ElectraNet SA
electricity transmission network

Application Notice

Proposed New Large Network Asset supplying the Southern Suburbs and supporting the Eastern Suburbs of Metropolitan Adelaide and the Eastern Hills and Southern Rural Regions of South Australia

ElectraNet Pty Ltd
(ABN 41 094 482 416)

16th March 2005

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1.0 EXECUTIVE SUMMARY

1.1 Background

In its role as the principal Transmission Network Service Provider (TNSP) in the State of South Australia, ElectraNet Pty Ltd (ElectraNet) continually monitors and assesses the performance of its transmission network against the relevant standards and principles contained within the National Electricity Code (NEC), the South Australian Transmission Code (ETC), and other relevant laws, standards, guidelines, and practices.

ElectraNet has assessed the forecast adequacy of the existing 275 kV electricity transmission system that supplies the Southern Suburbs of metropolitan Adelaide and the Southern Rural electrical loads further to the south (collectively referred to as the 'Southern Suburbs') and has identified emerging network limitations in this system. Due to the meshed nature of the transmission system, the effect of these limitations is not only isolated to the supply reliability of the Southern Suburbs, but also directly impacts the supply reliability of the load areas referred to as the 'Eastern Suburbs' (which includes the Adelaide CBD) and also the 'Eastern Hills'.

These load areas represent nearly 50% of South Australia's peak load. They cover a geographic region that extends from Golden Grove, about 20 kilometres to the north of Adelaide, down through the eastern suburbs, including the Adelaide CBD, and encompass the entire southern metropolitan area and the semi-urban and rural regions as far south as Victor Harbor, Rapid Bay, and Kangaroo Island, and also extend eastwards to Mount Barker and Murray Bridge. The majority of this load is supplied via a transmission corridor along the Adelaide Hills face extending from Para, southwards via Magill, Happy Valley, Cherry Gardens and Morphett Vale East.

ElectraNet, in conjunction with ETSA Utilities (ETSA), the principal Distribution Network Service Provider (DNSP) in South Australia, has undertaken comprehensive studies to assess the implications of the projected network limitations. Consideration of the results of those studies and other relevant information that was received following an initial joint consultation[1] by ElectraNet and ETSA to identify and assess feasible non-network alternatives to address the projected network limitations has resulted in the preparation and issue of this Application Notice by ElectraNet.

1.2 Description of Existing System

The Eastern and Southern Suburbs load regions are supplied by the 'Magill - East Terrace - Northfield' and 'Happy Valley - Morphett Vale East' grouped connection points, respectively, as defined in the ETC.

The Eastern Suburbs load comprises the Adelaide CBD, eastern, and north-eastern suburbs of Adelaide. Magill and East Terrace substations, two of the three main substations that make up the connection point, are responsible for supplying about 50% of the entire combined CBD and Eastern Suburbs portions of that load via their 275/66 kV transformers, and the two 275 kV lines that supply both substations also contribute to the supply of the Southern Suburbs grouped connection point. (Northfield 275/66 kV substation supplies the remainder of the Eastern suburbs load from an electrically separate 275 kV transmission network). The two lines supplying southwards from Para to Magill connect to the 275 kV switchyard at Torrens Island Power Station (TIPS) and to Para substation, on the north-western and northern outskirts of Adelaide, respectively. Both of these 275 kV lines traverse the Adelaide Hills for considerable

1 "Request for Information/Request for Proposals – Projected Transmission and Distribution Network and 275/66 kV Connection Point limitations, Electricity Supply to the Southern Suburbs of Metropolitan Adelaide, South Australia", published on ElectraNet's website in April 2004.

portions of their length, and both play a significant role in supplying metropolitan Adelaide and the CBD.

Happy Valley and Morphett Vale East 275/66 kV substations, that comprise the Southern Suburbs connection point, obtain their 275 kV supply from Magill substation, about 20 kilometres to the north-east of the connection point, and more locally from Cherry Gardens substation. As mentioned, Magill substation is supplied via two 275 kV lines, one from TIPS and one from Para substation. Cherry Gardens is supplied via a single circuit from TIPS, and two lines from Davenport substation, at Port Augusta, about 300 kilometres to the north of Adelaide. The two lines from Davenport also supply Robertstown, an intermediate substation about 110 kilometres, similarly, to the north of Adelaide, whose main role it is to provide supply to the Riverland region, to the east. However, due to their length, the two circuits from Robertstown are relatively weak in-feeds into this supply system, whereas the remaining three in-feeds (two from TIPS, and one from Para) provide strong 275 kV supply to both the Southern and Eastern Suburbs load regions.

Cherry Gardens substation also provides a 275/132 kV in-feed into the Eastern Hills load region. The Eastern Hills region is also supplied from Para and Tailem Bend 275/132 kV substations and includes major connection points at Mount Barker and Mobilong, near Murray Bridge. Importantly, all Murray River water pumping for Adelaide is provided from this 132 kV network.

1.3 Projected Network Limitations

Detailed analysis has shown that the transfer capability of the existing transmission system is limited southwards from Para towards Magill. An outage of the strong TIPS - Cherry Gardens in-feed to the Happy Valley - Morphett Vale East grouped connection point will result in thermal overloads in the remaining two circuits from Para and TIPS (the two lines that provide supply to Magill, which in turn supplies Happy Valley). To mitigate this situation, the electrical power that is able to be delivered into those areas must be limited to less than the peak forecast load levels expected to occur beyond summer 2006/07. However, this could potentially be a violation of the ETC, which states that the transmission network must be able to continuously supply the peak load of a Category 4 connection point (such as Happy Valley - Morphett Vale East) under all credible single contingency operating conditions. These thermal limitations also adversely impact the transmission network's ability to supply the Category 5 connection point that supplies the Eastern Suburbs and the Adelaide CBD, where still more stringent supply requirements apply. This is because not only are Magill and East Terrace 275/66 kV substations between them responsible for supplying about 50% of the entire combined CBD and Eastern Suburbs load, but also, East Terrace substation is totally reliant on the 275 kV supply to Magill substation because it is supplied radially out of Magill via a 275 kV cable.

In addition to the line overload limitations discussed, and as identified in the Request for Information / Request for Proposals paper published in April 2004, a voltage limitation exists, specifically in the Southern Suburbs load area. An outage of either the Magill - Happy Valley or the TIPS - Cherry Gardens 275 kV lines will result in substantially reduced 275 kV transmission voltages at the Southern Suburbs supply point, and this will ultimately lead to voltage collapse across the entire region, should the contingency occur at a time of high loads.

1.4 Discussion

Any augmentation of the transmission network specifically intended to remedy the projected limitation in the Southern Suburbs network would clearly be classified as a *reliability augmentation* under the National Electricity Code (NEC), and as such, must satisfy the ACCC Regulatory Test for this type of augmentation. A reliability augmentation option satisfies the Regulatory Test if …*"the option minimises the present value of costs, compared with a number of alternative options in a majority of reasonable scenarios".*

The anticipated total cost of the network augmentation needed to address this projected network limitation will exceed $10M, and as such, the necessary augmentation would be classified as a "new large network asset" under the NEC, and the consultation process associated with this type of development is therefore being followed by ElectraNet.

ElectraNet, in conjunction with ETSA, has carried out initial consultation with Code participants and other interested parties to identify feasible non-transmission alternatives to address the projected network limitations in the Southern Suburbs. While a number of potential solution providers made preliminary enquiries during this consultation process, no firm submissions or proposals for practical alternative non-network solutions were received.

A preliminary assessment of alternative network solutions that would increase the transmission capacity southwards of Para, and that invariably involved the rebuilding of existing 275 kV line routes from Para to Cherry Gardens using multiple circuit construction, was conducted. However, these options were dismissed due to their significantly higher costs, system security issues during construction, and their failure to deliver compensating technical or other benefits. Furthermore, bushfires pose the single largest, foreseeable threat to supply reliability for transmission lines through the Adelaide Hills, and additional lines through this area on common structures would not provide adequately reliable circuit separation.

Having ensured to the extent possible that it had not overlooked any superior non-network solutions, ElectraNet then commenced an assessment of the two most feasible network options that it had identified. This assessment has shown that the establishment of a 275 kV switching station at Tungkillo, at the point where the two 275 kV lines heading south-east out of Para to Tailem Bend cross over the two Robertstown – Cherry Gardens 275 kV lines, combined with the creation of a three-way connection between Happy Valley, Magill and Tungkillo, satisfies the Regulatory Test. It meets the required technical and service standards in the most cost-effective manner to participants in the National Electricity Market (NEM), and provides a technically efficient solution that utilises existing transmission assets, requires no new transmission line corridors, and yet augments the 275 kV network supplying all affected load areas. It also provides for a strategically diverse path from Para southwards to Cherry Gardens via the eastern side of the Adelaide Hills, through Tungkillo. Sensitivity analysis has shown this result to be robust under a range of assumptions.

