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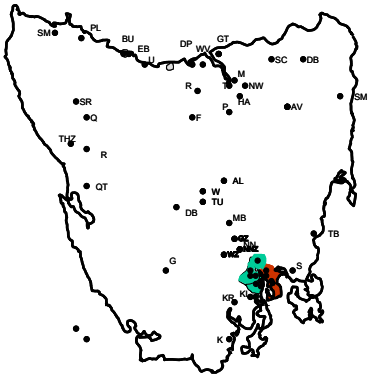

HOBART WEST

DEVELOPMENT PLAN

REV NO.	DATE	REVISION DESCRIPTION	APPROVALS	
0		Working Draft	Prepared by	
			Reviewed by	
			Approved by	

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1. EXECUTIVE SUMMARY

The Hobart-West (HW) planning area consists of the region west of the Derwent River, from Lower Taroona in the South to Bridgewater in the North, including the Hobart CBD and the city of Glenorchy.

HW is considered a medium growth area, recording a growth rate of 2-3% pa in 2009. The area contains a mixture of commercial, industrial and urban residential load.

Growth in the HW planning area is naturally constrained by Mount Wellington to the west, and the Derwent River to the east. As a result the bulk of load growth is due to consolidation of existing areas rather than development of new areas.

To facilitate the current and forecast load, the HW planning area maintains both a subtransmission network at 33 kV and distribution network at 11kV, incorporating a number of local distributing zone substations. HW is one of only two planning areas to accommodate such a network including 61,007 connected customers supplied by 9 11 kV substations and 1,150 km of OH and UG circuit.[1]

The identified or known large constraints are as follows:

- Bridgewater Terminal Substation is expected to exceed its firm capacity in 2012. In addition the 5 year plan identifies four feeders that exceed their planning rating during this period. These feeders include 48188, 48190 and 48191 that supply Brighton and 48182 that supplies Old Beach.

- The 5 year plan for the Chapel St. Substation identifies five feeders that exceed their planning rating during this period. These feeders include 20535 and 20547 that supply West Moonah, 20541 that supplies Berriedale, 20548 that supplies Lenah Valley and 20552 that supplies Montrose.

- Claremont Zone Substation is currently in excess of its firm capacity as of 2009. Also the Claremont transformers are due to be replaced in 2019/20.

- Creek Road Terminal Substation is expected to exceed its firm capacity in 2015.

- The Derwent Park Substation is expected to exceed firm capacity in 2012 and this is planned to be rectified with the transformer replacement in 2014/15.

[1] Data available in NW-#30146137-Feeder Data for Development Plans.

- The 5 year plan for the East Hobart Substation identifies one feeder that exceeds its planning rating during this period. This feeder is 14068 that supplies the Hobart Waterfront.

- The New Town Substation is expected to exceed its firm capacity in 2016.

- The North Hobart Terminal Substation is expected to exceed firm capacity in 2014. In addition the 5 year plan identifies two feeders that exceed their planning rating during this period. These feeders are 18131B that supplies the Hobart CBD and 18143B that supplies West Hobart.

- The 5 year plan for the Sandy Bay Substation identifies three feeders that exceed their planning rating during this period. These feeders include 12018 that supplies Mt. Nelson, 12019 that supplies Sandy Bay and 12036 that supplies the University.

- The 5 year plan for the West Hobart Substation identifies two feeders that exceed their planning rating during this period. These two feeders are 13045 that supplies South Hobart and 13055 that supplies Dynnyrne.

To address the above constraints the following is being proposed:

- Austins Ferry Zone Substation is proposed for 2016. This should reduce the load on the Claremont and Bridgewater Substations and ensure that they do not exceed their firm ratings.

- A new feeder in Bridgewater is being planned to relieve the congestion on the feeders that supply north in the Brighton area.

- The forecasted overloads on feeders 20547 and 20548 from Chapel St. have been recognised by Aurora and projects have been planned to address these limitations. Load transfers will be completed to address the limitations on feeders 20535, 20541 and 20552.

- The limitation on feeder 18143B from North Hobart will be addressed by the Aurora project to establish two new feeders from the West Hobart Substation to the west side of the CBD. Load transfers will address the limitation on feeder 18131B.

- The limitations on the two West Hobart feeders will be addressed by load transfers.

- With the planned reinforcement of the Salamanca and wharf areas in 2010/11 the loads on the East Hobart feeders will be reduced.

- To overcome the overloaded feeders in Sandy Bay a number of projects are planned. There are plans to extend Feeder 12034 to cut in and split the University HV ring. A new feeder has also been planned which should

split the network in the Sandy Bay residential area. Load transfers will also be used to reduce the overloads.

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2. STRATEGIC PLAN

HW will continue the development of a radial 33 kV subtransmission network and a highly interconnected 11 kV distribution network. Only 33 kV Major Injection Points will be encouraged with bulk load distributed at Aurora owned 33/11 kV zone substations.

The existing distribution arrangement of both an 11 kV Major Injection Point and Aurora owned 33/11 kV zone substations will co-exist for the foreseeable future.

Highly interconnected Low Voltage reticulation will continue to develop at 433V.

Embedded Generation options will be encouraged at the 11 kV and 433V connection points.

Demand Side Management solutions will be encouraged to reduce system peaks and defer large system upgrades where possible. Technologies to be implemented to limit the growth in demand to include:

- Communications infrastructure to customer installations to facilitate;

  - Hot water load control;
  - Load moderation utilising smart domestic appliances;
  - Load curtailment in commercial installations;
- Embedded/distributed generation and energy storage;
  - Close liaison with Tas Gas for generation opportunities;
  - Standby peak shaving generation;
  - Combined heat and power generation options; and
  - Modern network connected battery storage.
- Smart grid development;
  - Auto-reconfiguration and short-term dynamic ratings;

3. EXISTING SYSTEM

3.1 Substations

The HW planning area has a number of Transend owned major injection points and Aurora owned zone substations as follows:

Note: hyperlinks in the section below will display the power circuit one-line diagram from Transend's Operational Diagram System.

Transend owned substations

- Bridgewater – (*click here to see the 110/11kV single line diagram*)
- Chapel St – (220/110/11kV)
- Creek Rd – (110/33kV)
- North Hobart – (110/11kV)
- Risdon – (110/33/11kV)

Aurora owned substations

Details of drawings including single line diagrams of Aurora zone substations are available in NW-#284367-Aurora Zone and Terminal Sub Drawing Register from QDMS.

- Claremont 33/11kV, 2x 22.5 MVA Zone (click to see the single line diagram)
- Derwent Park 33/11kV, 2x 15 MVA Zone (click here to see the metering and protection single line diagram)
- East Hobart 33/11kV, 3x 30 MVA Zone (click here to see the single line diagram)
- New Town 33/11kV, 2x 22.5 MVA Zone (click here to see the single line diagram)
- Sandy Bay 33/11kV, 3x 30 MVA Zone (click here to see the single line diagram)
- West Hobart 33/11kV, 3x 30 MVA Zone (click here to see the single line diagram)

Risdon 110/33 kV supplies Derwent Park, New Town, and East Hobart Zones.

Creek Road 110/33kV supplies Claremont, Sandy Bay, and West Hobart Zones.

3.2 Supply Network

The supply network in the Hobart West development area incorporates two HV levels:

- 33 kV Subtransmission; and
- 11 kV Distribution.

Although the 33 kV subtransmission network in HW is limited to radial, transformer-ended feeders with no interconnectivity, there are strong 11 kV interconnections and transfer capability between the 110/11 kV and 33/11 kV substations.

3.3 Network Statistics

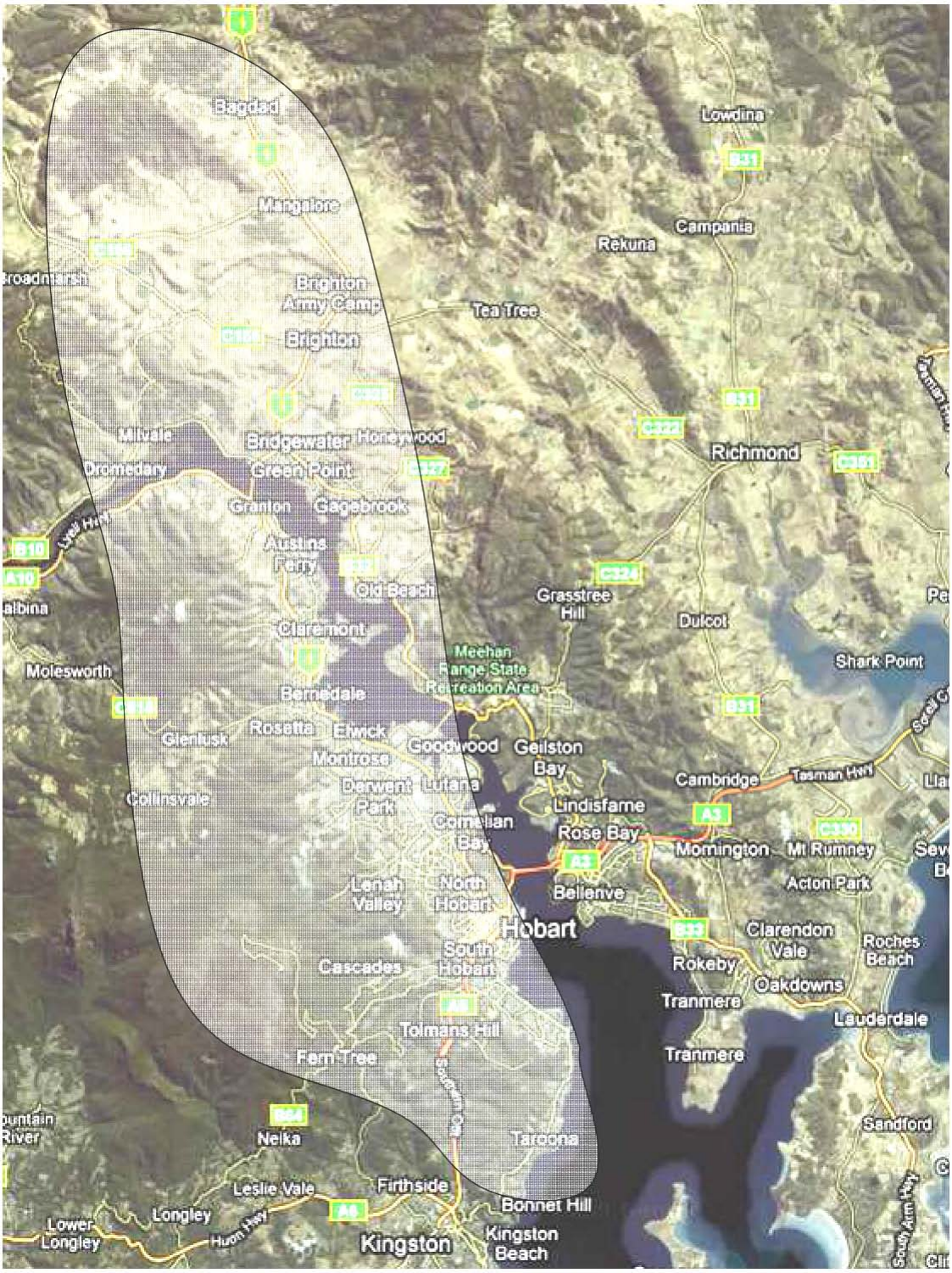
HW area network statistics [2]

11kV circuit length	1,054	km
Connected customers	67,007	
Connected transformer capacity	748,305	kVA
Customer density	58	per 11kV circuit km
Transformer capacity density	710	kVA per 11kV circuit km

[2] Data sourced from Gtech, query DISTFDR. See NW-#30146137-Feeder Data for Development Plans.

