



# North West planning area strategy

## **Development Strategies for Tasmania's Electricity Network**

**Version Number 2.0**

**Oct 2017**

## Authorisations

Action	Name and title	Date	Signature
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## Document control

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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.

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# Record of revisions

Section number	Details
Version 2.0	
Whole document	Formatting to ensure consistency throughout document

# Executive summary

The North West planning area extends over 15,000 km<sup>2</sup> from Deloraine in the east to the Tarkine rainforest areas of the upper west coast. The area is supplied through an interconnected 110 kV network from two 220 kV connections at Burnie and Sheffield substations. This strategy covers the interconnected 110 kV network and eight supply substations connected out of Burnie and Sheffield, and their associated 22 kV and 11 kV distribution networks.

There are a number of transmission connected hydro and wind generators in the North West area, including:

- Woolnorth wind farm; and
- Palooka power station.

Other power stations such as Fisher, Rowallan, Devils Gate, Cethana, and Wilmot are included in the Core Grid planning area strategy.

This area is the subject of significant interest in regards to:

- the integration of **large scale renewable generation**, in particular **wind generation** in the far north west and **pumped hydro storage** along the Mersey Forth power development. The North West planning area long term development plan incorporates those developments proposed to connect to the 110 and 22 kV networks.
- The development of a **second HVDC Bass Strait Interconnector** between Port Latta (Tasmania) and Anglesea/Geelong (Victoria) that will support additional renewable generation and provide additional security for customers and opportunity for Tasmanian generators;
- Tasmania's future role as the **Battery of the Nation** to support Australia's transition to a low emission energy future, including a **third HVDC Bass Strait Interconnector** between Tasmania and Victoria that will make use of Tasmania's vast energy resources and support the continued closure of coal power generators in Victoria and NSW.

All of which will influence the scope and timing of three Contingent Projects in our 2019-24 reset. These planning opportunities are largely covered in the Core Grid planning area strategy.

The long term network development plan for the North West planning area is small in terms of network augmentation requirements to 2050 based on load (2017 AEMO connection point forecast) and generation scenarios.

Significant interest in wind developments in the far North West is driving a number of development activities within the 15-year planning period. Whereas small demand growth and reliability performance localised in the Railton and Wynyard areas, may drive feeder reinforcement and substation development activity. Additionally there are a number of substation and transmission line asset replacements occurring within the planning area, proposed as business as usual activity.

The development plan for the planning period is listed in Table 1 and detailed within this strategy.

**Table 1: Network development strategy for the North West planning area**

Location	Proposed development	Investment need	Estimated cost (\$m)	Forecast completion
Wesley Vale Substation	Convert connection point voltage from 11 kV to 22 kV	Community reliability	1.6	17/18
Emu Bay Substation	Replace protection and 11 kV switchboard conversion	Asset condition / Site Development	2.0	18/19
Port Latta Substation	Augment 110 kV loop-n/out supply	Market Benefit	2.0	18/19
Port Latta Feeder 94002	Establish a mid-feeder 22 kV voltage regulator	Voltage compliance / Transfer capability	0.3	18/19
Smithton Substation	Establish a weather station to dynamically rate the 110 kV BU-PL-ST corridor	Market Benefit	0.3	18/19
Sheffield Substation	Energise spare 110/22 kV supply transformer	Community reliability	3.4 <sup>1</sup>	21/22
Port Latta Substation	Replace supply transformers	Asset condition	3.6	21/22
Ulverstone Substation	Replace 22 kV switchboard	Asset condition	1.9	22/23
Railton Substation	Replace 22 kV switchboard	Asset condition	1.9	22/23
BU-WT 110 kV TL	Replace pole structures	Asset condition	4.3	22/23
Railton Feeder 85006	Establish a mid-feeder 22 kV voltage regulator	Voltage compliance / Transfer capability	0.3	23/24

**Table 2:**

Location			Connection voltage (kV)	
Port Latta Substation			22	
Wesley Vale Substation			22	
Smithton Substation			110	
Smithton Substation			22	
Railton Substation			22	

<sup>1</sup> Includes \$2.4M and \$1.0M for Transmission and Distribution augmentation expenditure respectively.

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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 North West planning area.

## 1.3 Scope

The area strategy addresses the transmission and distribution electricity networks within the North West planning area.

## 1.4 Objectives

The objectives of this area strategy are to:

- provide an overview of the Eastern planning area, and the electricity network within it
- present the long term transmission and sub-transmission network vision based on generation and 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

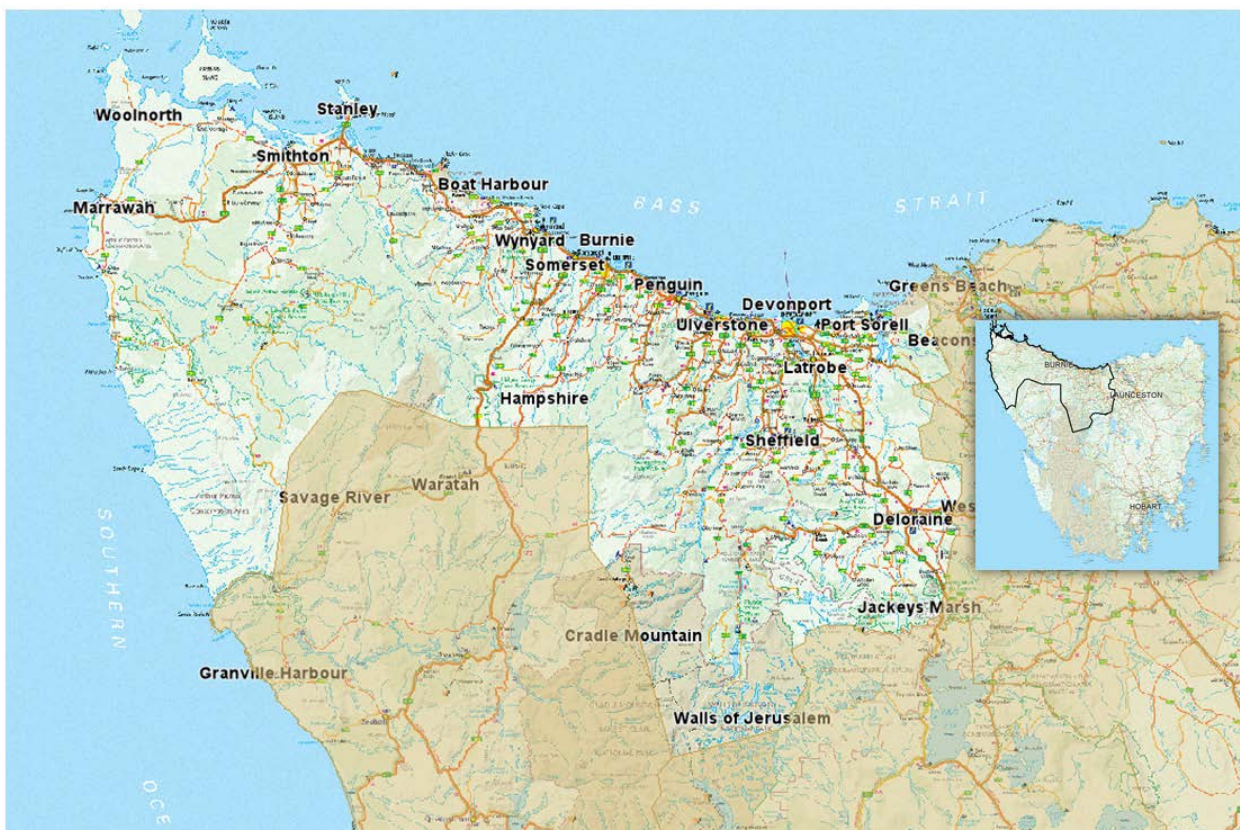
The North West planning area extends over 15,000 km<sup>2</sup> from Deloraine in the east to the Tarkine rainforest areas of the upper west coast, constituting over 20 per cent of Tasmania's land mass. The area is highlighted in Figure 1.

This area is the subject of significant interest in regards to:

- the integration of **large scale renewable generation**, in particular **wind generation** in the far north west and **pumped hydro storage** along the Mersey Forth power development.
- The development of a **second HVDC Bass Strait Interconnector** between Pot Latta (Tasmania) and Anglesea/Geelong (Victoria) that will support additional renewable generation and provide additional security for customers and opportunity for Tasmanian generators;
- Tasmania's future role as the **Battery of the Nation** to support Australia's transition to a low emission energy future, including a **third HVDC Bass Strait Interconnector** between Tasmania and Victoria that will make use of Tasmania's vast energy resources and support the continued closure of coal power generators in Victoria and NSW.

