Revised Regulatory Proposal

Supporting Information: Conductor Augmentation – Sandford (Section 10.4.1, Capacity Management Plan 2011)

Aurora response to the AER's Draft Distribution Determination

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Aurora Energy Pty Ltd
ABN 85 082 464 622
Level 2 / 21 Kirksway Place
Hobart TAS 7000
www.auroraenergy.com.au
Enquiries regarding this Document should be addressed to:
Network Regulatory Manager
Aurora Energy Pty Ltd
GPO Box 191
Hobart TAS 7001
e-mail: RRP2012@auroraenergy.com.au

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1. Introduction

Aurora provided the AER with its *Regulatory Proposal* on 31 May 2011 in accordance with the provisions of Chapter 6 of the *Rules*. Aurora also set out its answers to the Regulatory Information Notice (RIN) issued by the AER on 21 April 2011 in its response (*RIN Response*) of 31 May 2011.

The AER has reviewed Aurora's *Regulatory Proposal* and *RIN Response* and provided Aurora with the AER's *Draft Distribution Determination*, associated consultant's reports and AER models on 29 November 2011 in accordance with the provisions of Chapter 6 of the *Rules*.

Aurora provides its *Revised Regulatory Proposal* to the AER in response to the AER's *Draft Distribution Determination* in accordance with the provisions of Chapter 6 of the *Rules*. This document provides specific supporting information as an appended attachment to Aurora's *Revised Regulatory Proposal.*

2. Background

The Sandford conductor augmentation project is part of a larger project to address loading issues on Transend's Rokeby Terminal Substation and capacity issues on feeders serving the urban and rural areas of Sandford, Lauderdale, South Arm and Opossum Bay.

These constraints, amongst others, were the subject of the joint Transend-Aurora consultation process required under chapter 5 of the National Electricity Rules which was completed in June 2009.[1] No submissions were received during the course of the consultations. Accordingly, construction of the appropriate option (Option 2) commenced.

Under Option 2, the ultimate supply arrangement in the Sandford area will be the establishment of a 33/11 kV Zone Substation to address the loading constraint on Transend's Rokeby Terminal Station, which is forecast to occur in 2017. The new Sandford Zone Substation will be located south of Rokeby Terminal Substation towards the load centre of Sandford to provide localised support to the HV network in the Sandford and South Arm areas and reducing the need to reinforce the 11 kV networks between Sandford and Rokeby. The substation will be energised from Transend's new Mornington Terminal Substation[2] (which was also part of Option 2) via two 33 kV rated sub-transmission lines that will route past the Rokeby Terminal Substation.

Aurora recognises that the full solution for Option 2 will result in significant capital investment for distribution infrastructure, but has identified that a large portion of the investment can be deferred until beyond the end of the Forthcoming *Regulatory Control Period* using non-network solutions (see section 10 for more information).

To address the immediate capacity constraints on feeders in the area, Aurora intends to run a new feeder so that the load can be more easily managed. For maximal expenditure efficiency, Aurora intends to utilise this feeder as part of one of the two sub-transmission feeders supplying Sandford Zone Substation from the Mornington Terminal Substation on the former's construction.

In its *Regulatory Proposal*, Aurora forecast capex for the first stage of Option 2, to implement the non-network solutions and limited network solutions required to defer the requirement of the construction of the Sandford Zone Substation.

On the advice of its Principle Technical Advisor, Nuttall Consulting, the AER allowed all of the non-network forecast capex, but substituted Aurora's forecast capex for the network solutions with a value 10% of the original.

Aurora considers that the AER and Nuttall Consulting have inappopriately substituted the forecast capex for the network component of the project.

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[1] See the joint Transend-Aurora *Final Report, Proposed New Large Transmission Network Asset and Proposed New Large Distribution Network Asset, Development of the Electricity Supply Network in the Hobart Eastern Shore Region*, June 2009

[2] Construction of the Mornington Terminal Substation was completed in May 2011.

3. Regulatory Proposal

In its *Regulatory Proposal*, Aurora forecast capex of approximately $6.5 million (June $2010) for the construction of a new feeder from Rokeby Terminal Substation into the Sandford area to relieve loading constraints on the existing feeders in the area. A summary of the proposed work can be found in section 8.2.1.

This capex forecast was supported by the following attachments to the *Regulatory Proposal* and the accompanying RIN:

- *Hobart East Development Plan*;
- *System Strategic Planning Capacity Report – Hobart East, 2010*, produced by Aurecon for Aurora, which was attachment AE046 to Aurora's *Regulatory Proposal* (the Aurecon Report); and
- *Identification of Non-network Initiatives for the 2012-17 EDPR* produced for Aurora by Futura Consulting in July 2010, which was attachment AE055 to Aurora's *Regulatory Proposal* (the Futura Report).

