



SCOPE OF WORKS

Eyre Peninsula Reinforcement

May 2020

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Document Reference Code

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Glossary of Terms

Table 1: Glossary of Terms

Term	Description
AC	Alternating Current
ACSR/AC	Aluminium Conductor Steel Reinforced, Aluminium - Clad
AEMO	Australian Energy Market Operator
BCU	Bay Control Unit
BDAC	Barngarla Determination Aboriginal Corporation
CB	Circuit Breaker
CBF	Circuit Breaker Fail
CPS	Customer Performance Standards
CT	Current Transformer
CVT	Capacitor Voltage Transformer
DC	Direct Current
FTP	Fibre Termination Panel
GLD	Generation Dispatch Limiter
GPS	Generator Performance Standards
GPS	Global Positioning System
HMI	Human Machine Interface
IED	Intelligent Electronic Device
LV	Low Voltage
MVAr	Mega Volt Amps
NER	National Electricity Rules
OPGW	Optical Ground Wire
PSCAD	Power System Computer Aided Design
PSPM	Power System Performance Monitor
PSS/E	Power System Simulator for Engineering
SAPN	SA Power Networks
SAS	Substation Automation System
SC/AC	Steel Conductor / Aluminium Clad
SCADA	Supervisory, Control and Data Acquisition
SC/GZ	Galvanised Steel Conductor
SLD	Single Line Diagram
SMOF	Single Mode Optical Fibre
SMSC	System Monitoring and Switching Centre
SPAR	Single Pole Auto Reclose
TPAR	Three Pole Auto Reclose

1. Overview

The *EC.14172 Eyre Peninsula Reinforcement* Project's objectives are to improve network reliability and capacity in the region by replacing the deteriorated Cultana to Yadnarie and Yadnarie to Port Lincoln Terminal 132 kV transmission lines and avoiding the costs of continuing the network support arrangement at Port Lincoln Terminal.

The scope of the Project consists of the replacement of an existing radial 132 kV line from Cultana to Port Lincoln Terminal with a new double circuit line. The new transmission infrastructure will comprise a new 136 km long double-circuit line from Cultana to Yadnarie designed and built for 275kV operation but initially energised at 132 kV. The second section will be a new 126 km long double-circuit line from Yadnarie to Port Lincoln designed and built for 132 kV operation.

Brownfield substation works will be required at Cultana, Port Lincoln Terminal, Yadnarie, Middleback and Wudinna Substations. At Yadnarie, the integration of new lines to the existing Yadnarie Substation will utilise the existing F1810 and F1811 exits. A new connection to Middleback will be established as a tee from the new line and a 5 MVAR reactor will be deployed at the existing Wudinna substation.

The new electrical infrastructure will result in a robust Lower Eyre Peninsula transmission system able to support current and future increase in demand due to population growth, agricultural, commercial, mining and industrial development. Furthermore, the increased network capacity will be able to support the connection to the electricity grid of potential renewable energy generators in the Lower Eyre Peninsula region.

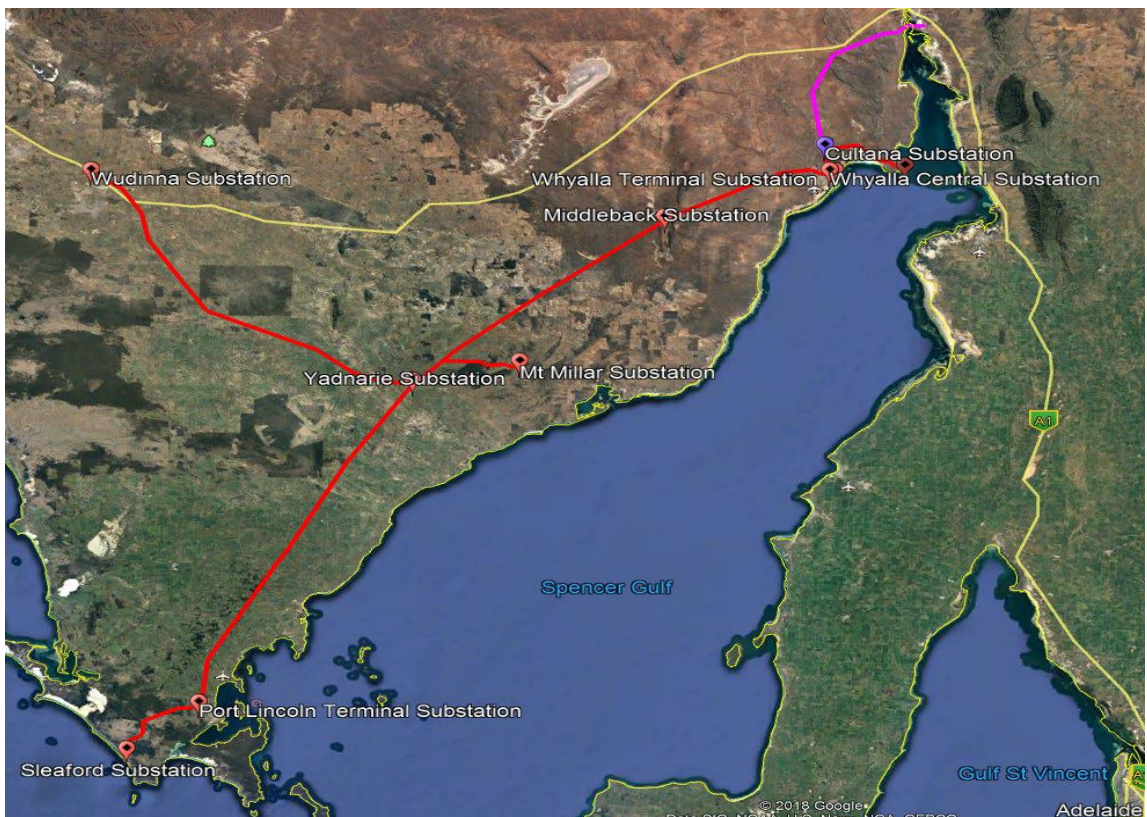


Figure 1: Eyre Peninsula Transmission Network

2. Environmental, Planning, Cultural Heritage, Native Vegetation, Approvals and Stakeholder and Community Engagement

2.1 Environmental and Planning Approvals

The Eyre Peninsula Reinforcement Project will require the following environmental and planning approvals under both South Australian and Commonwealth legislation:

1. Development Approval will be obtained for the construction of the new lines and augmentation or extension of existing yards under the Development Act 1993 (SA)/ Planning, Development and Infrastructure Act 2016 (SA);
2. An application will be lodged pursuant to the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 assessed by Commonwealth Department of the Environment and Energy and the State Government Department for Environment and Water DEW to cover any significant trees, natural wetlands, mangrove swamps, protected species habitat and State Heritage items or places;
3. Native Title consent will be obtained from the Native Title owners under the Native Title Act 1993 (SA) and Crown Lands Management Act 2016;
4. Construction Licences will be obtained for infrastructure works on Crown Land under the Crown Lands Management Act 2016;
5. Notification of landholders for access pursuant to the notice of entry requirements in the Electricity Act 1996 (SA).

2.2 Cultural Heritage

Consultation will be held with Traditional Owner Groups and Cultural Heritage surveys will be undertaken with the Barngarla Determination Aboriginal Corporation (BDAC) to obtain the required approvals under the Aboriginal Heritage Act 1988. Additionally, the following actions will be taken:

1. Further cultural heritage surveys will be undertaken during the Project development with BDAC to ensure that the Project does not impact sites, objects or artefacts;
2. Native Title consent will be obtained from the Native Title owners under the Native Title Act 1993 (SA) and Crown Lands Management Act 2016. The negotiations and agreements will include compensation for potential impacts to native title and employment opportunities for indigenous people;
3. Cultural Heritage Management Plan will be developed in consultation with BDAC.

