



CONSULTATION PAPER

DEVELOPMENT OF NEW TOMAREE 33/11kV SUBSTATION and A SECOND I32kV FEEDER TO NELSON BAY (to address capacity constraints on the Tomaree Peninsula)

12th November 2007

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EXECUTIVE SUMMARY

This paper has been prepared to provide a basis for EnergyAustralia to consult with registered and interested parties on the possible options for the development of the electricity supply network in the Tomaree Peninsula supply area to address projected limitations of that part of EnergyAustralia's distribution system. EnergyAustralia will conduct an economic analysis of possible options that satisfy regulatory test.

Section 1 of the paper provides a description of the Tomaree Peninsula supply area.

Section 2 presents EnergyAustralia's service standards for the area and describes, in detail, various asset condition and forecast capacity issues in the area that resulted in the need for augmentation of supply to the area.

Section 3 outlines the possible options to address the issues affecting the supply network including options for supply system development. Three feasible augmentation options are described:

Option 1 – New Tomaree 132/11kV zone substation and completion 2nd 132kV feeder (904 Stage 2B), to the Tomaree Peninsula for Summer 2008/09

Option 2 – New Tomaree 33/11kV zone substation and completion of 2nd 132kV feeder (904 Stage 2B), to the Tomaree Peninsula for Summer 2010/11 in combination with a demand management project to reduce demand in Summer 2009/10

These options are presented in the context of the corresponding strategic options, as a decision between these options will establish the future supply strategy for the Tomaree Peninsula.

Section 4 presents the results of a preliminary application of the regulatory test and the options are ranked.

Section 5 concludes that the most cost effective strategy within the regulatory test is Option 2 – *"New Tomaree 33/11kV zone substation and completion of 2nd 132kV feeder: 904 Stage 2B, to the Tomaree Peninsula for Summer 2009/10 in combination with a demand management project to reduce demand in Summer 2008/09"*, which is consistent with a strategy to construct a future 132/33kV STS on the Tomaree Peninsula. This option involves:

- Construction of a Tomaree 33/11kV zone on site owned by EnergyAustralia on Stockton street to be completed in 2010, which is consistent with a strategy to construct an STS on the Tomaree peninsula;
- Implementation of a demand management project to delay the thermal constraint on the 33kV network until summer 2010/11; and
- Delayed completion of feeder 904 Stage 2B until 2010, enabled by this demand management project.

The capital cost of this option is \$19.4m for construction of Tomaree 33/11kV zone and \$10.7m for construction of feeder 904 Stage 2B. The proposed demand management project is considered an operational expense, and involves expenditure of \$0.37m in summer 2009/10.

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1. INTRODUCTION

1.1 Purpose and Scope

This paper has been prepared to provide a basis for EnergyAustralia to participate with and consult registered and interested parties so as to identify possible options to address projected limitations of the electricity supply network in the Tomaree Peninsula Network Area.

It includes:

- a discussion of supply system limitations identified by EnergyAustralia that have led to the necessity of identifying possible options for augmentation of the distribution network in the area;
- a discussion of the service standard that has been adopted for planning purposes;
- a description of possible options which have currently been identified for development of the electricity supply in the area; and
- a detailed preliminary cost effectiveness analysis of each of these options, carried out in accordance with the requirements of the regulatory test.

The purpose of this paper is to consult on possible options for addressing capacity constraints at Nelson Bay zone and the associated 11kV network it supplies; and on the construction of a second 132kV feeder to the Tomaree Peninsula to address issues on the existing 33kV network. Note that these are two related but distinct projects and that the proposed feeder development is common to both strategies.

1.2 Supply Arrangements

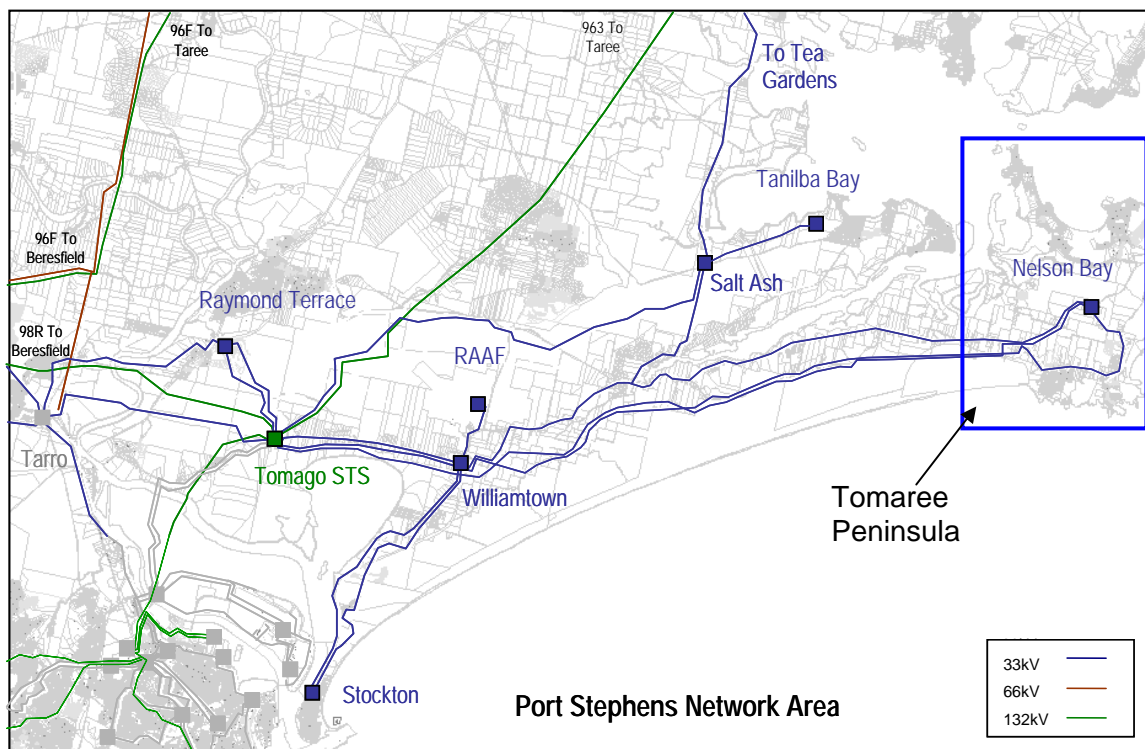


Figure I: A geographic map depicting the Port Stephens Network area.