3.4 Geographic Area

The map below shows the geographic area referred to as Hobart West.



4. LOCAL PLANNING ISSUES

4.1 Long Term System Strategy

HW will continue the development of a radial 33 kV subtransmission network and a highly interconnected 11 kV distribution network. Only 33 kV Major Injection Points will be encouraged with bulk load distributed at Aurora owned 33/11 kV zone substations.

The existing distribution arrangement of both Transend owned 11 kV Major Injection Points and Aurora owned 33/11 kV zone substations will co-exist for the foreseeable future.

Highly interconnected Low Voltage reticulation will continue to develop at 433V.

Embedded Generation options will be encouraged at the 11 kV and 433V connection points.

Demand Side Management solutions will be encouraged to reduce system peaks and defer large system upgrades where possible.

4.2 Local Government Authorities

For planning purposes, Aurora consults closely with the following local government authorities in the HW planning area: Hobart, Glenorchy, Kingborough and Brighton councils;

- Department of Infrastructure, Energy and Resources (DIER); and
- Southern Water Tasmania.

Each council has its own planning schemes and strategic plans for their area.

4.3 Existing Critical Loads

HW planning area has a large number of existing critical loads requiring a higher level of supply security or a limit to operational flexibility. Table 1 below details critical loads in the HW planning area:

Load Type	Description	Substation(s)	Feeder(s)	Asset Connection Point(s) - if applicable

Load Type	Description	Substation(s)	Feeder(s)	Asset Connection Point(s) - if applicable
Commercial / Major Retail	Hobart CBD	North Hobart West Hobart East Hobart	18131 18132 18133 18141 18142 13044 13048 14069 14070	
	Northgate, Glenorchy	Chapel St.	20540	T161706
	Moonah CBD & Derwent Park	New Town Derwent Park	16093 17103 17107 17108 17109	
	North Hobart: restaurants etc.	North Hobart	18134 18141	
	Salamanca	West Hobart East Hobart	13052 13053 14067	
Entertainment	Federation Concert Hall	East Hobart	14060	T10718
	Derwent Entertainment Centre	Derwent Park	17103	T171827
	Casino & Convention Centre	Sandy Bay	12037	T121209 T121541
	Elwick Racecourse	Derwent Park	17101	T172739
Medical	Royal Hobart Hospital	East Hobart North Hobart	14060 18132B 18133A	
	Hobart Private Hospital	"	"	
	Hobart Day Surgery	West Hobart	13043	T131744
	St Helens Private Hospital	West Hobart	13054	T111432
	Calvary[1]	North Hobart	18135	T141648 T142575

Load Type	Description	Substation(s)	Feeder(s)	Asset Connection Point(s) - if applicable
	St. Johns	West Hobart	13055	T131370
Nursing Homes & Rehabilitation Services	Mary's Grange	Sandy Bay	12030	T120912
	Vaucluse Gardens	West Hobart	13055	T131006
	Glenview Community Services	Derwent Park	17103	T152242
	Southern Cross Care Guilford Young Grove	Sandy Bay	12019	T121306
	Southern Cross Care Rosary Gardens	New Town	16098	T142276
	Southern Cross Care Sandown	Sandy Bay	12019	T122298
	St Ann's Homes Davey Street	West Hobart	13056	T132646
	The Gardens, Claremont	Claremont	21081	T202234
	The Mary Ogilvy Homes Society	North Hobart	18144	T180907
	Uniting Aged Care Queenborough Rise	Sandy Bay	12019	T122758
	Uniting Aged Care Strathaven	Chapel St.	20541	T161438
	Uniting Aged Care Strathglen	Chapel St.	20541	T201046
	Barrington Aged Care Services	New Town	16098	T181123
	Palliative care – Whittle Ward	West Hobart	13053	
	Palliative care – South	West Hobart	13053	
Industrial	Cadbury	Claremont	21083 21084	
	Nyrstar		?	
	Cascade Brewery	West Hobart	13045	T131060 T131480
	Port Authority	East Hobart	14062	T100770
Sewerage and Water Treatment Plants	Bagdad	Bridgewater	48190	T520093
	Brighton	Bridgewater	48190	T520274
Education	University of Tasmania	Sandy Bay	12036	
	Polytechnic – Drysdale Campus, Collins St.	North Hobart	18142B	T101431

Table 1 - Hobart West Critical Loads

1 – The Calvary supply is being augmented, see Proj00025 in: NW-#30136340-December 2010 Issued - Network POW - FY11-12

Improvements to supply security for the above connections and supply areas are encouraged.

4.4 Future Developments and Restrictions

- Council planning schemes

4.4.1 Hobart City

The Hobart City Council (HCC) covers the Hobart CBD and from New Town in the north, to Sandy Bay in the south. The Hobart City Council has adopted a 2025 Strategic Framework, which outlines the vision and future direction for the Hobart local government area. The council has also adopted a strategic plan for 2008 - 2013 to identify the priority actions that will work towards the 2025 community vision for Hobart.

The proposed future direction of the HCC are identified in the following statements:

- Offers opportunities for all ages and a city for life
- Is recognised for its natural beauty and quality of environment
- Is well governed at a regional and community level
- Achieves good quality development and urban management
- Is highly accessible through efficient transport options
- Builds strong and healthy communities through diversity, participation and empathy
- Is dynamic, vibrant and culturally expressive

The HCC has also released a 2009 planning scheme. This document divides the Hobart local government area into a number of zones and defines the type of development allowed in each zone (e.g. residential, industrial, mixed use).

The municipality of Hobart is covered by three planning schemes; the City of Hobart Planning Scheme (CHPS), the Sullivans Cove Planning Scheme (SCPS) (administered by the Sullivans Cove Waterfront Authority) and the Battery Point Planning Scheme (BPPS).

The planning schemes set out policies and requirements for the use, development, protection and conservation of land within the municipality.

Hobart City Council Planning Schemes

The current planning schemes in these three areas are from 1982, 1997 and 1979 respectively. A draft-planning scheme was released in 2009 and can be seen from the link below.

Draft City of Hobart Planning Scheme 2009

4.4.2 Glenorchy City

The Glenorchy City Council has adopted a strategic plan for 2009-2014 which outlines the values and mission of the council. It has also released a planning scheme that defines the type of development allowed in the local government area, as well as proposed future areas of urban development.

A copy of the Glenorchy Planning Scheme is available from the following link.

Glenorchy City Council Planning Scheme

4.4.3 Kingborough

The Kingborough council planning scheme is a performance based planning scheme and incorporates the following principles

- A focus on performance standards in assessing use or development;
- Greater flexibility through Use Classes to assess applications for use or Development based on merit;
- Land use zonings based on a ten year time frame for effective regulation of use
- Or development, having regard to likely development pressures and infrastructure capacity.

A copy of the Kingborough Planning Scheme is available from the following link.

Kingborough Council Planning Scheme

4.4.4 Brighton Council

The Brighton Council intends to establish residential growth within existing settlement areas. Growth is proposed to be via infill within the existing townships and suburbs to take advantage of existing infrastructure. Green field development will be limited to Tivoli Green, Old Beach and Brighton. The council intends to promote Brighton as the regions primary industrial location.

A copy of the Brighton Planning Scheme is available from the following link.

Brighton Council Planning Scheme

4.5 Proposed Plans and Developments

Zone/Terminal	Feeder	Project No.	Conceptual Plan	CPA	Scope	TX No.	Street	Note
North Hobart	18132B	00024	NW-#30081089		NW-#30090937	T101103		
	18133A	00024	NW-#30081089		NW-#30090937	T101637	Collins St	
	18136	00070	NW-#30077863			T140557	New Town Rd Clare St	
	18144	00069	NW-#30077833			T190810	Federal St Argyle St	
Meadowbank	45002	00022	NW-#30078249				Highland Lakes Rd	
Bridgewater	48190	00022	NW-#30078249				Highland Lakes Rd	
Claremont	21081	00304	NW-#30004561	NW-#30173178	NW-#30173030	T201205	Box Hill Rd Bilton St	
	21082	00026	NW-#30081826		NW-#30092917 NW-#30092897	T201316	Abbotsfield Rd Box Hill Rd	
	21083	00304	NW-#30004561	NW-#30173178	NW-#30173030	T201205	Box Hill Rd Bilton St	
East Hobart	14068	00068	NW-#30077804	NW-#30173111	NW-#30093087	T102638	Collins St Cresswells Row Terminus Row	
West Hobart	13052	00071	NW-#30078013	NW-#30078013			Mona St	
Chapel St	20535	00284					Ripley Rd	
	20548	00281				T151134	Girrabong Rd	
		00284					Ripley Rd	
	20556	00285					Chapel St	
	20557	00285					Chapel St	
New Town	16098		NW-#30081928		NW-#30088806		Tower Rd Risdon Rd Swanston St Giblin St	

							Forster St	
Rokeby	28223		NW-#30082307		NW-#30093093		South Arm Hwy	
	28224		NW-#30082307		NW-#30093093		South Arm Hwy	
	28228		NW-#30082307		NW-#30093093		South Arm Hwy	
Sandy Bay	12017	00077				T121773 T121519	Nelson Rd Nicholas Dr	
	12018	00077				T121773 T121519	Nelson Rd Nicholas Dr	
	12019	00066	NW-#30077764	NW-#30173107	NW-#30093092	T122758	Churchill Ave Peel St	
	12037	00067	NW-#30077774			T121408		
	12038	00078				T12100	Richardsons Ave	