All of which will influence the scope and timing of three Contingent Projects in our 2019-24 reset. These planning opportunities are largely covered in the Core Grid planning area strategy.

**Figure 1: Reference map of the North West planning area**





## 2.1 The network

North West planning area is supplied from a significant 220 kV hub at Sheffield Substation. This site facilitates the connection point of a number of hydro generators, and the transfer of significant power flows between Farrell, Palmerston, Burnie, and George Town. The North West planning area 220 kV network covered in more detail in the Core Grid area strategy. For the purposes of this area strategy, this section will focus on the 110 kV transmission networks and the localised 22 kV and 11 kV distribution networks.

The 110 kV network from Sheffield interconnects nine terminal substations, including Burnie, Port Latta, Smithton, Ulverstone, Emu Bay, Devonport, Wesley Vale, Railton, and Hampshire. These are isolated from other transmission networks, with the exception of a single link between Hampshire and Savage River substation via the Waratah Tee in the West Coast planning area. From Sheffield a single 220 kV circuit supplies Burnie Substation that also supplies the local 110 kV network.

The transmission network, and substation supply area is shown in Figure 2. Detail on the existing assets and transfer capability at the substations is presented in Appendix A.

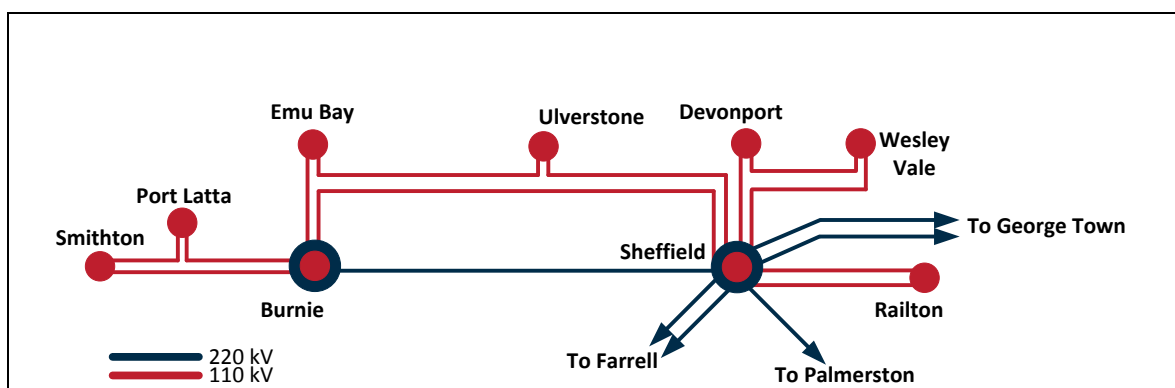
### 2.1.1 Transmission Network

The North West transmission network is considered as three localities for the purposes of area planning, including:

- **Burnie – Smithton locality:** two 110 kV circuits from Burnie Substation that supply Port Latta and Smithton substations and connects the Woolnorth (Bluff Point and Studland Bay) Wind Farm at Smithton.
- **Sheffield– Burnie locality:** two 110 kV circuits between Burnie and Sheffield that supply the Burnie, Emu Bay and Ulverstone Substations, and also connect Palloona power station
- **Devonport – Railton locality:** two 110 kV circuits that supply Devonport and Wesley Vale Substations, and two 110 kV circuits that supply Railton Substation, all supplied from Sheffield.

A simplified network diagram of the transmission network is shown in Figure 3 below. There have been a number of proposed developments in the North West planning area transmission network since publication of the previous North West area strategy in October 2015. These relate to asset renewal development, as well as a significant interest in the integration of large scale renewables in the North West. There are two committed projects and a number of proposed projects put forward in our 2019-24 reset. These projects are discussed in Section 4, however exclude Contingent Projects, which are discussed in our Core Grid planning area strategy.

**Figure 2: Simplified transmission network diagram of the North West planning area**



## 2.1.2 Transmission protection schemes

A number of protection schemes operate in the area in order to maintain system reliability and security. Schemes 5-7 relate to the operation of the 220 kV power system. These and are provided for information only, and are covered in more detail within the Core Grid planning area strategy.

1. Bluff Point and Studland Bay anti-islanding script calc:  
The scheme is designed to trip the Bluff Point and Studland Bay wind farms if there is electrical separation (island) formed, such that the wind farms are the only supply to the North West area load. This scheme is linked to Smithton, Burnie, Port Latta and Sheffield substations in North West area.
2. Bluff Point - Studland Bay regulation runback scheme:  
This runback scheme is designed to optimise the Studland Bay and Bluff Point MW output in relation to the thermal capacity of the Smithton-Burnie transmission corridor.
3. Sheffield Contingency Arming Scheme:  
The purpose of this scheme is to avoid islanding Sheffield 110 kV bus and associated generators and loads when Sheffield 110 kV bus is radially connected to 220 kV bus under special circumstances.
4. UFLS:  
The scheme aims to reduce the extent of disruption to power supplies following major system disturbances and maintains the balance between power supply and demand to prevent power system and customer assets from continued operation at abnormal frequencies. In North West area, Burnie, Devonport, Emu Bay, Port Latta, Railton, Smithton, and Ulverstone loads are included into the scheme.
5. SPS – NCSPS (Special Protection Scheme – Network Support System Protection Scheme):  
The purpose of this scheme is to remove potential thermal overloads in transmission circuit following a contingency of a critical circuit. This has been achieved by tripping generation and the scheme is in enable mode for Basslink export only. This has been implemented at Sheffield and Cethana in North West area in order to monitor and operate relevant machines and equipment in the network.
6. Backup NCSPS:  
These schemes are located in order to remove the overload in case NCSPS fails to act. In North West area, Backup NCSPS is located at Sheffield Cethana and Devils Gate.
7. SPS – FCSPS:  
Following a contingency of Basslink, the FCSPS will trip pre-armed generation (for Basslink export) or pre-armed load (for Basslink import) to ensure the Tasmanian system frequency remains within operational standards. This scheme is linked to Cethana, Devils Gate, and Woolnorth generators in North West area.