The Tomaree peninsula is part of the Port Stephens network area and is a geographically isolated area that incorporates suburbs of Nelson Bay, Shoal Bay, Fingal Bay, Corlette, Salamander Bay,

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Anna Bay and Boat Harbour. The area is a popular tourist destination and growth in the area is predominantly due to medium density tourist related expansion, especially in the vicinity of Nelson Bay, though there is also some residential urban development.

Supply to the Tomaree Peninsula is provided by Nelson Bay zone substation, which is supplied via three 33kV feeders from Tomago STS. This network is approaching the capacity that can reasonably be supplied at 33kV and conversion to a higher supply voltage is necessary. Supply at 132kV has been identified as the most appropriate supply voltage to provide for future requirements of the area.

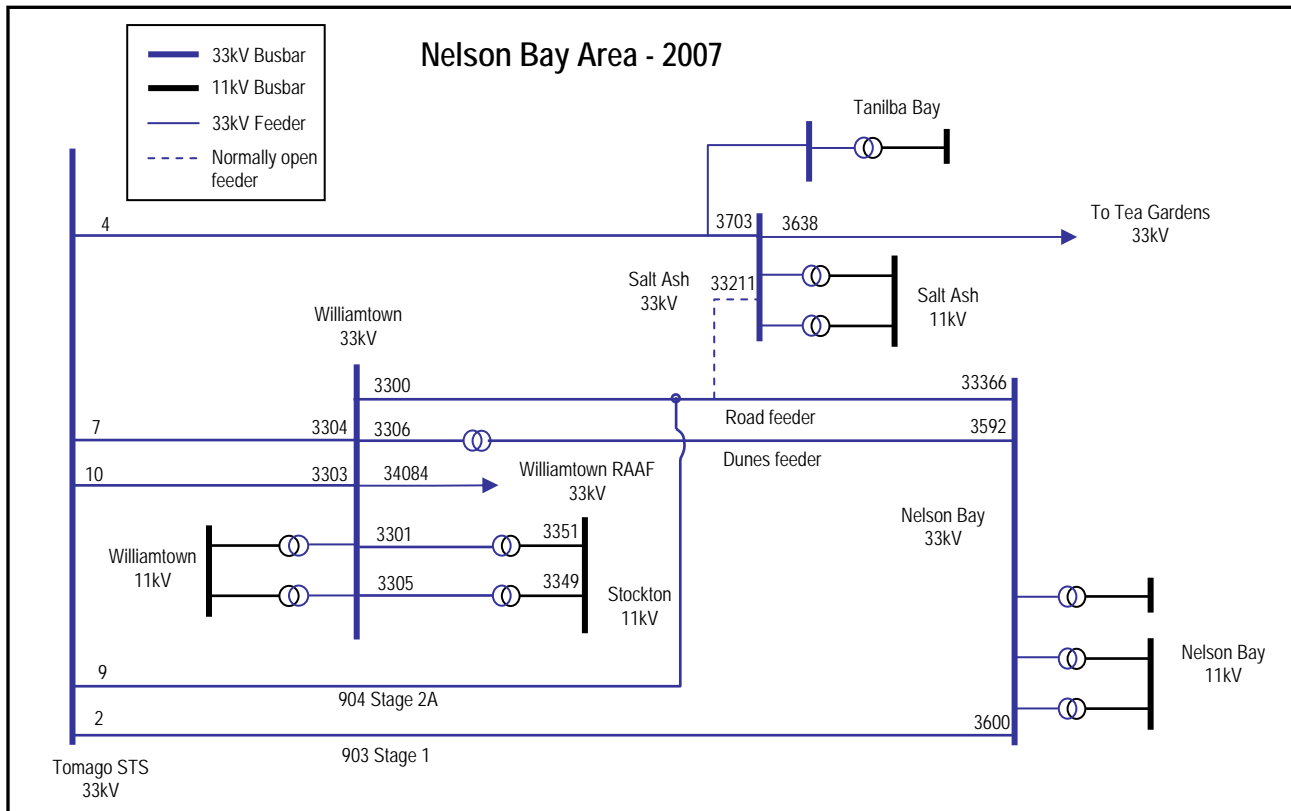


Figure II: Schematic depicting the normal supply arrangement for the Nelson Bay Area with completion of feeder 904 Stage 2A, which is expected by the end of this year.

1.2.1 33kV subtransmission network

The existing 33kV network includes two 33kV feeders that supply the Williamtown busbar, which in turn supplies the RAAF base and zone substations at Williamtown, Stockton and Nelson Bay. A third new 33kV feeder connects directly to Nelson Bay from Tomago STS. This new feeder (903) whilst operating at 33kV was constructed at 132kV and was the first stage of the development strategy for the area.

A third direct connection to Williamtown zone substation from Tomago STS, constructed at 132kV, but energised at 33kV, is scheduled for completion by the end of this year. This feeder is constructed with the intention that it will form part of a second direct 132kV supply to Nelson Bay when supply is converted to 132kV.

1.2.2 Nelson Bay zone substation

Nelson Bay Zone substation consists of a “permanent” two transformer zone substation and a “temporary” single transformer with a separate 11kV busbar, which was installed in 2000. For the loss of the temporary transformer 11kV feeder interconnections between the 11kV circuit breakers allow for the manual transfer of 11kV feeders between the 11kV busbars. The temporary 11kV switch room and third transformer were installed in August 2001 as an interim measure to meet rapidly rising demand.

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1.2.3 11kV distribution network

The Nelson Bay 11kV distribution network presently includes seven 11kV feeders. These feeders are typically long in length, with limited interconnection between feeders. As Nelson Bay is geographically isolated, there is negligible 11kV interconnection with neighbouring zones.

