



Greater Hobart planning area strategy

Area strategies for Tasmania's electricity network

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Executive summary

The Greater Hobart planning area covers the population centres along the western and eastern shores of the Derwent River between Bridgewater, and Taroona, and to the regional extents of Melton Mowbray, Richmond, Seven Mile Beach and the Sandford Peninsula. The area is supplied through three 220 kV connections from Gordon, Liapootah and Waddamana into Chapel Street and Lindisfarne Substations, and reinforced with 110 kV from New Norfolk and Waddamana between Chapel Street, Creek Rd, Risdon, and Lindisfarne substations.

The area is characterised by high density urban population and commercial centres supplied via a highly interconnected 11 kV distribution networks on both the western and eastern shores of the Derwent River. A small number of regional centres beyond the city of Hobart are also included in this planning area where interconnectivity and customer density reduce. Issues presented are predominately due to localised urban and commercial development and asset renewal activity, including:

- A number of terminal and zone substation transformers are being renewed or refurbished within the current and following periods,
- Reinforcement and modernisation of 11 kV underground feeder networks that supply the Hobart CBD that is currently undergoing high levels of commercial development and growth.

The long term network development plan for the Greater Hobart planning area is small in terms of network augmentation requirements to 2050.

Within the 15-year planning period, the network development plan at the transmission and major distribution supply level is small and mostly focussed on asset replacements. The proposed development plan for the planning period is listed in and detailed within this strategy. Additional limitations identified in this strategy will be monitored to assess whether corrective action is required.

Table 1: Network development strategy for the Greater Hobart planning area

| Location | Proposed development | Investment need | Estimated cost (\$m) | Forecast completion |
|--------------------------------------|--|---|----------------------|---------------------|
| North Hobart | Refurbish supply transformers | Asset condition | 0.6 | 2019 |
| North Hobart | Replace 11 kV switchboard | Asset condition, safety | 4.6 | 2019 |
| Claremont | Replace supply transformers | Asset condition | 3.0 | 2019 |
| Derwent Park | Replace supply transformers | Asset condition | 3.3 | 2021 |
| Geilston Bay | Replace supply transformers | Asset condition | 4.65 | 2023 |
| Bellerive | Replace supply transformers | Asset condition | 3.3 | 2024 |
| Hobart | Uprate 33 kV sub-transmission | Supply security | 2.0 | 2025 |
| Hobart CBD | Redevelopment feeder interconnections and distribution substations | Feeder supply capacity, capability, and reliability | 7.25 | 2029 |
| Sandford | Construct 33 kV rated 11 kV feeder from Rokeby | Supply capacity, reliability | 1.0 | 2030 |
| Bridgewater, Austins Ferry, Brighton | Bridgewater 33 kV, including Austins Ferry or Brighton Zone | Supply capacity | 23.0 | 2032 |

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1 General

1.1 Introduction

TasNetworks prepares a suite of eight area strategies for Tasmania. These area strategies drive the development strategies for each of the seven planning areas, based on a geographic breakup of the network. The development strategies ensure that the network remains adequate under forecast demand, generation and performance scenarios.

1.2 Purpose

The purpose of this document is to identify the development strategy to maintain an adequate electricity network in the Greater Hobart planning area.

1.3 Scope

The area strategy addresses the transmission and distribution electricity networks within the Greater Hobart planning area.

1.4 Objectives

The objectives of this area strategy are to:

- provide an overview of the Greater Hobart planning area, and the electricity network within it;
- present the long term transmission and sub-transmission network vision based on the maximum demand forecast to 2050;
- present the long term distribution network vision based on improved operability and development opportunities;
- identify existing and forecast limitations based on the maximum demand forecast, security and reliability requirements and other factors;
- present proposed developments to address the forecast limitations and other planning considerations such as asset retirements, operational constraints, and other factors;
- identify opportunities for new network load connections at a transmission-distribution connection point level.

1.5 Strategic context

The TasNetworks vision is to be trusted by our customers to deliver today and create a better tomorrow. The area strategies support this vision by ensuring the network continues to be adequate to cater for the demands on it (generation, load, reliability, performance and so on). The strategies also support the changing operation of the network to integrate more distributed energy resources and identifying opportunities to increase utilisation of the network, ensuring the lowest sustainable prices.

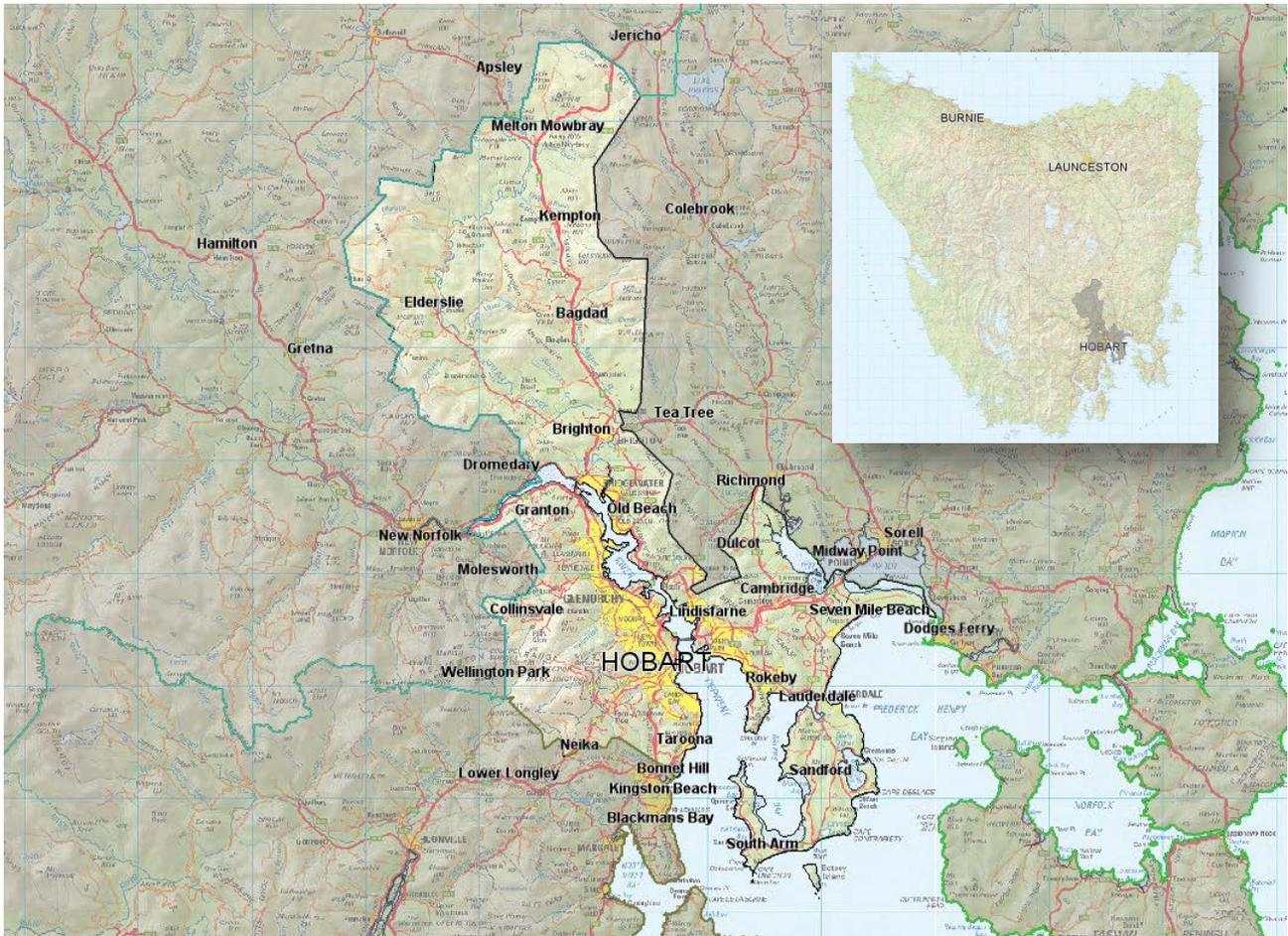
Strategic documents which the area strategies support include:

- TasNetworks Corporate Plan
- TasNetworks Business Plan
- TasNetworks Transformation Roadmap 2025
- Strategic Asset Management Plan
- Network Development Management Plan

2 Area overview

The Greater Hobart planning area is the main population centre of Tasmania, which includes the area west of the Derwent River, from Lower Taroona and South-Arm in the south to Melton Mowbray in the north, and towards Seven Mile Beach and Richmond in the east. The area is home to a high level of commercial and residential load containing the full range of reliability categories and communities, including the Hobart CBD Critical Infrastructure area. The Greater Hobart planning area is shown in Figure 1.

Figure 1: Geographic diagram of the Eastern planning area



2.1 The network

The Greater Hobart planning area is supplied by three (3) 220 kV double circuit transmission lines emanating from Gordon, Liapootah and Waddamana in the Central Planning area through Chapel Street Substation on Hobarts western shore and Lindsfarne Substation on Hobarts eastern shore. These 220 kV connections are supported by 110 kV circuits entering through New Norfolk and Bridgewater, that form a 110 kV ring through Chapel Street, Creek Rd, Risdon, and Lindsfarne substations.

There are four 110/11 kV connection sites, namely Chapel Street, North Hobart, Bridgewater and Rokeby, that supply the distribution network directly. There are four 33 kV connection sites at Creek Rd, Risdon, Lindsfarne and Mornington that supply a network of radial 33/11 kV zone substations that supply the majority of the 11 kV distribution networks.

For planning purposes the Greater Hobart planning area is divided into two localities;

- the **Hobart West** locality covering the western shore of the Derwent River plus the service region of Bridgewater Substation; and
- the **Hobart East** locality covering the rest of eastern shore of the Derwent River.

The transmission network, and substation supply area is shown in . Detail on the existing assets and transfer capability at the substations is presented in Appendix A.

2.1.1 Transmission and Sub-transmission network

The Greater Hobart area is supplied from the 110 kV and 220 kV transmission network connected to the Central Planning area, which is largely discussed in the Core Grid area strategy.

The main transmission network connections include three double circuit 220 kV transmission lines that connect into Chapel Street substation on Hobart's western shore and Lindisfarne on Hobart's eastern shore, these being:

- TL516 Gordon – Chapel Street;
- TL500 Liapootah – Chapel Street; and
- TL520 Waddamana – Lindisfarne.

A further four 110 kV transmission circuits connect into Chapel St, Creek Rd, and Bridgewater from New Norfolk and Waddamana from the Central planning area. Most of these lines were constructed in the early 1940' sand 1950's to connect the upper Derwent generators and serve as the backbone transmission network between north and south and facilitating the connection of the upper Derwent generators, however their role has reduced over time with the expansion of the 220 kV network. These networks are discussed in the Core Grid area strategy.

Chapel Street also offers the sole supply of electricity to the Kingston South Planning Area, which is achieved via a double circuit 110 kV transmission line.

The Eastern-south locality (Sorell and Triabunna) within the Eastern planning area also connects to this network via the double circuit 110 kV transmission line at Lindisfarne Substation.

The Greater Hobart planning area hosts a mixture of 110/33 kV and 110/11 kV connection points for the distribution network. The four 33 kV connection points listed below, supply 11x 33/11 kV zone substations via two or three transformer ended radial sub-transmission lines. These lines generally consist of overhead lines route through urban areas along public roads.