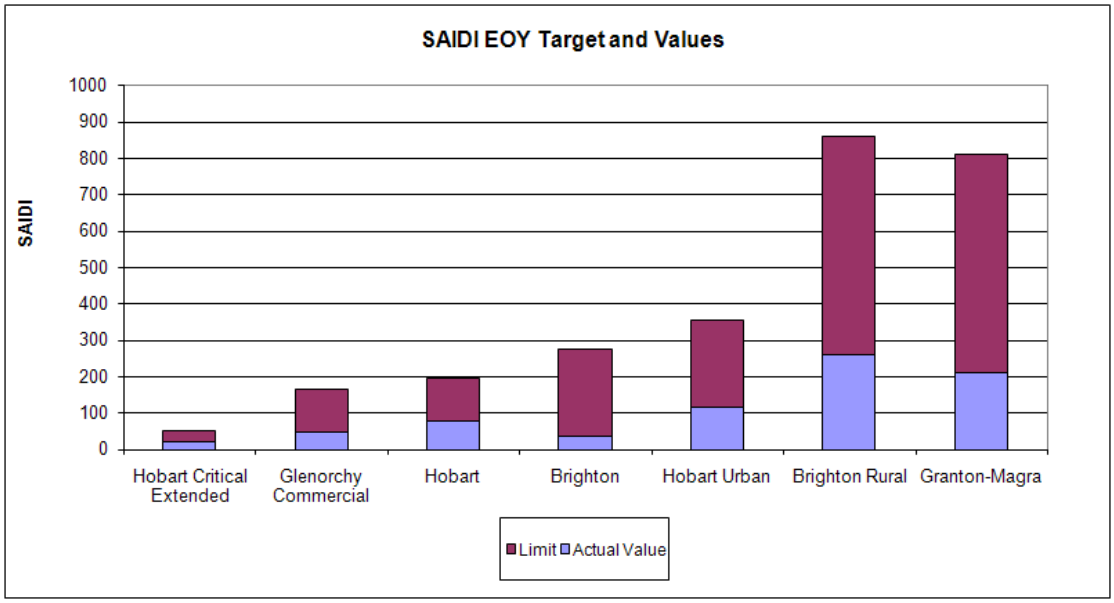
4.6 Reliability for the area

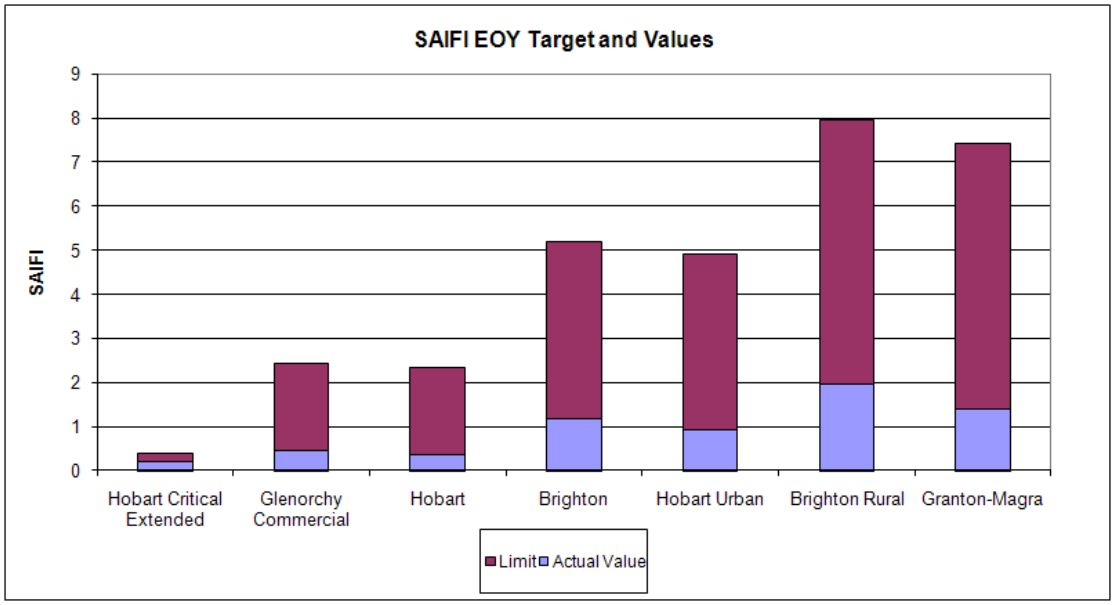
The HW planning area includes the following Reliability communities:

- Hobart Critical Extended (Critical Infrastructure)
- Glenorchy Commercial (High Density Commercial)
- Hobart (High Density Commercial)
- Brighton (Urban)
- Hobart Urban (Urban)
- Brighton Rural (High Density Rural)
- Granton Magra (High Density Rural)
-
-

Details of actual reliability performance in the 09/10 financial year are available in the link below (note: will need to be updated yearly).

NW-#30061377-Area Reliability Reporting 09_10





On figures for the 8 months to February 2010 the following communities appear likely to have reliability performance worse than target in 2010:

- Hobart Critical Extended (Critical Infrastructure)

4.7 Asset issues

There are a number of asset issues throughout the Hobart West area. Zone substation transformers are at or beyond their nominal end of life or in poor condition at the following zone substations:

- Derwent Park Zone
-

Further information is detailed in the following Asset Management Plans relevant to the HW planning area:

The Ground Mounted Substation Management Plan outlines issues associated with these substations. Such issues include:

- Aging substations;
- Fire protection (conversion from CO_2 to Stat-X suppression systems);
- Asbestos management;

- Ferroresonance;
- Switchgear failure;
- PCB contamination;
- Earthing safety;
- and corrosion.

This document also outlines the plans put in place to deal with these issues. Any planned work involving ground mounted substations should align with the management plan in order to help fix these issues and mitigate against any risks involved.

NW-#30160765-Management Plan 2011: Ground Mounted Substations

The High Voltage Regulators Management Plan identifies issues associated with these regulators including:

- Rusting of regulator tanks;
- Corrosion and water ingress on the tap change indicators;
- Tap changer motor drive capacitor replacement; and
- Oil containment.

Currently the tap changer motor drive capacitor is located within the voltage regulator tank and thus the replacement of this requires the unit to be removed from the site and detanked. It is recommended that the capacitors be placed inside the control cubicle outside the tank for easier access. This plan also states that only approximately 30 % of ground mounted regulator sites have adequate oil containment as per applicable standard at the time of installations. All of the three phase regulators contain greater than 500 L of oil in the device and therefore, according to the Australian Standards, bunding is necessary. Any planned work involving high voltage regulators should align with the management plan in order to help fix these issues and mitigate against any risks involved.

NW-#30161495-Management Plan 2011: High Voltage Regulators

Specific issues associated with such equipment are outlined in the Overhead Systems and Structures Management Plan. One of these includes fire mitigation which will be accomplished by replacing EDO fuse tubes at transformer sites in high and very high fire danger areas with fire safe

alternatives and undertaking bush fire mitigation works on HV and LV overhead conductor in high and very high bushfire areas.

Endangered species can come under threat from electrocution and thus measures are implemented to ensure fewer deaths to animals and less supply interruptions caused by such an event. These measures include possum guards, bird perches and insulators on stay wires.

Any planned work involving overhead systems and structures should align with the management plan in order to help fix these issues and mitigate against any risks involved.

NW-#30161322-Management Plan 2011: Overhead System and Structures

The Underground System Management Plan identifies several specific asset issues. One of these includes CONSAC cable failures which cause 70% of LV cable outages when only 17% of LV cables are CONSAC type and are therefore in the process of being replaced. Cast Iron Potheads are now also being replaced due to the cracking of the iron casing allowing water ingress and on occasion resulting in the casing being blown apart. UGLBS are scheduled for replacement due to multiple incidents where melting of the compound insulating the terminations occurred resulting in catastrophic failure and flashover.

Lightning arrestors are now being installed on critical HV termination poles and according to the new design standards every new HV feeder pole will have a lightning arrestor installed on it due to the increase in occurrences of lightning and associated outages.

Any planned work involving underground systems should align with the management plan in order to help fix these issues and mitigate against any risks involved.

NW30043361 - Management Plan 2010: Underground System

The Zone Substation Management Plan has identified issues associated with various zone substations including excessive noise, high moisture levels and aging transformers. Approximately 40% of the urban zone substation transformers are over 40 years old, with several approaching 50 years old.

Any planned work involving zone substations should align with the management plan in order to help fix these issues and mitigate against any risks involved.

NW-#30161548-Management Plan 2011: Zone Substations

4.8 Links

LAM Area Management Plans relevant to the HW planning area are:

- Hobart Urban and CBD NW-#183926-10/11 Area Management Plan Hobart Urban and CBD
- Midlands South NW-#164938-Area Management Plan Midlands South

In addition Transend's Annual Planning Report contains relevant information. It can be found on their website Transend Networks | Annual planning review

5. LOAD FORECAST

The Hobart-West planning area has experienced growth from 2-3% per year for the past two years and sustained growth in this area is expected.

The long-term medium growth rate from the Aurora forecast is approximately 1.5% for the Hobart-West planning area. Blanket load growth above this rate is considered unlikely, as the load is the Hobart city area is generally mature, and constrained by mountains to the west and the river to the East. However higher growth is likely in certain areas.

The following regions are considered to have potential for particularly high growth:

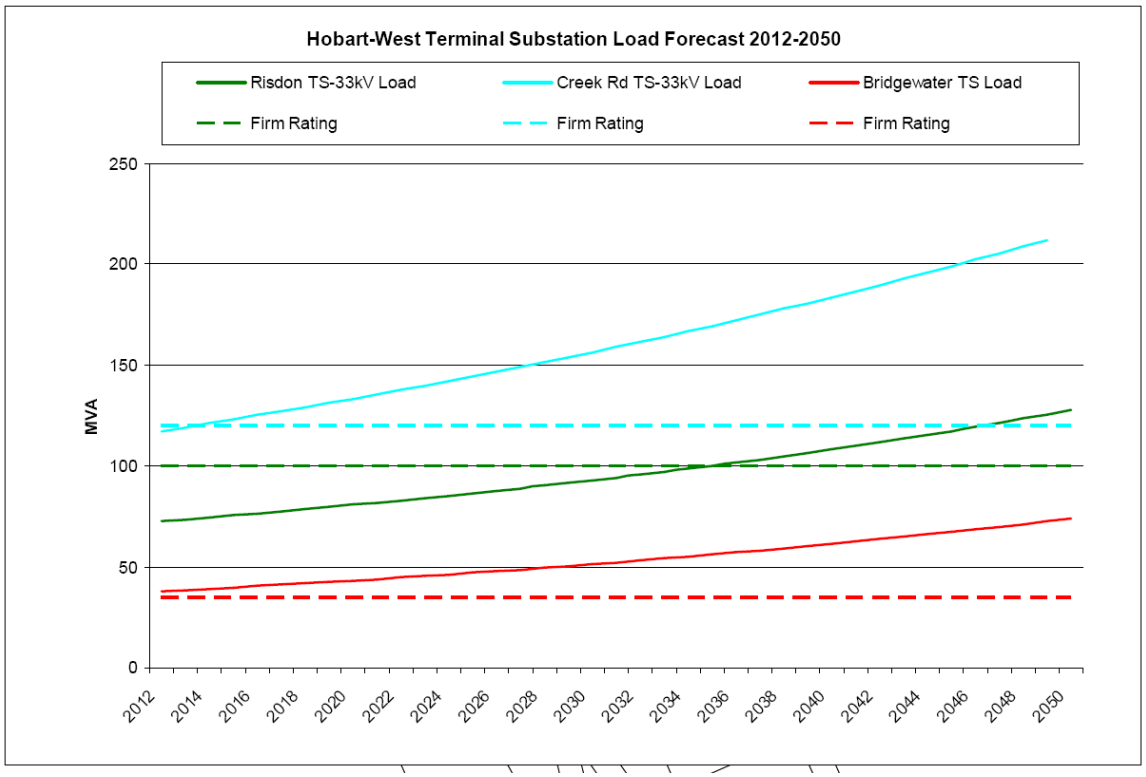
- Works are ongoing by the Department of Transport to establish Brighton as a transport hub. This will involve the termination of cargo train lines at Brighton, with cargo to be carried by road to the river at Bridgewater, and will likely see the connection of heavy machinery and associated loads at Brighton. A related project will also establish a dual carriageway bypass of Brighton, and is expected to encourage development in the valley around Brighton.