A project to install two new 11kV feeders is under development and is required for completion in 2008. This project will provide short term load relief to the existing feeders and allow for longer term supply options to be implemented. After the installation of two new 11kV feeders at Nelson Bay Zone no further 11kV circuit breakers are available at the zone substation for future augmentation of the 11kV distribution network.

2. IDENTIFICATION OF NEED FOR AUGMENTATION

2.1 Applied Service Standard

The service standards that are applicable to a consideration of supply constraints affecting the Tomaree Peninsula are summarised below:

2.1.1 Applicable to all Network Elements

The minimum requirement for any network element is that, with all elements in service, the thermal capacity is required to meet at least 115% of forecast demand. The requirements described in the following sections are additional to this requirement.

2.1.2 Zone substations and 33kV subtransmission network

For a failure of a single critical element (i.e. N-1 conditions) within zone substations supplying greater than 10MVA of load and for 33kV overhead network, the forecast demand is not to exceed the thermal capacity for more than 1% of the time i.e. a total aggregate time of 88 hours per annum; up to a maximum of 20% above the thermal capacity. Recovery of load should be within one minute.

The voltage regulation range of the 33kV system is determined by the requirement for zone transformers: to maintain regulation under normal system conditions; and be less than 4% below their set voltage level (allowing for line drop compensation) during first contingency outages. Voltage regulation on the 33kV network also needs to be maintained at adequate levels to ensure satisfactory 11kV distribution network regulation is achieved as described in section 2.1.3.

2.1.3 11kV distribution network

For urban feeders¹, the expected demand is to be no more than 80% of feeder thermal capacity (under system normal operating conditions), with switchable interconnection to adjacent feeders to enable restoration following an unplanned failure of a single network element (i.e. N-1 conditions).

For 11kV networks, voltage drops of up to 5% are regarded as satisfactory. Higher voltage drops are permissible provided that the network connection provided to low voltage customers is within the limits specified in Australian Standard AS2926.

2.2 Description of Network Issues

The network issues are summarised in the following sections according to their associated asset category, namely: 33kV subtransmission network; zone substations and 11kV distribution network.

Where forecasts are provided, they are based on actual loads up to summer 2005/06 and winter 2006.

¹ An urban feeder is defined as a feeder with actual maximum demand greater than 0.3MVA/km

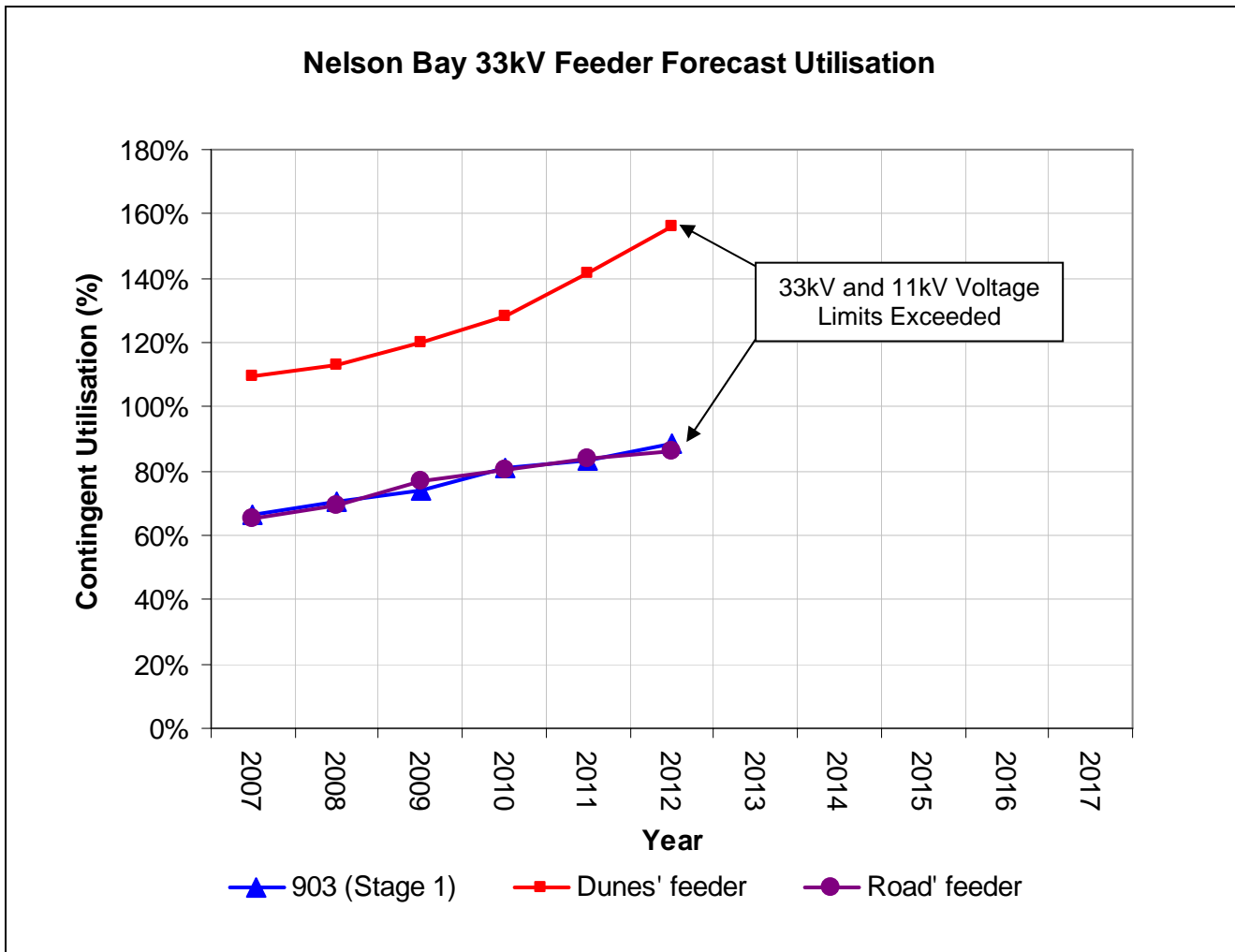
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2.2.1 33kV subtransmission network

Under the applicable design planning criteria, the load that could be reliably supplied to Nelson Bay through the 33kV distribution network is 44MVA. This network is forecast to exceed this limit in summer 2009/10.