1.5 Recommendation

As a result of undertaking the Regulatory Test, and following consideration of all available information, including input obtained from ETSA, Code Participants and interested parties as a result of the initial consultation, this Application Notice proposes that the Tungkillo Network Solution be implemented to address the projected network limitations in the transmission network that supplies the Southern and Eastern Suburbs of metropolitan Adelaide (including the Adelaide CBD) and supporting the Eastern Hills load region. The proposed new large network assets involve:

- The establishment of a 275 kV switching station at a vacant ElectraNet site at Tungkillo, approximately 40 kilometres east of the Adelaide CBD, at the point where the two Tailem Bend - Para 275 kV lines cross the two Robertstown - Cherry Gardens 275 kV lines;
- The reconfiguration of the four lines at Tungkillo to form:
  - One Robertstown to Para 275 kV circuit;
  - One Tailem Bend to Cherry Gardens 275 kV circuit;
  - One Robertstown to Tungkillo 275 kV circuit;
  - One Tailem Bend to Tungkillo 275 kV circuit;
  - One Tungkillo to Para 275 kV circuit;

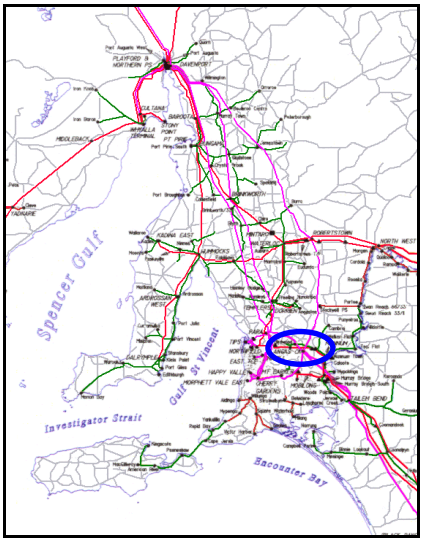
- One 275 kV circuit from Tungkillo (via Cherry Gardens) to tee into the Magill - Happy Valley 275 kV line;

- The stringing on the vacant side of the Cherry Gardens - Happy Valley 275 kV line of a new section of 275 kV line between Cherry Gardens and the point where it meets the Magill - Happy Valley line, and teeing that new section of line into the Magill - Happy Valley 275 kV line, and the modification of 275 kV transmission line entries at Cherry Gardens substation to accommodate a by-pass arrangement for the Cherry Gardens end of this new line and the subsequent creation of a three-way Magill - Happy Valley - Tungkillo 275 kV line, and;
- The upgrading of communication facilities at Tungkillo, Happy Valley and Magill substations to facilitate a protection scheme for this three-way connection.

The additional transmission work described in the third major dot-point above (the establishment of a new section of 275 kV line and the creation of a three-way Magill - Happy Valley -Tungkillo 275 kV line) is required to enable the existing network to cope with the vastly improved power flows into the Southern Suburbs network that the Tungkillo project produces. The establishment of Tungkillo substation significantly alters the existing power-flows into Cherry Gardens, the flow preference shifting markedly from the existing situation of Para to Cherry Gardens, via Magill, to that of Para to Cherry Gardens, via Tungkillo. Because of this shift, additional transmission works are required between Cherry Gardens and Happy Valley substations to prevent the thermal overloading of either the Cherry Gardens – Happy Valley or Cherry Gardens - Morphett Vale East 275 kV lines under single contingency conditions, from the summer of 2007/08.

The total cost of these new large network assets and associated system modifications is estimated to be $38.6 M.

ElectraNet invites submissions from Code Participants and interested parties on this Application Notice. Submissions close on Friday 6th May 2005.



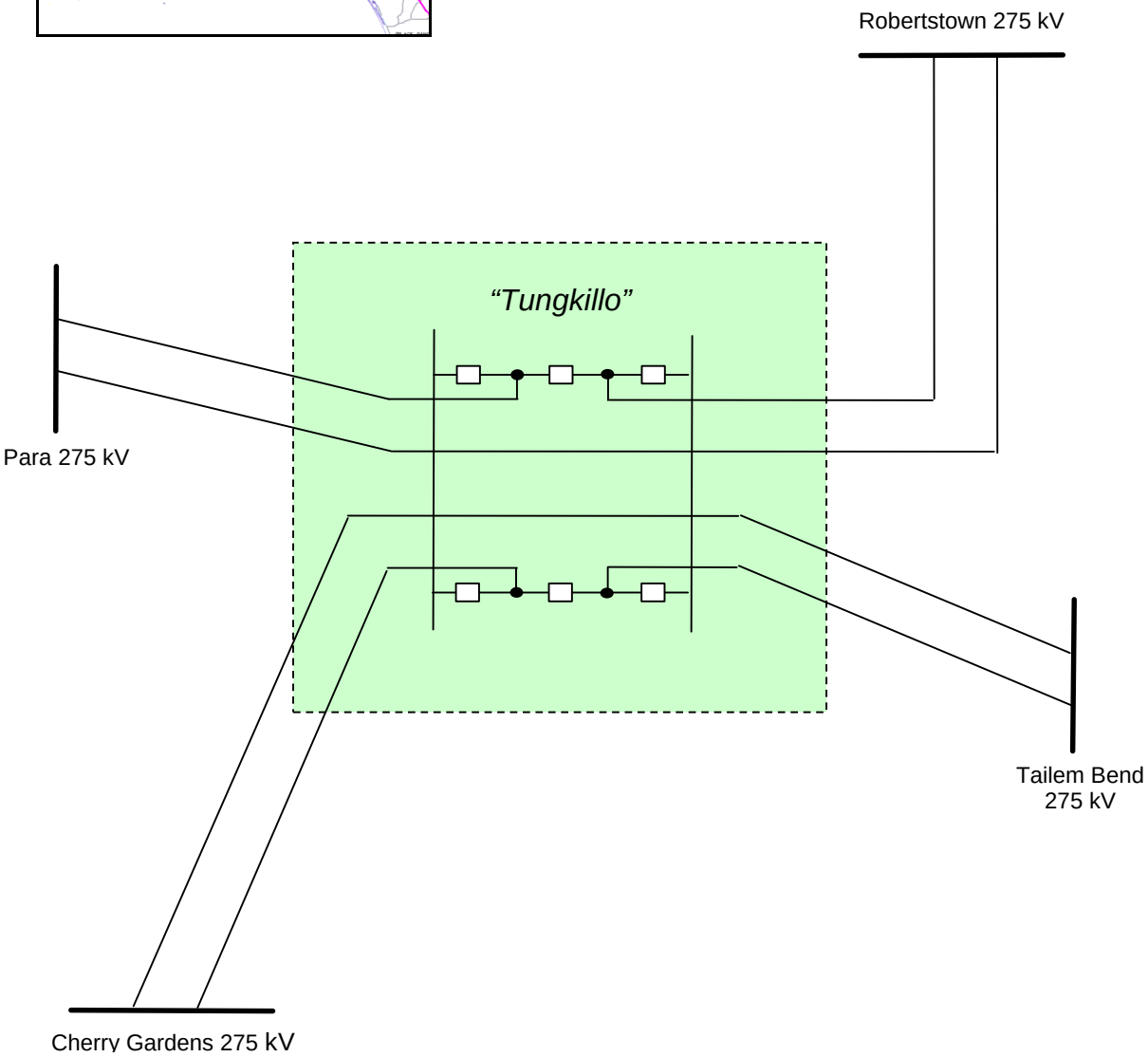


Diagram 1: Proposed layout of Tungkillo 275 kV switching station

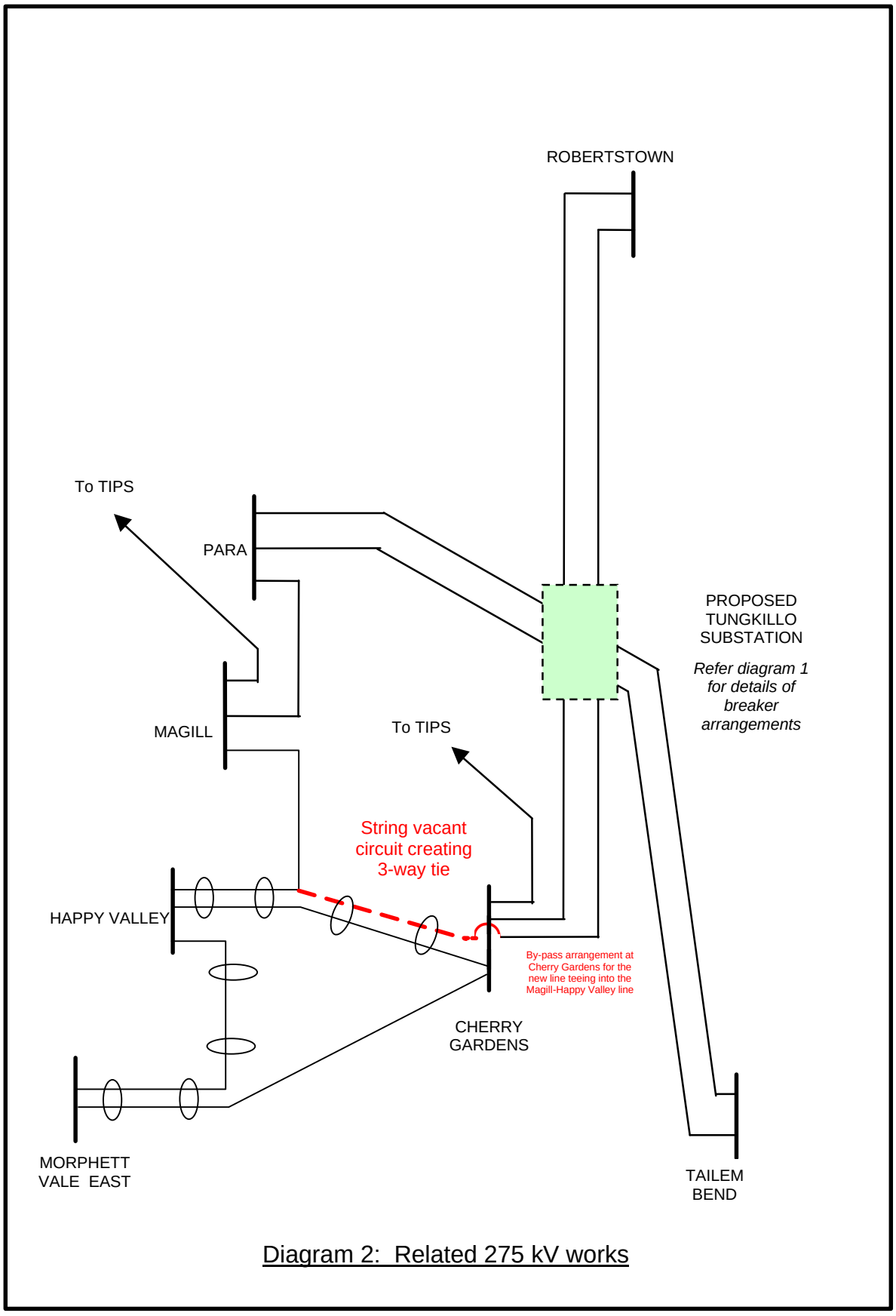


Diagram 2: Related 275 kV works

2.0 INTRODUCTION

ElectraNet has identified projected limitations in the electricity transmission network that supplies the Southern and part of the Eastern Suburbs of metropolitan Adelaide (including the Adelaide CBD), and supports the Eastern Hills region, extending to Murray Bridge. The analysis supporting these findings has culminated in the preparation and issue of this Application Notice.

