New Bells Creek Zone Substation

Memo

JANUARY 2024

energex
Part of Energy Queensland

DOCUMENT VERSION

Version Number	Change Detail	Date
1.0	Reviewed – Principal Planning Engineer	13/12/2023
2.0	Endorsed – Manager Sub-Transmission Planning	13/12/2023
3.0	Endorsed – GM Grid Planning	13/12/2023

1 SUMMARY

Title	New Bells Creek Zone Substation
DNSP	Energex
Expenditure category	☐ Replacement ☒ Augmentation ☐ Connections ☐ Non-Network
Identified need	☒ Legislation ☒ Regulatory compliance ☒ Reliability ☐ CECV ☐ Safety ☐ Environment ☐ Financial ☐ Other The Sunshine Coast area continues to see strong population growth and economic development. Major developments are currently progressing near Caloundra in the southern parts of Sunshine Coast. There is a large master-planned community (Aura) currently being developed in the areas of Bells Creek, that when completed is forecast to add at least 47MVA load to the network. The Aura development is a mix of residential, commercial and industrial areas. It includes shopping and dining precinct, community centres, schools, and transport centre in addition to the residential housing developments. Furthermore, the Sunshine Coast Industrial Park (SCIP) located in Bells Creek North is forecast to have an additional 15MVA of load to be added to the network. These developments are situated in the Caloundra 132/11kV Zone Substation supply area, it is forecast that they will add 62MVA to the ultimate electrical demand to the substation. Caloundra 132/11kV Zone Substation (SSCLD) provides electricity supply to over 22,600 predominantly domestic customers in the Aroona, Bells Creek, Caloundra, Currimundi, Little Mountain, Meridan Plains, Pelican Waters and Shelly Beach. It is supplied by part of a 132kV ring network from Mooloolaba 132/11kV Zone Substation (SSMLB), that is in turn supplied from Palmwoods Bulk Supply Substation (SSH9). The security standard safety net limit for SSCLD is 74.8MVA, it is forecast that the load will exceed this limit by 2028. Left unaddressed there will be an ongoing high level customer impact and business impact risks associated with not being able to supply new customers in the Aura and SCIP developments in a timely manner, as well as legislated requirements risk due to non-compliance to the Energex Distribution Authority requirements. These risks will continue to increase as more customers move into the area. Further information for this investment can be found in the attached Project Approval Report.
Summary of preferred option	The preferred option is that Energex establish Bells Creek Central 132/11kV Zone Substation (SSBCR) with 1 x 60MVA 132/11kV transformer, 2 x 132kV busses and 2 x 11kV busses, establish double circuit 132kV feeder with a mix of 8kms of overhead and 2.1kms of underground construction, reconfigure the 11kV network, replace 6.4km of OHEW with OPGW, establish 3.3km of ADSS and 6.2km of underground optical fibre, and upgrade 132kV feeder protection at Mooloolaba (SSMLB) and Caloundra (SSCLD) zone substations.

<table>
<tr><td>Expenditure</td><td>
<table>
<tr><th>Year</th><th>Previous period</th><th>2025-26</th><th>2026-27</th><th>2027-28</th><th>2028-29</th><th>2029-30</th><th>2025-30</th></tr>
<tr><td>$m, direct 2022-23</td><td>$18.951</td><td>$39.456</td><td>$23.461</td><td>$0.257</td><td>$0</td><td>$0</td><td>$63.174</td></tr>
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<tr><td>Benefits</td><td>After completion of the recommended works, the resulting level of risk on the impacts to customer, business and legislated requirements are down to As Low As Reasonably Practicable (ALARP).</td></tr>
<tr><td>Consumer engagement</td><td>On 9th November 2020 Energex published the Non-Network Options Report (NNOR) prepared in accordance with the requirements of clause 5.17.4(e) of the NER providing details on the identified need in the Caloundra area including both technical and economic information about possible solutions. This report sought information from interested parties regarding alternative potential credible options or variants to the potential credible option (network Option 1) presented by Energex.

In response to the NNOR, Energex received three submissions and identified one credible option.

A Draft Project Assessment Report (DPAR) was published on 16 August 2021, in accordance with the requirements of clause 5.17.4(i) of the NER, explaining Energex's preferred solution (Option 1) to address the identified need. The DPAR sought information from interested parties about possible alternate solutions to address the need for investment and the consultation was open for a minimum of six weeks.

No submissions were received in response to the DPAR.

Due to the proposed preferred option being more that the $12 million cost threshold a Final Project Assessment Report (FPAR) was published on 22nd October 2021 in accordance with the requirements of clause 5.17.4(o) of the NER.

The period (within 30 days) during which Registered Participants and Interested Parties may, by notice to the AER, dispute conclusions made by Energex in the FPAR (on the grounds of RIT-D application or assessment errors) expired on 21st November 2021.

Hence, the RIT-D process for the project has concluded.

The Final Project Assessment Report from the RIT-D process can be accessed via the link below:

• Caloundra Final Project Assessment Report</td></tr>
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Project Approval Report for Energex

PAR2023-SE-035
Work Request No. WR7072358
Project No. C0562034
30 September 2023

BCR Bells Creek Central – Establish 132/11kV Zone Substation

Part of Energy Queensland

DISCLAIMER

Project Approval Report

Executive summary

Description of the network risks

Caloundra 132/11kV Zone Substation (SSCLD) is located in Caloundra, in the Sunshine Coast area of Southeast Queensland. SSCLD provides electricity supply to over 22,600 predominantly domestic customers in the Aroona, Bells Creek, Caloundra, Currimundi, Little Mountain, Meridan Plains, Pelican Waters and Shelly Beach. It is part of a 132kV ring network from Mooloolaba 132/11kV Zone Substation (SSMLB), that is in turn supplied from Palmwoods Bulk Supply Substation (SSH9).

The Sunshine Coast area continues to see strong population growth and economic development. There is a large master-planned community (Aura) currently being developed to the south-west of SSCLD, in the areas of Bells Creek, that when completed is forecast to add at least 47MVA load to the network. The Aura development is a mix of residential, commercial and industrial areas. It includes shopping and dining precinct, community centres, schools, and transport centre in addition to the residential housing developments. Furthermore, the Sunshine Coast Industrial Park (SCIP) located to the west of SSCLD, in Bells Creek North, is forecast to have an additional 15MVA of load to be added to the network. These developments will add 62MVA to the ultimate electrical demand in the SSCLD supply area.

Left unaddressed there will be an ongoing high level customer impact and business impact risks associated with not being able to supply new customers in the Aura and SCIP developments in a timely manner, as well as legislated requirements risk due to non-compliance to the Energex Distribution Authority requirements. These risks will continue to increase as more customers move into the area.

Risks addressed

Safety	☐	Customer Impact	☒
Environment	☐	Business Impact	☒
Legislated Requirements	☒		

Corporate / Regulatory compliance

Project included in the Approved Budget/PoW?	☒
Project included in the latest DAPR?	☐
Project part of an AER business case?	☒
Alternative credible option > $6M identified?	☒
RIT-D undertaken?	☒
Project to address urgent & unforeseen network issue.	☐

Project Approval Report

RECORD OF ENDORSEMENTS AND APPROVAL:	
Recommendation: It is recommended that Energex establish Bells Creek Central 132/11kV Zone Substation (SSBCR) with 1 x 60MVA 132/11kV transformer, 2 x 132kV busses and 2 x 11kV busses, establish double circuit 132kV feeder with a mix of 8kms of overhead and 2.1kms of underground construction, reconfigure the 11kV network, replace 6.4km of OHEW with OPGW, establish 3.3km of ADSS and 6.2km of underground optical fibre, and upgrade 132kV feeder protection at Mooloolaba (SSMLB) and Caloundra (SSCLD) zone substations, for a total estimated cost of $109,754,831 at 2023/24 prices. The target completion date for the recommended development is February 2027.	
Submitted by: Signature: Name: Position: Senior Grid Projects Engineer	
Endorsed by: Signature: Name: Anish Varsani	Position: Manager Grid Projects
Endorsed by: Signature: Name: Sisira Weeratunga	Position: General Manager Grid Planning
Endorsed by: Signature: Name: Peter Price	Position: Chief Engineer
Approved to submit Board Memo: Signature: Name: Peter Scott	Position: Chief Executive Officer

TABLE OF CONTENTS

Project Approval Report

1.0 PREAMBLE

1.1 Distribution Annual Planning Report

The network limitation found in this report were not identified in the Energex *Distribution Annual Planning Report (DAPR)* 2022, required under *clause 5.13.2 of the NER*. This limitation was not identified in the DAPR 2022 due to being beyond the Distribution Annual Planning Report period. However, this will be included in the DAPR 2023.

2.0 EXISTING NETWORK

2.1 Introduction

Caloundra 132/11kV Zone Substation (SSCLD) is located in Caloundra, in the Sunshine Coast area of Southeast Queensland. SSCLD provides electricity supply to over 22,600 predominantly domestic customers in the Aroona, Bells Creek, Caloundra, Currimundi, Little Mountain, Meridan Plains, Pelican Waters and Shelly Beach. It is part of a 132kV ring network from Mooloolaba 132/11kV Zone Substation (SSMLB), that is in turn supplied from Palmwoods Bulk Supply Substation (SSH9).

The Sunshine Coast area continues to see strong population growth and economic development. There is a large master-planned community (Aura) currently being developed to the south-west of SSCLD, in the areas of Bells Creek, that when completed is forecast to add at least 47MVA load to the network. The Aura development is a mix of residential, commercial and industrial areas. It includes shopping and dining precinct, community centres, schools, and transport centre in addition to the residential housing developments. Furthermore, the Sunshine Coast Industrial Park (SCIP) located to the west of SSCLD, in Bells Creek North, is forecast to have an additional 15MVA of load to be added to the network. These developments will add 62MVA to the ultimate electrical demand in the SSCLD supply area.

Left unaddressed there will be an ongoing high level customer impact and business impact risks associated with not being able to supply new customers in the Aura and SCIP developments in a timely manner, as well as legislated requirements risk due to non-compliance to the Energex Distribution Authority requirements. These risks will continue to increase as more customers move into the area.

Geographic and schematic views of the network area under study are provided in Figure 1 and Figure 2.

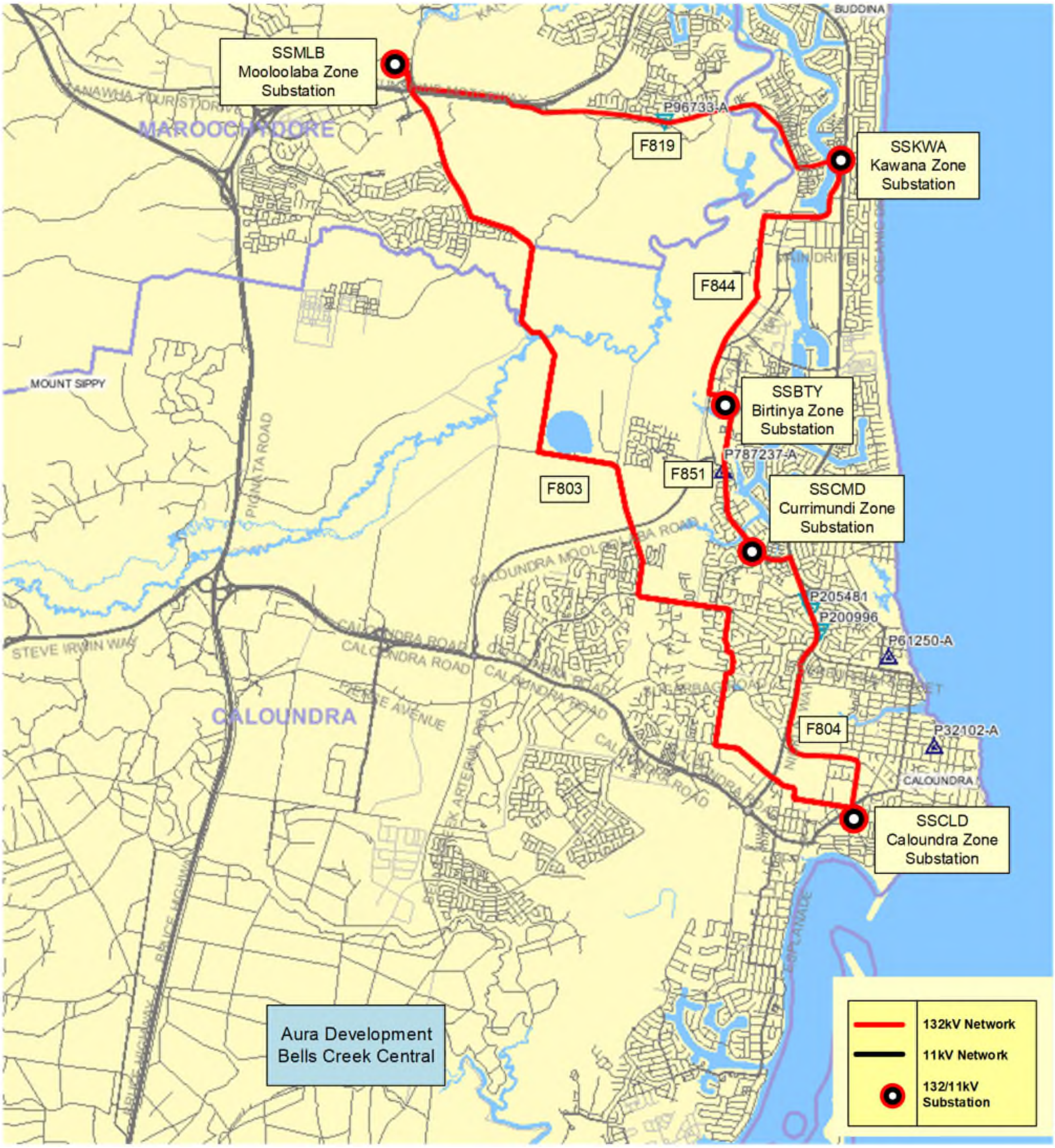


Figure 1: Existing 132kV network arrangement (geographic view)

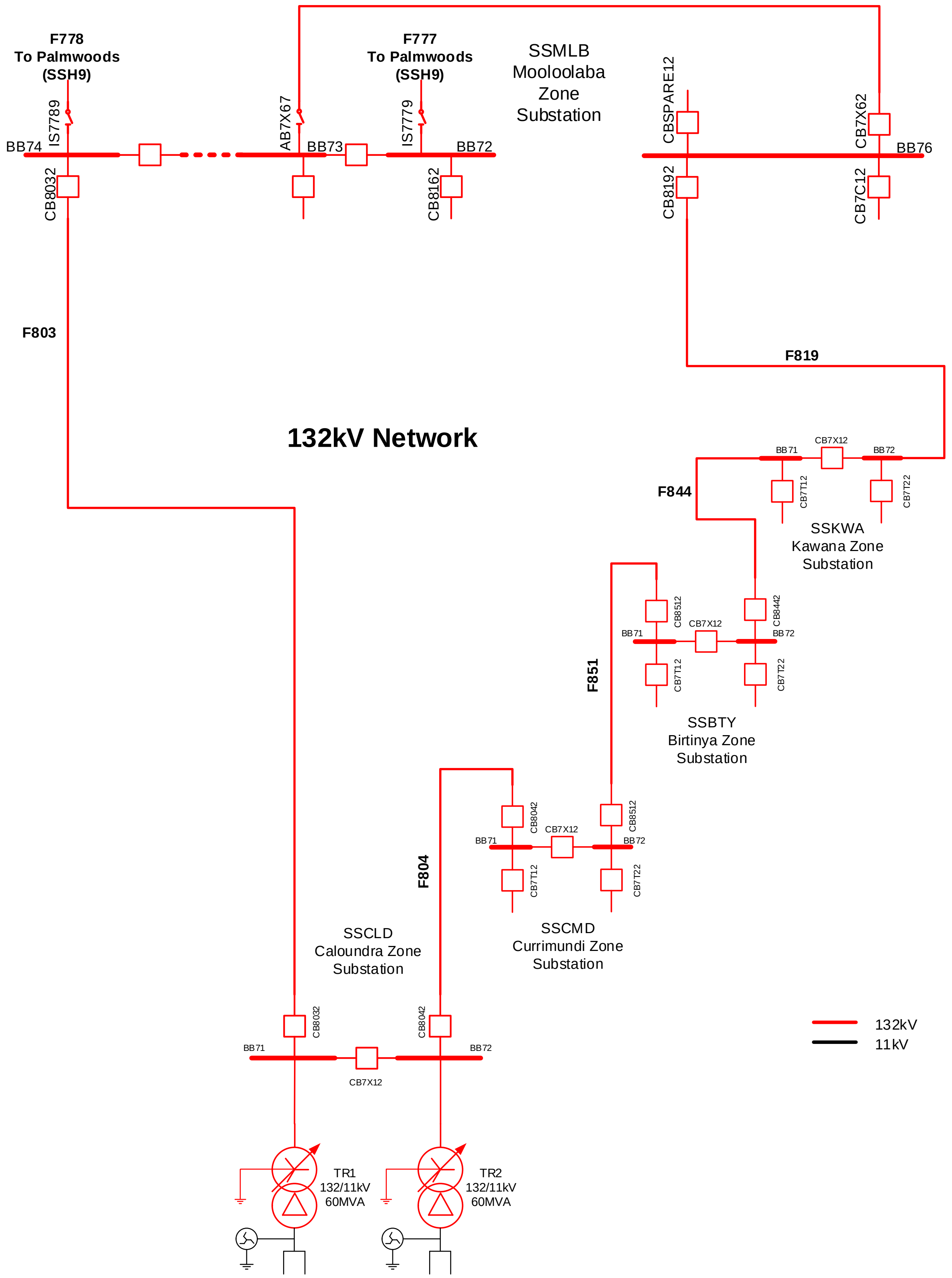


Figure 2: Existing 132kV network arrangement (schematic view)

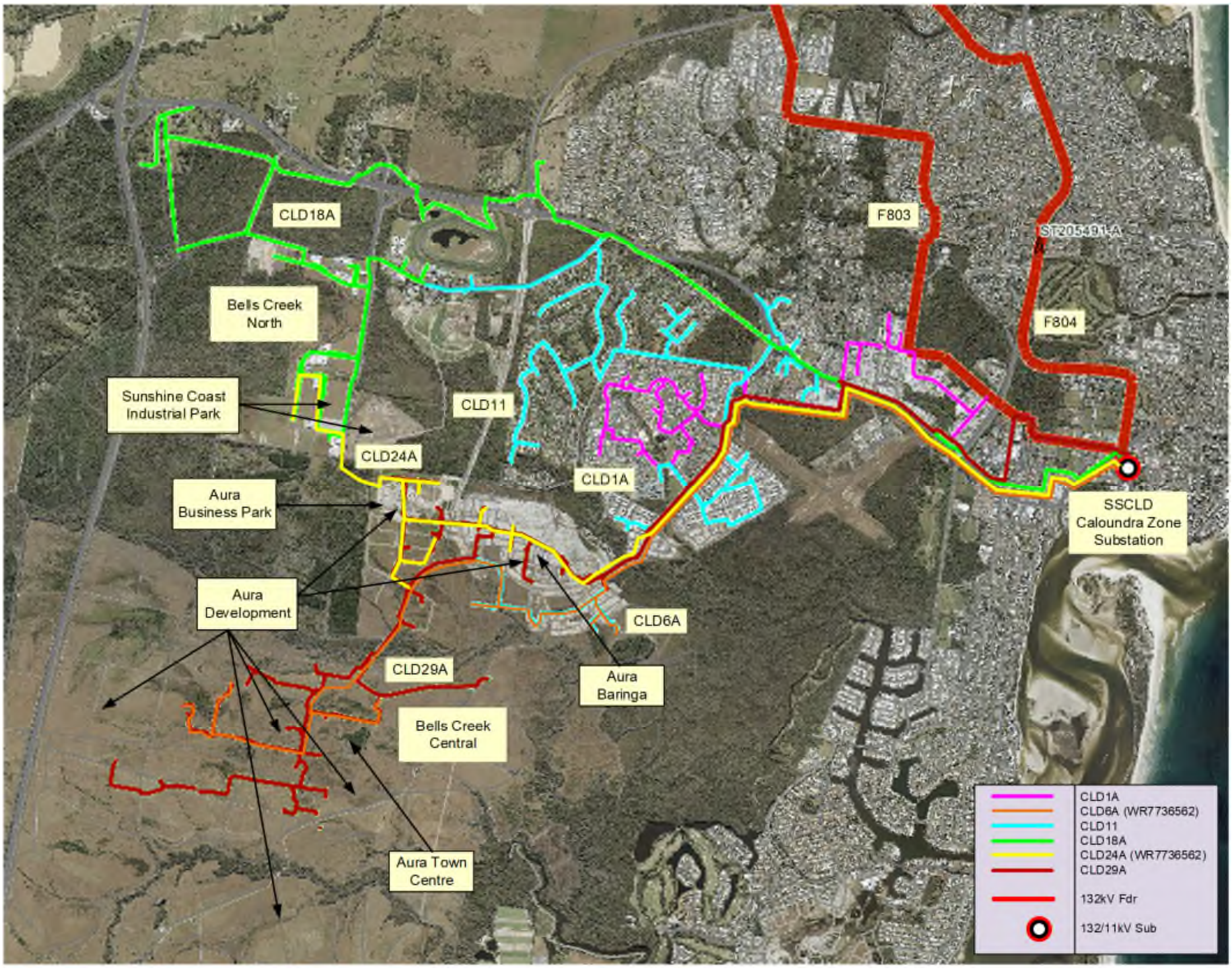
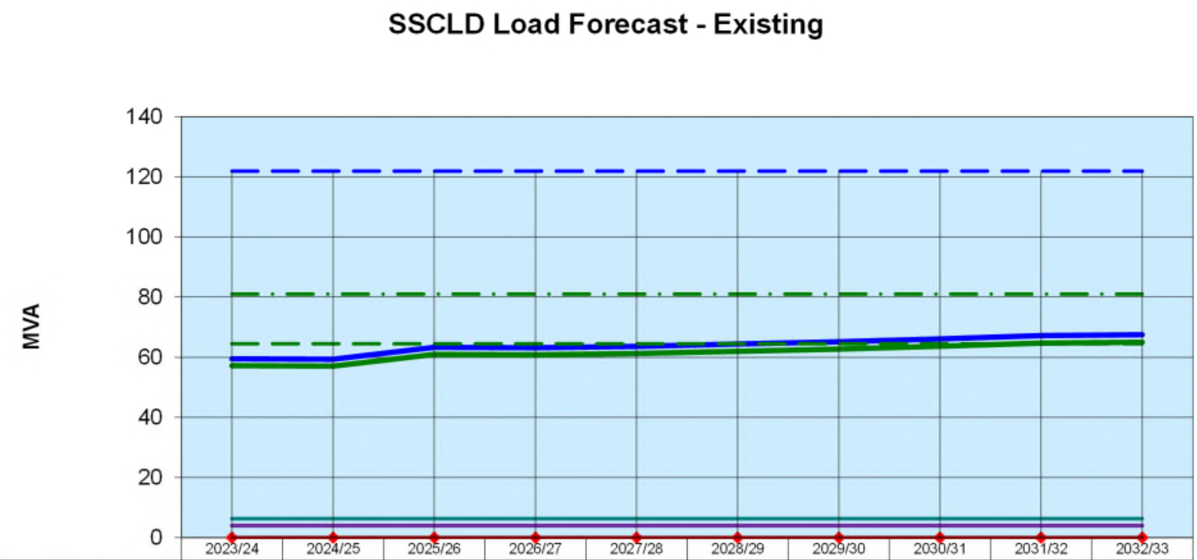


Figure 3: Existing 11kV network arrangement (geographic view)

2.2 Substation load

Substation load forecast and capacity

SSCLD is equipped with 2 x 60MVA 132/11kV transformers. The substation capacity is limited by the 11kV transformer cables and switchgear, providing a Normal Cyclic Capacity of 121.9MVA. The 10 year 10 PoE and 50 PoE load forecasts, and the existing Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment, are shown in Figure 4.



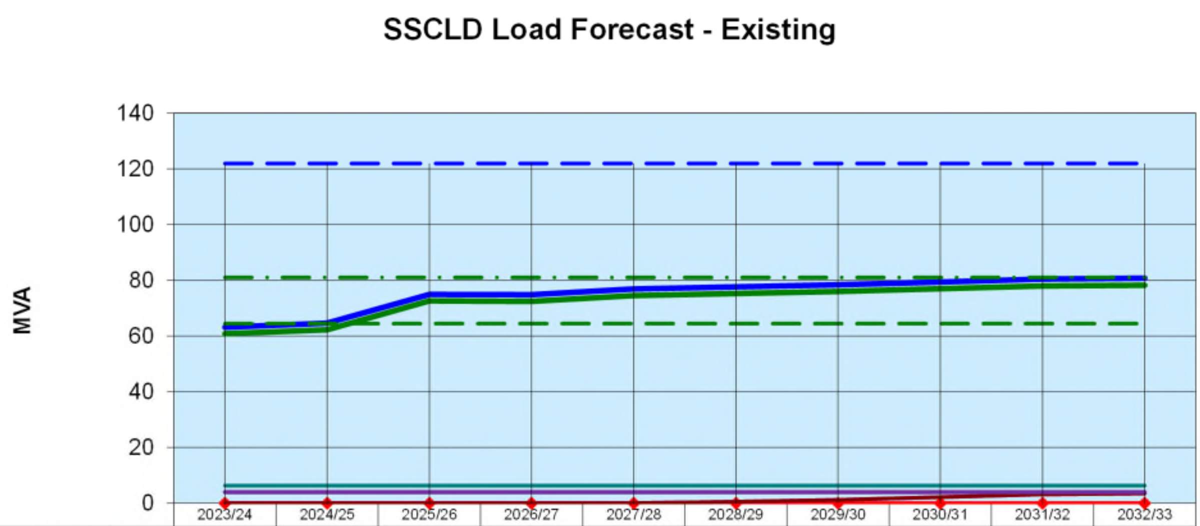
	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33
10 PoE Load	59.52	59.37	63.30	63.18	63.62	64.39	65.13	66.14	67.20	67.50
NCC	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	57.18	57.04	60.96	60.85	61.27	62.01	62.72	63.69	64.71	64.99
ECC	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50
2HEC	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
LAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Available Transfers	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 4: Substation load forecast (existing network)

The load forecast in Figure 4 includes the residential growth of approximately 7,000 new homes in Aura and the development of the Aura City Centre (5MVA). Other known block loads expected in the area within the planning horizon includes Aura College (0.36MVA), an electric bus depot (4MVA), sporting precinct (0.34MVA), large scale bakery (0.6MVA) and water pumping station (0.5MVA). These are not included in the above forecast as the connection applications are yet to be received. Refer to Appendix 1 for a link to the Aura Masterplan.