Substations supplying the 33 kV sub-transmission network include:

- Creek Road – supplies West Hobart, Sandy Bay and Claremont zone;
- Risdon – supplies East Hobart, Derwent Park and New Town zone;
- Lindisfarne – supplies Geilston Bay and Bellerive zone; and
- Mornington – supplies Howrah, and Rosny zone;

Substations directly supplying the 11 kV distribution networks are:

- North Hobart;
- Bridgewater; and
- Rokeby.

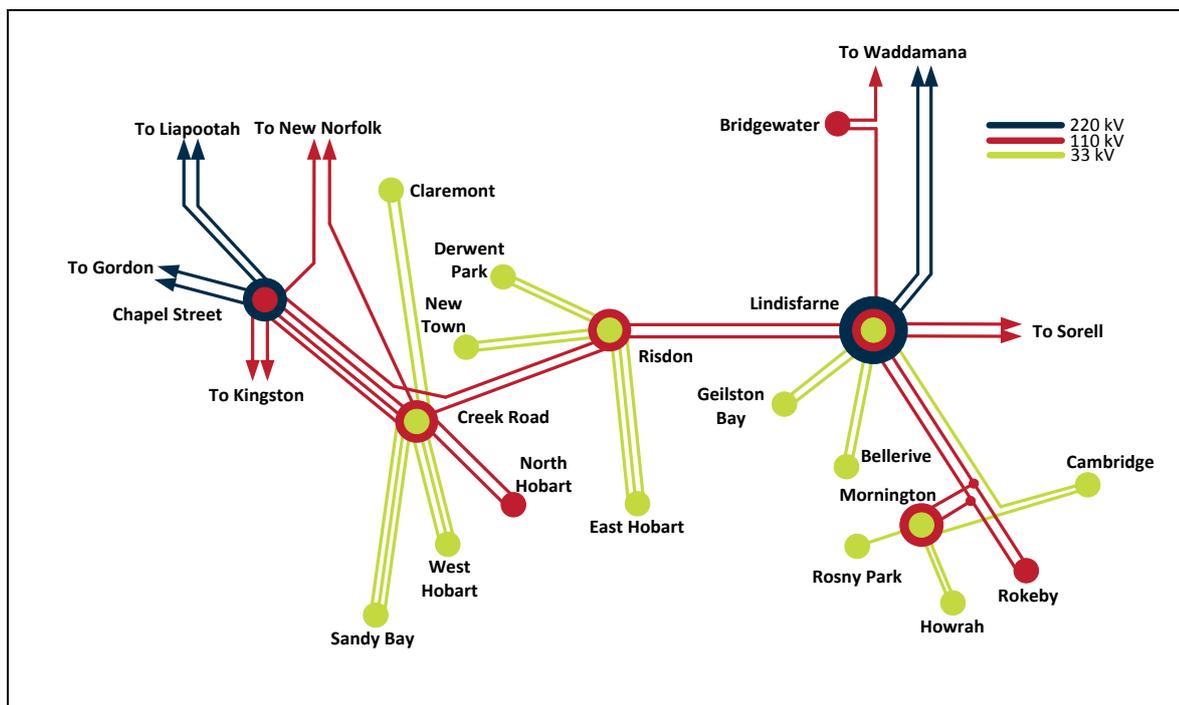
Significant developments within the transmission and sub-transmission network since publication of the last Greater Hobart area strategy in October 2015 include:

- Replacement of 11 kV oil filled switchgear at Rokeby and Bridgewater with air insulated switchgear: due to asset condition and safety issues, and partial discharge detection.
- Establishment of the new Rosny Park zone substation: the final stage of the Hobart eastern shore development project to relieve high loading on a number of existing substations.

There are two material projects committed or underway in the transmission network, including:

- Lindisfarne 110/33 kV transformer replacement – Asset renewal based on condition.
- [REDACTED] The project drivers are discussed in the Core Grid strategy, however have the following works that impact the Greater Hobart transmission network:
 - Relocate Lindisfarne 110 kV capacitor bank on site;
 - Establish new 110 kV bay at Lindisfarne;
 - Reconfigure 110 kV network from Lindisfarne to supply Bridgewater substation via a double 110 kV circuit.
- A minor project to install an inline 110 kV circuit breaker at Chapel Street has been revised to undertake 110 kV circuit reconfigurations instead. This is a lower cost option, and will be addressed during asset renewal works.

Figure 2: Simplified one line diagram of the Greater Hobart planning area



2.1.2 Distribution network

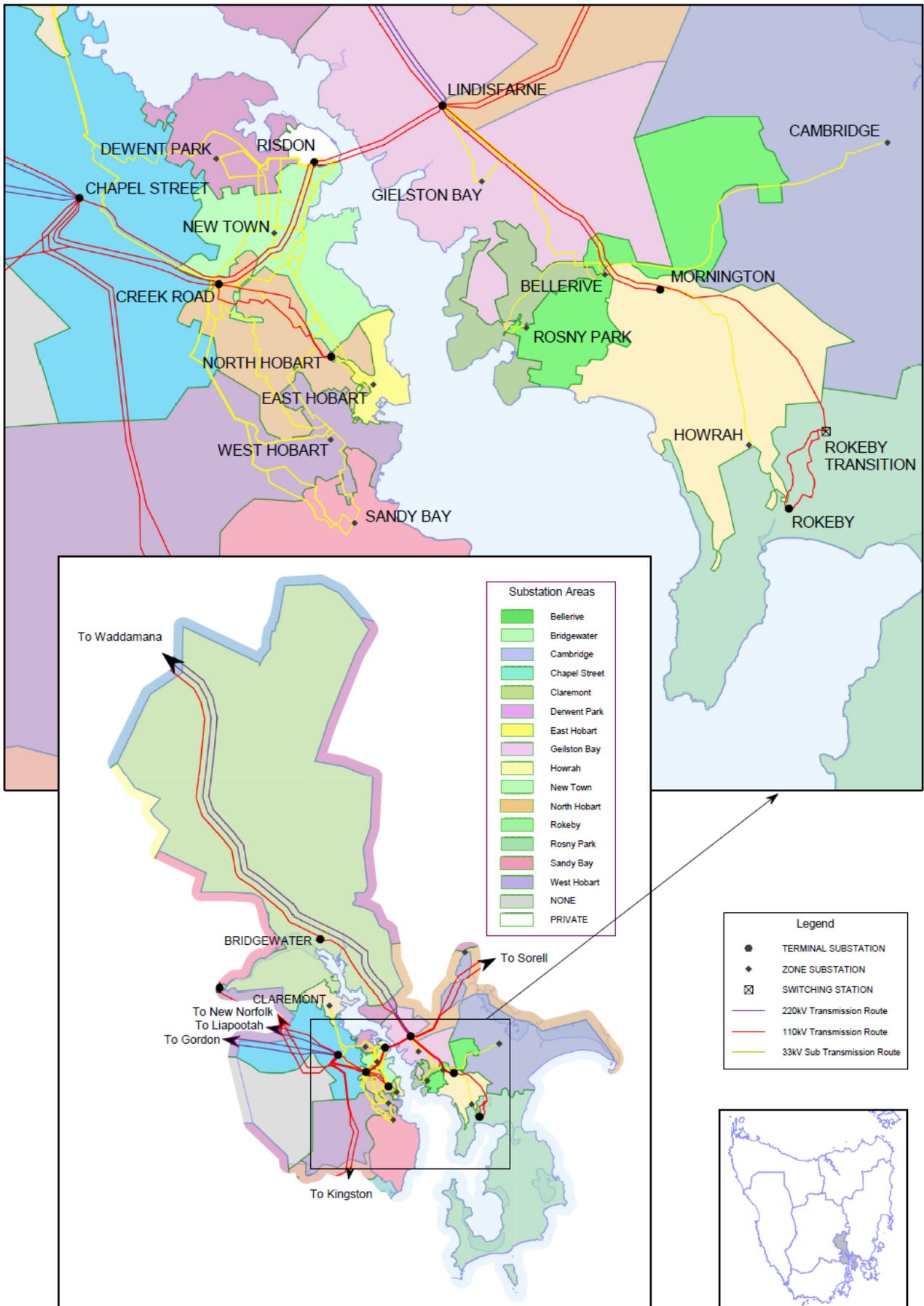
The distribution network in the Greater Hobart planning area is supplied from a combination of 110/11 kV connection points and 33/11 kV zone substations. The distribution network includes a mix of highly interconnected CBD and urban networks as well as long regional feeders.

Areas of interest within the Greater Hobart distribution network are:

- **Hobart Centre:** Predominantly commercial distribution network supplied from three 11 kV substations with generally good interconnections between substations. The area is challenging due to difficult network configurations, lack of network visibility, difficult to access sites, and aging differential protection systems between distribution substation sites.
- **Sandford Peninsula:** rural distribution network supplied by two long feeders from Rokeby zone substation.
- **Bridgewater-Brighton:** rural and urban distribution network supplied by the Bridgewater 110/11 kV substation.
- **Claremont-Bridgewater:** urban distribution network supplied by the northern distribution substations Claremont, Derwent Park and Bridgewater.

The 11 kV substation supply areas for the distribution networks are shown in below.

Figure 3: Transmission network and substation supply area in Greater Hobart planning area



Significant developments within the distribution network since publication of the last Greater Hobart area strategy in October 2015 include:

- Installation of Rifle Range Road (Sandford Peninsula) voltage regulator.
- Replacement of oil filled 11 kV switchgear and transformers within Hobart CBD substations.

There are four material projects committed or underway in the distribution network, including:

- Replacement of the North Hobart 11 kV switchboard due to condition and safety;
- 33 kV sub-transmission overhead line audit and development investigation;
- Upgrade and relocation of the Mangalore (Bridgewater-Brighton) voltage regulator and upgrade and replacement of the Dysart voltage regulator.
- Re-development of Franklin Square substation (Hobart CBD)

2.2 Customers

This section details the material existing and proposed generation and load customers in the Greater Hobart planning area.

2.2.1 Generation

There are no transmission-connected generation sites in the Greater Hobart planning area. There are two embedded generators over 0.5 MW, presented in Table 2. There is currently a connection enquiry for one new generation site.

Table 2: Embedded generation over 0.5 MW

| Location | | | | Connecting feeder |
|----------------|--|--|--|----------------------------|
| Jackson Street | | | | Chapel Street feeder 20551 |
| McRobies gully | | | | West Hobart feeder 13045 |

2.2.1.1 Other small scale generation

A 100 kW solar installation is located on the roof of the Australian Tax Office building on 200 Collins St.

Four 12 kW (48 kW total) Darrieus wind turbines are located on the top of the Marine Board Building situated on the front of Hobart city marina.

2.2.1.2

[Redacted content]

Figure 4: [REDACTED]



2.2.2 Load

[REDACTED]

Table 3: Transmission-connected customer in Greater Hobart planning area

| Customer | Operations | Contract capability (MW) | Supply arrangement |
|------------|------------|--------------------------|--------------------|
| [REDACTED] | [REDACTED] | [REDACTED] | [REDACTED] |

There are a number of large customers within the distribution network in the Greater Hobart planning area, of which many are contained within the Hobart CBD Critical Infrastructure area, and within a number of high density commercial areas. Table 4 lists some of the large customers of interest in the Greater Hobart planning area.

2.2.2.1 Hobart CBD

The Hobart CBD is within the Critical Infrastructure reliability community which covers the area from Salamanca towards Bathurst Street and North-East towards the Railway Roundabout.