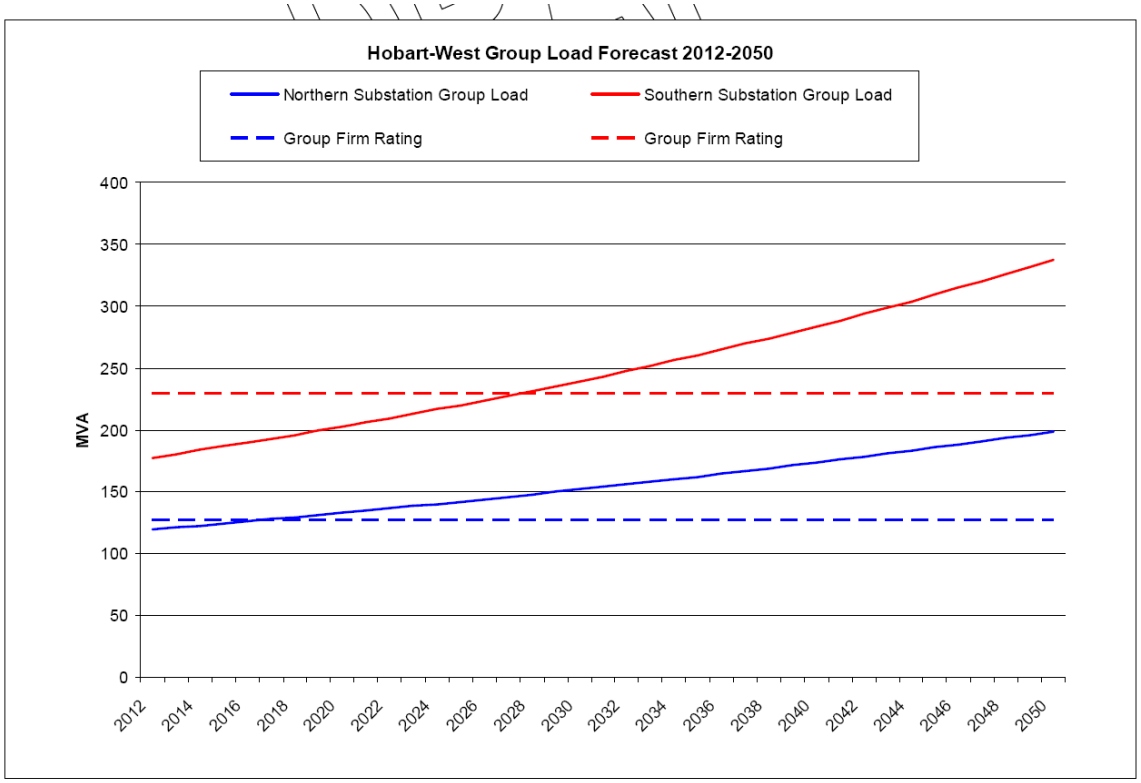
- The wharf area of Hobart is expected to experience significant load growth following the establishment of the Brighton Transport Hub. The cargo trains that currently unload at the wharf are expected to be phased out, with preference being to unload trains at Brighton and truck cargo to ship loaders at Bridgewater. This would free up a significant tract of land in the Hobart CBD for development.

As a result, to produce a conservative load forecast high growth has been applied to these areas, with medium growth applied to the remainder of the planning area. A point load of 4.5 MVA has also been added in the Brighton area to allow for industrial development at the Brighton Transport Hub prior to the beginning of the study in 2012.

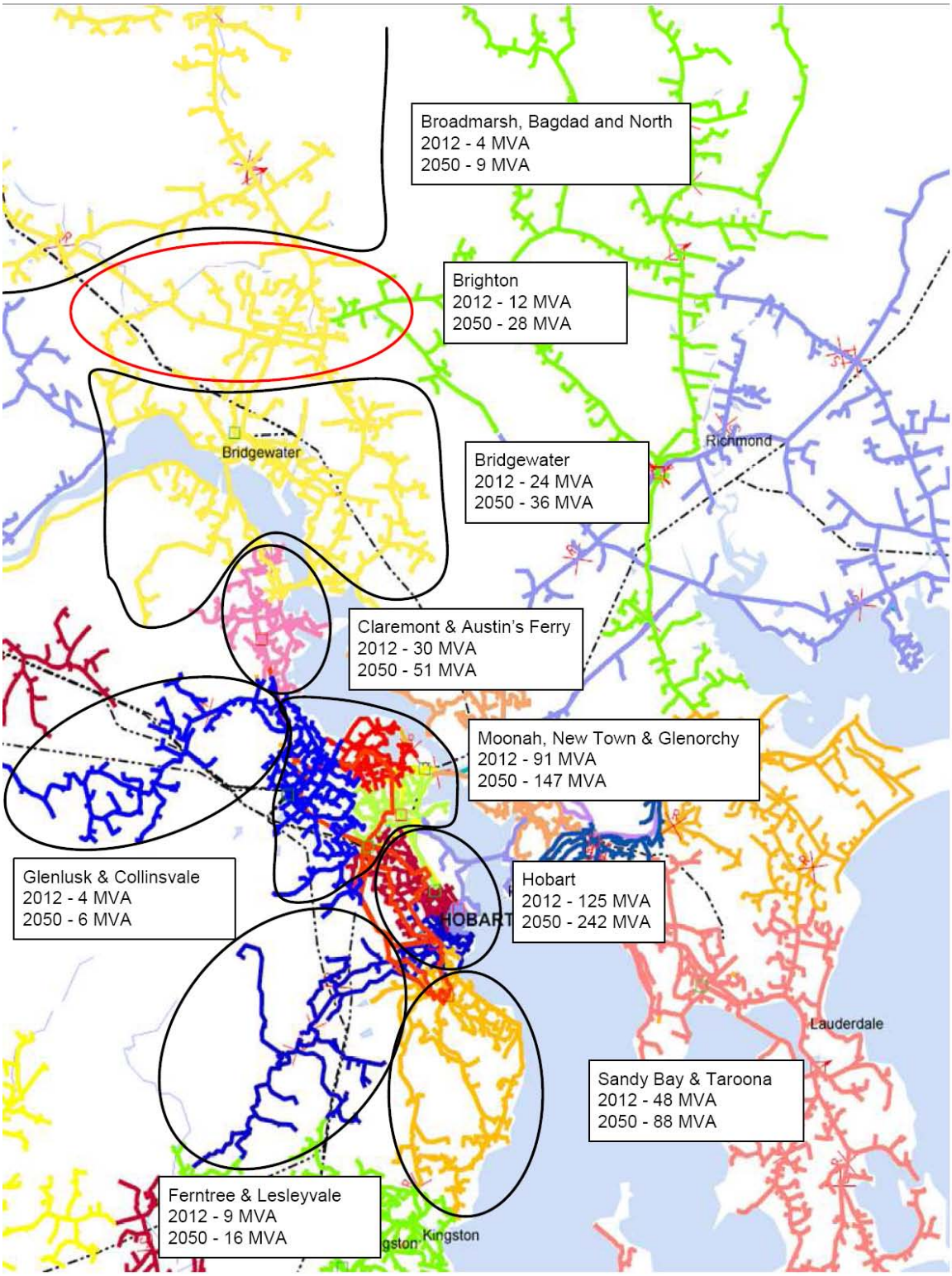
For the purposes of this study the planning area has been split into two groups of substations, with each group having significant transfer capacity amongst other substations of that group. The northern substations of Claremont, Derwent Park, New Town and Chapel St compose one group and the southern substations of East Hobart, West Hobart, North Hobart and Sandy Bay the other. It is assumed that a capacity limitation occurs when the group load exceeds the sum of the firm capacities.

The resulting 38-year load forecast and firm ratings for substations of the Hobart-West planning area are provided below.





The following figure provides a geographic view of the resulting load distribution in 2012 and 2050.



The 2009 10-year load forecast report by UES is used as the basis for this plan. NW30089965 - Aurora 2009 Maximum Demand & Consumption 10 year Forecast Report

Forecast load growth tables are stored in the spreadsheet NW-#30040697-Zone and Area MD and consumption tables 2009

	Planning Area	Connection Point Substation	Forecast Growth pa
	Hobart West	Bridgewater	2.3%
	Hobart West	Chapel St	2.8%
	Hobart West	Creek Rd	2.2%
	Hobart West	North Hobart	3.7%

Copy of load profile

5.1 Future committed point loads (> 1 MVA)

- Parliament House Substation (Repositioning) 1.438 MVA
- TAFI Aquaculture, Nubeena Crescent Taroona 2 MW
- Tasmanian Museum and Art Gallery 1.2 MW
- UTAS, Sand Bay Campus
- Myers Substation, 2-2.5 MVA
- News Limited Printing Press, Goodwood 1.5 MVA
- Menzies Centre, Hobart 1.5 MVA
- RACT, Hobart 1.2 MVA
- Brighton Transport Hub 2 MW
- BHT Load Connection, Brighton

- Derwent Park Data Centre, 2 MW

5.2 Possible point loads (> 1 MVA)

None at this stage

5.3 Possible point loads to be removed (> 1 MVA)

- Refer to Parliament House Substation Repositioning

5.4 Possible future embedded generation (> 1 MVA)

- None at this stage

Project Data from NW-#30012319-Customer_Connection_Status_Listing

5.5 Analysis of Load Forecast

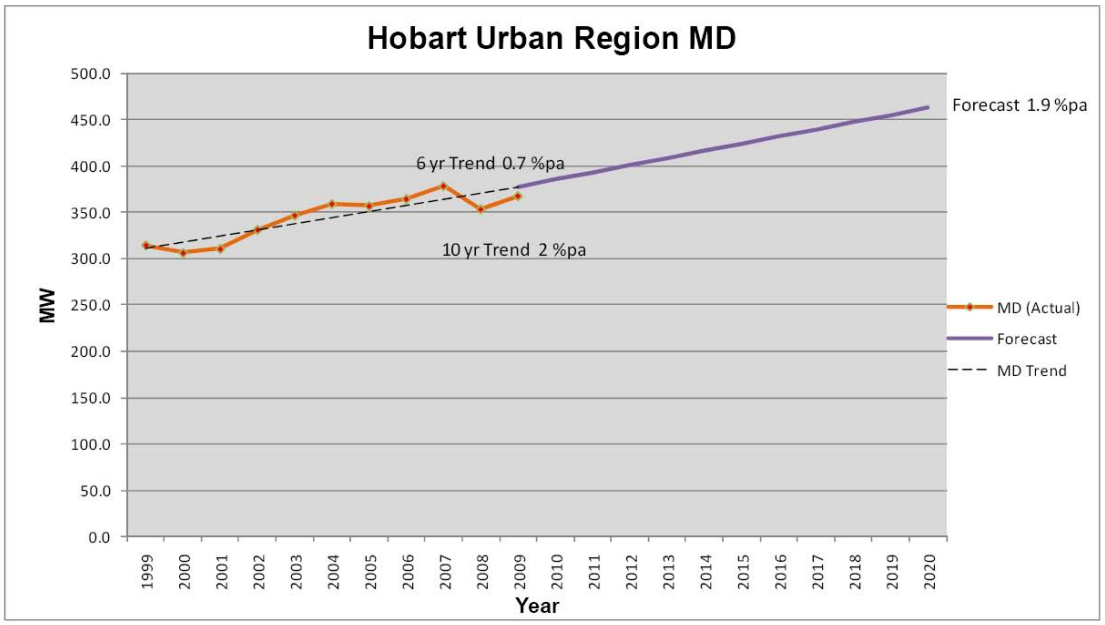
Detailed load forecast data is available in the following documents:

- Load model reference NW-#30069005-Hobart area load model (2009)

The UES 10 year load forecast document can be found at

NW30089965 - Aurora 2009 Maximum Demand & Consumption 10 year Forecast Report

The most recent forecast combines Hobart East and Hobart West into an area called Hobart Urban. The forecast growth in maximum demand extracted from the UES document for this area is shown below.