This Application Notice proposes the installation of the following network assets, along with appropriate system modifications to accommodate them (collectively referred to as the Tungkillo Network Solution), to address those limitations:

- The establishment of a 275 kV switching station at a vacant ElectraNet site at Tungkillo, approximately 40 kilometres east of the Adelaide CBD, at the point where the two Tailem Bend - Para 275 kV lines cross the two Robertstown - Cherry Gardens 275 kV lines;
- The reconfiguration of the four lines at Tungkillo to form:
  - One Robertstown to Para 275 kV circuit;
  - One Tailem Bend to Cherry Gardens 275 kV circuit;
  - One Robertstown to Tungkillo 275 kV circuit;
  - One Tailem Bend to Tungkillo 275 kV circuit;
  - One Tungkillo to Para 275 kV circuit;
  - One 275 kV circuit from Tungkillo (via Cherry Gardens) to tee into the Magill - Happy Valley 275 kV line, and;

as shown in Diagram 1, and;

- The stringing on the vacant side of the Cherry Gardens - Happy Valley 275 kV line of a new section of 275 kV line between Cherry Gardens and the point where it meets the Magill - Happy Valley line, and teeing that new section of line into the Magill - Happy Valley 275 kV line, and the modification of 275 kV transmission line entries at Cherry Gardens substation to accommodate a by-pass arrangement for the Cherry Gardens end of this new line and the subsequent creation of a three-way Magill - Happy Valley - Tungkillo 275 kV line, and;
- The upgrading of communication facilities at Tungkillo, Happy Valley and Magill substations to facilitate a protection scheme for this three-way connection;

as shown in Diagram 2.

The additional transmission work described in the third major dot-point above (the establishment of a new section of 275 kV line and the creation of a three-way Magill - Happy Valley -Tungkillo 275 kV line) is required to enable the existing network to cope with the vastly improved power flows into the Southern Suburbs network that the Tungkillo project produces. The establishment of Tungkillo substation significantly alters the existing power-flows into Cherry Gardens, the flow preference shifting markedly from the existing situation of Para to Cherry Gardens, via Magill, to that of Para to Cherry Gardens, via Tungkillo. Because of this shift, additional transmission works are required between Cherry Gardens and Happy Valley substations to prevent the thermal overloading of either the Cherry Gardens – Happy Valley or Cherry Gardens - Morphett Vale East 275 kV lines under single contingency conditions, from the summer of 2007/08.

The augmentation that ElectraNet is proposing to remedy the identified limitations in the 275 kV transmission supply network is driven by the need to meet the service standards outlined in the South Australian ETC as well as the technical standards of the NEC, clearly making it a *reliability*

augmentation. As such, it must satisfy the Regulatory Test promulgated by the ACCC for reliability augmentations[2], and this is demonstrated later in this document.

The recommendations in this Application Notice are based on:

- Identification of projected network limitations in the 275 kV transmission network supplying the Southern and Eastern Suburbs of metropolitan Adelaide and supporting the Eastern Hills region extending to Murray Bridge, during worst case single network contingencies from late 2006 onwards;
- The initial consultation undertaken by ElectraNet in conjunction with ETSA to identify potential non-network solutions to address the projected network limitations;
- An analysis of feasible options in accordance with the ACCC's Regulatory Test for reliability augmentations, and;
- An assessment that network augmentation is required as soon as possible after the summer of 2005/06 to maintain a reliable supply to customers in accordance with the requirements of the NEC and the ETC.

2 A reliability augmentation satisfies the Regulatory Test if…*"in the event the option is necessitated solely by the inability to meet the minimum network performance requirements set out in schedule 5.1 of the Code or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction – the option minimises the present value of costs, compared with a number of alternative options in a majority of reasonable scenarios"…*

3.0 PROJECTED NETWORK LIMITATIONS

3.1 Reliability Standards and Service Obligations

The South Australian ETC allocates to each customer connection point on the transmission system a reliability category, with specific reliability standards applying to the various categories. The ETC has allocated Category 4 status to the Happy Valley - Morphett Vale East grouped connection point (Southern Suburbs), and Category 5 status to the Magill – East Terrace – Northfield grouped connection point (Eastern Suburbs). This requires ElectraNet, as a licensed transmission entity in South Australia, to meet certain legally binding reliability and service standards with respect to the provision of transmission services at those connection points.

The specific (N-1) transmission line reliability standards and service obligations that ElectraNet must comply with for both the Southern and Eastern Suburbs are summarised below.

- The provision of N-1 line capacity of at least 100% of agreed maximum demand;
- The continuous availability of at least 100% of N-1 line capacity, and;
- The restoration of contracted line capacity within 12 hours of an interruption, using best endeavours.

ElectraNet is not permitted to contract for an amount of agreed maximum demand greater than 100% of installed line capacity. Furthermore, in the event that the agreed maximum demand at the grouped connection point exceeds available N-1 line capacity, ElectraNet must use its best endeavours to meet the standards within 12 months and, in any case, within 3 years of becoming aware of a violation.

In other words, this service standard requires that 100% of the AMD (which is effectively equivalent to the forecast peak demand in that year) for the Southern and Eastern Suburbs must be capable of being supplied instantaneously following a contingency without any loss of customer supply in the intervening period. Accordingly, any assessment of proposals to meet the projected network limitations must consider this requirement for a continuous supply of electricity and the capability to have contracted line and transformer capacity reinstated to agreed levels within the prescribed times.

The South Australian ETC also requires that ElectraNet take into consideration independent N-2 transmission line contingencies for the Eastern Suburbs grouped connection points as a Category 5 load. However, this N-2 “cover” is non-firm and allows for considerable load shedding in the Eastern Suburbs, and in reality infers entire load shedding of the Southern Suburbs.

The Eastern Hills loads are Category 3 and Category 1 loads, but as they contribute in a pre-contingent sense to the loading of the 275 kV transmission lines southwards from Para, they must also be taken into consideration.

3.2 Load Forecasts and Assumptions

ElectraNet obtains electricity demand forecasts over a ten-year horizon from ETSA. These forecasts take account of any known demand management programmes that are in-place or committed, and also the presence of embedded generation that may reduce the forecast peak demand supplied by a transmission connection point. However, to be effective in reducing the AMD at a connection point, these programmes or facilities must be continuously available and operating at times of peak load.

ETSA's most recent demand forecasts for the connection points supplying the southern region of metropolitan Adelaide suggest that the overall load growth, based on medium economic growth, will continue at an average rate of about 3.5% per annum for the foreseeable future (3.2% in the northern portion, and 4.2% in the southern portion, of the 66 kV system supplying the Southern Suburbs network). This growth in electricity usage is largely attributable to the continuing development of residential housing estates in the area. The Eastern Suburbs load growth, that includes the Adelaide CBD, will continue to grow at an average rate of about 2.7% per annum. The Eastern Hills region will continue to grow at a rate of about 3.6% per annum.

ETSA's load growth overview with supporting assumptions was reproduced in Section 7 of ElectraNet's 2004 Annual Planning Review that was published on ElectraNet's website in June 2004.

3.3 Capability During Single Contingencies

As previously described in section 1.2, the Eastern and Southern Suburbs load regions are supplied by the 'Magill - East Terrace - Northfield' and 'Happy Valley - Morphett Vale East' grouped connection points respectively, as defined in the ETC. The majority of this supply has to be transferred southwards from Para via Magill and Cherry Gardens substations, and this transfer is limited by the thermal capacity of the lines between Para and Magill. In addition, the 132 kV network defined as the Eastern Hills region is also supported through Cherry Gardens substation.

The Eastern Suburbs load comprises the Adelaide CBD, eastern, and north-eastern suburbs of Adelaide. Magill and East Terrace substations, two of the three main substations that make up the connection point, are responsible for supplying about 50% of the entire combined CBD and Eastern Suburbs portions of that load via their 275/66 kV transformers, and the two 275 kV lines that supply both substations also contribute to the supply of the Southern Suburbs grouped connection point. (Northfield 275/66 kV substation supplies the remainder of the Eastern suburbs load from an electrically separate 275 kV transmission network). The two lines supplying southwards from Para to Magill connect to the 275 kV switchyard at Torrens Island Power Station (TIPS) and to Para substation, on the north-western and northern outskirts of Adelaide, respectively. Both of these 275 kV lines traverse the Adelaide Hills for considerable portions of their length, and both play a significant role in supplying metropolitan Adelaide and the CBD.

Happy Valley and Morphett Vale East 275/66 kV substations, the two substations that comprise the Southern Suburbs connection point, obtain their 275 kV supply from Magill substation, about 20 kilometres to the north-east of the connection point, and more locally from Cherry Gardens substation. As mentioned, Magill substation is supplied via two 275 kV lines, one from TIPS and one from Para substations. Cherry Gardens is supplied via a single circuit from TIPS, and two lines from Davenport substation, at Port Augusta, about 300 kilometres to the north of Adelaide. The two lines from Davenport also supply Robertstown, an intermediate substation about 110 kilometres to the north of Adelaide that supplies the Riverland. However, because of their

length, the two circuits from Robertstown are relatively weak in-feeds into this supply system, whereas the remaining three in-feeds (two from TIPS, and one from Para) provide strong 275 kV supply to both the Southern and Eastern Suburbs and Eastern Hills load regions.

