TasNetworks
Delivering your power

West coast planning area strategy

Area Strategies for Tasmania's Electricity Network

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Tasmanian Networks Pty Ltd (ABN 24 167 357 299)

Authorisations

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February 2016	1.0	Original Issue	Network Planning	Network Planning Team Leader
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Responsibilities

This document is the responsibility of the Network Planning Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299.

Please contact Network Planning with any queries or suggestions.

Minimum requirements

The requirements set out in TasNetworks' documents are minimum requirements that must be complied with by TasNetworks staff, contractors, and other consultants.

The end user is expected to implement any practices which may not be stated but which can be reasonably regarded as good practices relevant to the objective of this document.

Disclaimer

Executive summary

The west coast planning area covers the west coast of Tasmania, from Savage River in the north to Queenstown in the south. This area serves an important function in delivering over 600 MW in generation to bulk supply points located at Burnie and Sheffield, via the 110 kV and 220 kV transmission networks respectively.

The west coast area is characterised by rugged terrain, inclement weather and geographic isolation. This has adverse effects on customer supply reliability. The transmission and distribution networks are mostly radial, with no distribution interconnectivity between substations. Issues presented are predominately those where it is difficult to maintain adequate supply and reliability to townships and the end of long distribution feeders.

The area mainly comprises mining load, with customers connected at both transmission and distribution levels. There is at least one mining customer connected to each of the substations in the area. There are also a significant number of residential customer connections, at the major townships across the area which include Rosebery, Tullah, Zeehan and Queenstown.

There are a number of capacity constraints which are current and which require attention during the forthcoming regulator period, and while the Australian Energy Market Operator's (AEMO)load forecasts are expected to remain relatively flat in the 15-year planning period; there have been a number of recent connection enquiries pertaining to mining load which, if they proceed, would necessitate further augmentations. The proposed development plan for the planning period is listed in Table 1 and detailed within this strategy. Additional limitations identified are captured within this document.

Table 1: Network development strategy for the west coast planning area

Location	Proposed development	Investment need	Estimated cost ($M)	Forecast completion
Strahan community	Install remote control switches with fault indication	Reliability/capacity	0.17	2018
West coast/Zeehan community	Audit with the intent to reinforce trunk sections	Reliability/capacity	0.03 (audit only)	2018
Renison Bell	New switching station for 44 kV feeders and line work	Reliability/capacity	0.8	2019
Farrell Substation	Install additional 220 kV coupler	Reliability/capacity	0.75	2021
Rosebery Substation	Re-rate 44 kV sub-transmission feeder	Capacity	0.5	2021
Rosebery Substation	Replacement of 44 kV switchgear, and gantry/bus	Asset condition	2.8	2021
Waratah Tee	Disconnector replacement project	Reliability	0.49	2021
Savage River Substation	Replace supply transformers	Asset condition	3.8	2022
Burnie-Waratah 110 kV transmission line	Replace wood H-poles with steel equivalents	Asset condition	4.4	2022
Rosebery Substation	Replace supply transformers	Asset condition/ capacity	7.1	2027

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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 a safe and efficient electricity network in the west coast planning area.

1.3 Scope

The area strategy addresses the transmission and distribution electricity networks within the west coast planning area.

1.4 Objectives

The objectives of this area strategy are to:

- provide an overview of the west coast planning area, and the electricity network within it
- present the long term transmission and sub-transmission network vision based on generation and maximum demand scenarios 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.

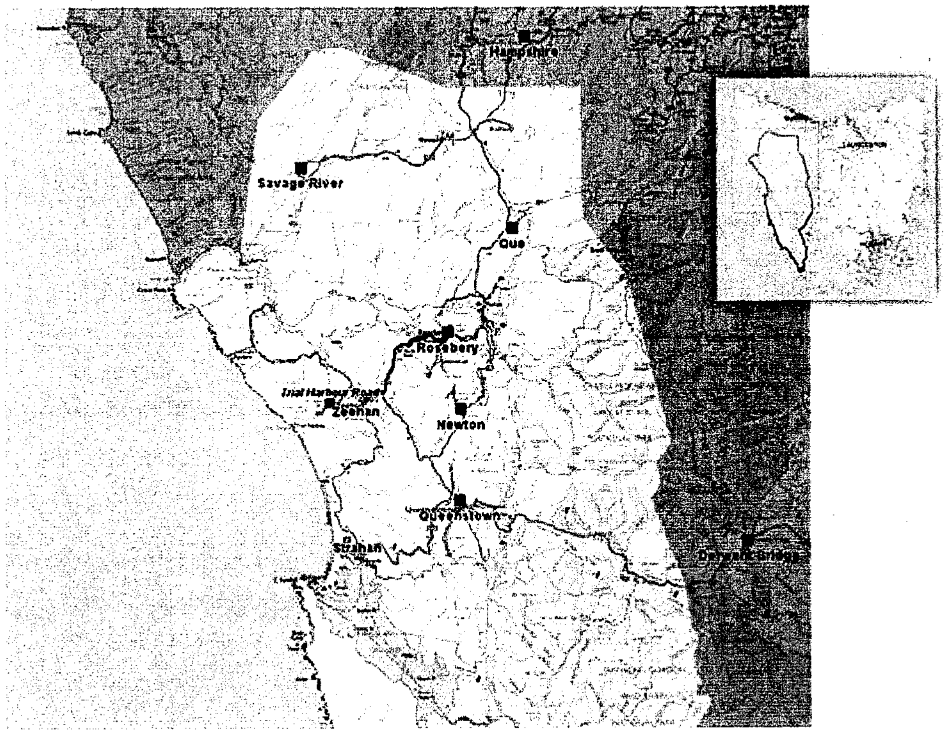
Strategic documents which the area strategies support include:

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

2 Area overview

The west coast area is a sparsely populated and geographically isolated area consisting of very rugged terrain. The area covers all customers, generators and substations connected to Farrell Substation in Tasmania's west. Most of the area falls under the municipality of the West Coast Council.

Figure 1: Geographic map of the West Coast planning area



2.1 The network

As a result of the high level of generation in the area, the west coast region is typically a net exporter of energy to load centres around Tasmania (and to Basslink HVDC interconnector in times of export flow). For planning purposes the area is divided into two localities, the Que Savage river locality to the north of Farrell Substation, and the Rosebery Newton Queenstown locality to the south.

