bungama – Brinkworth 275 kV line and a Brinkworth – Blyth West 275 kV line
- a new 160 MVA 275/132 kV transformer at Templers West that connects directly to the neighbouring Templers substation via a new 132 kV connection, utilising the exit at Templers for the existing Templers to Waterloo 132 kV line (which is to be de-energised).

2.1 Single line diagrams

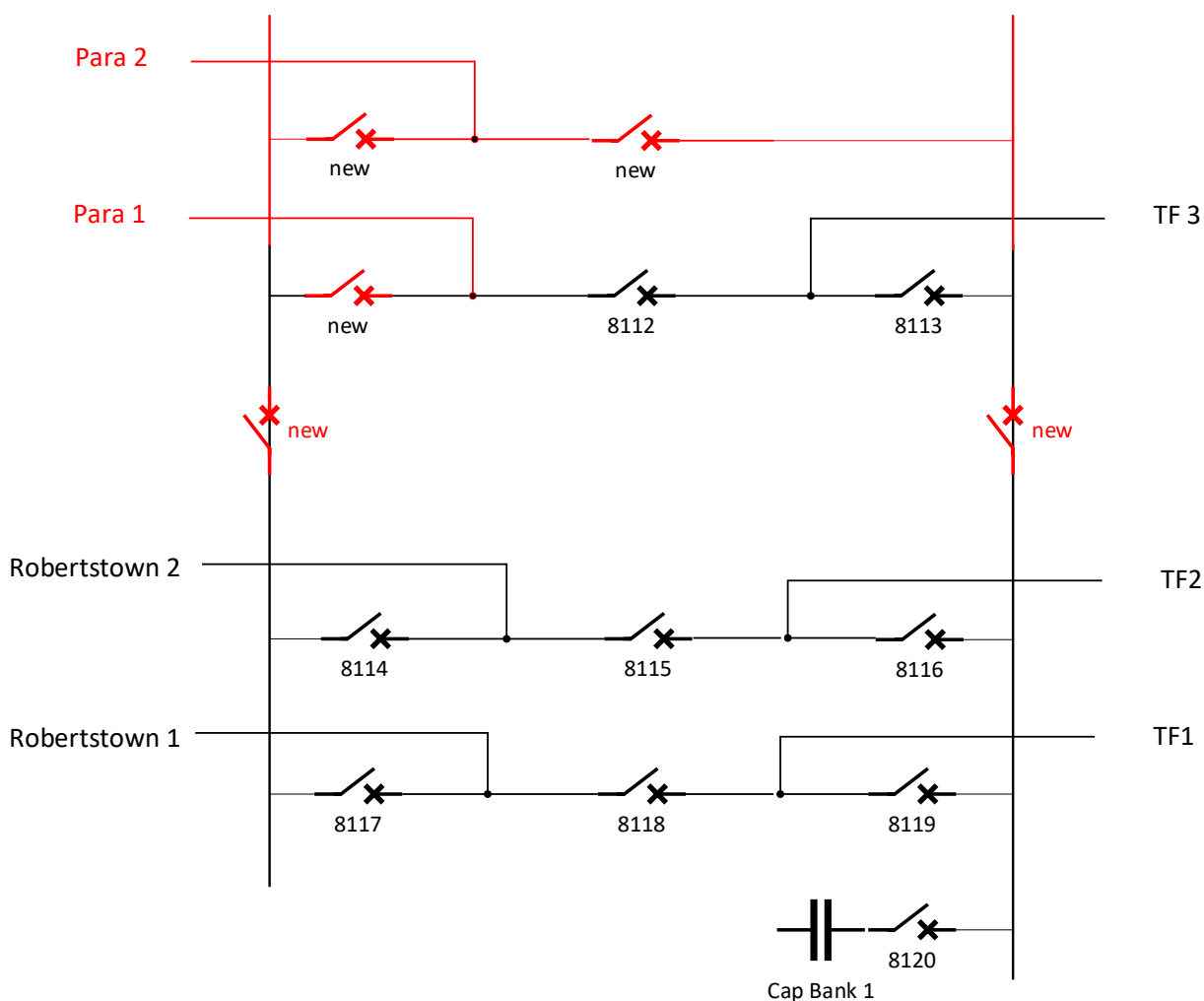


Figure 2 275 kV Works required at Bundey substation (new works shown in red)

Note: Configuration shown in black is following the completion of Project EnergyConnect