Substation load forecast including uncommitted block loads

The 10 year 10 PoE and 50 PoE load forecasts including the expected (but not committed) block loads, and the existing Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment, are shown in Figure 5.



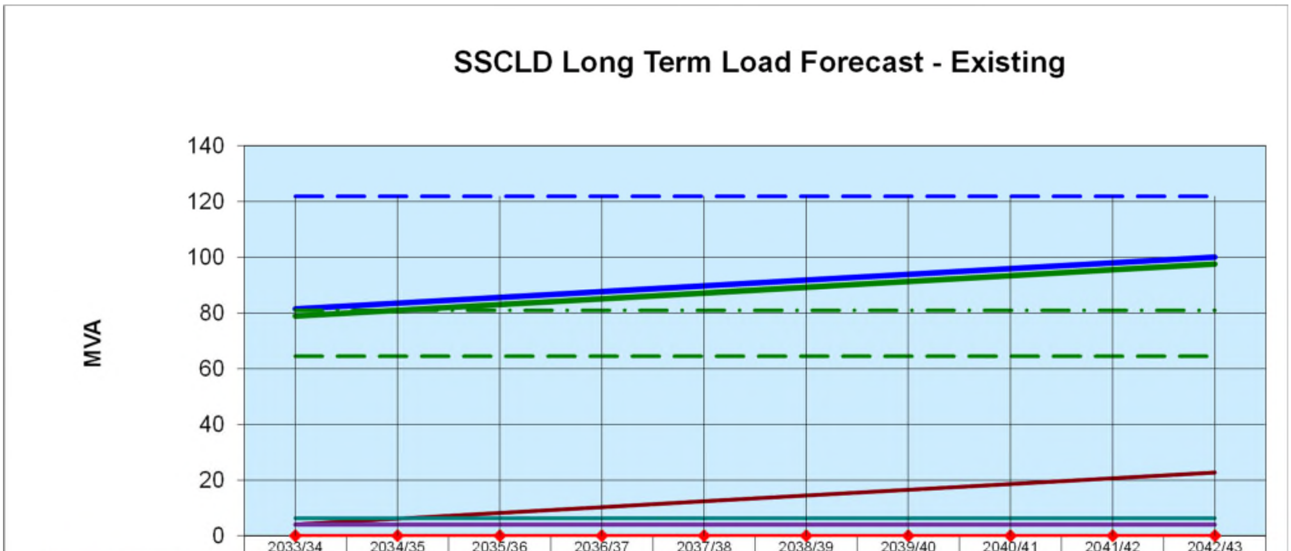
	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33
10 PoE Load	63.15	64.60	74.94	74.82	76.89	77.66	78.40	79.40	80.46	80.76
NCC	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	60.82	62.27	72.60	72.49	74.53	75.28	75.99	76.95	77.97	78.26
ECC	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50
2HEC	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
LAR	0.00	0.00	0.00	0.00	0.00	0.48	1.19	2.15	3.17	3.46
RLAR	0.00	0.00	0.00	0.00	0.00	0.48	1.19	2.15	3.17	3.46
Available Transfers	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 5: Substation load forecast (including uncommitted block loads)

The load forecast in Figure 5 shows the impact of the known block loads within Aura development. Generally, the forecast does not include smaller block loads as they are considered as part of the load growth of the substation. However, for a rapidly growing area such as Bells Creek, the combined demand of these smaller block loads within the same time frame is significant. As such, these smaller block loads were also reflected in the load forecast above. As a result, Figure 5 shows an increasing residual load at risk at SSCLD from 2028/29 during the contingency of losing one transformer at peak load conditions. This is after implementing the available 11kV feeder load transfers and deploying mobile generation.

Substation load forecast – 2033/34 to 2042/43

The 10 year 10 PoE and 50 PoE load forecasts for the period 2033/34 to 2042/43 incorporating the expected (but not committed) block loads, and the existing Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment, are shown in Figure 6. This forecast assumes a linear load increase of 2.07MVA per year over the 10-year period. By 2050 the load is expected to grow by 62MVA of additional forecast load at SSCLD. Refer to Table 1 for details of the additional load.



	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43
10 PoE Load	81.46	83.52	85.59	87.66	89.72	91.79	93.86	95.92	97.99	100.06
NCC	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	78.93	80.99	83.06	85.13	87.19	89.26	91.33	93.39	95.46	97.53
ECC	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50
2HEC	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
LAR	4.13	6.19	8.26	10.33	12.39	14.46	16.53	18.59	20.66	22.73
RLAR	4.13	6.19	8.26	10.33	12.39	14.46	16.53	18.59	20.66	22.73
Available Transfers	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 6: Substation load forecast (including uncommitted block loads)

The load forecast in Figure 6 shows an increasing residual load at risk at SSCLD from 2033/34 during the contingency of losing one transformer at peak load conditions. This is after implementing the available 11kV feeder load transfers and deploying mobile generation.

Actual Load

The actual load and load duration curves for SSCLD for the 2022/23 period are shown in Figure 7 and Figure 8. Generally, the load peaks during the summer and winter periods.

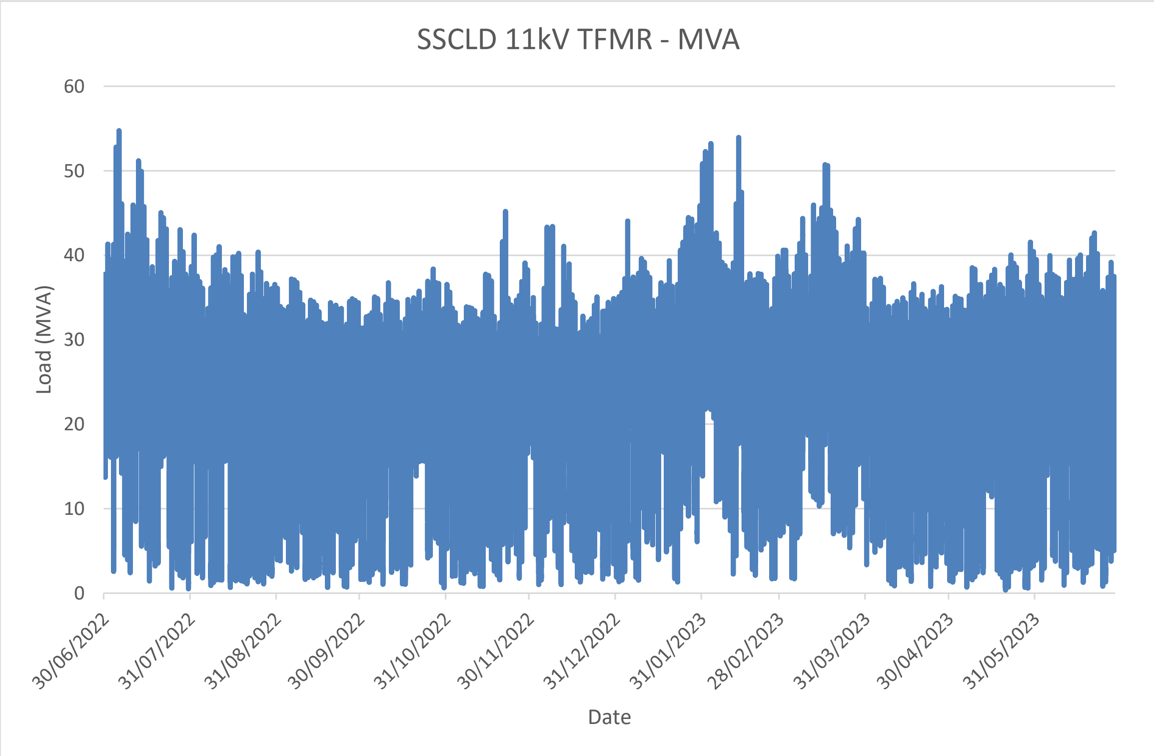


Figure 7: Substation actual load curve – SSCLD

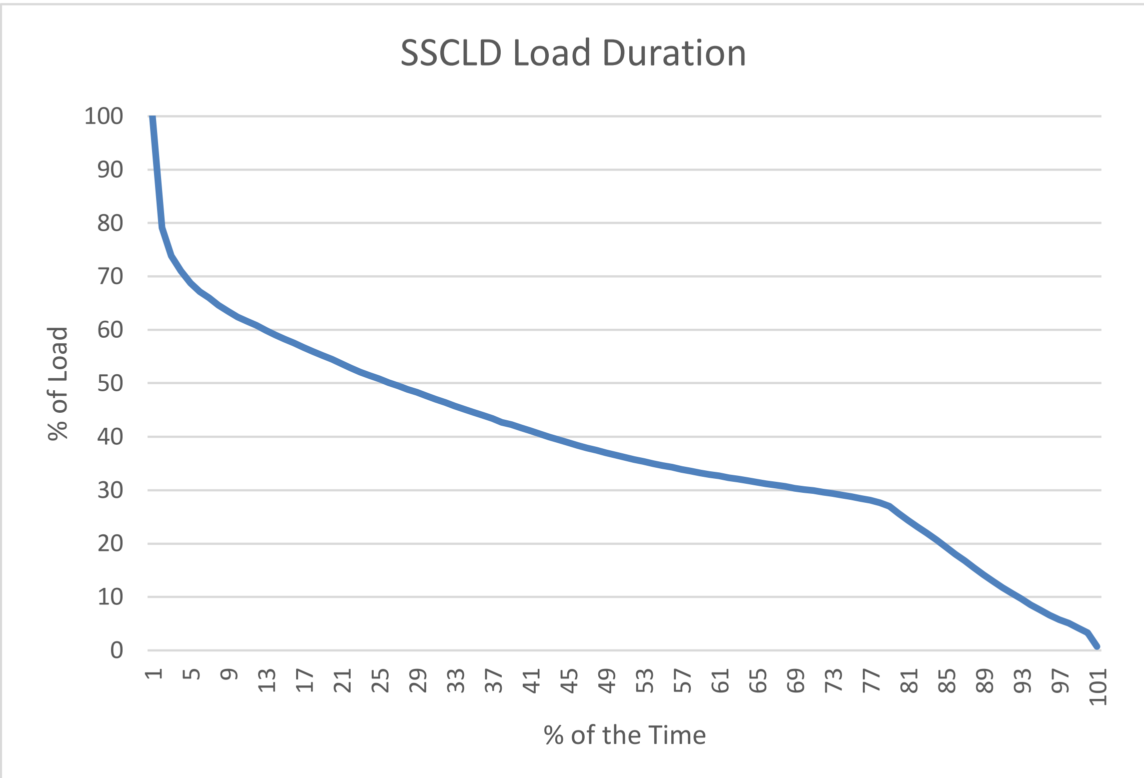


Figure 8: Substation load duration curve – SSCLD

Development overview and demand forecast

The Aura development is located in Bells Creek, south-west of SSCLD and is a master-planned community that will have over 20,000 new homes in a $24km^2$ site within the next 30 years. The development also includes a significant commercial and light industrial area, forecast to be roughly half the load of the development. Further to this, there is the existing SCIP directly west of SSCLD which is currently planned for a large expansion. When fully developed, this industrial park is forecast to have a load of 15MVA. Figure 9 shows the development areas in Bells Creek, with Table 1 showing the ultimate load of the area.

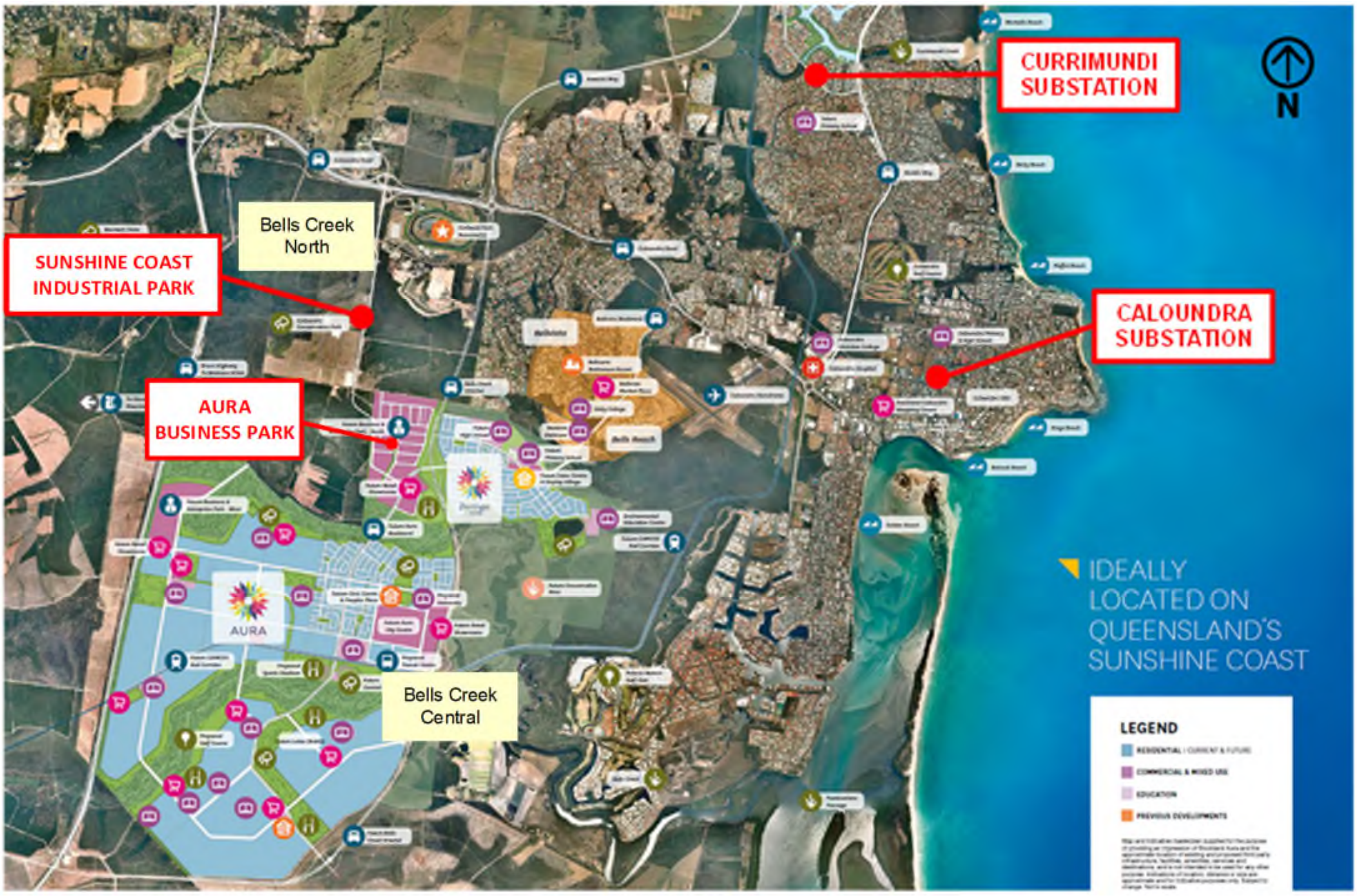


Figure 9: Proposed Aura development area

Figure 10 and Figure 11 show the rate of growth of the Aura development in Bells Creek from 2018 and 2023.

Figure 10: Proposed Aura development area in Bells Creek 2018 (geographic view)

Figure 11: Proposed Aura development area in Bells Creek 2023 (geographic view)

Load Type	Low Load Scenario (MVA)	Medium Load Scenario (MVA)
Commercial	14.9	18.6
Industrial Light	8.5	10.6
Residential High	0.5	0.6
Residential High B5	1.8	2.4
Residential Medium	6.0	8.0
Residential Undeveloped	15.3	20.4
Total for Aura Development	**47.0**	**60.4**
Sunshine Coast Industrial Park	15.0	20.0
Area Total – South Caloundra	**62.0**	**80.4**

Table 1: Ultimate load for development area (up to 2050)

As can be seen from Table 1, even under a low load scenario, the ultimate load in the Aura development alone totals at least 47MVA. When this is combined with the projected low load scenario of SCIP directly north of Aura the total load in the area is forecast to be at least 62MVA by 2050.

It should be noted that the load forecasts for Aura and SCIP have been developed based on known information about projected housing numbers and commercial / industrial development. The demand estimates are largely based around an After Diversity Maximum Demand (ADMD) of between 1.3kVA/dwelling to 1.6kVA/dwelling.

The two feeders currently supplying the Aura development are CLD11 and CLD29A. During 2022-23 these feeders had an ADMD of 1.97kVA/dwelling and 1.84kVA/dwelling respectively. The evidence to date and the plans for the Aura development includes relatively affordable housing, and hence further reductions in demand due to higher levels of battery/solar support appears unlikely. Hence, the forecasts developed are conservatively low, given recent experience.

2.3 Approved Capex works

Approved works not yet commissioned within the study area include:

- WR7736562 CLD – Establish 2 x New 11kV Feeders to the South by June 2024.

This project establishes 2 x 11kV feeders from SSCLD to supply loads in the Aura Development. It involves installing 2 x 11kV underground feeders, approximate length of 6kms each, in existing conduits. These two new 11kV feeders are to pick up loads from CLD1A, CLD11, CLD18A and CLD29A.

This project complements the options in this report.

2.4 Applied service standards

The service standards that are applicable to a consideration of supply constraints affecting this area of study are summarised below:

- As per the Network Planning Criteria stated in the *Safety Net Application Guidelines*, no transmission, sub-transmission or distribution network asset is planned to be operated above its Normal Cyclic Capacity for a forecast 10 PoE load under network normal conditions.

- Substation and sub-transmission network

    - As per *Safety Net Application Guidelines*, for a substation/sub-transmission feeder supplying urban customers in Energex, following an N-1 event, unsupplied load of up to 12MVA (5,000 customers) is allowed provided supply is restored within 3 hours.

- Distribution network

    – As per the *Standard for Sub-transmission and Distribution Planning,* no distribution feeder supplying urban customers is planned to be operated above the target maximum utilisation of 75% for a forecast 50 PoE load under network normal conditions.

- Customer connection

    – As per *Energex Connection Policy,* as a distribution network service provider, Energex is responsible for providing connection services to customers to physically connect their premises to the Energex distribution network.

2.5 Limitations of the existing network

The limitations identified in this report are due to load growth in the Caloundra area and the need to supply new customers in the Aura development and the SCIP. The following sections outline the network constraints resulting from the forecast load growth in the existing network.

The existing network limitations, based on the Energex Load Forecast (Forecast run 109 – Base Case 2023) including the expected (but not committed) block loads within the Aura development area, are as follows:

2.5.1 Subtransmission network limitations

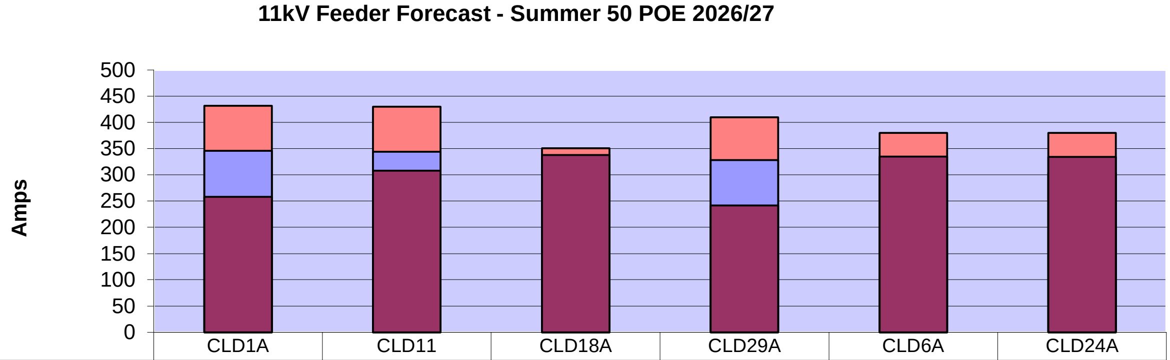
Substation capacity

As per Figure 4 and Figure 5 there are no forecast limitations at the transformers at SSCLD within the 10-year planning horizon. However, substation capacity at SSCLD will be exceeded should it supply the forecast ultimate load of the Aura development and SCIP, 47MVA and 15MVA, respectively.

2.5.2 Distribution network limitations

11kV feeder utilisation

The calculated worst case feeder utilisations of the 11kV feeders from SSCLD supplying the Aura development based on the 50 PoE load forecast, along with the existing feeder ratings are shown in Figure 12.



	CLD1A	CLD11	CLD18A	CLD29A	CLD6A	CLD24A
NCC Rating (A)	432	430	351	410	380	380
Target Utilisation (A)	346	344	281	328	304	304
Load (A)	258	308	338	242	335	334
% of rating	60%	72%	96%	59%	88%	88%

Figure 12: Maximum Summer 11kV feeder load forecast (existing network)

As outlined above, CLD18A, CLD6A and CLD24A are forecast to exceed the 75% target maximum utilisation in summer 2026/27 with maximum summer load. This 11kV feeder forecast includes the committed block loads and the two new 11kV feeders, CLD6A and CLD24A, to be established by June 2024 under WR7736562. The uncommitted block loads are not included as the feeders to be used to provide supply are yet to be determined.

11kV feeder voltage drop

The maximum voltage drop along the 11kV feeders supplying loads in the Aura development in 2026/27 load conditions are shown in Table 2.

Feeder	Existing Network
	Max voltage drop (PU)
CLD29A	0.93
CLD18A	0.90
CLD11	0.94
CLD1A	0.95
CLD24A	0.95
CLD6A	0.91

Table 2: 11kV feeder voltage drop

As shown above, the resulting voltage drop along CLD6A and CLD18A are below the maximum voltage drop of 7% for urban 11kV feeders as specified in the Standard for Sub-transmission and Distribution Planning. This target at 11kV is to ensure that the voltage at the LV system is within statutory limits of 253V to 207V as specified in *AS 60038:2022*.

11kV feeder geography

As the load at Aura increases further, establishment of new 11kV feeders from SSCLD will not be economically feasible as new conduit banks will have to be installed. The Aura City Centre is approximately 10kms from SSCLD.

Since Aura is a greenfield development, there are limited distribution assets in the area to supply the growing load. As can be seen from Figure 3, the existing load at Aura is supplied from SSCLD via CLD11 and CLD29A. The 11kV feeders CLD1A and CLD18A supplies the surrounding areas of Aura.

With the current projected load growth, Energex anticipates establishing a new 11kV feeder into the area every two to three years, depending on the load growth scenario, to service the load.

SSCLD currently only has six spare 11kV circuit breaker bays, with two already committed for the proposed new 11kV feeders under WR7736562. The other four bays with Mitsubishi (10VPR25B) 11kV circuit breakers are either recovered or parts removed to address issues elsewhere in the network. New circuit breaker trucks will have to be installed or units repaired if new feeders are required. While Energex is generally able to utilise a single circuit breaker for two feeders, there are reliability impacts from doing this in a widespread manner, particularly for long feeders with high customer numbers such as those that will be established from SSCLD to the Aura development. As such, due to the existing customer numbers per feeder, B-leg feeders are not desirable because of their reliability impact. Hence, Energex views that the limit of new 11kV feeders from SSCLD is four additional feeders.

It should also be noted that the Aura development will continue to move towards the south and new feeders from SSCLD will continue to be longer and more costly. In addition, there are limited 11kV corridors to be able to construct new feeders from SSCLD. This means that additional 11kV feeder establishment will incur significant costs for conduit establishment to provide for new 11kV feeder routes. The proposed two 11kV feeders under WR7736562 are expected to use the remaining existing spare conduits in the area. There are no other distribution assets to the west, south and directly east of Aura. The only corridor for 11kV feeders to supply Aura load will be from the north-east coming from SSCLD. This corridor is already congested with no available spare conduits. Hence, the need to establish a new bank of conduits to be able to install additional 11kV feeders from SSCLD to Aura. This will have to be installed through a built-up area and will cause significant disruption to the community and the local businesses, all contributing to a substantive civil cost for establishing conduits.

2.5.3 Opportunity for establishment of assets

As the combined load of the two growth areas, Aura development and SCIP, is forecast to reach 62MVA (low load scenario) the need for new substation becomes imminent. New substations would also require new 132kV feeders. Community Infrastructure Designation (CID) was granted by the Ministry for Energy and Water Supply through the Notice of Ministerial Designation of Land on 3 Sept 2013. This CID is for a 132kV DCCT OH feeder from Meridan Plains to Bells Creek North through rural private properties, Council land and SCIP. Energex owns a site for a future Bells Creek North Substation (SSBCN) intended to provide supply to the loads at SCIP.

However, the growth area within Bells Creek Central, which is the Aura development, is developing more rapidly than SCIP and is forecast to have a higher demand of 47MVA. Hence, a new substation in Bells Creek Central will be required, along with a 132kV DCCT feeder, to provide supply to the rapidly growing load. The developer of Aura is gifting land to Energex for a 132/11kV substation in exchange for Energex installing a section of the 132kV DCCT feeder as underground through Aura Business Park, through the proposed sporting fields and along Bells Creek Arterial. They also agree for Energex to install a section of the 132kV DCCT feeder as overhead along the fringes of the Aura Business Park. The substation site that the Aura developer is gifting to Energex is located across Bells Creek Arterial from the proposed Aura City Centre and a pocket of residential dwellings.

The Aura development is staged as follows:

- Completed – residential communities of Baringa, Nirimba and Banya, Baringa State Primary and Secondary Schools, Nirimba State Primary School, early learning centre, community centre, sports complex and early stages of Aura Business Park.

- Ongoing development to 2025 – Bells Creek Arterial Rd., Aura Brook residential community, primary and secondary Catholic School within Aura City Centre, Nirimba Childcare Centre, petrol station and service centre, sports parks and clubhouse.

- 2026 to 2030 – first stages of the Aura City Centre, additional stages of the Aura Business Park, Banya State Primary School, Banya Childcare Centre and additional residential community.

- Beyond 2030 – retail centre expansion, university within Aura City Centre, additional private and state schools, parklands and community gathering spaces.

Due to the higher balance of commercial and residential development beyond 2025, Energex considers that the window of opportunity to establish a new substation and 132kV overhead and underground feeders will be within the period of 2025 to 2030. Once the area is built-up and in the advanced stages of development, there is a higher risk of community objection to the establishment of a new substation and 132kV feeders. There will also be significant community impacts as the 132kV DCCT OH and UG sections are installed on the roads or road reserves.