4. Draft Distribution Determination

The AER's Principle Technical Consultant, Nuttall Consulting, reviewed Aurora's forecast capex and project documentation for the Sandford Conductor Augmentation project.

Nuttall Consulting considered that the purchase costs for the site of the future Sandford Zone Substation were "reasonable"[3], although it appears that Nuttall Consulting was of the opinion that the land was part of the non-network solutions:

> *In the case of the substation projects, Austins Ferry, Wynard substation, and Sandford zone substation, these three developments are considered by Aurora as good candidates to be deferred by the non-network solutions. Aurora has allowed for some modest capex to cover design, fees and land purchases where needed, which we consider is reasonable in the circumstances.* [4]

With regards to the conductor augmentation project, Nuttall Consulting agreed that the introduction of a new feeder to the Sandford aligned with the long-term solution involving the construction of the Sandford Zone Substation, but considered the underground-submarine cable to be overly expensive, and suggested that a cheaper short-term solution could be found.[5]

Additionally, Nuttall Consulting considered that the Futura Report suggested that non-network solutions would remove the necessity for any component of the Sandford Zone Substation to be built, including the feeder from Rokeby Terminal Substation which would become part of the sub-transmission feeder from Mornington Terminal Substation to Sandford Zone Substation.[6]

In light of this analysis, Nuttall Consulting formed the view that the whole of the forecast capex was to address operational issues, with no demand component. Nuttall Consulting then considered the effect of the AER's own demand forecasts. Based on the AER's forecast of increased demand on Rokeby Terminal Substation, Nuttall Consulting revised their estimate, allowing that 10 per cent of Aurora's forecast capex was demand-related.[7]

The AER accepted this view[8], and subsequently substituted a revised capex forecast of 10 per cent of Aurora's forecast capex, which value was used in the aggregate substitute capex forecast.[9]

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[3] Nuttall Consulting Capex Report, page 43.
[4] Nuttall Consulting Capex Report, page 43.
[5] Nuttall Consulting Capex Report, page 42
[6] Nuttall Consulting Capex Report, page 51
[7] Nuttall Consulting Capex Report, page 62
[8] Draft Distribution Determination, page 142
[9] AER spreadsheet *AER Capex Analysis – to Aurora*, worksheet *timing review – ex OH*)

5. Revised Regulatory Proposal

Aurora considers that there are two issues to be addressed as a result of the AER's substituted capex forecast for the Sandford conductor augmentation project.

The first issue is that the network solution is not necessary because the non-network solutions will solve the capacity constraints. Aurora contends that the non-network solutions are not the whole solution to the immediate capacity constraints in the Sandford area. This is addressed in section 5.1.

The second issue is that the network solution put forward in Aurora's *Regulatory Proposal* is unnecessarily costly. Aurora agrees that on review, the original solution was potentially excessive. Aurora addresses this in section 5.2.

5.1. Effect of Non-network Solutions

In their review of Aurora's proposal, Nuttall Consulting developed the view that non-network solutions were sufficient to defer the need for construction of the Sandford Zone Substation. The matter was discussed in their "Area Review Findings" section of their report,

> *Aurora is also proposing a non-network solution to defer the need for the related new Sandford zone substation project. We do not consider that Aurora's capex (and opex) allowance for this non-network solution is consistent with the assumption that this network project will be required also. Our view is that the non-network solution will most-likely mean that a network solution will not be required in the next period,*[10]

and,

> *In the case of the substation projects, Austins Ferry, Wynard substation, and Sandford zone substation, these three developments are considered by Aurora as good candidates to be deferred by the non-network solutions. Aurora has allowed for some modest capex to cover design, fees and land purchases where needed, which we consider is reasonable in the circumstances,*[11]

and in their discussion of non-network projects,

> *For these three projects, we have conducted a more detailed review to confirm that the Futura analysis is consistent with analysis Aurora has presented elsewhere on the network need and network preferred option. In all three cases, the assumptions on the network need, the timing of this need, and the cost of the preferred option are in accordance with the analysis presented in the relevant Aurecon reports.*
>
> *We have also assessed the economic analysis presented to justify the non-network solution. In all cases, the analysis supports the selection of the non-network option. However, we have two main concerns with the analysis, in the context of our findings discussed above on the network plans.*

[10] Nuttall Consulting Capex Report, page 42
[11] Nuttall Consulting Capex Report, page 43

