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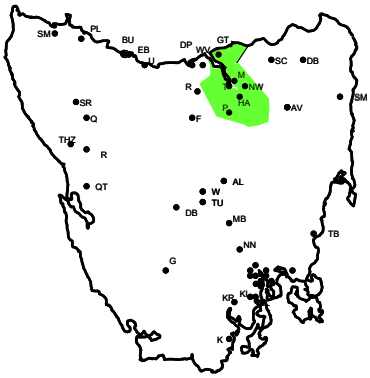

TAMAR

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 Tamar planning area covers the surrounding areas of Launceston, north to George Town.

Launceston has seen a consistent growth in the CBD and surrounding areas. There is strong commercial growth in the CBD and south of Launceston towards the airport and increasing industrial developments west in Westbury and in the industrial town of George Town.

The distribution network is under pressure due to consistent load growth and the wood heater buyback scheme, leading to increased electric heating load.

To facilitate the current and forecast load, the Tamar planning area maintains a 22kV distribution network. There are 6 Transend owned substations in the area, which supplies 60,162 connected customers via 3,051 km of OH and UG circuit.[1]

The identified or known large constraints are as follows:

- Non compliant Transfer Capability between Norwood feeders and adjacent Terminal Substation by Winter 2012
- Norwood Terminal Substation (110/22kV) operating above Emergency rating by Winter 2012

To address the above constraints the following is being proposed:

- Installation of a new 110/22kV injection point at St Leonards by Winter 2012 to improve transfer capability and ratings of Terminal substations in the Tamar Area.

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

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2. EXISTING SYSTEM

2.1 Substations

The substations supplying the Tamar planning area are listed below.

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

Transend owned substations

- George Town (click here to see the 220/110/22kV single line diagram)
- Hadspen (220/110/22kV)
- Mowbray (110/22kV)
- Norwood (110/22kV)
- Palmerston (220/110/22kV)
- Trevallyn (110/22kV)
- St Leonard's (estimated commissioning 2012)

Aurora owned substations

- There are no Aurora owned zone substations in the Tamar Planning Area.

2.2 Supply Network

Distribution within this planning area is at 22kV, supplied by 110/22kV terminal stations.

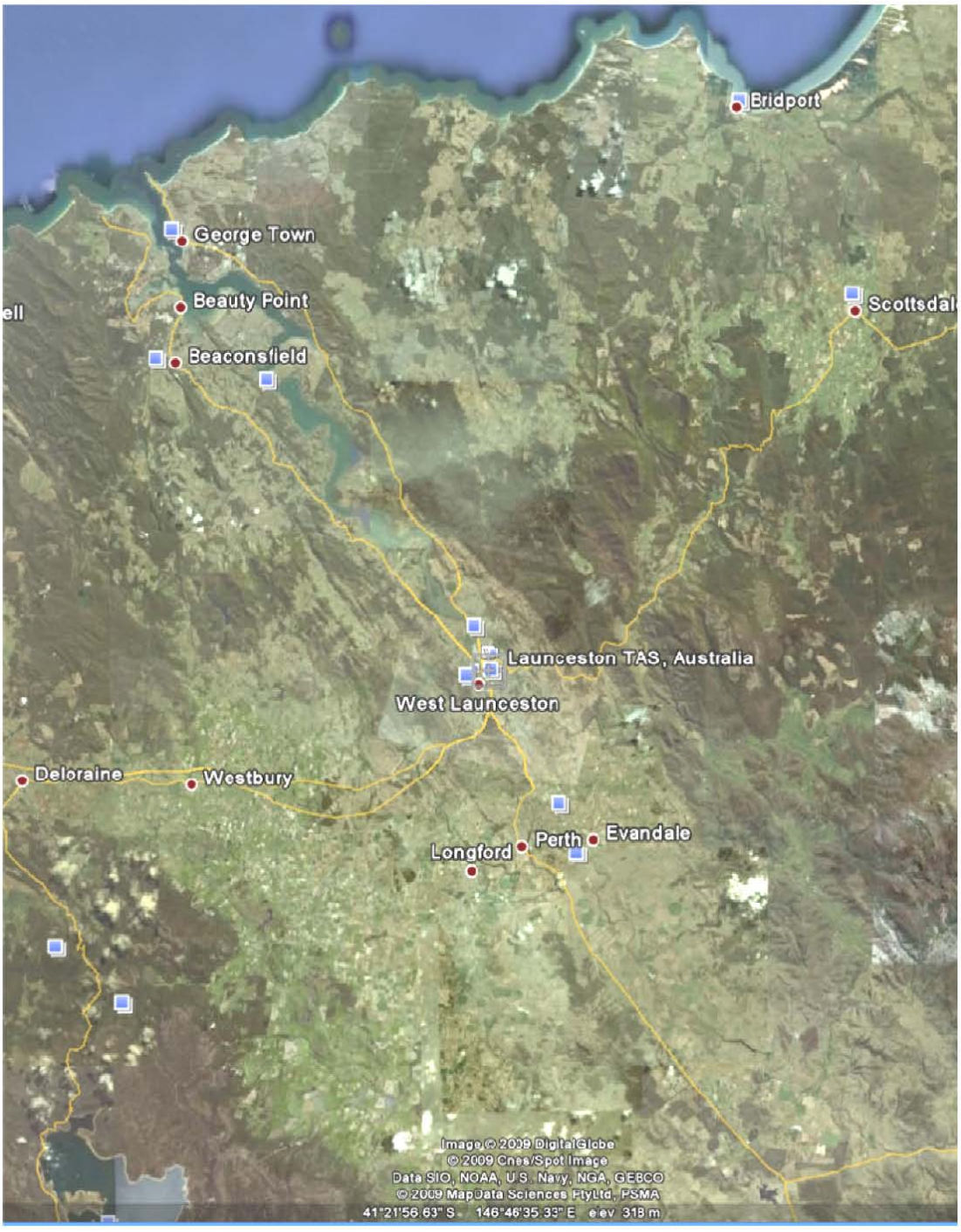
2.3 Network Statistics

Tamar area network statistics [2]

22kV circuit length	3,051	km
Connected customers	60,162	
Connected transformer capacity	838,520	kVA
Customer density	20	per 22kV circuit km
Transformer capacity density	275	kVA per 22kV circuit km

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

The map below shows the geographic area referred to as Tamar.



3. LOCAL PLANNING ISSUES

3.1 Long Term System Strategy

The Tamar planning area will continue the development of its 22kV distribution network. 22kV feeders are operated in radial configuration with normally open connections to adjacent feeders. This operating arrangement will continue for the foreseeable future.

The existing distribution arrangement of Transend owned Major Injection Points and Aurora owned 22kV distribution network will co-exist for the foreseeable future.

In the urban areas, highly interconnected Low Voltage reticulation will continue to develop at 433V.

Embedded Generation options will be encouraged at the 22 kV and 433V connection points.

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

3.2 Local Government Authorities

For planning purposes, Aurora consults closely with the following local government authorities in the Tamar planning area:

- George Town,
- West Tamar,
- Meander Valley, and
- Launceston.

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

Other relevant authorities include:

- Department of Infrastructure, Energy and Resources (DIER); and
- Ben Lomond Water.