Refer to Appendix 1 for a link to the published Aura Masterplan.

2.6 Impact of doing nothing

The “do nothing” option is not acceptable as the following do not comply with the applied service standards detailed in section 2.3:

- Continuous operation of existing 11kV network at SSCLD that has been deemed to reach capacity limits poses an ongoing medium-level customer impact risk due to reduced reliability during contingency conditions.

- Continuous operation of the existing network at SSCLD poses an ongoing medium-level customer impact risk to Energex due to its inability to supply customers leading to damage of brand or reputation.

- Continuous operation of the existing network at SSCLD poses an ongoing high-level business impact risk to Energex due to the requirement to establish additional 11kV feeders from SSCLD to supply the forecast load at Aura and SCIP.

- Continuous operation of the existing network at SSCLD poses an ongoing medium-level customer impact risk to Energex due to the resulting residual load at risk following an outage of a 132/11kV transformer at SSCLD once the ultimate forecast load at Aura and SCIP are realised after all load transfers and deployment of mobile equipment.

- Continuous operation of existing 11kV network at SSCLD results in a forecast load exceeding 75% utilisation of 11kV feeders CLD18A, CLD6A, and CLD24A in summer 2026/27 thereby breaching requirements of the Network Planning Criteria stated in the Safety Net Application Guidelines. This will result to limited 11kV feeder transfers during contingency conditions during peak loads and maintenance works.

- Legislative non-compliance with the Energex Distribution Authority requirements.

2.7 Current risk level

The current level of risk has been assessed according to the latest Network Risk Framework and is summarised in Table 3. Refer to Appendix 5 for details of the risk scenario maps.

Risk Category	Equipment	Risk Scenario	Current Risk Level	
Customer Impact	Feeder	Inability of Energex to supply the rapidly growing load at Aura leading to damage of reputation or brand.	L = 3	C = 5
			R = 15 (Medium Risk)	
Business Impact	Feeder	Community objection to establishing the 132kV DCCT OH/UG feeder thereby delaying the commissioning of the 132/11kV substation at Bells Creek Central results to Energex spending approximately $20 million to establish additional 11kV feeders from SSCLD.	L = 3	C = 6
			R = 18 (High Risk)	
Legislated Requirements	Feeder	Inability of Energex to supply the rapidly growing load at Aura leading to a breach of the conditions of the Distribution Authority to ensure adequate connection and supply of electricity to customers.	L = 3	C = 5
			R = 15 (Medium Risk)	
Legislated Requirements	Transformer	Failure of 1 x 60MVA 132/11kV transformer at SSCLD during peak load conditions causing unsupplied load and leading to a breach of the Energex Distribution Authority requirements.	L = 3	C = 4
			R = 12 (Medium Risk)	

Table 3: Summary of Current risk level

3.0 OPTIONS ANALYSIS

In the process of determining the most cost-effective solution to address the identified network limitations, Energex has sought to identify a practicable range of technically feasible, alternative options that could satisfy the network requirements in a timely and efficient manner. As a result of this process, Energex has identified a range of options that represent practical alternatives to address the network limitations in the required timeframe. The complete list of modelled or subsequent future projects for each option is shown in Appendix 3.

3.1 Alternative options rejected

For clarity, the following alternative option was considered but rejected as they were not practicable alternatives for the reasons indicated in Table 4.

Alternative option	Reasons for being rejected
Establish 11kV feeders from SSCLD to supply Aura load	– Does not enable the safety net standards to be met. – Causes capacity constraints at SSCLD. – Limited number of spare 11kV circuit breakers SSCLD. – Reliability impact due to the need to use circuit breaker B-legs for additional feeders. – Existing capacity of SSCLD will not be sufficient to supply ultimate forecast load. – Aura loads are more than 10kms from SSCLD. 11kV feeder capacity to be limited by voltage drop. – Will incur a significant incremental cost for 11kV feeder works beyond the two feeders that have already been proposed under WR7736562.
Establish SSBCN using 3-winding 132/33/11kV transformer (Stage 1) Establish SSBCR 33/11kV zone substation (Stage 2)	– No available transformer that has a tertiary winding with enough capacity to supply the forecast 11kV loads at SSBCN. – Using a non-standard transformer will drive the need to purchase another unit for spares. – Economically sub-optimal option.
Establish SSBCR and supply via 132kV feeders from SSCLD.	– Requires underground construction of the 132kV DCCT feeders from SSCLD to be established through congested commercial and residential areas (approximately 9.6km). – Requires two additional 132kV feeder bays at SSBCR to be able to supply the future SSBCN. – Economically sub-optimal option.

Table 4: Alternative options rejected

3.2 Network options

The options below have been assessed as meeting the applied service standards. The complete list of modelled projects and timings are shown in the Net Present Value Analysis in Appendix 3.

In addition to the following option that has been assessed as meeting the applied service standards, no other practically feasible and economically equivalent option has been identified in this analysis.

3.2.1 Option 1: Establish Bells Creek Central 132/11kV Zone Substation

This option involves:

- Stage 1 – establishing Bells Creek Central Zone Substation (SSBCR) with an indoor 132kV GIS (for 2 x 132kV feeders, 2 x transformers and 1 x bus section CB), 1 x 60MVA 132/11kV transformer, 2 x 11kV switchboards, 132kV DCCT mixed overhead and underground feeder, 4 x 11kV feeders and reconfiguration of the SSCLD 11kV network in 2027.

- Stage 2 – establishing 2nd 60MVA 132/11kV transformer at SSBCR in 2030.

- Stage 3 – establishing Bells Creek North Zone Substation (SSBCN) with 1 x 60MVA 132/11kV transformer in 2047.

Details of Option 1 are discussed in greater detail in latter sections of this report.

Refer to Table 14 in Appendix 3 for the succeeding stages for Option 1.

Figure 13 to Figure 15 provide geographic and schematic diagrams for Option 1 and are replicated in the Recommended development section.

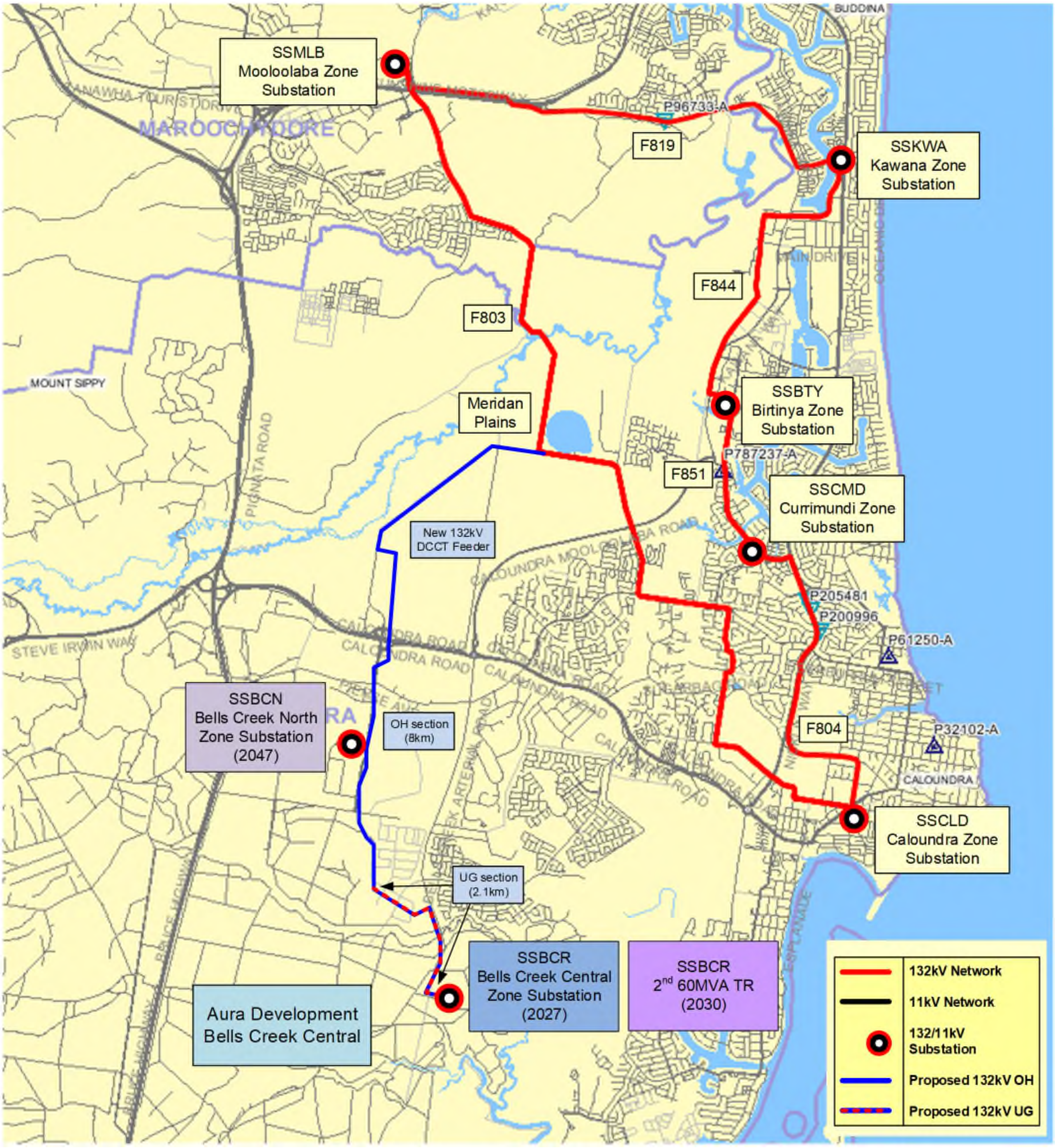


Figure 13: Proposed network arrangement Option 1 (geographic view)

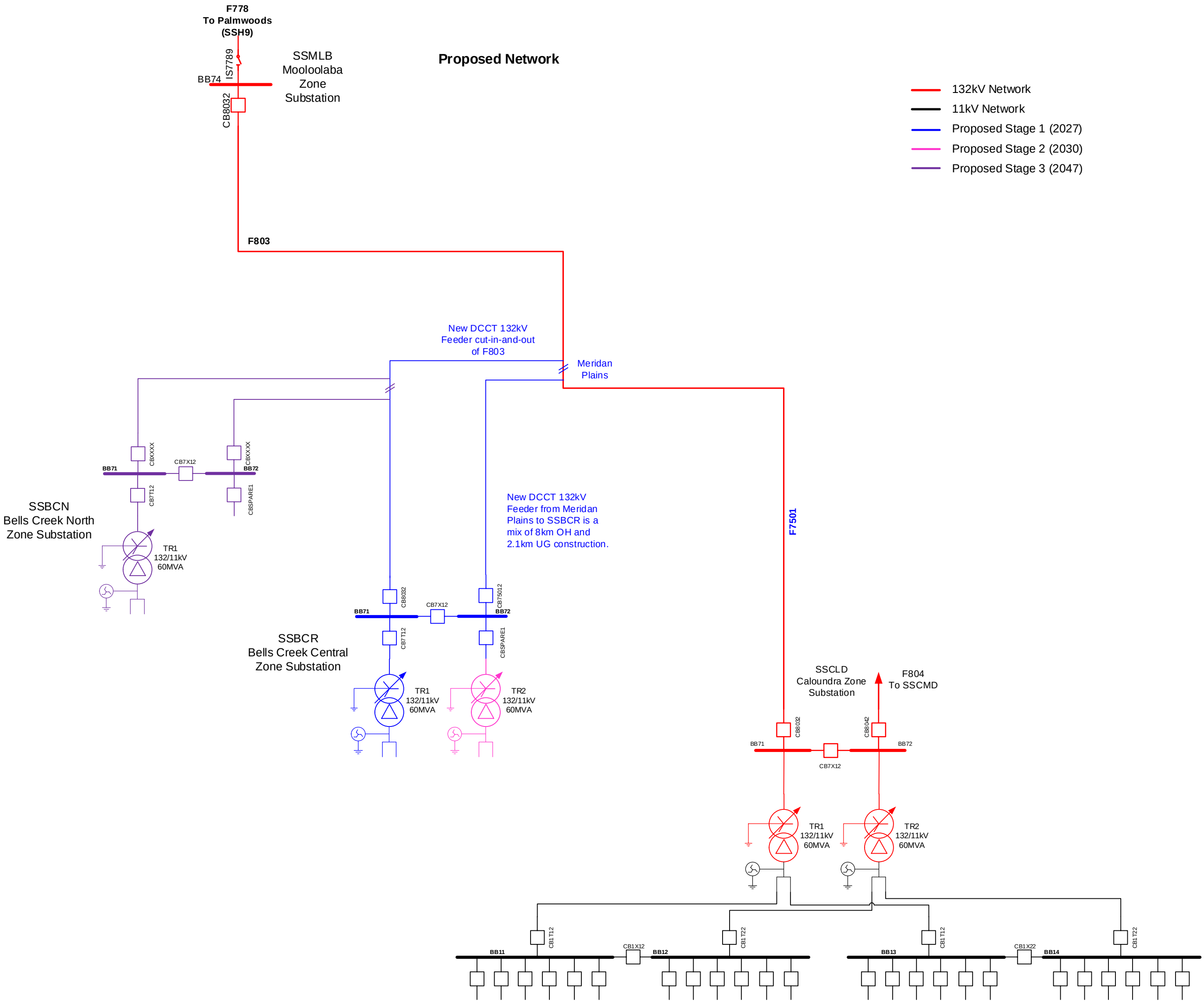


Figure 14: Proposed network arrangement Option 1 (schematic view)

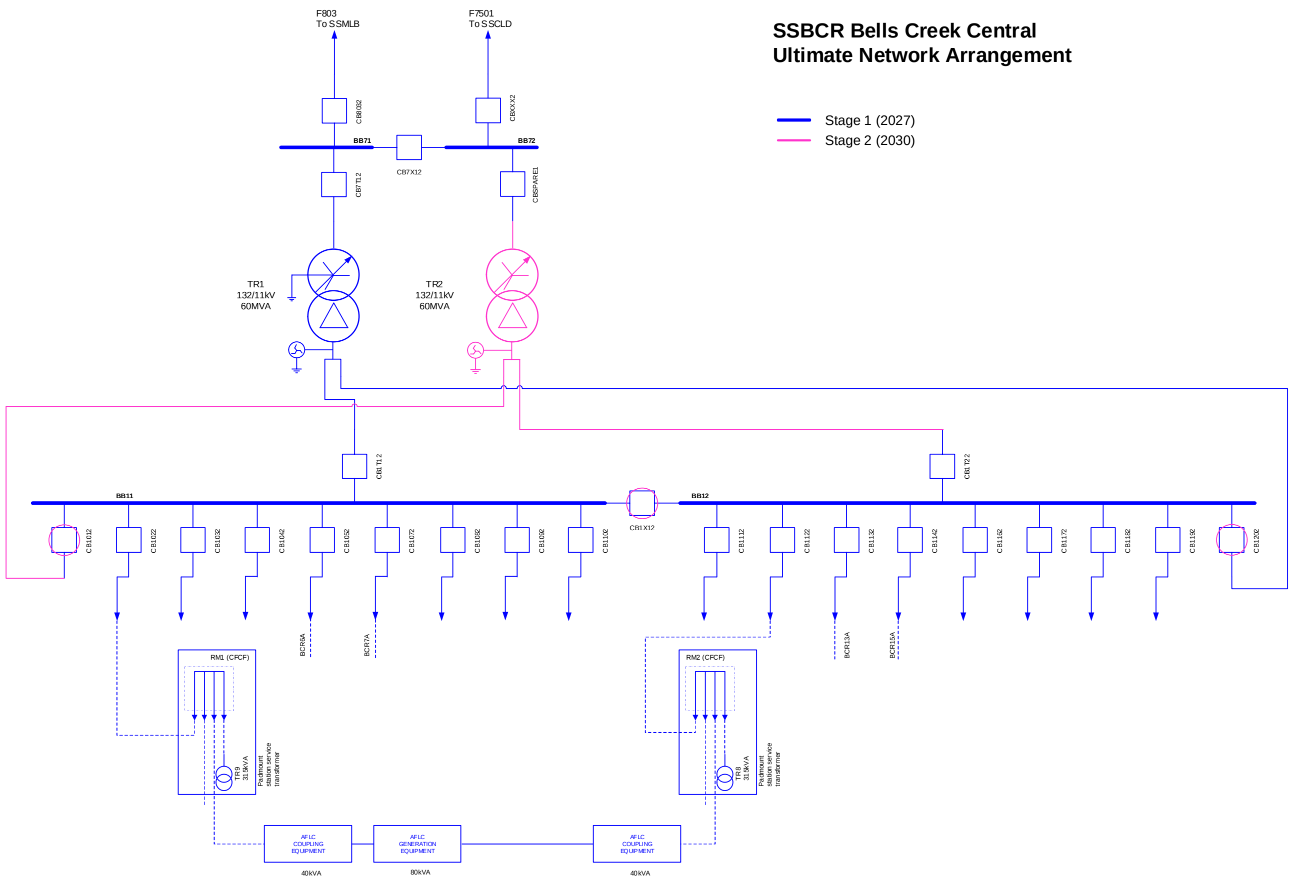


Figure 15: Proposed network arrangement Option 1 (schematic view)

3.2.2 Option 2: Establish 2 x 11kV feeders from SSCLD towards Aura

This option involves:

- Stage 1 – establishing 2 x 11kV feeders (approximately 10km each) in new conduits from SSCLD and reconfiguration of the 11kV network to supply the growing load at Aura in 2027.
- Stage 2 – establishing 2 x 11kV feeders (approximately 10km each), in conduits installed in Stage 1, from SSCLD and reconfiguration of the 11kV network to supply the growing load at Aura in 2030.
- Stage 3 – establishing SSBCR with an indoor 132kV GIS (for 2 x 132kV feeders, 2 x transformers and 1 x bus section CB), 1 x 60MVA 132/11kV transformer, 2 x 11kV switchboards, 132kV DCCT mixed overhead and underground feeder, 4 x 11kV feeders and reconfiguration of the SSCLD 11kV network in 2032.
- Stage 3 – establishing 2nd 60MVA 132/11kV transformer at SSBCR in 2037.
- Stage 4 – establishing SSBCN with 1 x 60MVA 132/11kV transformer in 2047.

Refer to Table 14 in Appendix 3 for the succeeding stages for Option 2.

Figure 16 to Figure 18 provide geographic and schematic diagrams for Option 2.

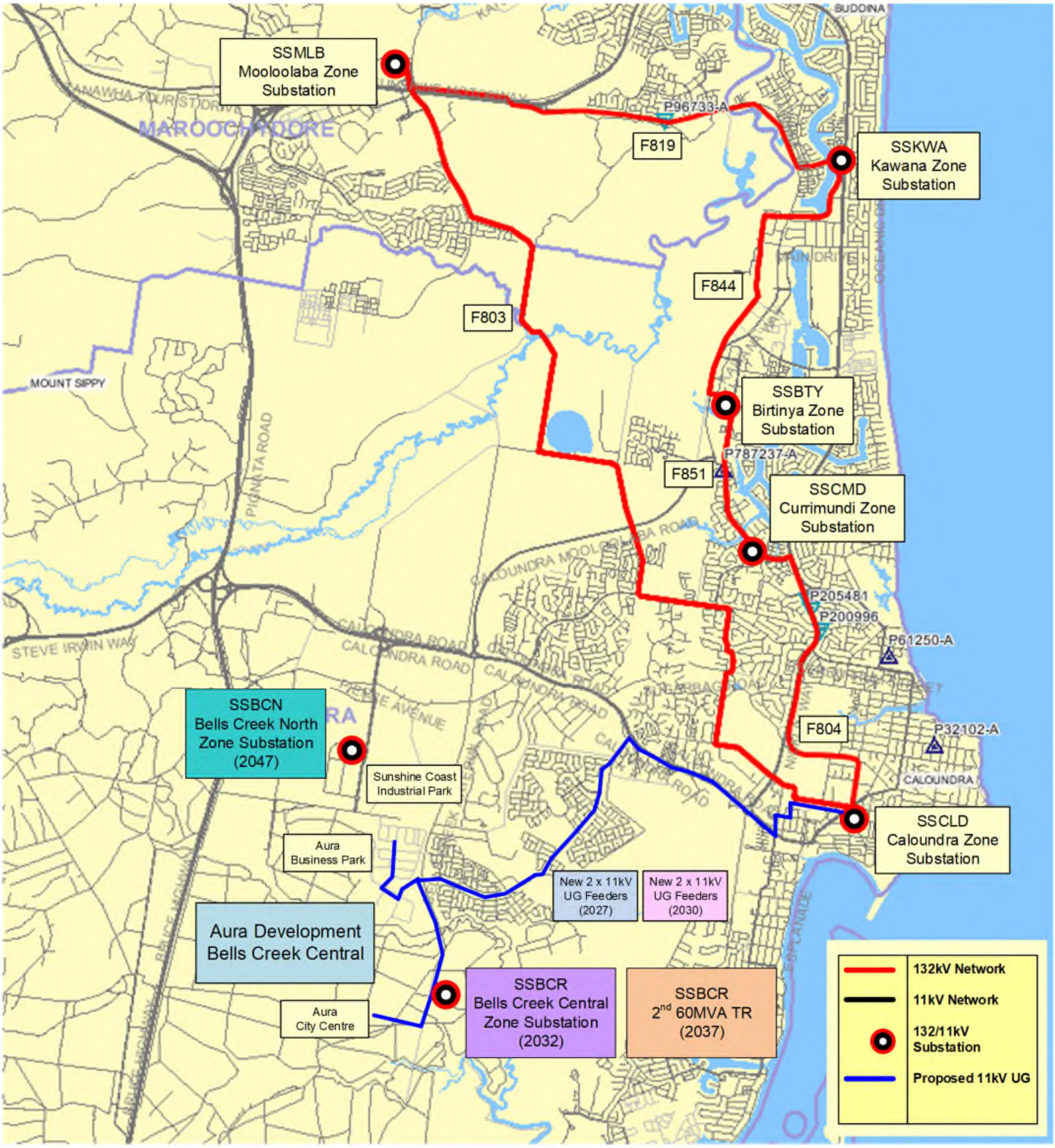


Figure 16: Proposed network arrangement Option 2 (geographic view)

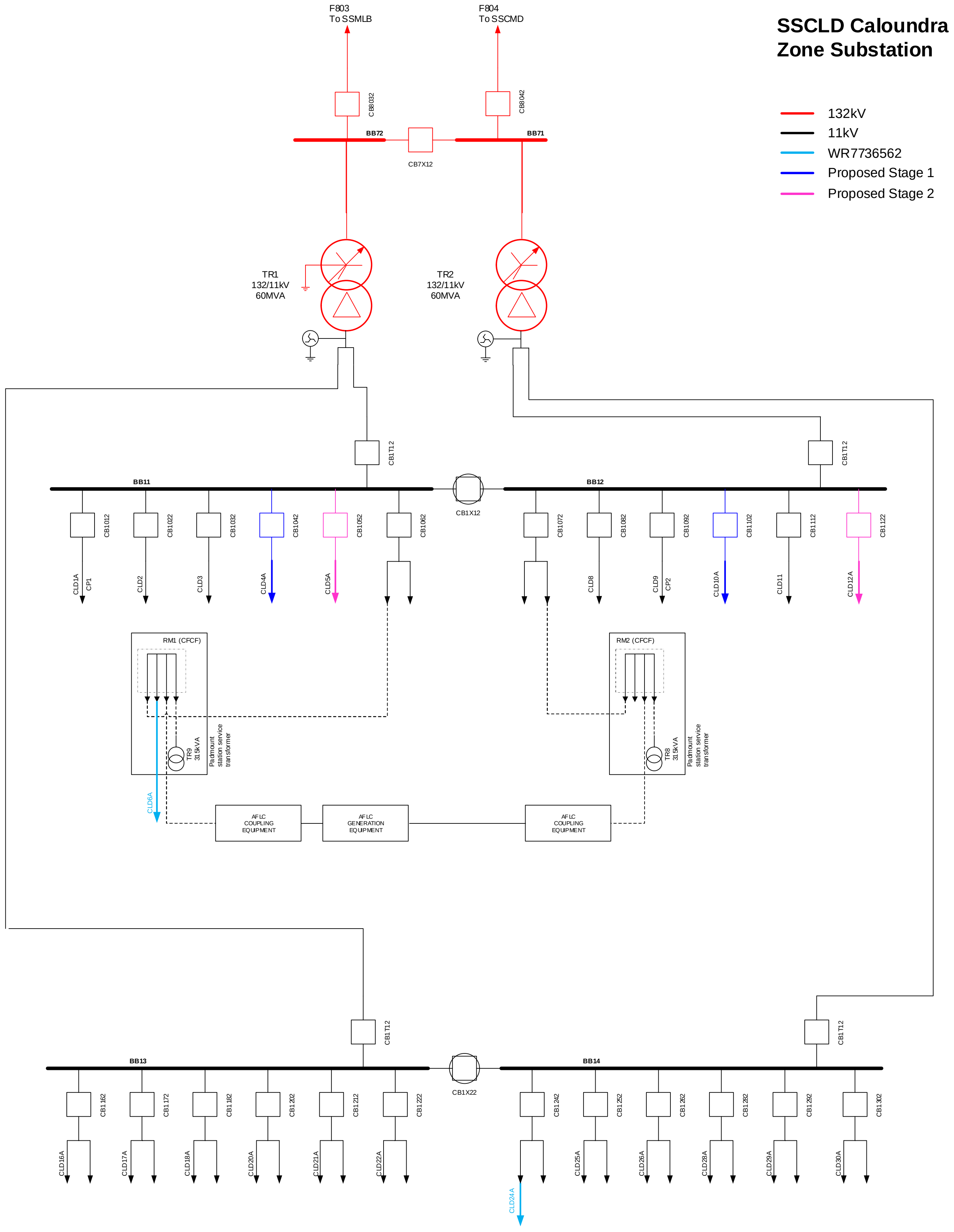


Figure 17: Proposed network arrangement Option 2 (schematic view)