Cherry Gardens substation also provides a 275/132 kV in-feed into the Eastern Hills load region. This region is also supported from Para and Tailem Bend 275/132 kV substations and includes major Connection Points at Mount Barker, and Mobilong, near Murray Bridge. Additionally, all Murray River water pumping for Adelaide is provided from this 132 kV network.

Detailed analysis has shown that the transfer capability of the existing transmission system is limited southwards from Para towards Magill. An outage of the critical TIPS - Cherry Gardens in-feed will result in thermal overloads in the remaining two circuits that provide supply for the Happy Valley –Morphett Vale East connection point (the TIPS - Magill and Para - Magill 275 kV lines, the two lines that provide supply to Magill, which in turn supplies Happy Valley substation). To avoid this situation, the electrical power that is able to be delivered into those areas must be limited to less than the peak forecast load levels expected to occur beyond summer 2006/07. However, this will potentially violate the ETC, which states that the transmission network must be able to continuously supply the peak load of a Category 4 connection point (such as Happy Valley - Morphett Vale East) under all credible single contingency operating conditions. These thermal limitations also adversely impact the transmission network's ability to supply the Category 5 connection point that supplies the Eastern Suburbs and the Adelaide CBD, where still more stringent supply requirements apply, because, as discussed, Magill and East Terrace substations are responsible for supplying about 50% of the entire CBD and Eastern Suburbs load via its their 275/66 kV transformers.

In addition to the line overload limitations discussed, and as identified in the Request for Information/Request for Proposals paper published in April 2004, a voltage limitation exists, specifically in the Southern Suburbs load area. An outage of either the Magill - Happy Valley or the TIPS - Cherry Gardens 275 kV lines will result in substantially reduced 275 kV transmission voltages at the Southern Suburbs supply point, and this will ultimately lead to voltage collapse across the entire region, should the contingency occur at a time of high loads

ElectraNet's analysis of the critical single contingencies, discussed earlier, shows that Code-compliant 275 kV voltage levels and operation within transmission line rating limits may not be achievable beyond summer 2005/06. This demonstrates that some form of additional reinforcement, extension, or augmentation of the power system that supplies the Southern and Eastern Suburbs and supports the Eastern Hills will need to be undertaken prior to summer 2006/07.

The table on the following page provides an indication of the level and period of load reduction that is expected to be required under contingency operating conditions in order to maintain plant and equipment within acceptable ratings and acceptable voltage levels on the transmission network, based on the most recent load forecast supplied by ETSA. As noted, such load reductions are not consistent with ElectraNet satisfying its reliability obligations under the South Australia ETC.

Year	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Load at risk* (MW)	0	1.0	25.6	50.9	77.2	104.4	132.6	161.7	191.9	223.1
Duration at risk (hrs)	0	0.3	7.7	14.9	21.8	28.4	34.9	41.1	47.1	52.9

* Load at risk is the load that would not be able to be supplied from the existing transmission or sub-transmission system following the occurrence of a critical single contingency event and the implementation of contingency plans to support the remaining load. Periods may occur following a critical contingency when significantly larger portions of the total load are without supply until contingency arrangements are placed into operation.

4.0 OPTIONS CONSIDERED

4.1 Progress of the Consultation Process

Since 2001, The Electricity Supply Industry Planning Council (ESIPC) Annual Planning Reviews[3] have foreshadowed that some form of reinforcement would be required to address projected transmission network limitations relating to the 275 kV supply for metropolitan Adelaide.

In April 2004 ElectraNet and ETSA jointly issued a consultation paper providing more detailed information on the projected network limitations in the Southern Suburbs. This paper sought information from Code Participants and interested parties regarding potential solutions to address a number of projected network limitations.

The closing date for submissions on this preliminary notification of network limitations was 26th May 2004. No firm submissions or proposals for practical alternative non-network solutions were received.

4.2 Non-Transmission Options Identified

4.2.1 Existing and New Generation

At present there are three existing sources of generation operating in the Southern Suburbs load area. They are the diesel generators located at Kingscote on Kangaroo Island, the Cummins distillate fired power station at Lonsdale, and the Starfish Hill wind powered generating station located at Cape Jervis on the Fleurieu Peninsula.

The Starfish Hill wind farm comprises 23 individual wind generators, each with a capacity of 1.5 MW, making a total installed capacity of 34.5 MW. This generating station connects into the Southern Suburbs 66 kV sub-transmission system at Yankalilla on the Fleurieu Peninsula.

In addition to the Starfish Hill wind farm, ElectraNet and ETSA are aware of several proposals for the establishment of additional wind farms along the coast between Adelaide and Rapid Bay. However, in the absence of any firm commitment by the proponents to date, these possible developments have been excluded from the analysis of the existing network.

Despite the potential abundance of wind farm developments, both existing and proposed, in the region, the unpredictable nature of the wind that provides their energy source inherently introduces a high level of uncertainty and volatility regarding the availability of generating capacity from those wind farms. Because of this, it has been assumed that this source of generation would provide a negligible contribution to the firm generating capacity that would otherwise be needed to meet network requirements.

The diesel generators located at Kingscote on Kangaroo Island have a total capacity of 2.4 MW and are only used when the supply from the mainland is unavailable. Their contribution to contingency support for the Southern Suburbs has therefore been discounted.

The Lonsdale generating plant comprises twenty individual distillate-fuelled generating units, each with a rating of 1 MW. It connects to the 11 kV system at Port Stanvac substation and runs infrequently, generally in response to the National Electricity Market, and has therefore been assumed to be off-line for the purposes of analysing the existing Southern Suburbs electricity supply system.

3 Published in June 2004

It should be noted that load growth within the Southern Suburbs supply area is such that even if an optimistic view was taken regarding the output of existing power stations in the area, the additional capacity that could be provided would not be sufficient to delay the need for augmentation by as little as 12 months.

Dry Creek Power Station is the only source of existing generation in the Eastern Suburbs. It can inject approximately 2x40 MW into ETSA's 66 kV network on a hot summer day. However, the off-loading effect of this power station is more noticeable at Northfield substation, supplied from a completely different 275 kV transmission network and is somewhat diminished at Magill due to the relatively high impedance of ETSA's 66 kV network.

ElectraNet is not aware of any additional existing or committed wind or non-wind generation developments, other than those discussed above, that will potentially impact on the 275 kV transmission network that supplies the Southern and part of the Eastern Suburbs and adjoining southern rural area of South Australia. No firm generation alternatives that could address the identified network limitations were received in response to the RFI/RFP document.

4.2.2 Demand Side Management

As mentioned, ElectraNet obtains electricity demand forecasts over a ten-year horizon from ETSA, South Australia's principal electricity distributor. ETSA confirms that these forecasts take into account both existing and proposed demand management programmes that may reduce the forecast demand at transmission connection points. Neither ElectraNet nor ETSA received information regarding demand-side or other initiatives in response to the public consultation that has been undertaken to date.

4.2.3 Embedded Generation

As with demand-side management programmes, ETSA's electricity demand forecasts take account of embedded[4] generation that is in-place, committed, or likely to occur, and that may similarly reduce the forecast demand at transmission connection points. Again, no information about initiatives was obtained from any other party during the consultation process.

4.3 Distribution Options Identified

Joint planning was undertaken between ETSA and ElectraNet regarding this projected network limitation. However, ETSA has advised that they do not have any economic distribution system solutions to address this particular situation. Only relatively weak 66 kV (dead) transfers are available between metropolitan regions, and notwithstanding this, all practical distribution in-feed alternatives are ultimately supplied from the same 275 kV transmission network.

4.4 Transmission Options Identified

In addition to the consultation process to identify possible non-network solutions, ElectraNet has carried out studies to determine the most appropriate transmission network solution to address the projected network limitations. Two feasible options were identified, and are described in detail in the following section.

4 An embedded generator connects directly to the low voltage distribution network. Output from such generators therefore reduces the expected energy that the transmission grid is required to deliver. Embedded generators may also reduce the demand the transmission grid is required to deliver, depending on their mode of operation.

5.0 IDENTIFIED TRANSMISSION SOLUTIONS

An overview of the feasible transmission options identified is provided in this section, with a more detailed summary of the financial analysis provided in Appendix 2.

5.1 Feasible Transmission Solutions

Option 1 – Tungkillo Network Solution[5]		
Date required	Proposed Augmentation	Total capital cost
October 2006	*At Tungkillo*	
	Establish a 275 kV switching station at the point where the two Tailem Bend - Para 275 kV lines cross the two Robertstown - Cherry Gardens 275 kV lines ('Tungkillo');	$32.2 M
	Reconfigure the four lines at Tungkillo to form: • One Robertstown to Para 275 kV circuit; • One Tailem Bend to Cherry Gardens 275 kV circuit; • One Robertstown to Tungkillo 275 kV circuit; • One Tailem Bend to Tungkillo 275 kV circuit; • One Tungkillo to Cherry Gardens 275 kV circuit, and; • One Tungkillo to Para 275 kV circuit.	
October 2007	*At Cherry Gardens* • String the vacant side of the existing (double circuit construction) Cherry Gardens - Happy Valley 275 kV line between Cherry Gardens and the point where it meets the Magill - Happy Valley line, and connect it into the Magill - Happy Valley 275 kV line, thereby creating a three-way Tungkillo - Happy Valley – Magill 275 kV line; • Modify 275 kV transmission line entries at Cherry Gardens to accommodate the above line works;	$6.4 M
	At the remote ends of the three-way tie (Tungkillo, Happy Valley and Magill) • Install appropriate equipment and communications to facilitate a three-way protection scheme.	
	TOTAL	***$38.6 M***

This relatively simple reconfiguration of the existing 275 kV network, as shown in Diagram 3, provides the dual benefits of augmenting supply to ElectraNet's connection points that supply the Southern and Eastern Suburbs and supporting the Eastern Suburbs and providing an additional source of reactive power to support voltage levels on ETSA's Southern Suburbs 66 kV network. It also achieves a more diverse and balanced high voltage in-feed into the Adelaide metropolitan

5 The timing of the augmentation is based on the electricity demand forecast as published in the initial consultation paper issued by ElectraNet in April 2004. The financial analysis evaluates possible variations to the timings for different load growth forecasts using the market development scenarios in section 6.0.

area, which improves supply reliability and reduces electrical losses (both real and reactive) by facilitating Para to Cherry Gardens southwards power-flow via Tungkillo rather than Magill and the Adelaide hills face. The diversity of this arrangement also provides circuit separation in the event of a major Adelaide Hills bushfire.

