# Proposed Establishment of a 110/33 kV Bulk Supply Substation at Coorparoo (CPR) and Two 33 kV Underground Feeders from Coorparoo (CPR) to Holland Park (HPK)

**consultation** report

## 1 February 2010

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# Appendices

# 1.0 INTRODUCTION

Holland Park zone substation (SSHPK) is supplied by Tennyson Bulk Supply (SST142) via 33 kV feeders F508, F512 and F544. The load on SST142 is forecast to exceed 2HEC in summer 2013/14. There is no plant overload protection scheme at SST142 to automatically reduce load to below 2HEC in the event of a contingency condition. Similarly, load on F544 is forecast to exceed NCC from summer 2018/19 and there is a forecast load at risk (LAR) of 1.65 MV.A in summer 2009/10 for an outage of F544.

Coorparoo zone substation (SSCPR) is supplied by 33 kV feeders F612 and F613 from Camp Hill zone substation (SSCHL), which is in turn supplied from Belmont Bulk Supply (SSBBS) via F648, F654 and F655. Load on F654 and F655 is forecast to exceed NCC from summer 2016/17.

33 kV feeders F508, F512, F544, F654, F655 and sections of F648 have been deemed to reach the end of their serviceable life by 2012.

The residual LAR arising from the capacity shortfall results in a failure to meet the EDSD recommendation for N-1 capability and demonstrates a need to take corrective action. This involves the proposed construction of new assets and refurbishment of existing plant.

Where Network Service Providers (NSPs) such as ENERGEX, propose to establish new large network assets to address such requirements, they are required to consult with registered participants, AEMO and interested parties under clause 5.6.2(f) of the National Electricity Rules (NER). This document has been prepared to comply with clause 5.6.2 of the National Electricity Rules (NER), which requires ENERGEX to:

- Identify future technical limitations to its network.
- Conduct an economic cost effectiveness analysis of possible solutions to the limitations in accordance with the Australian Electricity Regulator's (AER) Regulatory Test version 3 (November 2007) where the estimated cost of the augmentation component of the recommended development is greater than $1 million.
- Consult with Registered Participants, NEMMCO, and interested parties on possible options to address the projected limitations of ENERGEX's distribution system, where the estimated cost of the augmentation component of the recommended development is greater than $10 million.

This project has been considered under the reliability limb of the regulatory test as the service standards linked to the technical requirements of Schedule 5.1 of the NER are unable to be met as detailed in Section 2.3 of this report.

This project was identified in the ENERGEX Network Management Plan 2009/10 to 2013/14.

# 2.0 EXISTING NETWORK

## 2.1 Introduction

The ENERGEX 110 kV CBD East ring comprises Wellington Road (SSWRD), Charlotte Street (SSCST), Ann Street (SSAST), McLachlan Street (SSMLS), Victoria Park (SSVPK) and Newstead (SSNSD) substations and is normally supplied by Powerlink Queensland's Belmont (SSH3) and Murarrie (SSH21) substations.

Figures 1 and 2 provide geographic and schematic views of the 110 kV network area under study.

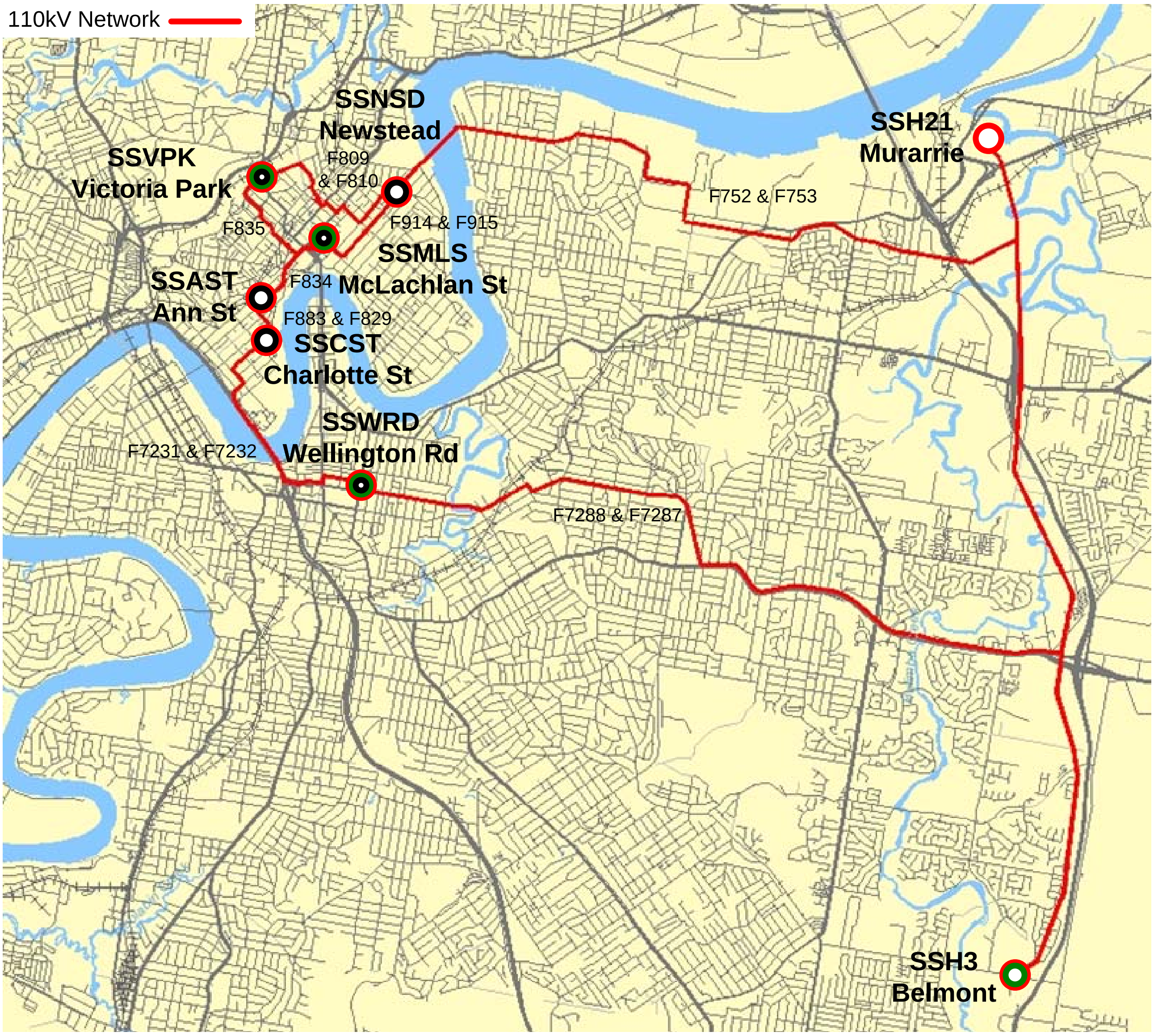



**Figure 1: Existing 110 kV Network Arrangement (Geographic View)**

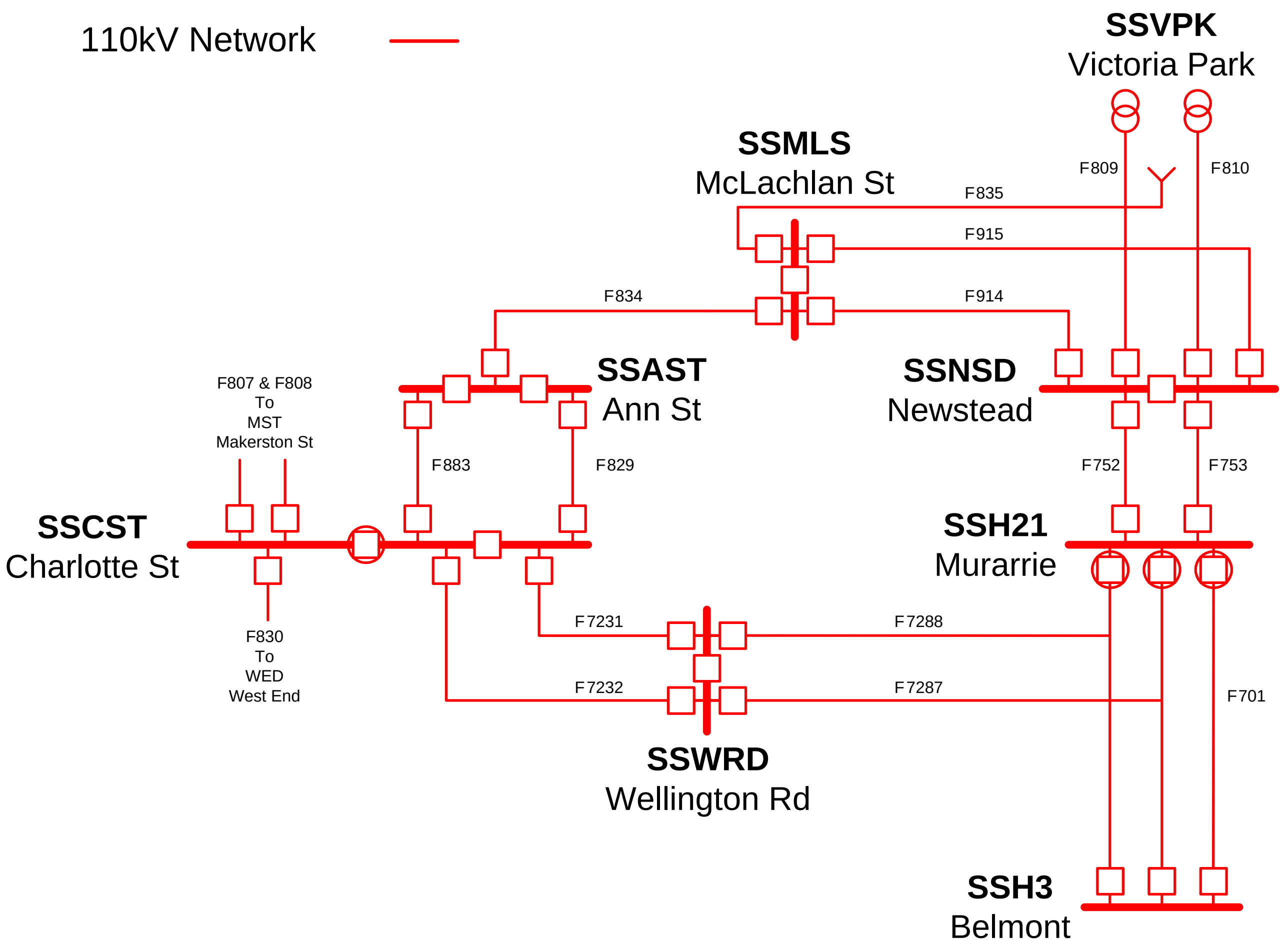



**Figure 2: Existing 110 kV Network Arrangement (Schematic View)**

Coorparoo zone substation (SSCPR) provides electrical supply to approximately 6,800 predominantly domestic customers in the suburbs of Coorparoo and Greenslopes. SSCPR is supplied by 33kV feeders F612 and F613 from Camp Hill zone substation (SSCHL), which in turn is supplied by 33kV feeders F648, F654 and F655 from Belmont bulk supply substation (SSBBS).

Significant loads supplied by SSCPR include the Gabba Business Park (SSGBP) and Caswell street (SSCWS).

The fault level on the 33 kV bus at SSCHL currently exceeds the 33 kV CB fault ratings. Unapproved project WR663423 proposes to split the 33 kV bus and install ACO to address this limitation. For the purpose of this report it is assumed that the bus split will proceed prior to summer 2009/10, with the ACO to follow by summer 2010/11.

Holland Park zone substation (SSHPK) provides electrical supply to approximately 10,300 predominantly domestic customers in the suburbs of Holland Park, Holland Park West, Greenslopes and Coorparoo. SSHPK is supplied by 33kV feeders F508 and F512 from Tennyson bulk supply substation (SST142) and 33kV feeder F544 from SST142 via Moorooka zone substation (SSMRK).

The 33 kV bus at SSHPK is split to maintain the fault level below the rating of the 33 kV transformer CBs.

Significant load supplied by SSHPK includes the Greenslopes hospital.

Figures 3 and 4 provide geographic and schematic views of the network area under study.