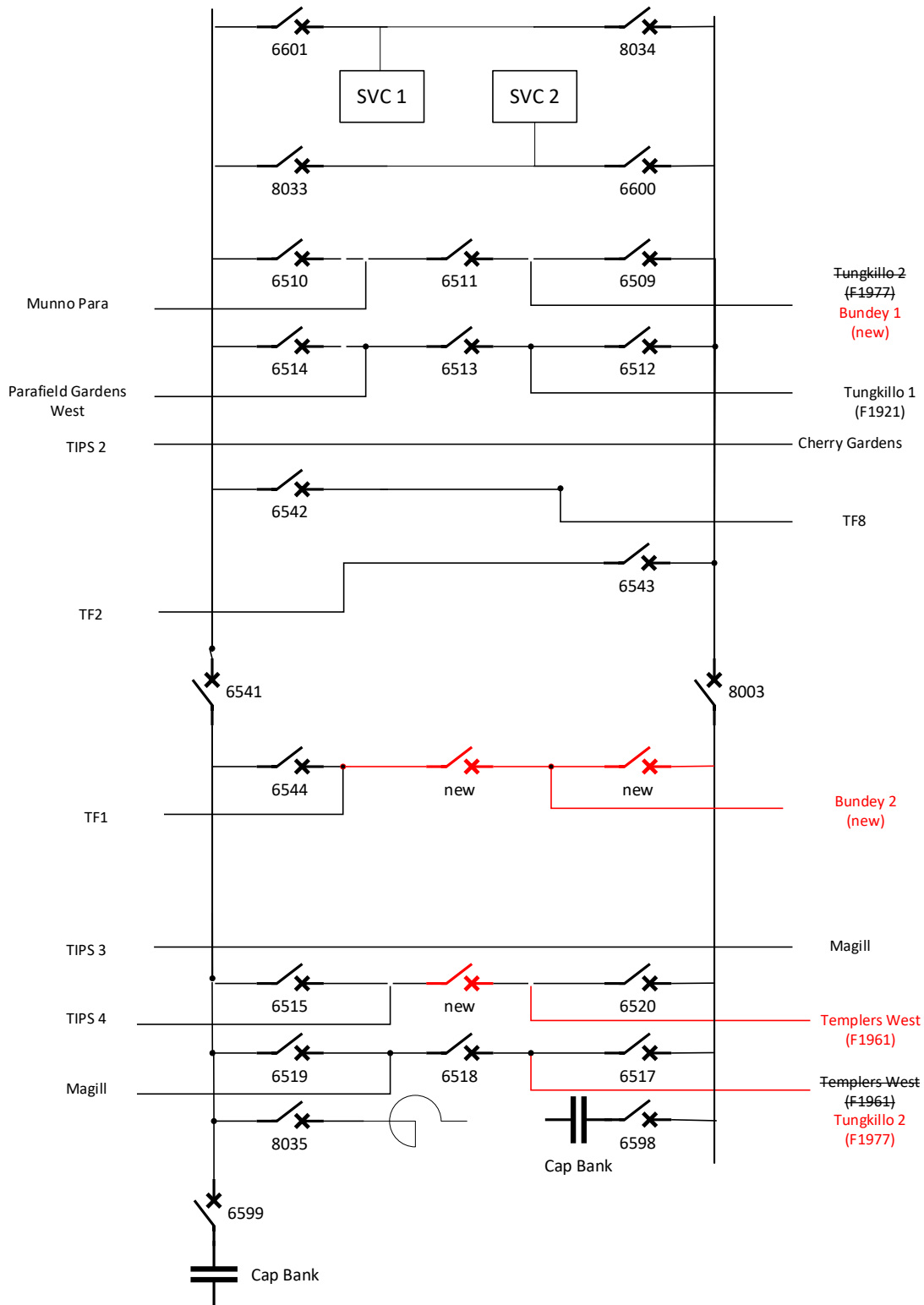


Figure 3 275 kV Works required at Para substation (new works shown in red)

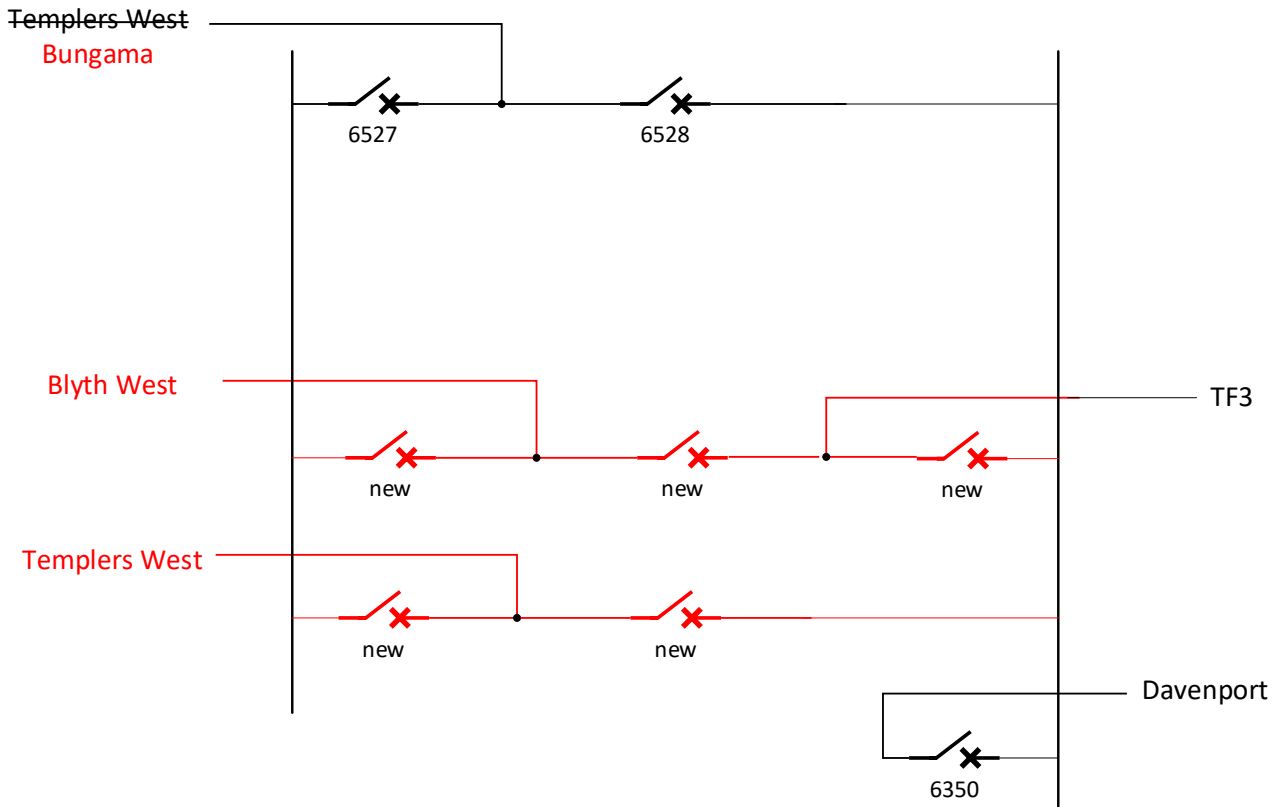


Figure 4 275 kV Works required at Brinkworth substation (new works shown in red)