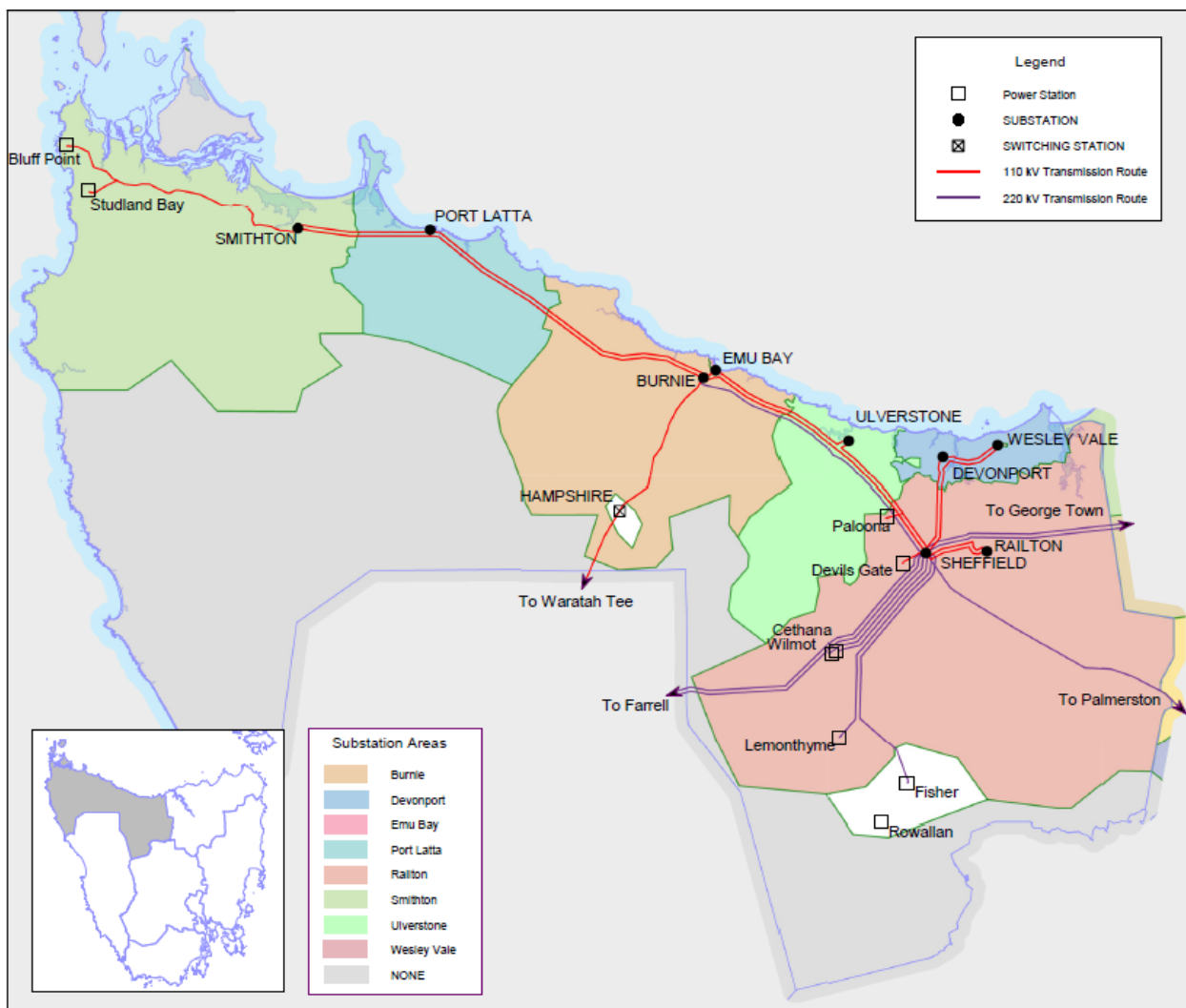
## 2.1.3 Distribution Network

The distribution networks in the North West planning area are supplied from eight terminal substations. Emu Bay and Wesley Vale substations operate as isolated 11 kV networks and are lightly loaded as they were built to serve paper manufacturing industries that have since closed. Both these sites will be converted (or largely converted) prior to mid-2019 to supply the local 22 kV networks from Burnie and Devonport respectively. The majority of the distribution networks in this area are a mix of highly interconnected 22 kV networks within large townships such as Devonport and Burnie, and long rural feeders that supply large regional areas.

Areas within the North West planning area distribution network of particular focus are characterised by urban population centres supplied via long distribution feeders, including those at the open points between substations. These localities are:

- **Port Sorell:** supplied from Devonport feeders 80001 and 80011. This township has grown significantly in previous years. The conversion of Wesley Vale Substation will support reliability and growth in this community.
- **Deloraine:** Deloraine is an Urban community supplied by Railton feeders 85002 and 85006. These feeders supply a large regional area and can be challenging to support during adverse weather events, which ultimately impacts reliability performance to Deloraine.
- **Sheffield:** Large township surrounding the Sheffield Substation. This community is supplied by Railton 85001, a long distance from Railton.
- **Burnie township:** Locality includes the township of Burnie to the west of the Bass Hwy and the Burnie CBD. The CBD is an isolated 11 kV network supplied by Emu Bay substation. This network cannot be supplied by the neighbouring 22 kV network from Burnie Substation, and vice versa.
- **Wynyard:** supplied by a number of long 22 kV feeder from Burnie Substation. This township supports a number of commercial and industrial customers, including a milk processing site at Fonterra.

**Figure 3: Distribution network substation supply area**



There have been no significant developments within the North West planning area distribution network since publication of the last North West area strategy in October 2015.

## 2.2 Customers

This section details the material existing and proposed generation and load customers in the North West planning area.

### 2.2.1 Generation

There are a number of material existing and proposed transmission generators and embedded generators in the North West planning area.

**Table 3: Transmission-connected generation**

Generation site	Description	Capacity (MW)
Paloona Power Station	Hydro power station connected at 110 kV, teed to the Sheffield-Ulverstone 110 kV transmission line..	28
Woolnorth Wind Farm	Wind farm, consisting of two sites at Bluff Point and Studland Bay, connected at Smithton 110 kV Substation via a privately owned 110 kV power line. The wind farm is large compared to load at Smithton and Port Latta substations, where the majority of power is exported to through to Burnie Substation.  This non-scheduled connection has a generation capacity that at times can utilise the full capacity of the BU-ST 110 kV corridor	140 Bluff Point 65; Studlands Bay 75

Other power stations in the North West area such as Fisher, Rowallan, Devils Gate, Cethana, and Wilmot are included in the Core Grid planning area strategy.

**Table 4: Embedded generation over 0.5 MW**

Location	Source	Description			Connecting feeder
Ulverstone	Natural gas	Simplot Ulverstone	■	■	Ulverstone feeder 82006
Nietta	Hydro	Nietta mini hydro	■	■	Ulverstone feeder 82004
Wynyard	Natural gas	Fonterra P/L	■	■	Burnie feeder 91004/5
Lake Parangana	Hydro	Parangana Hydro Tas	■	■	Railton feeder 85001
Sassafras	Wind	Nichols Poultry	■	■	Railton feeder 85004
Meander	Hydro	Huntsman Lake Meander	■	■	Railton feeder 85006

**Table 5: Proposed transmission-connected generation developments**

Location						
Wesley Vale						
Wesley Vale						
Wesley Vale						
Railton						
Port Latta						
Port Latta						
Smithton						
Smithton						
Smithton						
Smithton						
Smithton						
Burnie						
Burnie						

The proposed generation connections, timing and likelihood were current to the date of strategy publication. For the most recent information refer to the Customer Service Group.

## 2.2.2 Load

There are a number of material existing and proposed transmission direct connected and distribution loads in the North West planning area.

- Port Latta Substation supplies the directly connected customer, Grange Resources Tasmania, where they operate a plant converting iron ore slurry (from Savage River) into iron ore pellets for shipment.
- Fontarra, a milk processing facility located in Wynyard, and supplied at the end of two feeders from Burnie substation.
- Simplot is the main manufacturing connection to Ulverstone Substation.
- Kara Mine supplied from Burnie, located in the vicinity of Hampshire.
- Australian Cement, one of the largest distribution network customers, is connected directly to Railton substation
- Toll Ports, supplied by the Emu Bay 11 kV network.

## 2.3 Reliability

The North West planning area consists mainly of Low Density Rural supply reliability communities, with large pockets of High Density Rural supply reliability communities, as well as some urban communities in townships, and some High Density Commercial communities within the cities of Burnie and Devonport.

There are 21 reliability communities in the North West planning area. Four (4) of these communities are performing below target performance, detailed in Table 3 below.

**Table 6: North West poor performing reliability communities**

Community	Class	Performance Summary	Comment
Turners Beach	Urban	Average	Community performance is being addressed by a Loop Automation Scheme (17/18)
North West	Low Density Rural	Average	Community performance is being monitored.
Burnie Rural	Low Density Rural	Average	Community performance is being monitored.
Port Sorell	Urban	Average	Community performance is being addressed by the conversion of Wesley Vale Substation (17/18)

### 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 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.

With the exception of the Railton 22 kV connection point that exhibits moderate growth from 2017, the forecast for each connection point in general is flat or declining to 2021 before recovering. In extrapolating the forecast, 2021 was used as the base year with the growth factor between 2021 and 2026 used to extrapolate the forecast to 2050. The assumption being that this recovering or flat demand growth will continue. This assumption aligns with AEMO's 2016 National Electricity Forecasting Report (NEFR), which provides a regional (state) forecast for Tasmania, which forecasts a decline in early 2020s before recovering and continuing to grow to 2037, at 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 7: 2050 maximum demand forecast**

System	2016 maximum demand (MW)		Maximum demand forecast for 2050 (MW)
	Actual	Weather corrected	
Smithton	20.2	23.9	25.7
Port Latta (Summer)	17.5	19.8	26.7
Burnie	57.9	57.3	50.1
Emu Bay 11 kV	9.2	8.9	6.25
Emu Bay 22kV (2019)	-	-	TBC <sup>3</sup>
Ulverstone	27.5	28.2	20.9
Devonport	61.8	62.3	46.9
Wesley Vale 11 kV	0.1	0.3	-
Wesley Vale 22 kV (2018)	-	-	13.4 <sup>4</sup>
Railton (Summer)	45.7	49.9	83.5
Sheffield 22 kV (Summer 2021)	-	-	15.6 <sup>5</sup>

### 3.1.2 Generation

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

There are a number of proposed grid-scale generation developments in the North-West area identified in Section 2.2.1 that are considered.

Continuation to a low emissions future in the NEM means future renewable energy development in Tasmania is highly likely. In the North West planning area, this would most likely be wind farms.

Excluding the Sheffield 220 kV wind development, these developments will be sized to match the available capacity of the existing network and therefore no material network augmentation is anticipated. Depending on the operation of the proposed generation, they may have an impact on reducing maximum demand at the Railton, Wesley Vale and Smithton 22 kV substations.

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.