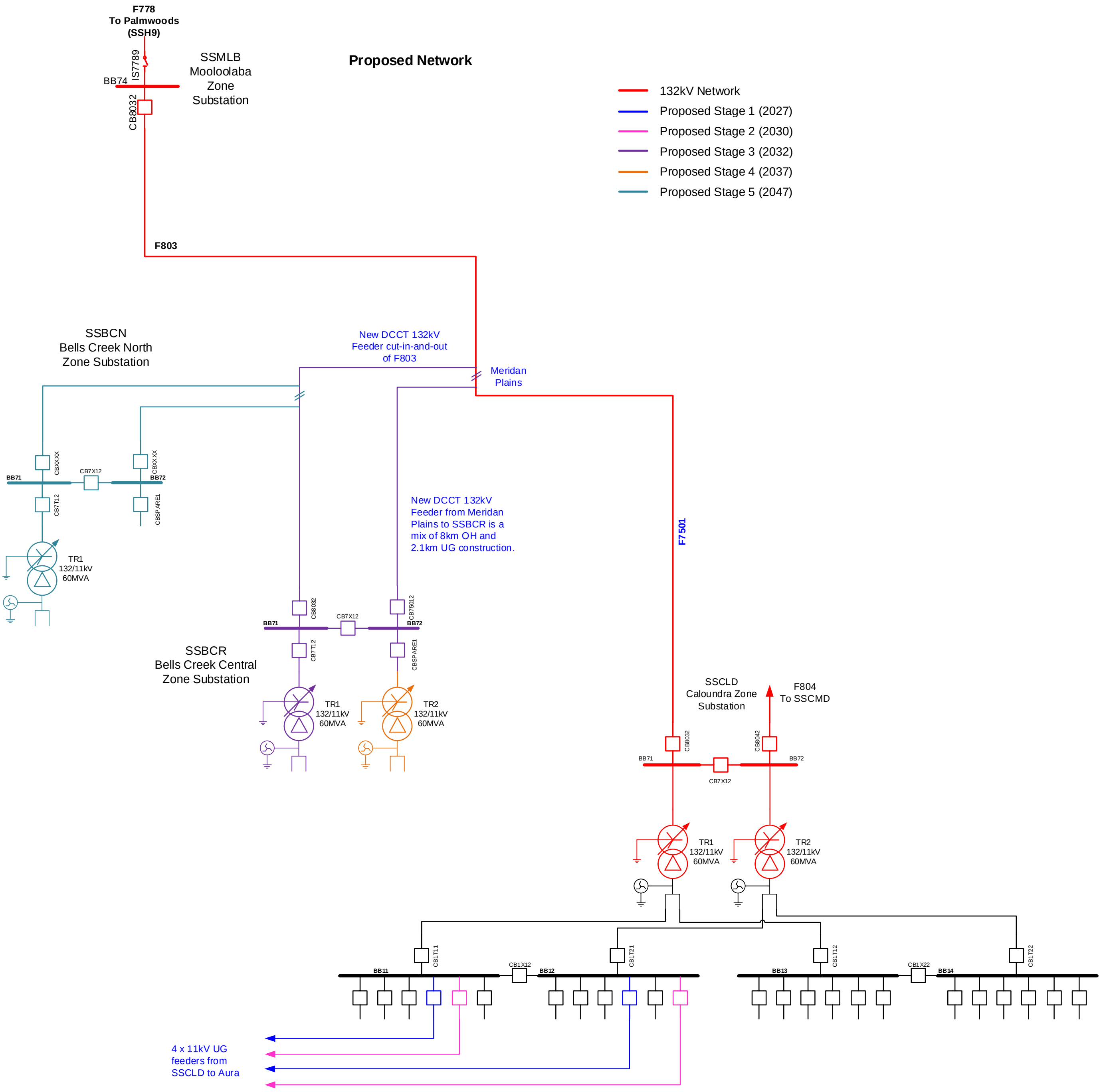


Figure 18: Proposed network arrangement Option 2 (schematic view)

3.2.3 Option 3: Establish Meridan Plains 132/33kV Bulk Supply and Bells Creek Central 33/11kV Zone substations

This option involves:

- Stage 1 – establishing a new 132/33kV bulk supply substation at Meridan Plains consisting of an indoor 132kV GIS (for 2 x 132kV feeders, 2 x transformers and 1 x bus section), 1 x 80MVA 132/33kV transformer, indoor 33kV GIS (for 2 x transformers, 3 x 33kV feeders, and 1 x bus section CB), establishing SSBCR Zone Substation consisting of 1 x 25MVA 33/11kV transformer, 33kV and 11kV switchgear (module 1); a double circuit 33kV underground feeder from Meridan Plains to SSBCR, 4 x 11kV feeders and reconfiguration of the SSCLD 11kV network in 2027.

- Stage 2 – establishing second 80MVA 132/33kV transformer at Meridan Plains and second module (with 25MVA 33/11kV transformer) at SSBCR in 2032.

- Stage 3 – establishing a third module (with 25MVA 33/11kV transformer) at SSBCR and third 33kV UG feeder from Meridan Plains to SSBCR in 2037.

- Stage 4 – establishing SSBCN 33/11kV Zone Substation with 1 x module in 2042.

- Stage 5 – establishing a second module (with 25MVA 33/11kV transformer) at SSBCN in 2050.

Refer to Table 14 in Appendix 3 for the succeeding stages for Option 3.

Figure 19 to Figure 22 provide geographic and schematic diagrams for Option 3.

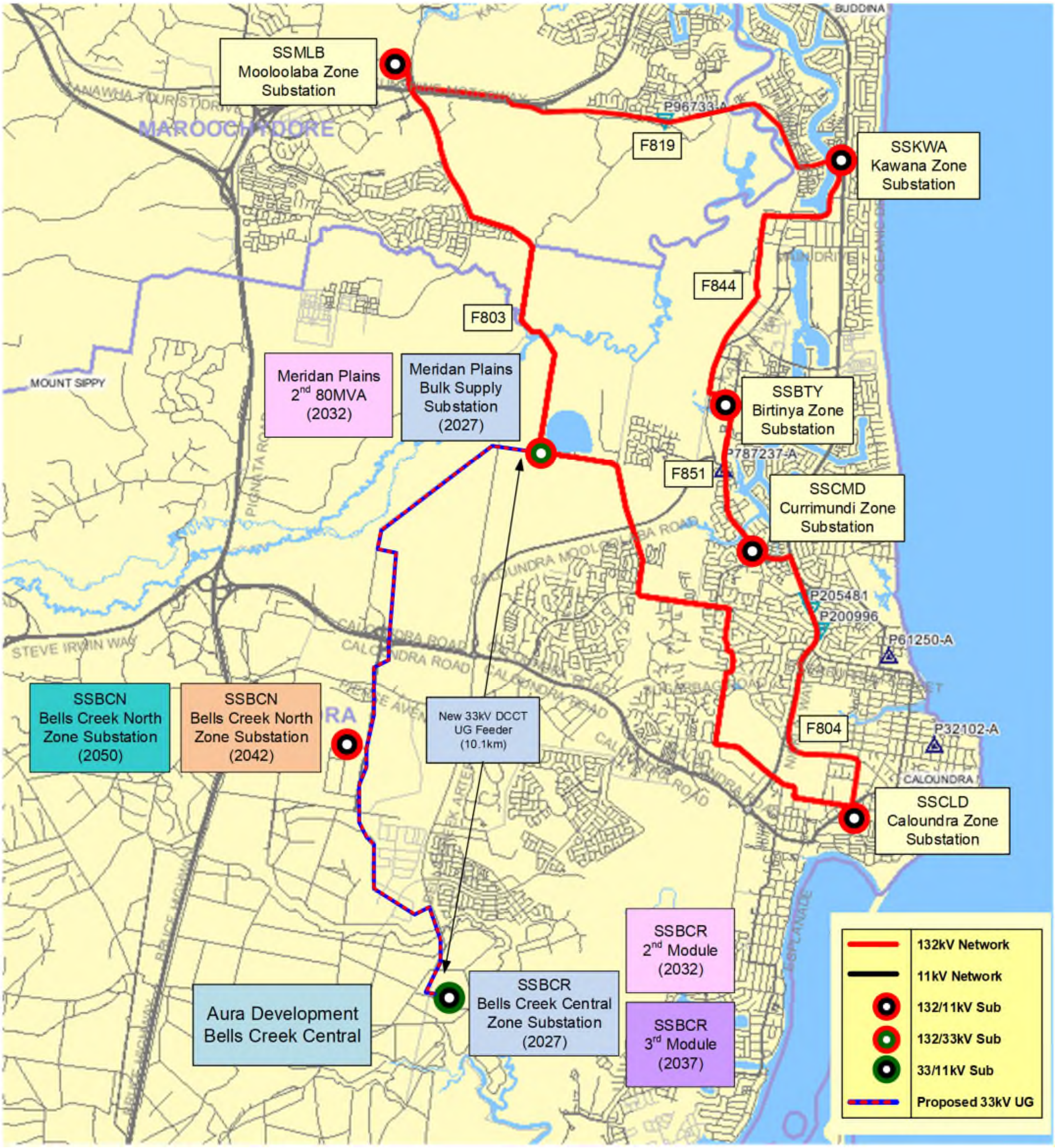


Figure 19: Proposed network arrangement Option 3 (geographic view)

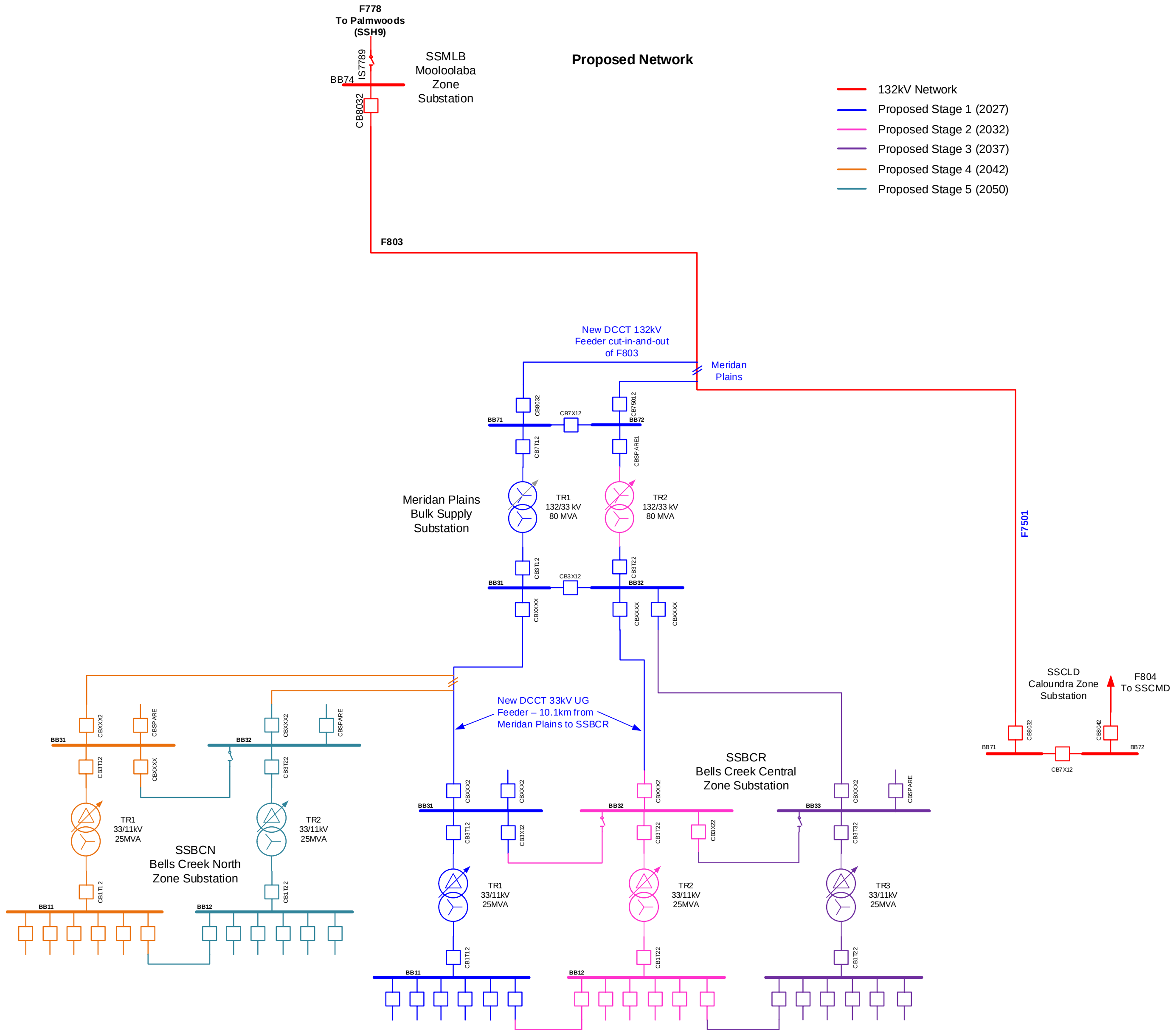


Figure 20: Proposed network arrangement Option 3 (schematic view)

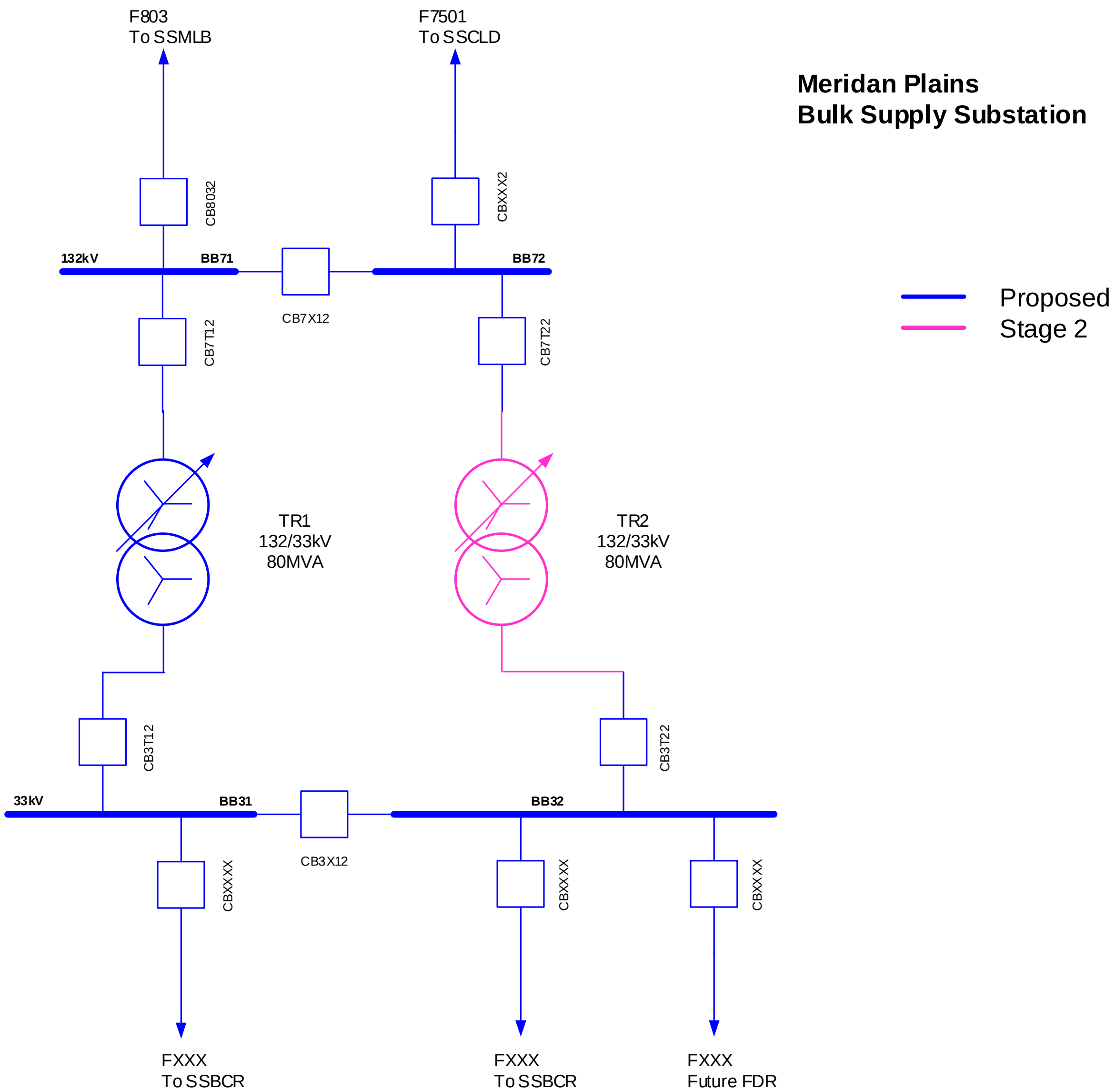


Figure 21: Proposed network arrangement Option 3 (schematic view)

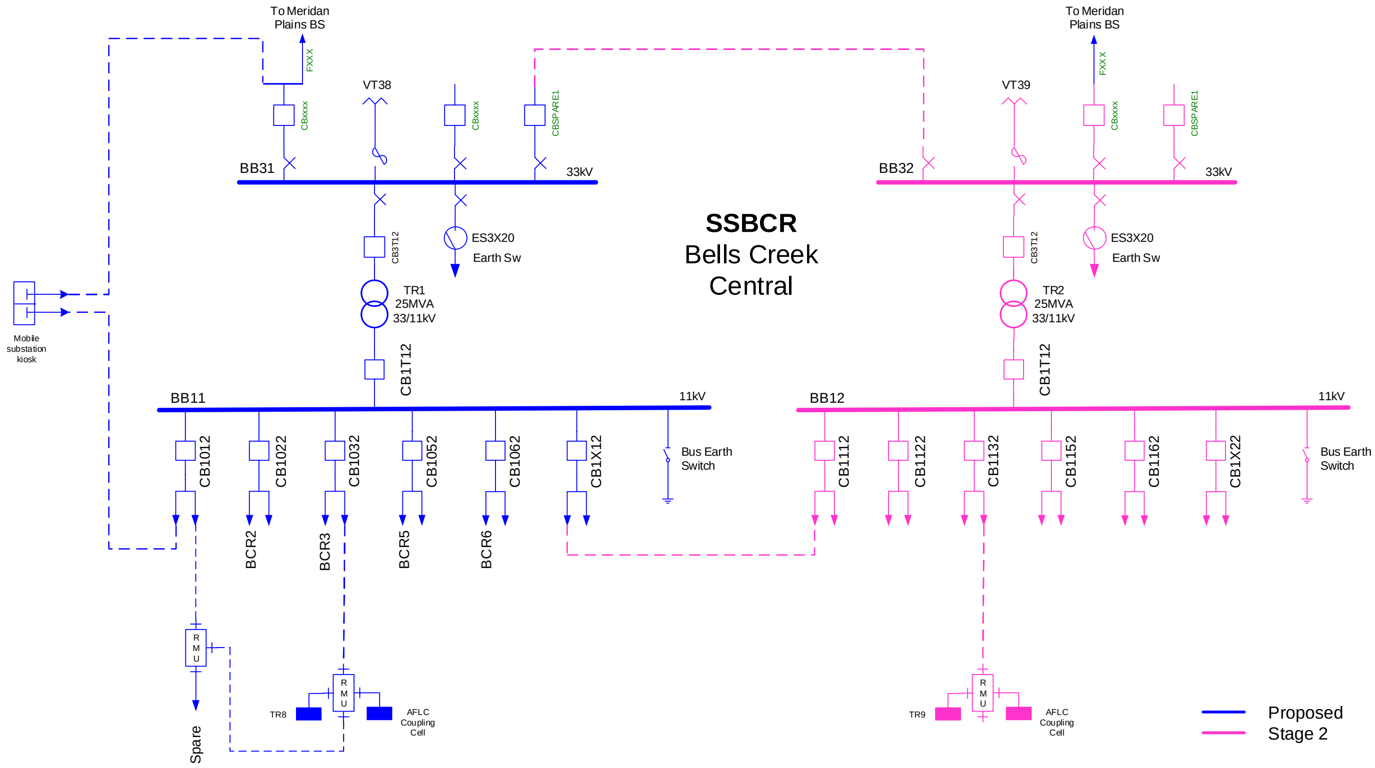


Figure 22: Proposed network arrangement Option 3 (schematic view)

3.2.4 Option 4: Establish Bells Creek North 132/33kV Bulk Supply and Bells Creek Central 33/11kV Zone substations

This option involves:

- Stage 1 – establishing SSBCN 132/33kV Bulk Supply Substation consisting of an indoor 132kV GIS (for 2 x 132kV feeders, 2 x transformers and 1 x bus section CB), 1 x 80MVA 132/33kV transformer, indoor 33kV GIS (for 4 x transformers, 3 x 33kV feeders, and 1 x bus section CB), a 132kV DCCT overhead feeder from Meridan Plains to SSBCN, establishing SSBCR Zone Substation consisting of 1 x 25MVA 33/11kV transformer, 33kV and 11kV switchgear (module 1), a 33kV DCCT underground feeder from SSBCN to SSBCR, and reconfiguration of the SSCLD 11kV network in 2027.

- Stage 2 – establishing second 80MVA 132/33kV transformer at SSBCN and second module (with 25MVA 33/11kV transformer) at SSBCR in 2032.

- Stage 3 – establishing a third module (with 25MVA 33/11kV transformer) at SSBCR and third 33kV UG feeder from SSBCN to SSBCR in 2037.

- Stage 4 – establishing a 25MVA 33/11kV transformer and 1-bus 11kV switchgear at SSBCN in 2042.

- Stage 5 – establishing a second 25MVA 33/11kV transformer and 1-bus 11kV switchgear at SSBCN in 2050.

Refer to Table 14 in Appendix 3 for the succeeding stages for Option 4.

Figure 23 to Figure 26 provide schematic and geographic diagrams for Option 4.

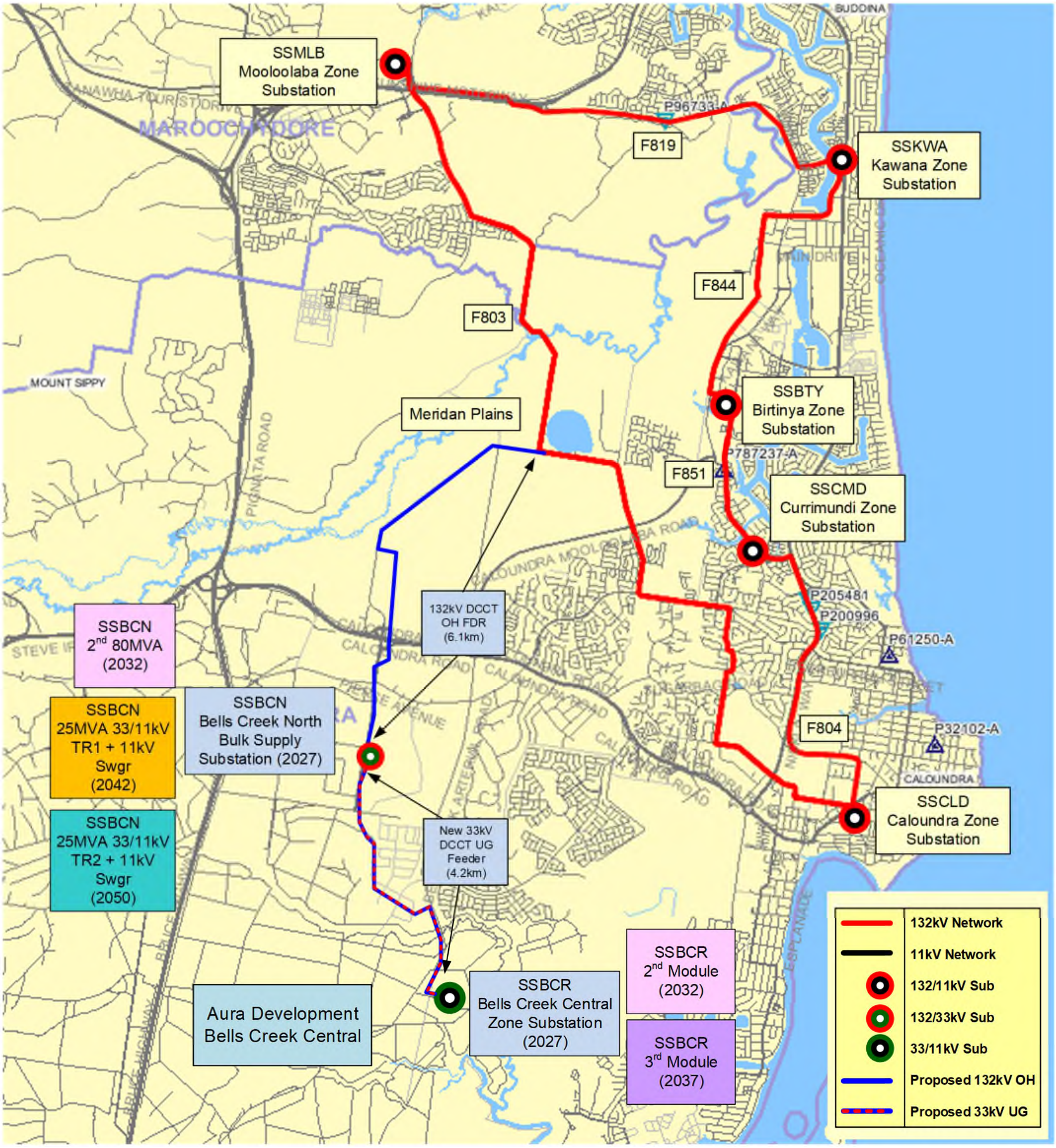


Figure 23: Proposed network arrangement Option 4 (geographic view)