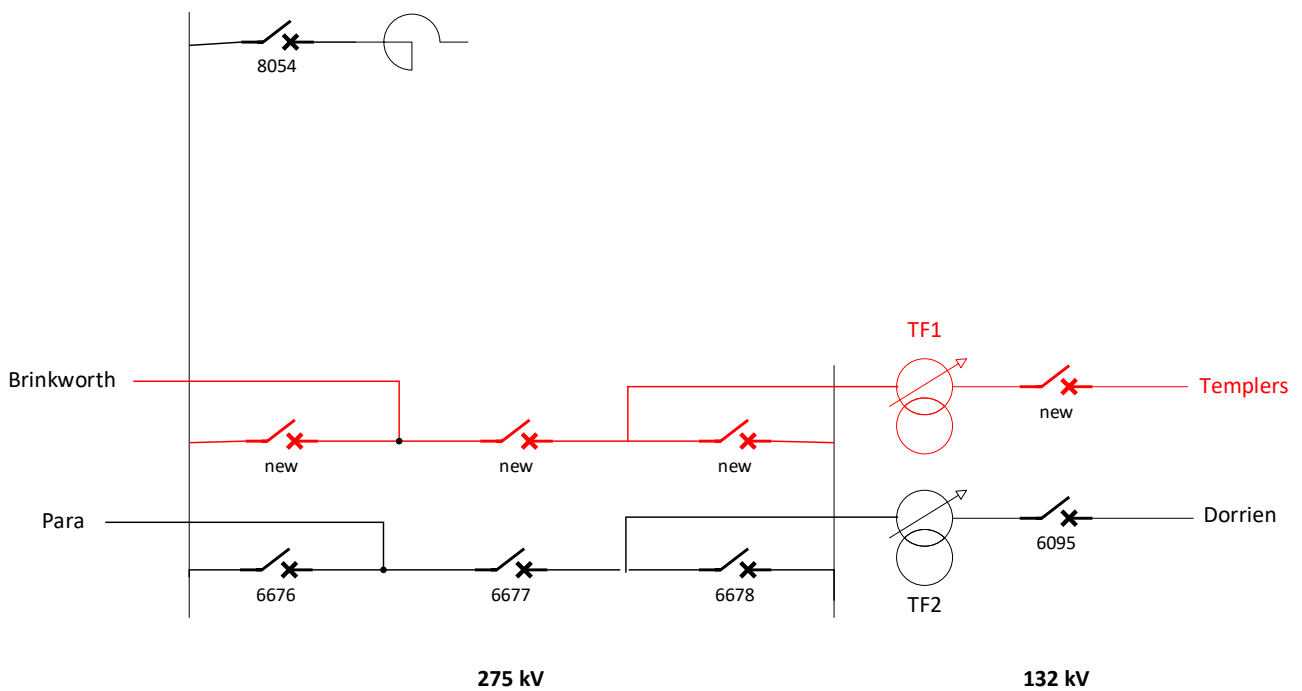


Figure 5 275 kV and 132 kV Works required at Templers West substation (new works shown in red)

2.2 Site layouts

Ultimate layout drawings (Appendix A) for Para 275 kV, Bunday, Brinkworth and Templers West show that each site can accommodate the proposed expansions indicated in section 2.1.

Multiple options for connection exist at Bunday – e.g. if the diameters indicated for expansion in Figure 3 are instead utilised for other connections, there is the capability for the 275 kV buses to be expanded in the other direction to accommodate multiple new diameters. Similarly, there are many options for diameters that can be developed at Brinkworth.

2.3 Asset list

At Para:

- One new 275 kV circuit breaker in an existing diameter, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- Two new 275 kV circuit breakers to complete a new diameter, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- Two new 275 kV line exits, with associated gantries and conductors.

At Bunday:

- Two new 275 kV section circuit breakers in existing buses, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- Two new 275 kV circuit breakers in a new 275 kV diameter, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- One new 275 kV circuit breaker in an existing 275 kV diameter, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- Two new 275 kV line exits, with associated gantries and conductors.

At Brinkworth:

- Three new 275 kV circuit breakers in a new 275 kV diameter, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- Two new 275 kV circuit breakers in a new 275 kV diameter, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- Two new 275 kV line exits, with associated gantries and conductors.

At Templers West:

- One new 160 MVA, 275/132 kV transformer installed adjacent to existing 275/132 kV transformer with associated required plant and infrastructure (e.g. firewall, bund, metering)
- Three new 275 kV circuit breakers in a new 275 kV diameter, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- One new 132 kV circuit breaker, with associated required plant (e.g. CTs, disconnectors, earth switches, secondary systems)
- One new 132 kV line exit, with associated gantries and conductors.

Line works:

- Approximately 130 km of new double-circuit twin-conductor (Sulfur) 275 kV transmission line from Bunday to Para.
- Approximately 6 km of new double-circuit single-conductor (Olive) 275 kV transmission line from Brinkworth to cut into the Bungama – Blyth West 275 kV circuit

- Disconnect existing Waterloo – Templers 132 kV line at each end
- Approximately 250 m of new single-circuit single-conductor (Mango) 132 kV transmission line from Templers West to Templers (utilise new 132 kV exit at Templers West, re-utilise Waterloo exit at Templers).

2.4 Easement assessment and route selection

Connectivity of the Mid-North REZ to the Adelaide Metropolitan load centre will require the construction of a new overhead 275 kV double circuit transmission line from Bunday located in the Mid-North to the Para substation, via Waterloo and Templers (Figure 6).

In identifying a possible line route, ElectraNet has considered the following key social, economic and environmental principles where possible:

- Follow existing transmission lines/easements where possible to consolidate infrastructure corridor and optimise augmentation and maintenance costs
- Minimise distance and number of angles
- Avoid sensitive land uses and built-up areas
- Avoid or minimise route in high bushfire risk areas
- Minimise impacts on vegetation, habitat, heritage and tourism
- follow closely to existing roads or tracks to minimise land disturbance for easier construction and maintenance access.

The proposed route is likely to follow near existing 132 kV transmission infrastructure which traverses predominately Rural zoning and comprises mostly cropping, grazing and intensive animal keeping land uses. Biosecurity management, including weed and pest/disease control, will be important for this project.

The proposed route alignment between Bunday and Para is approximately 130 km in length, and would traverse approximately 300 individual land parcels. Stakeholder Assessment section below outlines other key administrative aspect associated with the route.