2.3 Native Vegetation Clearance Application and Approvals

1. Native Vegetation surveys will be carried out along the entire alignment over a survey strip wider than the proposed line easement:
2. Native Vegetation clearance approvals will be obtained under the Native Vegetation Act 1991 (SA);
3. The Project will develop various environmental management plans that will cover vegetation management in one form or another. These will include; the Construction Environmental Management Plan, Threatened Species Management Plan and Weed Management Plan.

2.4 Stakeholder Engagement and Community Consultation

Key stakeholders for the Project include Commonwealth and State Government agencies, local councils, traditional owners, landowners, specialist interest groups, conservation bodies, regional development agencies, third party asset owners, consumers, generators, etc. To manage stakeholder interests and expectations, the Project will:

1. Undertake stakeholder engagement to meet regulatory requirements set out in the Development Act 1993; and
2. Provide stakeholders with a range of engagement and communication opportunities to enable accessible and genuine participation in the line route optimisation and project development processes.

3. Route Selection, Land Purchase and Easement Acquisition

The land and easements required for the delivery of the project have been acquired under a separate project which commenced in the 2013-2018 regulatory period as part of the strategic land acquisition program approved by the AER. All required land parcels have been secured, and the remaining easement negotiations are nearing finalisation under that project.

A new 100m wide easement has been established on the western side of the existing 132 kV easement from Cultana to Port Lincoln Terminal as illustrated in Figure 2.

About 20 to 25 km north of Port Lincoln, the new line route follows various deviations to align with local conditions. Also, for the last 5 km into Port Lincoln Substation, the new line easement overlaps with the existing line easement. Construction staging and temporary line arrangements will be required to construct and commission the new line along this section while maintaining supply to customers.

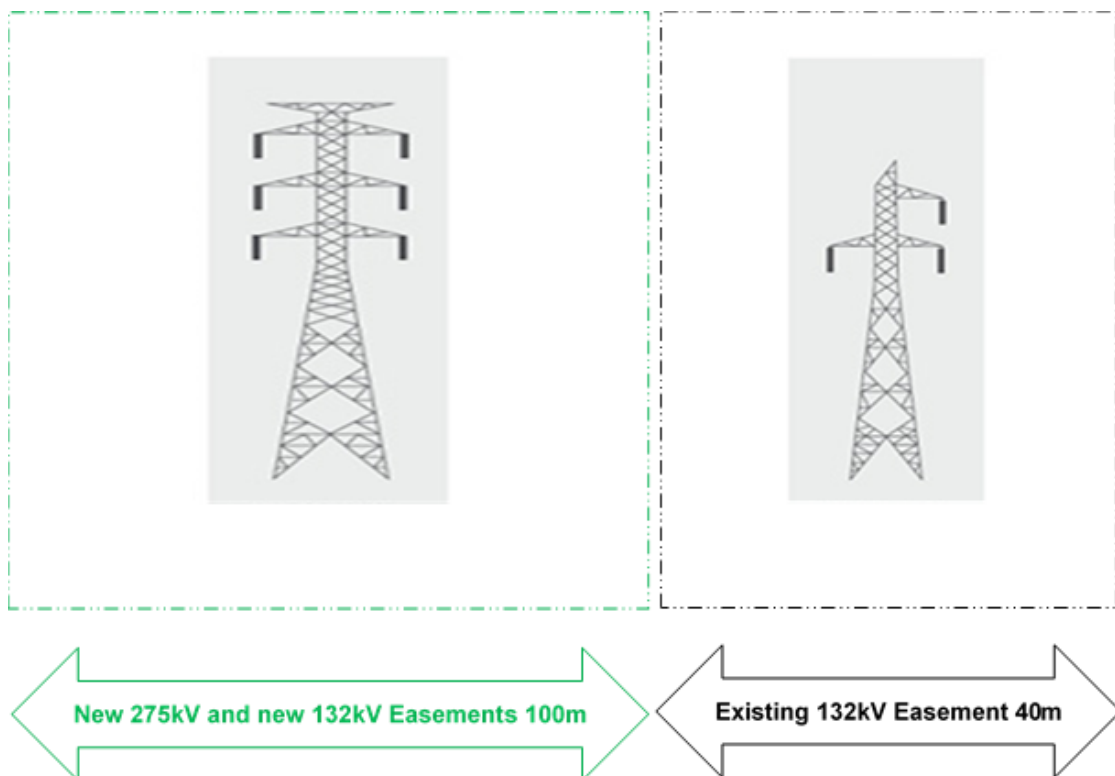


Figure 2: Proposed Line Easement Illustration

3.1 Line Route Optimisation

The Project will complete the finalisation of the line route and easement corridor to optimise the alignment for the proposed double circuit line, giving due consideration to cultural heritage, environmental/ native vegetation impact, technical, land access, social, economic and stakeholder factors together with any additional line deviations required to accommodate specific local requirements.

3.2 Land Access for Construction Works

The Project will carry-out the following activities to finalise land access for the construction works:

- a) Costs related to compulsory acquisition, should this become necessary to secure any final easements, noting that it is only possible to seek Ministerial approval to exercise compulsory acquisition powers where there is a demonstrated need and timing driver in connection with the current network project;
- b) Costs incurred by landowners related to operational costs and loss of revenue, such as crop damage and impacts on stock;
- c) Landowner infrastructure and property costs impacted by the construction works, including gate replacements (the existing line and access infrastructure is more than 50 years old), relocation of fences, relocation of water troughs and tanks, relocation of sheds and small infrastructure items;
- d) Pastoral track repair and remediation;
- e) Negotiation and agreement of Infrastructure Works Plans with each landowner covering farm rules and property specific requirements for the construction activities; and
- f) Temporary access Licences for temporary lines.

4. Transmission Lines

4.1 New Transmission Lines

The overhead transmission line scope of works required to replace the existing radial 132 kV line (F1810 / F1811) from Cultana to Port Lincoln Terminal is illustrated by the system diagram in Figure 3 and summarised below:

- a) Design, construction and commissioning of new F1882 (west) and F1883 (east) that will form the double circuit line from Cultana to Yadnarie (initially energised at 132 kV, built for future energisation at 275 kV):
 - (i) Approximately 136 km long;
 - (ii) New line corridor generally adjacent to existing easement; extension of easement on northern and western sides of Cultana to access northern exits from 132kV yard; and
 - (iii) New double circuit exits at Cultana, modification of single circuit exits at Middleback and Yadnarie.

- b) Design, construction and commissioning of new F1882 (west) and F1879 (east) that will form the double circuit 132 kV line from Yadnarie to Port Lincoln Terminal:
 - (i) Approximately 126 km long;
 - (ii) New line corridor adjacent to existing easement; and
 - (iii) Modifications of the single circuit exit at Yadnarie; modification of an existing exit and addition of a new exit to establish new double circuit exits at Pt Lincoln.