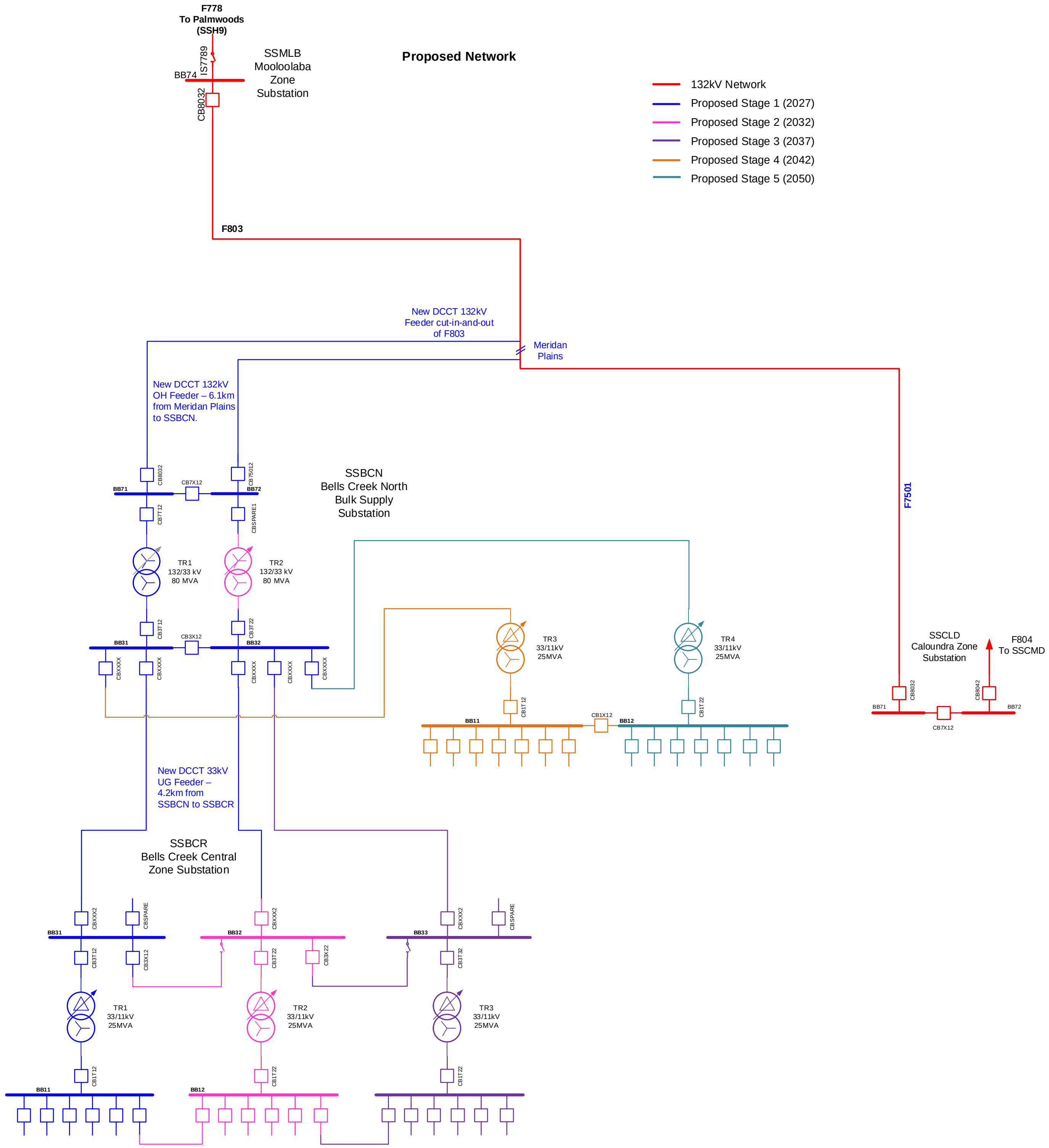


Figure 24: Proposed network arrangement Option 4 (schematic view)

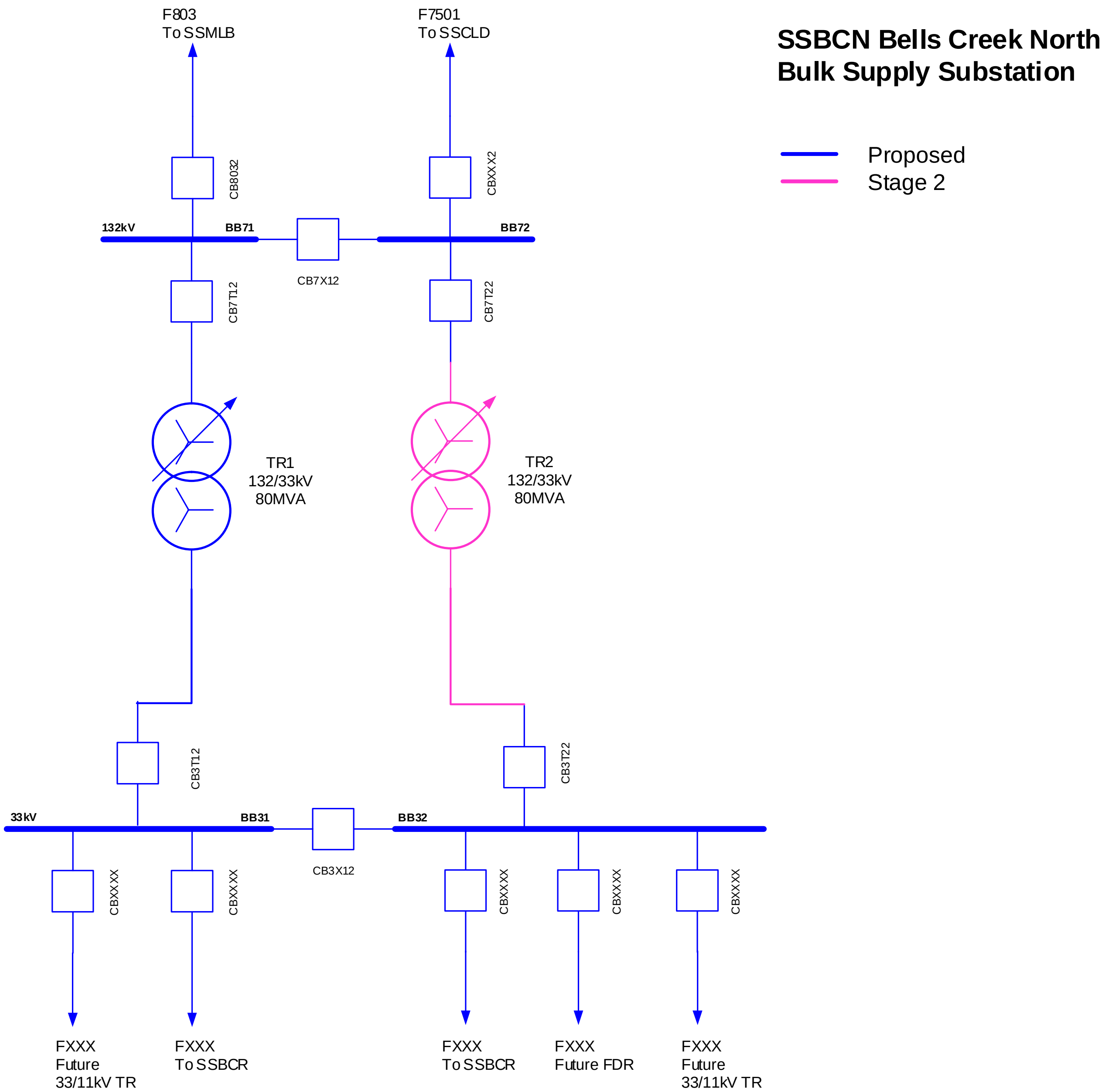


Figure 25: Proposed network arrangement Option 4 (schematic view)

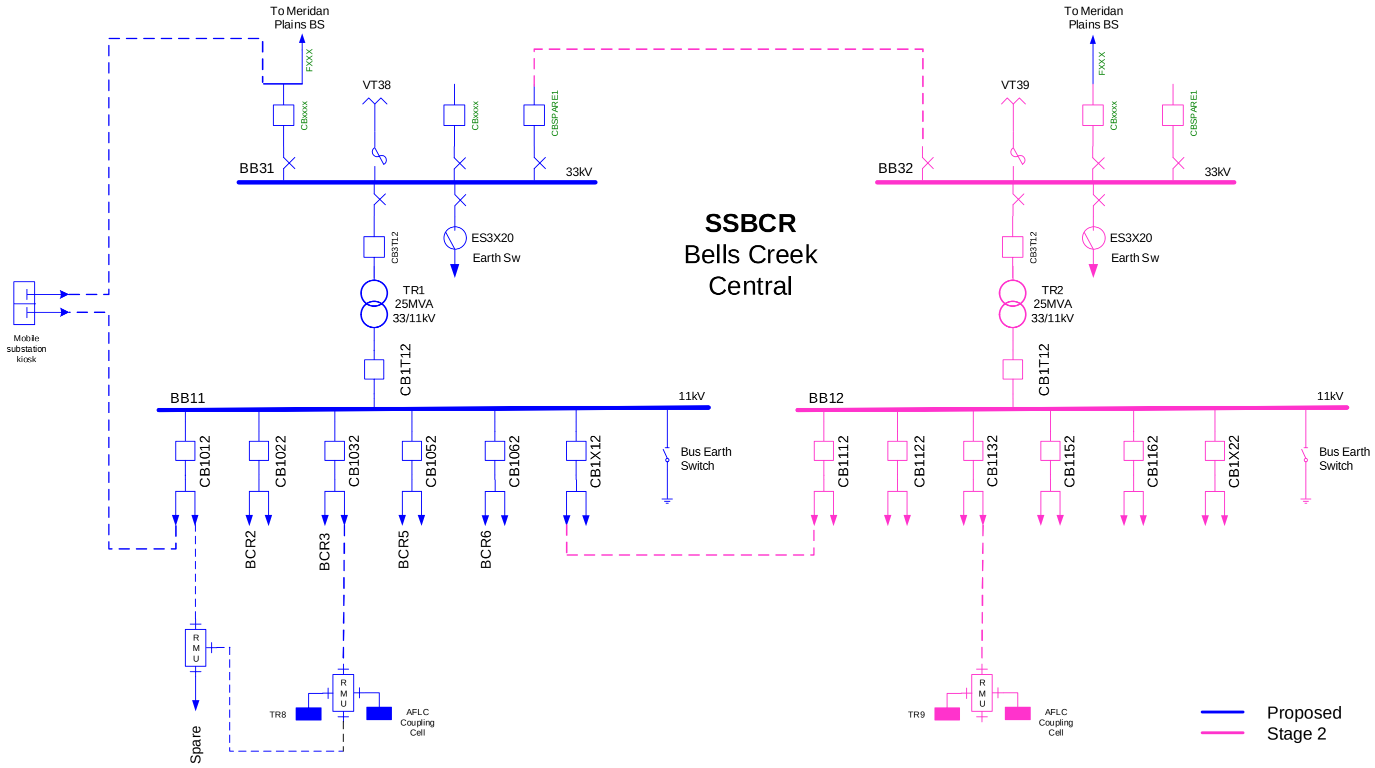


Figure 26: Proposed network arrangement Option 4 (schematic view)

3.2.5 Option 5: Establish Bells Creek North 132/33kV Bulk Supply and 33/11kV Zone Substation

This option involves:

- Stage 1 – establishing SSBCN 132/33/11kV Bulk Supply and Zone Substation consisting of an indoor 132kV GIS (for 2 x 132kV feeders, 2 x transformers and 1 x bus section CB), 1 x 80MVA 132/33kV transformer, 1 x 25MVA 33/11kV transformer, 2-bus 33kV switchgear, 2-bus 11kV switchgear, establishing a 132kV DCCT overhead feeder from Meridan Plains to SSBCN, establishing 2 x 11kV feeders and reconfiguration of the 11kV network in the Sunshine Coast Industrial Park and establishing 4 x 11kV feeders (2 x 3.8km + 2 x 4.6km) towards Aura development and reconfiguration of the SSCLD 11kV network in 2027.

- Stage 2 – establishing second 80MVA 132/33kV transformer at SSBCN Bulk Supply, establishing SSBCR Zone Substation consisting of 1 x 25MVA 33/11kV transformer, 33kV and 11kV switchgear (module 1) and establishing 33kV DCCT underground feeder from SSBCN to SSBCR in 2032.

- Stage 3 – establishing a second module (with 25MVA 33/11kV transformer) at SSBCR in 2037.

- Stage 4 – establishing a third module (with 25MVA 33/11kV transformer) at SSBCR and third 33kV UG feeder from SSBCN to SSBCR in 2042.

- Stage 5 – establishing second 25MVA 33/11kV transformer at SSBCN in 2050.

Refer to Table 14 in Appendix 3 for the succeeding stages for Option 5.

Figure 27 to Figure 29 provide schematic and geographic diagrams for Option 5.

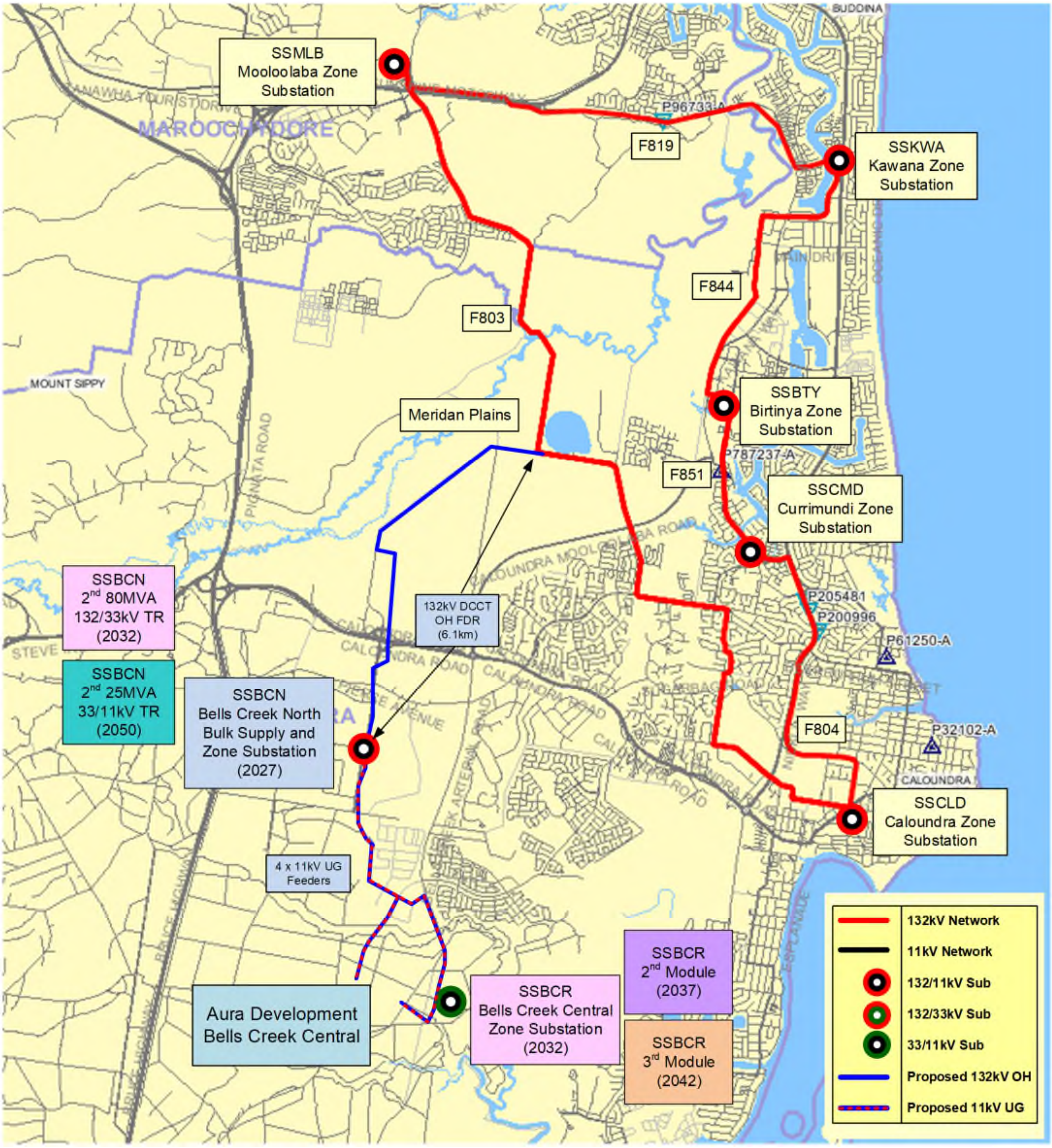


Figure 27: Proposed network arrangement Option 5 (geographic view)

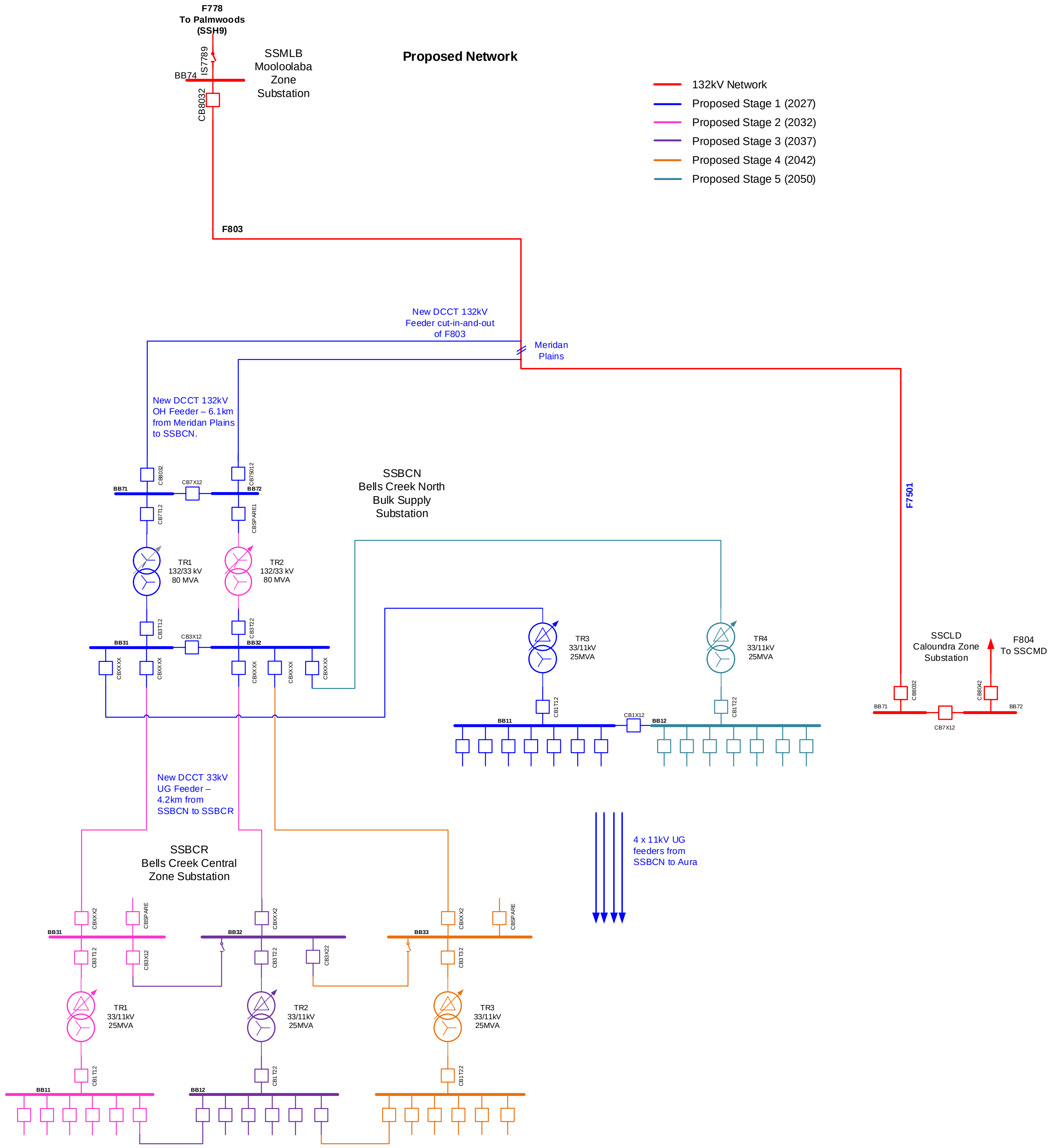


Figure 28: Proposed network arrangement Option 5 (schematic view)

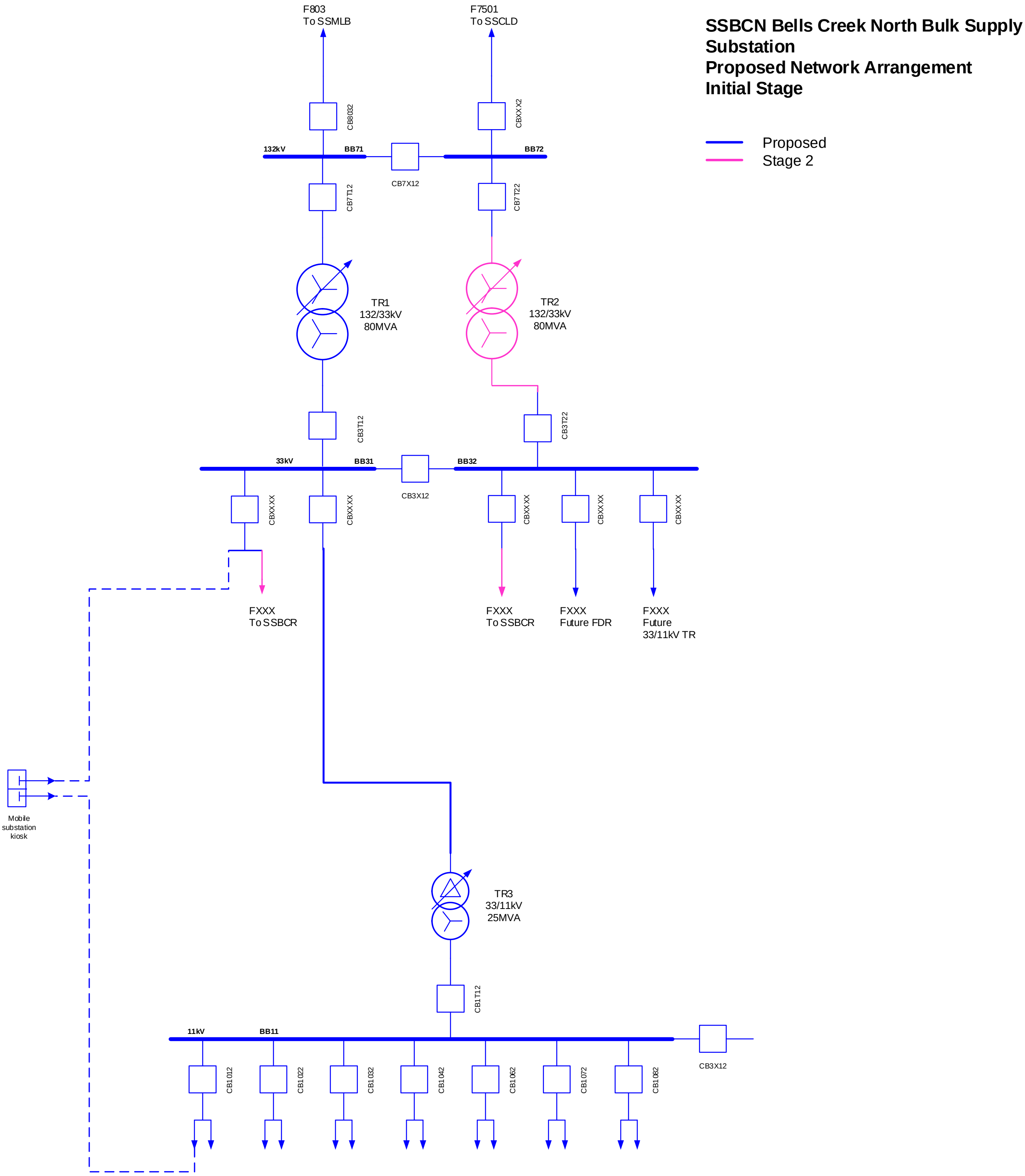


Figure 29: Proposed network arrangement Option 5 (schematic view)

3.3 Non-network alternative options

In addition to the above network options that have been assessed as meeting the applied service standards, Energex sought to identify credible non-network alternative options through the RIT-D consultation process.

During the RIT-D consultation process one submission was received in response to the Non-Network Options Report (NNOR) that was deemed credible.

Based on the load at risk and the capital cost of the proposed network option, the annuitized incentive available for a non-network solutions provider would be $1,080/kVA per year. Energex typically use a minimum cost threshold of $185/kVA per year for validating demand response/non-network alternative options, as per the AER Submission 2020-25.

3.3.1 Option 6: Contract a 24MW/39.75MWh Battery Energy Storage System

This option is a combination of non-network and network solutions. It involves entering into a contract with a non-network solutions proponent to provide a series of Battery Energy Storage System (BESS) totalling 24MW/39.75MWh for a 10-year period to eliminate load at risk in the SSCLD area. This will defer the capital works of establishing SSBCR 132/11kV Zone Substation for eight years. A non-network solutions proponent has submitted a proposal for a series of BESS sites with a total capacity of 30MW/53.2MWh installed in three phases over a five-year period. The proponent identified connection points for the BESS sites in the 11kV network of SSCLD. The BESS has an expected life of 20 years.

This option involves:

- Stage 1 – contracting a proponent to provide BESS over a period of 10 years.
    - Phase 1 – Proponent establishing BESS (3MW/3.4MWh capacity) in 2025.
    - Phase 2 – Proponent establishing BESS (additional 15MW/26.6MWh capacity) and Energex establishing a 132kV double circuit feeder (approximately 3km) energised at 11kV to serve as tie between CLD18A and CLD29A in 2026.
- Stage 2 – continuation of contract with proponent to provide BESS.
    - Phase 3 – Proponent establishing BESS (additional 12MW/23.2MWh capacity) and Energex installing 6 x 11kV UG feeders (3 x 7km, 3 x 10km) from SSCLD in 2030.
- Stage 3 – establishing SSBCR with an indoor 132kV GIS (for 2 x 132kV feeders, 2 x transformers and 1 x bus section CB), 1 x 60MVA 132/11kV transformer, 2 x 11kV switchboards, 6.1km of 132kV DCCT overhead feeder from Meridan Plains to connect to the 132kV UG feeder established in Stage 1/Phase 2 and 2.5km of 132kV DCCT underground feeder into SSBCR, 4 x 11kV feeders and reconfiguration of the SSCLD 11kV network in 2035.

- Stage 4 – establishing 2nd 60MVA 132/11kV transformer at SSBCR in 2040.
- Stage 5 – establishing SSBCN with 1 x 60MVA 132/11kV transformer in 2047.

Refer to Table 14 in Appendix 3 for the succeeding stages for Option 6.

Figure 30 and Figure 31 provide geographic and schematic diagrams for Option 6.