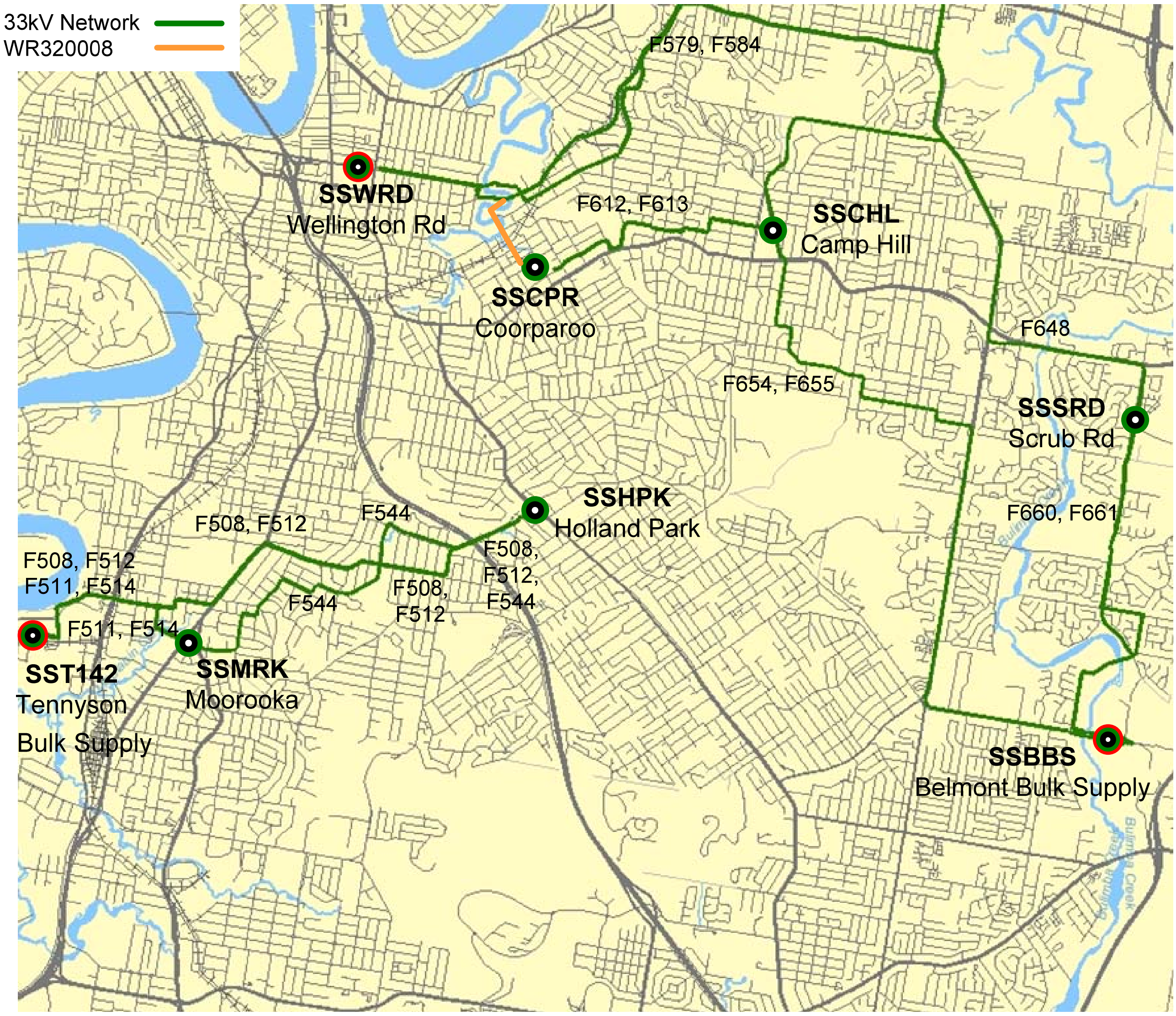



**Figure 3: Existing 33 kV Network Arrangement (Geographic View)**

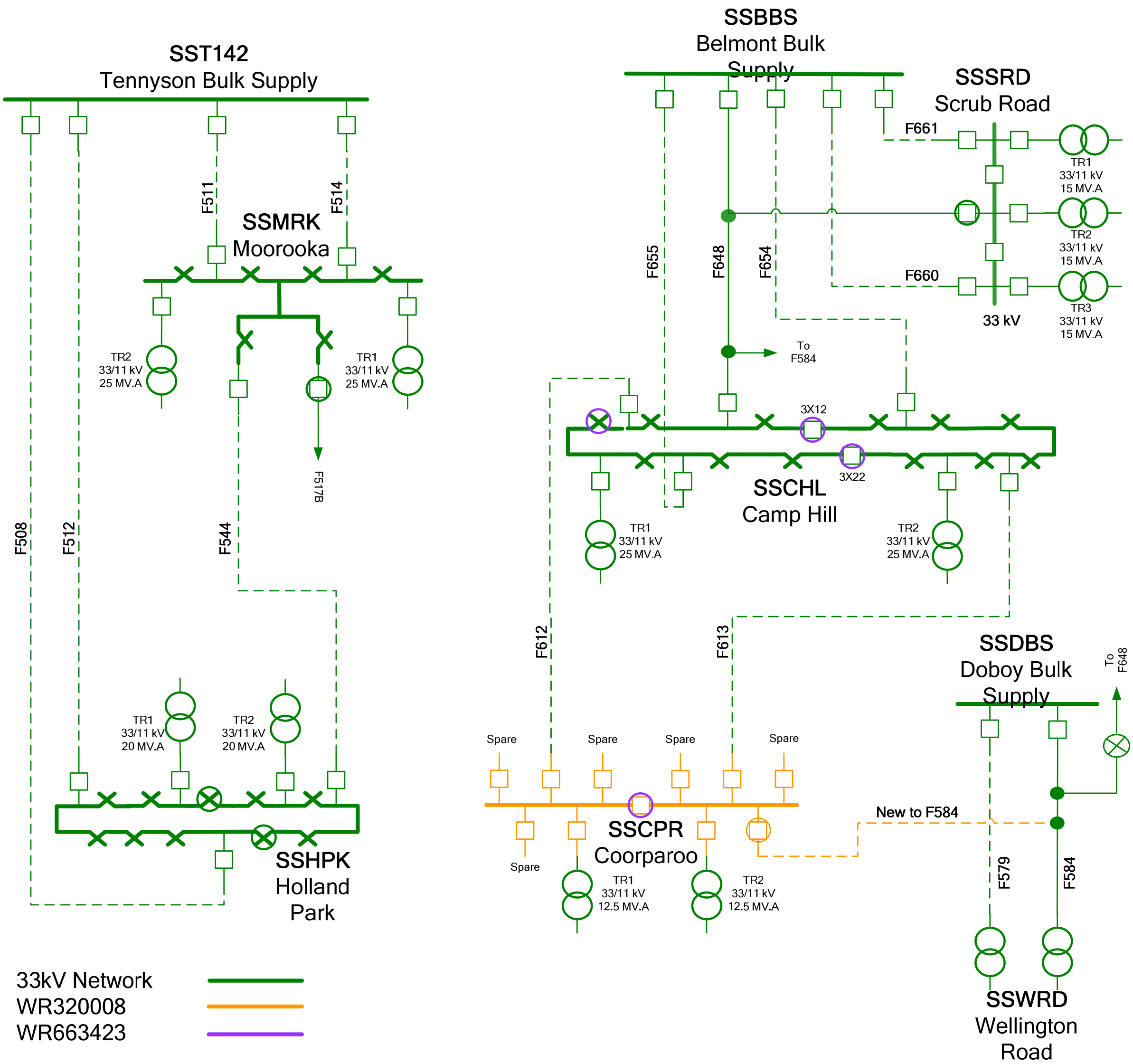



**Figure 4: Existing 33 kV Network Arrangement (Schematic View)**

## 2.2 Approved Capex / Opex Works

Approved works not yet commissioned within the study area include:

- WR663423 CHL Camp Hill – Split 33 kV bus and ACO scheme

This project splits the 33 kV SSCHL bus into three sections in order to reduce the fault levels below 33 kV CB ratings. The proposed works will also eliminate forecast NCC limitation on F654 and F655. Note that this project is not currently approved, but is considered very likely to proceed due to the existing fault limitations at SSCHL.

- WR320008 CPR Coorparoo - Est. 33 kV Switchgear & 33 kV Feeders by December 2009.

This project establishes a 33 kV bus at SSCPR, and one normally open 33 kV feeder from SSCPR that tees off F584 between Doboy bulk supply substation (SSDBS) and Wellington Road zone substation (SSWRD). The proposed works will address forecast ECC limitations of 33 kV feeders F654 and F655 by enabling the transfer of SSCPR to SSDBS under N-1 conditions.

- WR221042 TSN Tennyson – 1 x 25 MV.A 33/11 kV Transformer by May 2010.

This project establishes a new single-transformer zone substation at the existing SST142 site.

- WR659158 TWG Toowong – Install new transformer and replace ageing 33 kV switchgear by June 2011.

This project upgrades the 33 kV CBs and installs bus section CBs at SSTWG, which allows the transfer of load between SST142 to SST30 without manual switching at SSTWG.

## 2.3 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 ENERGEX maintenance Standards, no transmission, subtransmission or distribution network asset is planned to be operated beyond its assessed serviceable life.
- As per ENERGEX Transmission Planning Guidelines, plant overload protection must be provided to manage load for plant forecast to be loaded above 2 hour emergency capacity during contingency conditions.
- As per ENERGEX Supply Security Standard, no transmission, subtransmission or distribution network asset is planned to be operated above its normal cyclic capacity for a forecast 10% POE load under network normal conditions.
- As per ENERGEX Transmission Planning Guidelines, no transmission or subtransmission network asset is planned to be operated above its fault capacity under network normal conditions.
- Bulk Supply Substations and Transmission Network
    - As per ENERGEX Supply Security Standard, for an urban mixed/predominantly residential bulk supply substation having greater than or equal to 15 MV.A of load, interruption to supply is possible during N-1 conditions. This is provided that all supply is restored within 30 minutes.
    - As per ENERGEX Supply Security Standard, for transmission lines supplying CBD and critical installations, there shall be no interruption to supply during N-1 conditions. After an N-1 event, the network must be restored to a secure state (able to withstand a second credible contingency) within 1 hour of the first contingency.
- Zone Substations and Subtransmission network
    - As per ENERGEX Supply Security Standard, for an urban mixed/predominantly residential zone substation having greater than or equal to 15 MV.A of load, interruption to supply is possible during N-1 conditions. This is provided that all supply is restored within 3 hours.
    - As per ENERGEX Supply Security Standard, for subtransmission lines supplying urban/mixed predominantly residential zone substations of greater than 15 MV.A of

load, interruption to supply is possible under N-1 conditions.  This is provided that all supply is restored within 30 minutes.

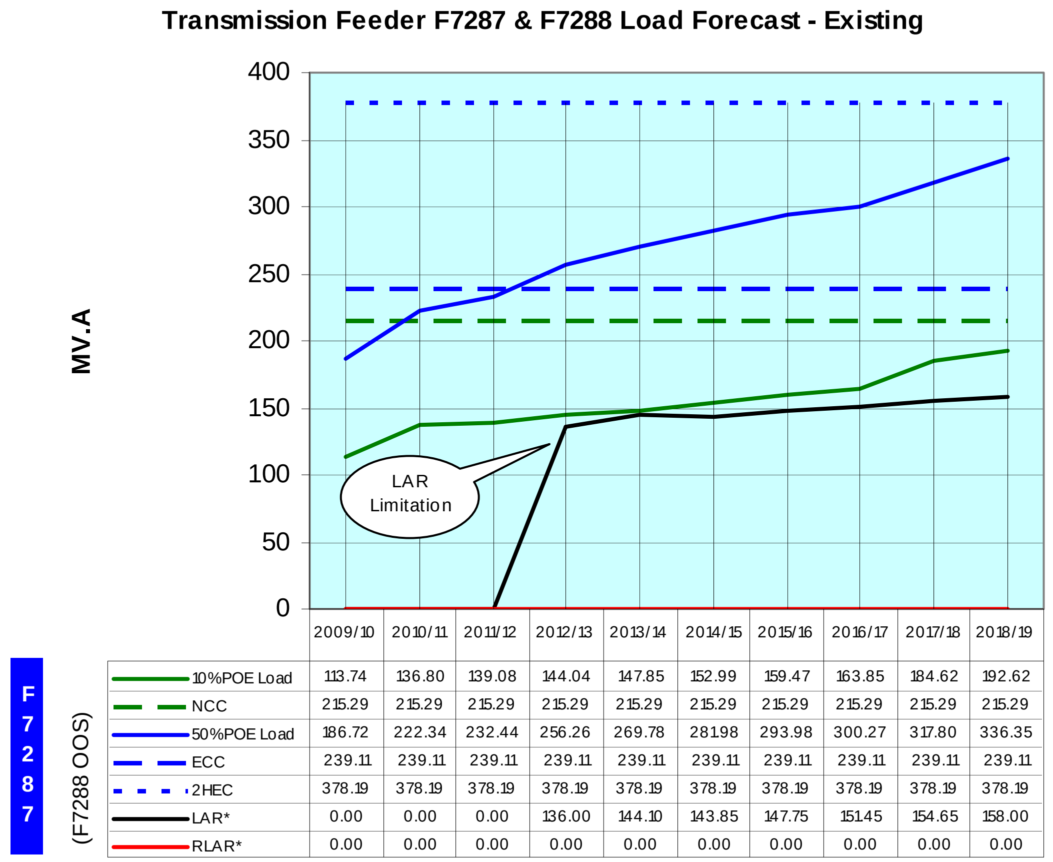
## 2.4 Limitations of the Existing Network

The existing network limitations are as follows:

### 2.4.1 Transmission Network Limitations

The ENERGEX 110 kV CBD East ring is supplied from SSH3 by 2 x 110 kV 1600 mm² Cu XLPE cables F7287 and F7288, providing a normal cyclic capacity of 430 MV.A.

The 10 year 10% POE and 50% POE load forecasts, and the existing normal cyclic capacity (NCC), emergency cyclic capacity (ECC) and 2 hour emergency capacity (2HEC) of transmission feeders F7287 and F7288, are shown below:




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 113.74 | 136.80 | 139.08 | 144.04 | 147.85 | 152.99 | 159.47 | 163.85 | 184.62 | 192.62 |
| NCC | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 |
| 50%POE Load | 186.72 | 222.34 | 232.44 | 256.26 | 269.78 | 281.98 | 293.98 | 300.27 | 317.80 | 336.35 |
| ECC | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 |
| 2HEC | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 |
| LAR* | 0.00 | 0.00 | 0.00 | 136.00 | 144.10 | 143.85 | 147.75 | 151.45 | 154.65 | 158.00 |
| RLAR* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*LAR above refers to the quantity of load interrupted immediately following a second contingency (loss of F7287), one hour after the first contingency (loss of F7288). RLAR above refers to the quantity of unsupplied load after all transfers, following the second contingency.