The area requires the highest reliability performance out of all the communities located in the state, and is supplied directly and indirectly by 29 distribution feeders. Reliability

¹ Nyrstar have recently advised TasNetworks of a staged winter demand forecast to 162 MW by 2022.

Table 4:

| | | | |
|--|--|--|--|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

2.3 Reliability

The Greater Hobart planning area consists mainly of Urban and High Density Commercial reliability communities, with areas of High Density Rural and Low Density Rural supply towards the outskirts. There are eleven (11) reliability communities in the area.

Of these, the Hobart Critical Extended include an area of concentrated critical infrastructure in Hobart CBD has recorded poor reliability performances in excess of the target set by OTTER, as shown in Table 5. Supply to this reliability community was non-conforming for frequency of outages (SAIFI) since 2011-12 and non-conforming for duration of outages (SAIDI) for 2014-15, 2015-16.

Table 5: Hobart Critical Extended reliability community SAIDI and SAIFI

| Limit exceeded | Target | 2011-12 | 2012-13 | 2013-2014 | 2014-15 | 2015-16 | 2016-17 |
|--------------------------|--------|---------|---------|-----------|---------|---------|---------|
| SAIDI – Outage duration | 30 | 25 | 30 | 16 | 54 | 34 | 27 |
| SAIFI – Outage frequency | 0.20 | 0.22 | 0.27 | 0.20 | 0.33 | 0.25 | 0.35 |

3 Long term network development

The long term network development presents the load and generation scenarios to 2050 and the likely state of the network required to support them. This long term network development has not been justified economically or deeply considered against alternative options, but provides a reasonable assessment of the solutions forecast in the long term if met by network development.

The long term network development plan informs the path that developments in the transmission and sub-transmission network 15-year planning horizon should follow to ensure that network development remains efficient in the long term.

A distribution network supply vision is also presented. This vision is largely driven by existing network and operational limitations and development opportunities. There are no specified triggers for this vision and it has not been justified.

3.1 Scenarios

We consider planning scenarios for load and generation as a basis for the long term network vision.

3.1.1 Load

The scenario considered in the load change to 2050 is the extrapolated AEMO connection point forecast. Specifically, this forecast is the 2017 AEMO Transmission Connection Point Forecasts for Tasmania (connection point forecast). This connection point forecast is provided to 2026 and has been extrapolated to 2050.

The forecast for the majority of connection points in general is flat or declining to 2021 before recovering. In extrapolating the Greater Hobart forecast, 2021 was used for most of the connection points as the base year with the growth factor between 2021 and 2026 used to extrapolate the forecast to 2050. For connection points not recovering in 2021 the corresponding year for the start of the recovering was used. The assumption being that this recovering demand growth will continue. This assumption aligns with AEMO's 2016 National Electricity Forecasting Report (NEFR), which provides a regional (state) forecast for Tasmania that forecasts a decline in early 2020s before recovering and continuing to grow to 2037, the end of the forecast.

AEMO's 2016 National Electricity Forecasting Report, including a regional (state) forecast for Tasmania, contains Neutral, Strong, and Weak economic scenarios. The connection point forecast is only provided under the Neutral scenario. Hence, the load scenario presented here is only provided under this single Neutral scenario.

Table 6: 2050 winter maximum demand forecast^{2,3}

| System | 2016 maximum demand (MW) | | Maximum demand forecast for 2050 (MW) |
|--------------------------|--------------------------|-------------------|---------------------------------------|
| | Actual | Weather corrected | |
| Chapel Street | 37.5 | 37.6 | 32.8 |
| North Hobart | 37.9 | 38.1 | 46.7 |
| Bridgewater | 31.7 | 31.4 | 51.2 |
| Rokeby | 20.6 | 20.5 | 34.8 |
| Creek Road | 87.1 | 88.6 | 74.3 |
| - Claremont | 19.28 | 19.8 | 16.9 |
| - Sandy Bay | 35.0 | 36.6 | 28.4 |
| - West Hobart | 36.1 | 37.5 | 31.8 |
| Risdon | 68.8 | 67.7 | 95.9 |
| - New Town | 23.3 | 24.0 | 30.6 |
| - Derwent Park | 19.5 | 19.6 | 28.1 |
| - East Hobart | 27.2 | 27.9 | 38.5 |
| Lindisfarne | 48.6 | 48.5 | 42.0 |
| - Geilston Bay | 23.9 | 24.9 | 21.1 |
| - Bellerive | 17.5 | 17.9 | 12.8 |
| - Cambridge ⁴ | 10.5 | 7.7 | 10.0 |
| Mornington | 22.5 | 23.2 | 66.5 |
| - Rosny Park | - | - | 24.6 |
| - Howrah | 16.4 | 17.0 | 33.8 |
| - Cambridge | 6.3 | 6.6 | 12.6 |

² Weather corrected maximum demand data for Zone Substations has been obtained from the Planning Forecast spreadsheet. Actual maximum demand data for Zone Substations has been obtained from historical data (eDNA).

³ Committed and non-committed loads identified in Appendix B may not have been included in the forecast.

⁴ Cambridge Substation has a split bus (normally open bus coupler) with one side supplied by Lindisfarne and the other Mornington.

3.1.2 Generation

The long term network development plan is also driven by generation scenarios within the area.

Continuation to a low emissions future in the NEM means future renewable energy development in Tasmania is highly likely. In the Greater Hobart planning area, we are unlikely to see the development of any large scale generation. As there are currently no specific identified opportunities or any level of certainty, this scenario is not included in the long term network development plan identified here.

There will be continued increase in embedded generation within the distribution network, including small-scale photovoltaic and batteries, with the effects of this reflected in the demand forecast.

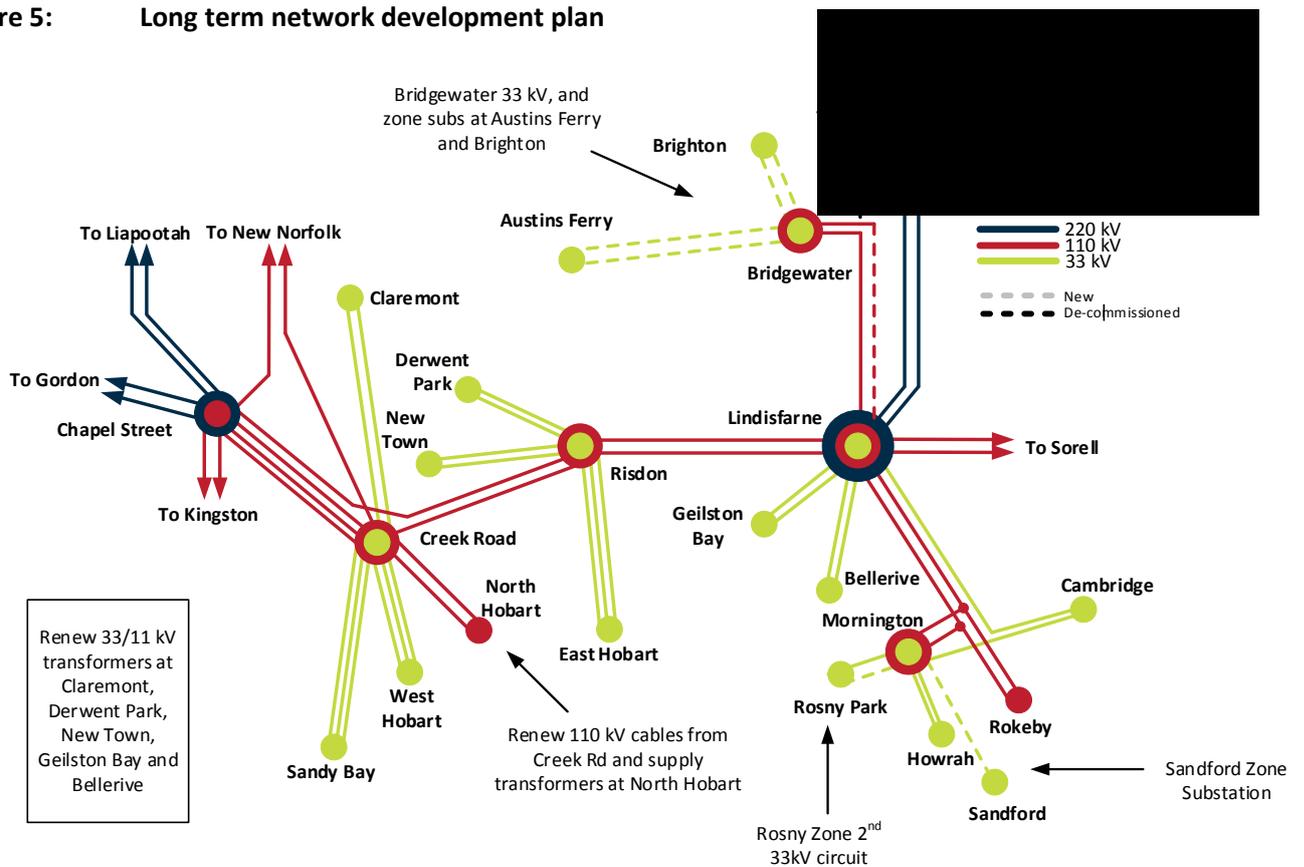
3.2 Long term network development plan

A number of network augmentations are expected to be required to meet the load and generation scenario requirements to 2050, presented in Section 3.1. This section presents the long term network development plan forecast requirement under these scenarios.

As discussed the long term network development plan has not been justified economically or deeply considered against alternative options, but provides a reasonable assessment of the solutions forecast in the long term if met by network development.

The long term network development plan of the transmission and sub-transmission network is displayed in Figure 5 and summarised below.

Figure 5: Long term network development plan



3.2.1 Supply transformation - Northern suburbs

The northern substation group comprises of Bridgewater, Claremont, Derwent Park, New Town and Chapel Street substations. A capacity limitation occurs when the group load exceeds the sum of the firm capacities. The northern substation group capacity is not forecast to be exceeded within the 2050 period based on the extrapolated AEMO forecast. Currently the group capacity is 162.4 MVA with the forecast predicting steady load growth from 132.4 MVA in 2016 to 159.6 MVA in 2050. It should be noted a number of committed and non-committed load connections in the area, [REDACTED] have not been incorporated in the forecast.

Individual substation firm capacity however are forecast to be exceeded at Bridgewater, New Town and Derwent Park substations. Bridgewater substation has two transformers rated at 35 MVA continuous rating. According to the forecast, firm ratings of Bridgewater Substation will exceed in 2032. Due to the location and feeder arrangement of Bridgewater Substation there is minimal capability to transfer the load to nearby substations. A number of solutions have been proposed to manage the issues at Bridgewater Substation and the neighbouring area.

These options will require further detailed analysis to determine a preferred solution based on their economic and technical feasibility. Solutions being considered include:

Option 1:

- 1) Construct a 33 kV connection point at Bridgewater in conjunction with the construction of a new zone substation at Austins Ferry. This strategy was developed in 2009 as part of a high growth strategic planning analysis, identifying it as the most economical strategy at the time.
- 2) Following the Austins Ferry substation, this option includes the establishment of a new zone substation at Brighton. The timing of this project is dependent on the load growth in the Brighton area and/or feeder limitations at Bridgewater Substation.