The Tungkillo 275 kV switching station would be constructed using a 'breaker-and-a-half' arrangement, essentially as shown in Diagram 1. This arrangement provides for greater system security and operational flexibility both during and following construction than would other switchyard arrangements. This is considered essential given the significance of the four 275 kV circuits involved in supplying the Adelaide metropolitan and CBD and Eastern Hills loads.

Option 1, the Tungkillo Network Solution, is expected to minimise environmental and visual impacts in comparison with other alternatives. ElectraNet already owns a vacant parcel of land of sufficient size to accommodate the proposed switching station directly adjacent the point where the two Tailem Bend - Para lines cross the two Robertstown - Cherry Gardens lines. The substation site is in an area of low population density that is used predominantly for stock grazing. Furthermore, the proposed new line between Cherry Gardens and the Magill - Happy Valley 275 kV line, required to prevent overloading of the existing 275 kV lines to Happy Valley and Morphett Vale East as the new injection from Tungkillo flows through Cherry Gardens, makes effective use of existing assets, as it is to be strung on the presently unused side of the Cherry Gardens - Happy Valley line.

No new line corridors are required for this option.

Planning studies show that Option 1 will not adversely impact other transmission networks, interconnection flows or generation despatch within the NEM, and, in fact, provides a tangible reduction in transmission system losses.

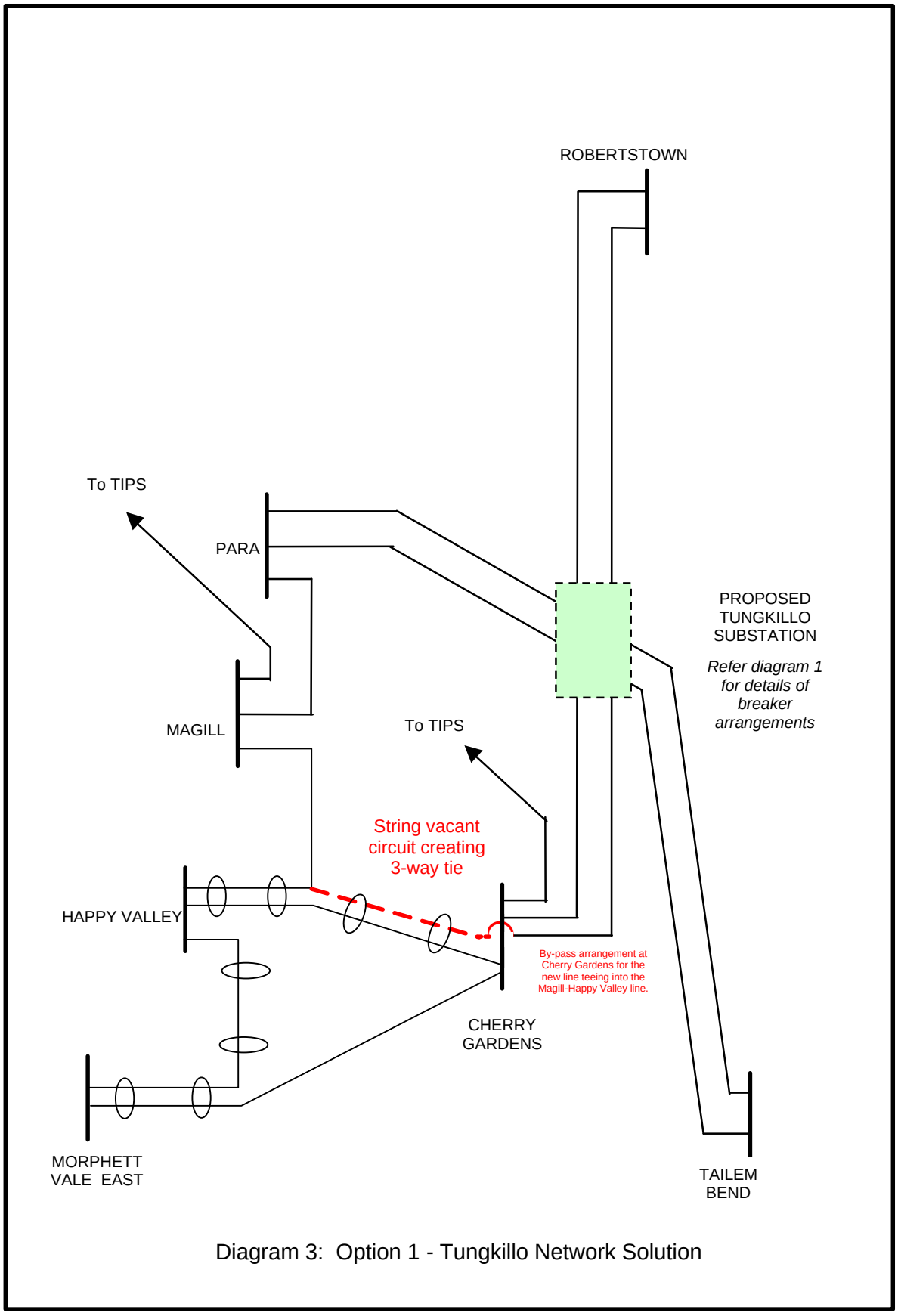


Diagram 3: Option 1 - Tungkillo Network Solution

Option 2 – Tailem Bend – Cherry Gardens double circuit 275 kV line[6]		
Date required	Proposed Augmentation	Total capital cost
October 2006	*Between Tailem Bend and Cherry Gardens substations* • Construct a new double-circuit 275 kV line of approximately 85 km length between Tailem Bend and Cherry Gardens substations, including two new 275 kV exits at Tailem Bend and one new 275 kV exit at Cherry Gardens substations; • Install appropriate communications to facilitate an appropriate protection scheme for the new exits;	$77.1M
	At Cherry Gardens • Establish a new 275 kV exit at Cherry Gardens substation; • String the vacant side of the (double circuit construction) Cherry Gardens - Happy Valley 275 kV line between Cherry Gardens and the point where it meets the Magill - Happy Valley line, and tee it into the Magill - Happy Valley 275 kV line, thereby creating a three-way Tailem Bend - Happy Valley - Magill line; • Install appropriate communications to facilitate a three-way protection scheme for the new configuration.	$7.4M
	At the remote ends of the three-way tie (Tailem Bend, Happy Valley and Magill) • Install appropriate equipment and communications to facilitate a three-way protection scheme.	
	TOTAL	***$84.5M***

This option requires the construction of a new double circuit 275 kV line between Cherry Gardens and Tailem Bend substations, as shown in Diagram 4.

The double circuit 275 kV line from Tailem Bend to Cherry Gardens substations will provide essentially the same technical benefits as would Option 1; specifically, those of strengthening supply to both the Southern and Eastern Suburbs, supporting the Eastern Hills, and providing an additional source of reactive power to support voltage levels on ETSA's Southern Suburbs 66 kV network.

As in Option 1, this scheme proposes stringing the vacant side of the Cherry Gardens - Happy Valley 275 kV line and teeing it into the Magill - Happy Valley 275 kV line to achieve the necessary augmentation of the 275 kV supply required when this new injection through Cherry Gardens would otherwise overload existing 275 kV lines into Happy Valley and Morphett Vale East.

Option 2 is expected to have a higher visual and environmental impact than Option 1 as it involves the construction of approximately 85km of new transmission line. Obtaining an

[6] The timing of the augmentation is based on the electricity demand forecast as published in the initial consultation paper issued by ElectraNet in April 2004. The financial analysis evaluates possible variations to the timings for different load growth forecasts using the market development scenarios in section 6.0

acceptable line route would require careful consideration of relevant environmental and cultural requirements and extensive consultation with all interested parties. This would be particularly important for the first 25 to 30 kilometres east of Cherry Gardens, given the environmental sensitivity of the southern Mount Lofty Ranges region.

Planning studies show that Option 2 will not adversely impact other transmission networks within the NEM.