> *Firstly, as was alluded to above, in the case of Sandford, the Futura analysis assumes the full cost of the project will be deferred by the non-network solution. This is not what Aurora has allowed for in its proposal, where it has included the sub-transmission line works, which constitute a large portion of the network solution. We do not consider that the non-network solution would be economic if this was to be the case. The Futura analysis seems to recognise that the non-network analysis needs to address the issue raised by Aurora as driving the need for the sub-transmission works i.e. heavily loaded feeders. As such, our view is that it is reasonable to assume that the non-network solution will relieve this network need, and consequently, the sub-transmission works proposed by Aurora should not be necessary – or a far more modest project should be sufficient to manage the risks.*

Aurora observes, in the first instance, that the forecast capex for the purchase of land for the Zone Substation at Sandford is not associated with the non-network solution, as seems to be the implication in the second quote.

The main issue, however, is the contention that non-network solutions alone will be sufficient to allow deferral of the Sandford Zone Substation.

A description of the system constraints in the Sandford-Lauderdale area is given in section 9. In particular, Table 2 in section 9.1 gives the results of a forecast of network constraints in 2017 under three scenarios:

- no work to address system constraints;
- non-network solutions to address system constraints; and
- combined non-network and network solutions to address constraints.

To arrive at the non-network values, it was assumed that 1.6 MVA could be addressed by any combination of non-network solutions (see section 5.1.1 for a brief explanation of the choice of target). The network solution involved the introduction of the fourth feeder from Rokeby Terminal Substation (the route of the feeder is immaterial to this discussion).

Note that the effect of the non-network solutions by themselves do not appreciably address the asset constraints:

- Rokeby Terminal Substation loading is reduced by five per cent;
- feeder loading is improved by around five per cent for all feeders, but feeder 28223 is still operating above firm capacity;
- asset loading improves by three or four per cent;
- voltage drop on two feeders is barely improved, and both are still non-compliant; and
- the load at risk changes significantly for only one feeder (28224).

The non-network solutions, by themselves, therefore, are not sufficient to address the existing system constraints.

When considered in conjunction with the network solution, however, there is significant forecast relief of the network constraints in 2017, the final year of the Forthcoming Regulatory Control Period:

- the loading on Rokeby Terminal Substation is not improved by an extra feeder serving the area because, until Sandford Zone Substation is constructed, this feeder is served by Rokeby Terminal Substation;

- feeder loading is improved by a further 31 per cent, with all feeders below firm capacity;
- asset loading improves by a further 29 per cent;
- voltage drop on two feeders is improved by a further 4.5 per cent, with one of the feeders becoming compliant; and
- the load at risk drops to zero for all feeders.

It is evident from this analysis that non-network solutions alone are not sufficient to defer the construction of the Sandford Zone Substation because non-network solutions in isolation are not sufficient to address the network constraints.

The primary intention of Aurora's non-network initiatives will be in the reduction of peak demand, whether through demand-side management, demand management, or the use of mobile generation at known periods of high demand. It is this peak shaving that will permit full deferral of the Sandford Zone Substation.

A brief discussion of Aurora's Non-network Initiatives, including the AER's decision to disallow capex for the acquisition of mobile generation capacity is discussed in section 10.

5.1.1. The Choice of the Non-network Initiative Targets

The Non-network Initiative targets were set on the basis of the Futura Report.[12] Futura notes that to defer the construction of Sandford Zone Substation by one year, the peak demand should be reduced by the year-on-year incremental growth in peak demand.[13] Futura estimated the annual incremental load growth on Rokeby Terminal Substation to be of the order of 0.8 MVA.

In consequence, to defer the need for the Sandford Zone Substation to beyond the end of the Forthcoming Regulatory Control Period, two years peak demand growth would need to be mitigated, which equates to 1.6 MVA.

5.2. Form of the Network Solution

Nuttall Consulting noted, in relation to the network solution proposed in the *Regulatory Proposal*, that:[14]

> *The remaining proposed works however still constitute a relatively major project, which allows for the development of two sub-transmission circuits, one of which is assumed to be submarine for a large part of its route. These circuits will operate as HV feeders, relieving the load in the area, until the new substation is constructed, when they will be used to supply this substation.*

Following discussions with staff of Nuttall Consulting during their review of Aurora's capex forecast, Aurora formulated an alternative network solution involving overhead infrastructure, which is significantly less costly than the solution originally put forward.

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[12] Futura Report, section 8.4
[13] Futura Report, page 73
[14] Nuttall Consulting Capex Report, page 171

A discussion of the Sandford conductor augmentation project is presented in section 8, with descriptions of the original and alternative network solutions in sections 8.2.1 and 8.2.2, respectively.