6. PLANNING CRITERIA

Planning criteria for the HW planning area are detailed in Aurora's Distribution Planning Manual and is consistent for the all planning areas:

NW102505705 - Distribution Network Planning Manual May 1999

More up to date information is included in this document in Appendix E on page 44.

7. CONSTRAINTS (LIMITATIONS)

Constraints in the HW planning area are classified under the following management groups:

Constraint	Description	Definition
Capacity	Substation Firm Capacity	Substation Maximum Demand > Substation Firm Capacity (N-1)
	Feeder Tail Capacity	Feeder Maximum Demand > 5 MVA for 11 kV OR 10 MVA for 22 kV
	Feeder Section Capacity	Load through conductor >conductor continuous rating
	Feeder Tie Capacity	Transfer Capacity limited due to undersized conductor/equipment
Fault Level	Substation Bus Fault Level	Maximum 3-phase fault level > 13.1 kA OR Maximum 1-phase > XX.X kA

Constraint	Description	Definition
	Equipment Rating Fault Level	Maximum 3-phase OR 1-phase fault level > equipment rating
Voltage	Normal load Voltage Drop	Voltage drop exceeds ± 6%
	Emergency load Voltage Drop	Voltage drop exceeds ± 10%
Reliability	SAIDI	Reliability community SAIDI performance has or is likely to exceed target
	SAIFI	Reliability community SAIFI performance has or is likely to exceed target

Table 2 - Constraint Definitions

Constraints are managed at the following levels

- Zone Substation
- Subtransmission Feeder
- Distribution Feeder
- Distribution Substation
- LV Systems

This document details constraints at the Zone Substation (inc Rural Zone Substations), Subtransmission Feeder and Distribution Feeder levels only. Refer to XXXXXXXXX for State wide management plans for the Distribution Substation and LV System planning levels.

7.1 Summary of Constraints

7.1.1 Zone Substation Constraints

Substation	Feeder(s)	Criteria	Description
Claremont Zone		Aged asset	Transformers recommended for replacement in 2019/20

Capacity Constraints				
Substation	**Firm Capacity (MVA)**	**Current Load (MVA)**	**Forecast to exceed (year)**	**Comments**
Bridgewater Terminal	60		2012	
Chapel St Terminal	60		2024	
Creek Rd Terminal	120		2015	
Derwent Park Zone	22.5		2012	Capacity/Aged Asset Transformers recommended for replacement on age in 2014/15.
East Hobart Zone	60		2046	Substation firm capacity limited by subtransmission feeder capacity.

Capacity Constraints				
Substation	**Firm Capacity (MVA)**	**Current Load (MVA)**	**Forecast to exceed (year)**	**Comments**
New Town Zone	22.5		2016	
North Hobart Terminal	60		2014	
Risdon Terminal	100		2042	
Sandy Bay Zone	60		2029	Substation firm capacity limited by subtransmission feeder capacity.
West Hobart Zone	60		2023	

Fault Level Constraints			
Substation	**Fault Level Description**	**Forecast replacement (year)**	**Comments**
			None identified

7.1.2 Subtransmission Constraints

Capacity Constraints				
Substation	**Feeder**	**Capacity constraint type**	**Forecast to exceed (year)**	**Comments**
				None identified

Voltage Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
			None identified

Reliability Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
			None identified

7.1.3 Distribution Feeder Constraints

Capacity Constraints				
Substation	**Feeder**	**Capacity constraint type**	**Forecast to exceed (year)**	**Comments**
		Feeder Section	Already Exceeding	
		Feeder Section	Already Exceeding	

Capacity Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
			None identified

Voltage Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
			None identified

Reliability Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
			None identified

7.2 Security

Aurora's zone substations are typically run in N-1 secure mode. This means that in the event of any single outage of a network element all load can still be supplied.

In some cases this level of security is not possible, and a 'switched firm' strategy is in place. In this case a single outage at a zone substation may cause an interruption to customers' supply, but it will be possible to restore supply by switching load to an adjacent substation.

7.3 Transfer and Operational Capability

The table below shows the rating, peak load and transfer capacity. The peak load figures are those recorded in winter 2010. Since Aurora's substations are subject to winter peaks, these are the most onerous.

	MVA				
Substation	**Rating**	**N-1 Rating**	**Peak Load**	**Transfer Capacity**	**Transfer Substation**
North Hobart	120	60		6.6	Newtown
				0.4	Chapel St
				14.1	East Hobart
				10.6	West Hobart
East Hobart	90	60		10.9	North Hobart
				9.9	West Hobart
				4.1	Geilston Bay
West Hobart	90	60		7.3	East Hobart
				5.2	North Hobart
				8.3	Sandy Bay
				1.0	Kingston
Sandy Bay	90	60		13.4	West Hobart
				0.5	Kingston
Bridgewater	70	35		6.1	Claremont

	MVA				
Substation	**Rating**	**N-1 Rating**	**Peak Load**	**Transfer Capacity**	**Transfer Substation**
				0.9	Geilston Bay
Claremont	45	22.5		1.4	Bridgewater
				4.1	Chapel St
Chapel St	120	60		12.6	Claremont
				11.1	Derwent Park
				2.7	Newtown
Derwent Park	45	22.5		13.8	Chapel St
				9.7	Newtown
New Town	45	22.5		7.4	North Hobart
				4.7	Chapel St
				4.4	Derwent Park
				3.8	Geilston Bay

The table shows that…

Details of the analysis carried out on load transfers in the Hobart West area are available in NW-#30088251-Hobart West area load transfer (2009).

7.4 Power Factor

- Customer power factor correction
- Network power factor correction

7.5 LV issues

There are no locations in the Hobart West Planning area where widespread LV network issues have been identified.

The table below shows the count of transformers in the planning area and the count of those that are at risk of overloading. This is determined by the count of connected customers indicating a load greater than 130% of nameplate

rating. It should be noted that the actual load on a transformer may be much different to its value calculated in this way.

	Total		>130% of rating[3]	
Tx size	**Count**	**Customer Count**	**Count**	**Customer Count**
< 50 kVA	693	1,274	14	83
>= 50 kVA	1,565	59,522	70	7,539

8. SHORT TERM PLAN (<5YR)

The Hobart West Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103835-Hobart West strategic plan Rev_3

A summary of the proposed works from 2010 to 2015 in the Hobart-West planning area is outlined in the following table.

Year	Proposed Project	Proposed Outcomes
2015	Upgrade Derwent Park zone substation	Replace ageing 33/11 kV transformers and increase firm capacity at Derwent Park

Further details of these and other potential long term projects in the HW area are discussed in Appendix A below.

9. MEDIUM TERM PLAN (5 TO 10YR)

The Hobart West Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103835-Hobart West strategic plan Rev_3.

A summary of the proposed works from 2016 to 2020 in the Hobart-West planning area is outlined in the following table.

Year	Proposed Project	Proposed Outcomes

[3] Data sourced from NW-#30075639-Statewide Distribution Transformers Customer Count Nov 09. Transformer data extracted from Gtech in November 2009.

2016	Establish Bridgewater 33kV injection point and zone substation at Austin's Ferry	Deload Claremont zone substation and Creek Rd 33 kV substation
2020	Upgrade Claremont zone substation	Replace ageing 33/11 kV transformers and increase firm capacity at Claremont

Further details of these and other potential long term projects in the HE area are discussed in Appendix B below.

10. LONG TERM PLAN (10YR+)

The Hobart West Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103835-Hobart West strategic plan Rev_3

A summary of the proposed works from 2021 to 2050 in the Hobart-West planning area is outlined in the following table.

Year	**Proposed Project**	**Proposed Outcomes**
2025	Establish Brighton zone substation	Deload Bridgewater and relieve Brighton and North 11 kV feeders
2026	Establish 110/11 kV substation at Creek Rd	Deload Creek Rd and Risdon 33 kV substations and northern and southern substation groups
2027	Upgrade North Hobart 110/11 kV transformers	Replace ageing 110/11 kV transformers
2030	Upgrade Bridgewater terminal substation	Replace ageing 110/11 kV transformers and increase firm capacity at Bridgewater
2031	Upgrade Derwent Park zone substation and install 33 kV tie to Creek Rd	Deload northern substation group and provide transfer capacity between Creek Rd and Risdon
2034	Upgrade Chapel St 110/11 kV transformers	Replace ageing 110/11 kV transformers
2034	Establish 33 kV injection point at McRobies Gully to supply Sandy Bay	Deload Creek Rd substation
2036	Establish Mt Nelson zone substation	Deload southern substation group

2042	Establish CBD zone substation	Deload southern substation group
2046	Establish West Moonah zone substation	Deload northern substation group and Risdon substation

Further details of these and other potential long term projects in the HE area are discussed in Appendix C below.

11. PROGRAM OF WORK DRAFT

12. OPERATIONAL PLANS

- Contingency plans (not at operational level)

Operations Group have developed a number of contingency plans to define operational actions to be taken in the event of substation, busbar and feeder outages. The document NW-#30126392-Contingency Plan Register provides links to contingency plan documents as they are produced.

13. REFERENCE DOCUMENTS

Self explanatory but listed documents for system studies, council plans etc

- Listing of DINIS personal files
- Links to other work documents

14. NOTES

- System development plans identified for the area should link to other plans. Consultation with other work groups, in particular System Performance, Distribution Operations, Area Managers and key external stakeholders e.g. Councils and Government Departments, is essential to ensure optimum outcomes.

- It would be useful to include any details of reference documents and schematic diagrams indicating current substation layout and HV feeder arrangements.

Appendix A. Short Term Plan (< 5 years) – Constraints Options and Solutions

A.1 Upgrade Derwent Park zone substation

A.1.1. Constraints

Derwent Park zone substation transformers have been deemed to be end of life by 2015.

A.1.2. Options considered

1. Upgrade Derwent Park zone substation
2. Non-network option
3. Do nothing option

Option 1 (recommended option) – Upgrade Derwent Park zone substation

To address the above limitations, it is proposed that the existing 33/11 kV transformers be replaced with new 25 MVA units in 2015.