3.3 Existing Critical Loads

Tamar 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 Tamar planning area:

Load Type	Description	Substation(s)	Feeder(s)	Asset Connection Point(s) - if applicable
Commercial / Major Retail	Launceston Airport	Hadspen Norwood	67090 65060	
	Launceston CBD	Trevallyn Trevallyn Trevallyn Mowbray Mowbray	61024 61039 61040 62009 62013	
	Connector Park Industrial Estate, Kings Meadows	Norwood	65061	
	Techno Park, Norwood	Norwood Norwood	65061 65060	
	Kings Meadows CBD	Norwood	65060	
Medical	St Vincent Hospital	Trevallyn Norwood	61040 65064	T320229
	St Lukes Hospital	Norwood Mowbray	65063 62009	T342702
	Launceston General Hospital	Trevallyn Norwood	61026 65062	T320960
Entertainment	Silverdome, Prospect	Hadspen	67081	T352500
	Launceston Country Club Casino	Hadspen	67085 67089	T352311
Nursing Homes & Rehabilitation Services	Glenara Lakes Nursing Homes	Norwood	65065	T350370
	Aldersgate Nursing Home, South L'ton	Norwood	65061	T330290
	The Manor Nursing Home, Kings Meadows	Norwood	65062	T353460
	Esk Nursing Home, St Leonards	Norwood	65063	T342050
	Aldersgate Nursing Home, Rocherlea	Trevallyn	61029	T370050
	Maranatha Nursing home, Legana	Trevallyn	61028	T691089
	LGH Geriatrics	Trevallyn	61026	T330780
	Fred French Nursing Home	Norwood	65066	T330740
	Masonic Garden Village Nursing Home	Norwood	65064 65066	T343940
	Tyler House Nursing Home	Hadspen	67086	T350060
Industrial	Gunn Kilndried, Inveresk	Mowbray	62013	C021039
	ACL – Repco, Rocherlea	Trevallyn	61029	T371093
	ACL – Repco, Mowbray	Mowbray	62010	C020848
	Bradken Resources, Youngtown	Norwood	65065	T351049
	Elster Metering, Youngtown	Norwood	65065	T352620

	Waverley Woollen Mill, St Leonards	Norwood	65063	T340450
	Examiner, Rocherlea	Trevallyn	61029	T372560
	James Nelson, Mowbray	Mowbray	62010	T370590
	Tote, Mowbray	Mowbray	62006	C021602
	Aurora Energy, Rocherlea	Trevallyn	61029	T372810
Sewerage & Water Treatment Plants	Reatta Rd Water Treatment Plant, Trevallyn	Trevallyn	61037	T360340
	Distillery Creek Water Treatment Plant, Waverley	Norwood	65067	T344916
	Hoblers Bridge Sewerage Treatment Plant	Norwood	65063	T340390
	Norwood Sewerage Treatment Plant	Norwood	65064	T343120
	Gilmore St Sewerage Treatment Plant	Mowbray	62013	T370100
	Reatta Rd Pumps, Trevallyn	Trevallyn	61037	T360370
Education				
	University of Tasmania (Newnham campus)	Trevallyn Mowbray	61029 62011	
	University of Tasmania (Inveresk Campus)	Mowbray	62008	
	TAFE - Alanvale	Mowbray		T375491

Table 1 – Tamar Critical Loads

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

3.4 Future Developments and Restrictions

- Council planning schemes

George Town

The George Town Council has a strategic plan document for 2007-2012. This document outlines the key areas affecting the municipality and the strategies to reinforce the direction of the council. The priorities of the George Town council include the six key areas of governance, corporate, planning and development, environment and heritage, infrastructure and community.

The George Town draft planning scheme is currently available for public comment. The planning scheme outlines a number of different zones and the development that is allowed in each zone. These intents will be taken into account in the development of the strategic plan for the Tamar.

George Town - Planning Scheme - Northern Tasmania

West Tamar

The West Tamar Council has a strategic plan document for 2009-2014. This document outlines the key areas affecting the municipality and the strategies to reinforce the direction of the council. The priorities of the West Tamar council include the five key objectives of community, economic and regional development, environment, infrastructure and organisation.

The West Tamar planning scheme was published in 2006. The planning scheme outlines a number of different zones and the development that is allowed in each zone. These intents will be taken into account in the development of the strategic plan for the Tamar.

West Tamar - Planning Scheme - Northern Tasmania

Meander Valley

The Meander Valley Council has a strategic plan document for 2004-2014. This document outlines the main objectives of the council. The priorities of the Meander Valley council include natural and built environment, economic growth, creative community learning, heath and well being, working together and infrastructure and services.

The Meander Valley planning scheme was originally published in 2007. The planning scheme outlines a number of different zones and the development that is allowed in each zone. These intents will be taken into account in the development of the strategic plans for Tamar and the North Coast. The document also outlines strategies for individual areas.

- Deloraine – develop industrial development in the East Goderich/Lake highway precinct and the
- Butter Factory site on Mole Creek Road
- Westbury – develop industrial development in the vicinity of Tasmanian Alkaloids off Birralee Road, promote low density residential development
- Prospect Vale – encourage commercial uses and restrict industrial, key area for residential growth
- Blackstone Heights – will not be promoted for residential development
- Hadspen – significant growth area between Meander Valley Road and the South Esk River
- Mole Creek – promote future incremental residential growth
- Chudleigh/ Meander/Elizabeth Town – low density residential development
- Bracknell/Kimberley/Exton/Hagley – not promoted for future growth

Meander Valley Council - Planning Scheme - Northern Tasmania

Launceston

The Launceston City Council has a strategic plan document for 2008-2013. This document outlines the key areas affecting the municipality and the strategies to reinforce the direction of the council. The priorities of the Launceston City council include the five key objectives of natural environment,

built environment, social and economic environment, cultural environment and governance services.

The Launceston City Council Vision 2020 document was published in 2006. This document outlines the vision for Launceston from both the council and the community.

The Launceston draft residential strategy provides a way forward for housing development in Launceston for the next 20 years. The goals in this strategy have been developed to be consistent with the outcomes required from Vision 2020. The strategy states that 'There is evidence of growing markets for smaller houses, renovation of inner city houses, and new flats and apartments in inner areas, along with significant growth in retirement village and residential aged care facilities.' The strategy discusses the issues faced by town planners and the proposed future housing demand for Launceston. The strategy discusses the transition of existing commercial areas in the CBD to higher density residential/mixed use. There are a number of areas in Launceston that have known constraints for development of higher density areas. This includes park areas, 100 year flood levels, land stability issues and heritage and scenic protected areas. These constraints, when combined with the 'walkability' principle, combine to show areas that are available for higher density development. Most land considered suitable for residential development in Launceston would need to be re-zoned for development to proceed.

The plan identifies suitable growth areas for rural residential development including:

- Expansion of the Los Angelos Rd area, Swan Bay area and the Dilston area east of the old highway
- Expansion of the Relbia Rural Residential zone
- Expansion at Lilydale (water supply limited at present)
- Expansion at White Hills (currently not zoned as rural residential)

Launceston City Council: Strategies and Plans

3.5 Reliability for the area

The Tamar Area includes the following Reliability communities:

- High Density Commercial - Launceston CBD, Kings Meadows
- Urban – Georgetown, Hadspen, Launceston Urban, Longford, Perth, Tamar South, Westbury
- High Density Rural - Dilston – Windermere, Longford Rural, Mid Tamar – Exeter etc, Upper Tamar
- Low Density Rural - Cressy - Blessington Rural, Georgetown Industrial, North East Rural, Tamar East, Tamar West

Details of actual reliability performance in the 09/10 financial year are available in here. (DM ref# 30061377)

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

- Georgetown (Urban)
- Mid Tamar – Exeter etc (High Density Rural)

3.6 Asset issues

There are no major asset issues throughout the Tamar area. No terminal substation transformers are at or beyond their nominal end of life or in poor condition.