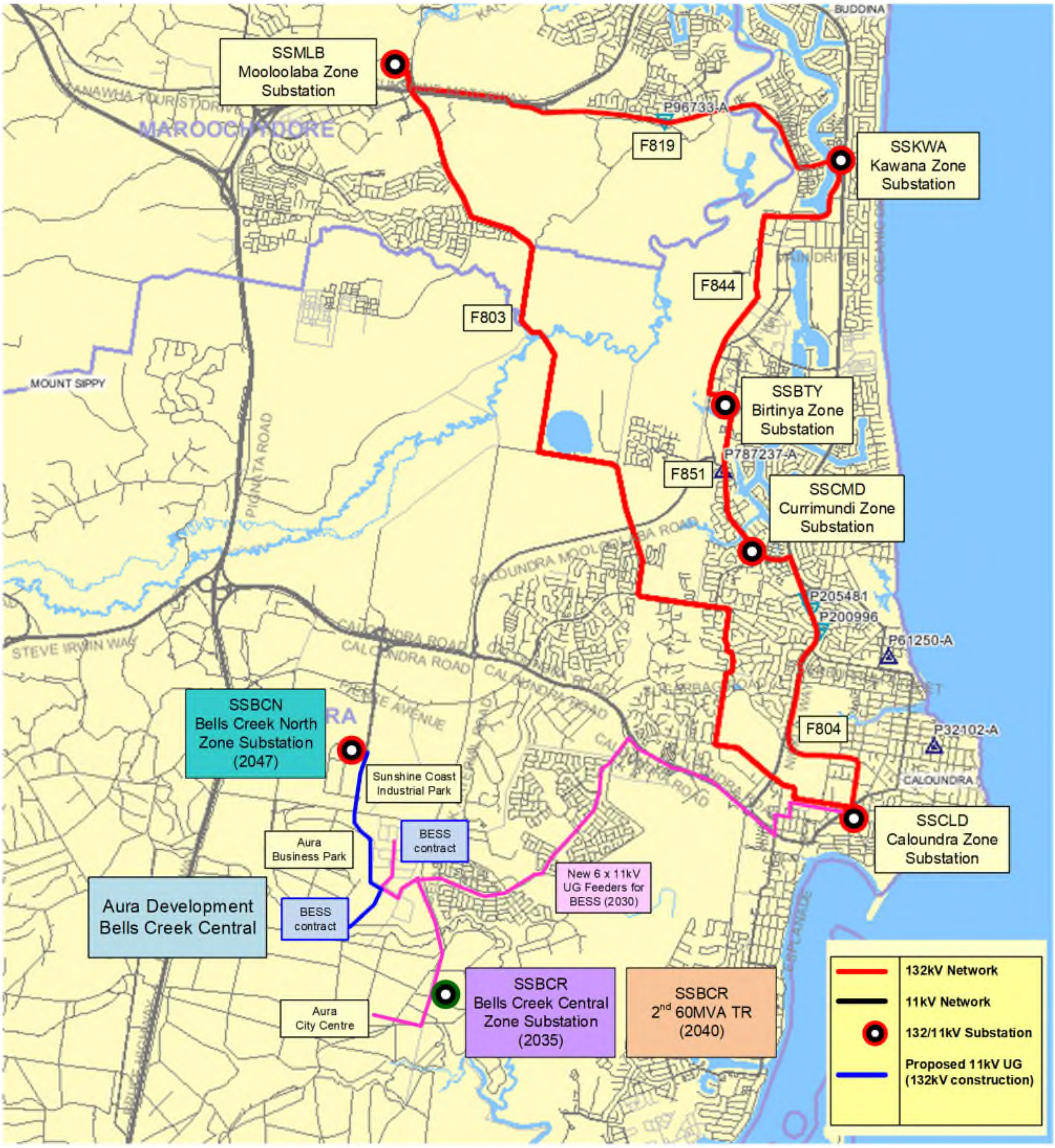


Figure 30: Proposed network arrangement Option 6 (geographic view)

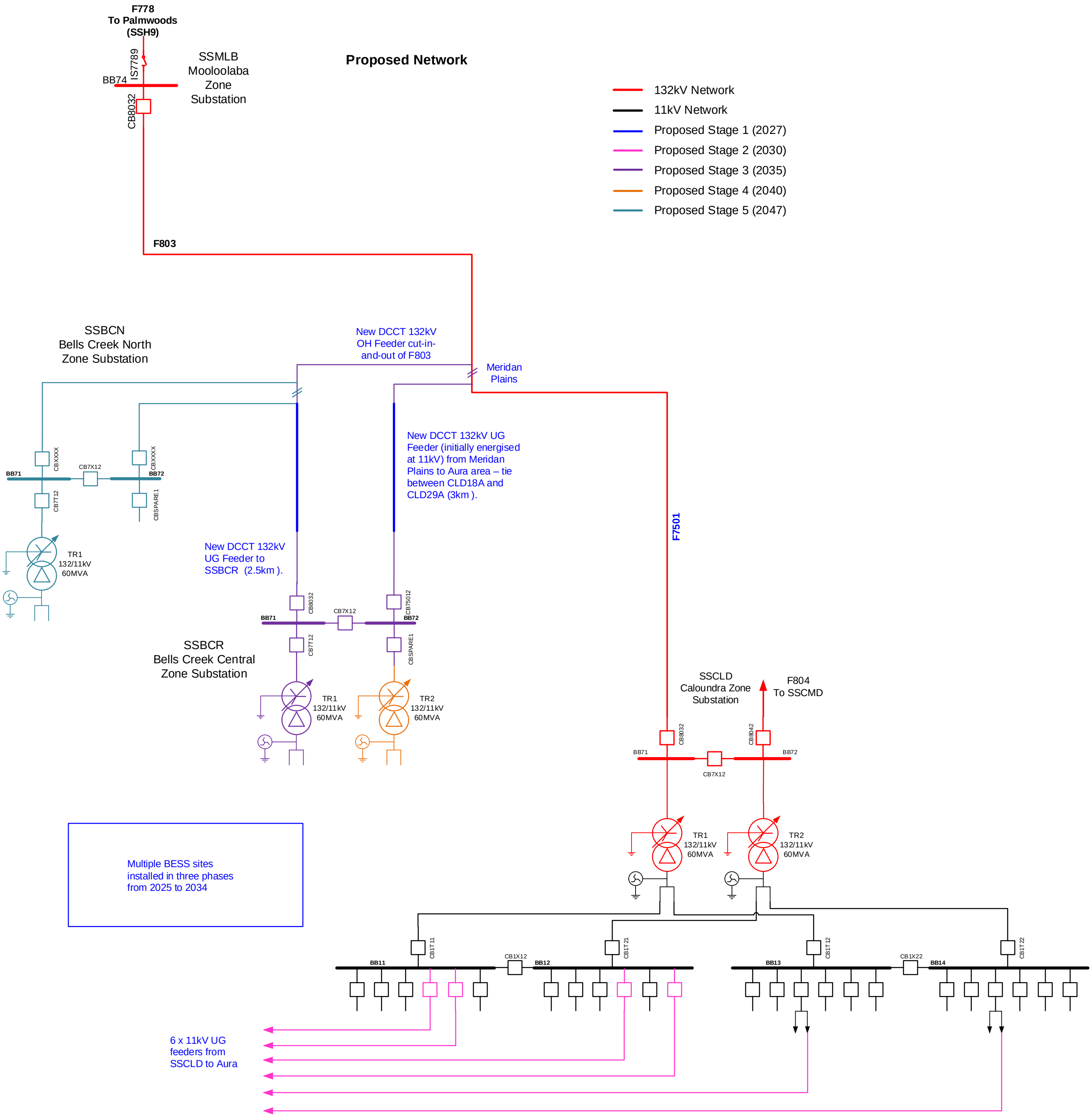


Figure 31: Proposed network arrangement Option 6 (schematic view)

3.4 Comparison of options

3.4.1 Technical comparison

A summarised comparison of the advantages and disadvantages of the alternative development options is given in Table 5.

Option	Advantages	Disadvantages
Network options		
Option 1 1. Establish SSBCR 132/11kV Zone Substation 2. Establish 2nd 60MVA TR at SSBCR (2030) 3. Establish SSBCN 132/11kV Zone Substation (2047)	+ Mitigates the future limitations at SSCLD in providing supply to the large development at Aura. + Addresses the need to provide supply to the fast-growing load at Aura and SCIP. + Allows Energex to build the 132kV OH/UG feeders and the new 132/11kV substation while the area is not yet fully developed to avoid community objections and minimises disruption to multiple large businesses. + SSBCR will be closer to the Aura residential, commercial and industrial loads. + Defers the need to establish SSBCN to supply load at SCIP. + Energex delivers on commitments to the Sunshine Coast Regional Council and complies with legislative requirements to supply the growing load in the area. + Consistent with the CID given by the Ministry for Energy and Water Supply through the Notice of Ministerial Designation of Land on 3 Sept 2013.	– No obvious disadvantages.

Option	Advantages	Disadvantages
Option 2 1. Establish 2 x 11kV FDRs from SSCLD 2. Establish two additional 11kV FDRs from SSCLD (2030) 3. Establish SSBCR 132/11kV Zone Substation (2032) 4. Establish 2nd 60MVA TR at SSBCR (2037) 5. Establish SSBCN 132/11kV Zone Substation (2047)	+ The 11kV feeders from SSCLD defers establishment of SSBCR for 5 years. + The new 11kV feeders will provide load transfer capability between SSCLD and the future SSBCR allowing the deferral of the establishment of 2nd 60MVA TR at SSBCR. + Consistent with the CID given by the Ministry for Energy and Water Supply through the Notice of Ministerial Designation of Land on 3 Sept 2013.	– No spare conduits for 11kV feeders available. – Need to replace 11kV CB trucks at SSCLD that have been recovered and used at other substations. – Establishing approximately 10kms of 4 x 11kV feeders over three years from SSCLD will require new conduits to be installed on built-up areas. – The new 11kV feeders will only be used to supply load for five years until SSBCR is established. – Risk of community objection to the proposed 132kV feeder and substation project when the area is built-up.
Option 3 1. Establish Meridan Plains 132/33kV Bulk Supply Substation + SSBCR 33/11kV Zone Substation 2. Establish 2nd 80MVA 132/33kV TR at Meridan Plains + 2nd Module (25MVA 33/11kV) at SSBCR (2032) 3. Establish 3rd Module (25MVA 33/11kV) at SSBCR + 3rd 33kV UG feeder from Meridan Plains to SSBCR (2037)	+ Lower complexity for construction of the 33kV UG feeders and the 33/11kV zone substation. + Ability to use mobile substation during contingency conditions and maintenance on transformers.	– A 33kV DCCT overhead feeder does not meet safe-work clearances when maintaining one circuit while keeping the other energised resulting to a full outage of SSBCR when maintenance works are required on one 33kV circuit. – The 33kV DCCT feeder from Meridan Plains to SSBCR will need to be established as underground. – The need to establish three substations. – The need to acquire more land at Meridan Plains for a bulk supply substation. – The need for a 3rd 33kV UG feeder (approx. 10km) on a diverse route from Meridan Plains to SSBCR, which will lead to disruption of major roads. – The voltage of 33kV is not used in the Sunshine Coast area of

Option	Advantages	Disadvantages
4. Establish SSBCN 33/11kV Zone Substation (2042) 5. Establish 2nd Module (25MVA 33/11kV) at SSBCN (2050)		the Energex network. – There are no other 33kV network in proximity that can connect to this option.
Option 4 1. <u>Establish SSBCN 132/33kV Bulk Supply Substation + SSBCR 33/11kV Zone Substation</u> 2. Establish 2nd 80MVA 132/33/11kV TR at SSBCN + 2nd Module (25MVA 33/11kV) at SSBCR (2032) 3. Establish 3rd Module (25MVA 33/11kV) at SSBCR + 3rd 33kV feeder from SSBCN to SSBCR (2037) 4. Establish 25MVA 33/11kV TR and 11kV switchgear at SSBCN (2042) 5. Establish 2nd 25MVA 33/11kV TR and 2nd 11kV switchgear at SSBCN (2050)	+ Establishing 33kV DCCT UG feeders from SSBCN to SSBCR may have better acceptance from the community. + Lower complexity for construction of the 33kV DCCT UG feeders from SSBCN to SSBCR and the zone substation. + Consistent with the CID given by the Ministry for Energy and Water Supply through the Notice of Ministerial Designation of Land on 3 Sept 2013. + Establishment of a 132kV DCCT OH feeder as per the CID obtained for the feeder section from Meridan Plains to Bells Creek North.	– The need for a 3rd 33kV UG feeder (approx. 4.6km) from SSBCN to SSBCR and disrupt major roads through Aura Business Park and along Bells Creek Arterial. – The voltage of 33kV is not used in the Sunshine Coast area of the Energex network. – There are no other 33kV network in proximity that can connect to this option. – Should there be a need for more space for the ultimate 2 x 132/33kV TRs, 2 x 33/11kV TRs, 132kV, 33kV and 11kV switchgear, the existing site for SSBCN cannot be expanded as the property on the adjacent lot is already built-up. There will be a need to establish a multi-level switchgear building.

Project Approval Report

Option	Advantages	Disadvantages
Option 5 1. Establish SSBCN 132/33kV Bulk Supply and 33/11kV zone substation + establishing 4 x 11kV feeders to supply Aura load 2. Establish 2nd 80MVA 132/33kV TR at SSBCN + establish 33/11kV Zone Substation at SSBCR + 33kV DCCT UG feeder from SSBCN to SSBCR (2032) 3. Establish 2nd Module (25MVA 33/11kV) at SSBCR (2037) 4. Establish 3rd Module (25MVA 33/11kV) at SSBCR + 3rd 33kV UG feeder from SSBCN to SSBCR (2042) 5. Establish 2nd 33/11kV transformer and 11kV switchgear at SSBCN (2050)	+ Establishing DCCT 33kV feeders from SSBCN to SSBCR may have better acceptance from the community. + Lower complexity for construction of the 33kV feeders from SSBCN to SSBCR and the zone substation. + Consistent with the CID given by the Ministry for Energy and Water Supply through the Notice of Ministerial Designation of Land on 3 Sept 2013. + Establishment of a DCCT 132kV feeder as per the CID obtained for the feeder section from Meridan Plains to Bells Creek North.	– The need for a 3rd 33kV UG feeder (approx. 4.6km) from SSBCN to SSBCR and disrupt major roads through Aura Business Park and along Bells Creek Arterial. – The voltage of 33kV is not used in the Sunshine Coast area of the Energex network. – There are no other 33kV network in the area that can connect to this proposed option. – Uses a non-standard 132/33/11kV transformer at SSBCN. – There is a risk that a 132kV, 33kV and 11kV switchgear and 2 x 132/33/11kV TRs at SSBCN may not fit the site. – The existing site for SSBCN cannot be expanded as the property on the adjacent lot is already built-up.

Option	Advantages	Disadvantages
Non-network options / Network combinations		
Option 6 1. Contract with proponent for 24MW/ 39.75MWh BESS – Phase 1 (2025) and Phase 2 (2026) 2. Contract for BESS – Phase 3 and Energex to establish 6 x 11kV feeders from SSCLD (2030) 3. Establish SSBCR 132/11kV Zone Substation (2035) 4. Establish 2nd 60MVA TR at SSBCR (2040) 5. Establish SSBCN 132/11kV Zone Substation (2047)	+ Non-network option defers the network investment by 8 years. + Proposed 11kV feeders from SSCLD will serve as transfer capacity when SSBCR is established.	– The non-network option requires network upgrade such as 11kV feeder ties and 11kV feeders from SSCLD. There may only be used for emergency transfer capacity once SSBCR is established. – Need to replace 11kV CB trucks at SSCLD that have been recovered and used at other substations. – Establishing 11kV UG feeders from SSCLD will require construction of a bank of conduits through built-up areas. – Risk of community objection to the proposed 132kV feeder and SSBCR substation project when the area is built-up.

Table 5: Technical comparison of alternative development options

3.4.2 Economic comparison

The *regulatory investment test for distribution* requires Energex to identify the credible option that maximises the present value of net economic benefit to all who produce, consume and transport electricity in the National Electricity Market.

Accordingly, a base case net present value comparison of the alternative development options has been undertaken. The financial analysis contains anticipated costs of providing, operating and maintaining the options as well as expected costs of compliance and administration associated with each option.

NPV ranking table

Table 6 provides an overview of the initial capital cost and present value of direct costs covering the period of study for each of the development options.

Table 13 in Appendix 3 provides an overview of the staging of the succeeding projects involving each of the development options.

The present value comparison summary includes all costs directly associated with constructing and providing the option. This includes the cost of land and easements currently owned or to be acquired for network augmentation.

Refer to the Net Present Value analysis in Appendix 3 for further details.

Option Number	Option Name	Rank	Initial Capital Cost (in $000's)	Net NPV (in $000's)	Capex NPV (in $000's)	Opex NPV (in $000's)
1	Establish SSBCR 132/11kV Zone Substation	1	$109,755	-$119,787	-$115,642	-$4,144
2	Establish 2 x 11kV FDRs from SSCLD	2	$19,788	-$131,290	-$126,831	-$4,459
3	Meridan Plains 132/33kV Bulk Supply Substation + Establish SSBCR 33/11kV Zone Substation	5	$101,081	-$161,972	-$157,673	-$4,299
4	SSBCN 132/33kV Bulk Supply Substation + Establish SSBCR 33/11kV Zone Substation	3	$107,005	-$136,628	-$132,089	-$4,539
5	Establish SSBCN 132/33kV Bulk Supply and 33/11kV Zone Substation	4	$88,662	-$141,399	-$136,747	-$4,652
6	Non-Network Option - contract for BESS	6	[redacted]	[redacted]	[redacted]	[redacted]

Table 6: Base case NPV ranking table

Sensitivity analysis

A sensitivity analysis was conducted on this base case to establish the option that remained the lowest cost option in the scenarios considered. In this instance, the scenarios that have been considered are:

1. **Medium demand** – under this scenario the existing load remains around the same as it currently is. This is consistent with the base case load forecast provided in SIFT. This scenario has been assigned a likelihood of 50% in the weighted average NPV.

2. **High demand** – under this scenario the only change from the Medium Growth scenario is that 2 x 11kV feeders will have to be established from SSCLD to supply the fast-growing load of Aura prior to the establishment of the proposed SSBCR Zone Substation. This scenario has been assigned a likelihood of 20% in the weighted average NPV.

3. **Low demand** – under this scenario the only change from the Medium Growth scenario is that the timing of the proposed works to address the identified limitations will be deferred by three years. This also applies to the succeeding stages of proposed

works This scenario has been assigned a likelihood of 30% in the weighted average NPV.

Table 7 provides the results of the sensitivity analysis. Refer to the Net Present Value analysis in Appendix 3 for further details.

Option Number	Option Name	Weighted Rank	Initial Capital Cost (in $000's)	Weighted Net NPV (in $000's)	Weighted Capex NPV (in $000's)	Weighted Opex NPV (in $000's)
1	Establish SSBCR 132/11kV Zone Substation	1	$109,755	-$120,741	-$116,604	-$4,137
2	Establish 2 x 11kV FDRs from SSCLD	2	$19,788	-$133,317	-$128,780	-$4,537
3	Meridan Plains 132/33kV Bulk Supply Substation + Establish SSBCR 33/11kV Zone Substation	5	$101,081	-$166,538	-$162,129	-$4,409
4	SSBCN 132/33kV Bulk Supply Substation + Establish SSBCR 33/11kV Zone Substation	3	$107,005	-$140,840	-$136,196	-$4,644
5	Establish SSBCN 132/33kV Bulk Supply and 33/11kV Zone Substation	4	$88,662	-$143,902	-$139,185	-$4,718
6	Non-Network Option - contract for BESS	6	[redacted]	[redacted]	[redacted]	[redacted]

Table 7: Scenario analysis - comparison of options

Further to the scenarios considered, a Monte-Carlo analysis simulation was undertaken on the base case project timings to assess the projects sensitivity to a change in the parameters of the NPV model. Table 8 outlines the major sensitivities analysed:

Parameter	Mode Value	Lower Bound	Upper Bound
Project Costs	Standard estimates	-40%	+40%
Project Costs	Approval estimates	-15%	+15%
Opex Costs	Calculated percentages	-5%	+5%

Table 8: Economic parameters and sensitivity analysis factors

The Monte-Carlo analysis undertook 1000 simulations of all the variables. Table 9 shows the percentage of times each option was the most economical across the simulations and also the average NPV cost of all the simulations.

[redacted]

Option 1 is the lowest cost option in the weighted average results across the three scenarios and also has the lowest average cost and is the most economical in 77.8% of cases in the Monte-Carlo simulations.

Option analysis summary

Based on the above technical and economic comparisons of options, Option 1 is considered to provide the optimum solution to address the forecast limitations and is therefore the recommended development option.

4.0 RECOMMENDED DEVELOPMENT (OPTION 1)

Refer to Appendix 1 for a link to the Project Brief.

4.1 Scope of proposed works

4.1.1 Description of works

To address the limitations at Caloundra, it is proposed to establish SSBCR. Works include:

- establishing an indoor 132kV GIS (for 2 x 132kV feeders, 2 x transformers and 1 x bus section);
- establishing 1 x 60MVA 132/11kV transformer;
- establishing 2 x 11kV switchboards;
- establishing 132kV DCCT mixed overhead (approximately 8kms) and underground (approximately 2.1kms) feeder from Meridan Plains to SSBCR;
- establishing 4 x 11kV feeders and reconfiguring the SSCLD 11kV network; and
- establishing optical fibre connection from SSMLB and SSCLD to SSBCR, includes replacing of 6.4km of OHEW with OPGW, establishing 3.3km of ADSS and 6.2km of underground fibre.

SSMLB

- upgrading 132kV feeder protection at SSMLB for F803 to match protection at SSBCR.

SSCLD

- upgrading 132kV feeder protection at SSCLD for F7501 (ex-F803) to match protection at SSBCR.

The 11kV bus configuration chosen for Option 1 includes additional 11kV circuit breakers than a typical 11kV bus to avoid the need for a future switchboard to connect the number of feeders required to supply the Bells Creek area.

The site for the proposed SSBCR will be gifted to Energex in exchange to installing a portion of the 132kV DCCT feeder as underground through the Aura Business Park, sporting fields and along Bells Creek Arterial all the way to SSBCR. This will ensure the minimal visual impact of the 132kV feeders within the Aura development.

The breakdown of the estimated proposed project cost is summarised in Table 10.

	Cost ($000's)	**% of total**
SSBCR + remote end works	$ 25,752.64	23%
Optical Fibre + Comms	$ 1,545.23	1%
132kV OH FDR	$ 49,041.29	45%
132kV UG FDR	$ 30,232.20	28%
11kV FDRs	$ 3,183.48	3%
Total	**$ 109,754.83**	**100%**

Table 10: Breakdown of proposed project cost

Figure 13 to Figure 15 show the proposed network on completion of the recommended works.

4.1.2 Staging of works

Detailed staging of the proposed project is included in the Project Brief.

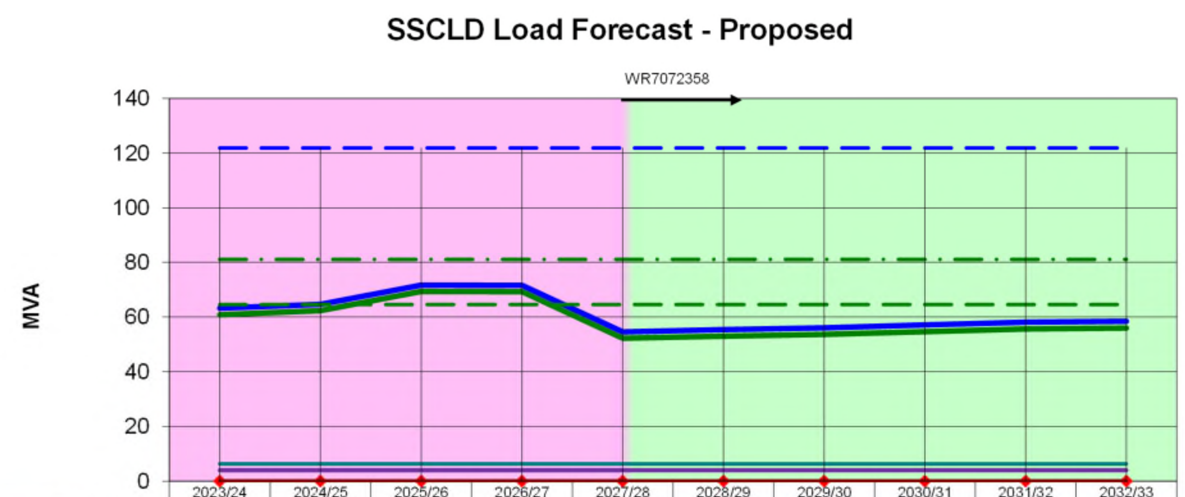
4.2 Impact of proposed works

The recommended works will have the following impact:

4.2.1 Subtransmission network

Substation capacity

The 10 year 10 PoE and 50 PoE load forecasts, and the Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment of SSCLD, are shown in Figure 32.



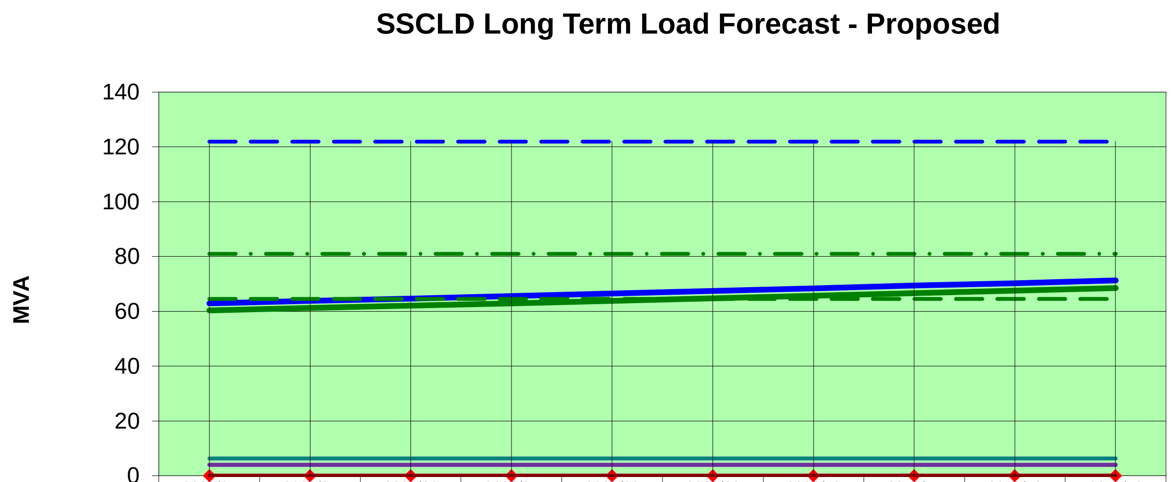
	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33
10 PoE Load	63.15	64.60	71.64	71.52	54.53	55.30	56.04	57.04	58.10	58.40
Summer NCC	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	60.82	62.27	69.30	69.19	52.17	52.92	53.63	54.59	55.61	55.90
Summer ECC	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50
Summer 2HEC	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
LAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Available Transfers	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 32: Substation load forecast SSCLD (proposed network)

As outlined above, there are no limitations within the next five years following project completion. Limitations beyond this period will be addressed by future projects or there are no limitations within the study period following project completion.