ElectraNet would seek to widen easements that we already have for single circuit 132 kV and 275 kV lines to 50 m wide (or seek new easements where deviating away from existing easements) for a 275 kV transmission line to allow for line design requirements. Additional construction work areas will be required which will be managed through access and works licences with individual landholders.

ElectraNet will undertake more detailed assessment of existing easements to identify any opportunities to expand and/or decommission existing 132 kV assets and rebuild with 275 kV infrastructure. For this report, ElectraNet has assumed decommissioning the existing Robertstown-Waterloo 132 kV line (currently de-energised) and varying the easement width could enable construction of the new line along the same route alignment.

The line route may also change with a wider assessment of the potential benefits of this project including reducing the supply impact risk of bush fires to the greater Adelaide region and removing known N-1 generator supply limitations in the metropolitan region.

A more challenging section of the route occurs near the town of Gawler in a suburb called Concordia, approximately 15 km north of the Para substation. Urban growth has resulted in residential development abutting both sides the existing 275kV transmission easement and there is no opportunity to widen this easement. Route options in this location are as follows:

1. Extended line outage/disconnection of F1961 Para – Templers West 275 kV line, decommission the existing line and rebuild new double circuit line in existing easement for the full line between Para and Templers West; or
2. Deviate line route to the east of Concordia by around 10 km (as shown in Figure 6).

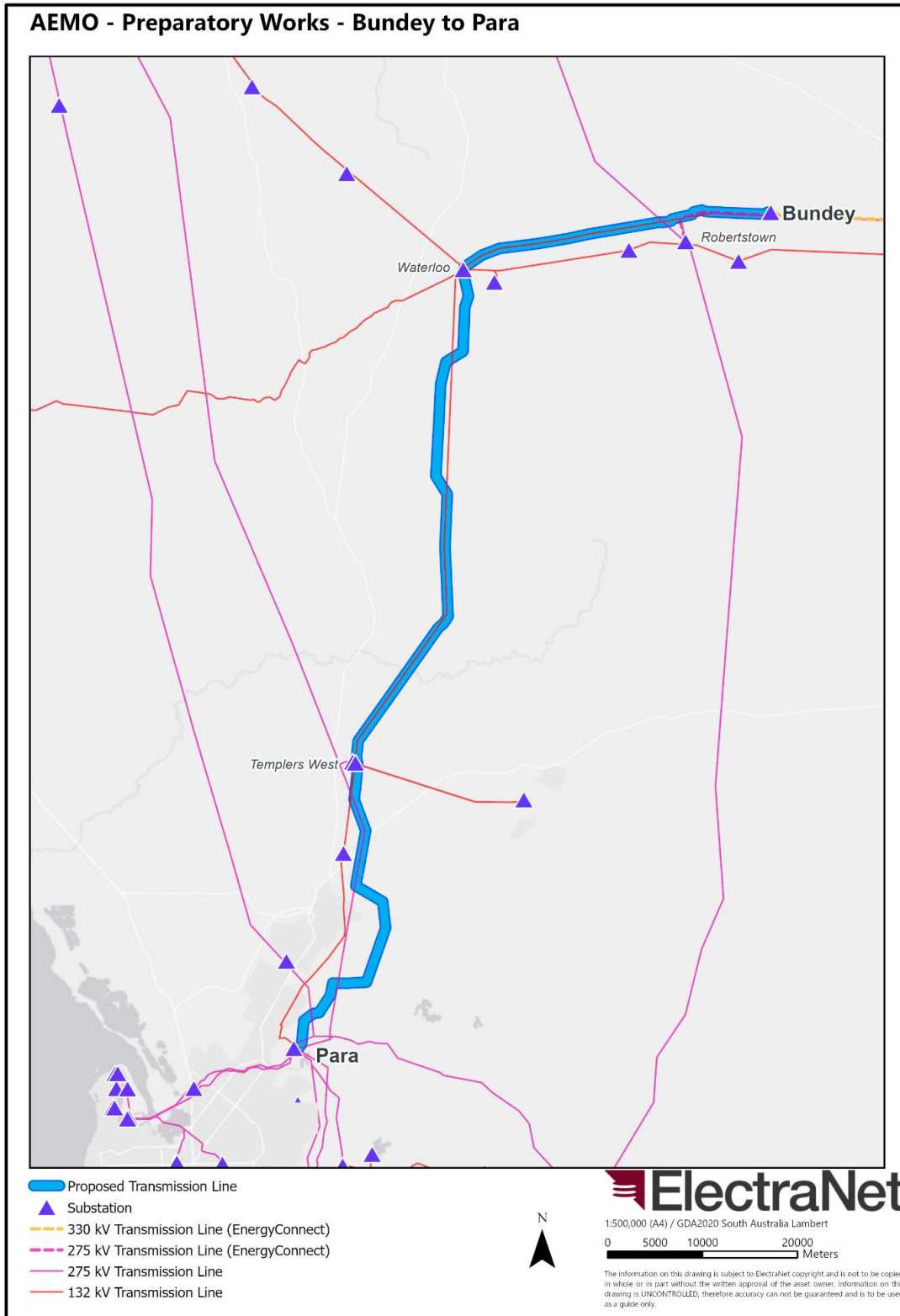


Figure 6 Proposed line route

2.5 Network parameters

Electrical network parameters have been determined to enable the project to be modelled for load flow, fault level and dynamic analysis (Table 1). These parameters are consistent with a 130 km twin Sulfur conductor 275 kV double circuit line (for the Bunday – Para circuits) and with an additional 6 km single circuit Olive conductor double circuit line (for the additional impedances for the Bungama – Brinkworth and Brinkworth – Blyth West 275 kV lines).

Table 1 Loadflow and fault level electrical parameters (per unit, 100 MVA base)

Circuit	R1	X1	B1	R0	X0	B0
Bunday – Para 275 kV No. 1	0.0054	0.050	0.39	0.039	0.15	0.23
Bunday – Para 275 kV No. 2	0.0054	0.050	0.39	0.039	0.15	0.23
Bungama – Brinkworth 275 kV	0.0054	0.035	0.13	0.020	0.09	0.10
Brinkworth – Blyth West 275 kV	0.0023	0.015	0.05	0.008	0.04	0.04
Bungama – Blyth West 275 kV	To be disconnected (reconfigured as a Bungama – Brinkworth 275 kV line and a Brinkworth – Blyth West 275 kV line)					
Waterloo – Templers 132 kV	To be disconnected					

10 Mvar line shunt reactors are to be connected at each end of each circuit.

The new lines between Bunday and Para are expected to each have summer thermal ratings of about 1,100 MVA and are expected to be operated in a secure manner with a combined N-1 rating around 1,100 MVA.