<sup>3</sup> The Emu Bay 22 kV CP will be available as part of a switchboard renewal project from June 2019. Potential load transfers from Burnie Substation as required. Under the connection point forecast, this is not required before 2050.

<sup>4</sup> Transfer from Devonport to Wesley Vale 22 kV in 2017.

<sup>5</sup> Transfer from Railton 85001 and 85003 to Sheffield 22 kV in 2021.

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. Some of the developments included here are currently committed or proposed prior to 2019. Although they are short-term, they have been included to provide overview and context.

The long term network development plan of the transmission network is displayed in Figure 4 and summarised below.

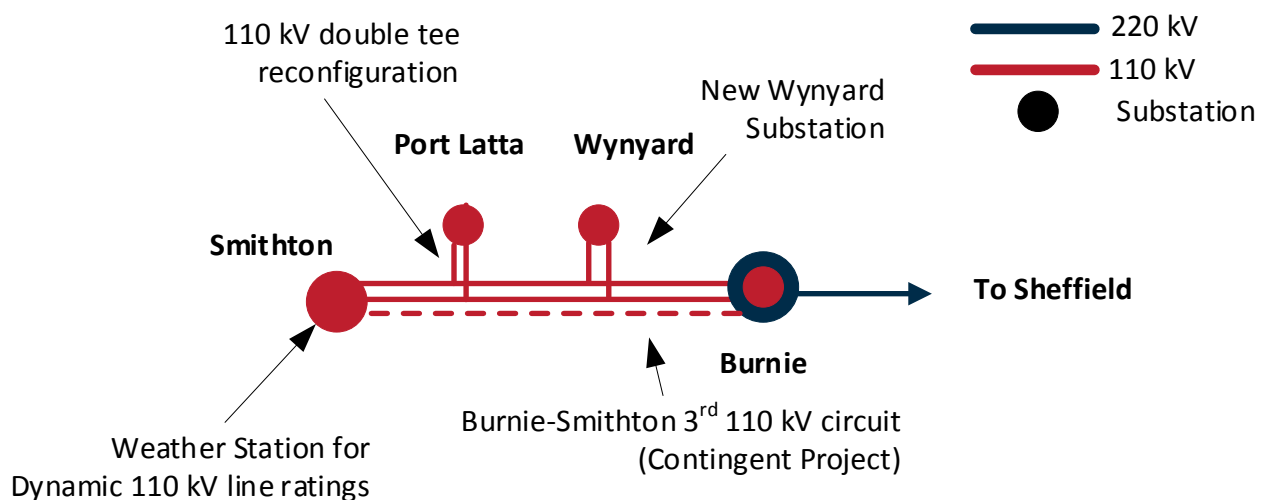
Although this plan excludes the 220 kV and 110 kV transmission networks that are covered within the Core Grid planning area strategy, some of the network development activities included here are required to facilitate components of those development strategies.

Refer Network Planning team for a staged development plan for the North West 110 and 220 kV networks.

### 3.2.1 Burnie-Smithton locality

The committed and proposed projects in the Burnie-Smithton locality within the period to 2050 are described in this section. The simplified long term development strategy for this locality is shown in Figure 4 below. The development plan here excludes development of the 220 kV network, which is covered by the Core Grid planning area strategy. Depending on the timing of core grid development in this locality, the proposed developments will alter accordingly.

**Figure 4: Long term development strategy for BU-ST locality (excluding Core Grid)**



#### Port Latta 110 kV supply arrangement (Generation)

The Port Latta Substation is supplied as a loop-in/out arrangement on the BU-PL-ST line. At times of high generation, this circuit and the BU-ST circuit have unbalanced loading, restricting the available capacity of this corridor.

TasNetworks propose to resupply the Port Latta substation as a double teed arrangement from the BU-ST lines. This is expected to increase the corridor capacity in the order of 20 MW. This project is proposed to be completed by mid-2019.

#### Smithton Weather Station (Generation)

The existing BU-PL-ST corridor used workbook line ratings to allow the corridor to operate up to 90% of the total corridor capacity i.e. non-firm. At time of high energy output from the existing wind farm, the 110 kV lines can become heavily loaded, resulting in the corridor being constrained.



With the addition of proposed wind generation connections at Port Latta and Smithton detailed in Section 3.1.2, the times that the corridor will become constrained will increase.

A weather station is proposed to be installed at Smithton to provide highly accurate weather information that will enable the 110 kV corridor to use dynamic line ratings. This is expected to increase the line capacity at times of high winds in the order of 40 MW. This project is proposed to be completed by mid-2019.

### **Port Latta supply transformers (Renewal)**

The existing Port Latta supply transformers are 22.5 MVA units. Within the period to 2050 they will require renewal or augmentation to larger units to manage load. It is anticipated that if replaced standard 25 MVA units will be installed, which having a 120% cyclic rating will be sufficient to manage load to 2050.

### **Burnie-Smithton 110 kV reinforcement (Generation)**

The proposed BU-PL-ST corridor is estimated to have a non-firm rating up to 200 MVA, with the addition of the PL teed 110 kV supply arrangement and dynamic ratings providing an additional 20 MW and 40 MW respectively. Although supportive of small increments in generation development, the corridor capacity will not be sufficient to support the significant interest in wind development proposed to connect within the planning period.

Possible development options and staging have been considered in conjunction with Core Grid plan development in the North West area. In this long term development strategy it is proposed to support wind generation development to the 110 kV network by reinforcing the BU-PL-ST corridor with a third 110 kV circuit.

The strategy includes the development of this line as a 220 kV dual circuit tower line, strung one side in SULPHUR conductor at 75°C, operating at 110 kV. This will support Core Grid planning activity associated with significant wind development in the North West area and a 2<sup>nd</sup> Bass Strait Interconnector to Victoria.

The project is estimated at \$72M. The magnitude of expenditure and uncertainty on scope and timing dictate this project is considered as a Contingent Project in the 2019-24 regulatory period. This proposal has not been economically justified.

### **Wynyard Substation (Development)**

Although the Burnie and Port Latta load forecast suggest that this once considered development will not be required to 2050, it is proposed that an additional 110/22 kV connection point may be required to manage considerations outside the forecast (uncommitted developments) and to support 220 kV development west of Burnie due to transmission corridor constraints.

Wynyard is an urban community to the west of Burnie substation supplied by four 22 kV distribution feeders. The township hosts a number of light industrial customers, including the Fonterra milk processing facility. There are a number of uncommitted load developments proposed in this area in the order of 2-3 MW that could occur in the next 5 years. These developments may require reinforcement of the 22 kV network, including an additional feeder from Burnie or from Port Latta.

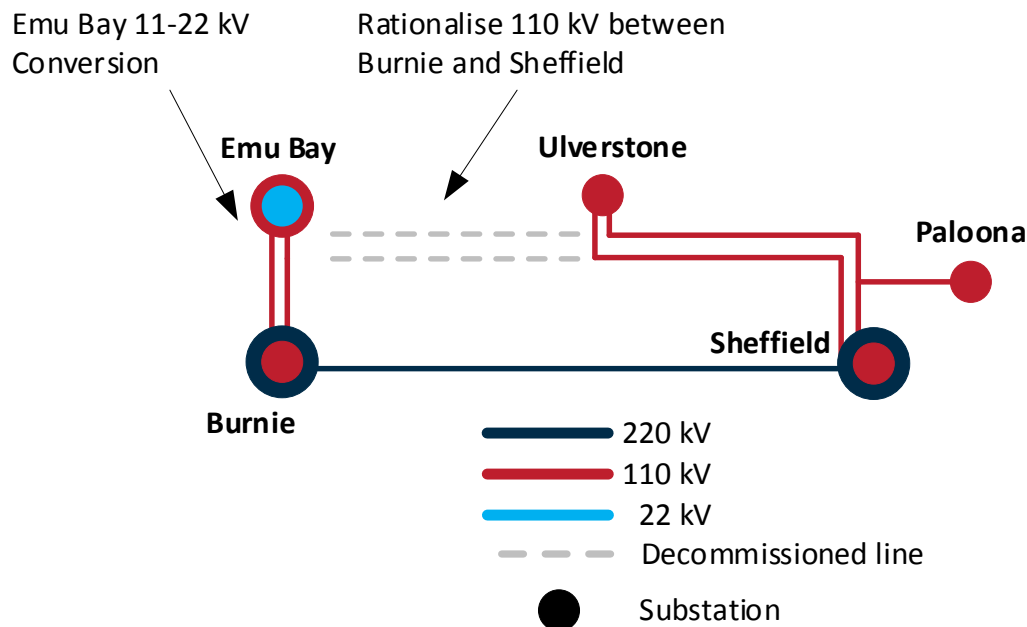
The transmission corridor west of Burnie is constrained. To facilitate the establishment of a Sheffield to North West Coast 220 kV transmission corridor (refer Core Grid planning area strategy), a number of 22 kV feeders that supply Wynyard will need to be relocated to allow widening of the transmission corridor.