Option 2:

- 1) The establishment of a new 110/11 kV terminal substation in the Gagebrook area de-loading Bridgewater and providing an additional supply point on the Eastern Shore between Bridgewater and Lindisfarne Substations.

For the purposes of long term planning, we have proposed to continue development of the 33 kV sub-transmission network. We expect that the strategy is still prudent, and will likely develop much later in the planning period.

Table 7 presents the requirements to defer the identified non-firm issue at Bridgewater Substation. The table presents the reduction in the forecasted load, or amount of generation support, required to defer the limitation by either one (to 2033) or five (to 2037) years. The reduction detailed is to maintain the load below 35 MVA, the short-term firm capacity of the transformers.

Table 7: Bridgewater Substation capacity limitation deferral

| Deferral period | Forecast Maximum demand (2032) (MW) | Generation support or reduction in forecasted load (MW) |
|-----------------|-------------------------------------|---|
| One year | 35.5 | 1.5 |
| Five years | | 4.5 |

3.2.2 North Hobart 110 kV cables and supply transformers

The North Hobart 110 kV cables will approach end of life within the planning period to 2050. The existing condition of the cables is unknown. If required, TasNetworks propose to renew these cables to continue operating the North Hobart substation at 110 kV.

The supply transformers at North Hobart are 45 MV three-winding units. Towards the end of the forecast period the loading on these transforms will exceed their continuous capacity. Additionally, TasNetworks intend to transfer more demand from East Hobart zone to North Hobart as required to enable East Hobart to focus on supporting development closer the CBD and wharf area.

TasNetworks propose to manage any increase in both organic growth (identified in the forecast), or strategic transfers from East Hobart in part through demand management activities and investment, including through the Demand Management Incentive Scheme.

To that end, the development plan for the North Hobart site is to maintain its continued operation and defer any upgrade or augmentation, until either demand management activities are exhausted or significant development triggers a need to provide additional transformation capacity.

In the current period TasNetworks propose to undertake minor refurbishment works on the North Hobart transformers, ensuring their continued operation of up to 20 years. At that time, the transformer units would be renewed with standard equivalents.

3.2.3 Rosny 33 kV expansion

Over the forecast period the demand on Rosny 33/11 kV zone increases to just below the existing substation capacity. This site is a single sub-transmission and supply transformer station within a high density commercial area. In order to manage supply security, as load at the site approaches 20 MVA, load would be strategically transferred to neighbouring sites Bellerive and Geilston Bay. However, depending on where growth develops, it is likely that a second 33 kV sub-transmission and 33/11 kV supply transformer will be required within the forecast period, beyond 2032.

3.2.4 Supply transformation – Rokeby and Sandford Peninsula

The eastern shore substation group in the south comprises of Howrah (Mornington) and Rokeby substations. The combined capacity of the substation group is 60 MVA and is forecast to be exceeded in the years prior to 2050.

The Sandford Peninsula is supplied via two long feeders from Rokeby Substation. The 11 kV supply is only available through Lauderdale, located at the neck of the peninsula, which geographically restricts the ability to transfer load to neighbouring networks and support the area. The maximum demand forecast for Howrah Substation for 2050 is 33.8 MVA. The current firm capacity of Rokeby Substation is 35 MVA with the forecast indicating load growth to 34.8 MVA in 2050.

In addition the Sandford area is considered a high growth area within the planning period, expecting to develop significantly with improvements in water and sewerage infrastructure through Lauderdale. The anticipated network solution in the long term is to establish a 33/11 kV zone substation in the Sandford area; either supplied from Mornington Substation directly or via a 33 kV switching station installed at Howrah Zone. This will allow Rokeby and Howrah 11 kV feeder networks to focus towards north assisting with load growth around the Bellerive and Rosny areas.

3.2.5 Zone Substation supply transformer renewals

A number of zone substation 33/11 kV supply transformers are forecast to reach end of life within the forecast period, including a number of sites within the 2019-24 period based on condition assessment. The substations include:

- Claremont;
- Derwent Park;
- Geilston Bay; and
- Bellerive

All these sites have existing 22.5 MVA transformers. It is proposed to renew the supply transformers using standard 25 MVA units, as used in recent years at Howrah, Summerleas, and Rosny.

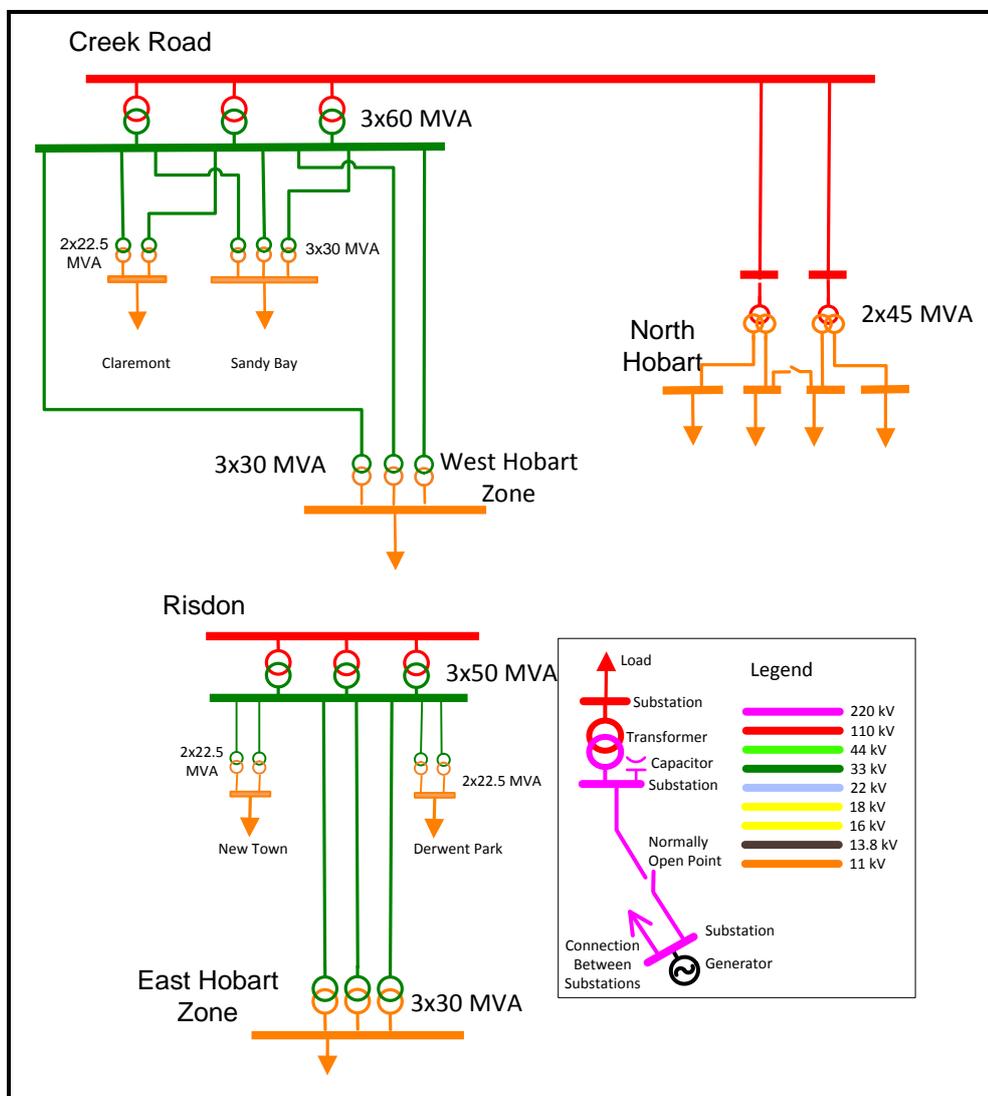
3.2.6 Hobart CBD

Although the forecast may not incorporate all the identified developments within the Hobart CBD area, the addition of those developments to the forecast to 2050 infers there will be sufficient transformation capacity within the Hobart CBD.

The Hobart CBD is fed directly and indirectly by twenty-nine 11 kV distribution feeders emanating from West Hobart, East Hobart and North Hobart Substations. Reinforcement of the 11 kV feeder network to accommodate the CBD developments is discussed in subsequent sections of this strategy. Load forecasts for these feeders have been developed and are presented in Table 16 in Appendix B.

The Hobart CBD is mainly supplied from the bulk transmission network at Creek Road and Risdon substations. Creek Road Terminal Substation supplies North Hobart Terminal, Claremont, Sandy Bay and West Hobart zone substations whilst Risdon Substation supplies East Hobart, New Town and Derwent Park zone substations. A high level one line diagram is presented in Figure 6.

Figure 6: Bulk transmission network from Creek Road and Risdon substations



3.3 Distribution network supply vision

A distribution network supply vision is presented for those supply areas within the distribution network where relevant. The vision is largely driven by existing network and operational limitations and development opportunities, and provided where these will likely drive material changes to the distribution network. There are no specified triggers for the vision and the vision has not been justified.

In the Greater Hobart planning area, four distribution network supply visions have been identified.

3.3.1 Sandford peninsula

As presented in Section 3.2.4, the long term network development plan for the Sandford peninsula is the establishment of a 33/11 kV Sandford zone substation supplied from Mornington Substation directly or via a 33 kV switching station installed at Howrah Zone. The construction of the Sandford Substation is expected to significantly deload the Rokeby 11 kV network to the south and east, allowing Rokeby to focus on the supply of the suburbs of Rokeby, Clarendon Vale, Oakdowns with the support to Tranmere and Lauderdale.

Two feeders 28222 and 28232 emanating from Rokeby Substation supply the Sandford peninsula. Currently both are constrained by voltage drop due to their long lengths and limited voltage regulation. This impacts maintenance and renewal operations during periods of peak load whereby not all the load can be maintained for planned and unplanned work on the feeder trunks.



Prior to the zone establishment, it is proposed that a future 33 kV cable section between Rokeby Substation into the Sandford area will be installed and operated at 11 kV from Rokeby Substation. This will provide necessary capacity and security to the supply in the area, and may contribute to deferral or part deferral of the Sandford Zone Substation construction. There is an existing proposal to establish part of this cable route through the Police Academy site. This proposal also removes the dual circuit pole line constraint along the South Arm Highway. This proposal was placed on hold pending an overall strategic review of the area supply.