As this project is justified on condition grounds and proposes a like-for-like replacement, for regulatory purposes it is considered a refurbishment project rather than an augmentation project. As such, a Regulatory Investment Test (RIT) is not required for this project.

Option 2 – Non-network option

No non-network alternatives have been considered.

Option 3 – Do nothing option

The do nothing option is not considered a feasible option as the Derwent Park transformers have been deemed to be end of life by 2015, and therefore must be removed from service by this time.

A.1.3. Possible Solution

It is proposed that the 2 x 22.5 MVA transformers be replaced by 25 MVA units in 2015. The estimated cost for the upgrade is $4 million.

This project increases the group firm capacity of the northern substations, deferring the group capacity limitation until 2021.

Appendix B. Medium Term Plan (5 to 10 years) – Constraints Options and Solutions

B.1 Establish Bridgewater 33kV injection point and zone substation at Austin's Ferry

B.1.1. Constraints

Bridgewater terminal substation is forecast to exceed firm capacity in 2012, however it is assumed that this can be deferred or mitigated until 2016 by load transfers to Derwent Park, Claremont and New Norfolk zone substations. Creek Rd is forecast to exceed firm capacity in 2015; however it is expected that this limitation can be deferred by load transfers from West Hobart to East Hobart. The northern substation group is forecast to exceed firm capacity in 2017.

B.1.2. Options considered

1. Establish Bridgewater 33 kV injection point and zone substation at Austin's Ferry
2. Establish Bridgewater 33 kV injection point and upgrade Claremont zone substation
3. Upgrade Bridgewater terminal substation and reinforce 11 kV network
4. Establish Bridgewater 33 kV injection point and zone substations at Bridgewater and Austin's Ferry

Option 1 (recommended option) – Establish Bridgewater 33 kV injection point and zone substation at Austin's Ferry

This option involves the establishment of a 33kV injection point at the existing Bridgewater terminal substation site and the establishment of a new zone substation at Austin's Ferry supplied from 2 x 33kV cables from Bridgewater in 2016.

Bridgewater 33 kV substation will consist of 2 x 60 MVA 110/33 kV transformers and two sections of 33kV switchgear. The new 110/33 kV transformers will be connected to the existing 110 kV buses via isolators.

Austin's Ferry zone substation will consist of 2 x 25 MVA 33/11 kV transformers and two sections of 11kV switchgear. The substation will be supplied, transformer-ended, from 33 kV cables from Bridgewater (approximately 5 km). The 33 kV cables will be required to cross the Derwent River – ideally the cables would be installed under the new bridge at Bridgewater (assuming the bridge is completed in time), otherwise submarine cables would be required.

An alternative option would be to establish the zone substation in the Old Beach area on the East bank of the river. This would avoid the requirement for 33 kV submarine cables; however an Old Beach substation would require

longer 33 kV feeders and additional 11 kV feeder crossings to deload Claremont. Additionally, although both areas have undeveloped land and are expected to experience significant load growth, Austin's Ferry is considered a superior location for a substation due to the magnitude of existing load in the area.

Option 2 – Establish Bridgewater 33 kV injection point and upgrade Claremont zone substation

This option is the same as option 1 except that instead of a new zone substation at Austin's Ferry, the cables from Bridgewater are run further south to Claremont zone substation (approximately 8 km).

An additional 33/11 kV transformer is installed at Claremont under this option, supplied as a transformer-ended feeder from Bridgewater. The 11 kV bus would be split, with one bus supplied by the new transformer and two buses supplied by the existing two transformers.

This option also requires augmentation of the 11 kV network to the north of Claremont in order to deload Bridgewater terminal substation and reduce loading of the 11 kV feeders from Claremont and Bridgewater into the Austin's Ferry area.

Option 3 – Upgrade Bridgewater terminal substation and reinforce 11 kV network

This option involves the replacement of the existing 2 x 35 MVA 110/11 kV transformers at Bridgewater with 60 MVA units in 2017.

This option also requires augmentation of the 11 kV network into the Austin's Ferry area, including additional 11 kV river crossings, in order to deload Claremont zone substation and reduce 11 kV feeder loading,

Option 4 – Establish Bridgewater 33 kV injection point and zone substations at Bridgewater and Austin's Ferry

This option is identical to option 1, except that the 110/11 kV terminal substation at Bridgewater is also replaced by a new zone substation. The benefit of this option is the reduction in 110 kV costs at Bridgewater, since the new 110/33 kV transformers can connect to the existing transformer bays.

Technical comparison

Option	Description	Advantages	Disadvantages

Option	Description	Advantages	Disadvantages
1	Establish Bridgewater 33kV injection point and zone substation at Austin's Ferry	• Deloads Bridgewater, Claremont and Creek Rd substations • 33kV injection point provides flexibility for future supply in the area • Shorter 33 kV cable run than option 2 • Increases firm capacity of northern substation group by 25 MVA • Results in shorter 11kV feeders than options 2 and 3, and hence increases reliability and defers future 11kV augmentation	• Requires purchase and establishment of a new site at Austin's Ferry

Option	Description	Advantages	Disadvantages
2	Establish Bridgewater 33 kV injection point and upgrade Claremont zone substation	• Deloads Bridgewater and Creek Rd substations • 33 kV injection point provides flexibility for future supply in the area • Increases firm capacity of northern substation group by 25 MVA	• Longer 33 kV cable run than option 1 • Requires additional 11 kV feeders out of Claremont substation to split existing feeders and transfer load from Bridgewater • Requires the 11kV bus to be split to avoid paralleling 33kV injection points
3	Upgrade Bridgewater terminal substation and reinforce 11kV network	• Deloads Claremont and Creek Rd substations • Increases firm capacity of Bridgewater substation by 25 MVA	• Requires additional 11 kV feeders out of Bridgewater substation (including river crossings) to split existing feeders and transfer load from Claremont

Option	Description	Advantages	Disadvantages
4	Establish Bridgewater 33kV injection point and zone substations at Bridgewater and Austin's Ferry	• Minimal 110 kV works required at Bridgewater • Deloads Claremont and Creek Rd substations • 33 kV injection point provides flexibility for future supply in the area • Shorter 33 kV cable run than option 2 • Increases firm capacity of northern substation group by 25 MVA • Results in shorter 11kV feeders than options 2 and 3, and hence increases reliability and defers future 11kV augmentation	• Non-standard zone substation transformers to maintain 35 MVA firm capacity • Requires purchase and establishment of two new zone substation sites

The above technical comparison of options indicates that option 1 provides the best technical solution.

Cost comparison

Option	Initial Capital Cost ($M)	Total Capital Cost ($M)	Net Present Value ($M)
1	27.5	44.0	23.2
2	26.7	47.5	24.3
3	19.6	49.3	23.8

4	34.5	45.0	26.0

The above cost comparison of options indicates that option 1 provides the lowest cost solution. Details of the NPV analysis are given in appendix B of NW-#30103835-Hobart West strategic plan Rev_3.

B.1.3. Possible Solution

Based on the technical and cost comparison, option 1 is considered the preferred option to address the forecast limitations.

Therefore it is recommended that 2 x 110/33 kV 60 MVA transformers and 110 kV and 33 kV switchgear be installed at the existing Bridgewater site in 2016 and that a new zone substation at Austin's Ferry be established and supplied from Bridgewater.

Completion of this project in 2016 defers the firm capacity limitation on Creek Rd and Bridgewater until 2020 and 2025 respectively.

B.2 Upgrade Claremont zone substation

B.2.1. Constraints

Claremont zone substation transformers have been deemed to be end of life by 2020.

B.2.2. Options considered

1. Upgrade Claremont zone substation
2. Non-network option
3. Do nothing option

Option 1 (recommended option) – Upgrade Claremont zone substation

To address the above limitations, it is proposed that the existing 33/11 kV transformers be replaced with new 25 MVA units in 2020.

As this project is justified on condition grounds and proposes a like-for-like replacement, for regulatory purposes it is considered a refurbishment project rather than an augmentation project. As such, a Regulatory Investment Test (RIT) is not required for this project.

Option 2 – Non-network option

No non-network alternatives have been considered.

Option 3 – Do nothing option

The do nothing option is not considered a feasible option as the Claremont transformers have been deemed to be end of life by 2020, and therefore must be removed from service by this time.

B.2.3. Possible Solution

It is proposed that the 2 x 22.5 MVA transformers be replaced by 25 MVA units in 2020. The estimated cost for the upgrade is $4 million.

Appendix C. Long Term Plan (>10 years) – Constraints Options and Solutions

C.1 Establish Brighton zone substation

Medium term plans to establish a 33kV injection point at Bridgewater terminal substation and a zone substation at Austin's Ferry in 2016 will address firm capacity limitations at Bridgewater terminal substation until 2025. The load in Brighton and to the north is forecast to exceed 20 MVA in 2025, which is likely to be difficult to supply via the existing 11kV feeders. To address these limitations it is recommended that a new zone substation be established in Brighton. Note that the timing of this project is dependent on the load growth in the Brighton area. Should the high growth not eventuate, the Brighton zone substation may be deferred until justified by capacity or feeder limitations at Bridgewater. Conversely, 11 kV feeder limitations may justify the project at an earlier date.

Brighton zone substation will have 2 x 25 MVA 33/11 kV transformers, and will be supplied from 33kV cables from Bridgewater installed as part of the Brighton Transport Hub project.

C.2 Establish 110/11 kV substation at Creek Rd

The combined load of Risdon and Creek Rd 33 kV substations is forecast to exceed firm capacity by 2026 (up to this time it is assumed that load can be balanced between Creek Rd and Risdon through 11 kV load transfers between East Hobart and West Hobart).

Therefore it is proposed that 2 x 110/11 kV 60 MVA transformers be installed at the existing Creek Rd site in 2026. This substation would deload the Chapel St, North Hobart and New Town zone substations. In doing so it would allow North Hobart to focus towards the CBD, deloading West Hobart and consequently deloading Creek Rd.

An alternative to this project would be to establish Creek Rd as a zone substation instead of a terminal substation, however it is expected that the cost in advancing other works to deload Creek Rd 33 kV would outweigh the savings and other benefits of a zone substation.

The alternative options to address the limitations at Creek Rd are discussed in more detail in Appendix D of NW-#30103835-Hobart_West_strategic_plan Rev_3.

It should be noted that the timing of this project is based on the northern and southern substation group firm capacity limitations, and assumes that individual substation and feeder limitations will be addressed by load transfers or feeder works. If such works are not possible, or are expected to be more expensive than justified by deferral of the Creek Rd project, the project requirement date may need to be brought forward.

C.3 Upgrade North Hobart 110/11 kV transformers

The North Hobart 110/11 kV transformers are nominally end of life in 2027. Therefore it is proposed that the 2 x 60 MVA transformers be replaced like for like in 2027. However, should it be determined that the transformers are in good condition beyond 2027, the replacement may be deferred until justified on condition basis.