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

NW30084385 - Management Plan 2010: Ground Mounted Substations

NW30070052 - Management Plan 2010: High Voltage Regulators

NW30084411 - Management Plan 2010: Overhead System and Structures

NW30043361 - Management Plan 2010: Underground System

NW30084386 - Management Plan 2010: Zone Substations

3.7 Links

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

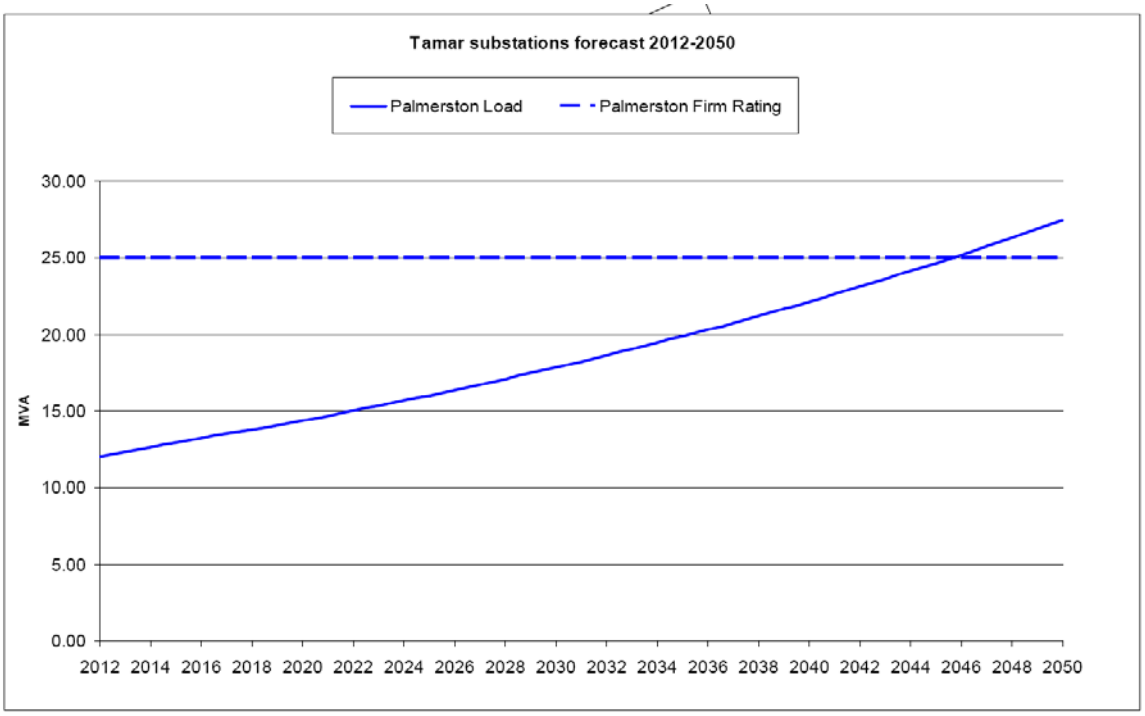
- Launceston CBD & Urban NW-#183795-Area Management Plan Launceston CBD & Urban
- Tamar West NW-#183794-Area Management Plan Tamar West
- North East NW-#215133-Area Management Plan North East
- Midlands North NW-#226271-Area Management Plan Midlands North

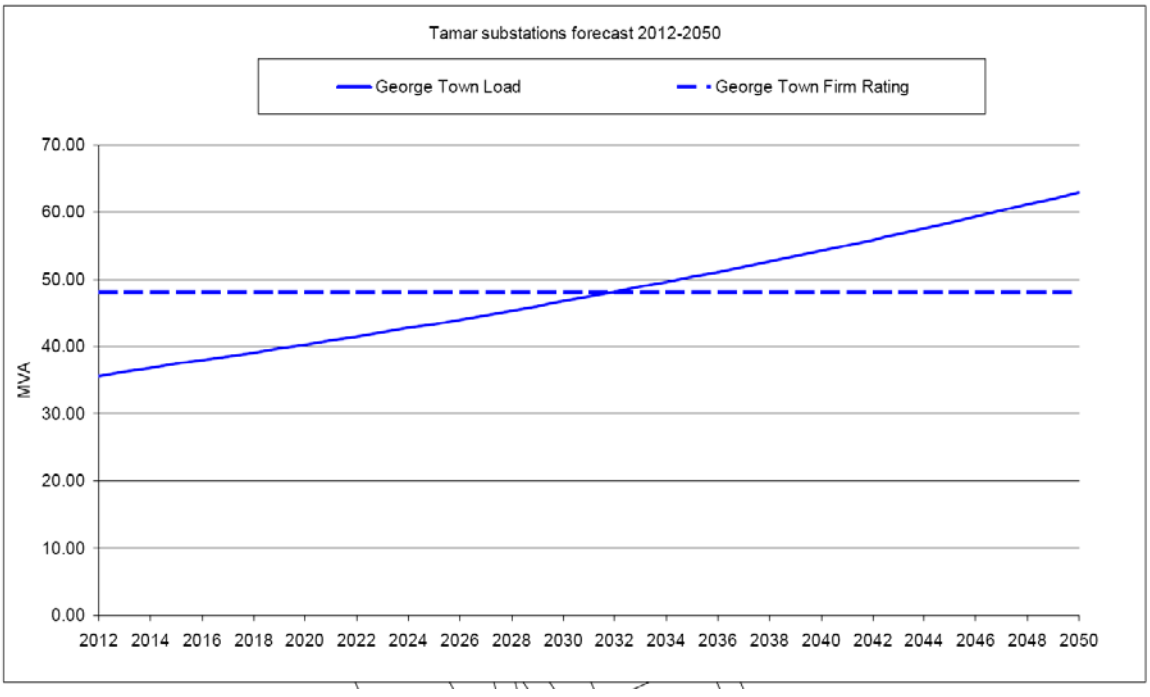
In addition Transend's Annual Planning Report contains relevant information. It can be found on their website www.transend.com.au.