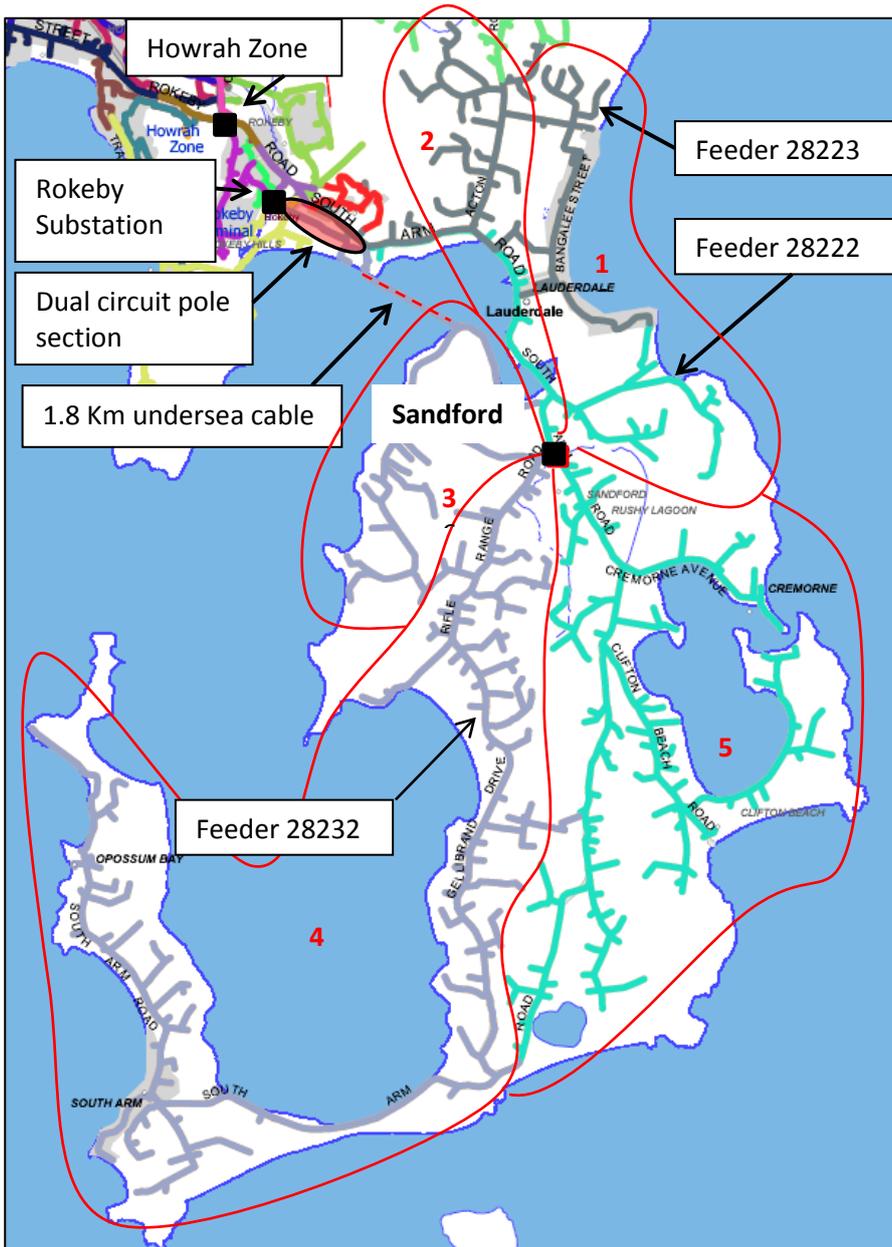
In the interim it is proposed to investigate the opportunities to manage system voltage and supply security prior to the establishment of Sandford Zone Substation.

Recently,

- a second voltage regulator was installed along Rifle Range Rd on Feeder 28232;
- a new feeder route investigation was conducted, identifying the likely route to the peninsula for an addition 33 kV or 11 kV feeder would be via submarine cable following the existing.

Figure 7 displays the proposed final feeder configuration for the Sandford peninsula following the construction of the Sandford Zone Substation.

Figure 7: Sandford proposed feeder configuration



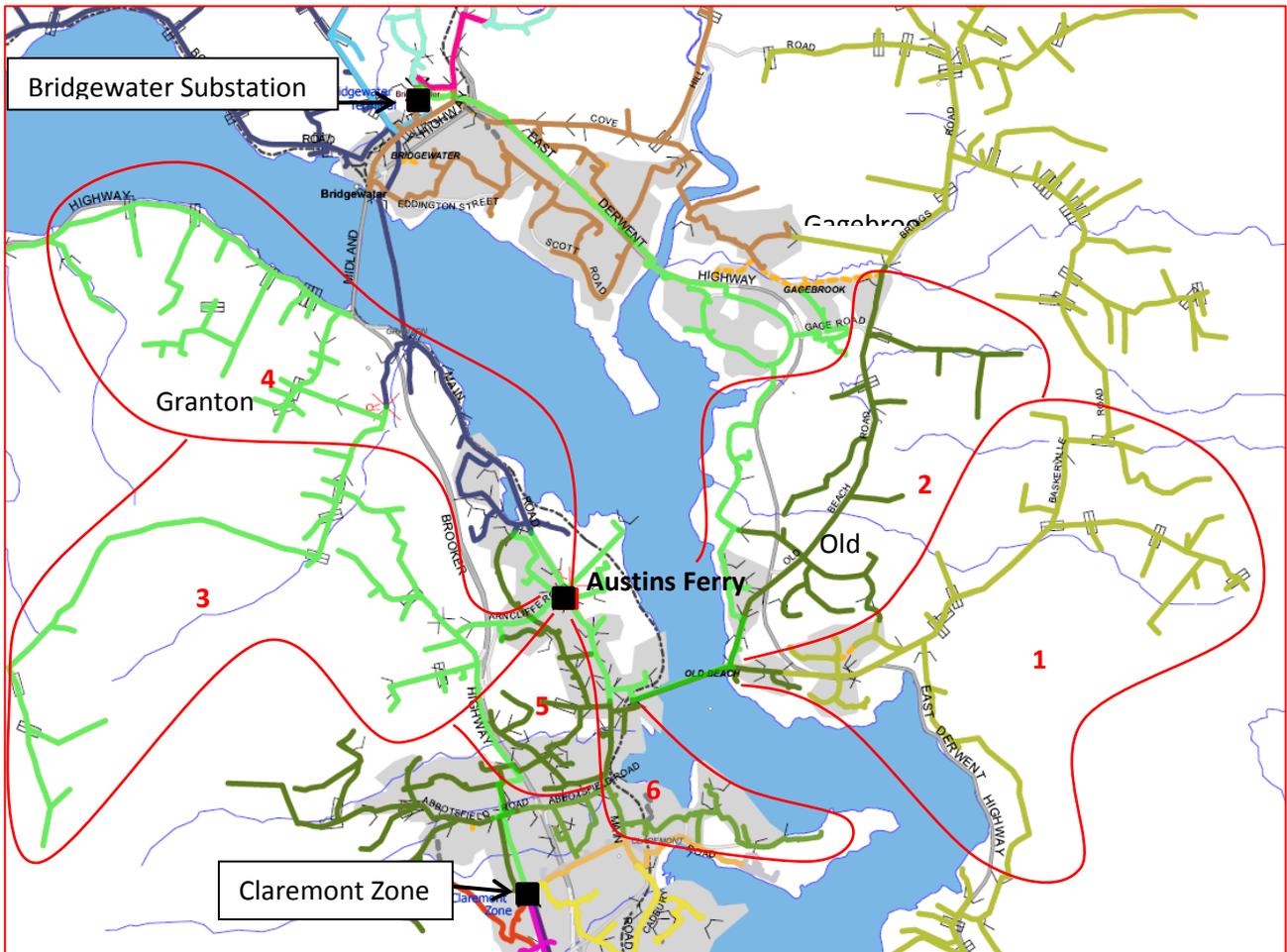
3.3.2 Austins Ferry supply area

As presented in Section 3.2.1 the long term development plan to address the firm capacity limitations of the Northern substation group and to address the 11 kV feeder limitations from Bridgewater and Claremont is the establishment of either Austins Ferry Zone Substation or a Terminal Substation in Gagebrook. The Austins Ferry Substation solution would be adopted in conjunction with the Bridgewater 110/33 kV injection point proposal. The potential challenges in the construction of the Substation is the establishment of the 33 kV supply from Bridgewater to Austins Ferry. This will be made easier with the Bridgewater-Granton bridge upgrade which will also provide the opportunity to improve transfer options from Bridgewater Substation with the installation of new 11 kV cables to strengthen the Bridgewater/Claremont/New Norfolk connections.

The requirement for future feeders will be dependent on the development of land in the area. There is significant undeveloped land in the areas around Austins Ferry and Granton, so ultimately new feeders may be required in all directions. Although the feeders to the Old Beach area are predicted to be quite heavily loaded as new subdivisions are developed. At this time the establishment of a zone substation at Brighton may be necessary to deload the Bridgewater feeders in the area, allowing them to provide support to Old Beach. Figure 8 displays the proposed feeder configuration for Austins Ferry Substation.

Our interim development strategy is to reinforce the transfers capability between Bridgewater and Claremont to defer investment in the transmission and sub-transmission networks.

Figure 8: Austins Ferry proposed feeder configuration



3.3.3 Brighton Township

As presented in Section 3.2.1 a possible solution to address the firm capacity limitations of the Northern substation group and to address the 11 kV feeder limitations from Bridgewater and Claremont is the establishment Austins Ferry Zone Substation and subsequently a Brighton Zone Substation. The Brighton Zone Substation was identified as a solution to load growth in the area as a result of the Brighton Transport Hub development. Should the high growth not eventuate, the Brighton zone substation may be deferred until justified by capacity or feeder limitations at Bridgewater. Conversely, 11 kV feeder limitations may justify the project at an earlier date.

Our interim development strategy is to reinforcing the 11 kV feeders heading north, and constrain and/or convert the northern extents of the Bridgewater 11 kV network to 22 kV (Melton Mowbray area).

3.3.4 Hobart CBD

This section discusses the main considerations that influence our distribution vision for the Hobart CBD.