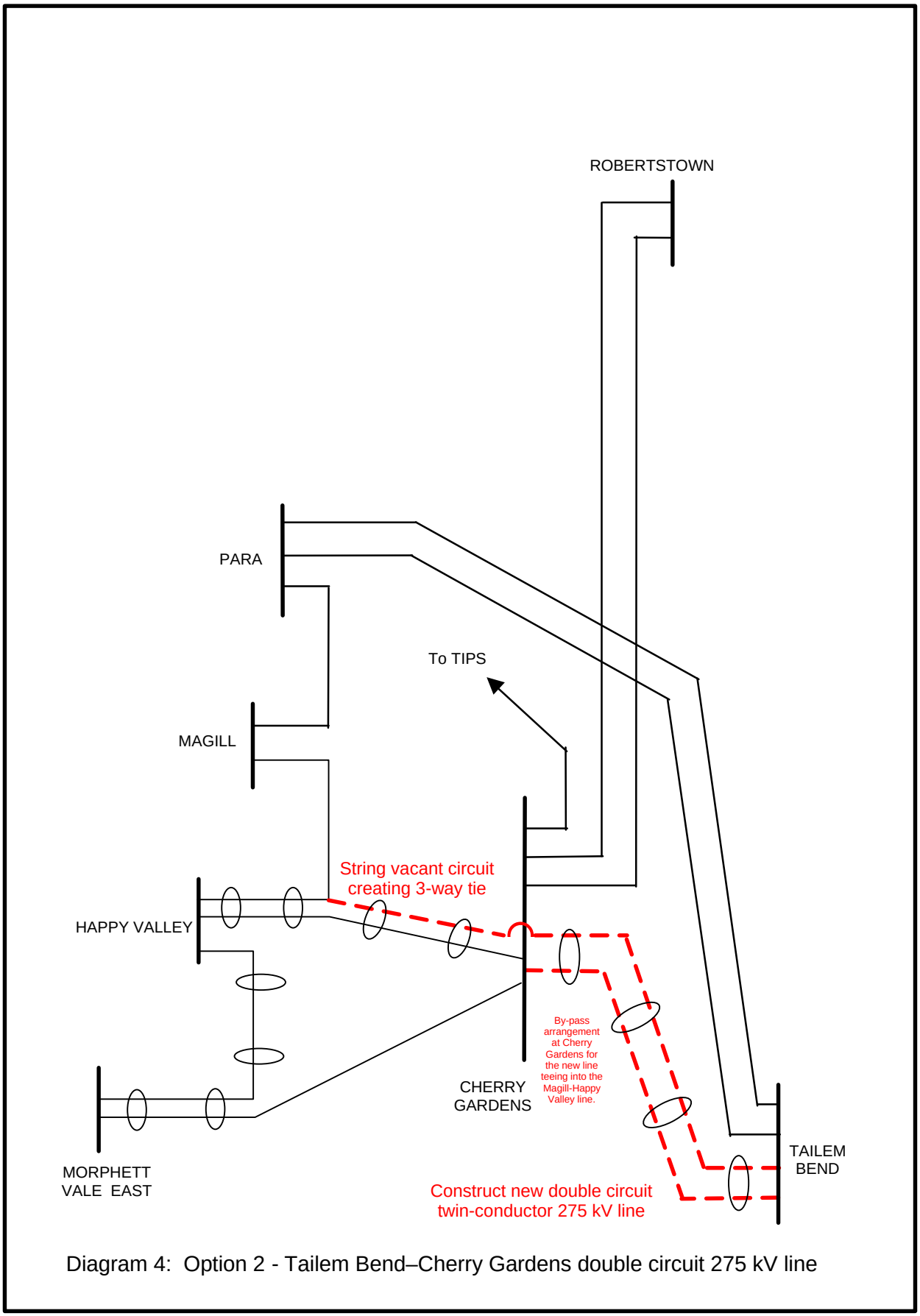


Diagram 4: Option 2 - Tailem Bend–Cherry Gardens double circuit 275 kV line

5.2 Other options that were identified but not pursued

Network reinforcement options

Two variations on Option 2 were considered by ElectraNet, but subsequently dismissed. They were the establishment of a dual circuit 275 kV line between Para and Cherry Gardens substations, and the building of a single circuit 275 kV line from each of Tailem Bend and Para to Cherry Gardens substations. Both of these options would similarly have required the stringing of the vacant side of the Cherry Gardens - Happy Valley 275 kV line and the teeing of this new line from Cherry Gardens into the Magill - Happy Valley 275 kV line, as in Options 1 and 2, to accommodate the increased power-flows through Cherry Gardens.

These variations were discarded by ElectraNet due mainly to the fact that any realistic line route between Para and Cherry Gardens substations would of necessity traverse the environmentally sensitive Mount Lofty Ranges region for its entire length of more than 50 kilometres. Since the intervening terrain is generally heavily wooded, the selected line route would require substantial vegetation clearance to meet bushfire and electrical clearance requirements. Furthermore, it is already relatively congested with transmission lines. Consequently, it is ElectraNet's opinion that it would be extremely difficult to obtain a mutually agreeable corridor through the region, and that once a suitable line route was agreed, that the cost to build such a line would be considerable considering the nature of the intervening terrain. When combined with the observation that these variations provide no technical advantage over either Option 1 or Option 2, ElectraNet considered that there was sufficient reason to dismiss these options. It should be noted also that in the 1970's the Electricity Trust of South Australia endeavoured to acquire easements northwards from Cherry Gardens towards Para. Easements were obtained with great difficulty as far north as the Verdun area before this was abandoned due to environmental pressures. With the advent of Northern Power Station in the 1980's, ETSA constructed the lines from Davenport to Cherry Gardens, and at that time Tungkillo was identified as the strategically superior alternative.

Generation options

ElectraNet has also considered it necessary to assess the benefits that generator proponents may be able to provide by connecting additional generation into the Southern Suburbs system, despite ElectraNet's recognition that it has only limited expertise in this field. This has been done to ensure that, in the absence of any generation proposals, ElectraNet can be confident that it has not overlooked a viable alternative means of reinforcing the network.

In order to be a viable alternative, any generation option would have to provide an equivalent level of network support to that provided by the transmission solutions identified. Furthermore, in order to meet ETC requirements, generation would have to be permanently available, continuously accessible, operate at times of high load, and be capable of supplying, as a minimum, loads in accordance with the table presented in section 3.2 of this document.

ElectraNet's view is that a generation option in the area is unlikely to be economically or technically feasible, due to issues regarding the location of the plant, development approval, and the availability of suitable economic fuel supplies. This view was supported by the fact that no generation proposals were received by ElectraNet in response to the initial RFI/RFP consultation process.

6.0 MARKET DEVELOPMENT SCENARIOS

6.1 Context for Evaluation of Options

All feasible solutions to the identified network limitations were viewed in the context of wider developments within the NEM. NEMMCO's Statement of Opportunities (SOO), issued in July 2004, contained information on existing and committed generation developments in South Australia, an extract from which follows:

> *"The supply-demand balance assessments of … the combined Victoria/South Australia region is showing a reserve deficit for summer 2004/05…*
>
> *…The expected commissioning of the Basslink interconnector in 2005 should provide an additional 600 MW of capacity for the 2005/06 summer peak, meeting the minimum reserve level requirement in Victoria/South Australia for that year…*
>
> *…load growth will erode these reserves, requiring more capacity in Victoria/South Australia to maintain minimum reserve levels from the summer of 2006/07"*

ElectraNet has demonstrated that this proposed large network augmentation will not inhibit the dispatch of existing and proposed new generation, and consequently further erode the situation described above, but rather, depending on the location of any proposed plant, the Tungkillo Network Solution could facilitate the connection of new generation.

6.2 Assumed Market Development Scenarios

The ACCC Regulatory Test requires that options to address a network limitation be assessed against a number of plausible market development scenarios. These scenarios need to take account of:

- The existing system;
- Future network developments;
- Variations in load growth;
- Committed generation and demand side developments, and;
- Potential generation and demand-side developments.

The Regulatory Test also requires sensitivity analysis with respect to key input variables, including capital and operating costs, the discount rate, and the commissioning date. The purpose of utilising this approach is to test the robustness of the outcomes of the test under a range of plausible scenarios that could feasibly occur in the NEM.

The NEC requires ElectraNet as a TNSP to analyse the expected future operation of its transmission network, taking into account any Market Network Service Provider (MNSP) options (refer Clause 5.6.2 (a) of the NEC). However, as this is an intra-regional development, there is by definition no feasible MNSP development (refer Clause 2.5.2 (a) of the NEC).

6.2.1 Existing Network and Future Transmission Developments

When formulating the market development scenarios, existing network behaviour and the impact of the two potential transmission augmentations identified in this document were taken into account. Other planned transmission augmentations are independent of the identified limitations and were therefore not included in the scenarios.

6.2.2 Variations in Load Growth

ElectraNet's planning studies rely on annual electricity demand forecasts provided by ETSA. These forecasts span a ten-year horizon and take into account demand management and embedded generation programmes, in-place, proposed, or reasonably anticipated, that may reduce the forecast demand at transmission connection points. ETSA confirms that these forecasts are representative of electricity usage during hot summer conditions.

The analysis of ElectraNet's transmission system in the Southern and Eastern Suburbs of metropolitan Adelaide, and the Eastern Hills region, for the 10-year period from 2004, has been based on the *medium* growth forecast provided by ETSA, as this represents the most likely load growth scenario. The results of this analysis have then enabled ElectraNet to identify and assess what potential limitations may occur in meeting system reliability and security standards in accordance with the NEC and ETC requirements.

ETSA also provides two other load forecasts - high and low – and ElectraNet has used these to provide an *indication* of the effects of possible changes to the level of economic activity within the State. This information and the basis of the forecasts are contained in the 2004 Annual Planning Review. The impact of applying the high and low forecasts was to confirm that the preferred option was robust under varying levels of economic activity within the State, a factor that is beyond the control of ElectraNet. The detailed results of the effect of varying levels of economic activity are provided in Appendix 2 of this document.

Market development scenarios were formulated to consider sensitivity to variations in load growth. The scenarios used in the analysis in this report are outlined in section 6.2.4.

6.2.3 Existing, Committed and Potential Generation Developments

At present there are three existing sources of generation operating in the Southern Suburbs load area, as discussed in section 4.2.1 of this document; the diesel generators located on Kangaroo Island, the Cummins distillate fired power station at Lonsdale, and the Starfish Hill wind powered generating station located at Cape Jervis. These sources of generation are considered to contribute a negligible amount to the generating capacity available to meet the Southern Suburbs load on a firm basis.

In the Eastern Suburbs, there is only one existing source of generation; specifically, Dry Creek power station at Kilburn. However, these gas turbines have minimal effect on the loading of the 275 kV transmission lines south of Para or the 275 kV voltages further to the south.