**Figure 5: Transmission Feeders F7287 and F7288 Load Forecast (Existing Network)**

As outlined above:

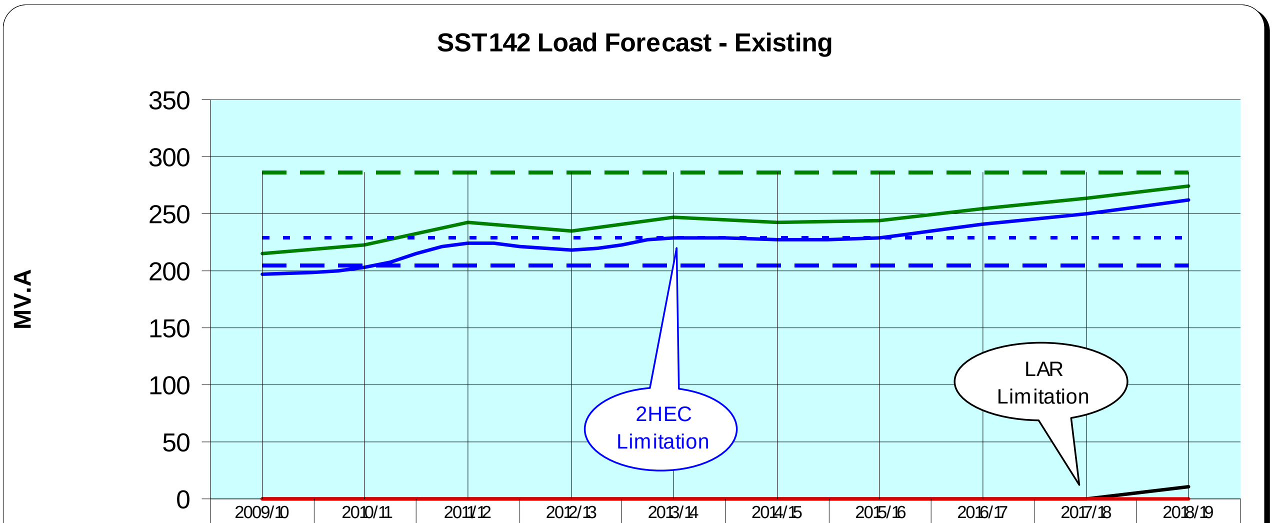
- The 50% POE load is forecast to exceed ECC in summer 2012/13.
- There is a forecast 136.00 MV.A LAR in summer 2012/13 after 1 hour.

It should be noted that the LAR and RLAR above refer to load at risk according to the N-2 security standard. There is no load at risk for the first contingency for the period of study.

## 2.4.2 Subtransmission Network Limitations

### Substation Capacity

SST142 is equipped with 3 x 80 MV.A 110/33 kV transformers. The substation capacity is limited by the transformers, providing an NCC of 286 MV.A. The ten year 10% POE and 50% POE load forecasts, and the existing NCC, ECC, LAR and RLAR of SST142 are shown below.




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 214.88 | 222.08 | 243.02 | 235.36 | 246.22 | 242.43 | 243.47 | 254.91 | 263.91 | 274.65 |
| NCC | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 |
| 50%POE Load | 196.80 | 203.73 | 224.27 | 218.12 | 229.11 | 226.99 | 229.36 | 241.24 | 250.65 | 261.43 |
| ECC | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 |
| 2HEC | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 |
| LAR* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 10.03 |
| RLAR* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*LAR above refers to the quantity of unsupplied load 30 minutes after an outage of a transformer at SST142. RLAR above refers to the quantity of unsupplied load following an outage of a transformer, after all available transfers.

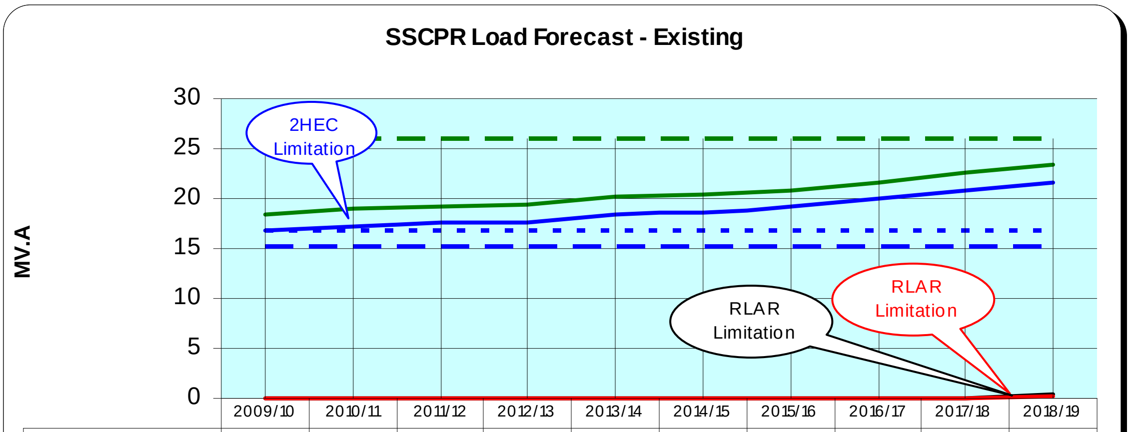
**Figure 5: SST142 Load Forecast (Existing Network)**

As outlined above:

- The 50% POE load at SST142 is forecast to exceed ECC in summer 2011/12 and 2HEC in summer 2013/14.
- There is a forecast of 0.06 MV.A LAR after 30 minutes in summer 2017/18 for an outage of a 110/33 kV transformer at SST142.

A Plant Overload Protection Scheme (POPS) is not installed at SST142 to automatically reduce load to below the 2HEC in the event of a transformer contingency.

SSCPR is equipped with 2 x 12.5 MV.A 33/11 kV transformers. The substation capacity is limited by the 11kV transformer cables, providing an NCC of 25.91 MV.A. The ten year 10% POE and 50% POE load forecasts, and the existing NCC, ECC, LAR and RLAR of SSCPR are shown below.




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 18.46 | 18.91 | 19.27 | 19.32 | 20.15 | 20.36 | 20.79 | 21.69 | 22.52 | 23.40 |
| NCC | 25.91 | 25.91 | 25.91 | 25.91 | 25.91 | 25.91 | 25.91 | 25.91 | 25.91 | 25.91 |
| 50%POE Load | 16.74 | 17.19 | 17.54 | 17.63 | 18.45 | 18.69 | 19.16 | 20.05 | 20.83 | 21.67 |
| ECC | 15.24 | 15.24 | 15.24 | 15.24 | 15.24 | 15.24 | 15.24 | 15.24 | 15.24 | 15.24 |
| 2HEC | 16.77 | 16.77 | 16.77 | 16.77 | 16.77 | 16.77 | 16.77 | 16.77 | 16.77 | 16.77 |
| LAR* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.43 |
| RLAR* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 |

*LAR above refers to the quantity of unsupllied load 3 hours after an outage of a transformer at SSCPR. RLAR above refers to the quantity of unsupplied load following an outage of a transformer, after all available transfers.

**Figure 6: SSCPR Load Forecast (Existing Network)**

As outlined above:

- The 50% POE load at SSCPR currently exceeds the ECC for an outage of a 33/11 kV transformer.
- The 50% POE load at SSCPR is forecast to exceed the 2HEC in summer 2010/11 for an outage of a 33/11 kV transformer.
- There is a forecast of 0.43 MV.A LAR in Summer 2017/18 for an outage of a 33/11 kV transformer at SSCPR.
- There is a forecast of 0.13 MV.A RLAR in Summer 2017/18 for an outage of a 33/11 kV transformer at SSCPR.

A POPS is installed at SSCPR to automatically reduce load to below 2HEC in the event of a contingency condition.

### Substation Fault Level

The existing fault capacities of the limiting plant at the relevant substations are shown below:

| Substation | Busbar Voltage (kV) | Three Phase | | Phase to Ground | | Rating | |
|---|---|---|---|---|---|---|---|
| | | (MV.A) | (A) | (MV.A) | (A) | (MV.A) | (A) |
| SSCPR | 33 | 871 | 15241 | 64.0 | 1120 | 1800 | 31500 |
| SSCPR | 11 | 187 | 9791 | 42.6 | 2238 | 250 | 13100 |
| SSHPK | 33[1] | 924 | 16173 | 160 | 2807 | 1000 | 17500 |
| SSHPK | 11[1] | 209 | 10978 | 42.5 | 2231 | 476 | 25000 |
| SSCHL | 33[2] | 701 | 12262 | 64.2 | 1124 | 1000 | 17500 |
| SSCHL | 11[2] | 216 | 11357 | 37.3 | 1958 | 381 | 20000 |

[1] SSHPK 33 kV bus has been split to reduce 33 kV fault levels.
[2] SSCHL 33 kV bus has been split to reduce 33 kV fault levels.

**Table 1: Fault Levels at Substation Busbars (Existing Network)**

### Asset Condition

SSHPK 33 kV outdoor CBs are between 43 and 57 years old. Circuit Breaker CB5082 has been identified in particular as approaching the end of its serviceable life. The remainder of the 33 kV CBs are expected to remain serviceable beyond 2020.

F508 and F512 from SST142 to SSHPK are HSL type cables and are 55 years old – beyond the expected life span of 40 years for HSL cables. These feeders contain a number of STC Styrene joints which have been known to be unreliable in the past.

F544 from SSMRK to SSHPK is an IP gas cable and is 42 years old. This type of cable has the potential to fail and remain out of service for extended periods. This is of particular concern since this feeder shares a common trench with F508 and F512, and due to their condition no feeders can be worked on with the adjacent feeders energised. There is also only a limited amount of spare cable available since this type of cable is no longer manufactured, and efforts are being made to remove it from the system where possible.

F654 and F655 from SSBBS to SSCHL are fluid filled cables and are 38 years old. Readings have indicated wide-spread sheath damage on these feeders.

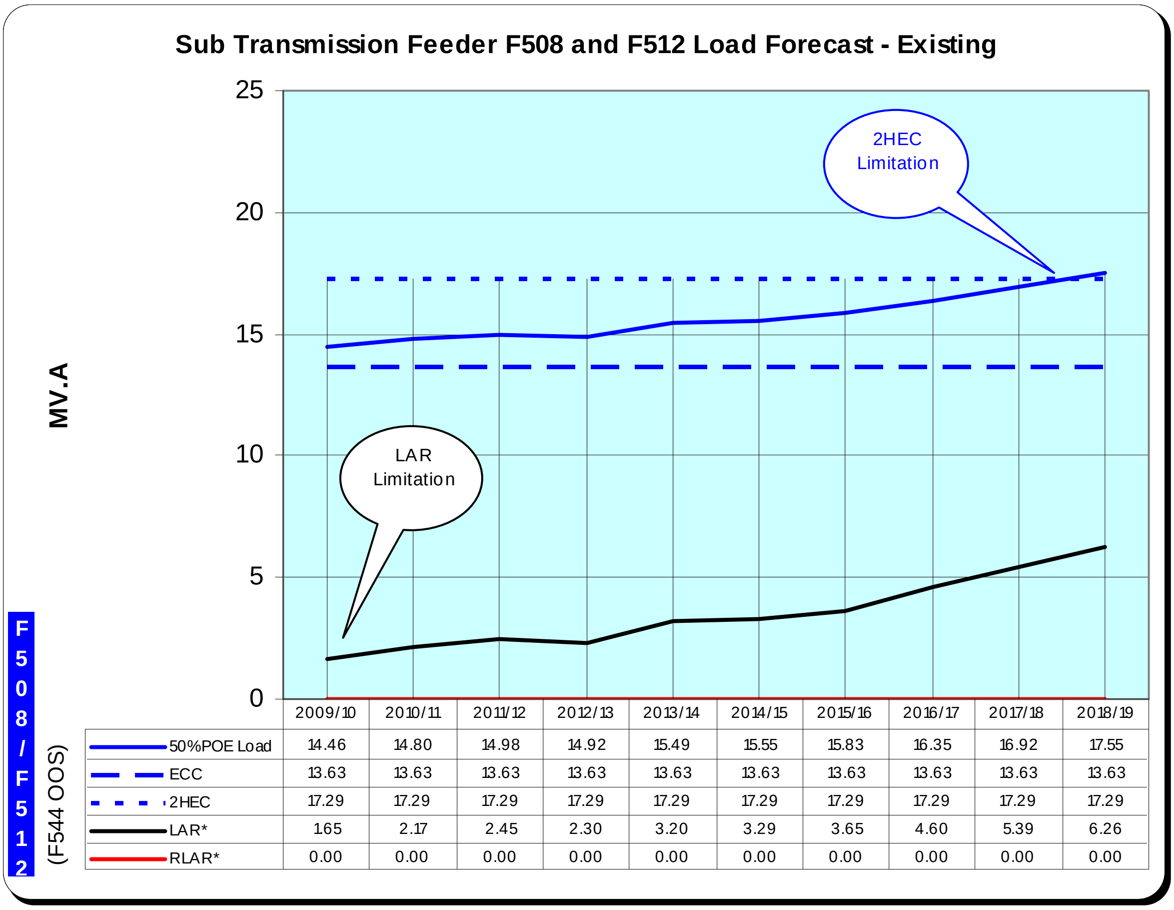
F648 from SSBBS to SSCHL is a predominantly overhead feeder with a 600 m IP gas cable tail at SSBBS. The gas tail is 38 years old and is recommended for decommissioning for similar reasons as F544. The 3.4 km section of 7/.104 has a history of poor reliability and is also recommended for replacement.

Based on a Condition Based Risk Management (CBRM) analysis of the effect of current condition and ageing on the expected life of the asset, the following have been deemed to reach the end of their serviceable life as follows:

- 33 kV CB5082 at SSHPK in 2012.
- 33 kV SSBBS-SSCHL feeders F654 and F655 in 2012.
- Sections of 33 kV SSBBS-SSCHL feeder F648 in 2012.
- 33 kV SST142-SSHPK feeders F508 and F512 in 2012.
- 33 kV SSMRK-SSHPK feeder F544 in 2012.
- 33 kV SSCHL-SSCPR feeders F612 and F613 in 2014.

## Subtransmission Feeder Capacity

The 10 year 50% POE load forecast, and the existing ECC, 2HEC, LAR and RLAR of subtransmission feeders F508 and F512 are shown below. The scenario with F544 out of service is shown since this represents the worst case.




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50%POE Load | 14.46 | 14.80 | 14.98 | 14.92 | 15.49 | 15.55 | 15.83 | 16.35 | 16.92 | 17.55 |
| ECC | 13.63 | 13.63 | 13.63 | 13.63 | 13.63 | 13.63 | 13.63 | 13.63 | 13.63 | 13.63 |
| 2HEC | 17.29 | 17.29 | 17.29 | 17.29 | 17.29 | 17.29 | 17.29 | 17.29 | 17.29 | 17.29 |
| LAR* | 1.65 | 2.17 | 2.45 | 2.30 | 3.20 | 3.29 | 3.65 | 4.60 | 5.39 | 6.26 |
| RLAR* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*LAR above refers to the quantity of unsupllied load 30 minutes after an outage of F544. RLAR above refers to the quantity of unsupplied load following an outage of F544, after all available transfers.