The Bungama – Brinkworth and Brinkworth – Blyth West 275 kV lines will have thermal ratings that match the 451 MVA summer thermal rating of the existing Bungama – Blyth West 275 kV line.

The new 160 MVA 275/132 kV transformer at Templers West will be designed to have electrical characteristics that match the existing transformer.

The new 132 kV connection between Templers West and Templers will have a low impedance due to its short (~250 m) relative distance.

2.6 Option to connect at Robertstown

Connection of the new double circuit lines at Bunday instead of Robertstown is anticipated to increase potential transfer capability, especially if new generator or customer connections to Bunday that are currently being considered become committed.

3 Project schedule and cost estimates

3.1 Schedule

We have developed a high-level project schedule based on the project being identified as actionable in a future ISP (Table 2).

Table 2 High-level project schedule

Activity	Duration of activity	Cumulative duration
Declared as actionable project in ISP	Start of project	Start of project timeline
RIT-T (PADR and PACR) Development applications and approvals Stakeholder engagement	12-18 months	12-18 months
Contingent project application and approval Stakeholder engagement	3-9 months	15-27 months
Project construction Stakeholder engagement	21-27 months	36-54 months

3.2 Cost estimates

Our total class 5b cost estimate for this project is \$416 million (Table 3).

Table 3 Class 5b cost estimate

Item	Estimated Cost
1x new 275 kV line exit at Bunday in existing diameter, including 1x 275 kV circuit breaker bay and 1x 275 kV line exit bay, excluding bench, gantry and overhead strung bus	\$6 million
1x new 275 kV line exit at Bunday in new diameter, including 2x 275 kV circuit breaker bays and 1x 275 kV line exit bay, including bench, gantry and overhead strung bus	\$12 million
2x new 275 kV bus section breakers in existing bus at Bunday, including 2x 275 kV circuit breaker bays, excluding bench, gantry and overhead strung bus	\$5 million
1x new 275 kV line exit at Para in existing diameter, including 1x 275 kV circuit breaker bay and 1x 275 kV line exit bay, excluding bench, gantry and overhead strung bus	\$6 million
1x new 275 kV line exit at Para, including 2x 275 kV circuit breaker bays and 1x 275 kV line exit bay, excluding bench, gantry and overhead strung bus	\$8 million
1x new 275 kV line exit at Brinkworth in new diameter, including 3x 275 kV circuit breaker bays and 1x 275 kV line exit bay, including overhead strung bus and gantry, excluding bench	\$12.5 million
1x new 275 kV line exit at Brinkworth in new diameter, including 2x 275 kV circuit breaker bays, including overhead strung bus and gantry, excluding bench	\$11 million
1x new 160 MVA 275/132 kV transformer at Templers West in new diameter, including 1x 132 kV circuit breaker bay, including overhead strung bus and firewall, excluding bench and gantry	\$12 million
2x new 275 kV line exits at Templers West in existing diameter, including 3x 275 kV circuit breaker bays, 1x line exit bay and new gantry, excluding bench	\$12.5 million
130 km 275 kV double circuit twin conductor (Sulfur) transmission line from Bunday to Para, including land easement and cultural heritage and environmental allowances	\$312 million
6 km 275 kV double circuit single conductor (Olive) transmission line from Brinkworth to cut into the Bungama – Blyth West 275 kV line, including land easement and cultural heritage allowances	\$18 million
250 m 132 kV single circuit single conductor (Mango) transmission line from Templers West to Templers	\$1 million
TOTAL	\$416 million

4 Approvals and stakeholders

4.1 Consumer Advisory Panel

ElectraNet's Consumer Advisory Panel (CAP) was established in 2015.

The CAP is part of ElectraNet's commitment to consumer engagement and the vehicle through which ElectraNet engages and collaborates with consumer representatives on the safety, affordability, and reliability of electricity transmission services in South Australia and the sustainability of ElectraNet's operations.

The overarching purpose of this engagement is to provide meaningful opportunities for input to improve the value of electricity transmission services in South Australia.

More specifically the role of the CAP is to:

- Provide considered advice, feedback and solutions to ElectraNet on significant current or future operational, industry and strategic issues that are of relevance to electricity consumers
- Provide considered advice, feedback, and solutions to ElectraNet on electricity consumer needs, concerns, issues, and services across areas including the energy transformation, network planning and operations, regulated revenue proposals, and transition to future energy markets
- Promote the delivery of lowest long-run cost services to consumers and their communities
- Provide two-way engagement between ElectraNet and consumers
- Assist in the development of a strengthened relationship between consumers and ElectraNet, through fostering open and honest dialogue.

ElectraNet will be engaging with the CAP throughout the planning, delivery and life cycle of all network investments including ISP projects.

The CAP Terms of Reference is attached to this report.

4.2 Estimate of planning approval complexity

ElectraNet's experience has shown that the level of complexity gaining development approval is often representative of the level of early community and stakeholder engagement undertaken. If open, genuine and transparent engagement is undertaken with landholders and community providing clear need for the project and allowing input into the route selection, it is more likely that the approval process will be less complicated.

Constructing new transmission lines near existing lines can reduce some common impacts, such as visual amenity, whilst benefiting from existing access arrangements and consolidating infrastructure to a corridor.

For the Mid-North REZ project, the communities which the proposed route traverses have had existing transmission lines (mostly 132 kV) running through the region for many years and therefore there will be a level of acceptance. This region is recognised for its primary production and landscape qualities and as such, historically there has been opposition to some renewable energy proposals in the region. Given that transmission lines don't significantly impact grazing and cropping activities, which are the predominant land uses in this region, it is not anticipated that obtaining development approval for a new transmission line will be a major obstacle.