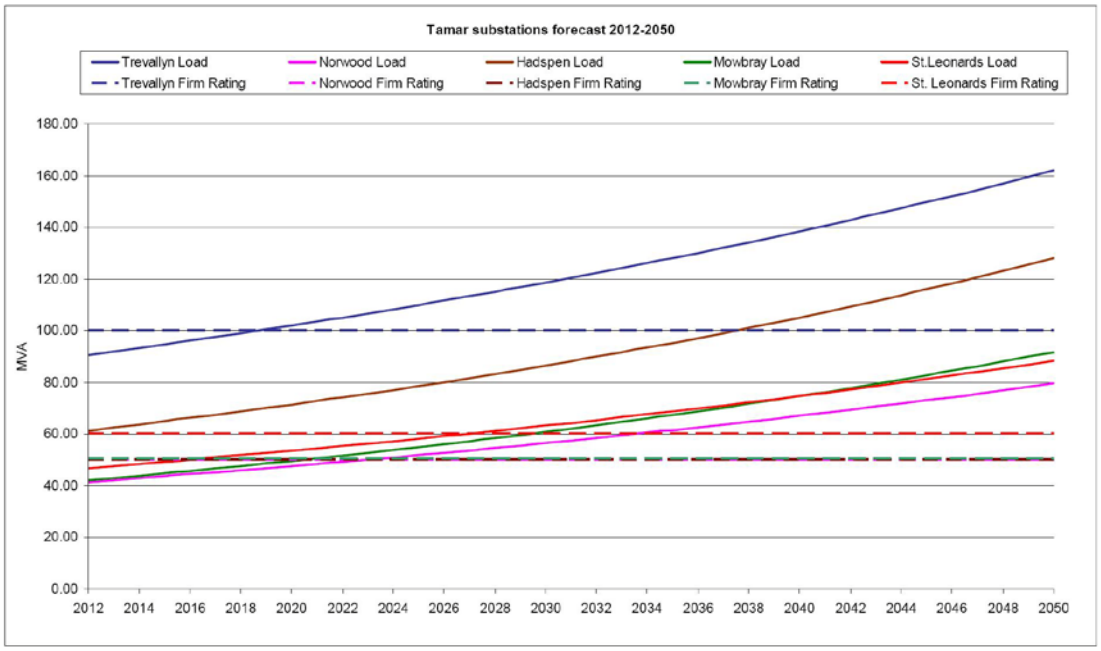
4. LOAD FORECAST

The growth in the Tamar region varies between medium and high growth development. The assumed high growth areas include Legana, Dilston, Rocherlea, Ravenswood, Longford, Westbury, Perth and Evandale. The assumed medium growth areas include Georgetown supply area, Invermay, West Launceston, Launceston CBD and surrounding suburbs, Norwood supply area and Palmerston supply area.

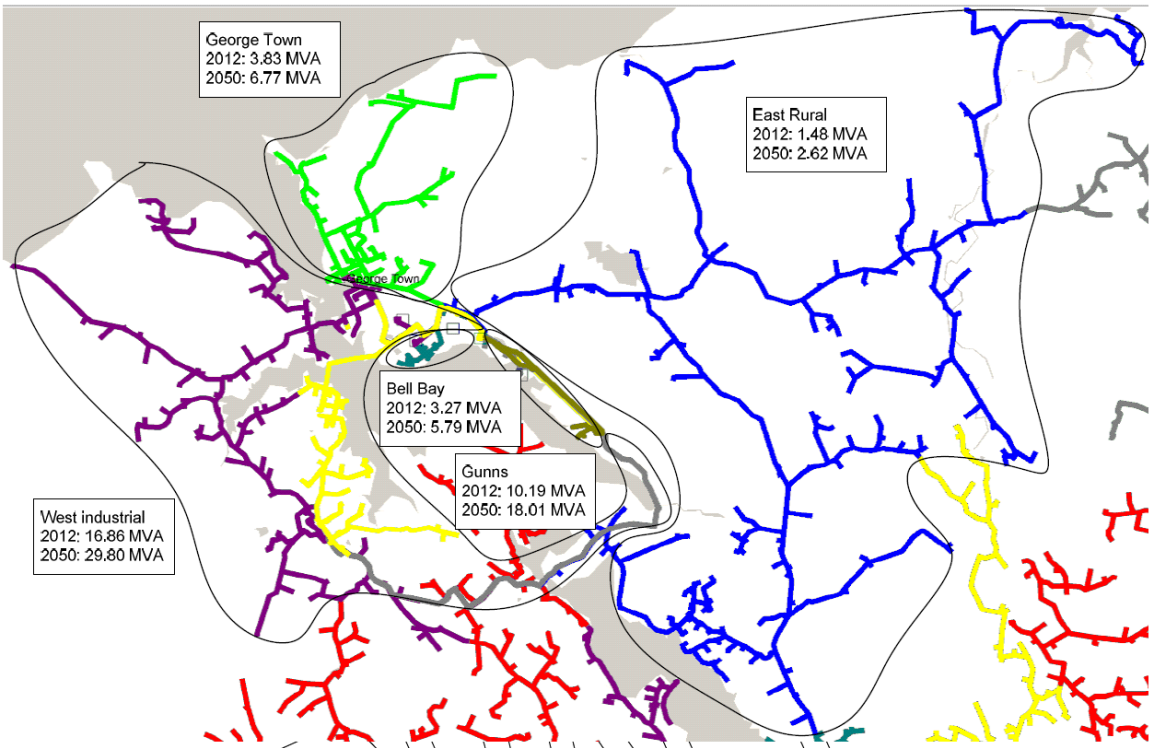
The resulting 38 year load forecast and firm ratings for substations of the Tamar planning area are provided below.