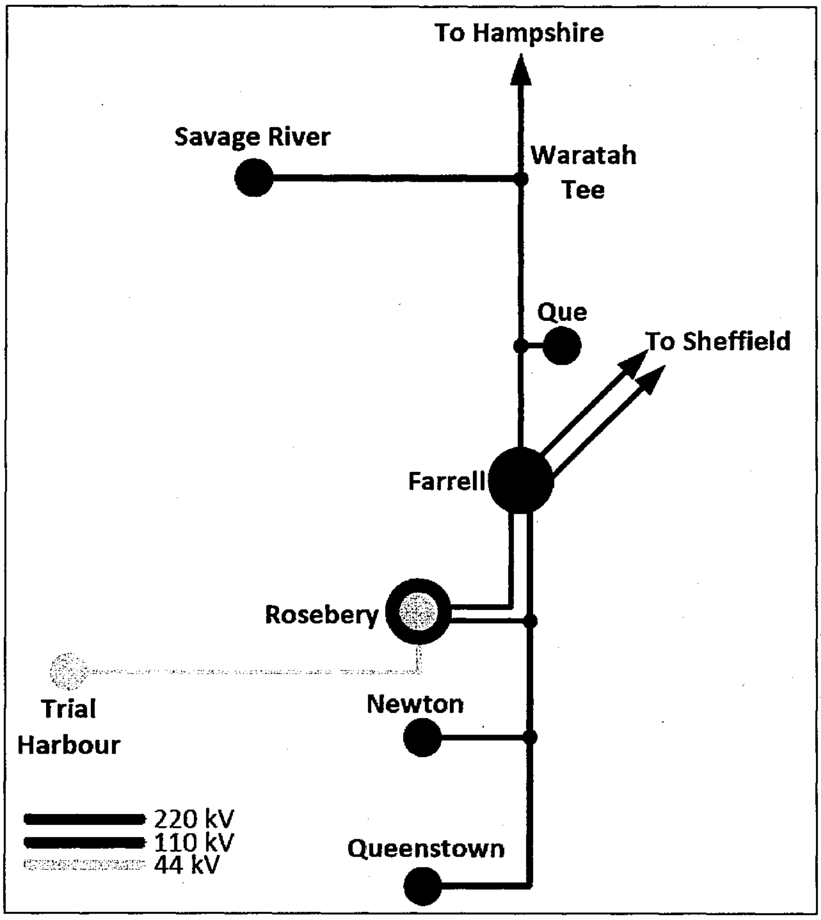
2.1.1 Transmission network

The west coast planning area is connected to the wider transmission system via the Sheffield-Farrell dual circuit 220 kV transmission line and the Burnie-Waratah 110 kV transmission line via Que, Waratah Tee and Hampshire.

John Butters and Tribute power stations are connected to Farrell Substation via the Farrell-John Butters 220 kV transmission line. The Farrell-Reece 220 kV transmission line connects Reece Power Station to Farrell Substation. Bastyan Power Station connects directly into the adjacent Farrell Substation at 220 kV.

The Farrell-Rosebery 110 kV transmission line connects the Farrell and Queenstown substations. Similarly, the Queenstown-Rosebery 110 kV transmission line connects the Rosebery and Queenstown substations. The 110 kV transmission system also supplies substations at Savage River, Newton and Que as well as generation at Mackintosh Power Station. For further information on the transmission system in this area, refer to Figure 2.

Figure 2: West coast area simplified one line diagram



2.1.2 Distribution network

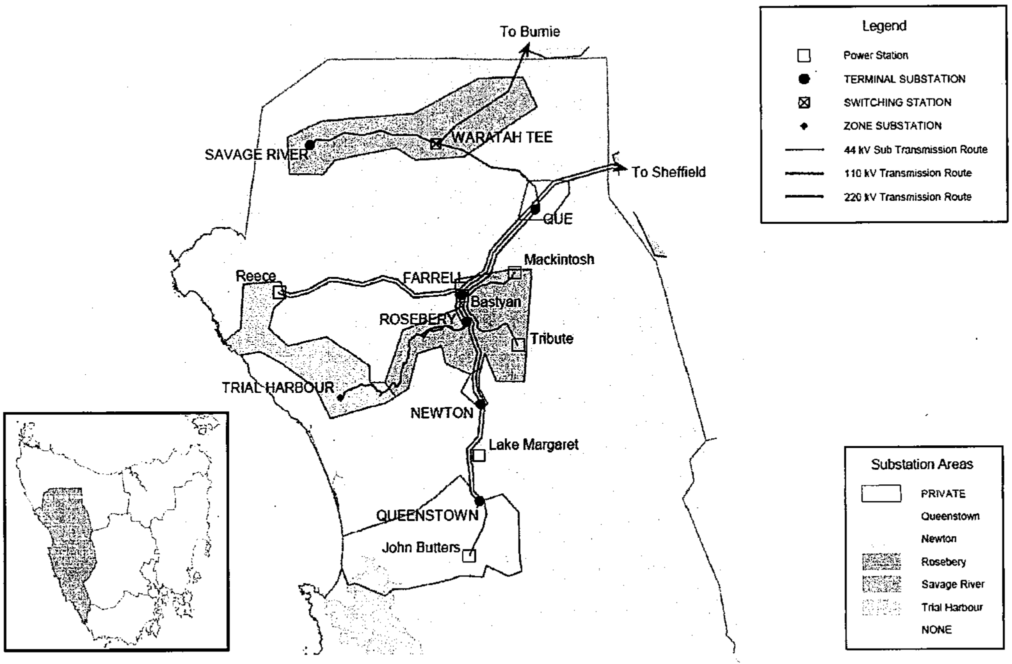
Two distribution feeders emanate from Rosebery Substation at 44 kV, with one supplying the 44/22 kV Trial Harbour Zone Substation (which supplies Zeehan at 22 kV), and another supplying a large 44 kV mining connection at Renison Bell. These feeders interconnect at Renison Bell, which provides a partially redundant supply to Trial Harbour Zone Substation. Rosebery Substation also directly supplies a 44 kV mining connection at Rosebery, by way of a private distribution feeder. There are also two 22 kV distribution feeders supplied from Rosebery Substation, which supply the Rosebery and Tullah townships.

Queenstown Substation comprises three 22 kV distribution feeders which supply Queenstown and Strahan townships. There are also two private 11 kV feeders which supply mining load.

Newton Substation features one 22 kV distribution feeder supplying mining load. Savage River Substation supplies the local mine at 22 kV via four private feeders, as well as a single 22 kV distribution feeder to Waratah. Que Substation facilitates a 22 kV mining connection by way of a single private feeder.

There is no interconnectivity between the aforementioned substations, at a distribution level.

Figure 3: Distribution network substation supply areas



2.2 Recent network developments

The following network developments have taken place since the last publication of the West Coast Planning Area Strategy (2016):

- The single-circuit radial transmission line between Queenstown and Newton substations was decommissioned due to poor asset condition in 2017. A new teed connection into the Queenstown-Rosebery 110 kV transmission line was provided as depicted in Figure 2.
- The Rosebery Substation transformer augmentation project was completed which saw the installation of cooling fans on the transformers to dynamically increase the firm capacity from 30 MVA to 36 MVA.
- The 44 kV bus disconnector at Rosebery Substation was motorised in 2017 to provide improved operational flexibility.
- The Avebury Mine supplied from Trial Harbour was subjected to new ownership during 2017.
- "Distance to fault" relay capability was installed on one 22 kV distribution feeder emanating from Queenstown.

2.3 Customers

This section details the material existing and proposed generation and load customers in the west coast planning area.

2.3.1 Generation

2.3.1.1 Hydro Tasmania generation

There are five transmission-connected Hydro Tasmania power stations in the west coast planning area, reaching a total of 627 MW. They are listed as follows:

- Tribute, 84 MW, Anthony Catchment, commissioned 1994
- Mackintosh, 81 MW, Pieman Catchment, commissioned 1992
- Bastyan, 81 MW, Pieman Catchment, commissioned 1983
- Reece, 238 MW, Pieman Catchment, commissioned 1986-87
- John Butters, 143 MW, King – Yolande Catchment, commissioned 1992

There are also two Hydro Tasmania embedded generators on the Lake Margaret scheme, also part of the King – Yolande Catchment. Both were refurbished in 2010 and together they generate 11.6 MW into Queenstown Substation via the private 11 kV network.