In addition, the 33kV feeders between Tomago STS and Nelson Bay zone substation are of significant length and consequently there is substantial voltage drop along the lines at times of peak load. These voltage issues are anticipated to worsen as load on the equipment increases. It is forecast that by summer 2011/12 voltage regulation limits will be exceeded during 33kV feeder outages at times of peak load.

The forecast feeder utilisations are provided in the following graph.



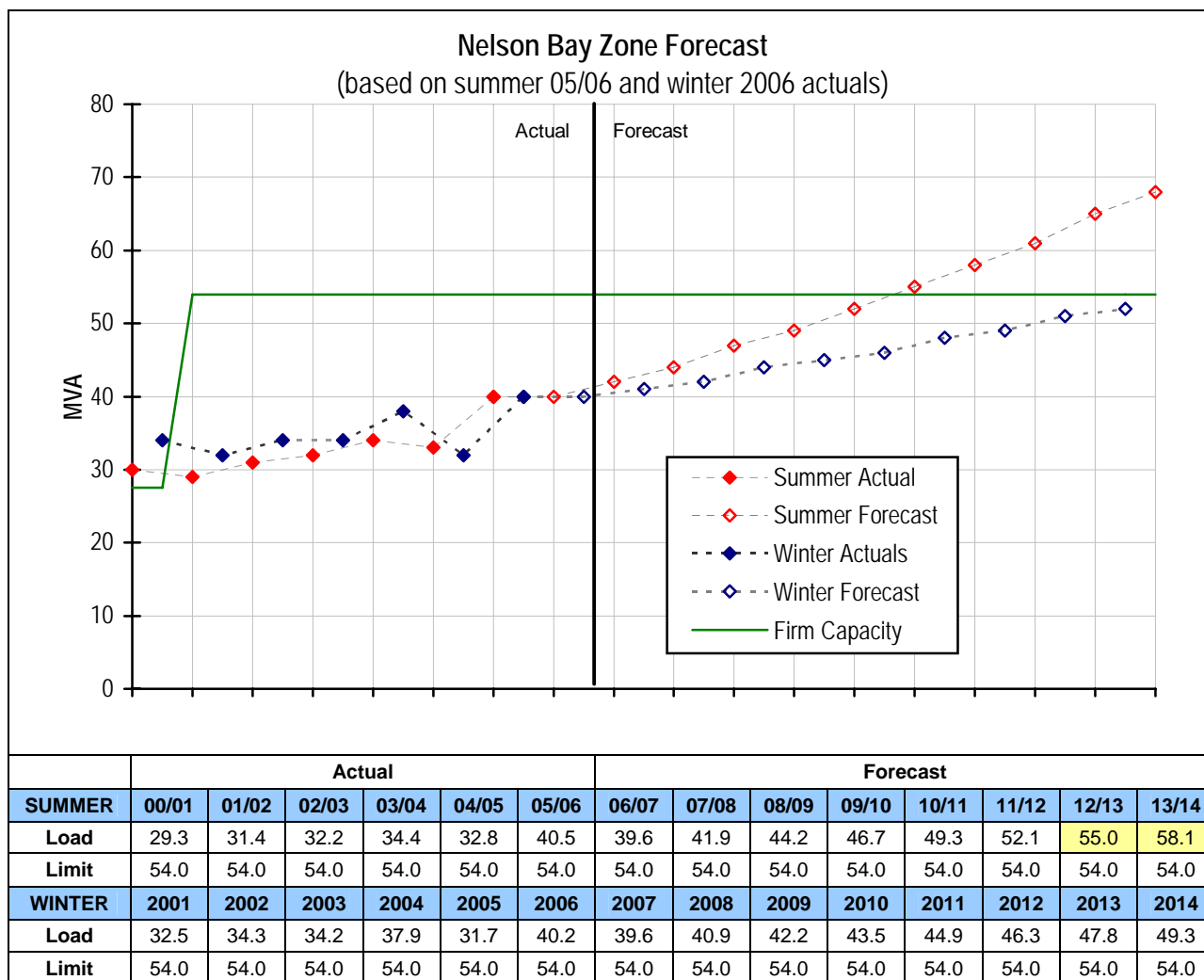
This network was constructed in the 1950s and 1960s and is exposed to the coastal environment, so has been subject to the harsh affects of salty moisture-laden air over a long period of time. Consequently it will likely have increased maintenance requirements in the medium term. Parts of the overhead network will also be subject to encroaching coastal sand dunes in the medium-long term.

2.2.2 Nelson Bay zone substation

Peak loading at Nelson Bay occurs in summer with forecast maximum loading detailed in the table/graph below.

The firm capacity of Nelson Bay Zone is restricted to 45MVA by the rating of the secondary 11kV switchgear. The applicable design planning limit for Nelson Bay zone is 120% of the firm capacity, or 54MVA. Nelson Bay Zone is forecast to exceed this limit in summer 2012/13.

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To comply with revised design planning criteria, a recovery time of less than one minute is required following failure of a single critical element in zone substations of this type. To achieve this, an auto changeover scheme would need to be installed between permanent and temporary 11kV bars; however, with the installation of the two new 11kV feeders previously discussed, there will be no spare 11kV bays to facilitate this.

There are condition issues at Nelson Bay zone substation that need to be addressed in the medium term, however they are not considered drivers for the investment currently under consideration. Future projects to address these issues are included in the economic analysis as they impact the relative net present cost of the options.

2.2.3 11kV distribution network

Under revised design planning criteria, this type of 11kV network is designed so that the expected demand is no more than 80% of the feeder thermal capacity with switchable interconnection to adjacent feeders to enable restoration for an unplanned network element failure. In addition, the voltage on this network should remain above 95% of the nominal system voltage. The Nelson Bay 11kV network does not currently meet these criteria. Even where feeder utilisations are below 80%, there is insufficient interconnection of this network to enable load to be restored following an unplanned outage.