Aurora considers the alternative option a more acceptable solution to the original problem, being both lower cost and relieving potential environmental issues rising from running infrastructure in the vicinity of sensitive wetlands.

Aurora acknowledges Nuttall Consulting's comment that "...a much lower cost, short-term, solution most likely could be found..."[15]. Aurora notes, however, that the short term solution is to defer, but not replace, the long term infrastructure, so that the long-term infrastructure is going to be built. It follows, therefore, that the short-term solution is efficient only if the aggregate of the entire cost of the short-term solution and the subsequent long-term solution is less than cost of building the long-term solution immediately.

[15] Nuttall Consulting Capex Report, page 42

6. References

- *Hobart East Development Plan*;
- *System Strategic Planning Capacity Report – Hobart East, 2010*, produced by Aurecon for Aurora, which was attachment AE046 to Aurora's *Regulatory Proposal* (the Aurecon Report); and
- *Identification of Non-network Initiatives for the 2012-17 EDPR* produced for Aurora by Futura Consulting in July 2010, which was attachment AE055 to Aurora's *Regulatory Proposal* (the Futura Report).

7. Confidentiality

Aurora does not consider any information contained within this document to be confidential.

8. Appendix: Sandford Conductor Augmentation Project

8.1. Overview

Joint planning exercises with Transend have identified two major constraints identified within the Rokeby and Sandford supply areas, including:

- Rokeby Terminal Substation capacity; and
- distribution feeder capacity issues in the Sandford Area.

Details of the constraints in the Rokeby and Sandford supply areas are given in section 9.

These constraints, amongst others, were the subject of the joint Transend-Aurora consultation process required under chapter 5 of the National Electricity Rules which was completed in June 2009. No submissions were received during the course of the consultations. Accordingly, construction of the appropriate option (option 2) commenced. Transend completed the Mornington Terminal Substation, which was part of the preferred option, in May 2011.[16]

The ultimate supply arrangement in the Sandford area will be the establishment of a 33/11 kV Zone Substation, energised from Mornington Terminal Substation via two 33 kV rated sub-transmission lines that will route past Rokeby Terminal Substation.

The Sandford Zone Substation will provide additional transformation capacity and will thus primarily address the loading constraint on Rokeby Terminal Station expected in 2017. The zone substation will be located south of Rokeby Terminal Substation towards the load centre of Sandford. This provides localised support to the HV network in the Sandford and South Arm areas, obviating the need to reinforce the 11 kV networks between Sandford and Rokeby.

Overall, the Sandford Zone Substation project is expected to result in a considerable capital investment. Aurora has identified that a significant proportion of the expenditure associated with the construction of the zone substation can be deferred using network and non-network solutions to manage peak demand on the feeders from the Rokeby Terminal Substation. For reference, the non-network solutions to manage load on Rokeby Terminal Substation to defer the construction of Sandford Zone Substation are discussed in section 10. To address the current feeder loading issues, which are also part of the Zone Substation deferral, Aurora considers that it is necessary to implement a network solution in the form of another feeder into the Lauderdale-Sandford Area, and the creation of a link between two adjacent feeders in the area to allow load shifting.

[16] Transend Networks, *Annual Planning Report 2011*, page 57

8.2. Network Solutions

Aurora proposes the following projects to manage the Lauderdale and Sandford supply area constraints:

- establish an 11 kV link between feeders 28223 and 28224 to manage overload on 28223; and
- establish a third circuit into the Sandford area.

Aurora intends to use a spare 11 kV circuit breaker and feeder tail from Rokeby Terminal Substation (which will be available after the commissioning of Howrah Zone Substation in 2012) to supply the fourth Sandford circuit.

Aurora considers that efficient expenditure considerations dictate that any major works and reinforcements to infrastructure in an area should align to the long-term plans for the area.[17] Aurora intends, therefore, to utilise the third circuit as a portion of the sub-transmission feeder from the Mornington Terminal Substation to supply the Sandford Zone Substation on the latter's construction. Accordingly, the feeder will be constructed to 33 kV standard. Whilst this will result in a small incremental cost, the incremental cost is insignificant in comparison to the cost of augmenting the feeder from 11 kV standard to 33 kV standard.

Aurora notes that there are two possible routes from the Rokeby Terminal Substation to the Sandford area:

- a direct route requiring a significant length of submarine infrastructure; or
- an indirect route utilising existing distribution infrastructure in a double-circuit configuration.

Only the first option was presented in Aurora's *Regulatory Proposal*. Discussions with the AER and Nuttall Consulting during the *Draft Distribution Determination* identified the alternative option. Aurora discusses these options in the following sections.