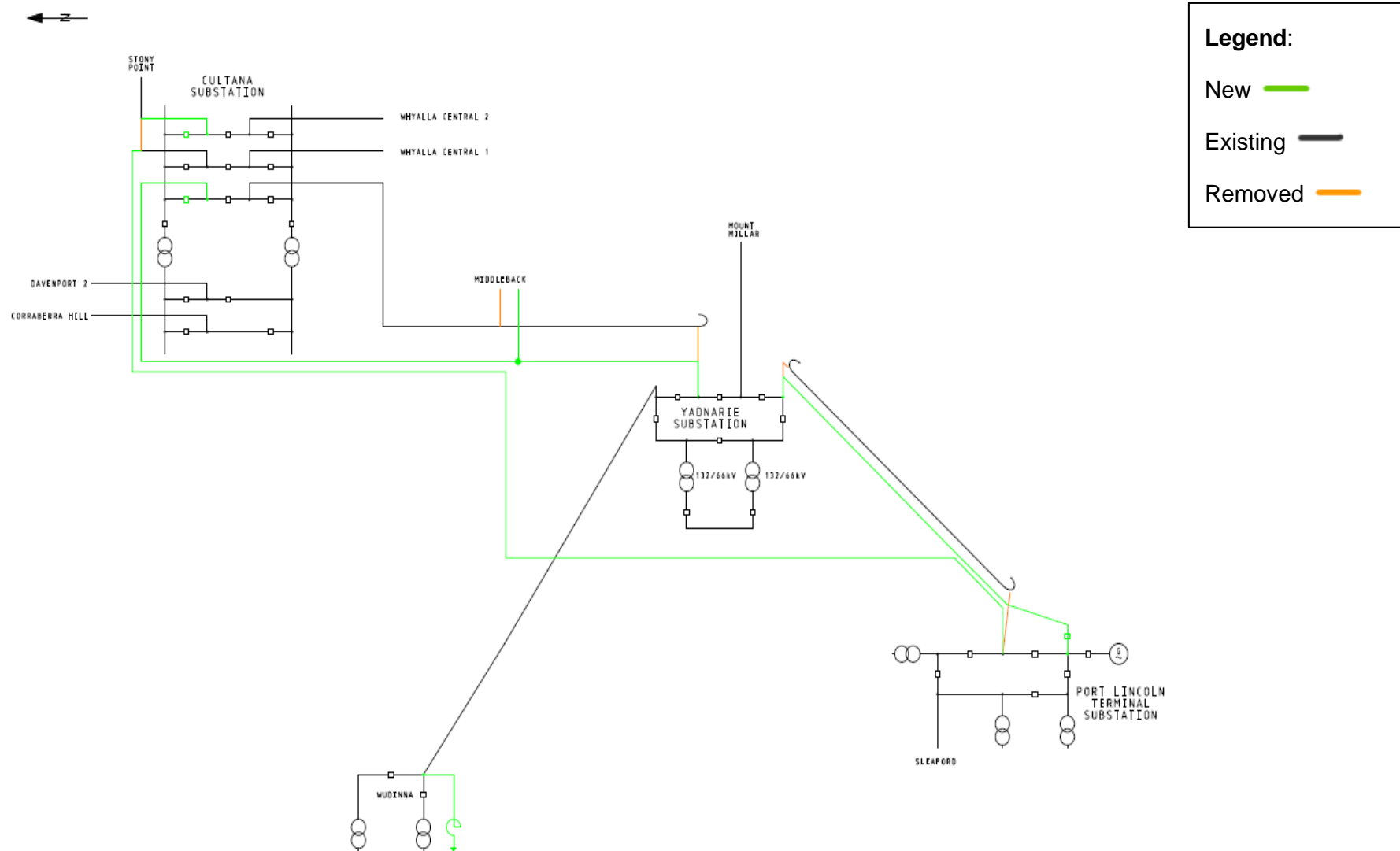


Figure 3: System Diagram for the New Double Circuit Transmission Line

4.2 Existing F1810 / F1811 Modifications and Temporary Bypass Lines

The scope includes modification and/or removal (and safe disposal) of sections of existing F1810 and F1811 transmission lines via the creation of temporary deviations to allow the construction of the new line. The new lines will make use of the existing alignments:

- a) F1811 Yadnarie to Port Lincoln Terminal 132 kV transmission line: -
 - (i) Temporary line deviation at Pillaworta Hill (vegetation protection);
 - (ii) Temporary line deviation at Whites Flat (to avoid built-up rural settlement);
 - (iii) Temporary line deviations at Boston (to avoid built-up area of the greater Pt Lincoln residential zone within 5km of the substation);
 - (iv) Sections of this existing line will be removed and the existing structures that demarcate the removed sections will be made safe using back stays and structure reinforcement as determined by the approved design.
- b) F1811 Yadnarie to Port Lincoln Terminal 132 kV transmission line: -
 - (i) Modification of existing F1810 exits at Middleback;
 - (ii) Modification of existing F1810 and F1811 exits at Yadnarie;
 - (iii) Modification of the existing of F1811 exit at Port Lincoln Terminal;
- c) Relocation of F1844 Stony Point exit from the northern end of diameter D03 to the northern end of diameter D04 in the 132 kV yard at Cultana Substation.

4.3 Line Tee-offs

Middleback substation will be connected to the new double circuit line from Cultana to Yadnarie via a line tee-off on the eastern circuit (F1883), creating a three-ended-tee; Cultana – Middleback – Yadnarie.

4.4 Overhead Line Materials

New overhead line conductors, Insulators, Line Hardware, OPGW and Earth Wire for feeder segments shall be installed for all lines including temporary lines and landing spans to Cultana, Middleback, Yadnarie and Port Lincoln Terminal.

4.4.1 275 kV line segments (Cultana - Yadnarie)

Phase conductor will comprise:

- a) Double circuit, simplex bundle 54/7/3.5 ACSR/AC (Code name Hurdles);
- b) Insulators: toughened glass discs;
- c) 1x earth wire OPGW (AFL DN8027);
- d) 1 x earth wire 19/2.75 SC/AC.
- e) Structures: new / existing suite of 275 kV double circuit lattice structures including suspension, angles, strain and termination types (steel mono poles will be used at selected locations along the line route);

- f) Structure Foundations: generally bored pile foundations, with variations to suit line geology and ease of access with equipment / construction materials.

4.4.2 132 kV line segments (Yadnarie - Pt Lincoln Terminal)

Phase conductor will comprise:

- a) Simplex bundle 54/7/3.0 ACSR/AC (Code name Golf);
- b) Insulators: toughened glass discs;
- c) 1x earth wire OPGW (AFL DN8027);
- d) 1 x earth wire 19/2.75 SC/AC;
- e) Structures: new / existing suite of 132 kV double circuit lattice structures including suspension, various angles and termination types (steel mono poles will be used at selected locations along the line route);
- f) Structure Foundations: generally bored pile foundations, with variations to suit line geology and ease of access with equipment / construction materials.

4.4.3 Temporary Line Deviations (Pillaworta, White Flats and Boston): -

Temporary line deviations will be constructed with ACSR/AC and SC/GZ conductor and structure type(s) adequate for the short duration of service (steel towers / poles, Stobie poles or timber poles).

4.4.4 The Landing Spans

The Landing Spans shall have:

- a) Twin earth wire for each feeder F1882 and F1883 at Cultana;
- b) Twin earth wire for F1883 at Yadnarie;
- c) Twin earth wire for F1879 at Yadnarie and Port Lincoln Terminal;
- d) Twin earth wire F1882 at Port Lincoln Terminal; and
- e) SC/AC earthwire size shall be subject to review against line fault rating.

4.5 Access Roads, Construction Pads and Lay-down Areas

The Project includes significant scope related to the installation of access roads to each transmission line structure or work site, construction pads for structure erection and stringing, as well as camps and material lay-down areas. Existing access tracks will require significant upgrades to suit heavy equipment associated with transmission line construction activities.

The following estimated quantities help to qualify the size of the scope associated with the access roads and associated with construction enabling infrastructure required for the Project:

- a) About 30 km of heavy access road for areas that are loose sand or are muddy when wet;
- b) About 170 km of new standard access track for dry and stable soils;

- c) About 120 km of existing access tracks to be upgraded for construction;
- d) About 260 km of access to be maintained;
- e) Approx. 450 work pads 30m x 30m (established and removed) in standard soils;
- f) Approx. 150 work pads 30m x 30m (established and removed) in poor soils;
- g) Approx. 90 stringing pads 120m x 30m (established and removed) in both standard and poor soils;
- h) Significant easement clearance to maintain safe electrical clearances to vegetation;
- i) Camps and laydown areas;
- j) Creek crossings; and
- k) Gates and pastoral tracks.

5. Substations

This document's section describes the various scope of works at the substation sites; Cultana, Yadarrie, Pt Lincoln, Middleback and Wudinna where brownfield augmentation works are required to enable the integration of the new double circuit line to the network.