As outlined in Section 3.4, the more challenging section between Gawler and Para Substation presents the highest risk of community opposition being built up/urban environments. Early

community and stakeholder engagement, together with clear communication and design requirements will be paramount to the project and approval success.

4.2.1 Environmental approvals

The Department of Climate Change, Energy, the Environment and Water EPBC Act Protected Matters search tool provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act. A search of the proposed line route indicates the possible existence of the following Listed Threatened Ecological Communities:

- Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia
- Iron-grass Natural Temperate Grassland of South Australia
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions
- Mallee Bird Community of the Murray Darling Depression Bioregion

In addition, along the proposed corridor there are approximately:

- 11 possible Threatened bird species
- 14 possible Threatened plant species
- 2 possible Threatened reptile species, including the Pygmy Blue-Tongue lizard.

It will be important during the early design phase to undertake environmental surveys to determine if any of the matters of National Environmental significance exist or are likely to exist along the route, and where possible redirect the route to avoid potential impacts. Depending upon the level of potential impacts, a referral and subsequent approval pursuant to the EPBC Act may be required.

There are no Commonwealth land or heritage locations impacted by the proposed route.

In addition to the EPBC listed species, it is likely that there will be a range of State protected species which may be impacted and require associated approval to clear or disturb.

4.2.2 Planning approvals

There are four possible approval pathways for the Mid North REZ project under the *Planning, Development and Infrastructure Act 2016* (PDI Act) in South Australia.

1. Approval by councils through the standard development assessment provisions
2. Essential Infrastructure pathway
3. Crown Development pathway (depending if proposed Regulation changes currently being considered don't allow transmission lines >5km to be assessed under Essential Infrastructure pathway)
4. Impact Assessment - if declared by Minister.

The standard development assessment provisions are not recommended (pathway 1 above) given the route passes through multiple council areas, each of which would require a separate approval. Table 4 provides a comparison of the other assessment pathway options. It assumes that assessment under the Impact Assessment provisions would be by environmental impact assessment.

Table 4 Comparison of Major Development and Crown Development or Essential Infrastructure Assessment Processes

Stage	Impact Assessment Process (Pathway 4)	Crown Development (Pathway 3) or Essential Infrastructure process (Pathway 2)
Declaration	Minister must declare a proposal to be a Major Development in the Government Gazette	The proposal meets the requirements for this section to apply. No declaration is required. Where a private sector developer is sponsored by a State Agency for the purposes of essential infrastructure, the application must be prepared and lodged by the state agency in accordance with the requirements of the PDI Act
Guidelines and level of assessment	State Planning Commission (the Commission) decides on assessment criteria that must be addressed in the Environmental Impact Statement (EIS) and level of assessment (e.g. standard or detailed) required. Process typically takes 2-3 months but can take longer	There are no specified levels of assessment and guidelines are not prepared
Public exhibition	EIS is prepared and exhibited for at least 30 business days. The Minister may also undertake, or require the applicant to undertake, any other consultation in relation to the EIS as the Minister sees fit, in accordance with the Commission's Community Engagement Charter	The assessment is included in a development application which is exhibited for at least 15 business days
Response to submissions	Proponent responds to issues raised in submissions received during the public exhibition timeframe via a formal Response Document which forms part of the documentation assessed by the Commission	There is no legislated requirement for the proponent to respond to issues raised in submissions but it is standard practice for the proponent to directly respond to each submitter. This does not form part of the documentation assessed by DPTI
Public hearings	Submitters do not have the opportunity to be heard after the public exhibition process has been completed	A submitter has the opportunity to appear before State Commission Assessment Panel (SCAP)
Assessment report	Minister prepares an assessment report	SCAP prepares an assessment report
Decision	Decision by Governor	Decision by Minister (or Delegate)
Appeal	No appeal rights, and prohibition on taking any proceedings against the decision (e.g. Judicial Review)	No appeal rights

4.3 Stakeholder assessment

There is a diverse range of anticipated stakeholders along the proposed route (Table 5).

Table 5 Anticipated stakeholders

Group	Key Stakeholders
Landholders	Approximately 300 land parcels and 190 landholders
Native Title Groups	Kaurna Peoples Native Title Claim Ngadjuri Nation #2
Local Government areas	City of Playford Town of Gawler Council Light Regional Council Clare and Gilbert Valleys Council The Regional Council of Goyder
Federal Electorates	Spence (Matt Burnell MP, Labor) Barker (Tony Pasin MP, Liberal) Grey (Rowan Ramsey MP, Liberal)
State Electorates	King (Rhiannon Pearce MP, Labor) Schubert (Ashton Hurn MP, Liberal) Light (Tony Piccolo MP, Labor) Frome (Penny Pratt MP, Liberal)
National Parks and Wildlife Regions	Adelaide and Mount Lofty Ranges Yorke and Mid North
Energy Sector	Energy generators and relevant industry associations
Local and Regional Community	Communities and local suppliers
Federal and State Government Agencies	This includes regulatory agencies and broader agencies e.g. Department of Climate Change, Energy, the Environment and Water (Cth), Department of Trade and Investment (DTI) and Department of Premier and Cabinet (DPC), Department for Environment and Water (DEW), Department of Primary Industries and Regions (PIRSA), Infrastructure SA etc.
Energy Regulator	Australian Energy Market Operator (AEMO), Australian Energy Regulator (AER)
Industry Representative Bodies	National Farmers Federation, Primary Producers SA, tourism bodies, winery and growers' associations
Environment	Conservation Council, Birdlife Australia, local environment groups

4.4 Stakeholder engagement plan

We have developed a high-level plan that defines the indicative points of stakeholder and reputation engagements that should occur with each stakeholder group at each stage of the Project lifecycle (Table 6). This plan would be further developed with a range of Stakeholder and Reputation Management activities together with an assessment of stakeholder priority levels.