8.2.1. *Regulatory Proposal* Solution

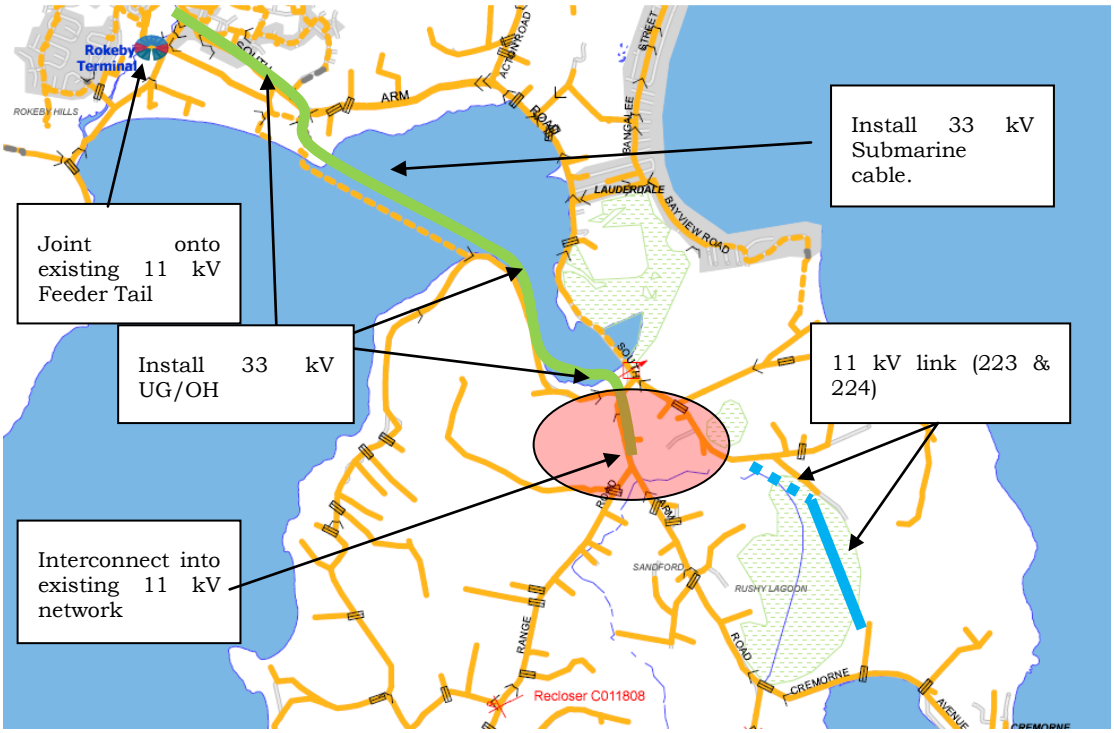
Figure 1 shows the arrangement of network augmentations presented in Aurora's *Regulatory Proposal*.

The additional circuit would interconnect into the 11 kV network in Sandford, and allow the existing voltage regulators to remain in their present configuration, removing any requirement to upgrade, relocate or invest in expensive civil works such as oil containment and site acquisition.

The proposal to undertake the submarine cable route and install underground and submarine assets for the majority of the route, as opposed to overhead assets, was to accommodate the anticipated limitations on Aurora's ability to install additional overhead services infrastructure towards and through the Lauderdale area.

[17] For the Sandford-Lauderdale area, these are contained within the Aurecon Report.

Figure 1. Sandford Augmentation –Solution from *Regulatory Proposal*



8.2.2. High Viability Alternative Network Solutions:

Following valuable discussions with the AER's consultants, Aurora reviewed its solution to running a fourth feeder circuit into the Sandford area from the Rokeby Terminal Substation with the intention of obtaining a lower cost solution.

Aurora now considers that an acceptable solution, albeit potentially controversial from a PR point of view, may be to construct the new feeder in double overhead configuration following existing feeder 28223/224 route from Rokeby to near the future substation site. This solution is shown in Figure 2, with the new feeder route in violet. A small section of underground cabling would be required where the route crosses an environmentally sensitive area (bird wetland area).

Estimates of the costs (in June $2010) associated with this solution are provided in Table 1. These estimated costs compare favourably with the forecast capex of approximately $6.5 million for the proposed solution in Aurora's *Regulatory Proposal*.