5.1 Cultana Substation

The scope of work at Cultana Substation is illustrated in the below figure and involves the:

- a) Addition of two new switching bays to complete diameters D02 and D04 to standard 132 kV breaker and half configuration underneath the existing strung bus;
- b) Establishment of two new line exits, which will allow connection of the two 132kV circuits to diameters D02 and D04;
- c) Relocation of Stony Point line exit from the northern end of diameter D03 to the northern end of diameter D04;
- d) Rectification of any defect notifications at the substation site.

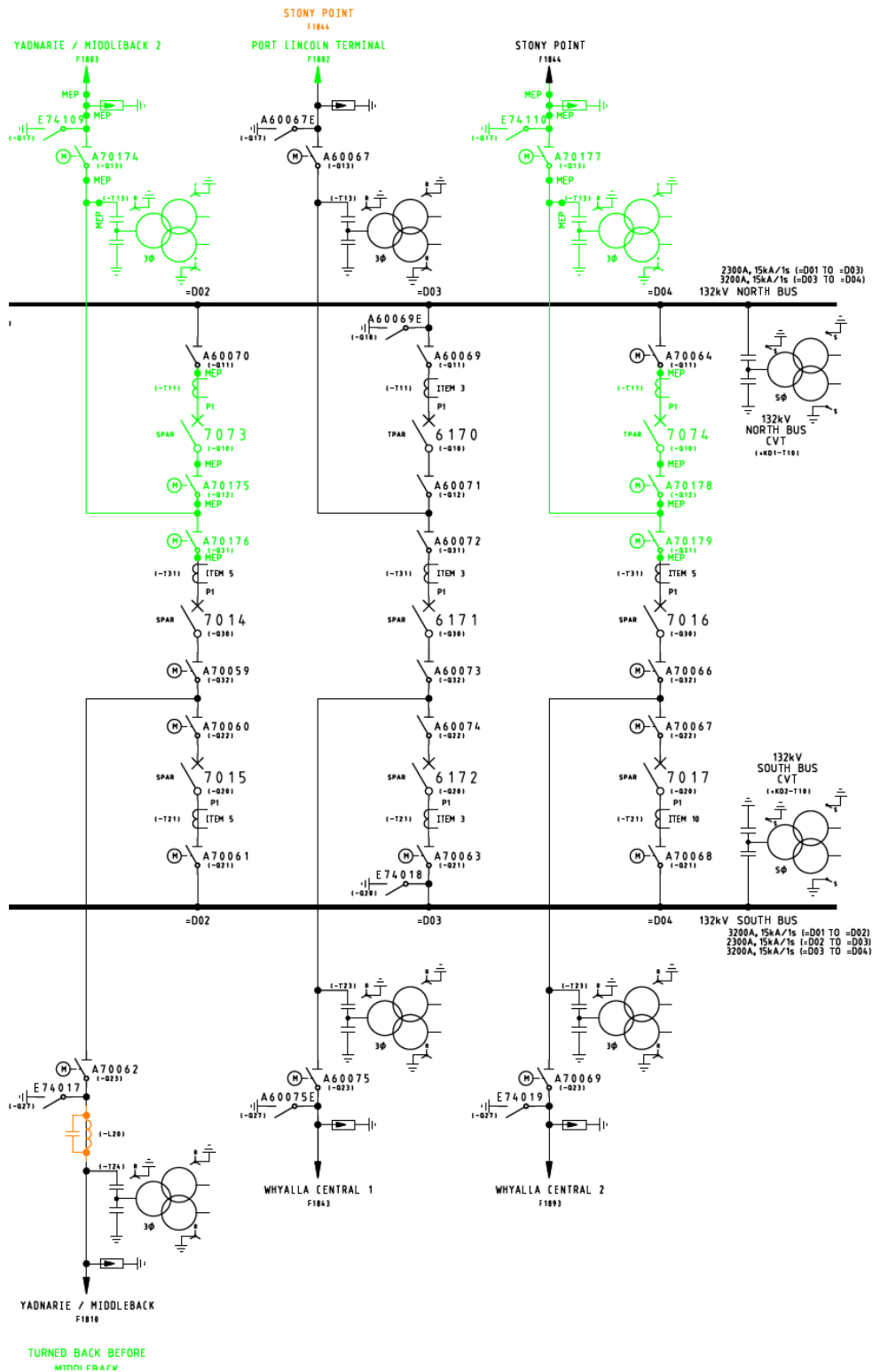


Figure 4: Cultana Proposed SLD – 132 kV Area

5.1.1 Civil and Infrastructure

The Scope will include the design, supply and construction of the following civil and infrastructure works:

- a) Design and construction of all footings for 132 kV plant;

- b) Verification and certification of structures and footings as required;
- c) Modification of the yard drainage to accommodate new plant and changes to the existing layout;
- d) Relocation of the existing VABs to suit the new switchyard configuration;
- e) Design supply and installation of the new earth grid risers for new plant;
- f) Removal and disposal of a line trap set.

5.1.2 Primary Plant

The scope will include the design, installation, commissioning and testing of the following:

- a) One (1) x 132 kV SPAR Circuit Breaker (CB);
- b) One (1) x 132 kV TPAR Circuit Breaker (CB);
- c) Two (2) x three-phase sets of 132 kV Current Transformers (CTs),
- d) Two (2) x three-phase sets of 132 kV Capacitive Voltage Transformers (CVTs);
- e) Six (6) x single-phase of ground-mounted 132 kV surge arresters;
- f) Two (2) x 132 kV motorised disconnectors, with a low-level stand; fitted with single non-motorised earth switch;
- g) Four (4) x 132 kV motorised disconnectors, with a low-level stand without any earth switches;
- h) Fifty-four (54) x 132 kV post insulators for use with disconnectors (three (3) spares included);
- i) Removal and recovery of two sets of post insulators currently installed where the new disconnectors A70176 and A70179 will be placed.

5.1.3 Protection and Control Schemes

The scope includes the design, supply, testing, installation and commissioning/decommissioning the following:

- a) Decommissioning of the existing 132 kV Stony Point feeder protection scheme;
- b) A new 132 kV feeder protection schemes for the Stony Point feeder (after it is relocated to the newly populated =D04 diameter),
- c) A new 132 kV feeder protection schemes for the Port Lincoln Terminal feeder (to be connected to the existing =D03-Q10 bay);
- d) A new 132 kV feeder protection schemes for the Yadnarie - Middleback 2 feeder (to be connected to the newly populated =D02-Q10 bay);
- e) A new CB management panel for the existing CB6170 and new CB7074;
- f) A new CB management panel for the new CB7073;
- g) Modifications to the existing 132 kV North bus zone protection scheme;
- h) Modifications to the existing CBF schemes for CB7014, CB7016 and CB6171;

- i) Modifications to the existing 132 kV Yadnarie-Middleback feeder three terminal protection scheme into a 132 kV duplicate stepped distance protection scheme with backup residual overcurrent; and
- j) Modifications to the existing inter-trip circuits and GOOSE signals as required to correctly integrate the new schemes into the substation.

5.1.4 Substation Automation System (SAS)

The scope includes the design, supply, testing, installation and commissioning / decommissioning the following:

- a) Decommissioning of SCADA alarms, indications and controls of the existing 132 kV Stony Point feeder;
- b) New SCADA Cubicles and BCUs for the relocated Stony Point Feeder and new feeder bays;
- c) Integration of the new plant and IEDs associated with the new and relocated feeders with the existing SAS for the supervisory control and monitoring of the substation in the new primary configuration;
- d) Modification of the existing IEDs associated with the existing 132 kV Yadnarie-Middleback feeder to suit the new arrangements of the turned-back feeder in the SAS for the supervisory control and monitoring of the substation in the new primary configuration;
- e) Modifications require to ensure that the existing SCADA Gateways exchange the required indications, alarms, measurements and controls with all new IEDs and communicate them to SMSC and local HMI system utilising the existing interface with these systems;
- f) Carrying out all necessary changes to the existing protection and control IEDs and GPS clock system to integrate the IEDs of the new bays;
- g) Updating of all the existing HMI displays, alarm / event database and configuration for the monitoring and control of the new bays and IEDs. The GOOSE isolations screens must also be modified for the new substation configuration; and
- h) Removal of PSPM connections for decommissioned line exits from the existing PSPM unit and integration of new line exit connections to the PSPM unit.