C.4 Upgrade Derwent Park zone and install 33 kV tie to Creek Rd

Subsequent to the long term establishment of a 110/11kV substation at Creek Rd in 2026 Risdon and Creek Rd 33 kV substations are again forecast to exceed firm capacity by 2031, with the northern substation group to follow in 2033. The most cost effective way to address both limitations at this time would be the installation of an additional 33/11 kV transformer and 33kV switchgear at an existing zone substation. A new 33kV feeder can then be installed to the zone substation from an adjacent 110/33 kV substation. This would increase the firm capacity of the northern substation group, while providing transfer capacity between adjacent 110/33 kV substations.

The most suitable candidate for a third 33/11 kV transformer would be Derwent Park zone substation, due to its proximity to the Creek Rd-Claremont feeder 10026, thus minimising the length of 33 kV cable required. New Town zone substation would also be a suitable candidate and is even closer to 10026, however the fact that it is supplied from an overhead and an underground cable make it unsuitable for a 33 kV switchboard due to uneven load sharing. It is also considered an inferior location for 11kV injection due to its proximity to expected 11 kV injection at Creek Rd.

It is proposed that a new 25 MVA 33/11 kV transformer be installed at Derwent Park in 2031, as well as three sections of 33kV switchgear with sufficient CBs to terminate the existing and new feeders and transformers. A new section of 33 kV cable is to be installed to tee off feeder 10026 (approximately 500m) and be terminated at a normally open CB at Derwent

Park. The existing Risdon-Derwent Park feeders would need to be uprated to 31 MVA to enable half of Claremont load to be transferred to Risdon.

As a result Derwent Park substation would have a firm capacity of 50 MVA and would deload Chapel St, North Hobart and New Town. It would also provide transfer capacity between the Risdon and Creek Rd 33 kV substations.

It should be noted that for the loss of one of the Risdon-Derwent Park 33 kV feeders, load on the remaining feeder would be above its emergency rating during peak load. To address this, it is recommended that an ACO scheme be implemented to perform switching at Claremont and Derwent Park such that the backup feeder supplies a single transformer and 11 kV bus at Derwent Park. The remaining Risdon-Derwent Park feeder would supply two transformers and two 11 kV buses, while Claremont would be supplied by a single feeder and transformer.

A discussion of some alternative options for the 33kV configuration at Derwent Park is given in Appendix C of NW-#30103835-Hobart_West_strategic_plan Rev_3.

A possible alternative to this stage of works would be to establish a new zone substation between Chapel St, Derwent Park and Claremont substation supplied from the existing Creek Rd to Claremont 33 kV feeders. Claremont would then be supplied from Bridgwater via a new 33 kV double circuit from Austin's Ferry, with 33kV switchgear installed at Austin's Ferry and Claremont. These works would be more expensive than the proposed option; however it may be a competitive option if significant 11 kV feeder works would otherwise be required into the area. This should be evaluated in more detail closer to the date.

C.5 Upgrade Bridgewater terminal substation

The Bridgewater 110/11 kV transformers were installed in 1980 and will be nominally end of life by 2030. Therefore it is proposed that these transformers be replaced by 60 MVA units in 2030. Should it be determined that the existing 110/11 kV transformers are still in good condition beyond 2030, the transformer upgrade may be deferred until dictated by capacity requirements.

An alternative option would be to establish a new Bridgewater zone substation on a nearby block, allowing space on the existing site for the installation of the third 110/33 kV transformer. This option also has the benefit that Aurora would have control over the 11kV injection at Bridgewater, simplifying the operation of the network and the establishment of future 11 kV feeders. However this option has not been recommended for the following reasons:

- It would bring forward the installation of the third 110/33 kV transformer at Bridgewater

- Replacing the existing 35 MVA transformers at Bridgewater with 25 MVA units would result in a deficit in firm capacity, which would require an additional zone substation establishment or upgrade to address

- It is likely to be a more costly option than a simple transformer replacement

C.6 Upgrade Chapel St 110/11 kV transformers

The Chapel St 110/11 kV transformers are nominally end of life in 2034. Therefore it is proposed that the Chapel St transformers be replaced like for like in 2034. However, should it be determined that the transformers are in good condition beyond 2034, the replacement may be deferred until justified on condition basis.

C.7 Establish 33 kV injection point at McRobies Gully to supply Sandy Bay

Subsequent to the long term establishment of a 110/11kV substation at Creek Rd in 2026, and the long term upgrade of Derwent Park zone substation in 2031, the combined load of Risdon and Creek Rd is forecast to exceed firm capacity again in 2034 (taking into account the transfer capacity between the two). The northern and southern substation groups follow soon after. Thus it is expected that new zone substations will be required in the northern and southern areas, with no spare capacity at the existing 33 kV substations. It is expected that a new 33 kV injection point will be required in Hobart around this time.

It is proposed that a new 110/33 kV substation be established in the McRobies Gully area as a block of land in the area is already owned by Transend and it is in the vicinity of the 110 kV transmission lines to the Kingston area. This location is also conveniently located to cut in to the Creek Rd-Sandy Bay feeders as well as to supply to a future zone substation at Mount Nelson. The substation will consist of 2 x 60 MVA 110/33 kV transformers with two sections of 33kV switchgear.

It is proposed that McRobies Gully supply Sandy Bay via two new 33 kV feeders teed off the existing 10008 and 10022 from Creek Rd to Sandy Bay (approximately 1.5 km). A new 33 kV switchboard will also be required at Sandy Bay, with the three feeders (two from McRobies Gully and one from Creek Rd) and three transformers terminated. Feeders 10008 and 10022 will be normally open at Creek Rd. These feeders could potentially be used to supply a future zone substation between McRobies Gully and Creek Rd. Alternatively; the feeders could be disconnected at Creek Rd, with the spare CBs used for the future West Moonah zone substation.

This project will deload Creek Rd by approximately 55 MVA in 2034, but it does not address the firm capacity limitations on the northern and southern

substation groups in the following years. These are addressed by future substation establishments at Mt Nelson, Hobart CBD and West Moonah.

C.8 Establish Mt Nelson zone substation

In order to address the firm capacity limitation on the southern substation group in 2036, it is proposed that a new zone substation be established in the Mount Nelson area.

The Mt Nelson zone substation will consist of 2 x 25 MVA 33/11 kV transformers and will be supplied by 2 x 33 kV feeders from McRobies Gully (approximately 4 km). This substation will deload Sandy Bay by approximately 15 MVA.

C.9 Establish Hobart CBD zone substation

The group load of the North, East and West Hobart, Sandy Bay and Mount Nelson substations is forecast to exceed firm capacity in 2042.

To address this limitation it is proposed that a new 33/11 kV substation be established in the Hobart CBD in 2042. This substation should be located equidistant from the existing Hobart substations, in the vicinity of 33kV feeder 10024, and would consist of 2 x 25 MVA 33/11 kV transformers (30 MVA units could be considered for consistency with the other CBD zone substations). The substation would cut in to the existing 33 kV Creek Rd-Sandy Bay feeder 10024 and be supplied as transformer-ended feeders.

This project would also require that a 33 kV switchboard be installed at West Hobart substation, with feeder 10024 cut outside the substation and terminated to two new CBs. In this way the new zone substation would be supplied from a transformer-ended feeder from Creek Rd and a transformer ended feeder from West Hobart, with a normally open tie from West Hobart to Sandy Bay allowing transfer capacity between Creek Rd and McRobies Gully. When the third transformer is required in 2047, a new feeder can be installed to the CBD substation from Creek Rd.

Alternatively, the substation could be supplied from two new 33 kV feeders from Creek Rd; however this would not provide the required transfer capacity between Creek Rd and McRobies Gully, and would be more expensive due to cabling costs through the CBD.

Another alternative would be to establish the CBD substation as a 110 kV substation supplied by new 110 kV cables from North Hobart. This would require a 110 kV indoor switchboard be installed at North Hobart. If space for the 110kV switchgear is not available at North Hobart, the switchboard could be installed at the new CBD substation; however this would require 4 x 110 kV cables to North Hobart and cable joint bays in the vicinity of North Hobart. It is expected that the 110 kV option will be more expensive than a 33 kV solution. The existing Creek Rd-North Hobart cables are rated 108 MVA, limiting the firm capacity of North Hobart and the new CBD substation.

This project would deload the North, East and West Hobart and Sandy Bay substations.

C.10 Establish West Moonah zone substation

In order to address the firm capacity limitation on the northern substation group in 2046, it is proposed that a new zone substation be established in the West Moonah area.

The West Moonah zone substation will consist of 2 x 25 MVA 33/11 kV transformers and will be supplied by two new 33 kV feeders from Creek Rd (approximately 2 km). This substation will deload New Town, Derwent Park and Chapel St substations.

This project would require the installation of 2 x 33 kV CBs at Creek Rd, or the normally open 33 kV feeders to Sandy Bay could be disconnected and these CBs reused for the West Moonah feeders.

An alternative to this project would be to extend the 33 kV network from Austin's Ferry to Claremont, thus supplying Claremont normally from Bridgewater 33 kV substation. This would allow the existing Creek Rd to Claremont 33 kV feeders to supply a new zone substation in the Montrose area. This option would likely be slightly more expensive than the West Moonah option due to the requirement for 33kV switchgear at each zone substation; however it would deload Creek Rd 33kV substation and would bypass potential issues with getting new 33kV cables out of Creek Rd. It would also address potential 11 kV feeder loading issues in the area between the Chapel St and Claremont substation.

Appendix D. Technical Data

D.1 Substation loading

Claremont			Capacity with all elements in service (N)		Capacity with one element out of service (N-1)		Maxium Demand 2008		Maxium Demand predicted summer 2009		Maximum Demand predicted for winter 2009	
Elements	No	Emergency Rating MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	N-1 Load at Risk	Summer MVA	N-1 Load at Risk
Transfomers	2	22.5	45	45	22.5	22.5			0	0	0	0
Subtransmission Feeder 10007			0	0	0	0			14.6	0	0	0
Subtransmission Feeder 10026			0	0	0	0			14.6	0	0	0

Derwent Park			Capacity with all elements in service (N)		Capacity with one element out of service (N-1)		Maxium Demand 2008		Maxium Demand predicted summer 2009		Maximum Demand predicted for winter 2009	
Elements	No	Emergency Rating MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	N-1 Load at Risk	Summer MVA	N-1 Load at Risk
Transfomers	2	22.5	45	45	22.5	22.5				0	30	7.5
Subtransmission Feeder xx023			0	0	0	0			14.6	0	0	0
Subtransmission Feeder xx025			0	0	0	0			14.6	0	0	0

East Hobart			Capacity with all elements in service (N)		Capacity with one element out of service (N-1)		Maxium Demand 2008		Maxium Demand predicted summer 2009		Maximum Demand predicted for winter 2009	
Elements	No	Emergency Rating MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	N-1 Load at Risk	Summer MVA	N-1 Load at Risk
Transfomers	3	30	90	90	60	60				0	0	0
Subtransmission Feeder 11004	1		0	0	0	0				0	0	0
Subtransmission Feeder 10005	1		0	0	0	0				0	0	0
Subtransmission Feeder 10006	1		0	0	0	0				0	0	0