Establishing a 110/22 kV substation (Potentially supplied via Port Latta) would better manage load development and reliability in Wynyard, and enable a large amount of 22 kV network to be removed rather than relocated. In this long term development plan, the connection point is supplied from the existing 110 kV network from Burnie.

### 3.2.2 Sheffield–Burnie locality

The committed and proposed projects in the Sheffield-Burnie locality within the period to 2050 are described in this section. The simplified long term development strategy for this locality is shown in Figure 5 below.

**Figure 5: Long term development strategy SH-BU locality**



#### Emu Bay 11-22 kV conversion (Renewal)

The substation protection and switchgear require condition based replacement. At this time the switchboard and connection point voltage will be converted to 22 kV, for which the transformers are capable. This is part of a development strategy to enable the removal of the isolated 11 kV network. The 11 kV reticulation won't be developed at this stage, however a number of 22/11 kV feeder connected Auto-transformers will be installed to maintain the 11 kV network. Future developments in this area will progress a conversion of the reticulation to 22 kV.

This project will support management of the existing Burnie 22 kV networks, and is scheduled to be completed prior to mid-2019.

#### Ulverstone 22kV Switchgear (Renewal)

The existing Ulverstone 22 kV switchgear are may require condition based renewal within the planning period. It is anticipated that a like-for-like replacement will be required to support existing distribution demand.

This project is estimated at \$1.9M and proposed to be completed in 2023.

#### Burnie Transformers (Renewal)

The existing Burnie supply transformers are 60 MVA units. Within the period to 2050 (2025) they may require condition based renewal. It is anticipated that if replaced, standard 60 MVA units will be installed, which will be sufficient to manage load to 2050. Depending on the available load transfers to Emu Bay and a Wynyard substation, smaller transformers may be considered.

#### Sheffield-Burnie 110 kV rationalisation (Development)

Although not required to manage load or generation constraints in this corridor, it is proposed to rationalise the 110 kV network along the Burnie-Sheffield corridor to support 220 kV development west of Sheffield due to easement and land acquisition constraints within the existing transmission 110 kV and 220 kV corridor.

The existing Emu Bay supply transformers are 38 MVA units. Within the period to 2050 they may require condition based renewal. It is anticipated that if replaced, standard 25 MVA units will be installed, which will be sufficient to manage load to 2050.

The committed and proposed projects in the Sheffield-Burnie locality within the period to 2050 are described in this section. The simplified long term development strategy for this locality is shown in Figure 6 below.

The diagram illustrates the proposed 22 kV network in the Sheffield area. A central substation, labeled 'Sheffield 22 kV semi-permanent Connection Point', is shown with a blue circle and a red dot. From this substation, several lines radiate outwards: a dark blue line to the left labeled 'To Burnie', a dark blue line to the bottom-left labeled 'To Farrell', a dark blue line to the bottom-right labeled 'To Palmerston', a dark blue line to the right labeled 'To George Town', and a red line to the right labeled 'To Railton'. A red line also extends upwards from the substation to a red dot labeled 'Devonport'. From 'Devonport', a red line goes to a blue dot labeled 'Wesley Vale'. An arrow points from the text 'Wesley Vale 11-22 kV Conversion' to the 'Wesley Vale' dot. Another red line extends from the substation to a red dot labeled 'Future Deloraine / Westbury'. An arrow points from the text 'Substation supply option to be determined' to this dot. A legend in the top-left corner identifies the line colors: dark blue for 220 kV, red for 110 kV, and light blue for 22 kV. A black circle represents a substation.

The Wesley Vale substation is currently being converted to 22 kV to support community reliability of the Port Sorell and Latrobe Urban communities that have historically performed below targets. It will be completed by mid-2018. Outcomes of this project that support the long term development plan include:

- Utilisation of a potentially stranded asset;
- Transfer capacity to/from Devonport Substation – supporting load and transformer activity at Devonport;
- Transfer capacity to/from Railton Substation – additional support for Railton substation demand growth beyond 2035.

A system spare 110/22 kV transformer for the north of the state will be stored at Sheffield Substation. Within the shorter term planning period, it is proposed to energise this transformer as a semi-permanent 22 kV connection point for the distribution network, which will support distribution community reliability targets.

By supplying the majority of the Railton feeders 85001 and 85003, it is expected that this will also assist in managing the Railton substation maximum demand through the planning period to 2035. Additional support from Sheffield 22 kV, Wesley Vale 22 kV, and the contributions from any large scale solar generation may further manage demand growth at the Railton site beyond 2035.

### **Railton Substation Capacity (Load)**

As discussed above, from 2035 the Railton substation will need additional support to manage demand growth according to the connection point forecast. This may be achieved by additional transfers to Sheffield and Wesley Vale, or through support from proposed large scale generation connections the area.

For the purposes of this long term development plan we have considered that the bulk of the demand growth is in the vicinity of Deloraine i.e. south, which is beyond the reach of the Sheffield and Wesley Vale connection points. Likely the growth in this area will exceed the capability of the existing 22 kV networks.

The Westbury area (discussed in the Northern planning area strategy) is located to the east of Deloraine, and supplied from Hadspen Substation. Demand growth in with region will influence any long term development plans for the Deloraine area.

The proposed strategy to manage growth in Westbury and Deloraine within the 15-year planning period is to reinforce the 22 kV networks from Railton, Hadspen and Palmerston. This includes upgrading the capacity of the existing feeders and establishing new feeders into these areas. When the available capacity at all these connection points is exhausted, it is proposed to establish additional transformation capacity between Deloraine and Westbury. However, a new substation connection point near Westbury is not considered technically or economically justified unless there is a material increase to the maximum demand forecast in the area, and therefore it is proposed that this may occur well outside the 15 year planning period. There are a number of options on how a new connection point may be supplied including:

- Railton 110 kV – redevelopment of the Needles line at 110 kV
- Railton 110 kV – using a combination of the Needles line and a redundant portion of the existing Palmerston-Sheffield 220 kV line
- Palmerston 110 kV – using a redundant portion of the existing Palmerston-Sheffield 220 kV line
- Palmerston 220 kV – using the existing Palmerston-Sheffield 220 kV line.
- Hadspen 110 kV – Extension of the Palmerston-Hadspen 110 kV following the Bass Hwy

For the purposes of this strategy we have not addressed the transmission supply arrangement.

### **Railton 22kV Switchgear (Renewal)**

The existing Railton 22 kV switchgear are may require condition based renewal within the planning period. It is anticipated that if replaced, an additional number of 22 kV bays will be included for feeder development from Railton substation to support growth at this site.

This project is estimated at \$1.9M and proposed to be completed in 2023.

### **Wesley Vale supply transformer (renewal)**

The Wesley Vale transformers have an assessed remaining life of at least 15 years to 2032. It is likely that these units will require replacement prior to 2050. It is proposed to replace these units with standard 25 MVA units.

### **Devonport supply transformers (Renewal)**

The existing Devonport supply transformers are 30 MVA units. Within the period to 2050 they may require condition based renewal. It is anticipated that if replaced, either standard 25 MVA units will be installed, or the transformers will be rationalised to two 60 MVA units, which will be sufficient to manage load to 2050.

## Railton supply transformers (Renewal)

The existing Railton supply transformers are 50 MVA units. Within the period to 2050 they may require condition based renewal. It is anticipated that if replaced, standard 60 MVA units will be installed, which will be sufficient to manage load to 2050, subject to available load transfers to Sheffield, Wesley Vale, and a future Deloraine/Westbury substation.