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[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.3.1.4 Mobile generation connections

TasNetworks has mobile generation connection capability at the following locations:

- Queenstown (1250 kVA)
- Zeehan (1250 kVA)
- Waratah (1250 kVA)

These sites rely on deployment of mobile generation plant kept on standby at the TasNetworks resource centre at Queenstown.

There is also a permanent diesel generation installation at Strahan (2500 kVA) to provide a back-up supply for the township, under contingency scenarios.

Additionally, there is up to 36 MW of transmission-connected mobile generation connection capability at Que Substation, which was utilised in 2016 when hydro generation and Basslink were both constrained. The site is designed to connect up to 36, 1 MW generating units using 6, 6.3 MVA transformer/switchgear assemblies.

2.3.2 Mining Load

The loading on the west coast is dominated by mining load which is connected across both distribution and transmission networks. Since mining activity is highly dependent on metals pricing and a number of other economic factors, loading activity in the west coast planning area has been in a continual state of change. This section highlights the various changes which have taken place since the last publication of the West Coast Planning Area Strategy (2016). Refer to Table 2 for summary connection information pertaining to these mines.

Table 2: Major West coast mines

Mine	Status	Supply voltage (connection type)	[redacted]
Avebury Mine (Dundas Mining)	Under new ownership by Dundas Mining; [redacted]	22 kV from Trial Harbour Zone Substation (distribution customer)	[redacted]
Renison Bell tin mine (Bluestone Mines)	Operational	44 kV from Rosebery Substation (distribution customer)	[redacted]
Henty Gold Mine (Diversified Minerals)	Operations re-commenced in 2016 following a period of care and maintenance from 2015.	22 kV from Newton Substation (distribution customer)	[redacted]
Hellyer Mine [redacted]	Currently under care and maintenance, anticipating restarting [redacted]	22 kV from Que Substation (transmission customer)	[redacted]
Savage River (Grange Resources)	Operational	22 kV from Savage River Substation (transmission customer)	[redacted]
Rosebery mine (MMG)	Operational	44 kV from Rosebery Substation (transmission customer)	[redacted]
Zeehan Zinc (Comstock Mine)	Currently under care and maintenance	22 kV from Trial Harbour Zone Substation (distribution customer)	[redacted]
Mt Lyell Mine (Copper mines Tasmania)	Currently under care and maintenance	11 kV from Queenstown Substation (transmission customer)	[redacted]
Zeehan tin	Pre-operational	To be confirmed	[redacted]

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2.4 Reliability

The West Coast Planning Area consists of five different reliability communities. Three of these communities are classified as Urban and are located at Roseberry, Queenstown and Strahan. The township of Zeehan is classified as a High Density Rural (HDR) community. All remaining areas on the west coast are subject to Low Density Rural (LDR) reliability standards.

In terms of the corresponding community reliability standards, the five-year (average) reliability performance statistics are as follows:

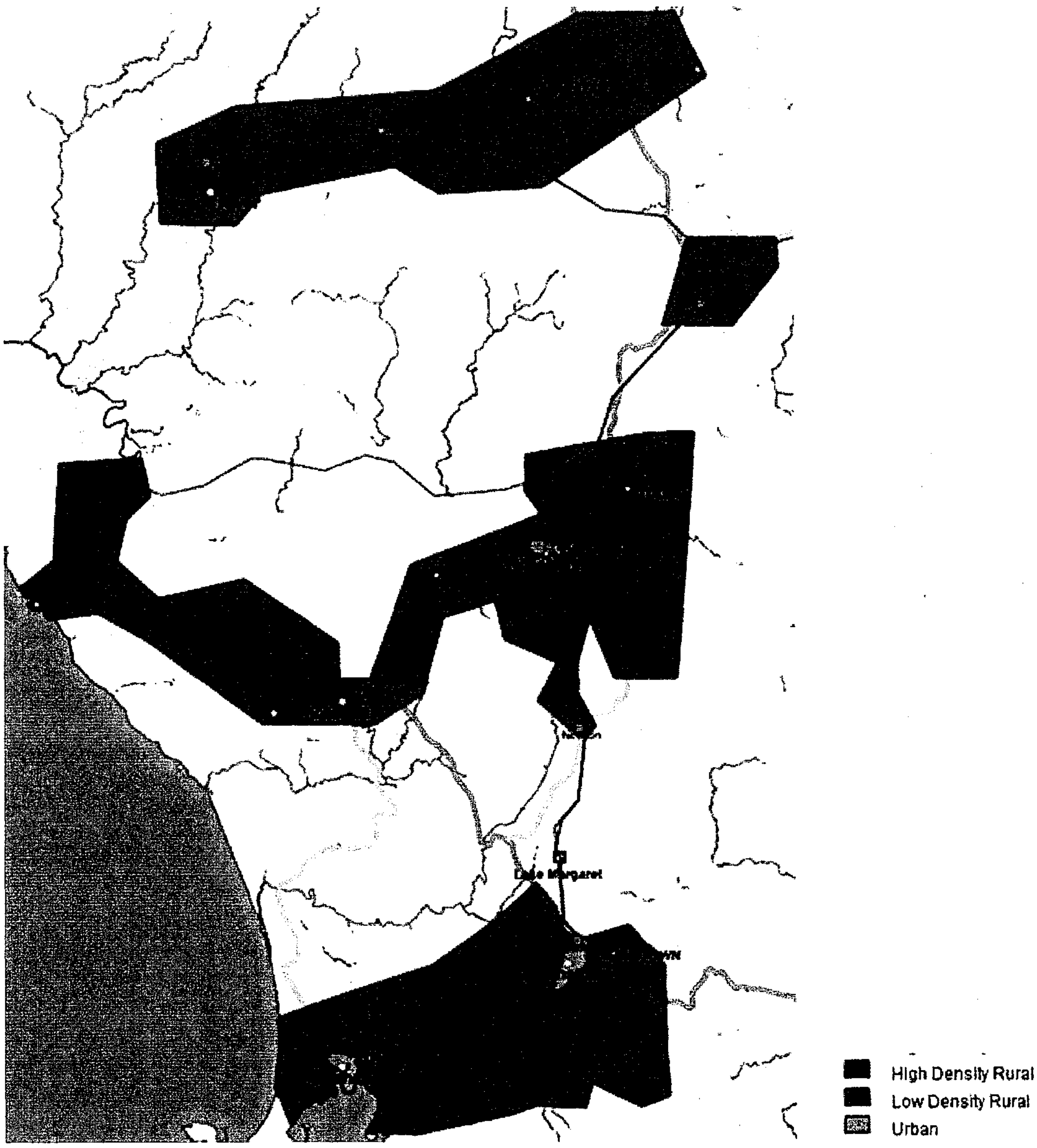
Table 3: West coast reliability performance summary

Community	SAIDI* target (minutes)	SAIDI 5-year average (minutes)	SAIFI** target	SAIFI 5-year average	Performance
Rosebery Urban	240	139	4	0.72	Good
Strahan Urban	240	617	4	5.17	Poor
Queenstown Urban	240	198	4	0.96	Average
Zeehan HDR	600	1024	6	3.36	Poor
West Coast LDR	720	774	8	3.02	Average

*SAIDI: System Average Interruption Duration Index, **SAIFI: System Average Interruption Frequency Index

The West Coast area is prone to wind and storm damage and is subject to operational response delays, given its remote location from resource centres (Queenstown and Burnie). In order to help expedite response times, which has favourable outcome on SAIDI, fixed standby generation has been installed at Strahan. In addition, mobile generation connection points have been created at Queenstown, Zeehan and Waratah to facilitate a faster back-up alternative in the event of significant network faults (and to offset network demand in event of capacity constraints). TasNetworks is also investigating introducing remote-controlled switchgear at key points on the distribution network on the west coast, to provide faster response times under contingency scenarios.