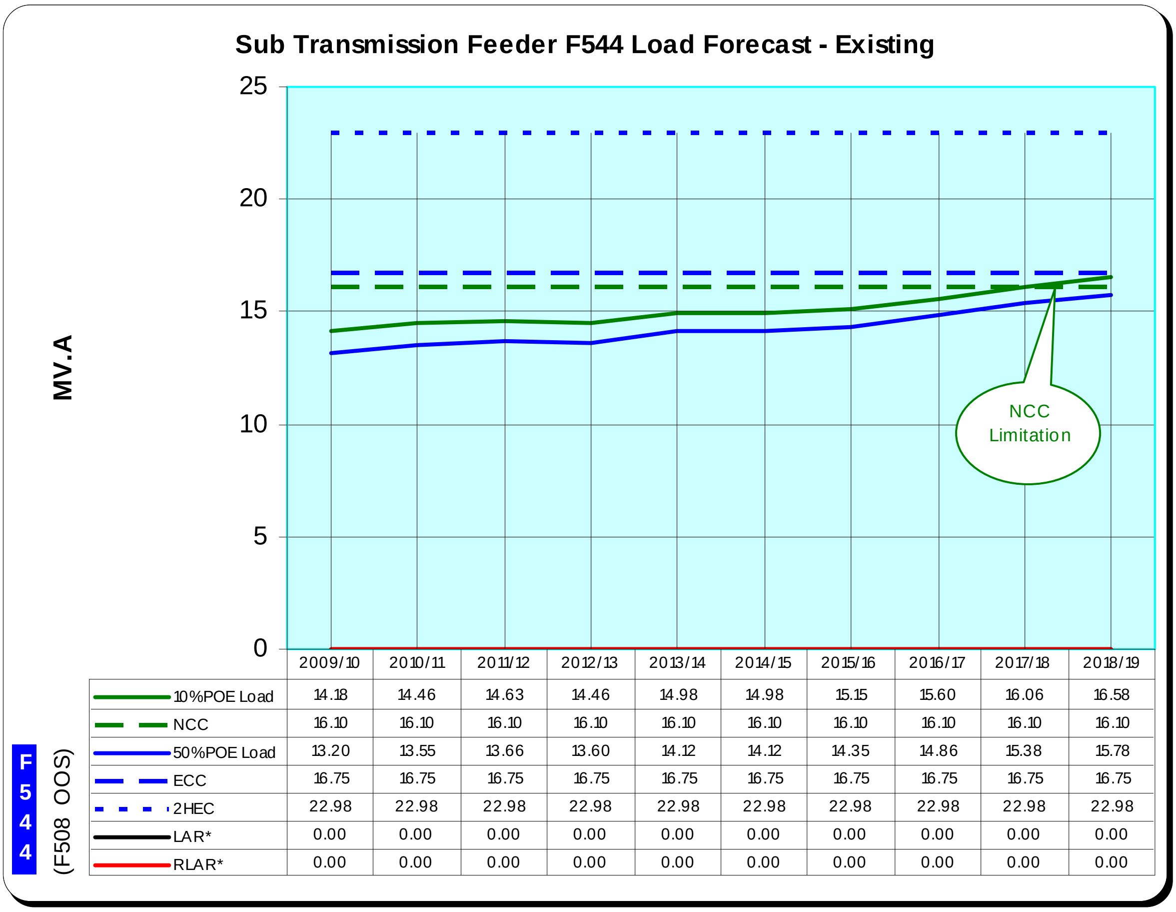
**Figure 7: Subtransmission Feeder Load Forecast (Existing Network)**

As outlined above:

- The 50% POE load on F508/F512 is forecast to exceed ECC in summer 2009/10 and 2HEC in summer 2018/19 for an outage of F544.
- There is a forecast of 1.65 MV.A LAR after 30 minutes (required security standard restoration time) in summer 2009/10 for an outage of F544. This LAR occurs because manual switching is required to close the 33 kV bus in order to restore supply.

A POPS is not installed at SST142 or SSHPK for a 33 kV feeder contingency.

The 10 year 10% POE and 50% POE load forecasts, and the existing NCC, ECC, 2HEC, LAR and RLAR of subtransmission feeder F544 is shown below.




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 14.18 | 14.46 | 14.63 | 14.46 | 14.98 | 14.98 | 15.15 | 15.60 | 16.06 | 16.58 |
| NCC | 16.10 | 16.10 | 16.10 | 16.10 | 16.10 | 16.10 | 16.10 | 16.10 | 16.10 | 16.10 |
| 50%POE Load | 13.20 | 13.55 | 13.66 | 13.60 | 14.12 | 14.12 | 14.35 | 14.86 | 15.38 | 15.78 |
| ECC | 16.75 | 16.75 | 16.75 | 16.75 | 16.75 | 16.75 | 16.75 | 16.75 | 16.75 | 16.75 |
| 2HEC | 22.98 | 22.98 | 22.98 | 22.98 | 22.98 | 22.98 | 22.98 | 22.98 | 22.98 | 22.98 |
| 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 |

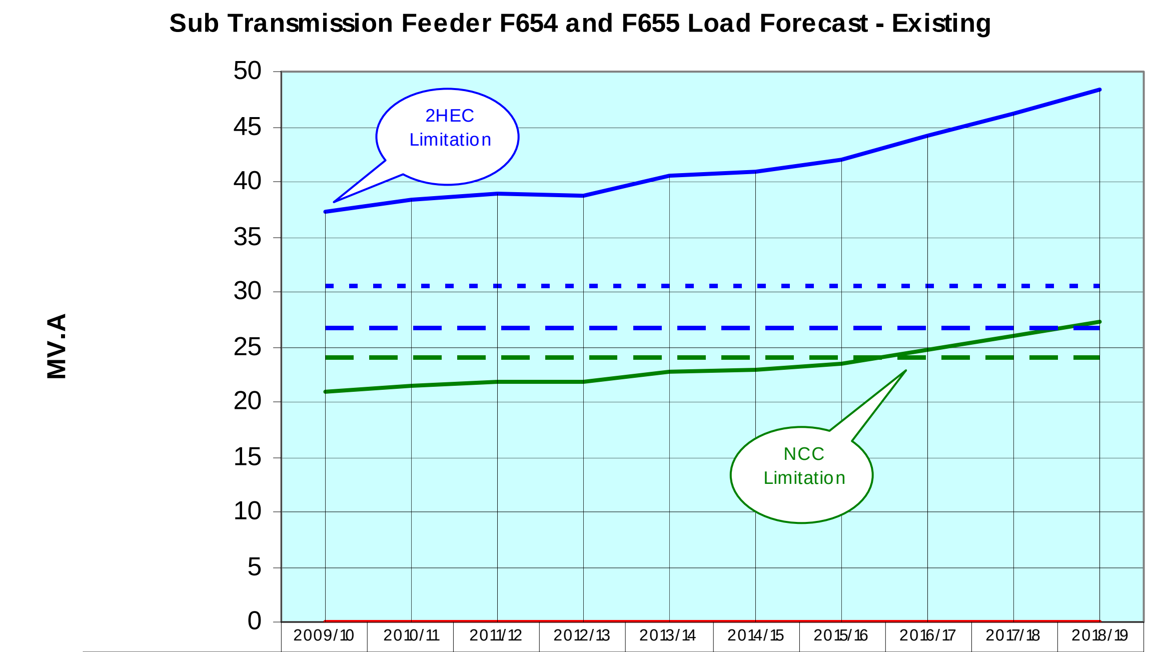
*LAR above refers to the quantity of unsupllied load 30 minutes after an outage of F508. RLAR above refers to the quantity of unsupplied load following an outage of F508, after all available transfers.

**Figure 8: Subtransmission Feeder Load Forecast (Existing Network)**

As outlined above:

- The 10% POE load on F544 is forecast to exceed NCC in summer 2018/19.

The 10 year 10% POE and 50% POE load forecasts, and the existing NCC, ECC and 2HEC of subtransmission feeders F654 and F655 is shown below.




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 20.92 | 21.49 | 21.89 | 21.78 | 22.81 | 22.92 | 23.49 | 24.75 | 25.95 | 27.21 |
| NCC | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 | 24.01 |
| 50%POE Load | 37.21 | 38.30 | 38.87 | 38.81 | 40.58 | 40.87 | 42.01 | 44.24 | 46.24 | 48.36 |
| ECC | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 |
| 2HEC | 30.52 | 30.52 | 30.52 | 30.52 | 30.52 | 30.52 | 30.52 | 30.52 | 30.52 | 30.52 |
| 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 |

*LAR above refers to the quantity of unsupllied load 30 minutes after an outage of F655. RLAR above refers to the quantity of unsupplied load following an outage of F655, after all available transfers.

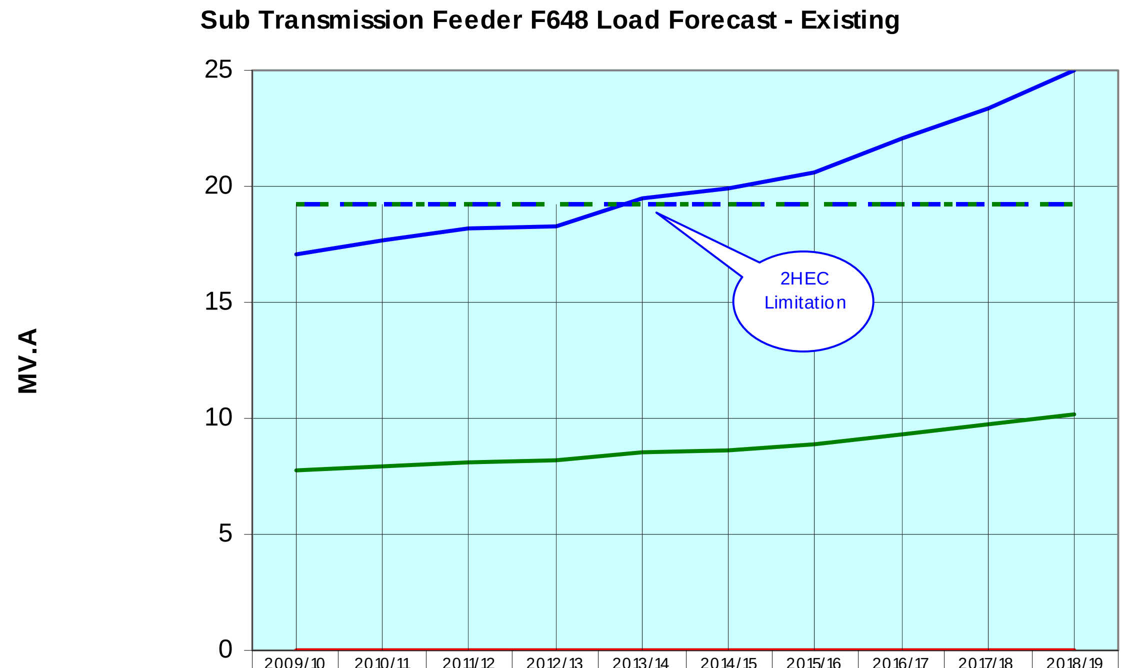
**Figure 9: Subtransmission Feeder Load Forecast (Existing Network)**

As outlined above:

- The 50% POE load on F654/F655 is forecast to exceed 2HEC in summer 2009/10.
- The 10% POE load on F654/F655 is forecast to exceed NCC in summer 2016/17.

A POPS is installed at SSCHL to reduce load for a 33 kV feeder contingency. The transfer of SSCPR to SSDBS by screen switching deloads F654/F655 for an outage of F655/F654.

The 10 year 10% POE and 50% POE load forecasts, and the existing NCC, ECC and 2HEC of subtransmission feeder F648 is shown below:




| F648 (655 OOS) | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 7.72 | 7.94 | 8.12 | 8.17 | 8.52 | 8.63 | 8.86 | 9.32 | 9.72 | 10.17 |
| 50%POE Load | 17.03 | 17.66 | 18.18 | 18.29 | 19.49 | 19.89 | 20.58 | 22.06 | 23.38 | 24.98 |
| ECC | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 |
| 2HEC | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 |
| 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 |

*LAR above refers to the quantity of unsupllied load 30 minutes after an outage of F655. RLAR above refers to the quantity of unsupplied load following an outage of F655, after all available transfers.

**Figure 10: Subtransmission Feeder Load Forecast (Existing Network)**

As outlined above:

- The 50% POE load on F648 is forecast to exceed 2HEC in summer 2013/14.

A POPS is not installed at SSCHL or SSCPR to deload F648 for a 33 kV feeder contingency. The transfer of SSCPR to SSDBS by screen switching deloads F648 for an outage of F655.

Additional subtransmission network details are provided in Appendix 1.

# 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. Those options considered include network solutions, generation options, demand side initiatives and fuel substitution.

As a result of this process, ENERGEX has identified a range of options that represent practical alternatives to address the network limitations.

The alternative options identified through this process are examined below:

## 3.1 Network Options

In addition to the following options that have been assessed as meeting the applied service standards, the option of installing POPS at SST142 in order to defer the 2HEC limitation was also considered. However there is no suitable zone substation to be shed in the event of a fault at SST142 due to the meshed 33 kV network, so this option does not satisfy the security standards.

### 3.1.1 Option 1: Establish Coorparoo Bulk Supply Substation & 110 kV DCCT WRD-CPR

This option involves the establishment of a bulk supply substation at the existing SSCPR zone substation site. The bulk supply consists of 2 x 80 MV.A 110/33 kV transformers, supplied by two new 110 kV transformer ended feeders from a new 110 kV switchboard at SSWRD.

A new 33 kV DCCT from SSCPR to SSHPK is also established, and 33 kV feeder F648 is refurbished. SSHPK and half of SSCHL are supplied from SSCPR under this option.

This option proposes to decommission 33 kV feeders F508, F512, F544, F654 and F655.

### 3.1.2 Option 2: Establish Coorparoo Bulk Supply Substation & Cut in to F7287

This option is the same as option 1, except that a 110 kV GIS switchboard is established at SSCPR and is supplied by cutting in to 110 kV feeder F7287.

Additionally, 33 kV feeder F544 is replaced with a new SCCT to provide additional transfer capacity away from SSCPR to avoid overloading the CBD East ring.

This option also proposes to decommission 33 kV feeders F508, F512, F544, F654 and F655.