5.1.5 Ancillary Items, Buildings and Amenities

The scope of works includes:

- a) Installation of multicore and optic fibre control and Low Voltage (LV) power and other multicore cables for Secondary Systems and Telecommunications functions;
- b) Two (2) VT marshalling boxes for the new 132 kV line exits;
- c) Review the existing AC supplies and assess adequacy of the entire AC supply chain to cope with the additional bay load; and
- d) Cubicle space is available in the existing Buildings +5 and +6 for devices for the new line protection schemes and breaker management schemes. New buildings are not required for this scope of works.

5.2 Port Lincoln Terminal Substation

The scope of works at Port Lincoln Terminal substation is illustrated in the below Figure and involves:

- a) The construction of a new feeder switching bay (single breaker) to connect the new Yadnarie line exit at the south eastern corner of the substation mesh bus sharing the Synergen power station connection point;
- b) Connection of the new Cultana line exit to the existing F1811 Yadnarie exit;
- c) Substation extension to accommodate the new line switching bay;
- d) Decommissioning and removal of the 11 kV capacitor banks;
- e) Rectification of any defect notifications at the substation site.

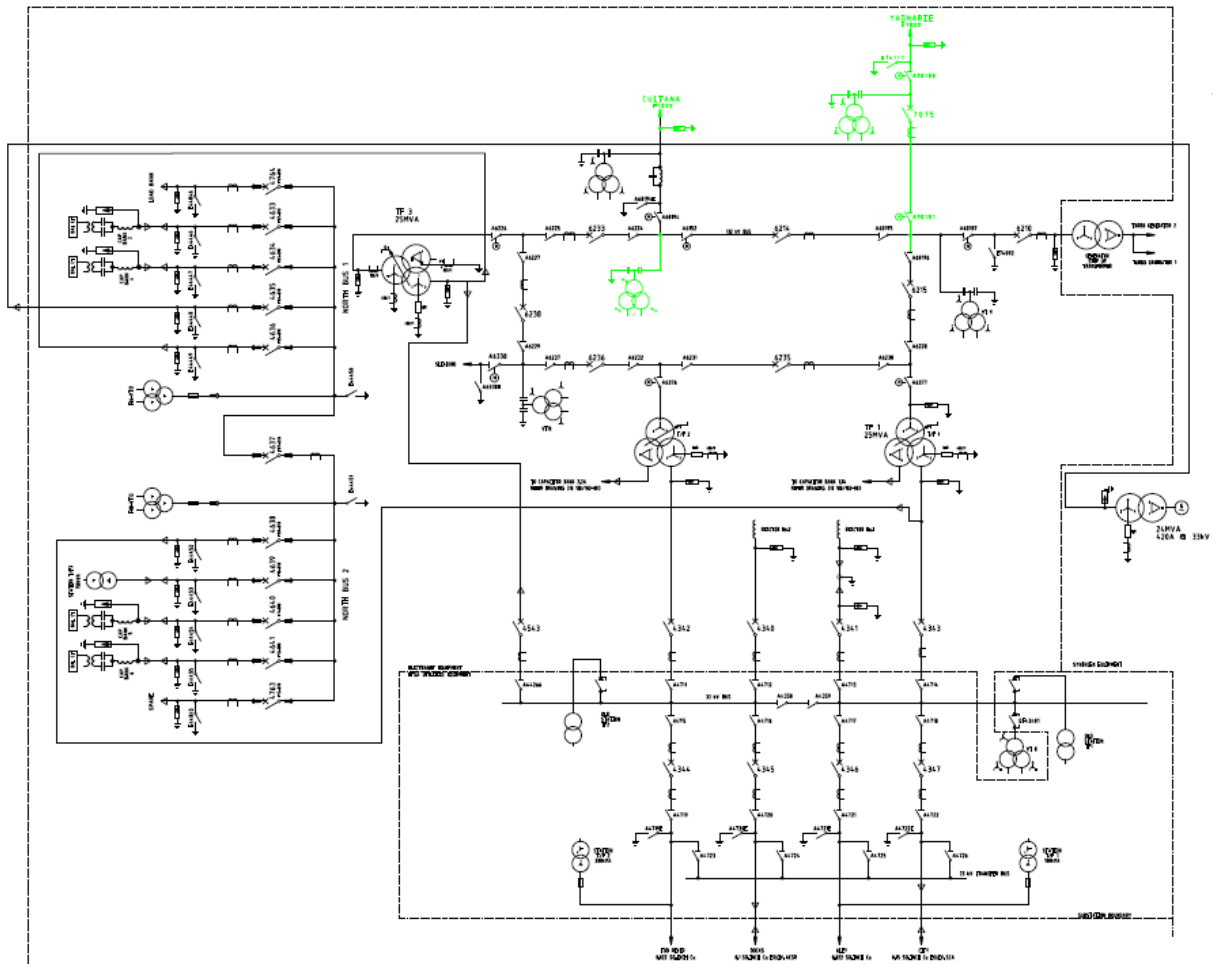


Figure 5: Pt Lincoln Proposed SLD

5.2.1 Civil and Infrastructure

The scope includes the design, supply and construction of the following:

- a) The bulk earthworks, terracing, retaining walls, access roads, drainage, surface finishing and fencing for the extension of the substation platform to accommodate a new switching bay;
- b) Footings for all 132 kV plant and new substation gantries;

- c) Installation, commissioning and testing of the Port Lincoln Terminal substation earth grid system extension to cover the area of the new switching bay;
- d) Verification and certification of structures and footings as required;
- e) Removal and disposal of the existing lattice structure currently serving as terminal tower for the existing 132 kV single circuit Yadnarie F1811 feeder;
- f) Removal and disposal of the two existing line traps currently installed on the Yadnarie line exit CVTs;
- g) Removal and disposal of the four (4) 11 kV Capacitor bank currently connected to the tertiary of the Transformer 1 and Transformer 2 respectively, including, CB, load switches, disconnectors, steel structures, fences, capacitors cans, HV and LV cable and connections associated.

5.2.2 Primary Plant

The scope of works includes the design, installation, commissioning and testing of the following:

- a) One (1) x 132 kV SPAR Circuit Breaker (CB);
- b) One (1) x three-phase set of 132 kV Current Transformers (CTs),
- c) One (1) x three-phase set of 132 kV Capacitive Voltage Transformers (CVTs);
- d) Six (6) x single-phase of ground-mounted 132 kV surge arresters;
- e) One (1) x 132 kV motorised disconnector,
- f) One (1) x 132 kV motorised disconnector, with a low-level stand, without an earth switch;
- g) Forty-four (44) x 132 kV post insulators for use with disconnectors and busbar systems (three (3) spares included);
- h) One (1) x single-phase 132 kV Capacitive Voltage Transformers (CVTs).

5.2.3 Protection and Control Schemes

The scope includes the design, supply, testing, installation and commissioning / decommissioning the following:

- a) Decommissioning of the existing 132 kV Yadnarie feeder protection scheme and associated tele protection devices;
- b) Decommission the existing 132 kV bus zone protection scheme;
- c) Decommission the existing CBF schemes for CB6233 and CB6214;
- d) Decommission the existing auto reclose schemes for CB6233 and CB6214;
- e) Decommission the all existing 11 kV Capacitor Bank protection schemes;
- f) A new 132 kV feeder protection scheme for the 132 kV Cultana feeder F1882 (to be connected to the existing Yadnarie feeder exit). This scheme will also implement duplicate CBF for CB6233 and CB6214.