Figure 8: Reliability community boundaries on the west coast



3 Long term 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.

3.1.1.1 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. Note: this forecast does not include recent potential loading increases from mining customers. This has been considered separately.

Load on the west coast is dominated by mining operations (classed as industrial load for forecasting purposes) and the operation of mining equipment requires consistent supply of energy which is largely independent of temperature. Temperature-sensitive loads such as heating and cooling are more closely related to residential and commercial activity.

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.

The forecasts for large mining customers in the area take into account:

- historical electrical loads and contractual arrangements (where known); and
- the international and domestic economic outlook generally and possible effects on selected commodity markets and commodity prices.

The forecasts for large mining customers in the area do not take into account:

- known expansions or contractions in production; and
- published company information on operations.

A number of mines in the area are currently in care and maintenance and are subsequently operating at a significantly reduced load. In the event that all mines were fully operational, there would be very little spare capacity at Queenstown and Rosebery (already operating above firm at times). If a new mine was to be opened in the area (under this full load scenario) and connect to either of these substations a substantial upgrade program would be required at the relevant substation.

Table 4: 2050 maximum demand forecast

System	2016 maximum demand (MW)		Maximum demand forecast for 2050 (MW)
	Actual	Weather corrected	
Que-Savage Locality	22.1	22.0	32.6
Rosebery-Newton-Queenstown Locality	34.0	33.9	44.0
Savage River Substation	22.4	22.3	33.0
Rosebery Substation	32.0	31.9	48.1
Newton Substation	1.7	2.7	1.7
Queenstown Substation	5.5	5.3	2.0

Note: Que Substation is included since it is a connection asset, not a network asset.

3.1.1.2 Generation

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

The only identified grid-scale potential generation development in the west coast area is Granville Harbour Wind Farm, as outlined in Section 2.3.1.3. If it proceeds, this development would see an additional generation being exported into the 220 kV transmission network via the Farrell-Reece and Sheffield-Farrell transmission lines. Studies conducted as part of the connection application process have concluded that there is available capacity in the network to accommodate this increase without compromising thermal limits.

Continuation to a low emissions future in the NEM means future renewable energy development in Tasmania is highly likely. In the west coast planning area, this would most likely eventuate in wind farms, due to the dominance of the Roaring Forties. 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 a 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. We expect that increasing photovoltaic and batteries will increase bi-directional power flows within the distribution network, but this will not be sufficient to material affect flows with the transmission and sub-transmission networks part of this long term network development plan.

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 summarised below.

3.2.1 Rosebery Substation supply transformers replacement

The maximum demand for Rosebery Substation exceeded its firm rating of 36 MVA in 2016. In addition, there have been a number of recent connection enquiries which would see a significant load increase on the substation. A project is proposed to replace these 36 MVA transformers with standard 60 MVA units to ensure there is sufficient capacity available to meet the expected demand potential from mining development in the long term to 2050.

3.2.2 44 kV sub-transmission feeders

At present the two 44 kV feeders emanating from Rosebery are operating within their thermal limits, however if anticipated load increases on Rosebery Substation eventuate as expected, this would necessitate a sub-transmission augmentation to increase the capacities of the existing feeders.

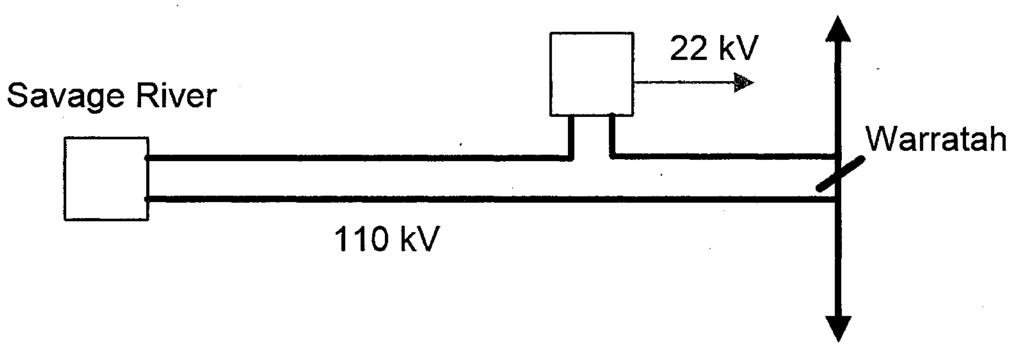
3.2.3 Savage River Substation supply transformers replacement

Savage River Substation transformers are reaching their end of life. During the forthcoming regulatory control period, TasNetworks plans to replace these transformers with 36 MVA transformers units.

3.2.4 Waratah Tee - Savage River 110 kV transmission line

The Farrell-Que-Savage River-Hampshire 110 kV transmission circuit is subject to constraint whereby a contingency event on the single circuit between the Waratah Tee and Savage River Substation could result in more than 300 MWh of unserved energy at Savage River Substation. In the long term, and dependent on future mining developments in the area, TasNetworks considers that a second 110 kV transmission circuit into Savage River would meet the jurisdictional requirements. In light of the aforementioned, a possible connection arrangement is proposed as follows:

Figure 9: Possible connection arrangement



Currently this constraint is being met by way of an exemption[1] under our jurisdictional network performance requirements.

3.2.5 66 kV sub-transmission feeder from Pieman to Trial Harbour

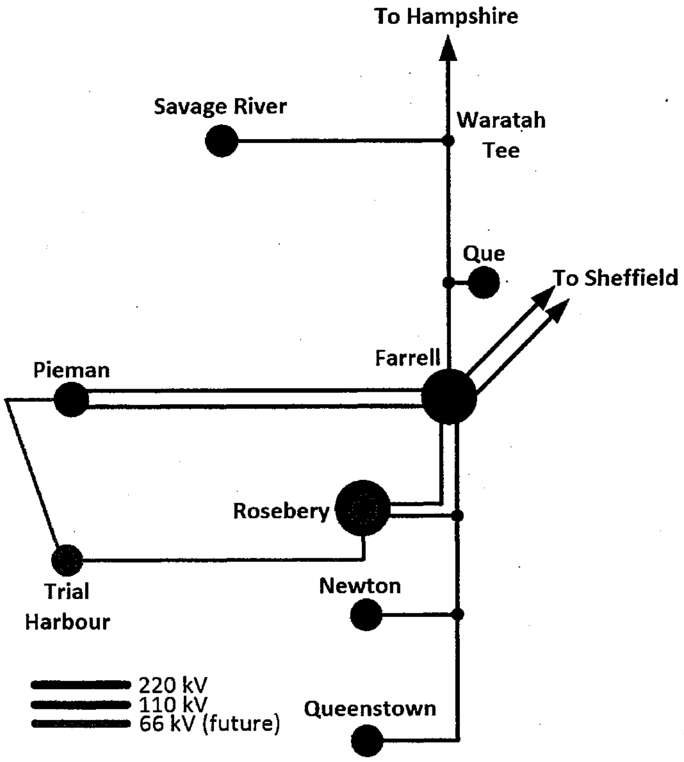
TasNetworks has recently received a connection application for a large wind farm which would connect to the Farrell-Reece 220 kV transmission line, near the Reece Power Station. To facilitate this connection, TasNetworks proposes the installation of a 220 kV switching station known as Pieman Switching Station.