Substation capacity SSCLD – 2033/34 to 2042/43

The 10 year 10 PoE and 50 PoE load forecasts for the period 2033/34 to 2042/43 and the existing Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment of SSCLD, are shown in Figure 33. Since the rapidly growing load of Bells Creek area will be supplied from SSBCR by this time, this forecast assumes a linear increase in load with a growth rate of 1.1% over the 10-year period.



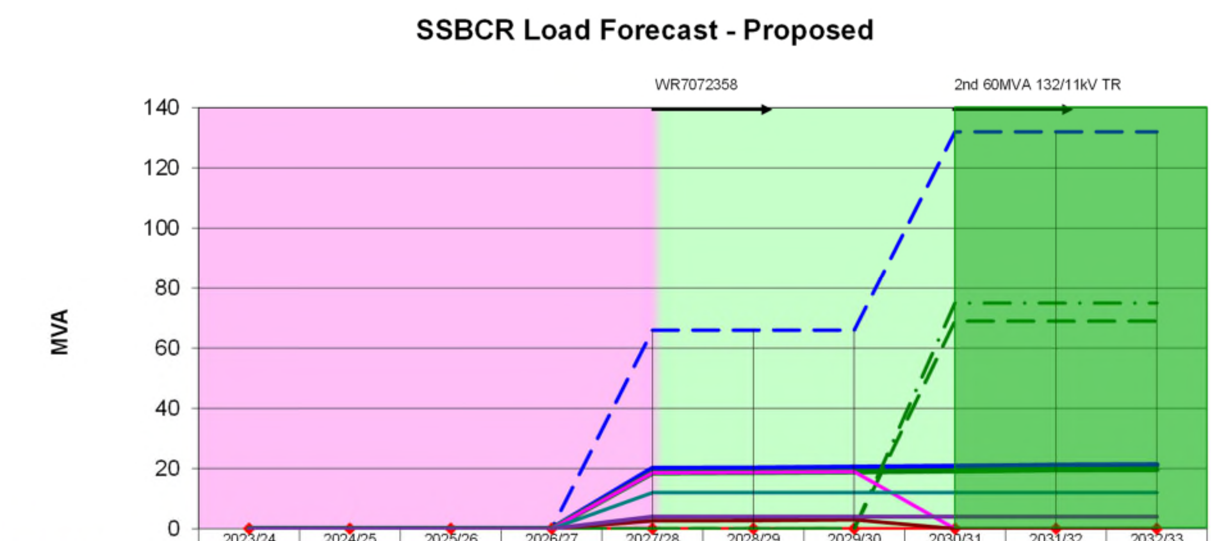
	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43
10 PoE Load	62.83	63.73	64.63	65.55	66.47	67.41	68.36	69.31	70.28	71.26
Summer NCC	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90	121.90
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	60.30	61.17	62.05	62.93	63.83	64.74	65.65	66.58	67.52	68.47
Summer ECC	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50	64.50
Summer 2HEC	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00	81.00
LAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Available Transfers	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 33: Substation load forecast SSCLD – Long Term (proposed network)

As outlined above, there are no limitations at SSCLD within the period from 2033/34 to 2042/43 following project completion. Limitations beyond this period will be addressed by future projects.

Substation capacity SSBCR

The 10 year 10 PoE and 50 PoE load forecasts, and the Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment of the proposed SSBCR, are shown in Figure 34. The load forecast at SSBCR shown includes the 11kV feeder transfers from SSCLD, as part of the network reconfiguration, and the major block loads that are expected within the planning horizon. The smaller block loads are already included in the 11kV load transfers. It is noted that not all identified block loads are being transferred to SSBCR.



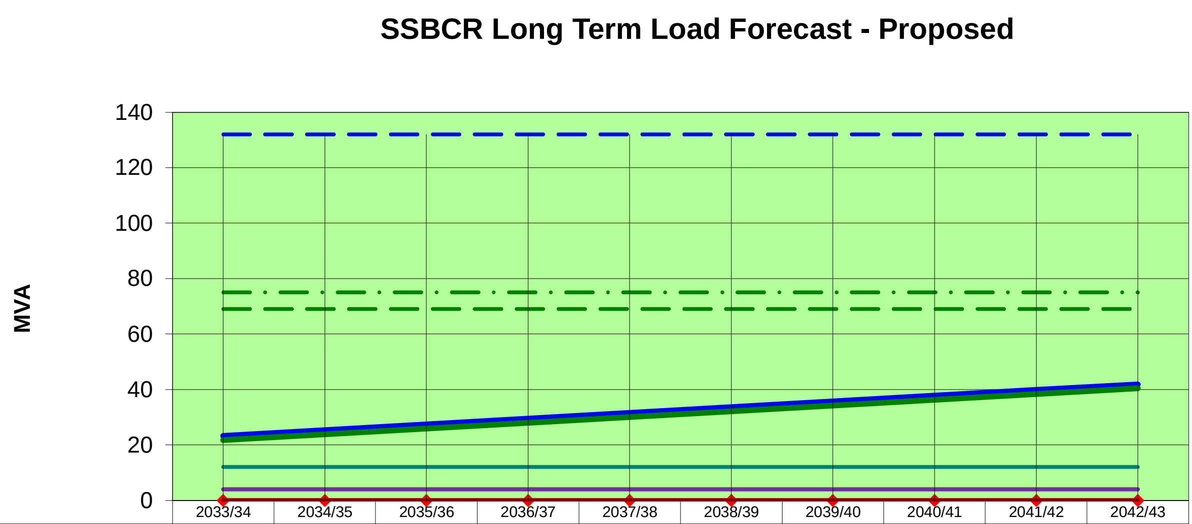
	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33
10 PoE Load	0.00	0.00	0.00	0.00	20.05	20.17	20.42	20.75	21.10	21.20
Summer NCC	0.00	0.00	0.00	0.00	66.00	66.00	66.00	132.00	132.00	132.00
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	0.00	0.00	0.00	0.00	18.63	18.74	18.96	19.27	19.60	19.69
Summer ECC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.00	69.00	69.00
Summer 2HEC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.00	75.00	75.00
LAR	0.00	0.00	0.00	0.00	18.63	18.74	18.96	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	2.63	2.74	2.96	0.00	0.00	0.00
Available Transfers	0.00	0.00	0.00	0.00	12.00	12.00	12.00	12.00	12.00	12.00
Avail Mobile Eqpt	0.00	0.00	0.00	0.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 34: Substation load forecast SSBCR (proposed network)

As outlined above, there is a limitation at SSBCR upon project completion. This limitation will be addressed by a future project to install a second 60MVA 132/11kV transformer at SSBCR, currently planned for 2030. A staged development approach was taken for SSBCR to observe the rate of load growth in the area due to the known (but not committed) block loads.

Substation capacity SSBCR – 2033/34 to 2042/43

The 10 year 10 PoE and 50 PoE load forecasts for the period 2033/34 to 2042/43 and the existing Normal Cyclic Capacity (NCC), Emergency Cyclic Capacity (ECC), Two Hour Emergency Capacity (2HEC), Residual Load at Risk (RLAR), available transfers and available mobile equipment of SSBCR, are shown in Figure 35. Since the rapidly growing load of Bells Creek area will be supplied from SSBCR by this time, this forecast assumes a linear increase of 2MVA per year over the 10-year period. By this time, the second 60MVA 132/11kV transformer at SSBCR is installed.



	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43
10 PoE Load	23.27	25.34	27.40	29.47	31.54	33.60	35.67	37.74	39.80	41.87
NCC	132.00	132.00	132.00	132.00	132.00	132.00	132.00	132.00	132.00	132.00
Load > NCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50 PoE Load	21.76	23.83	25.89	27.96	30.03	32.09	34.16	36.23	38.29	40.36
ECC	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00
2HEC	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
LAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RLAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Available Transfers	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Avail Mobile Eqpt	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Figure 35: Substation load forecast SSBCR – Long Term (proposed network)

As outlined above, there are no limitations at SSBCR within the period from 2033/34 to 2042/43 following project completion. Limitations beyond this period will be addressed by future projects.

Substation fault level

The expected fault capacities of the limiting plant at the substation are shown in Table 11.

Substation	Busbar Voltage (kV)	Three Phase		Phase to Ground		Rating	
		(MVA)	(kA)	(MVA)	(kA)	(MVA)	(kA)
SSBCR	132	1596	6.98	535	7.02	762	40
	11	183	9.61	12	1.93	476	25

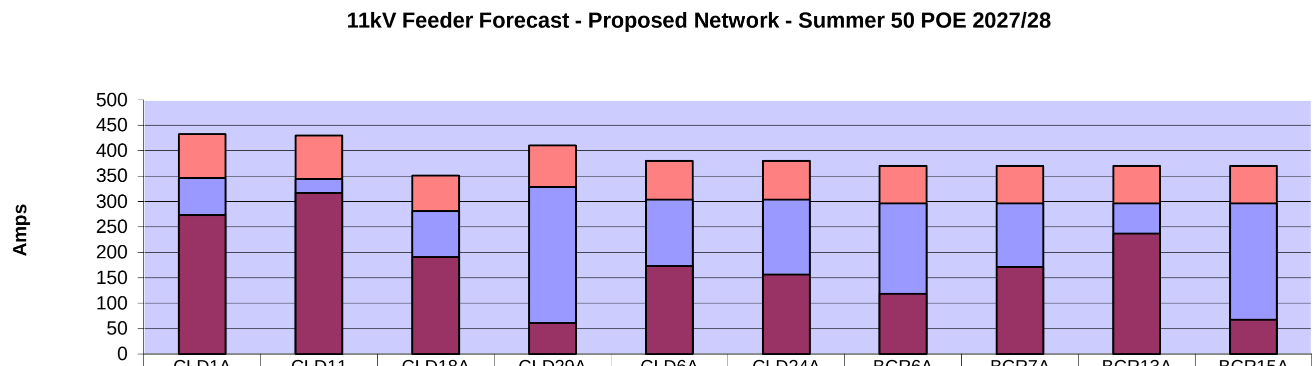
Table 11: Fault levels at substation busbars (proposed network)

As outlined above, the fault rating is not exceeded following project completion. With the resulting bus fault level at SSBCR, and the proposed 11kV network reconfiguration, there are no identified thermal fault rating limitations on the new 11kV feeders from SSBCR.

4.2.2 Distribution network

11kV feeder utilisation

The calculated worst case feeder utilisations based on a 50 PoE load forecast of the proposed 11kV feeders at SSBCR and the affected 11kV feeders at SSCLD, along with the normal cyclic ratings are shown in Figure 36.



	CLD1A	CLD11	CLD18A	CLD29A	CLD6A	CLD24A	BCR6A	BCR7A	BCR13A	BCR15A
NCC Rating (A)	432	430	351	410	380	380	370	370	370	370
Target Utilisation (A)	346	344	281	328	304	304	296	296	296	296
Load (A)	273	317	191	61	173	156	117.81	171.36	237	67
% of rating	63%	74%	54%	15%	46%	41%	32%	46%	64%	18%

Figure 36: 11kV feeder load forecast (proposed network)

As outlined above, the 11kV feeders are below target utilisation following project completion in 2027. The limitations identified in 2026/27 will be addressed by implementing 11kV network solutions such as 11kV feeder load transfers and/or proactive deployment of LV generation during forecast peak load days prior to completion of the proposed project.

The initial 11kV feeders from SSBCR are also shown above. These feeder loads include the smaller block loads that are expected (but not committed) in the area. The larger known (but not committed) block loads are not reflected in this forecast. Additional 11kV feeders will be installed as required by the larger block loads.

11kV feeder voltage drop

The resulting maximum voltage drop along the 11kV feeders supplying loads in the Aura development in 2027/28 load conditions after completion of the proposed works are shown in Table 12.

Feeder	Proposed Network
	Max voltage drop (PU)
CLD29A	0.97
CLD18A	0.94
CLD11	0.94
CLD1A	0.95
CLD24A	0.94
CLD6A	0.96
BCR6A	0.99
BCR7A	0.99
BCR13A	0.98
BCR15A	0.99

Table 12: 11kV feeder voltage drop (proposed network)

The identified voltage drop limitations on the 11kV network at SSCLD supplying Aura development are addressed following completion of the proposed works. The new 11kV feeders from SSBCR are also shown.

4.3 Target risk level

After completion of the recommended works, the resulting level of risk is shown in Table 13. This table also shows the comparison with the Current risk level. Refer to Appendix 5 for details of the risk scenario maps.

Risk Category	Equipment	Risk Scenario	Current Risk Level		Target Risk Level	
Customer Impact	Feeder	Inability of Energex to supply the rapidly growing load at Aura leading to damage of reputation or brand.	L = 3	C = 5	N/A	N/A
			R = 15 (Medium Risk)		N/A ALARP	
Business Impact	Feeder	Community objection to establishing the 132kV DCCT OH/UG feeder thereby delaying the commissioning of the 132/11kV substation at Bells Creek Central results to Energex spending greater than $20m to establish additional 11kV feeders from SSCLD.	L = 3	C = 6	N/A	N/A
			R = 18 (High Risk)		N/A ALARP	
Legislated Requirements	Feeder	Inability of Energex to supply the fast-growing load at Aura leading to a breach of the conditions of the Distribution Authority to ensure adequate connection and supply of electricity to customers.	L = 3	C = 5	N/A	N/A
			R = 15 (Medium Risk)		N/A ALARP	
Legislated Requirements	Transformer	Failure of 1 x 60MVA 132/11kV transformer at SSCLD during peak load conditions causing unsupplied load and leading to a breach of the Energex Distribution Authority requirements.	L = 3	C = 4	N/A	N/A
			R = 12 (Medium Risk)		N/A ALARP	

Table 13: Summary of risk after completion of proposed works

After completion of the recommended works, the target risk levels are shown as **ALARP** as the risks are eliminated.

4.4 Future network development

The following projects that affect SSBCR have been identified:

- BCR Bells Creek Central – Establish 2nd 60MVA 132/11kV transformer by October 2030.

This project proposes to establish the 2nd 60MVA 132/11kV transformer at SSBCR. The recommended works will provide the emergency capacity of SSBCR to maintain supply under N-1 contingencies.

- Future block loads

Future customer connection projects are expected as the known block loads applies for supply.

5.0 APPLICATION OF THE REGULATORY INVESTMENT TEST FOR DISTRIBUTION

Energex is required to apply a regulatory investment test for distribution (RIT-D) in relation to new distribution network investments where there are credible options with an estimated cost greater than $6 million. The purpose of the RIT-D is to analyse and assess the efficiency of new network augmentation investments and non-network alternative options that address the projected network limitations and maximises the net economic benefit to all those who produce, consume, and transport electricity in the National Electricity Market.

On 9th November 2020 Energex published the Non-Network Options Report (NNOR) prepared in accordance with the requirements of *clause 5.17.4(e) of the NER* providing details on the identified need in the Caloundra area including both technical and economic information about possible solutions. This report sought information from interested parties regarding alternative potential credible options or variants to the potential credible option (network Option 1) presented by Energex.

In response to the NNOR, Energex received three submissions and identified one credible option.

A Draft Project Assessment Report (DPAR) was published on 16 August 2021, in accordance with the requirements of *clause 5.17.4(i) of the NER*, explaining Energex's preferred solution (Option 1) to address the identified need. The DPAR sought information from interested parties about possible alternate solutions to address the need for investment and the consultation was open for a minimum of six weeks.

No submissions were received in response to the DPAR.

Due to the proposed preferred option being more that the $12 million cost threshold a Final Project Assessment Report (FPAR) was published on 22nd October 2021 in accordance with the requirements of *clause 5.17.4(o) of the NER*.

The period (within 30 days) during which Registered Participants and Interested Parties may, by notice to the AER, dispute conclusions made by Energex in the FPAR (on the grounds of RIT-D application or assessment errors) expired on 21st November 2021.

Hence, the RIT-D process for the project has concluded.

6.0 RECOMMENDATION

It is recommended that:

1. Energex establish Bells Creek Central 132/11kV Zone Substation (SSBCR) with 1 x 60MVA 132/11kV transformer, 2 x 132kV busses and 2 x 11kV busses, establish double circuit 132kV feeder with a mix of 8kms of overhead and 2.1kms of underground construction, reconfigure the 11kV network, replace 6.4km of OHEW with OPGW, establish 3.3km of ADSS and 6.2km of underground optical fibre, and upgrade 132kV feeder protection at Mooloolaba (SSMLB) and Caloundra (SSCLD) zone substations, for a total estimated cost of $109,754,831 at 2023/24 prices. The target completion date for the recommended development is February 2027.

2. A board memo be presented to the Board for approval to submit the SSBCR project to the shareholding Ministers.

3. A memo be presented to the shareholding Ministers for approval of the project.

7.0 GLOSSARY OF TERMS

10 PoE	10% Probability of Exceedance (Peak load forecast based on normal expected growth which has a 10% probability of being exceeded in any year)
50 PoE	50% Probability of Exceedance (Peak load forecast based on normal expected growth which has a 50% probability of being exceeded in any year)
2HEC	Two Hour Emergency Capacity (of all equipment excluding the largest parallel element)
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AFLC	Audio Frequency Load Control
ALARP	As Low as Reasonably Practicable.
C&I	Commercial and Industrial Customers
CAIDI	Customer Average Interruption Duration index (Performance measure of network reliability, indicating the interruption duration (minutes) that each interrupted customer experiences on average during the relevant period.
Capex	Capital Expenditure
CB	Circuit Breaker
CBD	Central Business District
CBRM	Condition Based Risk Management
COS	Customer Outcome Standards
Customer	End use customer plus retailer
DA	Distribution Authority
DAPR	Distribution Annual Planning Report
DNSP	Distribution Network Service Provider
ECC	Emergency Cyclic Capacity (to be used for contingency conditions)
GSL	Guaranteed Service Level
HV	High Voltage – Alternating current voltage above 1000 Volts
LV	Low Voltage – Alternating current voltage below 1000 Volts
MSS	Minimum Service Standard
MVA	Megavolt-amperes
NCC	Normal Cyclic Capacity
NDM	Network Demand Management
NEM	National Electricity Market
NPV	Net Present Value
Opex	Operating Expenditure
PAR	Project Approval Report
PoE	Probability of Exceedance
POPS	Plant Overload Protection Software
PoW	Program of Work
RIT-D	Regulatory Investment Test for Distribution
RLAR	Residual Load at Risk - Is the remaining interrupted 50 PoE load following the implementation of all available load transfers and/or deployment of mobile generation (up to 4MVA for urban of 10MVA for rural) or mobile substation (15MVA), which is not consistent with Security Standard timeframes.
Rules	National Electricity Rules
SAIDI	System Average Interruption Duration Index. (Performance measure of network reliability, indicating the total minutes, on average, that customers are without electricity during the relevant period)
SAIFI	System Average Interruption Frequency Index. (Performance measure of network reliability, indicating the average number of occasions each customer is interrupted during the relevant period)
SCADA	Supervisory Control and Data Acquisition
TR	Transformer
VCR	Value of Customer Reliability
WACC	Weighted Average Cost of Capital

Appendix 1

Supporting documents

Document	Document	Link
1	Project Brief	SSBCR Project Brief
2	Non-Network Options Report (NNOR) – Caloundra Network Limitation	NNOR
3	Draft Project Assessment Report (DPAR) – Caloundra Network Limitation	DPAR
4	Final Project Assessment Report (DPAR) – Caloundra Network Limitation	FPAR
5	Aura Development Information	Aura Masterplan
6	Community Infrastructure Designation	CID Designated Corridor

Appendix 2

Summary of service safety net targets

Customer Outcome Standards

Service safety net targets

The safety net approach complies with the jurisdictional obligations within the *Energex Distribution Authority*. The safety net targets are defined by the maximum number of customers and the load impacted covering durations of time. The safety net targets for each customer types are as follows:

- CBD – Any interruption in customer supply resulting from an N-1 event at the sub-transmission level is restored within 1 minute;
- Urban – Ensure that worst case outcome for customers following an N-1 event is:
  - no greater than 40MVA (16,000 customers) is without supply for more than 30 minutes;
  - no greater than 12MVA (5,000 customers) is without supply for more than 3 hours; and
  - no greater than 4MVA (1,600 customers) without supply for more than 8 hours.
- Rural – Ensure that worst case outcome for customers following an N-1 event is:
  - no greater than 40MVA (16,000 customers) is without supply for more than 30 minutes;
  - no greater than 15MVA (6,000 customers) is without supply for more than 4 hours; and
  - no greater than 10MVA (4,000 customers) is without supply for more than 12 hours.
- All analysis will be based on 50 POE loads.

Service safety net targets

The safety net approach complies with the jurisdictional obligations within the *Ergon Distribution Authority*. The safety net targets are defined by the maximum number of customers and the load impacted covering durations of time. The safety net targets for restoration of supply following a credible contingency event for each customer types are as follows:

- Regional Centre – Following a credible contingency event, load not supplied must be:
  - Less than 20MVA (5000 customers) after 1 hour;
  - Less than 15MVA (3600 customers) after 6 hours;
  - Less than 5MVA (1200 customers) after 12 hours; and
  - Fully restored within 24 hours.
- Rural Areas – Following a credible contingency event, load not supplied must be:
  - Less than 20MVA (7700 customers) after 1 hour;
  - Less than 15MVA (5800 customers) after 8 hours;
  - Less than 5MVA (2000 customers) after 18 hours; and
  - Fully restored within 48 hours.
- All analysis will be based on 50 POE loads.

Appendix 3

Economic comparison of options (Net Present Value analysis)

SCENARIO A			Medium load forecast	1	2	3	4	5	6
Option:		Hide Option		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
			NPV Ranking	1	2	5	3	4	6
			Net NPV	-$119,786,554	-$131,290,057	-$161,971,925	-$136,627,552	-$141,399,409	-$187,910,063
		Unhide Option	Component Count	5	8	9	10	12	17
			Hide Decommissioned Assets ☑						
ID	Life	Network Limitation	Component Title Selection	Stage Timing Option 1	Stage Timing Option 2	Stage Timing Option 3	Stage Timing Option 4	Stage Timing Option 5	Stage Timing Option 6
1	58	Insufficient network assets to supply growing large customer development	SSBCR 132/11kV 1 x 60MVA substation Bells Creek Central	2027	2032				2035
2	60		Meridan Plains - SSBCR 132kV DCCT OH feeder - 8km	2027	2032				
3	60		Meridan Plains - SSBCR 132kV DCCT UG feeder - 2.1km	2027	2032				
17	58		SSBCR 2nd 60MVA 132/11kV TR	2030	2037				2040
18	58		SSBCN 132/33/11kV 1 x 60MVA Zone Substation	2047	2047				2047
14	60		SSCLD to Aura 2 x 11kV FDRS (Initial) (10km)		2027				
15	60		SSCLD to Aura - Business Park 11kV FDR (3rd FDR)		2030				
16	60		SSCLD to Aura - Town Centre 11kV FDR (4th FDR)		2030				
4	58		Meridan Plains 132/33kV Bulk Supply Substation			2027			
5	58		SSBCR 33/11kV 1 x 25MVA substation			2027	2027	2032	
6	60		Meridan Plains to SSBCR 33kV DCCT UG feeder - 10.1 km			2027			
20	58		Meridan Plains 2nd 80MVA 132/33kV transformer			2032			
19	58		SSBCR 2nd Module 25MVA 33/11kV TR			2032	2032	2037	
21	58		SSBCR 3rd Module 25MVA 33/11kV TR			2037	2037	2042	
22	60		Meridan Plains - SSBCR 3rd 33kV FDR - 10km UG			2037			
23	58		SSBCN 33/11kV 1 x 25MVA sub (Module 1)			2042			
24	58		SSBCN 2nd Module 25MVA 33/11kV TR			2050			
9	58		SSBCN 132/33kV Bulk Supply Substation at Bells Creek North				2027	2027	
7	60		Meridan Plains - SSBCN 132kV DCCT OH feeder - 6.1km				2027	2027	2035
8	60		SSBCN - SSBCR 33kV DCCT UG feeder - 4.2km				2027	2032	
25	58		SSBCN 2nd 80MVA 132/33kV TR				2032	2032	
26	60		SSBCN - SSBCR 3rd 33kV FDR - 4.2km UG				2037	2042	
27	60		SSBCN 25MVA 33/11kV TR1 + 11kV Switchgear				2042	2027	
28	60		SSBCN 25MVA 33/11kV TR2 + 11kV Switchgear				2050	2050	
11	58		SSBCN 132/33/11kV Bulk Supply + Zone Substation						
12	60		BCN to Aura 2 x 11kV feeders (3.8km)					2027	
13	60		BCN to Aura 2 x 11kV feeders (4.6km)					2027	
43	60		NNO - 6 x 11kV FDRs from CLD to Aura - 3 x 7km + 3 x 10km						2030
44	60		NNO - Stage 4: Est 132kV DCCT UG FDR to BCR - 2.5km						2035
39	60		NNO - Tie between CLD18A and CLD29A (132kV construction energised at 11kV) - 3km						2026
40	20		NNO - Phase 1 - Initial 3MW - yearly fee						2025
41	20		NNO - Phase 2 - Additional 15MW - yearly fee						2026
41	20		NNO - Phase 2 - Additional 15MW - yearly fee						2027
41	20		NNO - Phase 2 - Additional 15MW - yearly fee						2028
41	20		NNO - Phase 2 - Additional 15MW - yearly fee						2029
42	20		NNO - Phase 3 - Additional 12MW - yearly fee						2030
42	20		NNO - Phase 3 - Additional 12MW - yearly fee						2031
42	20		NNO - Phase 3 - Additional 12MW - yearly fee						2032
42	20		NNO - Phase 3 - Additional 12MW - yearly fee						2033
42	20		NNO - Phase 3 - Additional 12MW - yearly fee						2034