- g) A new 132 kV feeder protection scheme for the 132 kV Yadnarie 2 feeder F1879 (to be connected to new feeder exit bay). This scheme will also implement duplicate CBF for CB7075 only.
- h) A new CB management panel for the new CB7075;
- i) A new CB management panel for the new CB6124;
- j) A new CB management panel for the new CB6233;
- k) Voltage selection scheme as required for the sync check and auto reclose functions of CB6233;
- l) A new 132 kV bus zone protection scheme to replace the existing 132 kV bus zone protection scheme and cater for the new 132 kV Yadnarie feeder exit bay;
- m) Modification of Transformers 1 & 2, Set 1 & 2 protection schemes to cater for the removal of the 11 kV CT connections and other DC signals due to the decommissioning of the 11 kV capacitor banks 1 & 1A and 2 & 2A respectively; and
- n) Modification of the existing inter-trip circuits as required to correctly integrate the new schemes into the substation.

5.2.4 Substation Automation System (SAS)

The scope of works includes the design, supply, testing, installation and commissioning / decommissioning the following:

- a) Decommissioning of SCADA alarms, indications and controls of all decommissioned protection schemes;
- b) Decommissioning of SCADA alarms, indications and controls of all 11kV Capacitor bank bays and associated plant (Capacitor banks 1, 1A, 2 and 2A);
- c) Decommission the existing GT Load shedding / Islanding scheme including the inter-trips to the generators and to Yadnarie and Sleaford substations;
- d) A new SCADA Panel for the new 132 kV Yadnarie 2 feeder switching bay, housed in the +1 Building;
- e) New BCU for the new 132 kV Yadnarie 2 feeder switching bay, installed in the new SCADA Panel;
- f) Integration of the new plant and the IEDs associated with the new 132 kV Yadnarie 2 feeder with the existing SAS for the supervisory control and monitoring of the substation in the new primary configuration;
- g) Modifications to enable the existing SCADA Gateways to exchange the required indications, alarms, measurements and controls with all new IEDs and communicate them to SMSC and local HMI system utilising the existing interface with these systems;
- h) Necessary changes to the existing protection and control IEDs and GPS clock system to integrate the IEDs of the new bays;
- i) Updating of the existing HMI displays, alarm/event database and configuration for the monitoring and control of the new bays and IEDs; and
- j) Removal of PSPM connections for decommissioned line exits from the existing PSPM unit and integration of new line exit connections to the existing PSPM unit.

5.2.5 Ancillary Items, Buildings and Amenities

The scope of works includes:

- a) Design and construction of the outdoor floodlight system for the new switching bay;
- b) New lightning protection system comprising overhead earth wires for covering all new electrical equipment and bus bars;
- c) Design, supply and installation of two (2) CVT Marshalling boxes;
- d) New bay marshalling kiosk adjacent to CB7075;
- e) One AC and on DC marshalling kiosk near the new switching bay;
- f) Installation of multicore and optic fibre control and Low Voltage (LV) power cables for Secondary Systems and Telecommunications functions;
- g) Review the existing AC supplies and assess adequacy of the entire AC supply chain to cope with the additional bay load and proposed lighting load; and
- h) No new buildings are included in the current scope of works for Port Lincoln Terminal substation.

5.3 Yadnarie Substation

The scope of works at Yadnarie substation is illustrated in the below Figure, and involves:

- a) Connection of the northern section of the eastern circuit on the new line (F1883) to the existing F1810 Cultana / Middleback exit;
- b) Connection of the new southern section of the eastern circuit on the new line (F1879) to the existing F1811 Port Lincoln Terminal exit;
- c) Structural assessment of existing 132 kV gantry systems for the Cultana / Middleback and Port Lincoln Terminal exits to determine the design loading on the structures and to determine maximum allowable loading for the new line landing spans;
- d) Removal of redundant line traps in the existing Cultana / Middleback and Port Lincoln Terminal exits; and
- e) The installation of a set of surge arresters in the Cultana / Middleback exit; and
- f) Rectification of any defect notifications at the substation site.

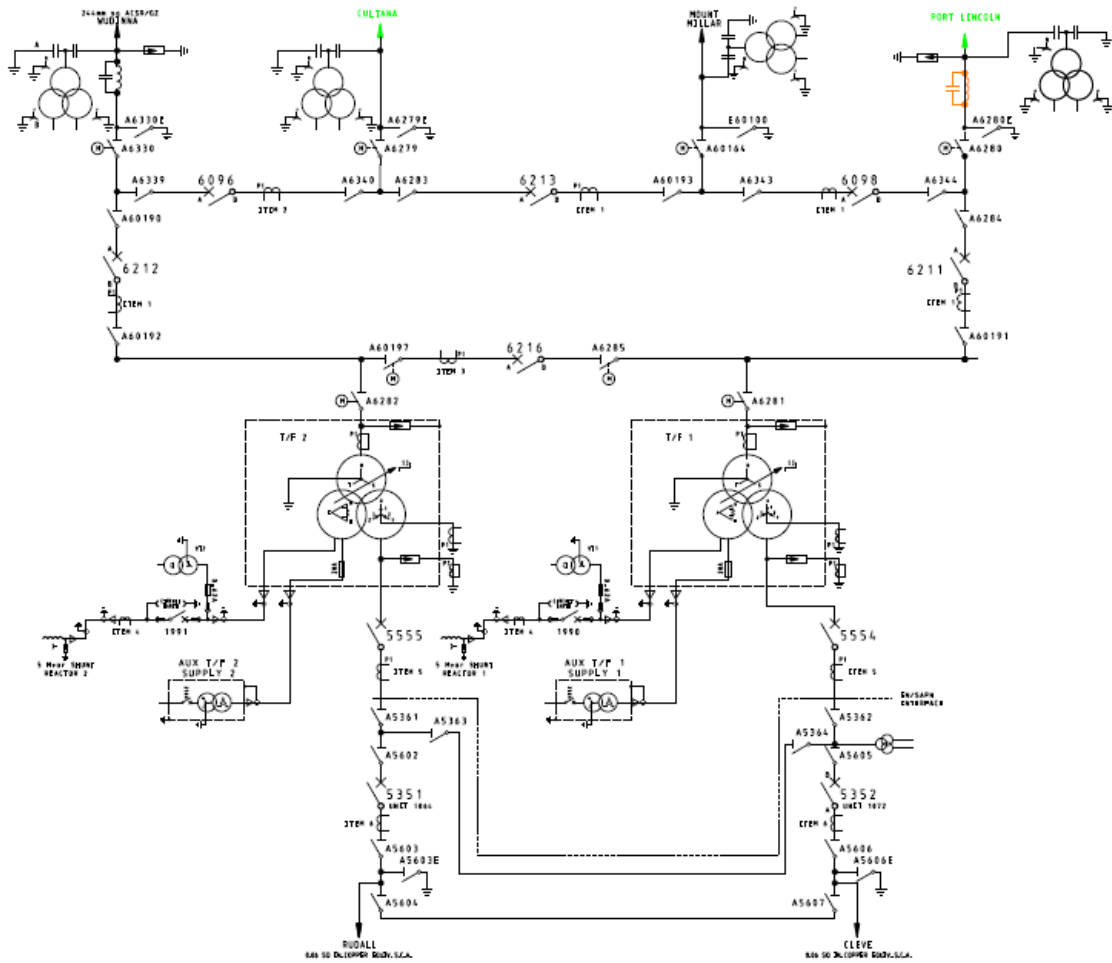


Figure 6: Yadrarie Proposed SLD

5.3.1 Civil and Infrastructure

The scope includes the design, supply and construction of the following:

- a) Footings and stands for the set of Surge Arresters;
- b) Verification and certification of structures and footings as required;
- c) Design supply and installation of the new earth grid risers and earth stakes for the new plant; and
- d) Removal and recovery of the two sets line traps currently installed on the Port Lincoln line exit CVTs and Cultana line exits CVTs.