Ultimately this switching station could be converted to a 220:66 KV substation, Pieman Substation, to provide a second 66 kV sub-transmission feeder to Trial Harbour Zone Substation. The new sub-transmission feeder would follow the existing 22 kV distribution line between Reece Power Station and Zeehan along Heemskirk Road. This would remove potentially 20 MW of loading from Rosebery Substation and provide valuable interconnection on an otherwise radial distribution network.

[1] Internal reference: R0000767199

There are no specified triggers for this project, and the vision has not been justified. The proposed wind farm and connection arrangement is also yet to be finalised.

Figure 10: Future arrangement showing 66 kV connections into Trial Harbour



4 Planned investments and forecast limitations

This section presents the planned investments and forecast limitations in the west coast 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 Rosebery Substation replacement supply transformers

Limitation overview

Rosebery Substation comprises two 36 MVA transformers, with no additional short-term rating. Whilst the half-hour interval substation maximum demand for 2016 was within the firm rating (a maximum of 35.9 MVA), the 36 MVA limit was exceeded at the 5-min data interval level. This firm rating exceedance was not identified in the maximum demand forecast as can be seen in Table 5. Maximum demand had previously been below, although close to, firm capacity and was forecast to remain relatively flat over the short to medium term. The increased coincident maximum demand in 2016 is attributed to a number of mining customers performing de-watering operations following heavy rains. There is no load transfer capability available away from Rosebery Substation.

The transformers are also in need of replacement or refurbishment before 2027 due to asset condition.

Proposed solution

TasNetworks has implemented operational solutions at Rosebery Substation to manage the possibility of non-firm operation however subsequent to this, a number of new connection enquiries have been initiated which (if they materialise) would prompt the need for an augmentation. An alternative solution would be demand management activities such contracted load shedding, although this solution is not deemed acceptable in the longer term. Notwithstanding, the installation of replacement transformers with larger standard units, 60 MVA in capacity is viewed as the most logical alternative given the load increases on the Rosebery Substation.

Rosebery Substation predominantly supplies mining customers, and existing or new mining customers may require additional demand with minimal lead time. As such we continue to closely monitor loading at Rosebery Substation and engage with existing and potential future customers.

The project is estimated to amount to $7.1M, to be delivered by 2027.

Limitation deferral

Table 5 presents the requirements to defer the identified capacity limitation at Rosebery Substation. The table presents the reduction in the forecasted load, or amount of generation support, required to defer the capacity limitation by either one (to 2018) or five (to 2022) years. The reduction would maintain the load below 36 MVA, the short-term firm capacity. Note this data is based on forecast data and does not take into account recent customer load enquiries.

Table 5: Rosebery Substation capacity limitation deferral

Deferral period	Maximum demand (2016) (MVA)	Generation support or reduction in forecasted load (MVA)
One year	35.9	0.1
Five years		0.2

4.1.2 44 kV sub-transmission feeders

Limitation overview

In the distribution network, the two 44 kV feeders emanating from Rosebery are likely to be constrained in the amount of capacity they can provide to Trial Harbour Zone Substation and Bluestone Mines at Renison Bell.

At present these sub-transmission feeders are operating within their thermal limits, however if anticipated load increases eventuate this could necessitate a sub-transmission augmentation (subject to further capacity studies).

This is especially true with regard to the 44 kV feeder supplying Trial Harbour Zone Substation, for which over 70% of the 36 km circuit is strung with 7/4.50 Aluminium conductor, which limits the overall capacity of the circuit. If there is a significant increase in mining development in the Zeehan area; this in combination with the greater Zeehan townships peak load of 1.8 MVA may result in a thermal capacity constraint on this feeder.

Proposed solution

TasNetworks has recently initiated a sub-transmission feeder audit on both feeders to determine whether these circuits can be re-rated to a higher operating temperature, thus increasing their capacity ratings. If this is deemed favourable, the lines could be re-rated without the need for a major augmentation (some sections may require re-tensioning to maintain minimum clearances).

Failing this, the alternative option would be to re-conductor sub-standard line sections; however this augmentation would only be triggered once the new/modified connections are formalised.

The estimated cost to re-rate these circuits is estimated at $0.5M, by 2021.

In order to meet demand requirements well into the future, augmented lines would be built to facilitate an eventual conversion to the 66 kV voltage level. A conversion to 66 kV is currently thought to be the best long term strategy to address growth in the west coast planning area. This has already been taken into account on the recently 44 kV sub-transmission feeder section between Zeehan and Trial Harbour (commissioned in 2008), which is insulated to 66 kV; and at Trial Harbour Zone Substation where the transformers were designed to include a 66 kV tapping for the eventual conversion. The 66 kV network would provide additional capacity in the sub-transmission network and is more cost-effective to install than new 110 kV network.

4.1.3 Savage River Substation replacement supply transformers

Limitation overview

Savage River Substation comprises two 15/22.5 MVA, 110:22 kV transformers which were installed in the 1970s and are reaching end of life. As such they are reaching the point of increased risk of failure. The combined mining and distribution network load on this substation has also on occasion exceeded firm capacity.

Proposed solution

Should this eventuate, TasNetworks' plan would be to replace these transformers to 36 MVA transformers, which could be transferred and refurbished from Rosebery Substation to coincide with its transformer replacement project. The estimated cost for this project is $3.8M with completion by 2022.

Limitation deferral

Table 6 presents the requirements to defer the identified capacity limitation at Savage River Substation. The table presents the reduction in the forecasted load, or amount of generation support, required to defer the capacity limitation by either one (to 2018) or five (to 2022) years. The reduction would maintain the load below 22.5 MVA, the short-term firm capacity.

Table 6: Savage River Substation capacity limitation deferral

Deferral period	Maximum demand (2016) (MVA)	Generation support or reduction in forecasted load (MVA)
One year	23.4	1.9
Five years		1.8

There is no load transfer capability available away from Savage River Substation.

4.1.4 Farrell bus coupler

Limitation overview

The west coast 110 kV transmission system is operated radially. Farrell Substation is the major substation in the west coast area. It is the connection point for all generation in the area. There is one 220 kV transmission line that connects the generation supply from Farrell Substation to the rest of the transmission network. There are two radial 110 kV networks in the west coast area: Farrell–Que–Waratah Tee–Savage River–Hampshire and Farrell–Rosebery–Queenstown–Newton.