Figure 2. Sandford Augmentation - Lower Cost Solution

Table 1. Estimate of Costs for Double Circuit Overhead Solution

Item	kms	2014/15	2015/16	Total $
Design costs		$ 85,000		
Overhead construction	5.6		$ 1,120,000	
Underground construction (thru wetlands)	0.6		$ 240,000	
Install regulator			$ 150,000	
Sub total $		**$ 85,000**	**$ 1,510,000**	
Total $				**$ 1,595,000**

8.2.3. Low viability Alternative Network Solutions:

Aurora also considered a range of other solutions to address the area system constraints (see section 9 of this document for more details). These generally focused on reinforcing the limiting components in the existing feeders:

- upgrade and relocate distribution transformer T281537;
- install an additional voltage regulator on feeder 28228 for voltage drop support;
- install an additional regulator or capacitors on 28223 for transfer capacity;
- reinforcement of the 28224 feeder tail and 28223 causeway crossing; and
- various works to improve interconnectivity within Sandford area

These works, however, provide only short-term solutions which do not address the over-riding system constraints. The capital costs of these works are significant. Aurora considers that, since the solutions will provide minimal benefit when the Sandford Zone Substation is built, it is not in the customer's interest to incur significant expense for short-term solutions.

9. Appendix: Area Constraints

9.1. Summary

The system constraints at the Rokeby Terminal Substation and the Lauderdale and Sandford supply area are summarised in Table 2.

It is evident from analysis of the data summarised below that, although the non-network initiatives will reduce the peak demand on Rokeby Terminal Substation, thereby deferring the establishment of Sandford Zone Substation, by themselves these initiatives will have only a marginal effect on managing the distribution constraints within the Sandford area itself. Additionally, the feeder works detailed in section 8.2 have no impact on the peak demand at Rokeby Terminal Substation.

Further information about the assets and values in this table is given in the remaining parts of this section 9 and in section 10.

Table 2 – Summary of Constraints

Constraint	Detail	2017 (No works)	2017 (NN only)	2017 (NN & N)	Comment on proposal
Substation Loading	Rokeby Firm Capacity	98%	93%	93%	Rokeby Peak Demand managed by NN
Feeder Loading	28223	120%	115%	80%	Feeder loading reduced to a manageable level in short-term
	28224	90%	85%	68%	Feeder loading reduced to a manageable level in short-term
	28228	89%	84%	42%	Feeder loading reduced to a manageable level in short-term
	*33 kV cable @ 11 kV	-	-	60%	
Asset Loading	T281537	99%	95%	68%	Asset loading reduced to a manageable level in short-term under normal configuration
	Causeway Crossing (28223)	78%	75%	51%	Asset loading reduced to a manageable level in short-term under normal configuration

Constraint	Detail	2017 (No works)	2017 (NN only)	2017 (NN & N)	Comment on proposal
	Submarine Crossing (28228)	70%	67%	30%	Asset loading reduced to a manageable level in short-term under normal configuration
Voltage Drop	@ T281537	8.0%	7.6%	5.3%	Voltage compliance alleviated
	@ T282552	16.6% (13.2%)*	16.4% (13.0%)*	10.0% (7.4%)*	Voltage compliance significantly improved
Operational	Load at risk – Loss of 28223	30%	27%	0%	No load at risk for feeder contingency
	Load at risk – Loss of 28224	30%	18%	0%	No load at risk for feeder contingency
	Load at risk – Loss of 28228	27%	27%	0%	No load at risk for feeder contingency
	Load at risk – Loss of Bus 1	70%	70%	22%	Load at risk significantly reduced

N – Network Augmentation
NN – Non-Network Initiatives
* Voltage Drop at nearest upstream customer

9.2. Relevant Feeder and Asset Loadings

Feeder 28224 has a relatively low peak cyclic rating. During feeder contingencies, this undersized section limits the transfer capability of feeder 28224. Reinforcement works will be required for operational management through this area of the network.

The underground causeway crossing on feeder 28223 will be operating above 75 per cent of its nominal rating by 2017. Whilst the voltage drop downstream of this section is non-compliant, this section will not be overloaded. However, once additional voltage support is developed, this undersized section of feeder trunk will limit the transfer capability of feeder 28223. Reinforcement works will be required for operational management through this area of the network.

By the end of the next regulatory period, regulator T281537 will be operating at its rated capacity under normal configuration. Under normal configuration, this regulator forms a limiting component on Aurora's ability to manage the network in the Sandford area. As such, an upgrade of the regulator capacity will be required. Such an upgrade will require significant expenditure to establish a site that meets present day compliance. This is unfortunate since the regulator is not due for asset replacement for another 17 years (based on a 50 year asset life).

The submarine cable section of feeder 28228 is expected to be operating at 70 per cent of its nominal rating by 2017. At present, load transfers onto this feeder are negligible due to existing voltage drop constraints. However, if additional voltage support is implemented, this undersized section of feeder trunk will limit the transfer capability of feeder 28228.