Forecast feeder utilisations and voltages for this network are provided in the following table. These figures are for the system in its normal configuration (i.e. all elements in service with normal

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switching) for peak summer conditions. Highlighted figures indicate that load is forecast to exceed 80% of the thermal capacity of the feeder, or that voltage has fallen below 0.95 per unit (pu)².

Feeder	Forecast Utilisation(%) and Voltages(pu)									
	2007/08		2008/09		2009/10		2010/11		2011/12	
33409	109%	0.99	85%	1.00	90%	1.00	95%	1.00	100%	0.99
33407	107%	0.95	91%	0.96	97%	0.95	103%	0.95	109%	0.94
11460	81%	1.00	81%	1.00	85%	1.00	90%	0.99	96%	0.99
11459	79%	0.97	77%	0.97	81%	0.97	86%	0.96	91%	0.95
11457	84%	0.97	89%	0.97	95%	0.96	101%	0.96	107%	0.95
11454	81%	0.95	48%	0.97	51%	0.97	54%	0.96	57%	0.96
11453	78%	0.94	53%	0.97	56%	0.97	60%	0.96	64%	0.96
33405 (New)	N/A	N/A	54%	0.96	57%	0.95	60%	0.95	64%	0.94
33411 (New)	N/A	N/A	57%	0.98	60%	0.97	64%	0.97	67%	0.96

2.3 Other Issues/Influences/Risks

2.3.1 Environmental Impact Statement (EIS)

Ministerial approval was obtained for construction of the 132kV feeders (903 and 904) to the Tomaree Peninsula and construction is to be in accordance with the environmental impact assessment (EIS), which was exhibited between April and May 2003. A portion of the route negotiated for feeder 904 may require revision due to the need to reduce the risk of sand dune encroachment within the anticipated life of the feeder.

2.3.2 Construction Window

Routes for the new feeder to Nelson Bay are limited and will therefore involve using existing 33kV easements. During stages of the construction, two of the three 33kV feeders that supply Nelson Bay zone will need to be de-energised for safety clearances in order to string conductors. These two feeders can only be de-energised when load is within the rating of a single feeder. Current information shows minimal load growth during seasonal shoulder periods and it is expected that the required outages will be possible for the next 5 years. If loading on the Nelson Bay substation increases at a faster rate than expected, outages of two feeders will become more difficult to obtain. The potential consequences are that work may need to be completed at night when load is lower or generator support may be required.

2.3.3 Community Expectations

- During public consultation for earlier stages of the works at Nelson Bay (2003), the indicative delivery date for feeder 904 was 2006 and for completion of the Tomaree zone substation and associated feeder extensions was 2009. The strategy scope of works and need dates have varied since this public consultation, and base completion date for these works as detailed in the preferred strategy is now 2010/11.
- Concrete poles were pre-ordered in September 2006, on the basis of the existing licence conditions at that time, and are stored on site at pegged pole locations.

² 'per unit' (pu) is expression a quantity in terms of a nominal or base value. In the case of 11kV distribution voltages, the nominal value is 11kV, and 0.95pu indicates that the voltage is reduced to 95% of this nominal value.

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- A commitment has been made to landholders containing easements for feeder 903/904 that the access tracks will be grassed once feeder construction is completed.

2.4 Consideration of Demand Side Management and Local Generation

The identified system limitations have arisen as a consequence of load growth on the Tomaree Peninsula, and accordingly are subject to consideration of demand management.

2.4.1 33kV subtransmission network constraint

Given that the connection infrastructure for a grid-connected diesel generator site still remains at Nelson Bay, this represents one demand management option that is clearly available without further investigation. Demand Management estimate that the cost for this option would be \$370,000 for a one summer deployment of 3MVA and \$1m for two summers with 6MVA in the second summer.

Taking into account the level of required demand management, the savings available from deferring the need, and the existence of at least one clearly available cost effective option in the Nelson Bay area, it is considered that demand management would be able to cost effectively defer the need for the proposed supply side investment. An investigation is currently underway to determine if additional, more cost-effective options are available and is expected to be completed by the end of the year.

2.4.2 Nelson Bay zone and 11kV distribution limitations

The potential for demand management to address the identified system limitations at Nelson Bay zone and on the associated 11kV distribution network is currently under investigation. The proposed supply strategy to address these needs is subject to the findings of this investigation, and will be completed prior to seeking approval.

2.5 National Electricity Rules Requirements

Nelson Bay zone substation and the associated 33kV and 11kV network are classified as distribution system assets by the National Electricity Rules (the Rules).

The Rules (clauses 5.6.2(e) and (f)) require that, where analysis indicates that any relevant technical limits of a distribution system will be exceeded, that the Distribution Network Service Provider must notify any affected Registered Participants of these limitations and of the expected time for corrective action and consult with affected Participants and interested parties on the possible options to address the projected limitations of the relevant distribution system. A Network Service Provider does not need to consult on a network option that would be a small network asset, or for options that do not augment the system.

Each of the options considered under Section 3 are considered new large distribution network assets as they involve a network augmentation with expenditure in excess of \$10 million. They are therefore subject to consultation in accordance with clause 5.6.2(f) of the Rules.

The new capacity provided by the proposed augmentation has been necessitated by the need to meet the service standards described in Section 2 and has therefore been treated as a reliability driven augmentation for the purposes of the Regulatory Test. Consequently, EnergyAustralia has used a least cost test to examine the options identified to address projected system limitations.

3. OPTIONS

This consultation paper has primarily been provided for consideration of options for two projects:

- Construction of a new (Tomaree) zone on the Stockton St site; and
- Construction of a second 132kV line (feeder 904 Stage 2B) to the Tomaree Peninsula;

However, the choice of configuration for the new Tomaree zone will establish the scope of future works and so consideration needs to be given to the broader strategic implications of this decision.

Two technically feasible strategies are under consideration for providing future supply to the Tomaree Peninsula:

- Construction of a new Tomaree 132/11kV zone and reconstruction of the existing Nelson Bay zone to 132/11kV; or
- Construction of a new Tomaree 33/11kV zone and 132/33kV Tomaree STS and refurbishment for the existing 33/11kV Nelson Bay zone.