ElectraNet is not aware of any existing or committed non-wind generation augmentations, including those discussed in section 4.2.1, that will potentially impact the 275 kV transmission network that supplies the Southern and part of the Eastern Suburbs and adjoining southern rural area of South Australia. No firm generation proposals were received by ElectraNet or ETSA in response to the Southern Suburbs RFI/RFP consultation.

Consequently, no scenarios have been developed for differing levels of output by either existing or committed power stations within the Southern or Eastern Suburbs areas, and all scenarios used in the Regulatory Test analysis have assumed zero output from these generators, since this represents a highly plausible scenario in the NEM environment.

It should be noted that load growth within the Southern and Eastern Suburbs and in the Eastern Hills supply areas is such that even if an optimistic view was taken regarding the output of these power stations, the additional capacity that could be provided would not be sufficient to defer the need for augmentation by 12 months. Because these generators are embedded in the distribution system, their output is netted from the load that is seen at the transmission connection points. As such, a market scenario that considers a lower level of load growth would

be a surrogate for a market scenario that assumed higher levels of generation from those power stations. Such a market scenario has been considered when undertaking the Regulatory Test.

6.2.4 Market Development Scenarios

Three market development scenarios have been formulated to simulate the impact of variations in load growth by applying the three load forecasts supplied by ETSA (refer section 6.2.2):

Scenario A	Low load growth forecast
Scenario B	Medium load growth forecast
Scenario C	High load growth forecast

These market development scenarios are analysed in detail in section 8 of this Application Notice.

7.0 FORMAT AND INPUTS TO ANALYSIS

7.1 Regulatory Test Requirements

The requirements for the comparison of options to address an identified network limitation are contained in the Regulatory Test promulgated by the Australian Competition and Consumer Commission (ACCC) in accordance with clause 5.6.5A of the National Electricity Code (Code).

An option satisfies the *Regulatory Test* if:

(a) In the event the option is necessitated solely by the inability to meet the minimum network performance requirements set out in schedule 5.1 of the Code or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction – the option minimises the present value of *costs*, compared with a number of *alternative options* in a majority of *reasonable scenarios.*

(b) In all other cases – the option maximises the expected net present value of the *market benefit* … compared with a number of *alternative options* and timings, in a majority of *reasonable scenarios*.

The Regulatory Test contains guidelines for the methodology to be used to calculate the present value of costs and the net present value (NPV) of the market benefit. Where an augmentation is required to satisfy minimum network performance requirements (i.e. a reliability augmentation), the methodology published by the ACCC defines "cost" as the total cost of that option (or an *alternative option*) to all those who produce, distribute or consume electricity in the National Electricity Market.

Information to be considered includes the *'efficient operating costs of competitively supplying energy to meet forecast demand'* and the cost of complying with existing and anticipated laws. However, the Regulatory Test specifically excludes indirect costs, and costs that cannot be measured as a cost in terms of financial transactions in the electricity market.

7.2 Inputs to Analysis

A solution to address projected network limitations in the Southern and Eastern Suburbs of metropolitan Adelaide as outlined in this document is required to satisfy reliability requirements linked to Schedule 5.1 of the National Electricity Code, ElectraNet's service obligations under the South Australian Electricity Transmission Code, and the requirements of the Electricity Act SA 1996[7].

According to the ACCC Regulatory Test, this means that the costs of all reasonable options must be compared, and the least cost solution is considered to satisfy the Regulatory Test. The results of this evaluation, carried out using a cash flow model to determine the present value (PV) cost of the various options, are shown in section 8.0.

Cost inputs to the economic analysis are described below.

7.2.1 Cost of Transmission Augmentations

The costs to implement the two network solutions outlined in section 5.0 of this document have been estimated by ElectraNet. Sensitivity studies have been carried out using variations in these capital cost estimates of plus and minus 15% (see section 8.3).

[7] Refer section 3.0.

The financial analysis considers all foreseeable cost impacts of the proposed network augmentations to market participants as defined by regulatory processes. As a component of this, the estimated saving in the cost of network losses for each option has been included, based on the assumption of a typical load factor and an average cost of losses (presently about $30/MW.h).

Costs for items that are common to both options were not included in the analysis. These common costs include the capital and operating costs of other future transmission works, where these costs are independent of the identified network limitations. As such, they have no impact on the relative ranking of options resulting from the analysis.

8.0 FINANCIAL ANALYSIS

8.1 Description of Financial Analysis Approach

The economic analysis undertaken considered the present value of the costs of the two options over the fifteen-year period from 2004/05 to 2019/20. A more detailed summary of the results of this analysis is contained in Appendix 2.

8.2 Present Value Analysis

Financial analysis was carried out to calculate and compare the Present Value (PV) of the costs to market participants of both of the options under the three market development scenarios defined in section 6.2.4.

A fifteen-year analysis period was selected for the financial analysis. ElectraNet has elected to use this period as a balance between the National Electricity Code requirements that TNSPs use a minimum planning horizon of ten years, combined with the view expressed by the Inter-regional Planning Committee (IRPC) that a planning horizon beyond ten years better reflects the long-term nature of transmission infrastructure investments.

A discount rate of 10% was selected as a relevant commercial discount rate, and sensitivity analysis was conducted to test the robustness of this assumption.

As discussed in section 7.2.1, the capital and operating costs for items that are common to both options were not included in the analysis. However, where the timing of common works has been affected by either of the proposed options, the cost of those other works has been included in the PV analysis.

It should also be noted that supporting studies are based on the medium load growth forecast supplied by ETSA, unless stated otherwise. This level of growth is considered to represent the most probable development scenario, with the high and low load growth options considered less likely to occur.

Under the Regulatory Test for reliability augmentations, it is the ranking of the options that is important, rather than the actual present value results. This is because the Regulatory Test requires that the recommended option minimise the present value of costs, compared with a number of alternative options, in a majority of reasonable scenarios.

The following table summarises the results of the economic analysis provided in Appendix 2. It shows the present value cost of implementing each of the options. For each of the scenarios considered, the best-ranked or least cost option is highlighted.

From the results, it can be seen that the level of load growth in the region impacts on both options in a similar manner.

Discount rate 10%	Option 1 Tungkillo Network Solution		Option 2 Tailem Bend – Cherry Gardens double circuit 275 kV line	
	Present Value Cost ($M)	Rank	Present Value Cost ($M)	Rank
Scenario A (low load growth)	$28.98	1	$64.16	2
Scenario B (medium load growth)	$27.69	1	$63.46	2
Scenario C (high load growth)	$26.87	1	$62.22	2

8.3 Sensitivity Analysis

In addition to examining the impact of market development scenarios, the sensitivity of the option-ranking to two other critical parameters was also examined. The following table shows the parameters that were investigated, the range over which each of the parameters was varied, the resulting present value cost, and the ranking of each option under the stated conditions. The analysis was conducted using the medium load growth scenario.

Parameter incurring variation (all studies at 10%pa discount rate, DNSP forecast loads and $30/MW.h cost of losses, unless stated otherwise)	Option 1 Tungkillo Network Solution		Option 2 Tailem Bend – Cherry Gardens double circuit 275 kV line	
	Present Value Cost ($M)	Rank	Present Value Cost ($M)	Rank
Discount Rate (% pa)				
7.5%	$31.60	1	$72.84	2
10%	$27.69	1	$63.46	2
12.5%	$24.53	1	$55.91	2
Capital Cost of project				
15% less than estimated cost	$22.74	1	$52.60	2
estimated cost	$27.69	1	$63.46	2
15% more than estimated cost	$32.65	1	$74.32	2

As can be seen in this table, Option 1 is the best-ranked option under both scenarios. These sensitivity analysis results are consistent with the base case economic analysis, and demonstrate that the outcome is robust in terms of variations in these particular parameters, the values of which can quite plausibly change in line with wider economic trends.

9.0 SUMMARY AND DISCUSSION OF RESULTS

The following conclusions have been drawn from the analysis presented in this report:

- There is no acceptable 'do-nothing' option. The projected network limitations must be addressed by the summer of 2006/07 in order to maintain system security and reliability standards during a single contingency of either the Torrens Island - Cherry Gardens or Magill - Happy Valley 275 kV transmission lines.
- In April/May 2004 ElectraNet, in conjunction with ETSA, carried out an initial consultation inviting interested parties to propose either network or non-network solutions to the network limitations. No proposals for feasible alternative non-network solutions were received.
- ETSA has advised that it does not have an economically feasible distribution network solution that would address the projected network limitations that will impact the Southern or Eastern Suburbs connection points.
- Economic analysis has identified that Option 1 is the solution that minimises the present value of costs over the fifteen-year period of analysis under all of the scenarios considered. On this basis, augmentation comprising:
    - The establishment of a 275 kV switching station at a vacant ElectraNet site at Tungkillo, approximately 40 kilometres east of the Adelaide CBD, at the point where the two Tailem Bend - Para 275 kV lines cross the two Robertstown - Cherry Gardens 275 kV lines;
    - The reconfiguration of those lines to create one line directly from Robertstown to Para substations, one line directly from Tailem Bend to Cherry Gardens substations, and one line each from Robertstown, Tailem Bend, Cherry Gardens and Para substations, to the newly established Tungkillo switching station;
    - The stringing on the vacant side of the Cherry Gardens - Happy Valley 275 kV line between Cherry Gardens and the point where it meets the Magill - Happy Valley line, of a new 275 kV line, and teeing it into the Magill - Happy Valley 275 kV line, thereby creating a three-way Magill - Happy Valley - Cherry Gardens line to accommodate the increased power-flows through Cherry Gardens;
    - The modification of 275 kV transmission line entries at Cherry Gardens substation to accommodate a by-pass arrangement for the Cherry Gardens end of the new line and the subsequent creation instead of a three-way Magill - Happy Valley - Tungkillo 275 kV line, and;
    - The upgrading of communication facilities at Tungkillo, Happy Valley and Magill substations to facilitate a protection scheme for the three-way connection;

  is the option that satisfies the ACCC Regulatory Test for reliability augmentations.
- Sensitivity analysis has shown that this conclusion is robust when considered against variations in capital cost and other factors outside of the influence of ElectraNet. Option 1 is also the highest-ranked option under all of the applicable market development scenarios.
- Implementation issues significantly favour Option 1 in preference to Option 2. Option 2 involves the construction of 85km of new transmission line. Obtaining a route for this line would require careful consideration of environmental and cultural issues, particularly for the first twenty-five kilometres or so east out of Cherry Gardens substation through the Southern Mount Lofty Ranges. In contrast, the preferred site for the Tungkillo 275 kV switching station is in a predominantly grazing area on land already owned by ElectraNet and directly adjacent the point of intersection of the four lines for which reconfiguration is proposed. The additional line planned to tee into the existing Magill - Happy Valley 275 kV line from Cherry

Gardens substation would be strung on the vacant side of an existing ElectraNet 'double-circuit' line.