Table 6 Stakeholder engagement plan

Stakeholder Group	PADR	Prior to DA Submission	Statutory Notification Period	Assessment Process	Project Approved	Construction	Operations
Commonwealth and State Government							
Local Government							
State / Federal Political Reps							
Consumer Advisory Panel							
Landholders, major land users, Traditional Owners							
Local community and suppliers							
Industry Associations							
Advocacy Groups							
Regional Service Providers							
Media							



Appendices

Appendix A Ultimate Site Single Line Diagrams

In the following single line diagrams, black represents existing plant and equipment, red represents potential future plant and equipment in the site's ultimate development.

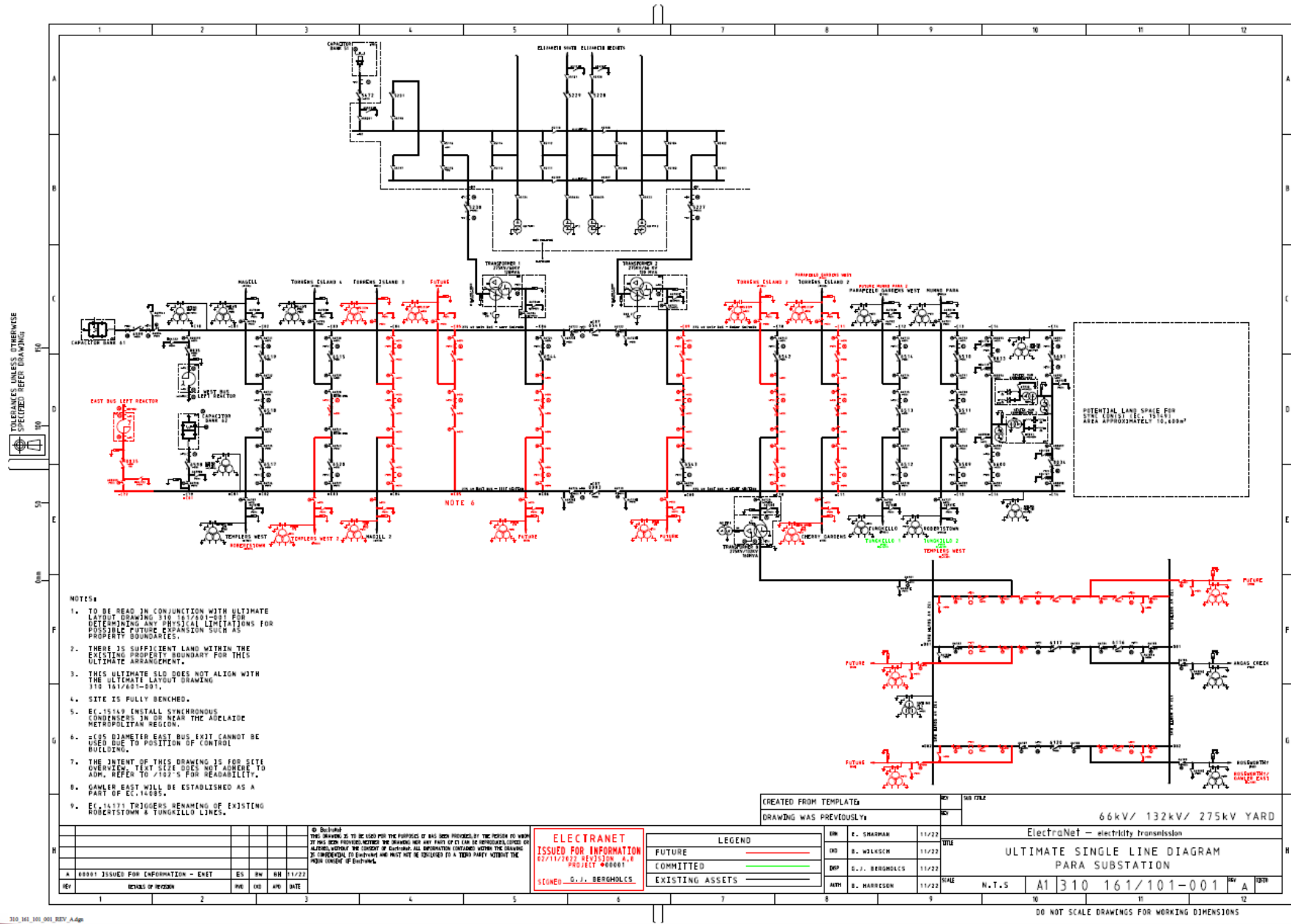


Figure 7 Para 275 kV ultimate single line diagram

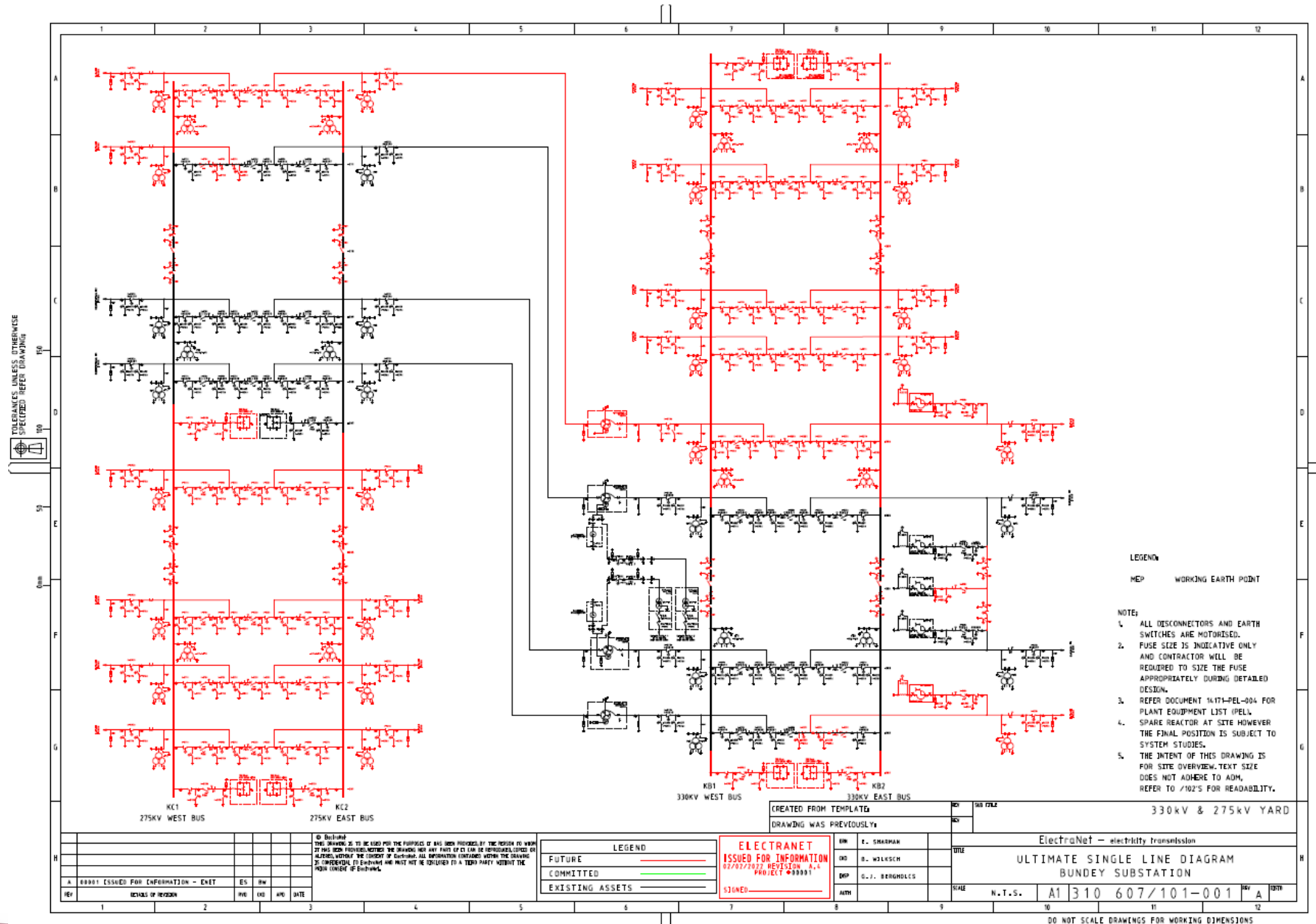


Figure 8 Bunday ultimate single line diagram

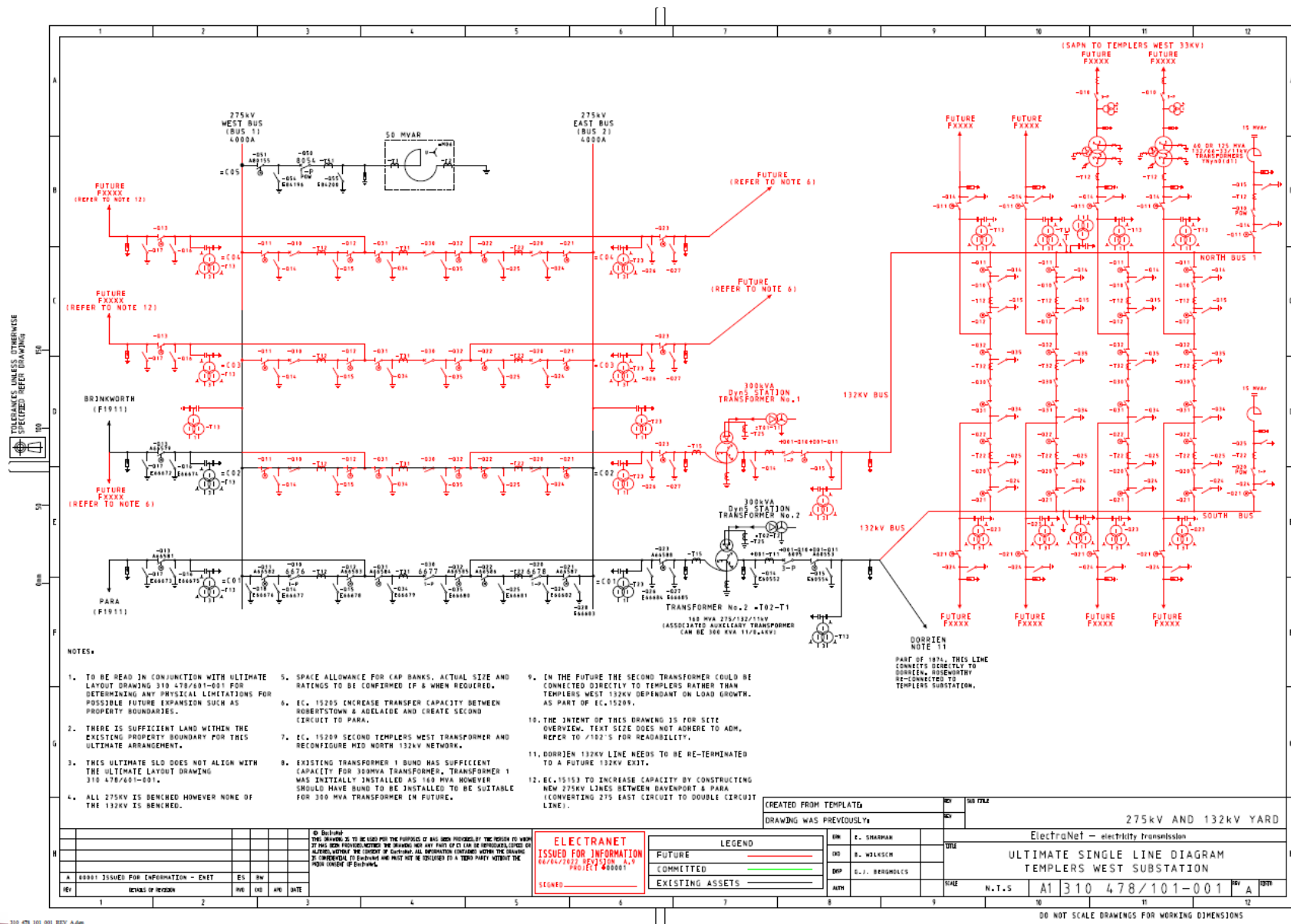


Figure 10 Templers West ultimate single line diagram