The Farrell–Que–Waratah Tee–Savage River–Hampshire 110 kV circuit supplies load at Que and Savage River substations with the circuit operated normally open at Hampshire Substation. The Farrell–Rosebery 110 kV and Farrell–Rosebery–Newton–Queenstown 110 kV transmission circuit supply loads at Rosebery, Queenstown and Newton substations. Figure 1 presents a geographical map of the west coast area, with Figure 2 presenting the associated schematic diagram.

TasNetworks has identified that failure of the 220 kV bus coupler circuit breaker at Farrell Substation would result in the loss of supply to the west coast area. During periods of high generation, this could lead to power system instability and possible black-outs.

The investment is required to meet the following ESI Regulations:

- 5(1) (a) (ii); which state that for any single asset failure, no more than 850 MW of load can be interrupted and
- 5(1) (a) (iii); which state that for any single asset failure is not to be capable of resulting in a black system.

Proposed solution

The Farrell Substation 220 kV layout is designed as a typical 220 kV double busbar with single bus coupler arrangement. In the event of this single bus coupler failing to operate (stuck condition), the result could lead to a total loss of supply to the west coast area plus the loss of connection to a significant amount of generation. The event may also lead to a partial or full system blackout due to the load and generation imbalance.

TasNetworks has therefore proposed a project in the forthcoming revenue reset period to install a second bus coupler in series to create a double circuit breaker arrangement. Protection and control schemes would also require modification to accommodate the primary plant arrangement.

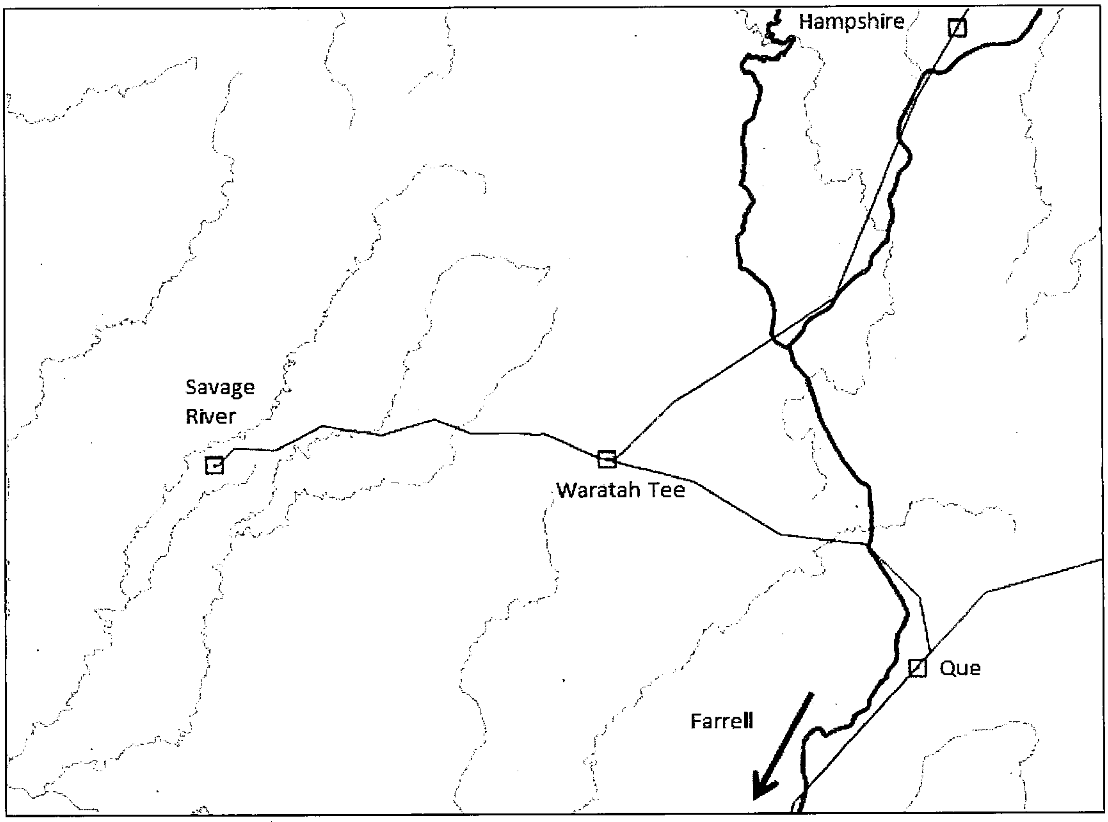
This project is being included as a NCIPAP project for the 2019–24 regulatory period and will be assessed under that mechanism. Indicative project costs are estimated to be $0.75M.

4.1.5 Waratah Tee disconnector replacement project

Limitation overview

Waratah Tee Switching Station provides sectionalisation of the Farrell–Que–Savage River–Hampshire 110 kV transmission circuit. Primarily, it allows supply restoration to Savage River Substation for faults on the Farrell–Waratah Tee or Hampshire–Waratah Tee sections of the Farrell–Que–Savage River–Hampshire 110 kV transmission circuit. The disconnectors at Waratah Tee Switching Station are manually operated, meaning an operator is required to attend site to operate them.

Figure 11: Waratah Tee location



Proposed solution

A project is scheduled for 2012 to replace three disconnectors with motorised remotely-operable units to reduce outage duration to Savage River Substation for transmission faults. This project is estimated to cost $0.49M.

4.1.6 Burnie-Waratah H-pole replacement program

There is an asset-based replacement project scheduled for completion in 2022 aimed at replacing wooden H-poles between Burnie and Waratah with steel equivalents, as part of an ongoing program. This project targets condemned poles and is estimated to cost $4.4M.

4.1.7 Strahan targeted reliability improvement project

Limitation overview

The Strahan township is subject to urban reliability performance standards. Normally the distribution network topology in urban areas is highly interconnected, allowing for a number of re-supply options under contingency. In Strahan however, there is only one supply route into the township from Queenstown, and this feeder like many others on the west coast is subject to harsh weather conditions and challenging terrain which adversely affects the reliability performance of this community.

Whilst the community has experienced success since the advent of the back-up diesel mobile generation units in the township, the reliability performance of the community is still 'poor' with duration-related performance in particular well in excess of the required limit (refer to Table 3).