### 3.1.3 Option 3: Upgrade Ashgrove West Bulk Supply Substation

This option involves the installation of a new 100 MV.A 110/33 kV transformer and 33 kV CB at SSAGW and the permanent transfer of SSIDY to SSAGW. 5 x 33 kV CB replacements are required at SSAGE to address fault level limitations.

The existing 33 kV circuits between SSBBS and SSCHL, and SST142 and SSHPK are also replaced under this option.

### 3.1.4 Option 4: Establish Moggill Bulk Supply Substation

This option consists of the establishment of a bulk supply substation on the existing Moggill (SSMGL) zone substation site and a new DCCT 33 kV from SSMGL to Kenmore substation (SSKMR). The substation is to consist of 2 x 110/33 kV transformers, 2 x 110 kV GIS outdoor CBs and a new 33 kV 2 bus indoor switchboard, and will be fed by a 2 x 110 kV overhead feeders teed off F776 and F7258.

The existing 33 kV circuits between SSBBS and SSCHL, and SST142 and SSHPK are also replaced under this option.

## 3.2 Non-network Options / Network Combinations

In order to satisfy the Regulatory Test, ENERGEX sought to identify non-network / demand side / or demand side/network combinations that address the network limitations at a lower total present value than the proposed network solution.

To be considered an alternative demand side option, the proposed solution was required to:

- have the capacity to defer the proposed network solution by reducing demand below the identified constraint limits, and
- cost less than the savings gained by deferring or removing the proposed network solution.
- meet all applied service standard requirements.

This analysis did not identify feasible demand side alternative options. Options investigated were:

- curtailable loads that are available at time of area peak;
- customer backup generation which can be used at time of area peak; and
- installation of small scale generation.

## 3.3 Comparison of Options

### 3.3.1 Technical Comparison

A summarised comparison of the advantages and disadvantages of the alternative development options is given in the following table:

| Option | Advantages | Disadvantages |
|---|---|---|
| Network Options | | |
| **Option 1**<br><br>"Establish Coorparoo Bulk Supply Substation & 110 kV DCCT WRD-CPR" | + Deloads SST142 by approximately 30 MV.A.<br>+ Consistent with network development plan.<br>+ Better operational flexibility than options 3 and 4. | – Increases load on the 110 kV CBD East ring. |
| **Option 2**<br><br>"Establish Coorparoo Bulk Supply Substation & Cut in to F7287" | + Deloads SST142 by approximately 30 MV.A.<br>+ Better operational flexibility than options 3 and 4. | – Not consistent with network development plan.<br>– Increases load on the 110 kV CBD East ring.<br>– Advances NCC limitation on 110 kV feeders due to load unbalance. |
| **Option 3**<br><br>"Upgrade Ashgrove West Bulk Supply Substation" | + Deloads SST142 by approximately 30 MV.A.<br>+ Better reliability than options 1 and 2 as overhead feeder F648 is used only for backup. | – Not consistent with network development plan.<br>– Increases load on the 110 kV CBD West ring. |
| **Option 4**<br><br>"Establish Moggill Bulk Supply Substation" | + Deloads SST142 by approximately 40 MV.A.<br>+ Better reliability than options 1 and 2 as overhead feeder F648 is used only for backup. | – Not consistent with network development plan. |

**Table 2: Technical Comparison of Alternative Development Options**

Based on the above technical comparison of options, Option 1 is considered to provide the optimum solution to address the forecast limitations.

### 3.3.2 Cost Comparison

The Regulatory Test requires ENERGEX to identify the option that minimises the present value of costs when compared with alternative options in the majority of reasonable scenarios.

Accordingly a base case net present value comparison of the alternative development options has been undertaken. The financial analysis contained anticipated costs of providing, operating and maintaining the options as well as expected costs of compliance and administration associated with each option. The costs of network losses were excluded from the analysis. The table below provides an overview of the initial capital cost and net present value cost over the period of study for each of the development options.

| Option | Description | Initial Capital Cost | Total Capital Cost | PV of Costs | Rank |
|---|---|---|---|---|---|
| NETWORK OPTION 1 | Establish CPR Bulk Supply Substation & 110kV DCCT WRD-CPR | $55,297,364 | $112,595,711 | $67,997,485 | 1 |
| NETWORK OPTION 2 | Establish CPR Bulk Supply Substation & Cut in to F7287 | $43,517,424 | $123,873,934 | $74,009,972 | 3 |
| NETWORK OPTION 3 | Upgrade AGW Bulk Supply Substation | $33,472,898 | $120,405,992 | $71,818,618 | 2 |
| NETWORK OPTION 4 | Establish MGL Bulk Supply Substation | $33,472,898 | $120,405,992 | $82,681,856 | 4 |

**Table 3: Base Case Net Present Value Comparison**

The NPV comparison above includes all direct costs associated with constructing & providing the option. This includes the cost of land/easements currently owned, but not yet utilised for network augmentation.

### 3.3.3 Sensitivity Comparison

A sensitivity analysis was conducted on this base case to establish the option that remained the lowest cost option in the majority of scenarios considered. The table below provides the results of this analysis.

| | Scenario | NETWORK OPTION 1 | NETWORK OPTION 2 | NETWORK OPTION 3 | NETWORK OPTION 4 |
|---|---|---|---|---|---|
| | | | | | |
| 1 | High WACC | $61,227,223 | $66,261,193 | $64,061,473 | $74,754,134 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |
| 2 | Low WACC | $86,410,810 | $94,922,259 | $92,612,890 | $103,147,604 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |
| 3 | Network CAPEX overspend | $74,797,234 | $81,410,969 | $79,000,479 | $90,950,042 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |
| 4 | Network CAPEX underspend | $61,197,737 | $66,608,975 | $64,636,756 | $74,413,671 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |
| 5 | Network OPEX over budget | $69,818,408 | $75,980,839 | $73,729,457 | $135,629,664 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |
| 6 | Network OPEX under budget | $66,176,562 | $72,039,105 | $69,907,778 | $80,329,561 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |
| 7 | Low growth scenario | $48,536,013 | $52,096,208 | $51,231,609 | $64,054,194 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |
| 8 | High growth scenario | $80,019,282 | $87,072,593 | $84,960,742 | $94,787,894 |
| | *ranking* | 1 | 3 | 2 | 4 |
| | | | | | |

**Table 4: Sensitivity Analysis - Comparison of Options**

Option 1 is clearly the lowest cost option in all of the scenarios considered and is therefore the recommended development option.

# 4.0 RECOMMENDED DEVELOPMENT (OPTION 1)

## 4.1 Scope of Proposed Works

### Description of Works

To address the limitations at SST142 and on subtransmission feeders F508, F512, F548, F648, F654 and F655 it is proposed to establish Coorparoo bulk supply substation and a new 33 kV DCCT from SSCPR to SSHPK. Works include:

**WR46252**

Works at SSWRD:

- Construct a new masonry 110 kV switchroom on the empty block adjacent to building 2 at SSWRD and install two sections of standard 110 kV GIS, comprising 2 x transformer CBs, 6 x feeder CBs and 1 x bus section CB.
- Retrofit 2 x 110 kV feeder CBs to the existing GIS switchboard at SSWRD.
- Cutover existing 2 x 60 MV.A 110/11/11 kV transformers to the transformer CBs in the new 110 kV switchroom.
- Install 2 x bus tie cables between the new and existing 110 kV GIS buses. One of the bus ties is to be run past the roof of each building so as to easily be terminated at future capacitor banks.
- Terminate the new 110 kV SSWRD-SSCPR feeders on feeder CBs in the new 110 kV switchroom.

Works at SSCPR:

- Extend 33 kV bus BB32 at SSCPR with 1 x Feeder CB, 1 x Capacitor CB and 1 x Universal CB.
- Install 2 x 80 MV.A 110/33 kV transformers at SSCPR and connect to new 110 kV feeders from SSWRD (transformer ended feeders) and 33 kV transformer CBs.
- Install 1 x 20 Mvar 33 kV capacitor bank and terminate at new capacitor CB.

Works at SST142:

- Disconnect tails of F508 and F512 from CBs at SST142.

Works at SSSRD:

- Make CB6482 normally closed at SSSRD.

Works at SSCHL:

- Disconnect tails of F654 and F655 from CBs at SSCHL.
- Disconnect tail of F612 at SSCHL and re-terminate to ex CB6542.
- Make CB3X12 and CB3X22 normally open at SSCHL so that one SSCHL 33/11 kV transformer is supplied by F648 from SSSRD, and the other supplied by F612 and F613 from SSCPR.

Works at SSBBS:

- Disconnect tails of F648, F654 and F655 from CBs at SSBBS.

110 kV Feeder Works

- Install 3 km 110 kV DCCT 1600mm$^2$ feeders from SSCPR to SSWRD.

33 kV Feeder Works

- Reconductor the 7/.104 Cu section of F648 from P62389 to P26784 with nominal 40 MV.A overhead conductor (approximately 4.2km). Recover/abandon the 0.25 Cu gas filled cable tail of F648 between SSBBS and P46470 (approximately 630m).
- Uprate the 19/.083 Cu section of F648 between P26784-D and SSCHL to 75catB nominal 28 MV.A rating (approximately 2.5 km).

**WR352374**

Works at SSCPR:

- Terminate new SSCPR-SSHPK feeders at designated CBs installed under WR320008 (SSCPR 33 kV switchgear upgrade).

Works at SSHPK:

- Disconnect tails of F508, F512 and F544 from CBs at SSHPK.
- Terminate new SSCPR-SSHPK feeders at ex CB5122 and ex CB5442.
- Recover CB5082 at SSHPK.

Works at SSMRK:

- Disconnect tail of F544 from CB5442 at SSMRK.

33 kV Feeder Works

- Install 3.7 km 33 kV DCCT UG feeders between SSCPR and SSHPK.

The network requirement date for completion of the recommended development is October 2009.

The target completion date for the recommended development is October 2012.

Shown below are geographic and schematic views of the proposed network on completion of the recommended works.