The loadings for the Rokeby feeders that supply the Sandford and Lauderdale supply area are given in Table 3.

The loadings for relevant assets on the feeders that supply the Sandford and Lauderdale supply areas are given in Table 4.

Table 3. Sandford and Lauderdale Area Peak Demands by Feeder

Feeder	2009	2014	2017	Comments
28223	241	278	302	120% loaded by 2017
28224	180	208	226	90% loaded by 2017
28228	178	206	224	89% loaded by 2017
Total (A)	599	692	752	
Total (MVA)	11.93	13.78	14.98	

Table 4. Asset Loading Information - Limiting Downstream Components - Sandford and Lauderdale Supply Area Feeders

Asset	2009	2017	Comments
28224 Feeder tail	56%	70%	Peak Cyclic Rating
28223 causeway UG crossing	62%	78%	185 mm^2 AA
28228 Submarine cable crossing	54%	70%	150 mm^2 AA
T281537 Regulator	80%	99%	5 MVA (1976)
T282552 Regulator	53%	73%	3 MVA (1978)

9.3. Power Quality (Voltage Compliance)

Distribution network assets that are contributing towards voltage non-compliances are listed in Table 5.

The voltage drop at T281537 is currently at compliance limits under normal configuration, and is expected to worsen throughout the period with general load growth. As a result, relocation of the regulator will be required. Such an upgrade will require significant expenditure to establish a site that meets present day environmental and electrical safety compliance requirements.

The voltage drop at T282552 is currently exceeding compliance limits. This regulator is located on the neck of South Arm and regulates towards Opossum Bay on feeder 28228. Additional voltage support will be required to manage the existing constraint. Due to the magnitude of the non-compliance it is likely that an additional voltage regulator site will be required. Such an augmentation will require significant expenditure to establish a site, which will then become redundant once Sandford Zone Substation is established.

It should be noted that there are no customers within 3 km upstream of T282552. The observed voltage non-compliance upstream of this site is in the order of 10 per cent, which is at the limits of allowable voltage range when the distribution network is in an unsatisfactory condition.

Table 5 – Sandford and Lauderdale Supply Area Voltage Constraints

Feeder	Worst Voltage Drop (2009)	Worst Voltage Drop (2017)	Comments
28223	6.3%	8.0%	Non-Compliant at Regulator site T281537
28224	2.9%	3.6%	Okay in normal configuration
28228	13.1%	16.6%	Non-Compliant at Regulator site T282552

9.4. Operational Management – Load at Risk

A comparison of the forecast changes in load at risk with the loss of a single feeder serving the Sandford supply area between the beginning and end of the Forthcoming *Regulatory Control Period* is presented in Table 6.

A comparison of the forecast changes in load at risk with the loss of a bus at Rokeby Terminal Substation between the beginning and end of the Forthcoming *Regulatory Control Period* is presented in Table 7.

With the current network loading and configurations, there is a significant amount of load at risk in the Sandford area for a range of major contingency events.

Table 6 – Transfer Capacity (loss of single feeder scenario)

Lost feeder	Mitigation Action	2009	Comment	2017	Comments
28223	Transfers to 28228	0	Due to existing voltage drop constraint	0	Due to existing voltage drop constraint – assumed to continue
	Transfers to 28224	120 A	Due to existing voltage drop constraint	74 A ((180+120)-226)	
	Summary		121 A unable to serve	228 A unable to serve	
28224	Transfers to 28228	0	Due to existing voltage drop constraint	0	
	Transfers to 28223	0	Due to existing voltage drop constraint	0	
	Summary		180 A unable to serve	226 A unable to serve	
28228	Transfers to 28223	72 A	Due to existing voltage drop constraint (includes load shuffle to 224)	18 A ((241-25+72)-302+32)	
	Transfers to 28224	25 A	Transferred from 223 (load shuffle)	32 A	
	Summary		106 A unable to serve	205A unable to serve	

Table 7 – Transfer Capacity (Loss of Bus A scenario)

Loss of Bus 1 (223 and 224)	2009	Comment	2017	Comments
Transfers to 28228	0	Due to existing voltage drop constraint	0	
Summary		421 A unable to serve	528 A unable to serve	8.4-10.5 MVA at risk
Note – Loss of Bus 2 is the same as loss of Feeder 28228 scenario				

10. Appendix: Non-network Initiatives

To enable the deferral of expenditure associated with the mitigation of capacity issues on the Rokeby Terminal Substation which will require the construction of a Zone Substation in the Sandford area, Aurora proposes to manage the high expected load growth in the greater-Rokeby area through the implementation of non-network solutions. Potential solutions include a combination of Demand Side Management, Distribution Generation and Mobile Generation.