5.3.2 Primary Plant

The scope includes the design, installation, commissioning and testing of three (3) single-phase, ground-mounted 132 kV surge arresters (for Cultana / Middleback line exit).

5.3.4 Protection and Control Schemes

The scope includes the design, supply, testing, installation and commissioning/decommissioning the following:

- a) Decommissioning of the existing 132 kV Cultana-Middleback feeder protection scheme and associated tele protection devices;
- b) Decommission the existing 132 kV Port Lincoln Terminal feeder protection scheme and associated tele protection devices;
- c) Decommission all the existing 132 kV leakage zones;
- d) Decommission the existing CBF schemes for CB6096, CB6098, CB6211, CB6212, and CB6213;
- e) Decommission the existing auto reclose schemes for CB6096, CB6098, CB6211, CB6212 and CB6213;
- f) A new 132 kV feeder protection scheme for the new three terminal 132 kV Cultana-Middleback 2 feeder F1883 (to be connected to the existing Cultana-Middleback feeder exit). This scheme will also implement duplicate CBF for CB6096 and CB6213;
- g) A new 132 kV feeder protection scheme for the 132 kV Port Lincoln Terminal 2 feeder F1879 (to be connected to the existing Port Lincoln Terminal feeder exit). This scheme will also implement duplicate CBF for CB6098 and CB6211;
- h) A new CB management panel for CB6096 and CB6213;
- i) A new CB management panel for CB6098 and CB6211;
- j) A new Set 2 CBF for CB6212;
- k) Modification of the existing Set 1 protection for the 132 kV Wudinna feeder to implement a new Set 1 CBF function for CB6212; and
- l) Modification of the existing inter-trip circuits as required to correctly integrate the new schemes into the substation.

5.3.5 Substation Automation System (SAS)

The scope includes the design, supply, testing, installation and commissioning / decommissioning the following:

- a) Decommissioning of SCADA alarms, indications and controls of all decommissioned protection schemes;
- b) Decommission the existing GT Load shedding / Islanding scheme including the inter-trips to Port Lincoln Terminal substation;
- c) Modifications required to enable the existing SCADA Gateways to exchange the required indications, alarms, measurements and controls with all new IEDs and communicate them to SMSC and local HMI system utilising the existing interface with these systems;
- d) Necessary changes to the existing protection and control IEDs and GPS clock system to integrate the IEDs of the new bays;
- e) Updating of the existing HMI displays, alarm/event database and configuration for the monitoring and control of the new bays and IEDs; and
- f) Modifications to the existing PSPM connections for the 132 kV Cultana-Middleback feeder and 132 kV Port Lincoln Terminal feeder to remove the auxiliary CTs and externally summate the CT circuits.

5.3.6 Ancillary Items, Buildings and Amenities

The scope of works includes:

- a) Relocation of some VABs to suit the installation of the new surge arresters;
- b) Installation of multicore and optic fibre control and Low Voltage (LV) power cables for Secondary Systems and Telecommunications functions;
- c) No additional power requirements are expected at the existing Yadnarie substation;
and
- d) No new buildings are included in the current scope of works for Yadnarie substation.

5.4 Wudinna Substation

The scope of works at Wudinna substation is illustrated in the below Figure and involves:

- Installation of a non-switchable line reactor rated at 132 kV 5 MVar connected to the 132 kV bus extension;
- Rectification of any defect notifications at site as provided by ElectraNet.

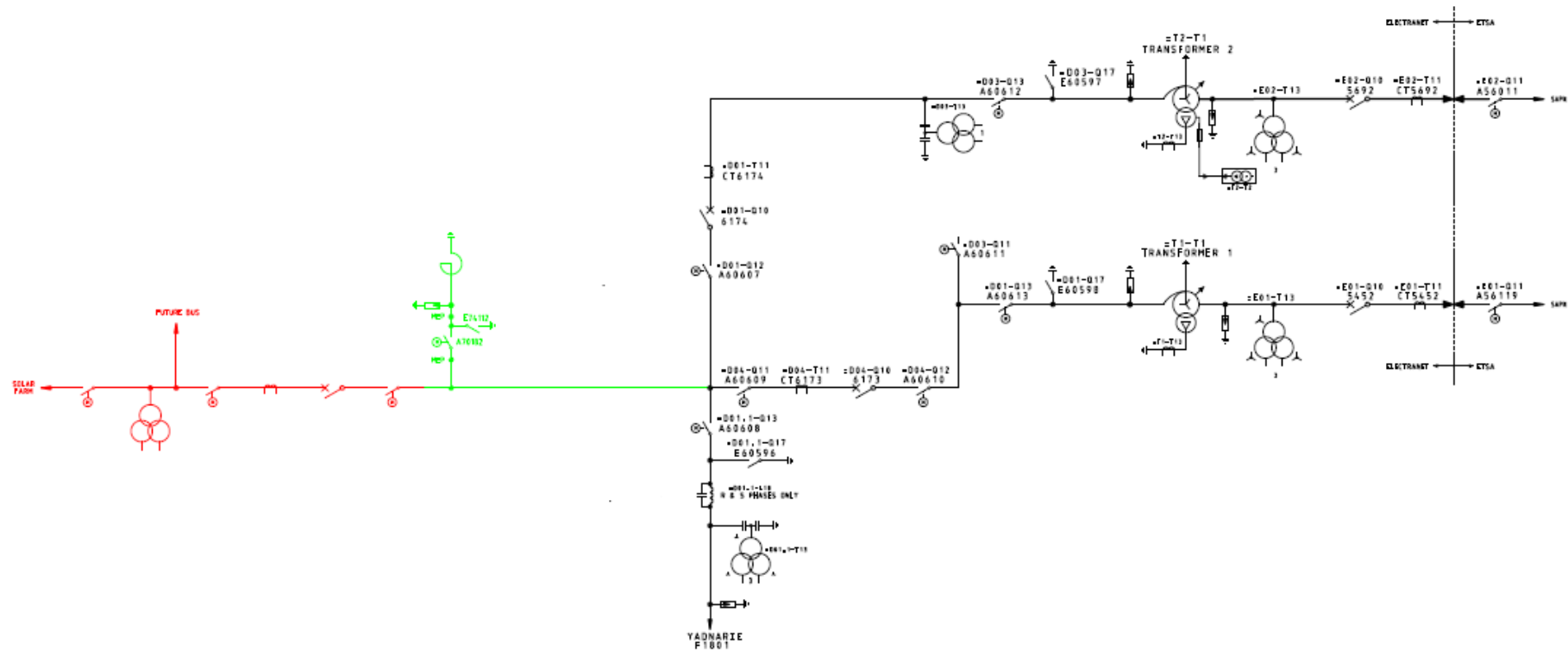


Figure 7: Wudinna Proposed SLD

5.4.1 Civil and Infrastructure

The scope includes the design, supply and construction of the following:

- a) Footings and stands for all 132 kV plant including the bund for the non-switchable 132 kV, 5 MVAR shunt reactor;
- b) Verification and certification of structures and footings as required;
- c) Installation of VABs around the new equipment;
- d) Lightning protection system, one (1) 20 metre lightning mast to provide lightning coverage over new reactor location;
- e) Supply and installation of one (1) class -1 one coalescing plate oil water separation system for the bund drainage; and
- f) New earth grid risers and earth stakes for new plant, trench covers and lightning mast.

5.4.2 Primary Plant

The scope includes the design, installation, commissioning and testing of the following:

- a) One (1) 132 kV shunt reactor with a continuous rating of 5 MVAR with bushing Current Transformers (CTs);
- b) Three (3) x single-phase of reactor-mounted 132 kV surge arresters;
- c) One (1) x 132 kV motorised disconnecter, with a low-level stand and a manually operated earth switch; and
- d) Twenty-three (23) x 132 kV post insulators for use with disconnectors and bus bar extensions (three (3) spares included).