Table 14 – Option stages details

Project Approval Report

Component ID	Component Description	Component Type	Useful Life (years)	Mode CAPEX ($ real)	Lower Bound CAPEX ($ real)	Upper Bound CAPEX ($ real)	Mode OPEX ($)	Lower Bound OPEX ($)	Upper Bound OPEX ($)
1	SSBCR 132/11kV 1 x 60MVA substation Bells Creek Central	Substation 132/11kV	58	30,481,346	$ 18,288,808	$ 42,673,884	$ 40,418	$ 36,376	$ 44,460
2	Meridan Plains - SSBCR 132kV DCCT OH feeder - 8km	Feeder 132kV OH	60	49,041,287	$ 29,424,772	$ 68,657,802	65,261	$ 58,735	$ 71,787
3	Meridan Plains - SSBCR 132kV DCCT UG feeder - 2.1km	Feeder 132kV UG	60	30,232,197	$ 18,139,318	$ 42,325,076	24,813	$ 22,331	$ 27,294
4	Meridan Plains 132/33kV Bulk Supply Substation	Substation 132/33kV	58	24,208,000	$ 14,524,800	$ 33,891,200	40,418	$ 36,376	$ 44,460
5	SSBCR 33/11kV 1 x 25MVA substation	Substation 33/11kV	58	23,000,000	$ 13,800,000	$ 32,200,000	40,418	$ 36,376	$ 44,460
6	Meridan Plains to SSBCR 33kV DCCT UG feeder - 10.1 km	Feeder 33kV UG	60	53,873,400	$ 32,324,040	$ 75,422,760	24,100	$ 21,690	$ 26,510
7	Meridan Plains - SSBCN 132kV DCCT OH feeder - 6.1km	Feeder 132kV OH	60	37,393,981	$ 22,436,389	$ 52,351,574	49,762	$ 44,786	$ 54,738
8	SSBCN - SSBCR 33kV DCCT UG feeder - 4.2km	Feeder 33kV OH	60	22,402,800	$ 13,441,680	$ 31,363,920	17,095	$ 15,385	$ 18,804
9	SSBCN 132/33kV Bulk Supply Substation at Bells Creek North	Substation 33/11kV	58	23,000,000	$ 13,800,000	$ 32,200,000	40,418	$ 36,376	$ 44,460
10	SSBCR 33/11kV 1 x 25MVA sub (Module 1)	Substation 132/33/11kV	58	107,004,781	$ 64,202,869	###########	40,418	$ 36,376	$ 44,460
11	SSBCN 132/33/11kV Bulk Supply + Zone Substation	Substation 132/33/11kV	58	35,862,531	$ 21,517,519	$ 50,207,543	40,418	$ 36,376	$ 44,460
12	BCN to Aura 2 x 11kV feeders (3.8km)	Feeder 11kV UG	60	8,299,200	$ 4,979,520	$ 11,618,880	6,518	$ 5,867	$ 7,170
13	BCN to Aura 2 x 11kV feeders (4.6km)	Feeder 11kV UG	60	7,106,400	$ 4,263,840	$ 9,948,960	7,891	$ 7,102	$ 8,680
14	SSCLD to Aura 2 x 11kV FDRS (Initial) (10km)	Feeder 11kV UG	60	19,788,000	$ 11,872,800	$ 27,703,200	17,154	$ 15,438	$ 18,869
15	SSCLD to Aura - Business Park 11kV FDR (3rd FDR)	Feeder 11kV UG	60	5,190,000	$ 3,114,000	$ 7,266,000	8,577	$ 7,719	$ 9,434
16	SSCLD to Aura - Town Centre 11kV FDR (4th FDR)	Feeder 11kV UG	60	5,190,000	$ 3,114,000	$ 7,266,000	8,577	$ 7,719	$ 9,434
17	SSBCR 2nd 60MVA 132/11kV TR	Transformer	58	5,000,000	$ 3,000,000	$ 7,000,000	$ 2,699	$ 2,429	$ 2,969
18	SSBCN 132/33/11kV 1 x 60MVA Zone Substation	Substation 132/11kV	58	30,481,346	$ 18,288,808	$ 42,673,884	$ 40,418	$ 36,376	$ 44,460
19	SSBCR 2nd Module 25MVA 33/11kV TR	Substation 33/11kV	58	13,200,000	$ 7,920,000	$ 18,480,000	$ 3,502	$ 3,151	$ 3,852
20	Meridan Plains 2nd 80MVA 132/33kV transformer	Substation 132/33kV	58	5,000,000	$ 3,000,000	$ 7,000,000	$ 2,699	$ 2,429	$ 2,969
21	SSBCR 3rd Module 25MVA 33/11kV TR	Substation 33/11kV	58	13,200,000	$ 7,920,000	$ 18,480,000	$ 3,502	$ 3,151	$ 3,852
22	Meridan Plains - SSBCR 3rd 33kV FDR - 10km UG	Feeder 33kV UG	60	41,840,000	$ 25,104,000	$ 58,576,000	28,691	$ 25,821	$ 31,560
23	SSBCN 33/11kV 1 x 25MVA sub (Module 1)	Substation 33/11kV	58	23,000,000	$ 13,800,000	$ 32,200,000	40,418	$ 36,376	$ 44,460
24	SSBCN 2nd Module 25MVA 33/11kV TR	Substation 33/11kV	58	13,200,000	$ 7,920,000	$ 18,480,000	$ 3,502	$ 3,151	$ 3,852
25	SSBCN 2nd 80MVA 132/33kV TR	Transformer	58	5,000,000	$ 3,000,000	$ 7,000,000	$ 2,699	$ 2,429	$ 2,969
26	SSBCN - SSBCR 3rd 33kV FDR - 4.2km UG	Feeder 33kV UG	60	17,572,800	$ 10,543,680	$ 24,601,920	12,050	$ 10,845	$ 13,255
27	SSBCN 25MVA 33/11kV TR1 + 11kV Switchgear	Substation 132/33/11kV	60	4,159,000	$ 2,495,400	$ 5,822,600	2,834	$ 2,551	$ 3,118
28	SSBCN 25MVA 33/11kV TR2 + 11kV Switchgear	Substation 132/33/11kV	60	4,159,000	$ 2,495,400	$ 5,822,600	2,744	$ 2,469	$ 3,018
29	SSBCN 2nd 25MVA 33/11kV TR	Transformer	60	2,119,000	$ 1,271,400	$ 2,966,600	2,016	$ 1,814	$ 2,218
30	Land acquisition for easements	Land	100	14,000,000	$ 8,400,000	$ 19,600,000			
31	11kV FDR from SSCLD to Aura - Business Park	Feeder 11kV UG	60	5,190,000	$ 3,114,000	$ 7,266,000	8,577	$ 7,719	$ 9,434
32	11kV FDR from SSCLD to Aura - Town Centre	Feeder 11kV UG	60	5,190,000	$ 3,114,000	$ 7,266,000	8,577	$ 7,719	$ 9,434
33	33kV DCCT UG feeder from SSBCN to SSBCR along Aura Development - through the C&I area - 4.2km	Feeder 33kV UG	60	22,402,800	$ 13,441,680	$ 31,363,920	24,100	$ 21,690	$ 26,510
34	Establish 4 x 11kV FDRs from SSCLD on new conduits - 10km	Feeder 11kV UG	60	30,168,000	$ 18,100,800	$ 42,235,200	34,307	$ 30,876	$ 37,738
35	SSBCN 2nd 80MVA 132/33kV TR	Transformer	58	5,000,000	$ 3,000,000	$ 7,000,000	$ 2,699	$ 2,429	$ 2,969
36	2 x 11kV FDRs from CLD to Aura (High Load Scenario)	Feeder 11kV UG	60	19,788,000	$ 11,872,800	$ 27,703,200	17,154	$ 15,438	$ 18,869
37	NNO - 132kV DCCT FDR from CLD - 4km	Feeder 132kV UG	60	57,585,137	$ 34,551,082	$ 80,619,192	47,262	$ 42,536	$ 51,989
38	NNO - 1 x 11kV FDR from CLD - 10km	Feeder 11kV UG	60	5,040,000	$ 3,024,000	$ 7,056,000	8,577	$ 7,719	$ 9,434
39	NNO - Tie between CLD18A and CLD29A (132kV construction energised at 11kV) - 3km	Feeder 132kV UG	60	43,188,853	$ 25,913,312	$ 60,464,394	35,447	$ 31,902	$ 38,991
40	NNO - Phase 1 - Initial 3MW - yearly fee	BESS	20	127,500	$ 76,500	$ 178,500			
41	NNO - Phase 2 - Additional 15MW - yearly fee	BESS	20	1,116,465	$ 669,879	$ 1,563,051			
42	NNO - Phase 3 - Additional 12MW - yearly fee	BESS	20	5,739,008	$ 3,443,405	$ 8,034,611			
43	NNO - 6 x 11kV FDRs from CLD to Aura - 3 x 7km + 3 x 10km	BESS	60	34,536,000	$ 20,721,600	$ 48,350,400	30,019	$ 27,017	$ 33,021
44	NNO - Stage 4: Est 132kV DCCT UG FDR to BCR - 2.5km	Feeder 132kV UG	60	35,990,711	$ 21,594,427	$ 50,386,995	29,539	$ 26,585	$ 32,493

Table 15 – Option cost details

Appendix 4

Regulatory reporting summary

Project Approval Report

PROJECT DESCRIPTION AND CHANGES									
SUBSTATION ID	SUBSTATION TYPE	PROJECT ID	PROJECT TYPE	PROJECT TRIGGER	VOLTAGE (KV)	SUBSTATION RATING NORMAL CYCLIC (MVA)		SUBSTATION RATING N-1 EMERGENCY (MVA)	
	Select from list		Select from list	Select from list		PRE	POST	PRE	POST
SSBCR	Zone Substation	C0562034	New substation establishment	Demand growth	132/11	0	60	0	0

SUBSTATION ID	TRANSFORMERS		SWITCHGEAR	CAPACITORS
	UNITS ADDED	MVA ADDED	UNITS ADDED	MVAR ADDED
SSBCR	1	60	5 x 132kV 21 x 11kV	0

PROJECT DESCRIPTION AND CHANGES					
LINE ID	PROJECT ID	PROJECT TYPE	PROJECT TRIGGER	VOLTAGE (KV)	ROUTE LINE LENGTH ADDED
		Select from list	Select from list		KM ADDED
F803 F7501	C0562034	New line on new route – dual circuit	Demand growth	132	10.1

LINE ID	OVERHEAD LINES		UNDERGROUND CABLES	
	CIRCUIT KM ADDED	CIRCUIT KM UPGRADED	CIRCUIT KM ADDED	CIRCUIT KM UPGRADED
F803 F7501 DCCT 132kV 11kV FDRS BCR6A BCR7A BCR13A BCR15A	8km		2.1km 8.7km (total)	

Information addressing item 8.3(r), Schedule 1 of Regulatory Information Notice Under Division 4 of Part 3 of The National Electricity (South Australia) Law (Qld)

8.3 (r) where Energex proposes to commence or continue a Demand-Related Capex Project or Program during the *Forthcoming regulatory control period* on a *zone substation* (or relevant *substations* for a *sub-transmission line*):

assumed future load transfers between related *substations*;	As per Scenario 44 Run 109 SIFT forecast and load flow study results by Distribution Planning.
assumed underlying load growth rates (exclusive of *transfers* and specific *customer* developments);	As per Scenario 44 Run 109 SIFT forecast.
assumed specific *customer* developments, and associated demand assumptions;	As per information provided by developer of Aura and demand calculations of Sub-transmission Planning. As per information provided by Distribution Planning on known block loads (including un-committed).
existing *embedded generation* capacity, and associated assumptions on the impact on demand levels;	
assumed future *embedded generation* capacity, and associated assumptions on the impact on demand levels;	
existing non-network solutions, and the associated assumptions on the impact on demand levels;	
assumed future non-network solutions, and associated assumptions on the impact on demand levels; and	
diversity with related substations.	

Appendix 5

Risk scenario maps

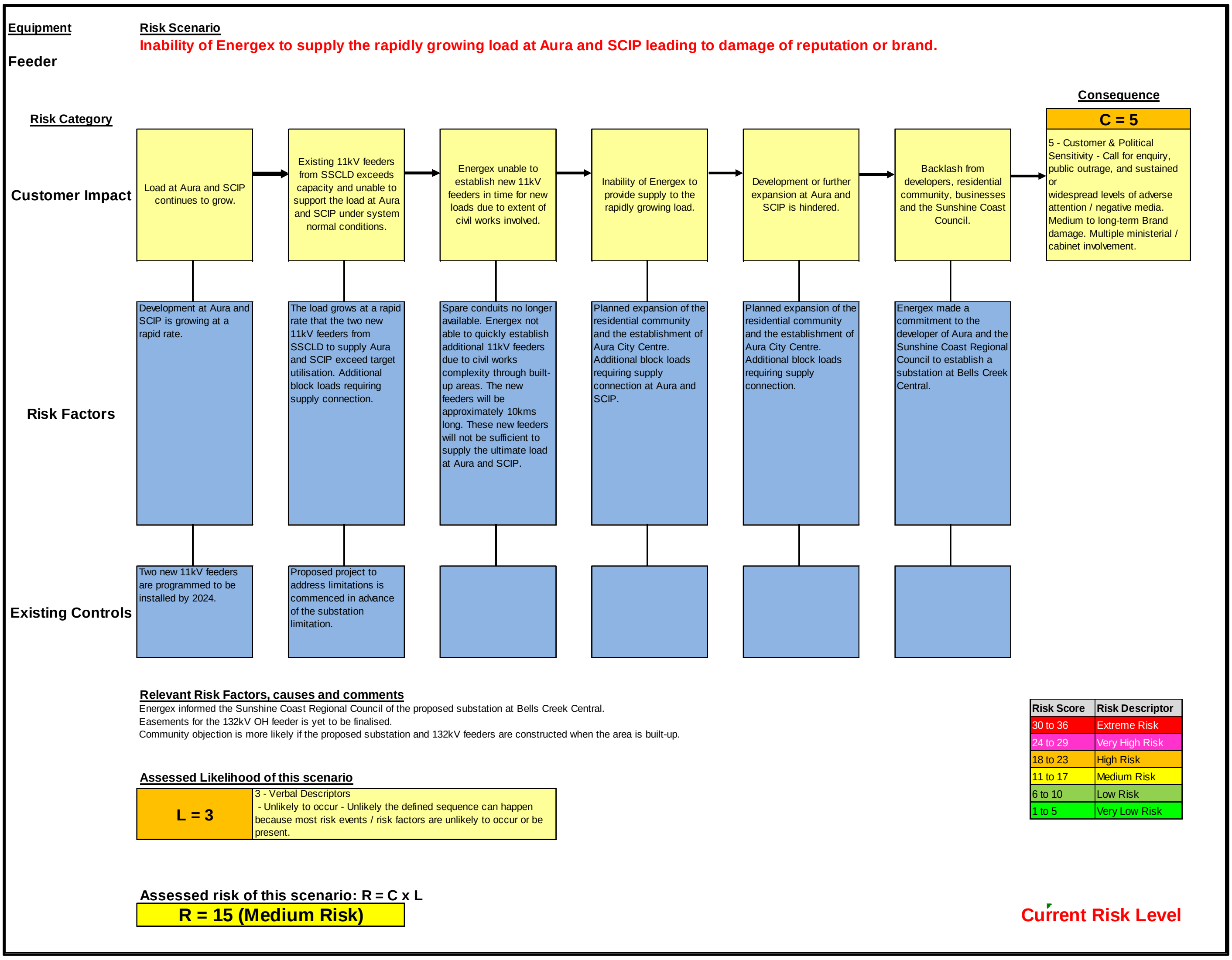


Figure 37: Risk scenario map – Current risk level

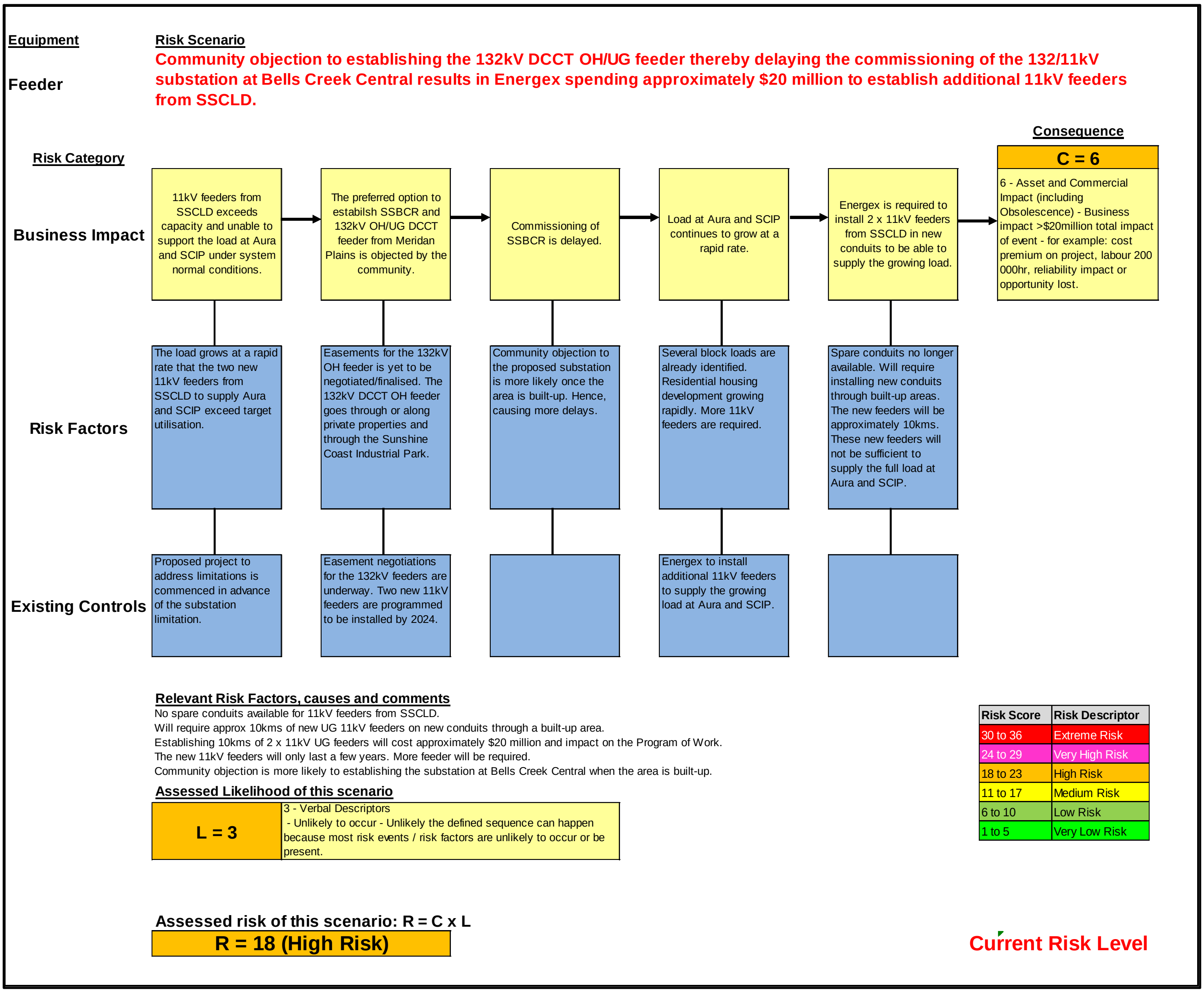


Figure 38: Risk scenario map – Current risk level

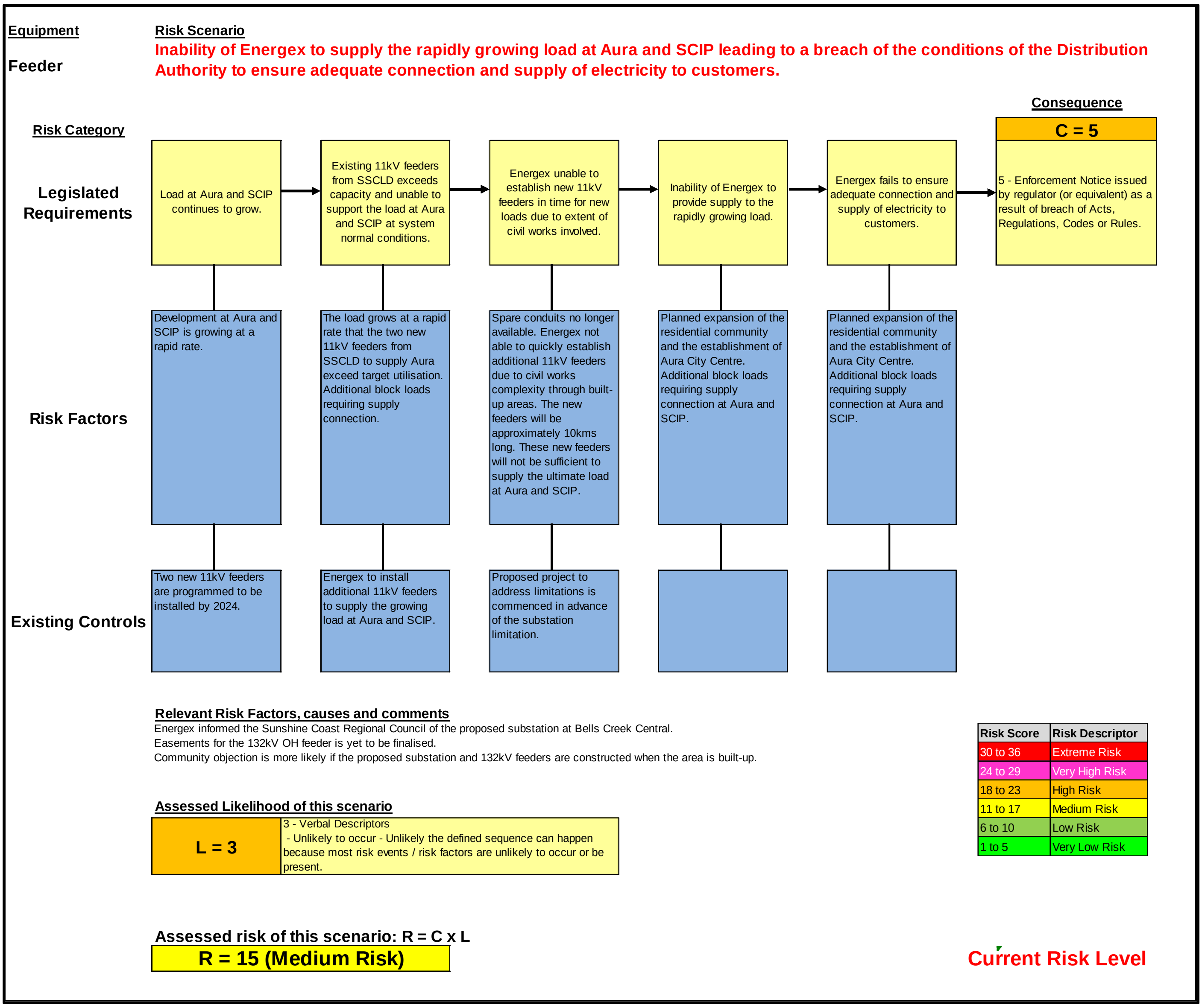


Figure 39: Risk scenario map – Current risk level

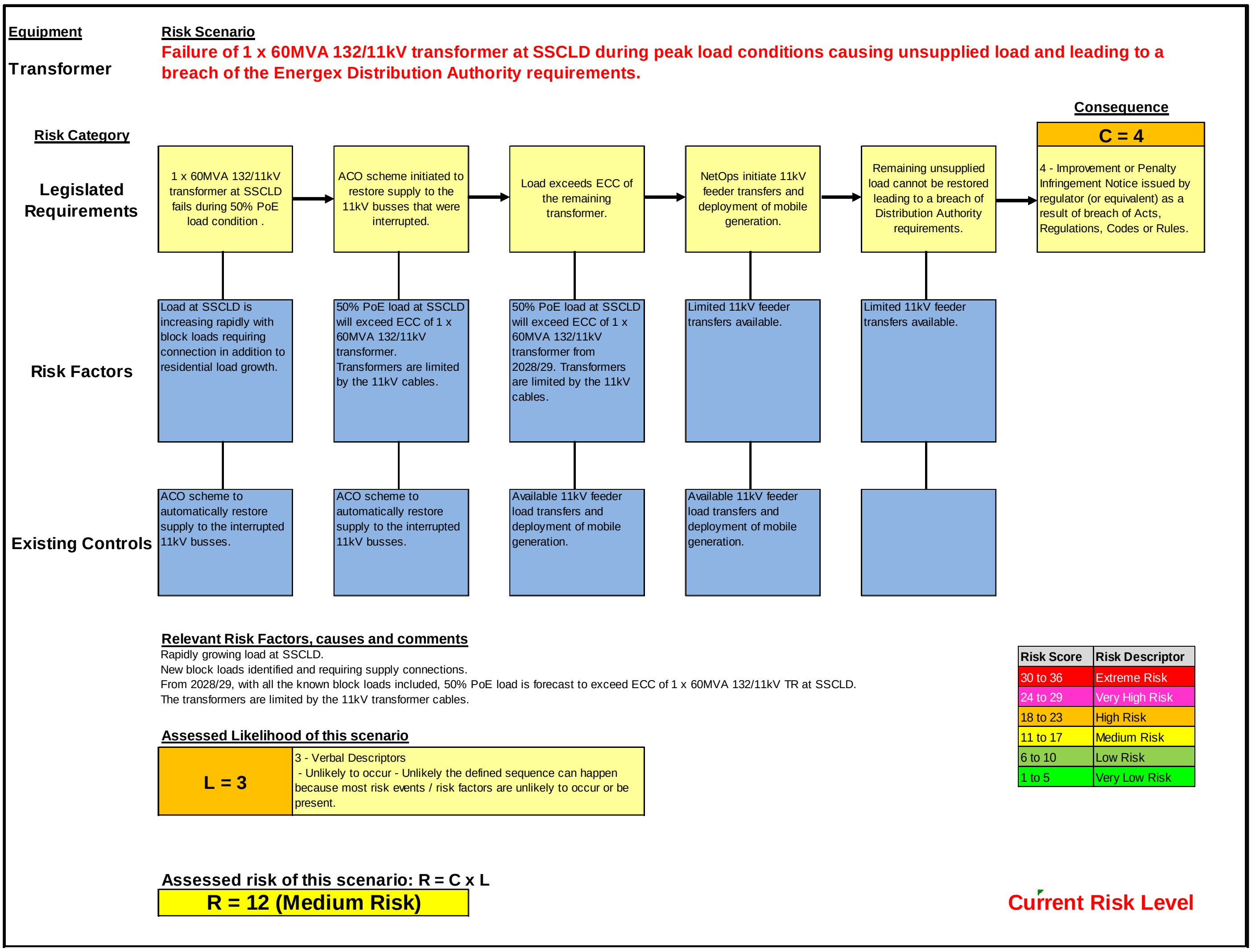


Figure 40: Risk scenario map – Current risk level

Appendix 6

Project Scope Statement and Estimate Consolidation Report