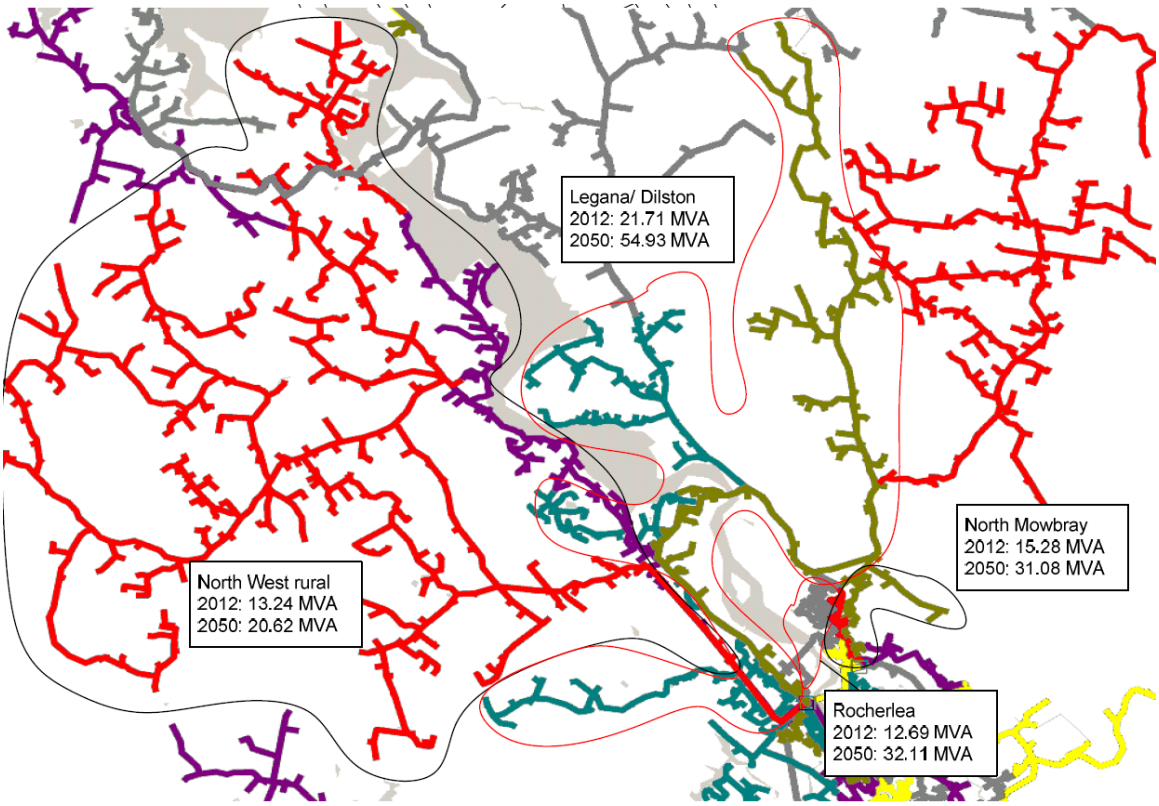


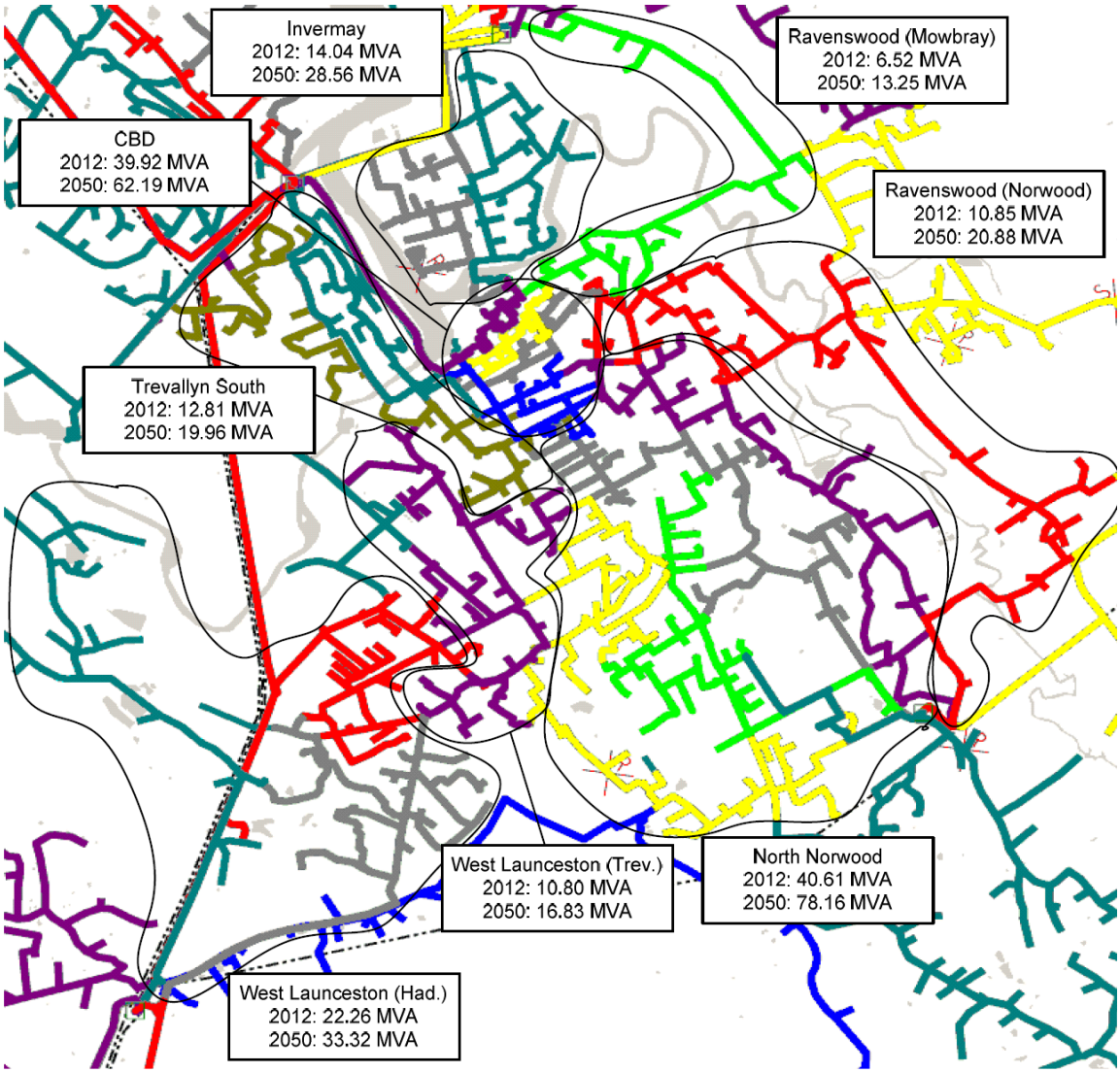


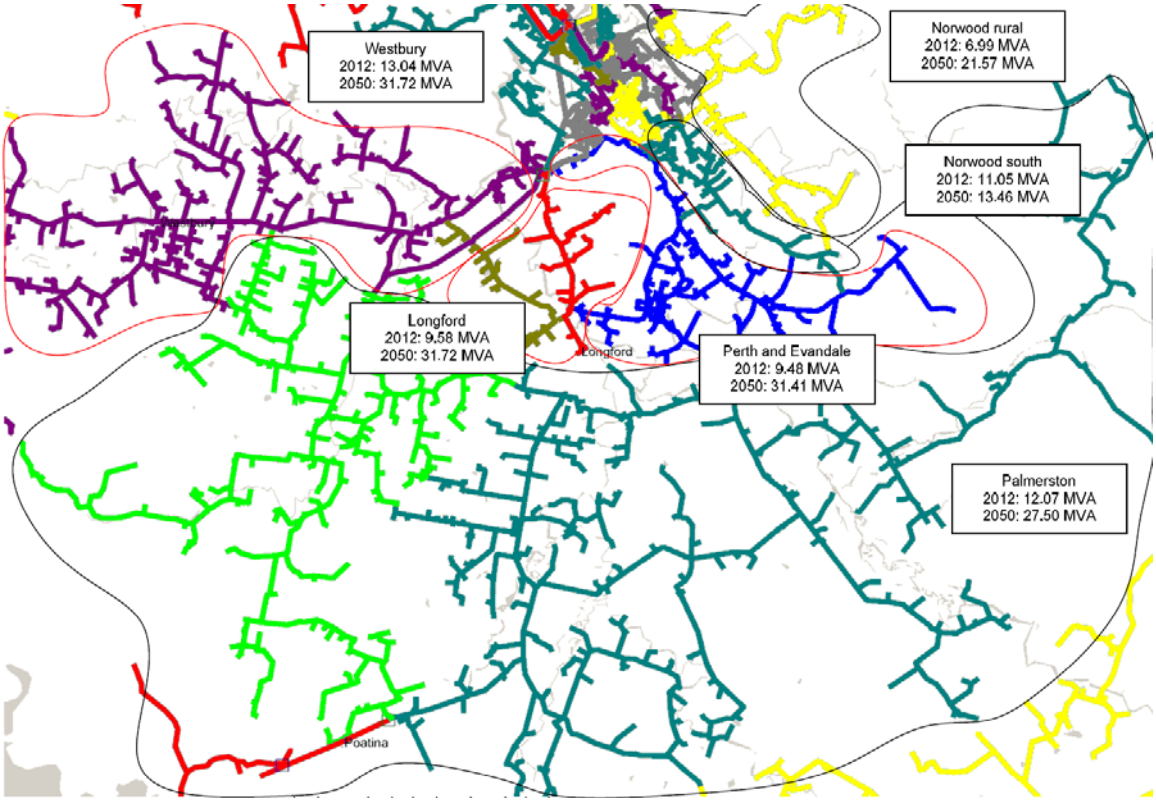


The following figures provide a geographic view of the resulting load distribution in 2012 and 2050.