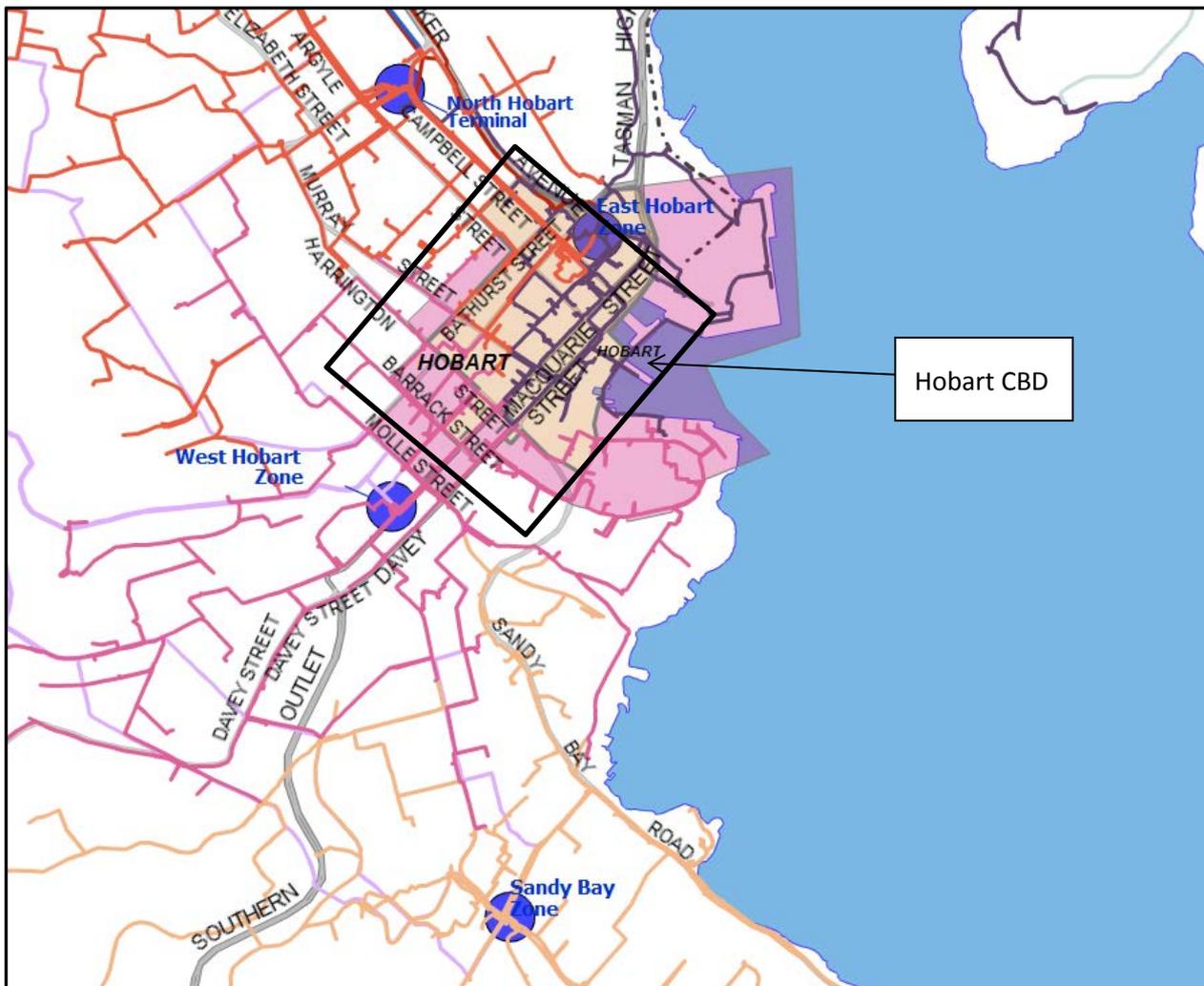
3.3.4.1 Overview

The Hobart CBD is the main central business district in Tasmania encompassing the Hobart Critical Extended and much of the Hobart Commercial reliability communities. The economy of Hobart is diverse but largely driven by the services, tourism and public service industries. Planned economic development in this area includes a major central business district (CBD) development, a new or significantly refurbished public hospital, new accommodation facilities to cope with increased tourism and expanding higher education.

The Hobart CBD is largely supplied from East Hobart Zone Substation and to a lesser extent, from North Hobart Terminal and West Hobart Zone substations. The combined peak loads of these 3 substations were 115 MW in 2015.

Our distribution vision for the development of the Hobart CBD distribution network covers the planning period up to 2032. A high level overview of the existing transmission and distribution substations and the network supplying the Hobart CBD is illustrated in Figure 9.

Figure 9: Overview of the network supplying the Hobart CBD



The strategic development plan of the Hobart CBD assumes that the three injection points of East Hobart, West Hobart and North Hobart will be retained into the foreseeable future. This provides a perspective on feeder exit points and planning for feeder interconnectivity.

3.3.4.2 Feeder and feeder protection

The feeders from East Hobart Zone Substation supply the inner Hobart CBD, whilst feeders from North Hobart and West Hobart supply the outer Hobart city area.

Feeders typically comprise:

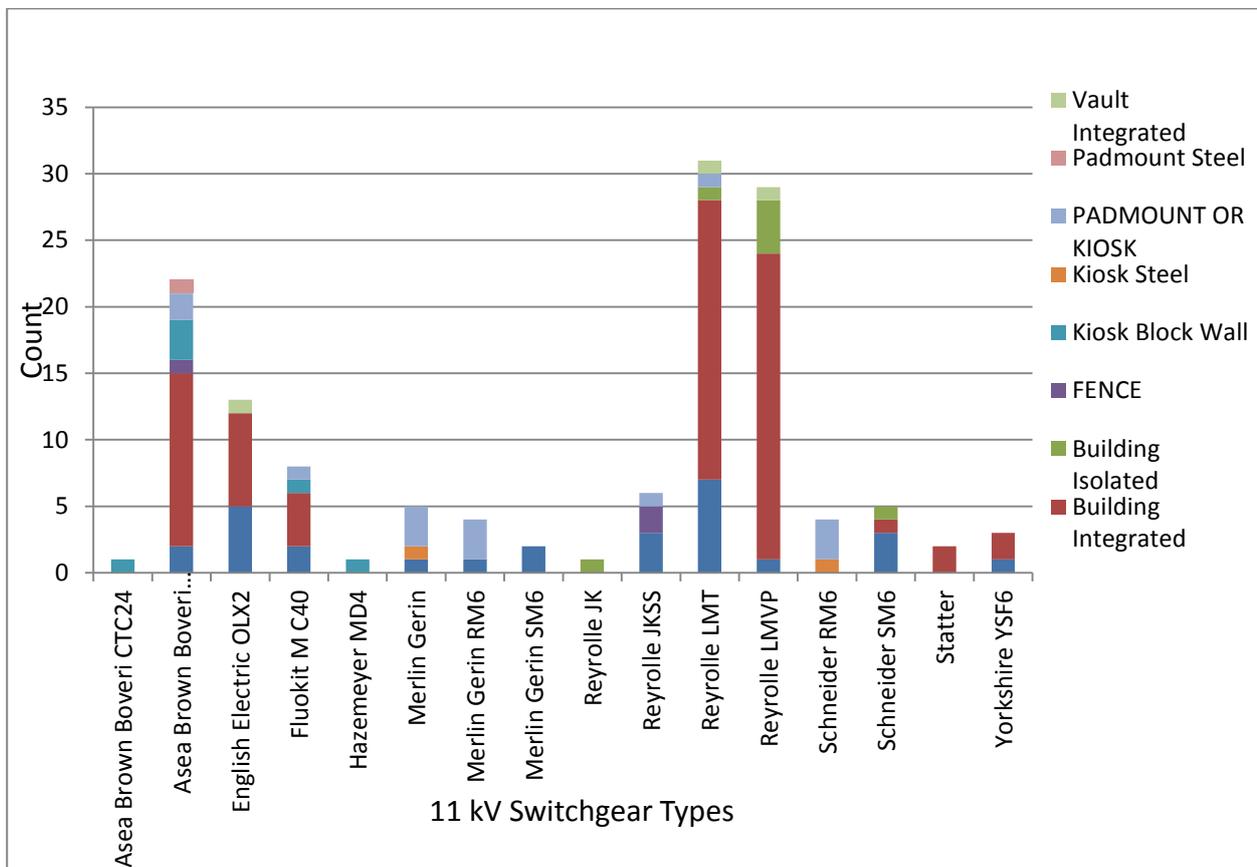
- a radial backbone (trunk) that emanates from a terminal substation connection point;
- feeder laterals; and
- radial spurs.

The Hobart CBD area utilises a wide variety of different protection schemes, chief of which is a feeder differential unit protection scheme, known by the tradename *Translay*. *Translay* operates across a number of short cable sections of an underground feeder, isolating the faulty section and allowing for the restoration of the remaining healthy sections. The protection scheme utilises a number of electromechanical protection and auxiliary relays and a network of copper pilot cables, all of which are considerably aged and in need of replacement in the upcoming revenue reset period. A recent audit indicates TasNetworks has 87 *Translay* protection schemes across the distribution network, with a small number being three-ended and the majority being two-ended in nature.

3.3.4.3 Distribution Substations

There are 143 distribution substations in the Hobart CBD precinct in total. Presently the number of substations 40 years old and above is 34, or 24% of the population. In the next 10 years, approximately 43% of the 143 substations will reach or pass the end of their expected service life. There are a broad range of substation types in the CBD which are highlighted in Figure 10.

Figure 10: Hobart CBD substation and switchgear types



From the 16 different switchgear types, there are a number of asset and operational issues which have bearing on the overall operability and performance of the network both now and into the future. For instance 9 of the 16 switchgear types feature line switches instead of circuit breakers (37% of the substation population). This means that there is no opportunity to utilise feeder differential unit protection across these substations which may affect future reliability and asset integrity; it also limits remote switching capability.

There are also a significant number of substations (36%) which utilise oil-filled switchgear. These relate to four types of switchgear. Aged oil-filled switchgear is regarded by TasNetworks as potentially hazardous; as such there are a number of replacement programs underway to help manage the risk.

There are also a small number of substations which are limited in operation under contingency scenarios due to the design of the switchgear itself. Hazemeyer MD4 cannot be operated under fault conditions as it requires the operator to manually insert a withdrawable section with the danger of closing onto a fault.

Vault substations are also limiting under fault conditions due to restricted access. There are 3 vault substations in the Hobart CBD which have this limitation.

3.3.4.4 Reliability and demand growth

The Hobart CBD reliability community is classified as Critical Infrastructure and is currently experiencing poor reliability (SAIFI and SAIDI). With the exception of faults isolated by the various differential protection schemes, outages within the Hobart CBD are isolated manually by field operators. Response times can be significant due to traffic congestion, and difficult access to building integrated and vault type substations throughout the area.

The CBD is experiencing a period of growth with significant hotel, education, government, and healthcare developments completed and underway in recent years. A number of these developments have not been included in the connection point forecast.

3.3.4.5 Reinforcement strategy

Our distribution vision for the Hobart CBD is based on the following principals:

- Meeting future Hobart CBD capacity needs under long term development planning scenarios;
- Optimising the use of the existing network;
- Improve reliability to Hobart CBD critical extended reliability community to meet the reliability performance targets;
- Use of new technology and non-network solutions where possible;
- Developing strategies for condition based asset replacement; and
- Opportunity based replacement to meet our long term strategical needs

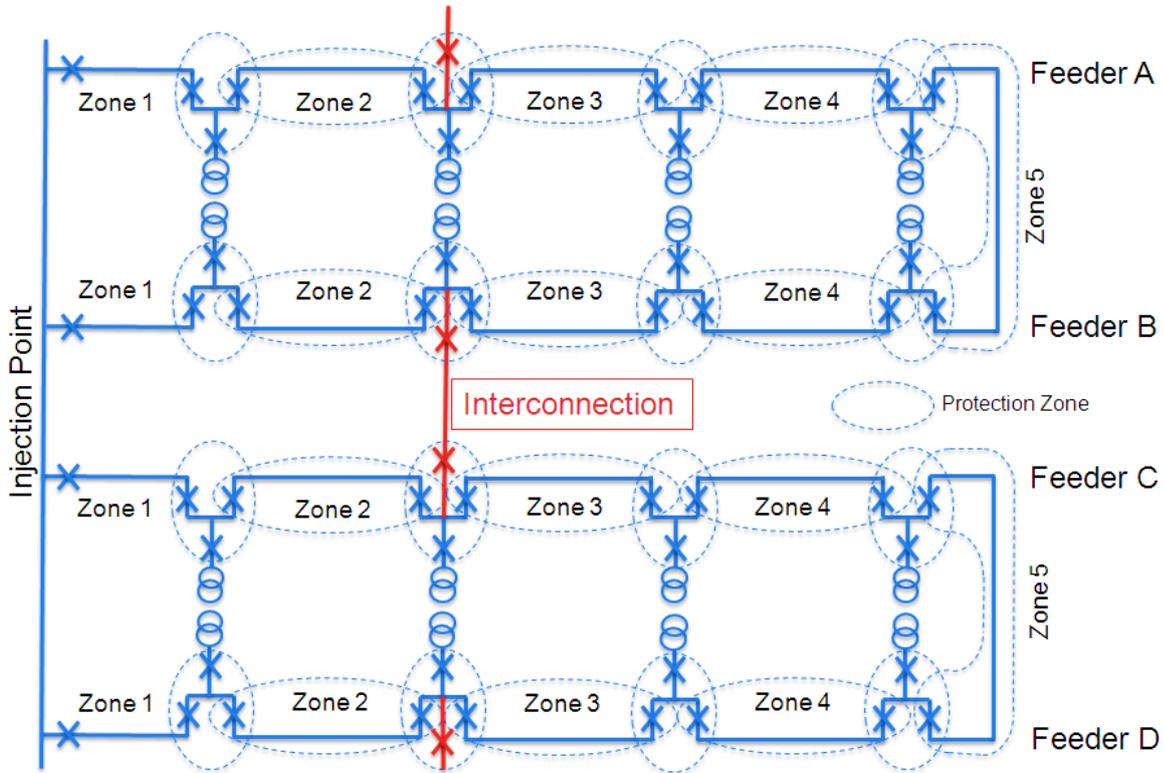
Our strategy for the distribution substations in the Hobart CBD will consider these basic planning and design principles:

- Feeder Interconnections will be reinforced to improve transfer capacity and network access. This will support load development, and enable better network access management.
- Remote visibility and control will be strategically deployed to limit the need for response operators to access substation sites such as vault-type substations and enhance fault response capability.
- Oil-filled switchgear replacements will be prioritised according to load criticality and condition.
- The utilisation of dry-type transformer designs in the CBD as an environmentally sensitive alternative to the conventional oil-filled solution will be carefully administered, due to inherent capacity constraints (short term ratings reductions) associated with dry-type technology.
- re-introduce closed feeder loops in the Hobart CBD to reduce outage impacts for feeder faults.