5.4.3 Protection and Control Schemes

The scope includes the design, supply, testing, installation and commissioning / decommissioning the following:

- a) A new 132 kV reactor protection scheme for the new 5 MVAR shunt reactor;
- b) Modification of the existing 132 kV Yadnarie feeder protection scheme to cater for the new reactor (AC circuits and auto reclose blocking);
- c) Modification of the existing duplicate CBF schemes for CB6173 and CB6174 to add status checked CBF for reactor faults; and
- d) Modification of the existing inter-trip circuits as required to correctly integrate the new schemes into the substation.

5.4.4 Substation Automation System (SAS)

The scope includes the design, supply, testing, installation and commissioning / decommissioning the following:

- a) New BCU for the new reactor switching bay;

5.5.1 Civil and Infrastructure

The Contractor must carry out the removal and disposal of the two-line traps currently installed on dedicated post insulators in the line. The post insulators and the associated structures are to be retained.

5.5.2 Primary Plant

No new plant installations will be required at the existing Middleback substation. The existing equipment for the current exit for F1810 will be used to connect the new circuit to the existing Yard.

5.5.3 Protection and Control Schemes

The scope includes the design, supply, testing, installation and commissioning/decommissioning of the following:

- a) Decommissioning of the existing 132 kV Cultana-Yadnarie feeder protection scheme and associated tele protection devices;
- b) Decommissioning of the existing duplicate CBF scheme for CB6180 implemented in the transformer protection relays;
- c) A new 132 kV feeder protection scheme for the new three-terminal 132 kV Cultana - Yadnarie feeder;
- d) Modification of the existing inter-trip circuits as required to correctly integrate the new schemes into the substation.

5.5.4 Substation Automation System (SAS)

The scope includes the design, supply, testing, installation and commissioning/decommissioning of the following:

- a) Decommissioning of SCADA alarms, indications and controls of all decommissioned protection schemes;
- b) Modifications required to ensure that the existing SCADA Gateways exchange the required indications, alarms, measurements and controls with all new IEDs and communicate them to SMSC and local HMI system utilising the existing interface with these systems;
- c) Necessary changes to the existing protection and control IEDs and GPS clock system to integrate the IEDs of the new bays; and
- d) Updating of the existing HMI displays, alarm/event database and configuration for the monitoring and control of the new bays and IEDs.

5.5.5 Ancillary Items, Buildings and Amenities

No additional power requirements are expected at the existing Middleback substation.

No new buildings are included in the current scope of works for Middleback substation.

6. Telecommunications

The new diverse telecommunications path between Cultana and Port Lincoln Terminal to carry protection and SCADA will consist of OPGW fibre on the new 275/132 kV transmission lines.

New bearers will be established to link Cultana, Yadnarie, Middleback and Port Lincoln Terminal substations, over the OPGW, while the diverse path remains as existing Microwave Radio.

The OPGW terminates at the terminal towers outside the substation and direct buried Single Mode Optical Fibre (SMOF) will complete the path into the substations at Cultana, Yadnarie and Port Lincoln Terminal.

New equipment will be installed at Cultana, Yadnarie and Port Lincoln Terminal substations to facilitate the new bearers and services (SCADA, engineering access (OpsNet) and telephony).

In summary, the Telecommunications scope shall include:

- a) Design, supply and installation of the OPGW fibre;
- e) Design, supply and installation of the SMOF into the substations and required pits;
- f) Supply and installation of all telecommunication equipment (FTPs and cubicles) and cabling required to facilitate protection signalling, SCADA, and general telephony;
- g) End-to-end commissioning and provision of data required to create the telecommunications network for operational use.

7. Power System Planning, Integration and Testing

The following planning, system integration and testing requirements are applicable for the Project:

- a) Detailed design studies for scoping and specification of the Project;
- b) AEMO and inter-regional coordination:
 - (i) Engage AEMO for due diligence during the Project; and
 - (ii) Develop AEMO Operating Agreement;
- c) Voltage control and reactive planning:
 - (i) Reactive planning and requirement identification studies;
 - (ii) Undertake voltage control strategy review and update as required including operating instructions;
 - (iii) Reactive plant co-ordination and setting review; and
 - (iv) Voltage control schemes and reactive switching control;
- d) Develop performance standards for new plant;
- e) Review / update power system models:
 - (i) PSS/E Version 34 model for Mount Millar Wind Farm;
 - (ii) PSCAD models for Port Lincoln Power Station and Cathedral Rocks Wind Farm; and

- (iii) Review impact of network change on generator performance;
- f) Review and modify relevant existing protection and control schemes:
 - (i) Special protection schemes – review, design, functional specification for protection against abnormal operating conditions and events; and
 - (ii) Protection schemes, including protection co-ordination / protection grading with other schemes and third parties;
- g) Assess impact of network augmentation on relevant existing generator or load connections (GPS and CPS and the need for and implementation of amendments):
- h) Assess the impact on existing SAPN connection points:
 - (i) Calculate critical clearing times for protection system settings and NER compliance checks; and
 - (ii) SAPN due diligence and impact advice (i.e. secondary systems, primary plant, earth grid limits);
- i) System strength assessment:
 - (i) Develop / update system strength limit advice; and
 - (ii) Oscillatory stability assessment;
- j) Specialist studies:
 - (i) Electrical line design studies - network performance, BIL adequacy, lightning performance adequacy;
 - (ii) Assess and rebase line generation power quality contributions / performance and update power factory models;
 - (iii) Develop commissioning testing plans, hold point reports and attend Line Impedance Testing; and
 - (iv) Calculate thermal line ratings;
- k) Development of operational support materials for the ongoing operation of the new plant (including development of limit advice):
 - (i) Limit equations to manage construction outages;
 - (ii) Limit equations for ongoing operation after project implementation;
 - (iii) Generation Dispatch Limiter (GDL) equations where relevant;
 - (iv) Develop / update of operating instructions for control room;
 - (v) Development of stability and constraint equations for managing outages.

8. Outages for Construction

While it is expected that work will be planned to maximise the amount of work that can be done prior to needing any outages, generation support is required during execution of cut-over and in-situ replacement works. The Synergen Power generators at Port Lincoln and additional portable generators will be required to support the load at Port Lincoln, Wudinna and Cleve during outages caused by the Project’s construction activities.

Outages and associated generation support mentioned in this clause refer to those that are required for construction, not outages for through-life support.

High level outage requirements summarised in Table 2 below are based on a preliminary work staging plan that will be developed further during design and construction planning.

Table 2 Construction Outage Requirements

ID	Works	Items Affected by Outage	Expected Timing
1	Temporary line deviation at Pillaworta Hill (section 1811-STR522 to 1811-STR525 inclusive)	F1811 Yadnarie to Port Lincoln Terminal	2 days
2	Temporary line deviation at Whites Flat (section 1811-STR566 to 1811-STR568 inclusive)	F1811 Yadnarie to Port Lincoln Terminal	2 days
3	Temporary line deviations at Boston (section 1811-STR609 to 1811-STR615 inclusive)	F1811 Yadnarie to Port Lincoln Terminal	3 days
4	Relocation of the F1844 Stony Point from D03 to D04	- F1844 Cultana Stony Point - Cultana 132kV North Bus	2 days
5	Connection of F1882 Cultana Port Lincoln (west circuit) to Port Lincoln Substation	F1811 Yadnarie Port Lincoln Terminal	3 days
6	Connection of F1879 Yadnarie to Port Lincoln (east circuit) to Yadnarie and Port Lincoln Substations	F1811 Yadnarie Port Lincoln Terminal	3 days
7	Connection of F1883 Cultana Yadnarie 2 (east circuit) to Middleback and Yadnarie Substations	F1810 Cultana Yadnarie	3 days
8	Bus extension for reactor connection at Wudinna	F101 Wudinna Yadnarie	2 days