Legana/ Dilston
2012: 21.71 MVA
2050: 54.93 MVA
North Mowbray
2012: 15.28 MVA
2050: 31.08 MVA
North West rural
2012: 13.24 MVA
2050: 20.62 MVA
Rocherlea
2012: 12.69 MVA
2050: 32.11 MVA


Invermay
2012: 14.04 MVA
2050: 28.56 MVA
Ravenswood (Mowbray)
2012: 6.52 MVA
2050: 13.25 MVA
CBD
2012: 39.92 MVA
2050: 62.19 MVA
Ravenswood (Norwood)
2012: 10.85 MVA
2050: 20.88 MVA
Trevallyn South
2012: 12.81 MVA
2050: 19.96 MVA
West Launceston (Trev.)
2012: 10.80 MVA
2050: 16.83 MVA
North Norwood
2012: 40.61 MVA
2050: 78.16 MVA
West Launceston (Had.)
2012: 22.26 MVA
2050: 33.32 MVA



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
	Tamar	George Town	4.2%
	Tamar	Hadspen	2.4%
	Tamar	Mowbray	1.8%
	Tamar	Norwood	2.1%
	Tamar	Palmerston	3.9%
	Tamar	Trevallyn	1.5%

The 2009 Tamar area load model is available at NW-#30067062-Tamar area load model (2009).

[Further comment about load growth forecast?]

Copy of load profile

4.1 Future committed point loads (> 1 MVA)

- None identified

4.2 Possible point loads (> 1 MVA)

- Major Subdivisions (>200 lots)
  - o

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

- None identified

4.4 Possible future embedded generation (> 1 MVA)

- None identified

4.5 Analysis of Load Forecast

Detailed load forecast data is available in the following documents:

- Load model reference NW-#30067062-Tamar 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

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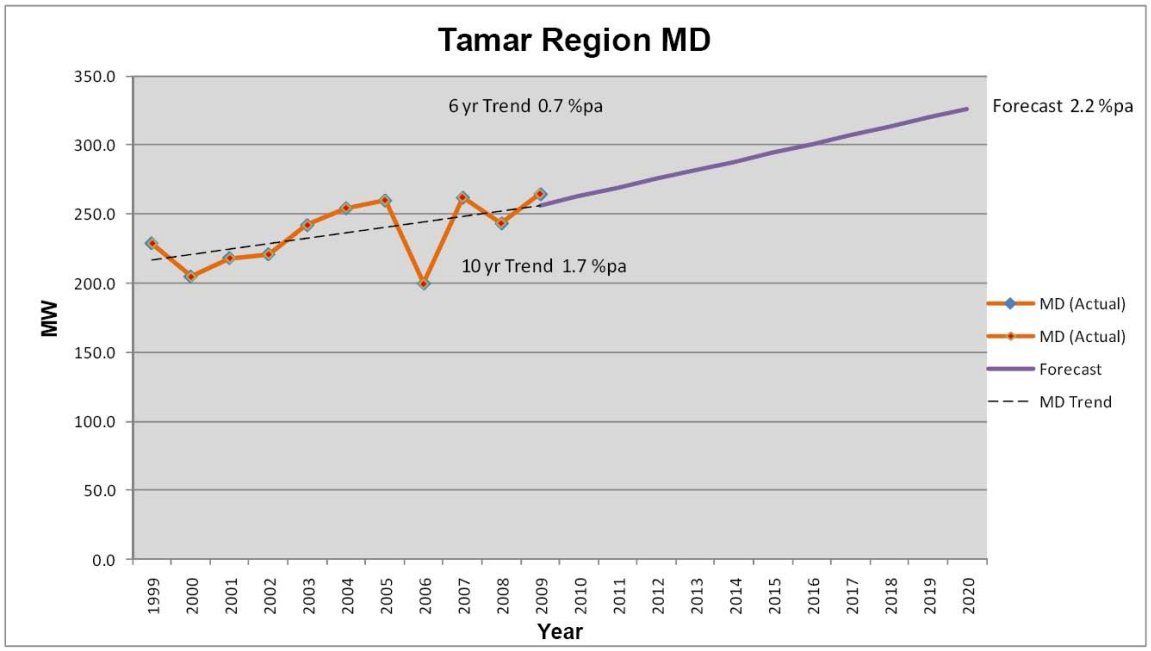


5. PLANNING CRITERIA

Aurora's Distribution Network Planning Manual issued in May 1999 is available in DM, ref NW10250570.

More up to date information is included in this document in Appendix E on page 40.

6. CONSTRAINTS (LIMITATIONS)

Constraints in the Tamar 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
	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.

6.1 Summary of Constraints

6.1.1 Terminal substation constraints

All terminal substations in the Tamar planning area are owned by Transend. Constraints identified are addressed through joint planning processes.

Capacity Constraints				
Substation	**Firm Capacity (MVA)**	**Current Load (MVA)**	**Forecast to exceed (year)**	**Comments**
George Town	48	36.0	2032	
Palmerston	25	13.2	2046	
Hadspen	50	48.3	2012	
Mowbray	50 (40)	37.5	2011	The terminal substation capacity is currently limited to the N-1 super feeder rating of 40 MVA. This will increase in 2012 under the St. Leonard's project when the 110 kV ring around the city is completed.
Norwood	50	70.9		Already exceeded
Trevallyn	100	89.7	2020	

Fault Level Constraints			
Substation	**Fault Level Description**	**Forecast replacement (year)**	**Comments**
Trevallyn	15.5 ka		None identified
Mowbray	15.0 ka		

6.1.2 Zone Substation Constraints

The Tamar planning area does not include any zone substation assets.

6.1.3 Subtransmission Constraints

The Tamar planning area does not include any subtransmission assets.

6.1.4 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

6.2 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.

Since there are no Aurora zone substations in the Tamar area this level of security is not considered.

6.3 Transfer and Operational Capability

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

	MVA				
Substation	**Rating (MVA)**	**N-1 Rating (MVA)**	**Peak Load (MW)**	**Transfer Capacity (2010)**	**Transfer Substation**
Trevallyn	150	100	89.7	6.1	Hadspen
				1.3	George Town
				2.1	Norwood
George Town	96	48	36.0	0	
Mowbray	100	50 (40)	37.5	3.0	Norwood
Hadspen	100	50	48.3	16.3	Trevallyn
				3.9	Palmerston
				4.3	Norwood
Norwood	100	50	70.9	2.5	Hadspen
				6.2	Trevallyn
				13.7	Mowbray
				1.1	Palmerston
Palmerston	50	25	13.2 summer peak	6.2	Hadspen
				1.5	Norwood

The table shows that…

Details of the analysis carried out on load transfers in the HE area are available in NW-#30066977-Tamar area load transfer (2009).

-

6.4 Power Factor

6.5 LV issues

There are no locations in the Hobart East 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 indicated 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	2,742	5,379	102	627
>= 50 kVA	2,709	54,083	104	5,315

7. SHORT TERM PLAN (<5YR)

The Tamar Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103851-Tamar area strategic plan Rev_3.

Year	**Proposed Project**	**Proposed Outcomes**
2012	St Leonards 110/22 kV substation	Address firm capacity issues at Norwood substation, improved supply for Launceston area

St. Leonard's substation is currently in the planning stage and will be in operation in 2012. It will supply the St. Leonard's/Ravenswood area and into the urban area currently supplied by Norwood. It will also supply into Inveresk to assist the Mowbray substation.