Figure 11 shows a concept configuration including protection overlay for feeder and distribution substations supplying the Hobart CBD.

The reinforcement strategy for this area is to develop the feeders networks towards this vision in conjunction with development and renewal activity, including customer initiated developments and network initiated switchgear and transformer renewal. The feeder arrangement provides for two-feeder closed loop operation and remote switching capability at strategic substation sites between zones.

Figure 11: Closed loop feeder interconnection and protection vision for Hobart CBD



4 Planned investments and forecast limitations

This section presents the planned investments and forecast limitations in the Greater Hobart planning area for the 15-year planning horizon to 2032. The planned investments present the investment need, timing, deferral opportunity and proposed solution with expected cost and other options considered. Forecast limitations present the location and timing of limitations, requirements to defer the limitation, and potential options to alleviate them.

4.1 Planned investments

This section presents the planned investments within the network during the next 15 years. These projects have been identified as the preferred solutions through technical and economic analysis.

4.1.1 North Hobart Substation supply transformer refurbishment

Issue overview

The two supply transformers at North Hobart Substation (Wilson 110/11/11 kV 30/45 MVA) have a continuous firm rating of 45 MVA. The firm capacity of these supply transformers are not forecast to be exceeded within the 15 year period.

We propose to strategically transfer load onto this site as required from East Hobart zone to allow East Hobart to support developments closer to the CBD and the wharf area.

Proposed solution

TasNetworks intends to undertake refurbishment of existing transformers to secure they remain in safe and reliable operation for up to 20 years through the planning period.

We plan to manage additional load transfers over the period through demand management initiatives, such as through the Australian Economic Regulators Demand Management Incentive Scheme.

4.1.2 North Hobart Substation 11 kV switchgear replacement

Issue overview

The two 11 kV switchboards at North Hobart Substation were manufactured in 1976 and are no longer supported by the manufacturer. We do not have this type of switchgear installed at any other site. The switchboards are not designed for arc containment and are not explosion proof. The circuit breakers also require manual spring charging after each operation, resulting in delays in restoring supply.

In addition, the switchboards comprise six feeder circuit breakers each and provide connection to 22 distribution feeders plus two local service station transformers. That is, 12 circuit breakers provide connection to 24 x 11 kV circuits. This arrangement reduces the reliability of supply to the Hobart CBD area, as a single feeder fault will trip its associated circuit breaker resulting in the loss of supply to both the faulty feeder and the healthy feeder connected to that circuit breaker.

Proposed solution

TasNetworks originally examined an option of utilising 24 kV GIS switchgear. The reason for this was to provide uniformity across the network and standardisation on system spares. This assumption is no longer valid as the use of 11 kV rated switchgear in the Hobart area has been standardised and there is no likelihood of changing this at all in the future. As such the option for use of 24 kV GIS switchgear is not considered further.

We propose to replace the 11 kV switchboards at North Hobart Substation with new 12 kV air-insulated switchboards (operated at 11 kV) that have sufficient circuit breakers to enable one feeder to be connected per circuit breaker. The new switchgear will have air-insulated busbars and vacuum circuit breakers. It will include arc containment facilities, be explosion proof, and be fully remote controllable.

This project is a keystone part of future Hobart supply security. It is planned for the North Hobart Substation site to be a major injection point into the Hobart CBD area which contain some high reliability customers, predominately the Royal Hobart Hospital, major accommodation centres and major retailers along with major government and other business activities.

The estimated cost of the project is \$4.6 million and is proposed to be operational by June 2019.

4.1.3 Spare three-winding transformer

Issue overview

In the Hobart West locality, North Hobart and Chapel Street substations have two three-winding transformers each to supply the distribution network. The three-winding transformers, with the 11 kV busbar arrangement, maintain a lower fault level than would otherwise be present. Currently there is no spare three-winding transformer, and a failure of a unit at North Hobart or Chapel Street substations would result in non-firm supply to the Hobart CBD until a new transformer was procured.

Proposed solution

TasNetworks intend to procure a new system spare unit to cover North Hobart and Chapel Street. It is hoped that during the design phase, the unit could be made suitable for possibly Risdon and Boyer substations as well.

4.1.4 Zone substation transformer replacements

Table 8 details the proposed supply transformer replacements at our zone substations in the Greater Hobart planning area. The replacements in this section are due to asset condition, and therefore the following points apply to all proposed replacements:

- the issues do not impact on the capacity of the relevant transmission-distribution connection point;
- any load transfer capacity will not decrease the impact of, or defer, the issues;
- a reduction in forecast load will not defer the issues; and
- we propose to replace with units of standard sizes.

Table 8: Planned zone substation transformer replacements

| Zone substation | Existing transformers (MVA) | Year of manufacture | Forecast end of life | Proposed solution | Estimated cost (\$m) | Estimated completion date | APR where first identified |
|-----------------|-----------------------------|---------------------|----------------------|---------------------|----------------------|---------------------------|----------------------------|
| Claremont | 2 x 22.5 | 1969 | Within 5 years | Replace with 2 x 25 | 3.0 | June 2019 | 2015 |
| Derwent Park | 2 x 22.5 | 1964 | Within 5 years | Replace with 2 x 25 | 3.3 | June 2021 | 2015 |
| Geilston Bay | 2 x 22.5 | 1968 | Within 10 years | Replace with 2 x 25 | 4.65 | June 2023 | 2015 |
| Bellerive | 2 x 22.5 | 1971 | Within 10 years | Replace with 2 x 25 | 3.3 | June 2024 | 2015 |

4.1.5 Sub-transmission upgrading

Issue overview

A number of 33 kV sub-transmission circuits within the Greater Hobart planning area consist of aged overhead conductors. In summer when ambient temperatures are high, these overhead sections de-rate the supply capacity of the zone substations. In Tasmania the peak demand occurs in winter, where the ambient temperature is low, where the summer limitation is not an issue.

Zone substations are managed to an N-1 planning standard (including switched firm where economical), whereby the zone substation is designed such that the loss of a single sub-transmission element will not impact supply. With the de-rating of the overhead sections of the sub-transmission lines, the N-1 capacity of the substations in the summer period are significantly lower than the substations transformation capacity.

Substation loading in summer has grown over time such that during a contingent event, substation load would need to be transferred to neighbouring networks or shed. Table 9 identifies the affected sub-transmission lines, the forecast year of non-firm for summer and winter periods, the load transfer capability away from the zone substations supplied from these lines, and the load reduction required to defer the limitations. The load transfer capability is the capability during winter, when peak loading occurs – we have not assessed summer transfer capability for these lines as yet. In deferring the limitation, power factor improvement is not a viable option as the MW load is in excess of the MVA firm rating, meaning only load reduction or generation support will have the capability to defer this issue.

Table 9: Sub-transmission line non-firm limitations

| Sub-transmission lines | Forecast year non-firm | | Load transfer capability (MVA) (winter) | Load reduction required to defer limitation (MVA) (summer) | |
|------------------------|------------------------|-----------|---|--|---------|
| | Summer | Winter | | 1 year | 5 years |
| Creek Road–West Hobart | Current | 2023 | 23.4 | 1.0 | 2.7 |
| Risdon–Derwent Park | Current | 2021 | 23.3 | 1.5 | 2.7 |
| Risdon–New Town | Current | 2017 | 20.3 | 4.8 | 6.2 |
| Creek Road–Claremont | 2017 | Past 2025 | 10.9 | 0.4 | 1.5 |
| Risdon–East Hobart | 2017 | Past 2025 | 25.5 | 11.8 | 14.3 |

Proposed Solution

We propose a rating upgrade strategy to address these limitations. The strategy has three components, depending on the limiting section of the sub-transmission line.

The strategy is as follows:

- replace limiting copper sections of overhead line with modern standard conductor. We already propose a program to replace these copper sections and others due to asset condition, and therefore plan to fund these replacements under that program;
- increase the operating temperature of limiting sections of overhead line through re-tensioning conductor, installing additional poles, or re-locating line sections where required; and
- re-rate or apply short-term ratings to limiting underground cable sections.

4.1.6 Hobart CBD Reinforcement

A number of substation sites and third party underground works will progress in the current and forecast periods. As part of these works TasNetworks will continue to ensure development activity and opportunities align to the Hobart CBD development strategy. Key development sites are briefly described below.

4.1.6.1 Substation redevelopment

Issue Overview

The Franklin Square, Anglesea, and Watchorn St distribution substations have a number of asset issues that are being addressed in the current period. These sites are strategically located (regarding MV and LV interconnectivity), are on a title owned by TasNetworks (excluding Anglesea), and afford a large amount of building area.

Proposed Solution

In conjunction with addressing the asset related issues, the sites are being redeveloped into significant switching stations by incorporating additional 11 kV switchgear, feeder interconnectivity, and remote visibility and control. Additionally modern protection relays and optic fibre communication links will be developed where economical.

In reference to Figure 11 above, the Franklin Square, Anglesea and Watchorn St sites are considered 'Zone 2/3' substations, supplied from East Hobart, West Hobart and North Hobart respectively, with high levels of interconnectivity between the three supply stations.

Multiple stage development plans have been proposed, with the initial stages in the current regulatory period addressing the asset issues and associated civil works. The initial stage will enable subsequent development stages to occur within the forecast period as required.

4.1.6.2 Oil filled switchgear and transformer replacements

Issue Overview

There is a large program of asset renewal activity associated with primary systems occurring within the Hobart CBD area. The general approach is to replace these assets like-for-like with non-oil equivalents.

Proposed Solution

In conjunction with addressing the asset related issues, the sites will be evaluated in regards to development opportunity. Sites may incorporate additional switchgear and other associated infrastructure where economical and practical. In some instances, the existing sites may not be suitable for like-for-like replacements due to limited space (unable to incorporate current day clearances and switchgear footprint). These sites may be rationalised requiring the development of neighbouring substation sites and associated feeder connections.

4.1.6.3 Differential relay and pilot wire replacements

Issue Overview

There is a large program of asset renewal activity associated with secondary systems occurring within the Hobart CBD area. The general approach is to replace these assets like-for-like.