Both these strategies involve rebuilding the existing 33kV subtransmission network at 132kV and construction of a new "Tomaree" zone substation on a site situated on Stockton Street, Nelson Bay, which was strategically purchased for this purpose³. Details of these strategies and the corresponding project options are provided in the following sections.

The options for construction of the second 132kV feeder (904 Stage 2B) are limited by the requirement for future supply to be at 132kV; and by environmental and community factors, which require that the new feeder be formed by reconstructing the existing network to avoid clearing of sensitive habitat.

A geographic map depicting the feeder route is provided in APPENDIX B: Geographic map of proposed feeder 904 route, and also shows the location of the existing zone on Frost Road and the Stockton street site for the proposed Tomaree zone. The 132kV construction of feeder 904 Stage 2B is common between both strategies up to the "Mine Road".

3.1 Option 2: 132kV/11kV Tomaree zone and Completion of 132kV Feeder 904 Stage 2B in 2009 (Strategy 1)

This option involves:

- Construction of a Tomaree 132/11kV zone on site owned by EnergyAustralia on Stockton street to be completed in 2010; and
- Construction of a 132kV feeder 904 Stage 2B to the "Mine Road" and extension from the "Mine Road" to the existing Nelson Bay site on Frost Road. This feeder will initially be energised at 33kV.

The capital cost of this option is \$37.1m for construction of Tomaree 132/11kV zone, including 11kV augmentation and extension of feeders 903 and 904 from the existing Nelson Bay zone site at Frost road to the Stockton street site; and \$13.3m for construction of feeder 904 Stage 2B to Frost road.

³ Public consultation and negotiation with the Port Stephen's council was undertaken in 2005 for the selection of this site.

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The ultimate configuration under this scenario will be two 132/11kV zones supplied via two direct 132kV overhead lines from Tomago STS. The scope of works for this strategy is provided below in Table 1.

In order to energise the new 132kV/11kV Tomaree zone substation, supply to the area needs to be converted to 132kV. Once this is completed, it will not be possible to maintain the existing Nelson Bay zone as there will no longer be a secure 33kV connection to the substation. All load will therefore be transferred to the new Tomaree zone. The existing Nelson Bay zone will then be decommissioned and a new 132/11kV zone constructed in its place.

The timing of feeder 904 is determined by the need to supply the new Tomaree zone at 132kV.

Proposed Project	Approximate Cost (\$m)	Indicative Completion
Construct second 132kV feeder (904 Stage 2B) to Frost Road	13.3	2009
Tomaree 132/11kV zone substation	26.9	2010
11kV augmentation for Tomaree zone	10.2	2010
Decommission Nelson Bay 33/11kV zone	1.0	2011
Tomago STS 33kV CB replacement	13.9	2012
Nelson Bay (new) 132/11kV zone	24.3	2012
TOTAL	89.7	

The total net present cost (NPC) of this strategy is \$78.9m, which includes operational and maintenance costs.

3.2 Option 2: 33/11kV Tomaree zone and Deferred Completion of 132kV Feeder 904 Stage 2B with Demand Management

This option involves:

- Construction of a Tomaree 33/11kV zone on site owned by EnergyAustralia on Stockton street to be completed in 2010;
- Implementation of a demand management project to delay the thermal constraint on the 33kV network until summer 2010/11; and
- Delayed completion of feeder 904 Stage 2B until 2010, enabled by this demand management project. Works will be initiated in 2008 for practical construction reasons; however the works will be spread over three years. This will enable flexibility to prioritise other works and will defer expenditure, producing a net cost saving. Feeder 904 will be constructed at 132kV to the "Mine Road", and initially energised at 33kV.

The capital cost of this option is \$19.4m for construction of Tomaree 33/11kV zone and \$10.7m for construction of feeder 904 Stage 2B. The proposed demand management project is considered an operational expense, and involves expenditure of \$0.37m in summer 2009/10.

The ultimate configuration under this scenario will be two 33/11kV zones supplied from a 132/33kV STS located near Anna Bay. The STS will be supplied by two direct 132kV overhead lines from Tomago STS to the new STS. The scope of works for this strategy are provided below in Table 2

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Under this strategy the existing Nelson Bay 33/11kV zone will be retained. Tomaree 33/11kV zone will be supplied by the existing 33kV network, which will be extended to the new site. Load will be transferred from the existing Nelson Bay zone to the new Tomaree zone to resolve the 11kV and zone capacity constraints, and will allow the removal of the temporary substation at the existing Nelson Bay zone.

With completion of the second 132kV feeder (904 Stage 2B), the system has capacity to supply the network until summer 2014/15, at which point the system is forecast to reach its voltage regulation limit for contingencies during system peak. To resolve this, a 132/33kV STS will be constructed, which will provide 33kV supply to Tomaree and Nelson Bay zone substations. The 132kV feeders (903 and 904) will be converted to 132kV operation to supply the new STS.

It is anticipated that the STS site will be located in the vicinity of the "Mine Road". Costs to extend feeder 904 from the "Mine Road" to the STS site are included in the connection costs for the STS.

Unlike Strategy 1, the timing of feeder 904 is determined by the thermal capacity of the existing 'Dunes feeder'. It is considered that demand management would be able to cost effectively defer the need date for this project.

A one year deferral of the completion of feeder 904 Stage 2B is possible by installing 3MVA of portable generation. Further investigation of demand management is underway, both with relation to feeder 904 and for other projects within the scope of works for this strategy, which may produce further opportunities.

Table 2: Scope of works and approximate timing and costs for Option 2		
Proposed Project	Approximate Cost (\$m)	Indicative Completion
Construct second 132kV feeder (904 Stage 2B) to Mine Road	10.7	2010
Tomaree 33/11kV zone	19.4	2010
Decommission Nelson Bay zone temporary substation	0.1	2010
Tomago STS 33kV CB replacement	13.5	2010
4MVAR capacitors at Nelson Bay zone	0.7	2012
Rebuild 33kV feeder number 1 to Tomaree	2.4	2014
Nelson Bay 132/33kV STS	32.7	2014
Replace 33kV Switchgear at Nelson Bay zone	6.6	2018
TOTAL	86.2	

The total net present cost (NPC) of this strategy is \$68.1m, which includes operational and maintenance costs.