The implementation of non-network initiatives was investigated in section 8.4.5 of the Futura Report. The focus was on the impact of non-network solutions on the peak demand of Rokeby Terminal Substation and the resulting deferral benefit of increasing the amount of transformation capacity in the Rokeby supply area.

It was identified that any non-network initiatives would need to manage both the loading constraint on Rokeby Terminal Substation and the loading constraints on two of the feeders supplying the Lauderdale and Sandford areas.

Futura considered that the need for a Zone Substation at Sandford could be deferred by two years (and potentially to beyond the Forthcoming Regulatory Control Period) if it were possible to manage 1.6 MVA of peak load by 2014.[18]

For simplicity in modelling, it has been assumed that the Sandford area will contribute 50 per cent (0.8 MVA) to the total load reduction target of 1.6 MVA for the Rokeby Terminal Substation supply area, with the remainder being from the Lauderdale area.

Even were Aurora were successful in achieving this aim, the requirement for Sandford Zone Substation is not deferred indefinitely. Table 8 and Table 9 show the expected 'health' of the Lauderdale and Sandford area supply in 2017 as a result of the successful implementation of the proposed non-network initiatives based on the assumptions of the non-network objectives. Please note that the constraints in the Lauderdale and Sandford area have worsened over time.

Table 8. Estimated Feeder Demand including Non-Network targets by 2017

Feeder	2017	2017 with 1.6 MVA Peak Demand Management targets	Comments
28223 (A)	302	288	115% loaded by 2017
28224 (A)	226	212	85% loaded by 2017
28228 (A)	224	210	84% loaded by 2017
Total (A)	752	710	
Total (MVA)	14.98	14.14	5.6% Reduction

[18] Futura Report, page 73

Table 9. Estimated Feeder Voltage Drop by 2017, including Non-network Initiative Effects

Feeder	Worst Voltage Drop (2017)	Worst Voltage Drop (2017) with 1.6 MVA Peak Demand Management	Comments
28223	8.0%	7.6%	Non-Compliant at Regulator site T281537
28224	3.6%	3.3%	Okay in normal configuration
28228	16.6% (13.2%)	16.4% (13.0%)	Non-Compliant at Regulator site T282552

10.1. Mobile Generation

Aurora intended one of the major components of its non-network solution to defer need for the Sandford Zone Substation to be mobile generation. By locating mobile generators in the Sandford-Lauderdale area at times of expected peak demand Aurora could "peak shave" a significant portion of the required 1.6 MVA necessary for the deferral of the Zone Substation. These generators would counter the expected slow uptake of non-mandated demand-side management initiatives such as hot-water control and time-of-use network usage pricing mentioned by Futura.[19]

Nuttall Consulting, also, explicitly mentioned mobile generation as an option for peak demand management.[20] Aurora is confused as to why, then, Nuttall Consulting considered Aurora's forecast capex to acquire the necessary mobile generation capability to be purely for operational purposes (that is, not to address demand issues)[21], and subsequently recommended that none of the forecast capex be allowed[22].

The AER, also, considered that mobile generation may be a component of a potential non-network solution to the Sandford issue[23], but subsequently did not allow the expenditure as it was not designed to address demand issues.[24]

Aurora does not currently possess sufficient mobile generation capacity for peak demand shaving purposes. The AER's decision introduces a degree of difficulty into achieving the target of 1.6 MVA peak demand control which is required to defer the construction of the Sandford Zone Substation.

[19] Futura Report, page 76
[20] Nuttall Consulting Capex Report, page 171
[21] Nuttall Consulting Capex Report, page 44
[22] Nuttall Consulting Capex Report, page 57
[23] Draft Distribution Determination, page 142
[24] Draft Distribution Determination, page 143; AER spreadsheet *AER Capex Analysis – to Aurora*, worksheet *timing review – ex OH*)

11. Glossary of Terms Used in this Document

A	Amps
AER	Australian Energy Regulator
Aurecon Report	*System Strategic Planning Capacity Report – Hobart East, 2010*, produced by Aurecon for Aurora, attachment AE046 to Aurora's *Regulatory Proposal*
ESI Act	Electricity Supply Industry Act 1995
Futura Report	*Identification of Non-network Initiatives for the 2012-17 EDPR* produced for Aurora by Futura Consulting in July 2010, attachment AE055 to Aurora's *Regulatory Proposal*
HV	High Voltage, as defined in the ESI Act
km	Kilometre(s)
kV	KiloVolt
mm	Millimetre
MVA	MegaVolt-Amps
RIN	Regulatory Information Notice
UG	Underground