Proposed Solution

In conjunction with addressing the asset related issues, the sites will be evaluated in regards to development opportunity (in regards to secondary systems). Where economical and practical, the secondary systems within the site as well as the up and downstream connection sites may be developed to support the feeder development vision as shown in Figure 11 above.

4.2 Forecast limitations

This section presents the forecast limitations, not addressed by a planned investment in Section 4.1, within the network during the 15 year planning period. These limitations identify the points in the network that are currently inadequate to cater for the future demand on the network due to the following considerations:

- demand forecast
- asset refurbishment replacement or retirement requirements
- security and reliability requirements
- regulatory and jurisdictional requirements
- power quality
- fault levels
- generation, demand-side and other developments
- operational constraints
- national transmission network development plan
- power system risk review
- market benefits assessment

The limitations identified here are those in the transmission network and those in the distribution network that are likely to have a material effect on operation of the network.

4.2.1 Fault level issues

Within our network, the maximum allowable fault current contribution at the connection points between the transmission and distribution networks has historically been 13 kA. This was determined on the assumption that the distribution network design fault current is 16 kA, with a 3 kA margin for embedded generation. For all voltage levels, new circuit breakers require a minimum symmetrical three phase fault current withstand capability of 25 kA for connection to the transmission network, and 16 kA for connection to the high voltage side of the distribution network.

We have a number of transmission-distribution connection points in the Hobart West locality where the maximum fault level exceeds 13 kA, as listed in Table 10. All new connecting circuit breakers to the network are to meet a minimum access standard.

Table 10: Fault level issues within the Greater Hobart planning area

| Substation | Management strategy ⁵ |
|---------------|---|
| Bridgewater | Bus coupler operated normally-open, with auto-close scheme |
| Chapel Street | Bus coupler operated normally-open, with auto-close scheme |
| Creek Road | Bus coupler operated normally-closed, when fault current exceeds 13 kA open transformer T3 33 kV circuit breaker C552 |

4.2.2 New Town Zone Substation transformer capacity

Issue overview

New Town Zone Substation has two 22.5 MVA supply transformers, with a short-term firm rating of 22.9 MVA (limited by the rating of the 11 kV switchboard). Demand is forecast to exceed the short-term firm rating of the transformers, and rating of the 11 kV switchboard, from winter 2017. The station is currently operated with the 11 kV bus coupler normally-open, with an auto-close scheme.

⁵ Standing instructions - 062

Limitation deferral

Table 11 presents the requirements to defer the identified non-firm issue at New Town Zone Substation. The table presents the reduction in the forecasted load or amount of generation support, or improvement in power factor required to defer the limitation by either one (to 2018) or five (to 2022) years. The reduction or improvement detailed is to maintain the load below 22.9 MVA, the short-term firm rating of the transformers.

Power factor improvement is not a viable option to defer this issue by five years. By then, the MW load will be in excess of the MVA rating of the transformers, meaning only load reduction or generation support will have the capability to defer this issue.

Load transfer is available away from New Town Zone Substation to Chapel Street, Derwent Park Zone, East Hobart Zone and North Hobart substations. Theoretically, a total load transfer of 20.3 MVA to these substations is available for short periods.

Table 11: New Town Substation limitation deferral

| Deferral period | Forecast for 2017 | | Generation support or reduction in forecasted load (MVA) | Improved power factor |
|-----------------|----------------------|-----------------------------------|--|-----------------------|
| | Maximum demand (MVA) | Maximum demand (MVA) Power factor | | |
| One year | 23.2 | 0.960 | 0.6 | 0.984 |
| Five years | | | 2.4 | - |

Potential solutions

Potential solutions to manage the forecast loading issues at New Town Zone Substation include:

- demand management activities, including embedded generation or contracted load shedding;
- strengthening the distribution network to provide either post-contingent (automated) or permanent load transfers away from New Town Zone Substation;
- real-time (dynamic) rating of the transformers; and
- replacement of the transformers with larger units;

Real-time rating or replacing the transformers also requires the replacement of the 11 kV switchboard to remove the rating limitation.

5 Network opportunity

The Greater Hobart planning area has a number of load connection points with sufficient capacity such that new loads could connect with minimal or no augmentation to the connection point substation to accommodate it. Note that although capacity at the substation may be available, the new load may require other augmentation work within the 11 kV distribution network to address local capacity or reliability issues that arise from the connection.

Table 12 shows the available firm capacity at each connection point substation now and at the end of the planning period where redundancy is available, and the non-firm capacity at single transformer substations.

Table 12: Available substation capacity (MW)

| Substation | Firm capacity | Existing | | 2032 | |
|----------------|---------------|----------|--------------------|-----------------|--------------------|
| | | Demand | Available capacity | Forecast demand | Available capacity |
| Chapel Street | 60 | 37.5 | 22.5 | 33.2 | 26.8 |
| North Hobart | 45 | 37.9 | 7.1 | 45.1 | 14.9 |
| Bridgewater | 35 | 31.7 | 3.3 | 35.5 | 0 |
| Rokeby | 35 | 20.6 | 14.4 | 24.7 | 10.3 |
| Creek Road | 120 | 87.1 | 32.9 | 77.8 | 42.2 |
| - Claremont | 22.5 | 19.3 | 3.2 | 17.7 | 4.8 |
| - Sandy Bay | 60 | 35.0 | 25 | 29.8 | 30.2 |
| - West Hobart | 60 | 36.1 | 23.9 | 33.3 | 26.7 |
| Risdon | 100 | 68.8 | 31.2 | 74.9 | 25.1 |
| - New Town | 22.5 | 23.3 | 0 | 23.9 | 0 |
| - Derwent Park | 22.5 | 19.5 | 3 | 22.0 | 0.5 |
| - East Hobart | 60 | 27.2 | 32.8 | 30.1 | 29.9 |
| Lindisfarne | 60 | 48.6 | 11.4 | 35.9 | 24.1 |
| - Geilston Bay | 22.5 | 23.9 | 0 | 18.1 | 4.4 |
| - Bellerive | 22.5 | 17.5 | 5 | 11.0 | 11.5 |
| Mornington | 60 | 22.5 | 37.5 | 47.4 | 12.6 |
| - Rosny Park | 25 | - | - | 17.5 | 7.5 |
| - Howrah | 25 | 16.4 | 8.6 | 24.1 | 0.9 |
| - Cambridge | 20 | 13.4 | 6.6 | 18.3 | 1.7 |

Appendix A – Area capability information

This appendix provides information on the network capability in the Eastern planning area. The supply transformer capacity at each substation is provided in Table 13. The transfer capability from each substation is provided in Table 14 and Table 15.

Table 13: Substation supply transformer capacity

| Terminal Substations | | | | |
|----------------------|------------------------|-------------------|-----------------------------|-------------------------------|
| Substation | Number of Transformers | Transformer (MVA) | Transformer Primary Voltage | Transformer Secondary Voltage |
| Bridgewater | 2 | 35 | 110 kV | 11 kV |
| Chapel St | 2 | 45 | 110 kV | 11 kV |
| Creek Rd | 3 | 60 | 110 kV | 33 kV |
| Lindisfarne | 2 | 45 | 110 kV | 33 kV |
| North Hobart | 2 | 45 | 110 kV | 11 kV |
| Mornington | 2 | 60 | 110 kV | 33 kV |
| Risdon | 3 | 50 | 110 kV | 33 kV |
| Rokeby | 2 | 35 | 110 kV | 11 kV |
| Zone Substations | | | | |
| Bellerive | 2 | 22.5 | 33 kV | 11 kV |
| Cambridge | 2 | 20 | 33 kV | 11 kV |
| Claremont | 2 | 22.5 | 33 kV | 11 kV |
| Derwent Park | 2 | 22.5 | 33 kV | 11 kV |
| East Hobart | 3 | 30 | 33 kV | 11 kV |
| Geilston Bay | 2 | 22.5 | 33 kV | 11 kV |
| Howrah | 2 | 25 | 33 kV | 11 kV |
| New Town | 2 | 22.5 | 33 kV | 11 kV |
| Sandy Bay | 3 | 30 | 33 kV | 11 kV |
| West Hobart | 3 | 30 | 33 kV | 11 kV |
| Cambridge | 2 | 20 | 33 kV | 11 kV |
| Rosny Park | 1 | 25 | 33 kV | 11 kV |

Table 15: Transfer capability - Hobart East Locality

| Hobart East Locality | | From | | | | |
|----------------------|---------------------------------------|--------|------------------------|----------------------------|---|-------------------------------|
| | | Rokeby | Howrah (Mornington) | Bellerive (Lindisfarne) | Cambridge (Lindisfarne/ Mornington) | Geilston Bay (Lindisfarne) |
| To | Rokeby | | 7.1 | 3.1 | 7.4 | |
| | Howrah (Mornington) | 4.8 | | 3.1 | | |
| | Rosny | | | | | |
| | Bellerive (Lindisfarne) | | 2.4 | | 7.4 | 5.1 |
| | Cambridge (Lindisfarne/Mornington) | 4.8 | | 6.2 | | |
| | Geilston Bay (Lindisfarne) | | | 4.1 | | |
| | Derwent Park | | | | | 5.1 |
| | East Hobart | | | | | 3.8 |

Appendix B –CBD Feeders and proposed developments

Table 16: Hobart CBD Feeder AEMO 2050 Forecast

| Substation | Feeder | 2017 maximum demand (MW) | Maximum demand forecast for 2050 (MW) |
|--------------|--------|--------------------------|---------------------------------------|
| North Hobart | 18131A | 3.3 | 4.8 |
| North Hobart | 18131B | 2.1 | 3.1 |
| North Hobart | 18132A | 0.4 | 0.5 |
| North Hobart | 18132B | 2.5 | 3.6 |
| North Hobart | 18133A | 2.2 | 3.3 |
| North Hobart | 18133B | 1.2 | 1.8 |
| North Hobart | 18142A | 0.6 | 0.8 |
| North Hobart | 18142B | 0.9 | 1.3 |
| West Hobart | 13044 | 4.9 | 4.4 |
| West Hobart | 13045 | 4.4 | 4.0 |
| West Hobart | 13046 | 1.3 | 1.2 |
| West Hobart | 13047 | 1.1 | 1.0 |
| West Hobart | 13048 | 3.8 | 3.4 |
| West Hobart | 13049 | 3.1 | 2.8 |
| West Hobart | 13050 | 1.5 | 1.3 |
| West Hobart | 13051 | 4.9 | - |
| West Hobart | 13052 | 5.1 | 4.5 |
| West Hobart | 13053 | 2.8 | 2.5 |
| West Hobart | 13054 | 2.7 | 2.4 |
| West Hobart | 13058 | 1.4 | 1.2 |
| East Hobart | 14060 | 0.1 | - |
| East Hobart | 14061 | 1.6 | 2.3 |
| East Hobart | 14062 | 2.3 | 3.3 |
| East Hobart | 14063 | 2.4 | 3.4 |
| East Hobart | 14064 | 2.2 | 3.1 |
| East Hobart | 14065 | 3.7 | 5.3 |
| East Hobart | 14066 | 2.0 | 2.9 |
| East Hobart | 14067 | 4.5 | 6.4 |
| East Hobart | 14068 | 3.3 | 4.8 |
| East Hobart | 14069 | 2.7 | 3.9 |
| East Hobart | 14070 | 4.2 | 5.9 |