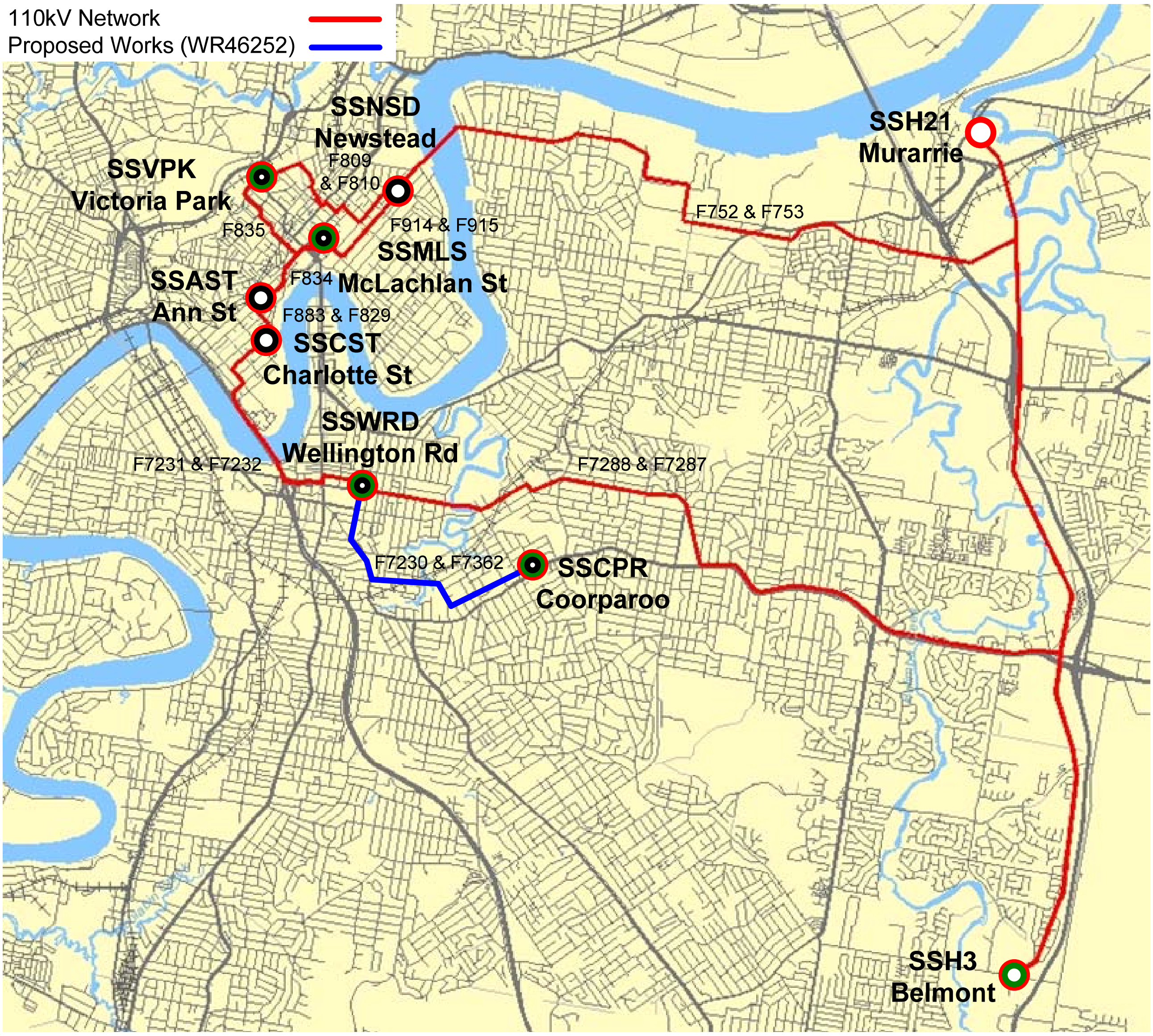



**Figure 11: Proposed 110 kV Network Arrangement (Geographic View)**

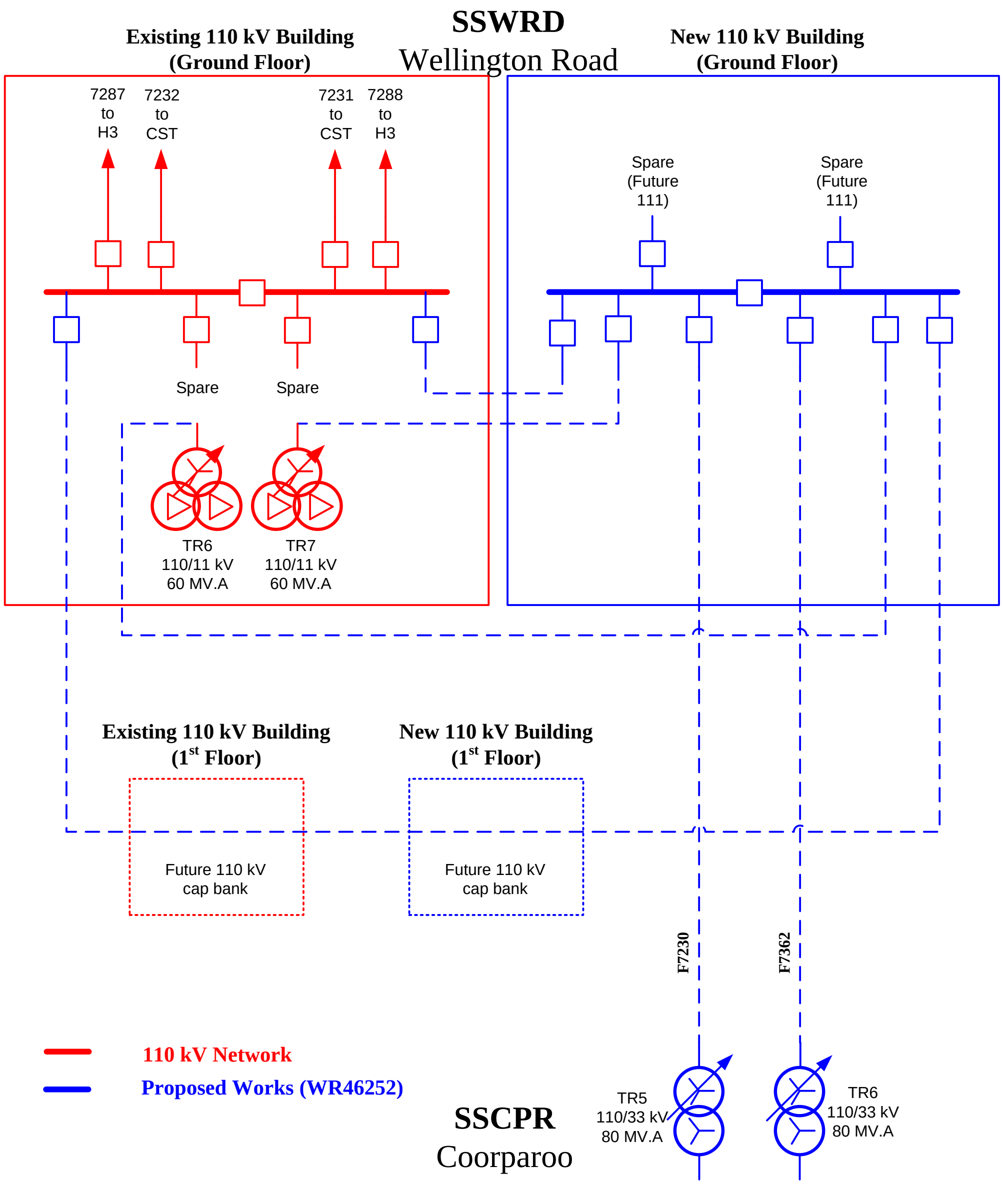



**Figure 12: Proposed 110 kV Network Arrangement (Schematic View)**

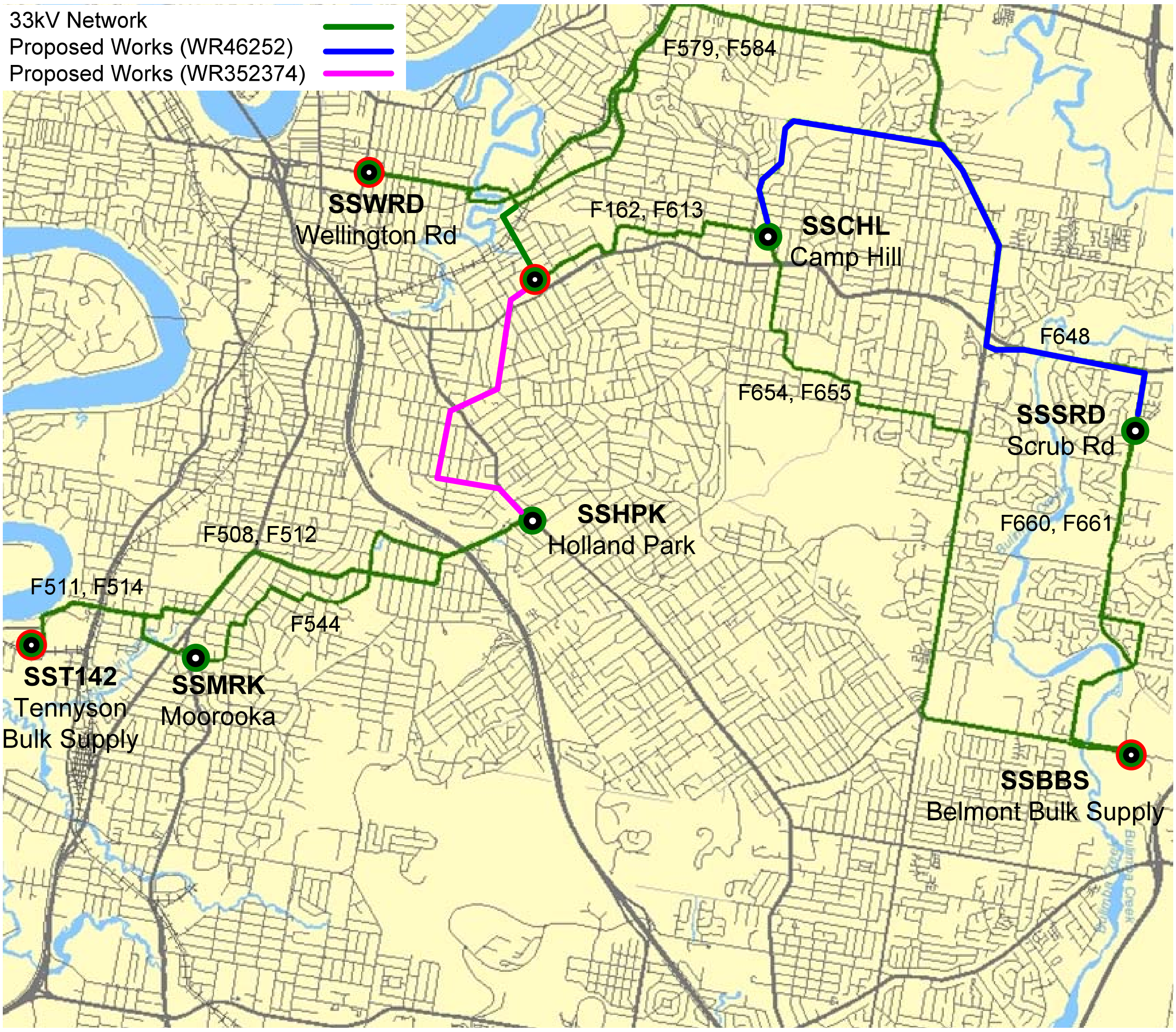



**Figure 13: Proposed 33 kV Network Arrangement (Geographic View)**

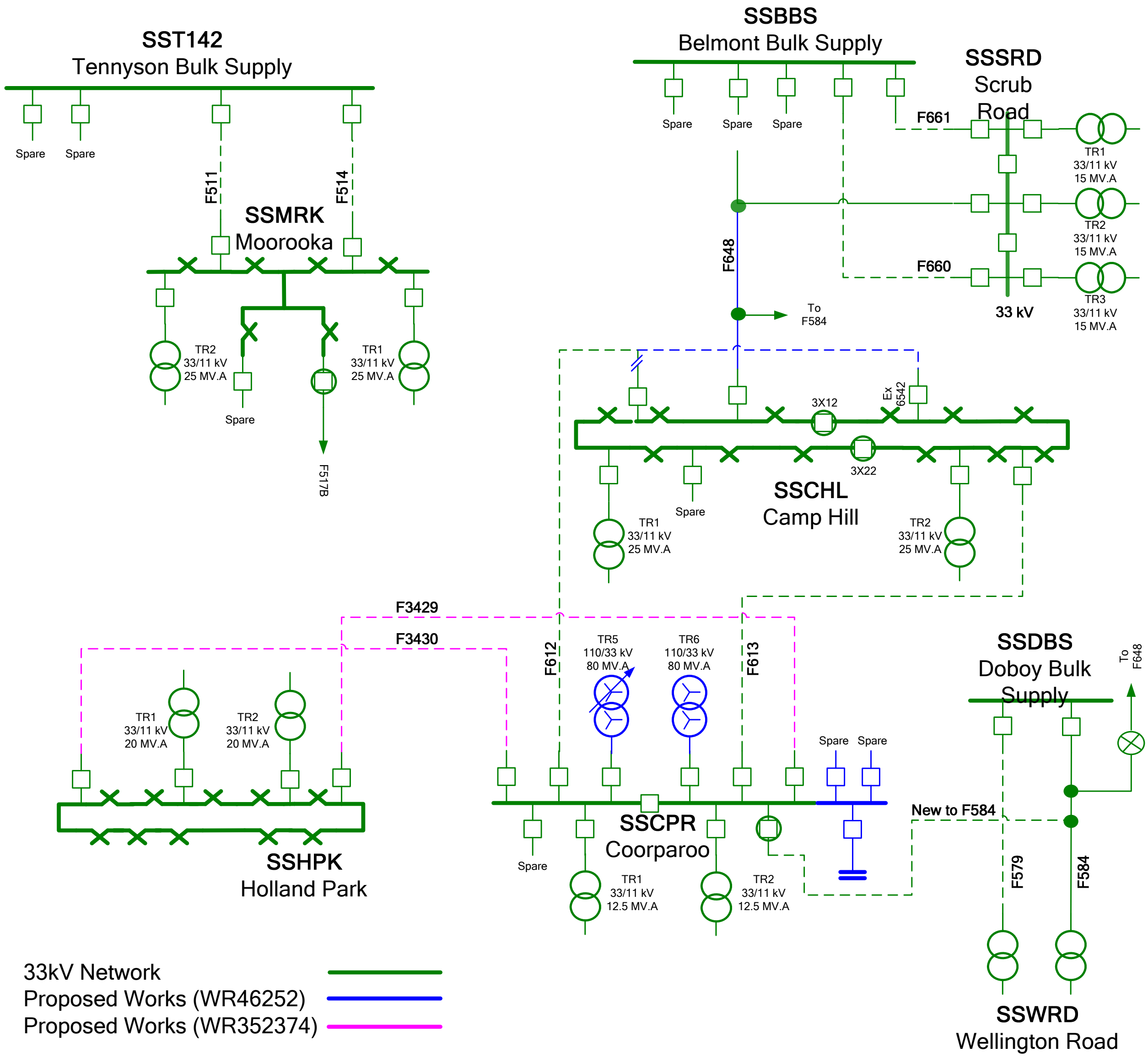



**Figure 14: Proposed 33 kV Network Arrangement (Schematic View)**

### Staging of Works

Coorparoo bulk supply must be commissioned under WR46252 prior to the termination of the 33 kV feeders at SSHPK under WR352374.

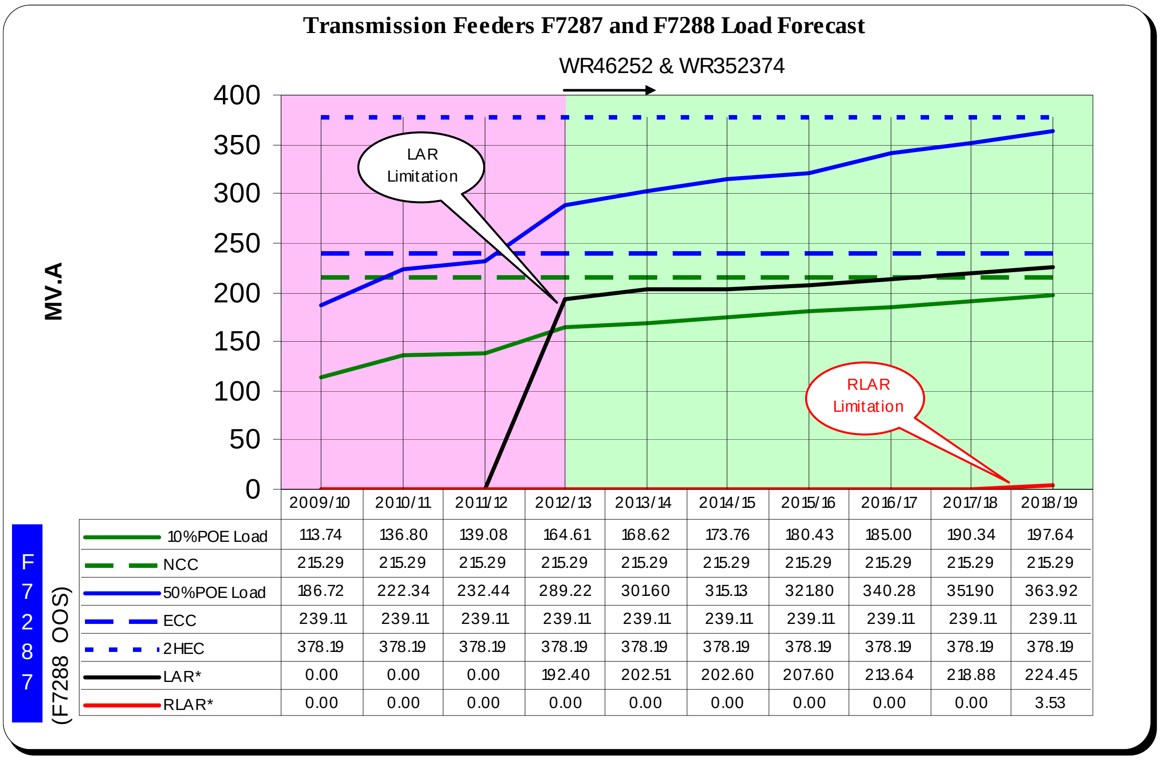
## 4.2 Impact of Proposed Works

The recommended works will have the following impact:

### 4.2.1 Transmission Network

### Transmission Feeder Capacity

The 10 year 10% POE and 50% POE load forecasts, and the NCC, ECC, 2HEC, LAR and RLAR of feeders F7287 and F7288 are shown below:




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 113.74 | 136.80 | 139.08 | 164.61 | 168.62 | 173.76 | 180.43 | 185.00 | 190.34 | 197.64 |
| NCC | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 | 215.29 |
| 50%POE Load | 186.72 | 222.34 | 232.44 | 289.22 | 301.60 | 315.13 | 321.80 | 340.28 | 351.90 | 363.92 |
| ECC | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 | 239.11 |
| 2HEC | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 | 378.19 |
| LAR* | 0.00 | 0.00 | 0.00 | 192.40 | 202.51 | 202.60 | 207.60 | 213.64 | 218.88 | 224.45 |
| RLAR* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.53 |

*LAR above refers to the quantity of load interrupted immediately following a second contingency (loss of F7287), one hour after the first contingency (loss of F7288). RLAR above refers to the quantity of unsupplied load after all transfers, following the second contingency.