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3.3 Preferred Option

The preferred option is Option 2, based on least net present cost in accordance with the regulatory test. This option involves:

- Construction of a Tomaree 33/11kV zone on site owned on Stockton St, which is consistent with a strategy to construct an STS on the Tomaree peninsula (Strategy 2);
- Implementation of a demand management project to delay the thermal constraint on the 33kV network until summer 2010/11; and
- Delayed completion of feeder 904 Stage 2B until 2010, enabled by this demand management project.

The capital cost of this option is \$19.4m for construction of Tomaree 33/11kV zone and \$10.7m for construction of feeder 904. The demand management project is considered an operational expense, and involves expenditure of \$0.37m in summer 2009/10.

This option is consistent with a strategy to construct a future 132/33kV STS on the Tomaree Peninsula.

4. APPLICATION OF THE REGULATORY TEST

A preliminary economic analysis has been carried out in accordance with the regulatory test promulgated by the ACCC under clause 5.6.5A of the National Electricity Rules. As indicated in section 4, the “reliability limb” of the test was applied. It involves the comparison of options on an economic basis by carrying out NPC analysis for each of the three options. The option which satisfies the regulatory test is the one that minimises the present value of the costs of meeting relevant service standards discussed in section 2.

EnergyAustralia has included a range of parameters in comparison of options such as change in load growth and variations in material costs. In summary, the three options presented are technically and economically comparable, given due consideration to all capital and operating costs that are able to be defined and quantified.

4.1 Base Case Analysis

The options considered are ranked by cost considering 8.5% discount rate as the base case in the following table. The options are considered in the context of the broader area strategy. Detailed analysis is provided in APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE.

Description	Cost* (\$m)	NPC* (\$m)
Option 1: 132/11kV Tomaree and Nelson Bay zones (Strategy 1)	89.7	78.9
Option 2: Construct 33/11kV Tomaree zone and a 132/33kV Nelson Bay STS with Demand Management (Strategy 2)	86.2	68.1

* Total capital Cost and NPC calculation considering long term requirements for each option.

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4.2 Sensitivity Analysis

Sensitivity Analysis was carried out to consider the impact of different discount factors, growth rates, and escalation rates; and for uncertainties relating to the location of the STS in Strategy 2. The base case and the range over which sensitivity checks were conducted are shown in Table 4.

Table 4: Sensitivity analysis conducted		
Parameter	Base Case Value	Cases Considered
<u>Discount Rate</u>		
Real Discount Rate	8.5%	7% and 10%
<u>Escalation</u>		
Overhead line costs	Varies between 1.0-3.0% real	2% increment of the overhead line escalation rate
Substation material costs	1% real	2% increment of the substation material escalation rate
Labour costs	Varies between 1.0-2.5% real	2% increment of the overhead line escalation rate
<u>Load Growth</u>		
Variation in general growth rate	As per 2005/06 forecast	1% increment/decrement of the forecast growth rate
Spot Load Increase	None	None
<u>STS Site</u>		
To account for uncertainty about the STS site for Strategy 2 (affects Options 2 and 3 only)	Presumed Site Location <i>Site within 0.5km of Nelson Bay Road between the intersections with Gan Gan Road (Anna Bay roundabout) and Frost Road (existing Nelson Bay zone)</i>	Alternative Site location <i>Site within 0.5km of Nelson Bay Road and west of the Gan Gan road intersection (Anna Bay roundabout)</i>
Ease of feeder connections to the new STS dependent on the site location.	Site within 0.5km of Nelson Bay Road at standard per unit rate	Feeder costs for STS increased by factor of two
Land costs	Standard land per unit rate	50% increment and 25% decrement in land per unit rate

This analysis concluded that Strategy 2 is and correspondingly Option 2: Construct 33/11kV Tomaree zone and a 132/33kV Nelson Bay STS with Demand Management (Strategy 2) is preferred under all sensitivity scenarios considered.

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4.2.1 Variation of Discount Rate

The impact of a change in the discount rate is shown in Table 5.

Table 5: Change in the discount rate	NPC (\$m)		
	8.50%	7.00%	10.00%
Real Discount Rate			
Option 1: 132/11kV Tomaree and Nelson Bay zones (Strategy 1)	78.9	81.4	76.5
Option 2: Construct 33/11kV Tomaree zone and a 132/33kV Nelson Bay STS with Demand Management (Strategy 2)	68.1	71.4	65.1

4.2.2 Escalation

The impact of real increases in cost for the major project constituents was considered by varying the escalation rate for overhead lines, substation materials and labour. The results are shown in Table 6.

Table 6: Overhead feeder and Labour Escalation	2% increment to overhead line escalation rate		2% increment to substation material escalation rate		2% increment to labour escalation rate	
	Scenario	NPC (\$m)	Cost (\$m)	NPC (\$m)	Cost (\$m)	NPC (\$m)
Option 1	79.7	90.7	84.6	97.1	83.7	95.7
Option 2	69.2	87.7	74.9	96.7	72.6	92.8

4.2.3 Load Growth

General Growth Rate

The impact of a variation in the general load growth rate was considered, calculated by changing the growth rate by $\pm 1\%$ i.e. a 1% increment in the growth rate is an additional 1% growth in each year. The summer general load growth rate for the Tomaree Peninsula is forecast at 5.3%, which is relatively high. Results are shown in Table 7.

Table 7: Variation of General Growth Rate	1% increment to general growth rate		1% decrement to general growth rate	
	Scenario	NPC (\$m)	Cost (\$m)	NPC (\$m)
Option 1	78.9	89.7	78.9	89.7
Option 2	70.0	86.0	64.2	87.4

The main impact is a change in the timing of the STS in Option 2, which is required in 2013 for a 1% increment in the general growth rate, and in 2018 for a 1% decrement. There is no impact on Option 1 as work is driven by 11kV network limitations, which currently do not meet the revised planning criteria during peak periods.