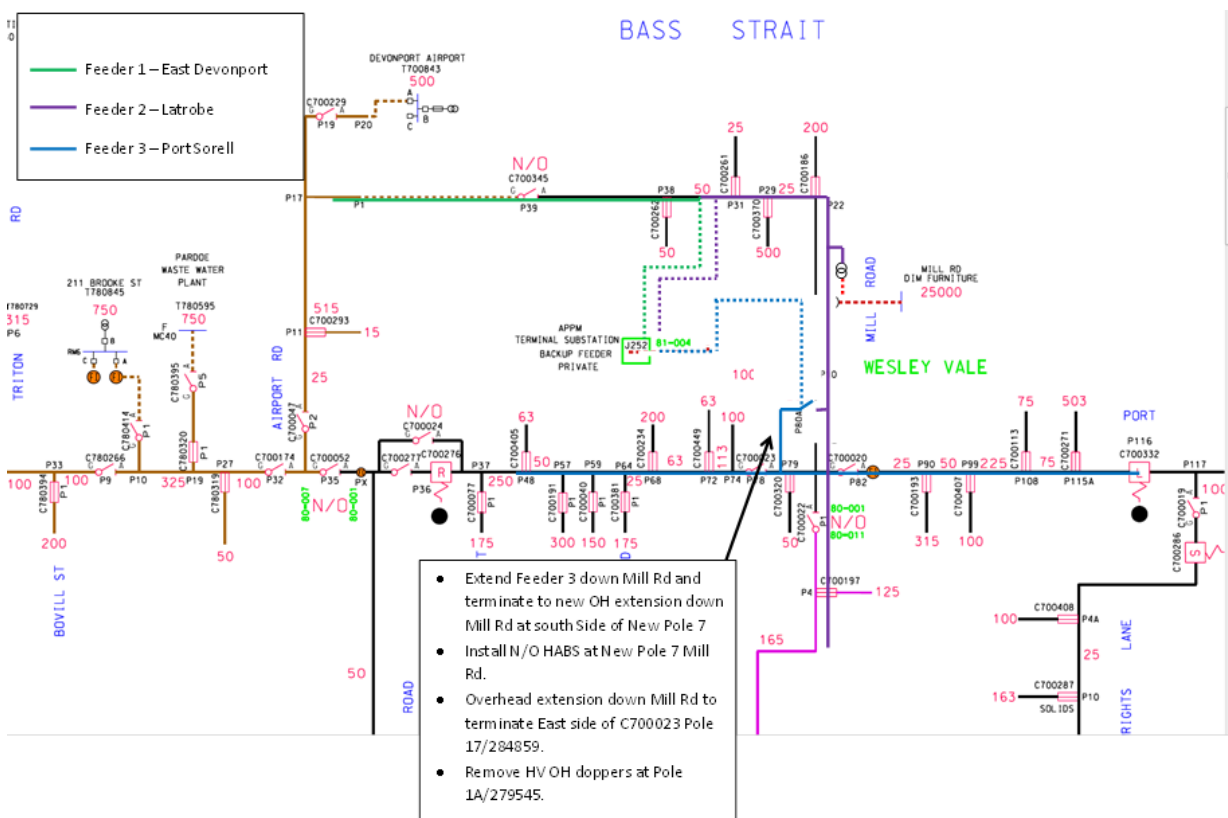
## 3.3 Distribution network supply vision

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 North West planning area, five distribution network supply vision have been identified.

### 3.3.1 Port Sorell (Wesley Vale)

The Port Sorell community is supplied from Devonport feeders 80001 and 80011. This township has grown significantly in previous years, and has represented a challenge for Distribution Operations to manage. The conversion of Wesley Vale Substation, discussed in Section 4.1.1 will support reliability and growth in this community.

**Figure 7: Proposed Wesley Vale 22 kV feeder configuration**



### 3.3.2 Deloraine (Needles Line)

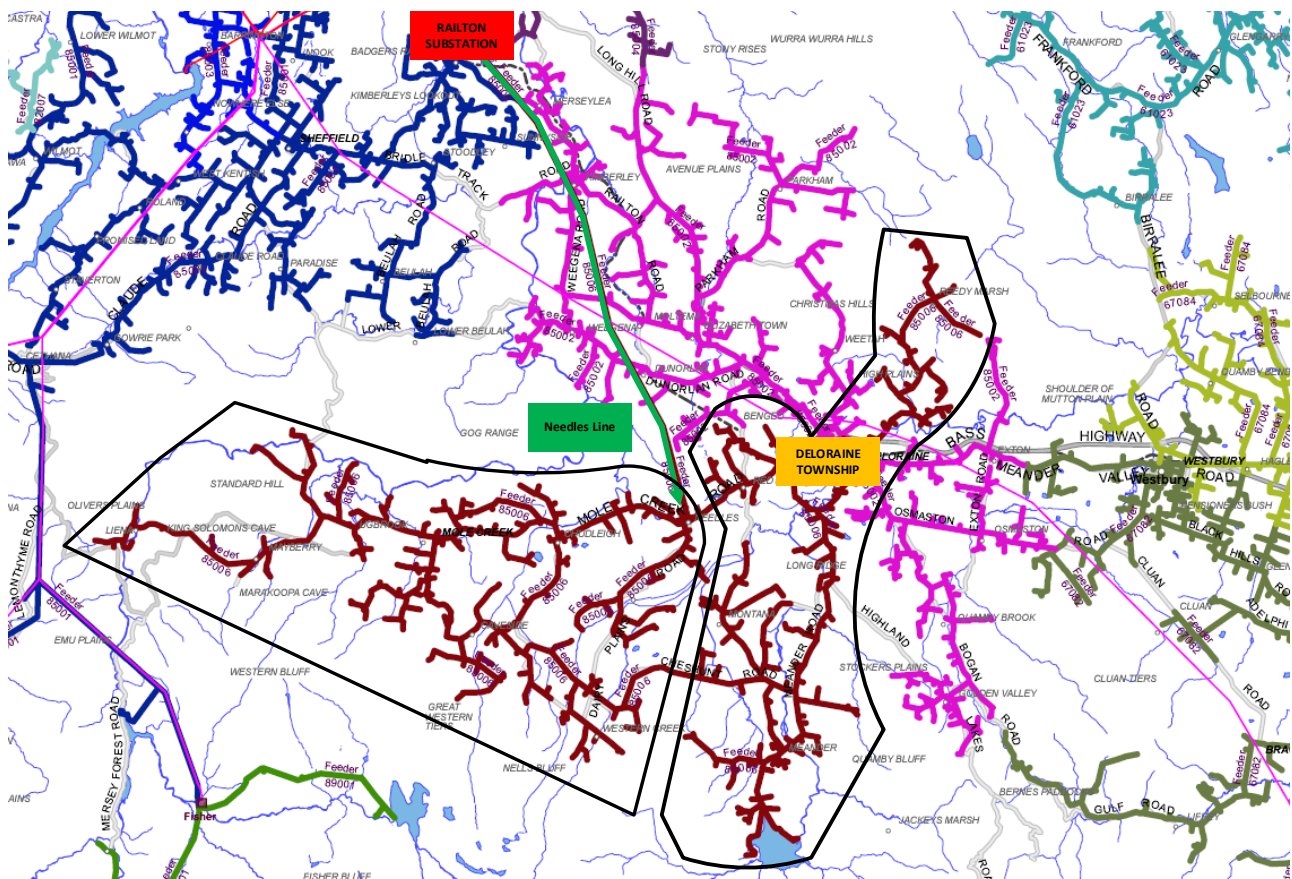
Deloraine is an Urban community supplied by Railton feeders 85002 and 85006. These feeders supply a large regional area and can be challenging to support during adverse weather events, which ultimately impacts reliability performance to Deloraine.

Prior to an additional substation being established between Deloraine and Westbury (+2035-50) it is proposed to manage these networks by splitting the two circuits into three. It is proposed to achieve this by splitting the Needles line (ex 88 kV Railton-Waddamana line operating as a dual ckt 22 kV line on 85006) into two separate circuits.

The conductor on the Needles line is 19/0.083 Cu. When operating as two separate lines the voltage drop at peak loading will exceed 10%. As such it is proposed to operate these sections as voltage regulator ended sub-transmission lines, allowing up to 15% voltage drop.

By splitting the two feeders into three, it is expected that the reliability performance of the relevant communities will improve as a result of reduced exposure per feeder.