**Figure 15: Transmission Feeder F7287 & F7288 Load Forecast (Proposed Network)**

As outlined above:

- The 50% POE load is forecast to exceed ECC in summer 2012/13.
- There is a forecast 192.40 MV.A LAR in summer 2012/13 after 1 hour.
- There is a forecast 3.53 MV.A RLAR in summer 2018/19 after all available transfers.

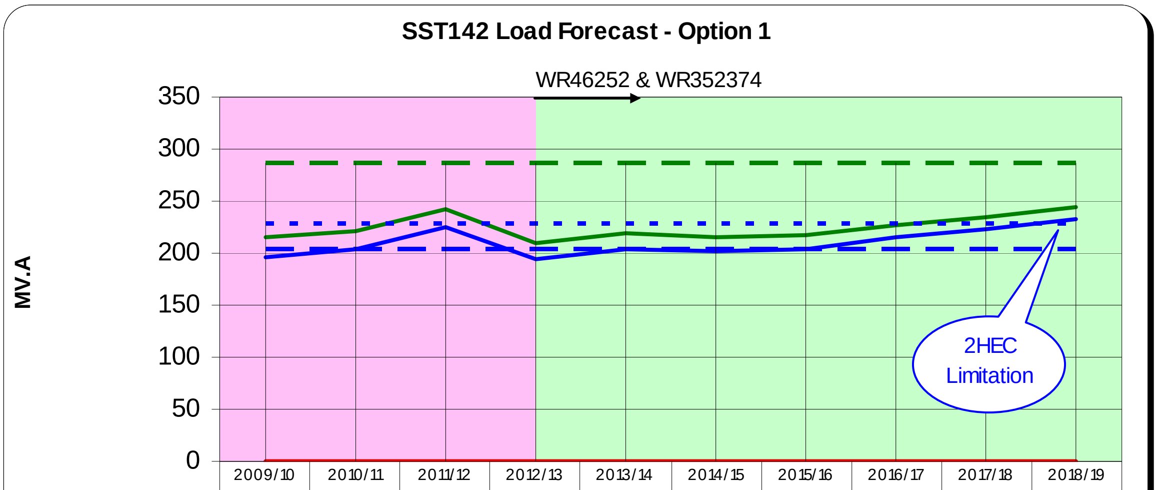
It should be noted that the LAR and RLAR above refer to load at risk according to the N-2 security standard. There is no load at risk for the first contingency for the period of study.

It is expected that the above limitations will be addressed by the proposed installation of a new 110 kV DCCT between SSWRD and the proposed Woolloongabba substation (SS111), and a new 110 kV DCCT between SSVPK and SSAST, both proposed for 2013.

### 4.2.2 Subtransmission Network

#### Substation Capacity

The 10 year 10% POE and 50% POE load forecasts, and the NCC, ECC, 2HEC, LAR and RLAR of SST142 are shown below:




| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 214.88 | 222.08 | 243.02 | 209.36 | 219.07 | 215.82 | 216.84 | 227.12 | 235.23 | 244.92 |
| NCC | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 | 286.00 |
| 50%POE Load | 196.80 | 203.73 | 224.27 | 194.09 | 203.90 | 202.12 | 204.33 | 214.97 | 223.45 | 233.15 |
| ECC | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 | 204.00 |
| 2HEC | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 | 229.00 |
| 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 |

*LAR above refers to the quantity of unsupplied load 30 minutes after an outage of a transformer at SST142. RLAR above refers to the quantity of unsupplied load following an outage of a transformer, after all available transfers.

**Figure 16: Substation Load Forecast (Proposed Network)**

As outlined above, the transfer of SSHPK to SSCPR defers the 2HEC limitation at SST142 until summer 2018/19. This network limitation will be addressed by future projects.

Additional subtransmission network details are provided in Appendix 1.

The 10 year 10% POE and 50% POE load forecasts, and the NCC, ECC, 2HEC, LAR and RLAR of SSCPR bulk supply are shown below:

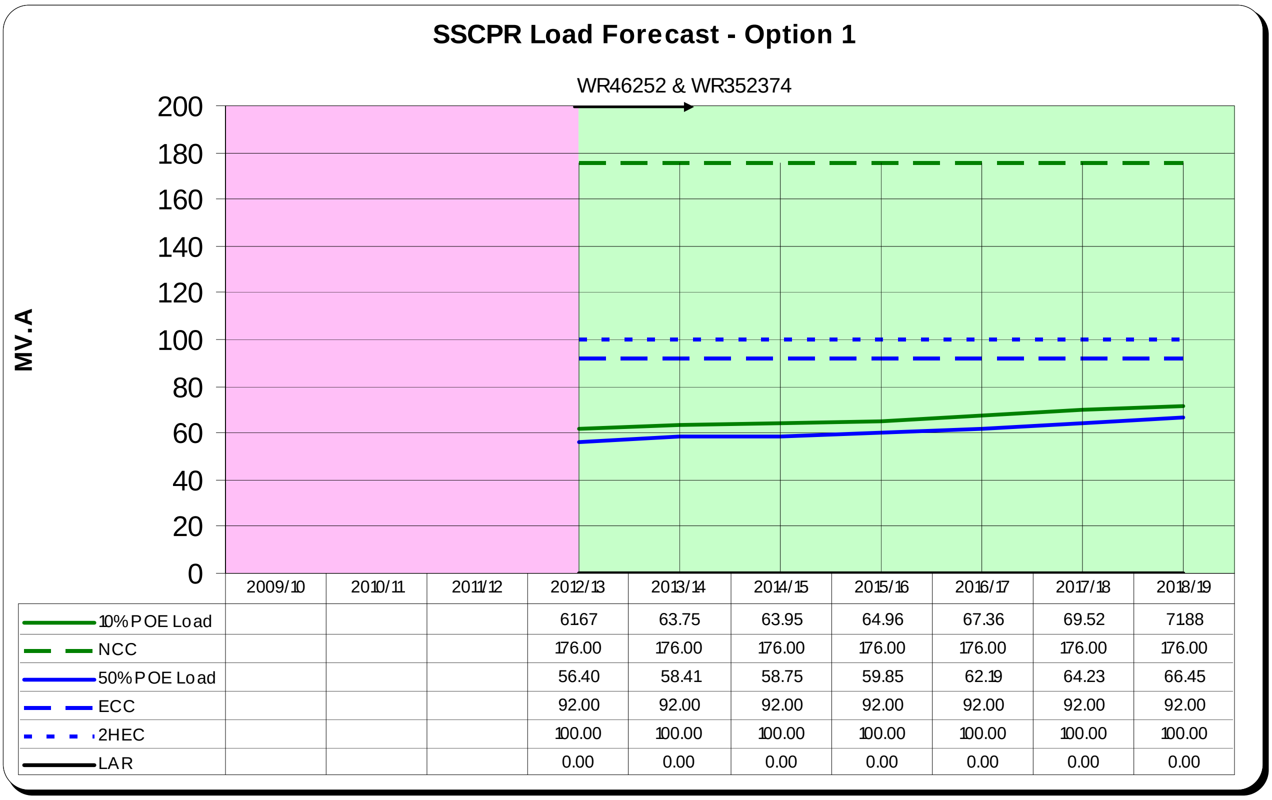



**Figure 17: Substation Load Forecast (Proposed Network)**

As outlined above, there are no forecast limitations at SSCPR bulk supply within the period of study.

### Substation Fault Level

The expected fault capacities of the limiting plant at the substation are shown below:

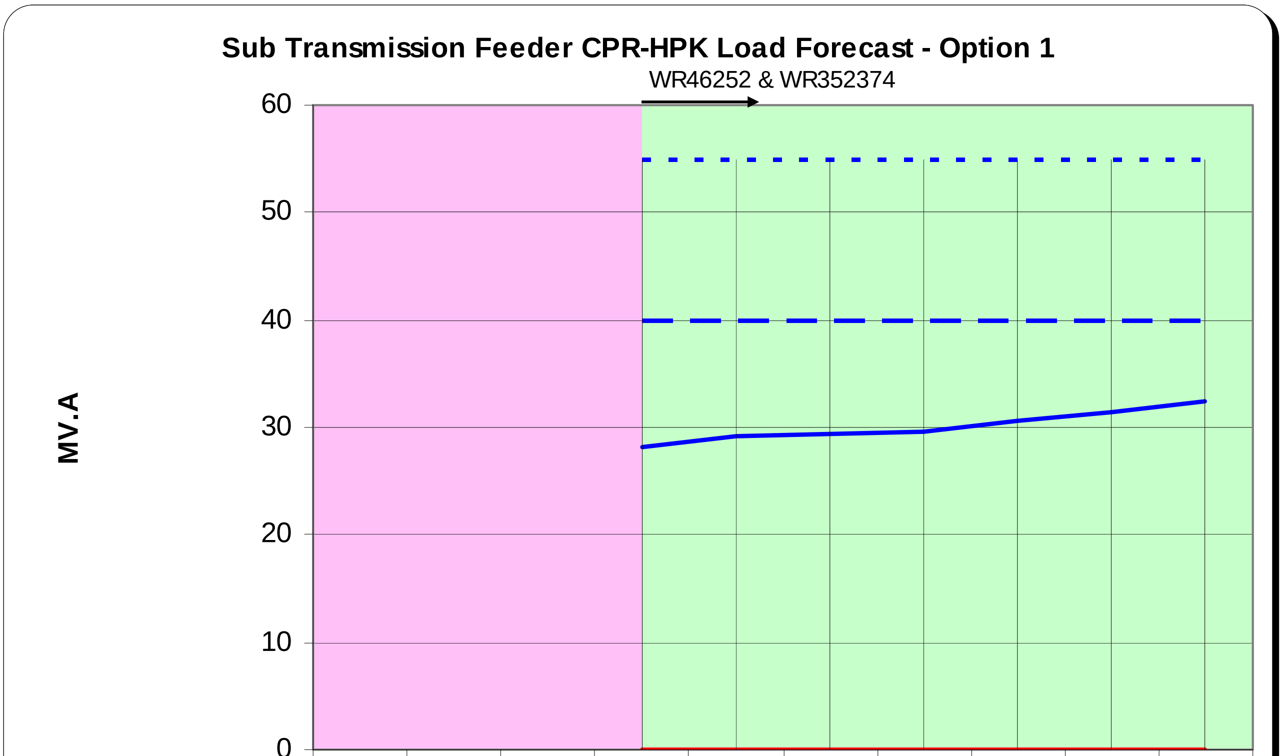
| Substation | Busbar Voltage (kV) | Three Phase | | Phase to Ground | | Rating | |
|---|---|---|---|---|---|---|---|
| | | (MV.A) | (A) | (MV.A) | (A) | (MV.A) | (A) |
| SSCPR | 110 (TR5,TR6) | 3801 | 19952 | 1517 | 23894 | - | - |
| SSCPR | 33 | 990 | 17327 | 45 | 2351 | 1800 | 31500 |
| SSCPR | 11 | 191 | 10004 | 14 | 2255 | 250 | 13100 |
| SSHPK | 33 | 842 | 14742 | 44 | 2305 | 1000 | 17500 |
| SSHPK | 11 | 200 | 10504 | 14 | 2238 | 476 | 25000 |
| SSCHL | 33 | 882 | 15428 | 44 | 2325 | 1000 | 17500 |
| SSCHL | 11 | 120 | 6311 | 12 | 1959 | 381 | 20000 |

**Table 5: Fault Levels at Substation Busbars (Proposed Network)**

As outlined above, fault ratings are not exceeded following project completion.

## Subtransmission Feeder Capacity

The 10 year 50% POE load forecast, and the ECC, 2HEC, LAR and RLAR of the new CPR-HPK 33 kV feeders are shown below:




| F3430 (F3429 OOS) | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50%POE Load | | | | 28.18 | 29.21 | 29.32 | 29.49 | 30.58 | 31.44 | 32.47 |
| ECC | | | | 40.00 | 40.00 | 40.00 | 40.00 | 40.00 | 40.00 | 40.00 |
| 2HEC | | | | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 |
| LAR | | | | 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 |

**Figure 18: Subtransmission Feeder Load Forecast (Proposed Network)**

As outlined above, there are no limitations on F3429 or F3430 within the period of study.

Additional subtransmission network details are provided in Appendix 1.

### 4.2.3 Network Losses

To date ENERGEX has voluntarily reported its greenhouse gas emissions under the Greenhouse Challenge. Commencing in 2008/2009, ENERGEX was required, under the National Greenhouse and Energy Reporting Act 2007 to compulsorily report its contribution to the national greenhouse inventory. Network losses have been identified by quantification of greenhouse gas emissions as one of the significant control opportunities associated with reducing these emissions.

The expected savings in network losses is forecast to be 2,213 kW at time of peak load. This also represents an estimated reduction of 3586 tonnes CO2-e (carbon dioxide equivalent) per annum based on emission factors consistent with the National Greenhouse Accounts (NGA) factors (version June 2009) for transmission and distribution network operators.