Spot Load Increases

There are no large spot load increases proposed for the Tomaree Peninsula and this is considered unlikely to change within the time frame of the project.

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4.2.4 Site location for Tomaree STS

A site is not currently owned that is suitable for Tomaree STS. The connection requirements will be determined by the site. The base case presumed a site within 0.5km of Nelson Bay Road between the intersections with Gan Gan Road (Anna Bay roundabout) and Frost Road (existing Nelson Bay zone), and assumed that relatively direct feeder routes would be possible.

Two sensitivity scenarios were considered; a factor of two increase in connection costs for the base case; and an alternative site 0.5km of Nelson Bay Road and west of the Gan Gan road intersection (Anna Bay roundabout). The results of these scenarios are provided in Table 8.

Table 8: Variation of STS connection costs	Increase in STS connection costs		Alternative Site Location	
	Scenario	NPC (\$m)	Cost (\$m)	NPC (\$m)
Option 1	78.9	89.7	78.9	89.7
Option 2	71.8	92.3	64.8	80.5

To examine the impact of land cost on the choice of strategy, a 50% increase and a 25% decrease in the standard per unit rate for land purchases on the Tomaree peninsula was considered. Results are provided in Table 9.

Table 9: Variation in Land cost	50% increase in land per unit rate		25% decrease in land per unit rate	
	Scenario	NPC (\$m)	Cost (\$m)	NPC (\$m)
Option 1	78.9	89.7	78.9	89.7
Option 2	68.9	87.2	67.7	85.6

5. CONCLUSION

Of the strategies considered, a strategy to construct a future 132/33kV STS on the Tomaree Peninsula has the least net present cost under all sensitivity scenarios. On this basis and subject to comments received during the consultation period, EnergyAustralia favours construction of Option 2: "33/11kV Tomaree zone and Deferred Completion of 132kV Feeder 904 Stage 2B with Demand Management". This option involves:

- Construction of a Tomaree 33/11kV zone on site owned by EnergyAustralia on Stockton street to be completed in 2010;
- Implementation of a demand management project to delay the thermal constraint on the 33kV network until summer 2010/11; and
- Delayed completion of feeder 904 Stage 2B until 2010, enabled by this demand management project.

The capital cost of this option is \$19.4m for construction of Tomaree 33/11kV zone and \$10.7m for construction of feeder 904 Stage 2B. The proposed demand management project is considered an operational expense, and involves expenditure of \$0.37m in summer 2009/10.

6. CONTACT DETAILS

Comments on this consultation paper, including proposals for alternative options must be in the form of written submissions, which may be in hard copy or suitable electronic format and must be provided by 12th January 2008. Proposals or other enquiries should be directed to the contact listed below:

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7. APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE

Discount Rate = 8.5%

All figures are in 2006/07 real dollars and include expected real increases in cost.

Option 1: Construct 132/11kV Tomaree and Nelson Bay zones (Strategy 1)													
Proposed projects	NPC (\$k)	Total (\$k)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Construct second 132kV feeder (904) to Frost Road	12,350	13,330	2,122	10,861	347	-	-	-	-	-	-	-	-
Tomaree 132/11kV zone substation	23,601	26,936	1,511	12,534	11,768	1,123	-	-	-	-	-	-	-
11kV augmentation for Tomaree zone	8,177	10,235	-	-	-	10,235	-	-	-	-	-	-	-
Decommission Nelson Bay 33/11kV zone	841	1,033	-	65	539	403	26	-	-	-	-	-	-
Tomago STS 33kV CB replacement	9,872	13,875	-	-	-	1,131	12,744	-	-	-	-	-	-
Nelson Bay (new) 132/11kV zone	18,264	24,326	-	-	1,582	12,827	8,149	1,768	-	-	-	-	-
Total Capital Cost	73,106	89,736	3,633	23,460	14,236	25,719	20,919	1,768	-	-	-	-	-
Operational and Maintenance Costs	5,788	-	-	18	135	207	335	440	467	584	655	784	889
Total Cost	78,894	89,736	3,633	23,478	14,372	25,926	21,254	2,208	467	584	655	784	889

Option 2: Construct 33/11kV Tomaree zone and a 132/33kV Nelson Bay STS with Demand Management (Strategy 2)													
Proposed projects	NPC (\$k)	Total (\$k)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Construct second 132kV feeder (904) to Mine Road	9,494	10,711	2,436	3,267	3,321	1,687	-	-	-	-	-	-	-
Tomaree 33/11kV zone	16,508	19,427	192	5,204	11,073	2,959	-	-	-	-	-	-	-
Decommission Nelson Bay zone temporary substation	53	65	-	-	35	30	-	-	-	-	-	-	-
Tomago STS 33kV CB replacement	11,283	13,468	-	1,113	12,355	-	-	-	-	-	-	-	-
4MVAr capacitors at Nelson Bay zone	513	740	-	-	-	-	622	118	-	-	-	-	-
Rebuild 33kV feeder number 1 to Tomaree	1,432	2,410	-	-	-	-	-	-	2,226	184	-	-	-
Replace 33kV Switchgear at Nelson Bay zone	2,876	6,650	-	-	-	-	-	-	-	-	-	-	6,650
Tomaree 132/33kV STS	20,742	32,681	-	-	-	2,144	1,327	11,050	16,541	1,619	-	-	-
Total Capital Cost	62,900	86,153	2,627	9,584	26,785	6,819	1,949	11,168	18,767	1,803	-	-	6,650
Operational and Maintenance Costs	4,882	-	-	13	61	195	229	239	308	450	592	627	636
Demand Management	311	-	-	-	370	-	-	-	-	-	-	-	-
Total Operational and Maintenance Costs	5,193	-	-	13	431	195	229	239	308	450	592	627	636
Total Cost	68,094	86,153	2,627	9,597	27,216	7,014	2,178	11,407	19,075	2,253	592	627	7,286

8. APPENDIX B: Geographic map of proposed feeder 904 route