Details of the constraints, options and possible solutions analysed to arrive at these proposed projects are included in Appendix A on page 30.

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

8. MEDIUM TERM PLAN (5 TO 10YR)

The Tamar Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103851-Tamar area strategic plan Rev_3.

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

Year	Proposed Project	Proposed Outcomes
2017	Westbury 110/22 kV substation	Address firm capacity issues at Hadspen substation, improved supply for Launceston area

Details of the constraints, options and possible solutions analysed to arrive at these proposed projects are included in Appendix B on page 31.

9. LONG TERM PLAN (10YR+)

The Tamar Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103851-Tamar area strategic plan Rev_3.

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

Year	Proposed Project	Proposed Outcomes
2021	Longford 110/22 kV substation	Address firm capacity issues at Hadspen and Norwood substations, improved reliability of supply to Perth, Evandale, Longford and Launceston Airport
2027	East Launceston CBD 110/22 kV substation	Address firm capacity issues on city substations, improved reliability of supply for Launceston CBD
2029	Transformer upgrade at Norwood	Increase firm capacity at Norwood, improved reliability for Norwood supply area
2030	Exeter 110/22 kV substation	Address firm capacity issues at George Town and Trevallyn substations, improved reliability for large rural area and industrial point loads
2040	Transformer upgrade at	Increase firm capacity at Mowbray,

Year	Proposed Project	Proposed Outcomes
	Mowbray	improved reliability for Mowbray supply area
2043	Third transformer at St. Leonard's	Address firm capacity issues at the city substations, improved reliability for Launceston area
2046	Transformer upgrade at Palmerston	Increase firm capacity at Palmerston, improved reliability for Palmerston supply area

Details of the constraints, options and possible solutions analysed to arrive at these proposed projects are included in Appendix C on page 35.

10. PROGRAM OF WORK DRAFT

Project	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Install UG HV - 6 feeder tails New Norfolk Zone		$ 173,000				
(Project BW 006] Install 0.2 km HV UG Huntingtier Rd PID 221007 to Hardwicks Rd Bagdad PID 390836	$ 80,000					
Augment OH HV - 14 Mile Rd, Tarraleah					$ 210,000	
Augment OH HV - Fdr 37002 stage 1 Gretna Zone associated with Zone replacement					$ 411,000	
Augment OH HV - Fdr 37002 stage 2 Gretna Zone associated with Zone replacement					$ 411,000	
Augment OH HV - Fdr 37002 stage 3 Gretna Zone associated with Zone replacement					$ 206,000	
Derwent Bridge - Install 3rd wire Lyell Hwy (generator stability) 2 kms	$ 40,000					
Derwent Bridge - Install permanent connection point generator	$ 25,000					
Install 1 x 6.6/ 22 kV step up stations at todds corner						$ -
Install 19/3.25 AA OH link Hamilton - F45003 2 kms	$ 130,000					
Install OH HV - Auburn Rd to Macquarie Rd						
Install OH HV - Derwent Bridge to Bronte Link					$ 630,000	
Install OH HV - link Meadowbank 45003 to Wayatinah 49412 to Tunagtinah 49305						$ 420,000
Install OH HV - link to Lake Cresent 3 ph (to assist in removal of SWER)				$ 630,000		
Install OH HV - link Victoria Valley SWER to Tungatinah fdr 49303, Dee Lagoon					$ 124,000	
Install OH HV - new Feeder, Elderside						$ -
Install OH HV - Upgrade SWER, Dee Lagoon Link, Victoria Valley Rd				$ 294,000		
Project BW 004 Reinsulate7.6 k & 8 tx Bridgewater F48 190 to 22 kV and supply from Meadowbank TS	$ 300,000					
Project BW 005 Reinsulate 10.0 k &11 tx Bridgewater F 48 190 to 22 kV and supply from Meadowbank TS		$ 352,000				
Project MB 001 - Westerway 38002 OH conversion to 22 kV (10 km OH and 15 tx's)		$ 400,000				
Project MB 002 - Westerway 38002 OH conversion to 22 kV (12 km OH and 22 tx's)			$ 460,000			
Project MB 003 - Westerway 38002 OH conversion to 22 kV (11 km OH and 15 tx's)					$ 360,000	
Tods corner - Convert 6.6 kv line to 22 kv						$ -
Augment pole sub 300 kVA First Avenue New Norfolk	$ 40,000					
Augment pole sub Fairfax Terrace New Norfolk	$ 40,000					
Install new pole sub George Street New Norfolk	$ 40,000					
Install Substation - new or augment pole type 300 kVA				$ 30,000	$ 30,000	$ 30,000
Augment OH LV - overloaded LV ccts Highlands stage 2		$ 14,000				
Augment OH LV - overloaded LV ccts Midlands South stage 2		$ 14,000				
Augment OH LV - overloaded LV ccts Midlands South stage 3		$ 14,000				
Augment OH LV - overloaded LV ccts Midlands South stage 4				$ 14,000		
	$ 695,000	$ 967,000	$ 460,000	$ 968,000	$ 2,382,000	$ 450,000

11. 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.

12. REFERENCE DOCUMENTS

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

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

13. 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

St Leonards substation?

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

B.1 Westbury 110/22 kV substation

B.1.1. Constraints

Hadspen terminal substation has two 50 MVA 110/22 kV transformers. The terminal substation load in 2012 is forecast to be 61.25 MVA and it is forecast to grow to 74.14 MVA in 2022. This load is well above the firm capacity of the substation. Two 5 MVAr capacitor banks have recently been installed at Hadspen which will slightly reduce the peak load on the substation.

Railton terminal substation has two 50 MVA 110/22-11 kV transformers. The forecast load for 2012 is 52.02 MVA and it is forecast to grow to 56.15 MVA in 2022. The distribution feeders are heavily loaded and there are no spare circuit breakers on the 22kV switchboard. Railton substation will be partially deloaded by the conversion of Wesley Vale substation to a new connection point in 2012.

Two 5 MVAr capacitor banks have recently been installed at Railton which will slightly reduce the peak load on the substation.

Another main driver for this project is the reliability of the 22 kV network in the Deloraine and Westbury areas. These areas are fed by 30 and 40 km long 22 kV feeders from Hadspen and Railton and a number of the anticipated new point loads will be situated on the end of these feeders.

Transend has a transmission line age limitation on the 220 kV line running from Palmerston to Sheffield (through Westbury/Deloraine). This line was installed in 1955 and is no longer considered suitable to operate as part of the main 220 kV backbone from the North Coast.

B.1.2. Options considered

1. Installation of a new 110/22 kV connection point at Westbury
2. Installation of a third transformer at Hadspen and new 22 kV feeders to Westbury
3. Installation of a 110/66 kV substation at Longford and a 66/22 kV zone substation at Westbury
4. Non-network option
5. Do nothing option

Option 1 – Installation of a new 110/22 kV connection point at Westbury

The first option involves the establishment of a new terminal substation in the Westbury area in 2017.

Two 110/22 kV 60 MVA transformers and 22 kV switchgear should be installed. This will address the

firm capacity issues at Hadspen and Railton, provide additional 110 kV support to Railton via Sheffield and improve the reliability of the 22 kV network currently supplied from Railton.