Proposed solution

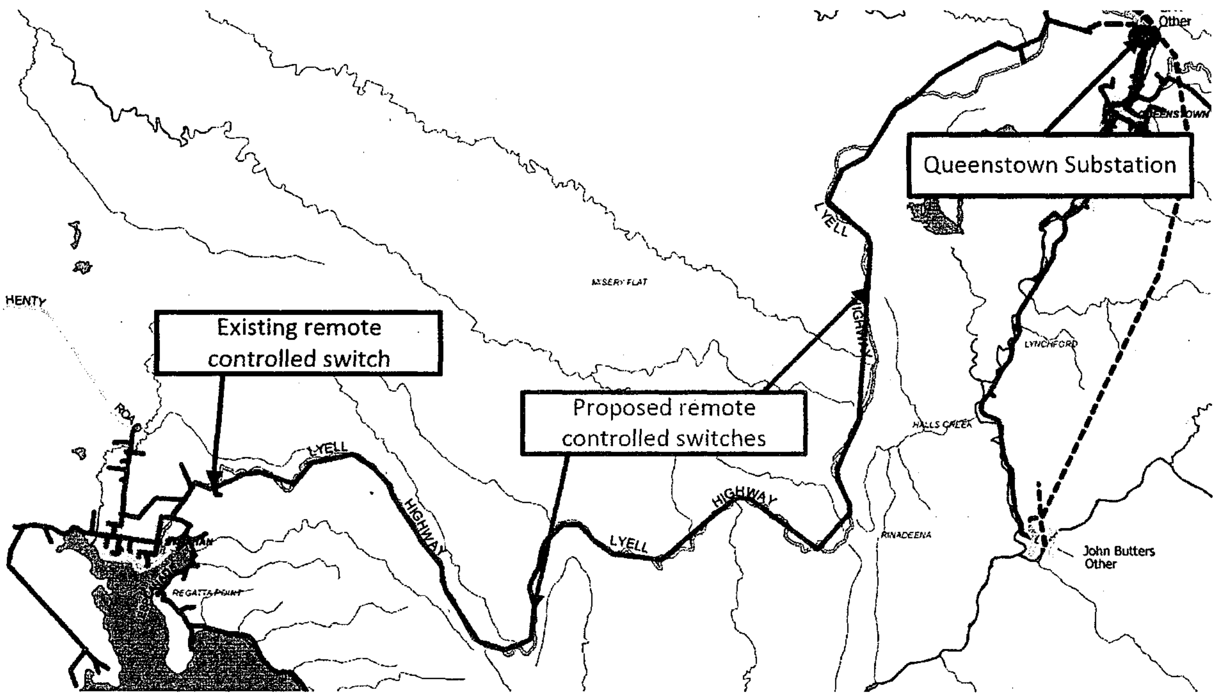
As such, TasNetworks aims to improve response times to network faults on the supply feeder into Strahan by adding a series of remote controlled switches dispersed along the feeder trunk for the main purpose of fault indication. Enhanced fault indication capability on this feeder would allow the 30 km feeder trunk, which follows the winding of the Lyell Highway, to be partitioned into smaller segments such that fault location could be determined faster than the current arrangement, which often results in lengthy patrol times.

The estimated cost of the project is $0.17M and is proposed to be operational by June 2018.

Historically TasNetworks undertook a trial using conductor-mounted fault indicators which provided remote monitoring capability via a solar-powered collator unit; however due to the inclement weather conditions which restricted solar power charging capability, these units failed. The proposed remote controlled switches use a voltage transformer-derived power source which overcomes the solar power issue.

Figure 12 shows the 22kV feeder supply Strahan from Queenstown, and where the remote controlled switches would be positioned. This positioning partitions the feeder into three segments to facilitate faster restoration times for feeder trunk faults.

Figure 12: Remote switch locations for fault indication



4.1.8 West coast/Zeehan targeted reliability improvement project

Limitation overview

The two 44 kV feeders which originate at Rosebery are vulnerable to lengthy vegetation-related outages which have adverse effects on the reliability performance of:

- West Coast LDR reliability community, for which 5-yearly performance is 'average'; and
- Zeehan HDR reliability community, for which 5-yearly performance is 'poor' (refer to Table 3).

Faults on the 44 kV sub-transmission network normally require specialist operational support from the Burnie resource centre, which adds to the overall response time.

Proposed solution

TasNetworks has therefore proposed a project to reinforce trunk sections between the Rosebery substation and the first protection device emanating from the substation; with the aim to prevent outages from occurring and/or reduce outage times.

The first stage of the project comprises analysis (audit and reporting functions) to identify correlations in outage causes. The second stage involves remedial actions such as vegetation clearance, and asset hardware upgrades - depending on the outcome of the analysis phase.

The estimated cost of stage 1 of the project is $0.03M and is due for completion in June 2018. Stage 2 will not be costed until the analysis component is delivered. The solution will be delivered during the 2019-24 revenue reset period.

4.1.9 Renison Bell 44 kV switching station project

Limitation overview

The current 44 kV network arrangement at Renison Bell (located within a mining installation) has been deemed unsuitable to manage future loading requirements. There are a number of capacity, asset condition and safety issues associated with the shared-asset site. Another factor is that since the current switching station is contained within the mine's premises, TasNetworks' fault response efforts are subject to mining personnel availability and accompaniment to the switchgear location. This adds greatly to the delay in restoring supply, and affects reliability performance in addition to the aforementioned commentary in Section 4.1.8.

Proposed solution

TasNetworks' plan is to install a new switching station outside the mine's perimeter fencing in a more convenient location. This would remove the technical limitations associated with the current switching station and expedite fault response efforts under contingency scenarios.

The 44 kV switching station would comprise one dead tank circuit breaker, and four disconnectors; two of which would be motorised for remote-controlled operation.

The estimated cost of this project would be of the order of $0.5M and the timing is estimated to be required by 2019.

4.1.10 44 kV feeder line augmentation

If the aforementioned development proceeds, this would also warrant a line reinforcement project to strengthen the interconnect-ability between the two 44 kV feeders and extend the supply to the new switching station site. It is envisaged the feeders will require realignment works and easement widening between the existing and new switching stations.

These works are estimated to cost approximately $0.3M and the timing is estimated to be required by 2019.

4.1.11 Rosebery Substation 44 kV switchgear and gantry/bus replacement

There is also an asset-based replacement project scheduled for completion in 2021 at Rosebery Substation. The project involves replacement of SF6 breakers, and the 44 kV overhead bus/gantry arrangements due to condition. The estimated project cost for this project amounts to $2.8M.

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 Savage River Substation transmission network performance requirement

The Farrell-Que-Savage River-Hampshire 110 kV transmission circuit supplies a distribution load at Savage River Substation and transmission-connected customers at both Savage River and Que substations.

A contingency event occurring on this circuit between the Waratah Tee and Savage River Substation could result in more than 300 MWh of unserved energy at Savage River Substation, the maximum amount allowed under our jurisdictional network performance requirements. This situation applies now, and is not dependent on load growth.

TasNetworks has an agreement under the network performance requirements with the transmission customers supplied from Savage River Substation that there is insufficient benefit to undertake a network augmentation solution to address this limitation. We are thus exempt under clause 8(4) of the jurisdictional network performance requirements, for the period 1 June 2013 until 30 June 2018, from planning the network to meet this requirement.

The exemption will cease from the date of expiry (June 2018), or when an affected customer considers remedial action has sufficient benefit, or circumstances have materially changed. TasNetworks has in-principle agreement from the customer to extend this agreement over the forthcoming regulatory period.

In the long term TasNetworks considers that a second circuit would be the ultimate solution to remove this constraint.

4.2.2 Farrell Rosebery Queenstown single circuit reliability

Identified need

The loss of the single circuit Farrell-Rosebery-Queenstown transmission line would result in the loss of customers connected to the Queenstown and Newton substations. This risk would impact large customers such as Copper Mines Tasmania (CMT) and Henty Gold and could cause a non-compliance with the ESI Regulations 300 MWh unserved energy limit.

Proposed solution

At the time of area strategy development, Copper Mines Tasmania is in care and maintenance and Henty Gold has only recently returned to full production. This issue is therefore included as a 'watch and act' issue.