## 4.3 Project Timing Risk

### Level of Risk Associated with the Date of Practical Completion

In accordance with the ENERGEX network risk based assessment framework, the level of risk associated with the date of practical completion has been determined. The results of the analysis are shown in the table below:

| Scenario | | 2009/10 | 2010/11 | 2011/12 | 2012/13 |
|---|---|---|---|---|---|
| 33 kV feeder F544 failure (end of life 2012) | Consequence Rating | 2 | 2 | 2 | 2 |
| | Likelihood Rating | 4 | 4 | 5 | 6 |
| | Risk | Low | Low | Low | Moderate |
| 33 kV feeder F508, F512, F648, F654 or F655 failure (end of life 2012) | Consequence Rating | 1 | 1 | 1 | 1 |
| | Likelihood Rating | 4 | 4 | 5 | 6 |
| | Risk | Very Low | Very Low | Very Low | Low |
| 33 kV feeder F654 & F655 concurrent failure | Consequence Rating | 4 | 4 | 4 | 5 |
| | Likelihood Rating | 3 | 3 | 3 | 6 |
| | Risk | Moderate | Moderate | Moderate | Intolerable |

**Table 6: SSCPR Risk Rating**

As outlined in the table above, it has been determined that it results in an **Intolerable** risk to defer the date of practical completion beyond the target completion date.

### Risk Mitigation Strategy

As the date of practical completion is consistent with the target completion date, the level of network risk can be managed using existing network contingency plans.

## 4.4 Future Network Development

The following projects that affect the area of study have been identified:

- WR233759 BDA Buranda – Establish 2 x 33 kV feeders, 2 x 25 MV.A 33/11 kV substation and 5 x 11 kV feeders in June 2011.

SSBDA is proposed to be fed by SST142 via DCCT UG 33 kV feeders from SSALY. The establishment of SSBDA will increase load on SST142 due to load transfers from SSWED and SSWRD.

- WR366225 111 Woolloongabba – Establish 110/11 kV 2 x 60 MV.A zone substation by August 2013

This project establishes a new 110/11 kV zone substation at Woolloongabba with a 110 kV switchboard. Supply to SS111 will be from Powerlink Queensland's Rocklea substation (110 kV feeders to be installed under WR4838979).

- WR4838979 110 kV DCCT RKL Rocklea – 111 Woolloongabba, 110 kV DCCT 111 Woolloongabba – WRD Wellington Road, 110 kV SCCT 111 Woolloongabba – WED West End by May 2013.

This project will establish 110 kV transfer capacity between the CBD East, West and South 110 kV networks and is expected to relieve the limitations on 110 kV feeders F7287 and F7288.

- WR5049766 VPK Victoria Park – AST Ann Street Establish new DCCT 110 kV feeder by October 2013

This project will establish a new 110 kV DCCT between SSAST and SSVPK, improving security on the 110 kV CBD East network.

- WR3942721 CHL-CPR Replace 33 kV Feeders F612 & F613 by October 2014.

This project replaces the existing underground gas cables from SSCHL to SSCPR with 630mm2 Cu XLPE/LY/HDPE direct buried cable. On completion of this project, the 33 kV bus at SSCHL may be closed with SSCHL fully supplied from SSCPR bulk supply.

- DJ20165 – GSP Greenslopes – Establish zone substation by October 2015

This project will establish a new zone substation in Greenslopes which is expected to cut into the 33 kV SSCPR-SSHPK feeders installed under this project.

## 5.0 APPLICATION OF THE REGULATORY TEST

ENERGEX is required to apply a Regulatory Test in relation to new distribution network investments estimated to require a total capitalised expenditure in excess of $1 million. The purpose of the Regulatory Test is to analyse and assess the efficiency of new network augmentation investments and non-network alternative options that address the projected network limitations.

Where an investment is a new large distribution network asset, clause 5.6.2(f) of the NER requires ENERGEX to consult with Registered Participants, NEMMCO and interested parties on the possible options, including demand side, generation and market network service options, to address the projected limitations of its distribution system. Consultation is not required for a new small distribution network asset.

Where a proposed investment is a mix of augmentation and replacement, a Regulatory Test is required if the augmentation component is $1 million or above. Consultation will be required if the augmentation component is $10 million or above.

The recommended augmentation investment option contains a mix of replacement and augmentation components. The total capitalised expenditure is estimated to be $55,297,364 and will provide an additional 92 MV.A of firm capacity. Accordingly, the estimated augmentation component is $45,485,543. Therefore, the recommended development option does require a Regulatory Test and consultation on options to address the projected network limitations.

## 6.0 BUDGET PROVISION

The Budget Provision for WR46252 is outlined in the following table in 2009/10 dollars:

| Budget Composition | | Financial Year Provision | |
|---|---|---|---|
| **Component** | **Cost (in 09/10 dollars)** | **FY** | **Cost (in 09/10 dollars)** |
| **Transmission** | 43,184,521 | **2008/09** | - |
| **Distribution** | 1,165,577 | **2009/10** | 1,289,563 |
| **TOTAL** | 44,350,098 | **2010/11** | 27,913,745 |
| | | **2011/12** | 14,757,214 |
| | | **2012/13** | 389,576 |
| | | **Total Project Cost** | 44,350,098 |

**Table 7: Budget Provision**

The Budget Provision for WR352374 is outlined in the following table in 2009/10 dollars:

| Budget Composition | | Financial Year Provision | |
|---|---|---|---|
| **Component** | **Cost (in 09/10 dollars)** | **FY** | **Cost (in 09/10 dollars)** |
| **Transmission** | 10,947,266 | **2008/09** | 88,982 |
| **Distribution** | - | **2009/10** | 179,179 |
| **TOTAL** | 10,947,266 | **2010/11** | 295,497 |
| | | **2011/12** | 8,729,453 |
| | | **2012/13** | 1,654,155 |
| | | **Total Project Cost** | 10,947,266 |

**Table 8: Budget Provision**

## 7.0 DRAFT RECOMMENDATION

It is recommended that:

1. ENERGEX establish Coorparoo bulk supply substation, establish a new 110 kV switchboard at Wellington Road substation, construct a 110 kV underground double circuit between Coorparoo and Wellington Road substations and a 33 kV underground double circuit between Coorparoo and Holland Park substations for a total estimated cost of $55,297,364 at 2009/10 prices. The target completion date for the recommended development is October 2012. The date of practical completion is October 2012.

## 8.0 CONSULTATION

In accordance with the Rules, ENERGEX invites submissions from Registered Participants and interested parties on this Consultation Report.

Submissions are due by Tuesday the 16th March 2010.

Please address submissions to:

Bevan Holcombe
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Tel: (07) 3407 4061
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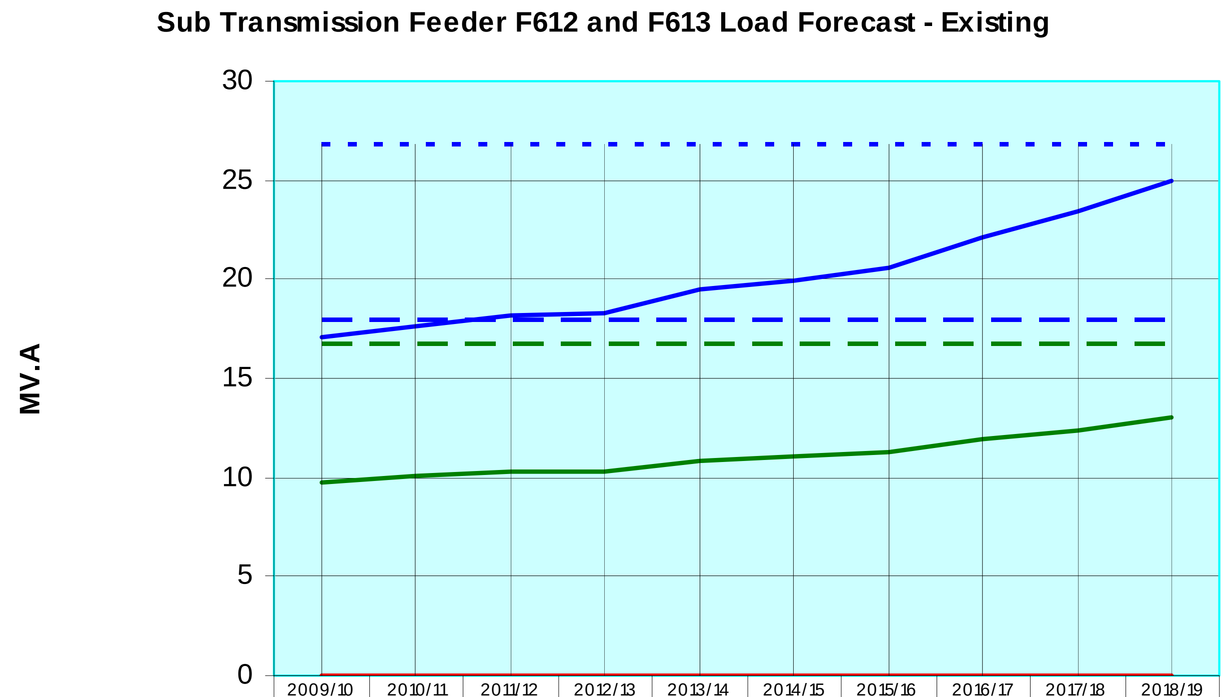
# APPENDIX 1

## *Additional Network Data for Proposed Works*

### SUBTRANSMISSION DATA

The 10 year 10% POE and 50% POE load forecasts and the existing NCC, ECC, 2HEC, LAR and RLAR of subtransmission feeder F612 and F613 are shown below.



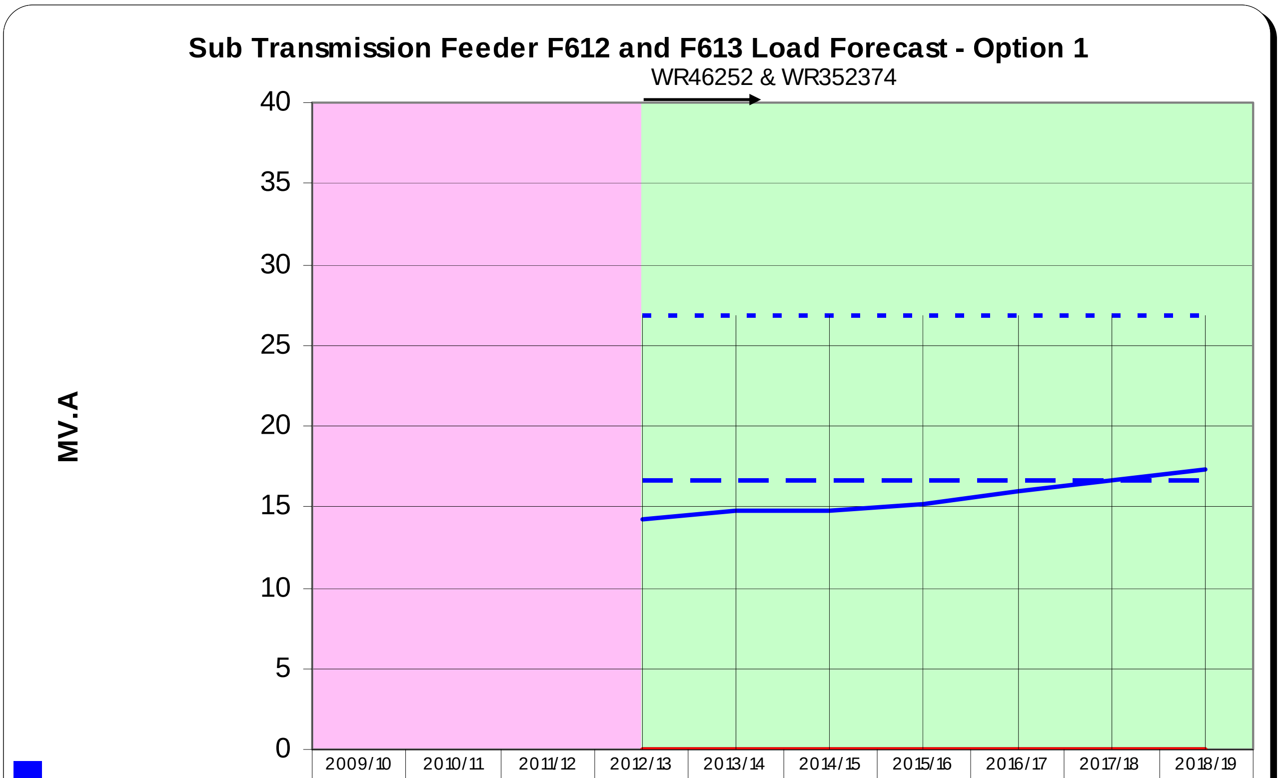

F612 (F613 OOS)

| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 10%POE Load | 9.77 | 10.06 | 10.29 | 10.35 | 10.86 | 11.03 | 11.32 | 11.89 | 12.40 | 13.03 |
| NCC | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 |
| 50%POE Load | 17.03 | 17.66 | 18.18 | 18.29 | 19.49 | 19.89 | 20.58 | 22.06 | 23.38 | 24.98 |
| ECC | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 |
| 2HEC | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 |
| 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 |

**Figure 19: Subtransmission Feeder Load Forecast (Existing Network)**

As outlined above, there are no limitations on F612 or F613 in the period of study.

The 10 year 10% POE and 50% POE load forecasts and the proposed NCC, ECC, 2HEC, LAR and RLAR of subtransmission feeder F612 and F613 are shown below:




F612 (F613 OOS)

| | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50%POE Load | | | | 14.23 | 14.75 | 14.80 | 15.20 | 15.95 | 16.63 | 17.32 |
| ECC | | | | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 | 16.70 |
| 2HEC | | | | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 | 26.80 |
| LAR | | | | 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 |

**Figure 20: Subtransmission Feeder Load Forecast (Proposed Network)**

As outlined above, there are no limitations on F612 or F613 within the period of study.

## NETWORK LOSSES DATA

The network losses are expected to reduce with the commissioning of this project as shown in the table below:

| System (kV) | Existing (kW) | Proposed (kW) | Saving (kW) |
|---|---|---|---|
| **110** | 3,216 | 3,968 | -752 |
| **33** | 2,276 | 1,386 | 890 |
| **Total** | 5,492 | 5,354 | 138 |

**Table 9: Comparison between Existing and Proposed Network Losses**