Option 2 – Installation of a third transformer at Hadspen and new 22 kV feeders to Westbury

This option involves the installation of a third transformer at Hadspen and new 22 kV feeders to supply the increasing load at Westbury. This will address the firm capacity issues at Hadspen.

Option 3 – Installation of a 110/66 kV substation at Longford and a 66/22 kV zone substation at Westbury

This option involves the installation of a 110/66 kV substation at Longford and a 66/22 kV zone substation at Westbury. Two new 60 MVA transformers will be installed at Longford and a new 66 kV circuit to a new zone substation at Westbury with two 25 MVA 66.22 kV transformers. This will address the firm capacity issues at Hadspen.

Option 4 – Non-network option

No non-network alternatives have been considered.

Option 5 – Do nothing option

The do nothing option is not considered a feasible option as the firm capacity at Hadspen and Railton has been exceeded.

Technical comparison

Option	Description	Advantages	Disadvantages
1	Installation of a new 110/22 kV connection point at Westbury	• Address firm capacity limitations at Hadspen and Railton • Greatest reliability improvement • Highest operational flexibility • Consistent with network development plan (remove surrounding load from Hadspen so it can feed towards Launceston)	• Requires new site • Dependent on Transend 220 kV transmission works

		• Utilises existing 22 kV feeders • Provides additional 110 kV support to Railton via Sheffield	
2	Installation of a third transformer at Hadspen and new 22 kV feeders to Westbury	• Increases firm capacity at Hadspen by 50 MVA • Addresses firm capacity limitation at Hadspen • Utilises existing site	• Does not address firm • capacity issues at Railton – The project for the replacement of the Wesley Vale transformers will need to be brought forward to assist Railton • Additional feeders required from Railton to address reliability issues on 22 kV feeders (new circuit breakers or 22 kV network reconfiguration will be required) • Not consistent with strategic plan (Hadspen to feed toward Launceston) • Construction of long 22 kV feeders required (30 km Hadspen to Westbury) • Increased O&M costs on new long 22 kV feeders
3	Installation of a 110/66 kV substation at Longford and a 66/22 kV zone	• Addresses firm capacity limitation at Hadspen and	• Requires new site at Westbury • Requires additional site at

	substation at Westbury	Railton • Utilises existing 22 kV feeders • Utilises existing Longford site	Deloraine for a zone substation in 2027 • Required construction of 66kV subtransmission circuits

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	19.2	26.9	15.8
2	15.9	32.1	18.0
3	30.0	56.0	28.8

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-#30103851-Tamar area 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 Transend:

- Establish a Terminal station at Westbury with 2 x 110/22 kV 60 MVA transformers,
- Install a new 220kV line between Sheffield and Palmerston and convert the existing 220kV line to 110 kV.

It is recommended that Aurora install 22kV feeder tails to cut and connect the existing 22kV network to the new substation.

The installation of the Westbury substation in 2017 addresses the firm capacity issues at both Hadspen and Railton substations.

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

C.1 Longford 110/22 kV substation

It is recommended that a new terminal substation is established in the Longford area in 2021. Two 110/22 kV 60 MVA transformers should be installed. This will address the firm capacity issues at Hadspen and Norwood and will allow load to be shifted between the relieved substations and Trevallyn, Mowbray and St. Leonard's. This substation will supply the growing areas of Longford, Perth, Evandale and the Launceston airport.

C.2 East Launceston CBD terminal substation

It is recommended that a new terminal substation is established on the existing East Launceston CBD site in 2027. Two 110/22 kV 60 MVA transformers and new 22 kV switchgear should be installed. This will address the firm capacity issues of the Launceston substations and provide a reliable source of supply to the CBD. This will also help address the distribution feeder access limitations of running 22kV feeders in from the surrounding substations.

This project will need to be further assessed in comparison to the establishment of a third transformer at St. Leonard's substation.

Further information on the recommendation of the installation of a substation in the Launceston CBD is provided in Appendix C of NW-#30103851-Tamar area strategic plan Rev_3.

C.3 Norwood transformer upgrade

It is recommended that the two 110/22 kV 50 MVA transformers at Norwood be upgraded to 60 MVA in 2029. This will address both capacity and age limitations on the Norwood transformers.

C.4 Exeter 110/22 kV substation

It is recommended that a new terminal substation is established in the Exeter area in 2030. Two 110/22 kV 60 MVA transformers should be installed. This will address the firm capacity issues at George Town and Trevallyn and will allow load to be shifted between the Launceston substations.

C.5 Mowbray transformer upgrade

It is recommended that the two 110/22 kV 50 MVA transformers at Mowbray be upgraded to 60 MVA in 2040. This will address a capacity limitation on the Mowbray transformers and delay the installation of a third transformer at St. Leonards.

C.6 St. Leonard's third transformer installation

It is recommended that a third 110/22 kV 60 MVA transformer be installed at St. Leonard's substation in 2043. This will address the firm capacity issues at the five Launceston substations. A number of new 22 kV distribution feeders will need to be installed to heavily loaded areas supplied by Mowbray.

This project will need to be further assessed in comparison to the establishment of the East Launceston CBD substation.

C.7 Palmerston transformer upgrade

It is recommended that the two 110/22 kV 25 MVA transformers at Palmerston be upgraded to 30 MVA in 2046. This will address both capacity and age limitations on the Palmerston transformers.

Appendix D. Technical Data

D.1 Substation loading

Reference master document # 30006462

D.2 Aurora Zone Substation data sheet

There are no Aurora Zone substations in the Tamar planning area.

Reference master document #30040697

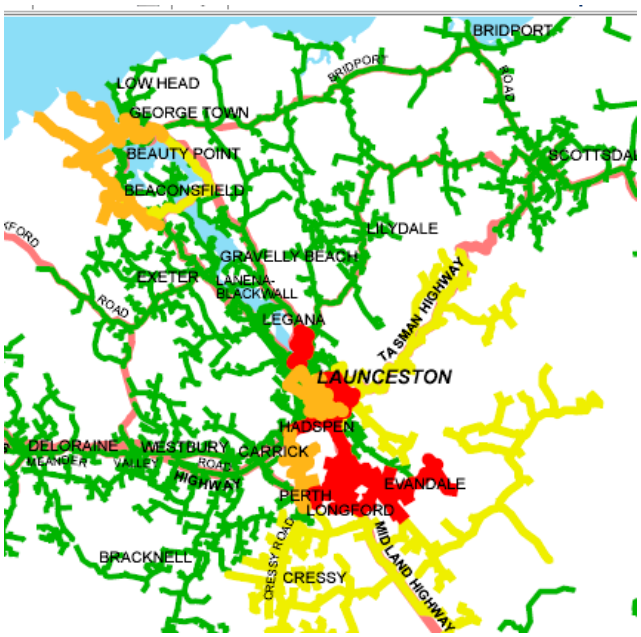
D.3 Transend Station data sheet

Planning Area	Connect Point Substation	Connection Company	Connection Voltage kV	No. Of Connection Points	Type
Tamar	George Town	Transend Networks	22	10	Distribution
Tamar	Mowbray	Transend Networks	22	10	Distribution
Tamar	Norwood	Transend Networks	22	8	Distribution
Tamar	Palmerston	Transend Networks	22	3	Distribution
Tamar	Trevallyn	Transend Networks	22	14	Distribution
Tamar	Hadspen	Transend Networks	22	8	Distribution

Reference master document #30040697

D.4 High Voltage feeder loading

2008/2009



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.”*