**Figure 8: Proposed split feeders from the Needles line (85006)**



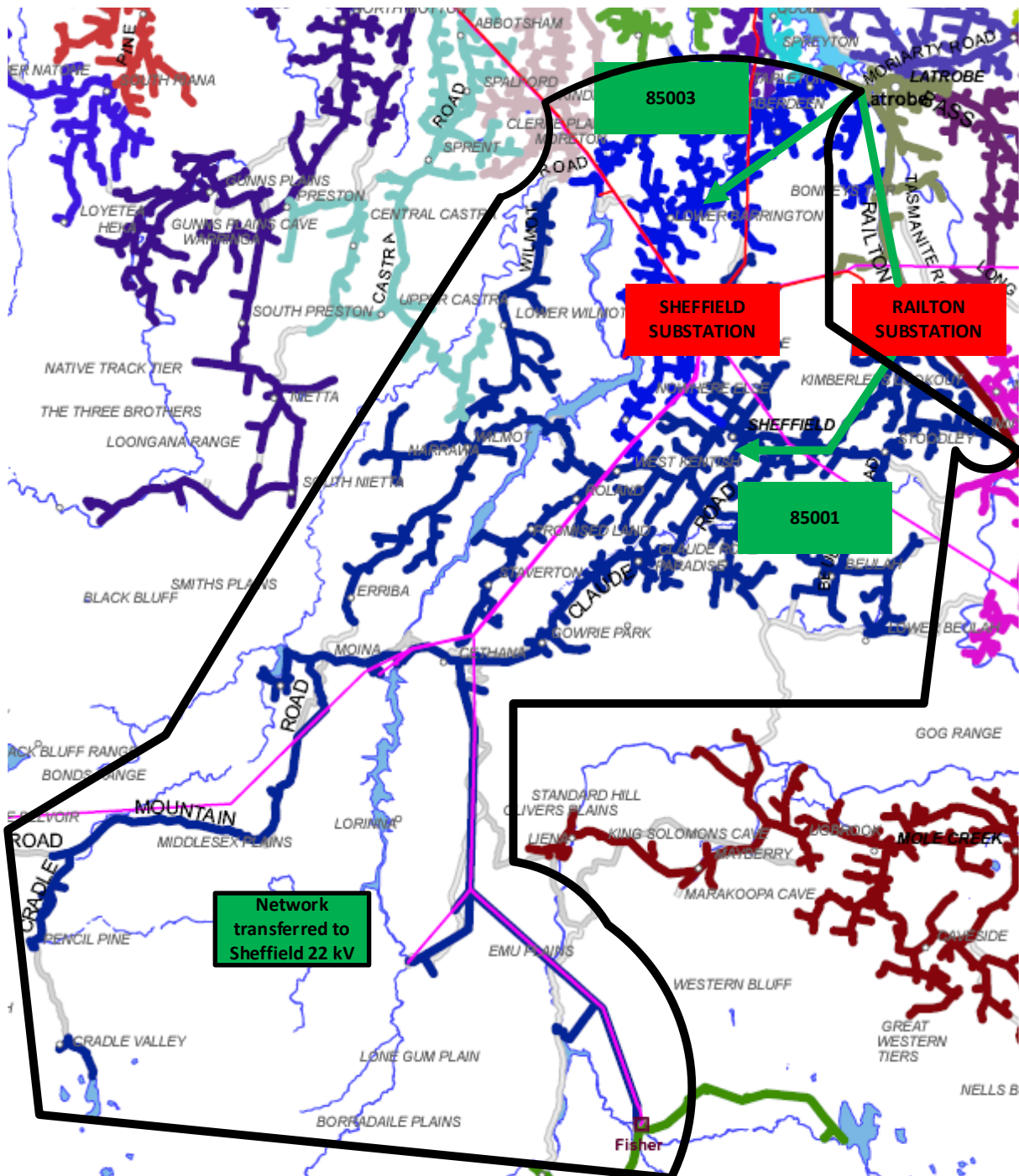


### 3.3.3 Sheffield (Sheffield 22 kV)

Sheffield is a Large township surrounding the Sheffield Substation. This community is supplied by Railton 85001 and supported by Railton feeder 85003, both of which are a long distance from Railton. Feeder 85001 goes onto supply Cradle Mountain and Fisher Power Station.

It is proposed to establish a 22 kV connection point at Sheffield by mid-2022. Once completed it is expected that the reliability performance of the relevant communities will improve as a result of reduced exposure per feeder.

**Figure 9: Proposed network transferred to Sheffield 22 kV connection point**



### 3.3.4 Burnie CBD

the CBD of Burnie is an isolated 11 kV network supplied by Emu Bay substation. This network cannot be supplied by the neighbouring 22 kV network from Burnie Substation, and vice versa. Burnie CBD development has been relatively slow in previous years and with the closer of the paper mill, Emu Bay substation has a large amount of spare capacity.

The long term plan is to transition the 11 kV reticulations to 22 kV. The conversion of Emu Bay Substation as part of an asset renewal development, discussed in Section 4.1.1 will enable this strategy to commence.

It is proposed that any new developments be connected directly off the converted Emu Bay 22 kV connection. Refer Figure 10.

### 3.3.5 Burnie Wynyard

Wynyard is supplied by a number of long 22 kV feeder from Burnie Substation. This township supports a number of commercial and industrial customers, including a milk processing site at Fonterra. Small growth is expected to be managed through reinforcement of the existing 22 kV feeder networks from Burnie. Longer term it is expected that an additional 22 kV connection point will be required. This may be triggered by a combination of localised development in Wynyard, and a need to relocate significant 22 kV feeder sections that supply Wynyard to allow an expansion of the 220 kV transmission network from Sheffield. Refer the Core Grid planning area strategy.

## 4 Planned investments and forecast limitations

This section presents the planned investments and forecast limitations in the North West 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 Wesley Vale 11-22 kV Conversion (Reliability / Utilisation)

##### Limitation overview

The distribution networks in the surrounding area of Wesley Vale Substation, including the Port Sorell urban community, operate at 22 kV from Devonport and Railton substations. These networks cover large areas, with coastal and/or rural exposure, and have experienced below target performance in recent years. Reinforcement of the 22 kV networks in these areas are challenging due to the large distances and limited feeder bays in existing substations.

The Wesley Vale Substation is closer to the load centre of the Port Sorell urban community than the existing substations that supply the area. Accordingly reliability of the area can be improved, by utilising the Wesley Vale Substation and building shorter feeders from this site.

The Wesley Vale Substation site was initially constructed to supply a directly connected transmission network customer, who terminated operations in 2010. This substation has two 110/11-22 kV transformers, having firm capacity of 25 MVA. Currently the substation is supplying a single distribution customer in 'care and maintenance' at 11 kV; with a demand of less than 0.5 MW since 2012, resulting in a very low utilisation of these substation assets over a number of years.



As per the condition assessment report (R146002), the Wesley Vale transformers have a remaining life of at least 15 years, from 2012. Furthermore, the high voltage switchgear currently operating at 11 kV was built in 2005, and designed for 24 kV. Accordingly, Wesley Vale substation can be converted into a 110/22 kV substation with minimal investment, providing an improvement in reliability the surrounding distribution supply areas, and increased utilisation of the assets at this site.

### **Limitation Deferral**

This project is driven by distribution reliability. Load deferral at this stage of the project is not practical.

### **Committed Solution**

Convert Wesley Vale Substation to 22 kV connection point, establish three 22 kV feeders from Wesley Vale Substation to the existing feeder 80001 and install 22 kV to 11 kV transformer for the existing customer. That would improve the utilisation of the existing assets at Wesley Vale Substation.

The project is budgeted at \$1.62m and will be completed by mid-2018. Outcomes of this project that support the long term development plan include:

- Utilisation of a potentially stranded asset;
- Transfer capacity to/from Devonport– supporting load and transformer activity at Devonport;
- Transfer capacity to/from Railton Substation – additional support for Railton substation demand growth beyond 2035.

## **4.1.2 Emu Bay 11-22 kV conversion (Renewal)**

### **Limitation Overview**

The existing Emu Bay substation supplies an isolated 11 kV system to the east of the Burnie 22 kV network as shown in Figure 5 below. Historically this site was considered to convert to 22 kV to support the Burnie 22 kV network that was forecast to exceed station capacity. Under the connection point forecast this constraint doesn't occur within the 15 year period or long term planning period to 2050.

The Switchgear and Protection systems are however scheduled to be renewed in the current period. At this time it is proposed to convert the Emu Bay station to 22 kV as an opportunity investment to facilitate changes in the forecast.

### **Limitation Deferral**

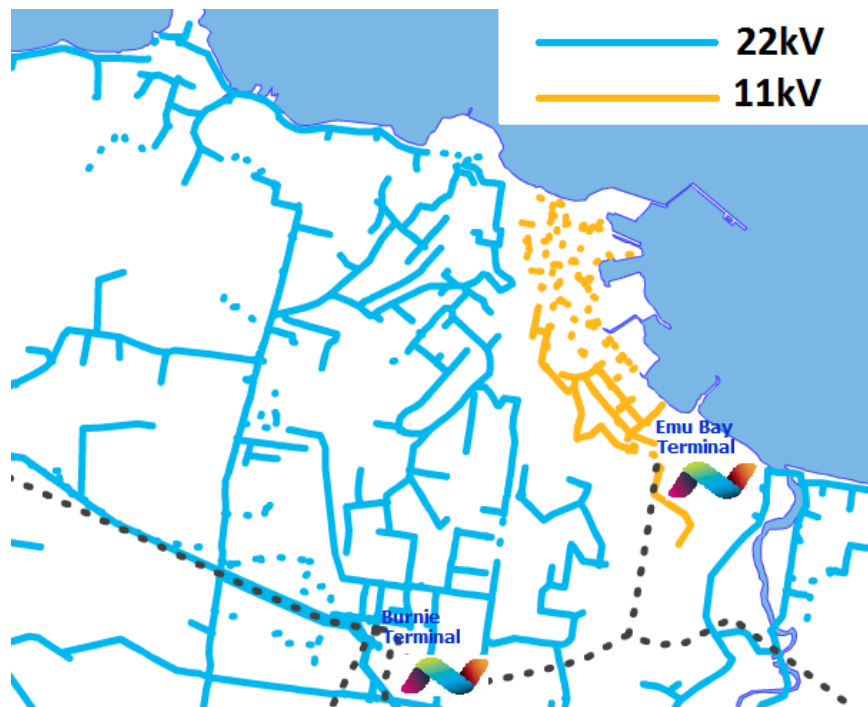
This project is being driven by renewal activity. Load deferral at this stage of the project is not relevant.