If loading levels do return to the levels which make this constraint binding, TasNetworks' preferred option would be to seek an exemption under clause 8(4) of the jurisdictional network performance requirements. Ongoing customer engagement will ensure we are abreast of customer developments and can act appropriately with our customers to manage this issue when it becomes necessary to act.

4.2.3 Issue Newton Substation feeder capacity

Identified need

The distribution feeder from Newton Substation supplying customer load is overloaded under certain high load conditions on a hot summer day.

Proposed solution

The load on the distribution feeder will continue to be monitored for the extreme condition described above but it is considered unlikely to occur with any regularity.

4.2.4 Waratah-Savage River transmission circuit thermal capacity limit

Identified need

During very high temperatures in the summer period, the Waratah to Savage River transmission line has the potential to exceed its thermal design limit of 49 degrees. The result of this non-compliance is an unsafe ground clearance and a significant risk of bushfire, damage to property, and public risk in cases of extreme sag at highway crossings. This event will continue to occur intermittently in the future as it has done in the past.

Proposed solution

If the temperature at Farrell Substation exceeds 35 degrees then an asset manager would be dispatched to inspect the ground clearances and temperatures of the Waratah to Savage River transmission line. If the result of the inspection is an unsafe operating environment then demand on the line would be reduced until a safe operating environment is restored. This demand reduction would impact load connected Savage River substation. There have been earth works under some spans to increase the clearance levels and this could be further considered in the future for problematic spans. There are no current plans to improve the rating of the transmission line due to the infrequent nature of the non-compliance of the thermal limit in the past.

Any expenditure on this particular transmission line requires consultation with Grange Resources as any capital costs would be recovered from them through transmission use of service charges. Ongoing customer engagement will be undertaken.

5 Network opportunity

The west coast planning area has a number of load connection points with insufficient capacity such that an increase in load would necessitate an augmentation to the connection point substation to accommodate it.

Note that although capacity at the substation may be available, the new load may result in other augmentation work required for capacity increases deeper in the transmission network or for network security or reliability reasons.

Table 7 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 7: Available substation capacity (MVA)

Substation	Connection voltage (kV)	Firm capacity	Existing		2032	
			Demand	Available capacity	Forecast demand	Available capacity
Newton	22	22.5	1.7	20.8	1.8	20.7
Queenstown	22	25	5.7	19.3	3.2	21.8
Rosebery	44	36 (to 60)	35.9	0.1	37.1	22.9
Savage River	22	22.5 (to 36)	23.4	0	25.4	10.6

Note: Que Substation is included since it is a connection asset, not a network asset.

Appendix A – Summary of network issues

Table 8 presents a summary of network issues in the West Coast area strategy

Table 8: Summary of network constraints in West Coast area strategy

Issue No.	Issue/Constraint	Driver(s)	(Action) Trigger(s)	Strategy
Rosebery Newton Queenstown locality				
1	Farrell Rosebery Queenstown single circuit reliability	ESI Regulations (Transmission Performance) / Reliability	300 MWh unserved energy	Monitor the situation and act if mining loads return to full operation.
2	Rosebery Substation capacity	Capacity/ Customer	Rosebery Substation load / asset condition	Upgrade the 36 MVA transformers to 60 MVA standard units.
3	Newton Substation feeder capacity	Capacity/ Customer	Feeder loading	Monitor loading
4	Poor reliability at Zeehan	Reliability	High SAIDI and SAIFI	44 kV switching station augmentations which will improve operational response to contingency events.
5	Poor reliability at Strahan	Reliability	High SAIDI and SAIFI	Install fault indication capability along the main trunk between Queenstown and Strahan.
Que Savage River locality				
6	Waratah-Savage River transmission circuit reliability	ESI Regulations (Transmission Performance) / Reliability	300 MWh unserved energy	No action is currently required for this issue, however, consultation with customers will need to occur to ensure that the exemption is still appropriate beyond the current exemption period.

7	Waratah-Savage River transmission circuit thermal capacity limit	Capacity	Thermal conditions	If the temperature at Farrell Substation exceeds 35 degrees then an asset manager is sent to inspect the ground clearances and temperatures of the Waratah to Savage River transmission line.
8	Savage River Substation transformers	Asset condition	Condition, capacity	The transformers have had condition assessments and are due for replacement during the revenue reset period. The combined loading has also exceeded firm capacity.

Appendix B – Area capability information

Table 9: Substation supply transformer capacity

Substation	Number of transformers	Transformer firm capacity (MVA)	Transformer primary/secondary voltage
Newton	1	22.5	110/22
Queenstown	2	25	110/22
Rosebery	2	36 (to 60)	110/44/22
Savage River	2	22.5 (to 36)	110/22
Que	1	50	110/22

Appendix C – Transmission network by locality

Figure 13: Que Savage River locality

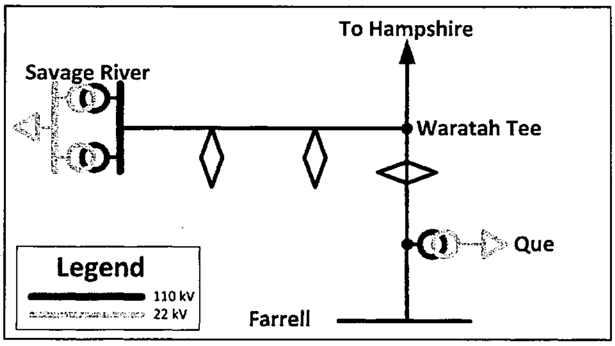


Figure 14: Rosebery Newton Queenstown locality

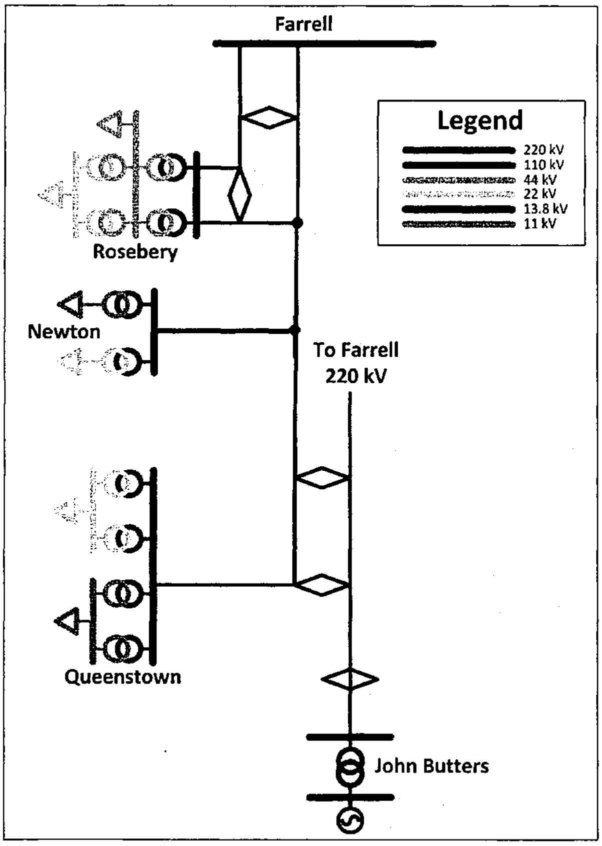


Figure 15: Distribution network