New Town			Capacity with all elements in service (N)		Capacity with one element out of service (N-1)		Maxium Demand 2008		Maxium Demand predicted summer 2009		Maximum Demand predicted for winter 2009	
Elements	No	Emergency Rating MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	N-1 Load at Risk	Summer MVA	N-1 Load at Risk
Transfomers	2	22.5	45	45	22.5	22.5			14.6	0	30	7.5
Subtransmission Feeder 11023			0	0	0	0			14.6	0	0	0
Subtransmission Feeder 11027			0	0	0	0			14.6	0	0	0

Sandy Bay			Capacity with all elements in service (N)		Capacity with one element out of service (N-1)		Maxium Demand 2008		Maxium Demand predicted summer 2009		Maximum Demand predicted for winter 2009	
Elements	No	Emergency Rating MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	N-1 Load at Risk	Summer MVA	N-1 Load at Risk
Transfomers	3	30	90	90	60	60			14.6	0	30	7.5
Subtransmission Feeder CR008			0	0	0	0			14.6	0	0	0
Subtransmission Feeder CR022			0	0	0	0			14.6	0	0	0
Subtransmission Feeder CR024			0	0	0	0			14.6	0	0	0

West Hobart			Capacity with all elements in service (N)		Capacity with one element out of service (N-1)		Maxium Demand 2008		Maxium Demand predicted summer 2009		Maximum Demand predicted for winter 2009	
Elements	No	Emergency Rating MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	N-1 Load at Risk	Summer MVA	N-1 Load at Risk
Transfomers	3	30	90	90	60	60			14.6	0	30	7.5
Subtransmission Feeder CR004			0	0	0	0			14.6	0	0	0
Subtransmission Feeder CR005			0	0	0	0			14.6	0	0	0
Subtransmission Feeder CR006			0	0	0	0			14.6	0	0	0

Reference master document # 30006462

D.2 Aurora Zone Substation data sheet

Planning Area	Zone Substation	Type	Primary Voltage (kV)	Secondary Voltage	No of Feeders In Service
Central	Gretna	Rural - minor	22	11	2
Central	Hamilton	Rural - minor	22	11	0
Central	New Norfolk	Rural - minor	22	11	3
Central	Todds Corner	Rural - minor	6.6	22	1
Central	Wayatinah	Rural - minor	11	22	3
Central	Westerway	Rural - minor	22	11	2

Reference master document #30040697

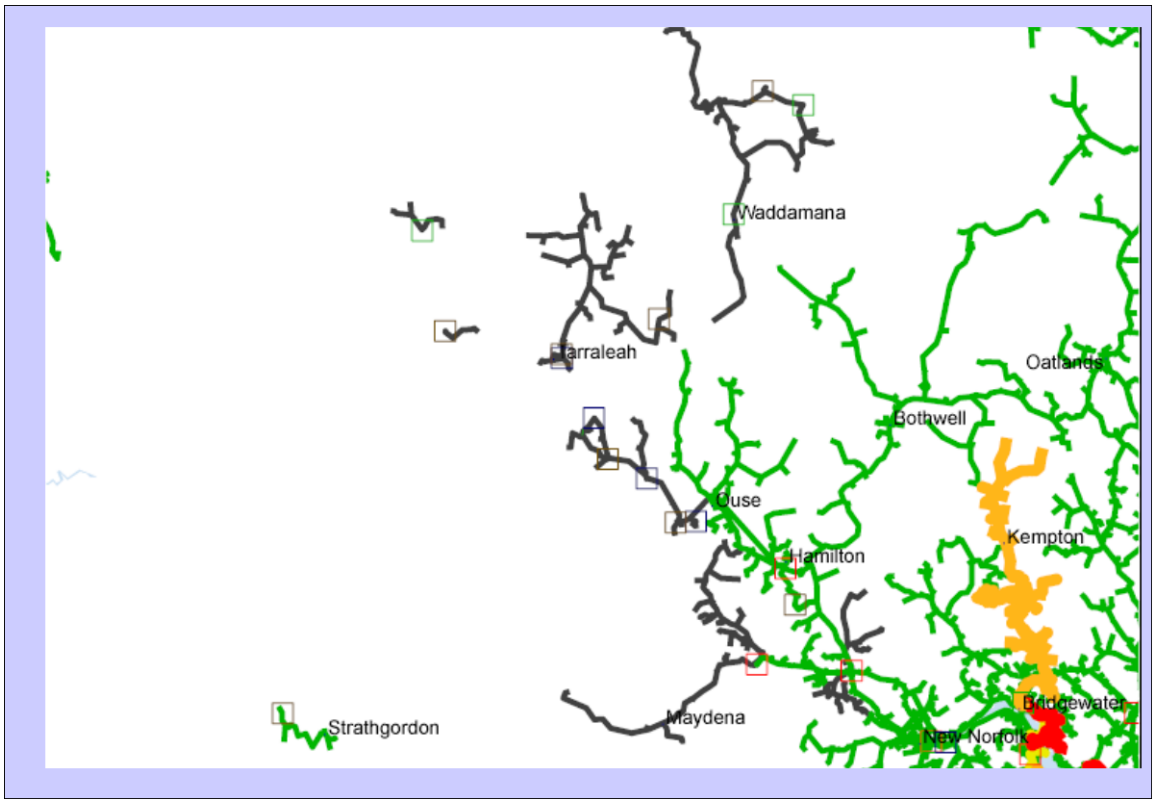
D.3 Transend Station data sheet

Planning Area	Connect Point Substation	Connection Company	Connection Voltage kV	No. Of Connection Points	Type
Central	Arthurs Lake	Transend Networks	6.6	1	Distribution
Central	Derwent Bridge	Transend Networks	22	1	Distribution
Central	Gordon	Hydro Tasmania	11	1	Distribution
Central	Meadowbank	Transend Networks	22	3	Distribution
Central	New Norfolk	Transend Networks	22	8	Distribution & subtransmission
Central	Tungatinah	Transend Networks	22	4	Distribution
Central	Waddamana	Hydro Tasmania	22	1	Distribution
Central	Fisher	Hydro Tasmania	22	1	Distribution
Central	Wayatinah	Hydro Tasmania	11	4	Distribution

Reference master document #30040697

D.4 High Voltage feeder loading

2008



Planning Area	Station	Feeder Number	Voltage	Sum of MD (MVA)	Planning Std (MVA)	Load in 5 years (MVA)
Central	Fisher	3 (C252)	11	0.9	5	1.0
		4 (D252)	11	0.0	5	0.1
	Meadowbank	45001	22	1.6	10	1.9
		45002	22	2.1	10	2.4
		45003	22	3.2	10	3.6
	New Norfolk (Terminal)	39563	22	7.5	10	8.3
		39565	22	6.2	10	6.9
		39568	22	2.3	10	2.6
		39569	22	0.1	10	0.2
		39570	22	6.1	10	6.8
		39571	22	3.6	10	4.0
	New Norfolk (Zone)	35010	11	2.9	5	3.2
		35011	11	2.3	5	2.7
		35012	11	2.3	5	2.6
	Tungatinah	T8&T9	22	1.4	10	1.6
	Waddamana	202	22	0.6	10	0.7
	Wayatinah	1	0	0.0	0	0.1
		2	0	0.0	0	0.1
		3	0	0.0	0	0.1

Reference master document #30040697

D.5 Transfer Capacity

- MD transfer capacity with other stations (order of)
-
-
- Brief outline of transmission and subtransmission feeder arrangements, ratings and capabilities

Note it would be useful to include any details of reference documents and schematic diagrams

- HV feeder ratings, current summer and winter loads. MD's
- Provide high and low load forecasts i.e. +/- 10% of base load as above for each HV feeder for the next 10 years
- Indicate anticipated summer and winter load growths for each of the existing HV feeders in the area including ratings of the feeder.
- As above for major zones
- Reference Transend Annual Planning Report.

Appendix E. Planning Criteria and Guidelines

E.1 Transmission Planning Criteria

Transend's planning criteria are fundamentally based on:

- the National Electricity Rules (NER);
- the Electricity Supply Industry (Network Performance Requirements) Regulations 2007; and
- good electricity industry practice

The following criteria are used when planning for the transmission system.

Transmission and transformer loading

- Transmission lines and autotransformer loadings for an intact system or for a contingency (N–1) should not exceed their continuous ratings in planning studies. For supply transformers four-hour emergency ratings can be used to defer augmentations depending on the peak duration of the load duration curve.
- Transmission line loading on circuits covered by NCSPS should not exceed 95 per cent of their rating for an intact system when Basslink is exporting. When Basslink is not in service or importing, standard N–1 criteria applies.

Load interruptions

For an intact system, i.e. where no elements are out of service for maintenance the following should apply as per Network Performance Requirements:

- no credible single contingency event will interrupt more than 25 MW load;

- no single asset failure will interrupt more than 850 MW or, in any event cause a system black;
- the unserved energy to loads interrupted as a result of damage to a network element related to a credible contingency event must not exceed 300 MWh; and
- the unserved energy to loads interrupted as a result of a single asset failure must not exceed 3,000 MWh

Single asset failure that would cause large load interruptions is the loss of a double circuit line, a bus section fault or a bus coupler fault. In calculating unserved energy, the ability to transfer load and the time required for load restoration should be taken into account.

Exposure due to maintenance outage

- Where a network element has been withdrawn from service for maintenance, replacement or repair, the energy exposed to interruption by a credible contingency event must not exceed 18,000 MWh.

In calculating unserved energy, the ability to transfer load should be taken into account.

Maximum repair / replacement time

Minimum Performance Requirements state that for the purpose of calculating unserved energy, any replacements or repairs undertaken, should not exceed the following:

- Transmission line repair – 48 hours
- Transformer replacement – 8 days
- Auto transformer replacement – 18 days

E.2 Distribution Planning Criteria

Key planning standards include: -

System Performance

- Voltage regulation range of + 6% and – 6% of the nominal HV voltage and a LV voltage range of 230/400 V +10% and –2%;
- Power quality standards are recognised in accordance with the TEC, NER and applicable Australian Standards; and
- Tasmanian Reliability Performance Standards

Table Appendix E -1 Tasmanian Reliability Performance Standards

Community category	Frequency standard (Maximum average number of supply interruptions per year)		Duration standard (Maximum total time without electricity in a year measured in minutes)	
	For the category	For each community	For the category	For each community
Critical infrastructure	0.2	0.2	30	30
High density commercial	1	2	60	120
Urban and regional centres	2	4	120	240
Higher density rural	4	6	480	600
Lower density rural	6	8	600	720

Source: Tasmanian Electricity Code

Capacity

Maximum average loading considerations for distribution feeders facilitating HV feeder interconnectivity;

- 22 kV – 10 MVA continuous and 15 MVA (typically one hour) emergency;
- 11 kV - 5 MVA continuous and 7.5 MVA (typically one hour) emergency.

Security of supply

Group firm philosophy or a deterministic planning standard, e.g. “N-1”, dependent on elements of security, load and exposure to risk

Schedule 5.1.2.2 (a) of the NER states:

> *"In the satisfactory operating state, the power system must be capable of providing the highest reasonably expected requirement for power transfer (with appropriate recognition of diversity between individual peak requirements and the necessity to withstand credible contingency events) at any time."*