### **Proposed Solution**

The Protection and Switchgear require condition based replacement. At this time the switchboard and connection point voltage will be converted to 22 kV, for which the transformers are capable. This is part of a development strategy to enable the removal of the isolated 11 kV network. The 11 kV reticulation wont be developed at this stage, however a number of 22/11 kV feeder connected Auto-transformers will be installed to maintain the 11 kV network.

Future developments in this area will progress a conversion of the reticulation to 22 kV. For example, any committed development requiring upstream augmentation will connect to the 22 kV network as appose to the 11 kV.

The estimated augmentation cost (feeder connected Auto-transformers) is estimated at \$2m, and is scheduled to be completed prior to mid-2019.

**Figure 10: Burnie/Emu Bay supply arrangements**

### 4.1.3 Port Latta 110 kV supply (Generation)

#### Limitation Overview

The Port Latta Substation is supplied as a loop-in/out arrangement on the BU-PL-ST 110 kV line. At times of high generation from the existing Woolnorth wind farm, this circuit and the BU-ST circuit have unbalanced loading, restricting the available capacity of this corridor.

Additionally, for faults on the BU-PL segment, the resulting fault level at the Port Latta site drops significantly with the increase in network impedance.

#### Proposed Solution

TasNetworks proposed to resupply the Port Latta substation as a double teed arrangement from the BU-ST lines, including associated protection modifications at Port Latta, Smithton and Burnie. The development will create two three-three ended transmission lines between BU and ST, balancing the network loading and impedance; enable more capacity out of the existing corridor (up to 20 MW) for additional renewable generation energy and development into the market.

This project is estimated at \$2m and is proposed to be completed by mid-2019.

### 4.1.4 Smithton Weather Station (Generation)

#### Limitation Overview

The existing BU-PL-ST corridor uses workbook line ratings in conjunction with a run-back scheme to allow the corridor to operate up to 90% of the total corridor capacity i.e. non-firm. At time of high generation from the existing Woolnorth wind farm, the corridor can become heavily loaded, resulting in the wind farm being constrained to a lower output.

With the addition of the proposed wind generation connections at Port Latta and Smithton detailed in Section 3.1.2, the times that the corridor will become constrained will increase.

### Proposed Solution

A weather station is proposed to be installed at Smithton to provide highly accurate weather information that will enable the run-back scheme to use dynamic line ratings. This is expected to increase the line capacity at times of high winds in the order of 40 MW.

This project is estimated at \$0.3m and is proposed to be completed by mid-2019.

### 4.1.5 Port Latta feeder 94002 under voltage

#### Limitation Overview

The far south extremities of Port Latta distribution feeder 94002 are below the allowable limits at times of peak load as per the Tasmanian Electricity Code (TEC). This exists under current loading conditions and will be exacerbated by further load growth.

#### Limitation Deferral

The limitation could be managed through demand management activities in the order of 500 kW per annum.

#### Proposed Solution

The construction of a new open delta regulator at Montumana has been proposed to relieve the constraint. Studies have been completed which confirms this being a viable option. No other options have been considered at this stage however the investigation is ongoing.

This proposed solution provides additional transfer capacity between the Port Latta and Burnie 22 kV networks near Wynyard.

## 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 Sheffield 22 kV Connection Point (Reliability / Load)

### Limitation Overview

The distribution reliability performance of the Railton Rural and Meander Valley Rural communities has historically been poor— currently, excluding Major Event Days (MEDs) the 5 year average performance is ok, however, in consideration to actual performance (including MEDs), the performance is poor.

These networks are supplied from Railton feeder 85001 and 85003. The performance is largely related to the exposure of the overhead networks that cover large service areas, and travel challenges with feeder patrols and fault response.

### Limitation Deferral

This project is driven by distribution reliability.

### Proposed Solution

A system spare 110/22 kV transformer for the north of the state will be stored at Sheffield Substation within the current regulatory period. It is proposed to energise this transformer as a semi-permanent 22 kV connection point for the distribution network, which will support distribution community reliability targets.

By supplying the majority of the Railton feeders 85001 and 85003, it is expected that this will also assist in managing the Railton substation maximum demand through the planning period to 2035. Additional support from Sheffield 22 kV, Wesley Vale 22 kV, and the contributions from any large scale solar generation may further manage demand growth at the Railton site beyond 2035.

## 4.2.2 Deloraine (Needles Line)

### Limitation Overview

The distribution reliability performance of the Railton Rural and Meander Valley Rural, and Deloraine Urban communities have historically been poor – currently, excluding MEDs the 5 year average performance is trending within targets, however, in consideration to actual performance (including MEDs), the performance is poor.

These networks are supplied from Railton feeder 85002 and 85006. The performance is largely related to the exposure of the overhead networks that cover large service areas, and travel challenges with feeder patrols and fault response.

### Limitation Deferral

This project is driven by distribution reliability.

### Proposed Solution

It is proposed to manage these networks by splitting the two feeders 85002 and 85006 into three. It is proposed to achieve this by splitting the Needles line (ex 88 kV Railton-Waddamana line operating as a dual cct 22 kV line on 85006) into two separate circuits.

The conductor on the Needles line is 19/0.083 Cu. When operating as two separate lines the voltage drop at peak loading will exceed 10%. As such it is proposed to operate these sections as voltage regulator ended sub-transmission lines, allowing up to 15% voltage drop.

By splitting the two feeders into three, it is expected that the reliability performance of the relevant communities will improve as a result of reduced exposure per feeder.

The main investment for this project is the installation of an additional voltage regulator at the end of the existing Needles line. This project is estimated at \$0.3M and proposed to for 2024.

## 5 Network opportunity

The North West 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 result in other augmentation work required for capacity increases deeper in the transmission network or for network security or reliability reasons.

Table 5 shows the available firm capacity at each connection point substation now and at the end of the planning period where redundancy is available.

**Table 8: Available substation capacity (MVA)**

Substation	Firm capacity (MVA)	Existing		2032	
		Demand	Available capacity	Forecast demand	Available capacity
Burnie	60	58.3	1.7	52.0	8.0
Devonport	60	47.9	12.1	46.8	13.2
Emu Bay	38	8.8	29.2	7.3	30.7
Port Latta	22.5	19.5	3.0	20.6	1.9
Railton	50	52.9	0.0	56.0	0.0
Smithton	35	23.3	11.7	23.9	11.1
Sheffield	25 <sup>6</sup>	-	-	11.3	13.7
Ulverstone	45	27.3	17.7	23.3	21.7
Wesley Vale	25	13.4	11.6	13.4	11.6

<sup>6</sup> Sheffield will have a single supply transformer (non-firm only)

## Appendix A – Area capability information

**Table 9: Existing Assets**

Terminal Substations				
Substation	Number of Transformers	Transformer MVA	Transformer Primary Voltage	Transformer Secondary Voltage
Burnie	2	120	110 kV	22 kV
Devonport	3	90	110 kV	22 kV
Emu Bay	2	76	110 kV	11 kV
Port Latta	2	45	110 kV	22 kV
Railton	2	100	110 kV	22 kV
Smithton	2	70	110 kV	22 kV
Ulverstone	2	90	110 kV	22 kV
Wesley Vale	2	50	110 kV	22 kV

**Table 10: Transfer capability**

North West Planning Area		From							
		Burnie	Devonport	Emu Bay	Port Latta	Railton	Smithton	Ulverstone	Wesley Vale
To	Burnie				3.9			6.8	
	Devonport					8.7		10.3	
	Emu Bay								
	Port Latta	8.8					5.1		
	Railton		5.1					3.4	
	Smithton				3.9				
	Ulverstone	8.8	6.3			4.4			
	Wesley Vale								