- The proposed solution makes efficient use of existing assets, and increases the security, reliability and diversity of supply to the Southern and Eastern Suburbs regions of metropolitan Adelaide.

10.0 RECOMMENDATION

Based on the outcomes of the Regulatory Test, this Application Notice proposes that the following 'new large network assets' be constructed to address the projected transmission network limitations in the Southern Suburbs of metropolitan Adelaide and rural electricity loads immediately to the south (Southern Suburbs), and the Eastern Suburbs and Eastern Hills regions:

At Tungkillo

- Establish a 275 kV switching station at a vacant ElectraNet site at Tungkillo, approximately 40 kilometres east of the Adelaide CBD, at the point where the two Tailem Bend - Para 275 kV lines cross the two Robertstown - Cherry Gardens 275 kV lines.

- Cut into the four lines at their point of intersection and reconfigure them to form:
    - One line directly from Robertstown to Para substation;
    - One line directly from Tailem Bend to Cherry Gardens substation;
    - One Robertstown to Tungkillo 275 kV circuit;
    - One Tailem Bend to Tungkillo 275 kV circuit;
    - One Tungkillo to Happy Valley 275 kV circuit, and;
    - One Tungkillo to Para 275 kV circuit.

At Cherry Gardens (to accommodate the increased power-flows through Cherry Gardens)

- String the vacant side of the Cherry Gardens - Happy Valley 275 kV line (built as a double-circuit line, but with one side presently unused) for a distance of 2.5 kilometres from Cherry Gardens substation to the point of intersection with the Magill - Happy Valley line, and connect the new circuit into the Magill - Happy Valley 275 kV line via a tee-arrangement;

- Modify 275 kV transmission line entries at Cherry Gardens substation to enable the existing Robertstown - Cherry Gardens #2 line to be re-routed so as to electrically by-pass the substation and to then be connected into the new segment of 275 kV line between Cherry Gardens and the Magill - Happy Valley line, thereby creating a three-way Tungkillo - Happy Valley - Magill 275 kV line;

- Relocate, with refurbishment of aged switchgear where necessary, existing diameters within Cherry Gardens substation to accommodate the line entry modifications described above, and;

- Upgrade and install appropriate communications and protection systems to facilitate the three-way line connection.

At the remote ends of the three-way tie (Tungkillo, Happy Valley and Magill)

Install appropriate communications and protection systems to facilitate the three-way line configuration.

The new large network assets and associated asset refurbishment are required to be commissioned by October 2006.

The total cost of these new large network assets is estimated to be $38.6 M.

Technical details relevant to these proposed new large network assets are contained in Appendix 1. Following completion of the consultation process (assuming there are no changes required), ElectraNet will proceed immediately to implement the recommendations contained in this Application Notice.

The proposed construction timetable provides for award of equipment and construction contracts and the commencement of on-site construction in early 2006, following satisfactory resolution of Development Approvals, to ensure completion within the required timeframe.

11.0 CONSULTATION

In accordance with Code requirements, ElectraNet invites submissions from Code Participants and interested parties on this Application Notice. Submissions are due by Friday 6th May 2005.

Please address submissions to:

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APPENDIX 1

TECHNICAL DETAILS OF PROPOSED NEW LARGE NETWORK ASSETS

The proposed new large network assets recommended in this Application Notice comprise the following works:

At Tungkillo

- Establish a 275 kV switching station at a vacant ElectraNet site at Tungkillo, approximately 40 kilometres east of the Adelaide CBD, at the point where the two Tailem Bend - Para 275 kV lines cross the two Robertstown - Cherry Gardens 275 kV lines.

- Cut into the four lines at their point of intersection and reconfigure them to form:
    - One line directly from Robertstown to Para substation;
    - One line directly from Tailem Bend to Cherry Gardens substation;
    - One Robertstown to Tungkillo 275 kV circuit;
    - One Tailem Bend to Tungkillo 275 kV circuit;
    - One Tungkillo to Happy Valley 275 kV circuit, and;
    - One Tungkillo to Para 275 kV circuit.

At Cherry Gardens (to accommodate the increased power-flows through Cherry Gardens)

- String the vacant side of the Cherry Gardens - Happy Valley 275 kV line (built as a double-circuit line, but with one side presently unused) for a distance of 2.5 kilometres from Cherry Gardens substation to the point of intersection with the Magill - Happy Valley line, and connect the new circuit into the Magill - Happy Valley 275 kV line via a tee-arrangement;

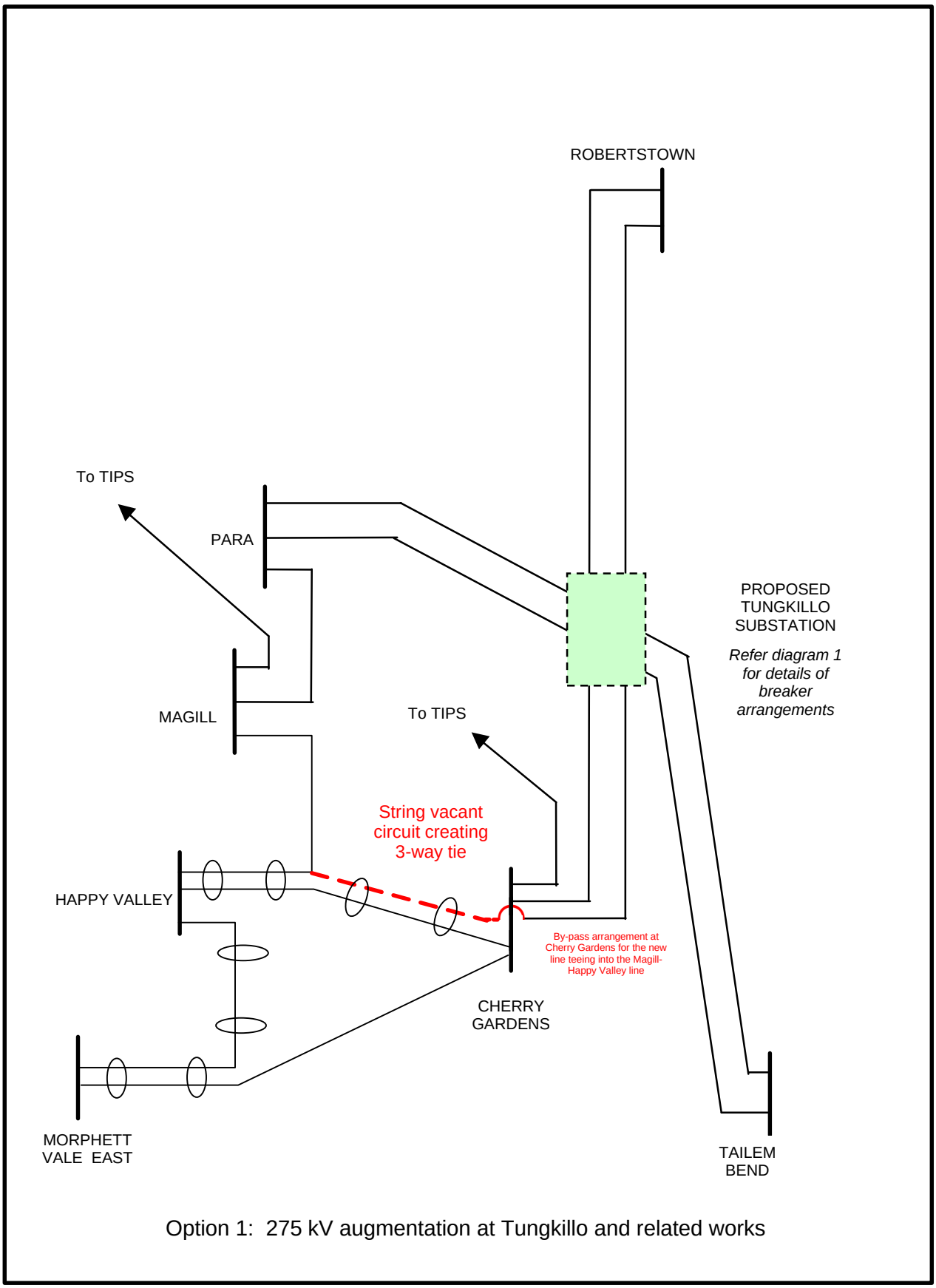
- Modify 275 kV transmission line entries at Cherry Gardens substation to enable the existing Robertstown - Cherry Gardens #2 line to be re-routed so as to electrically by-pass the substation and to then be connected into the new segment of 275 kV line between Cherry Gardens and the Magill - Happy Valley line, thereby creating a three-way Tungkillo - Happy Valley - Magill 275 kV line;

- Relocate existing diameters within Cherry Gardens substation to accommodate the line entry modifications described above, and;

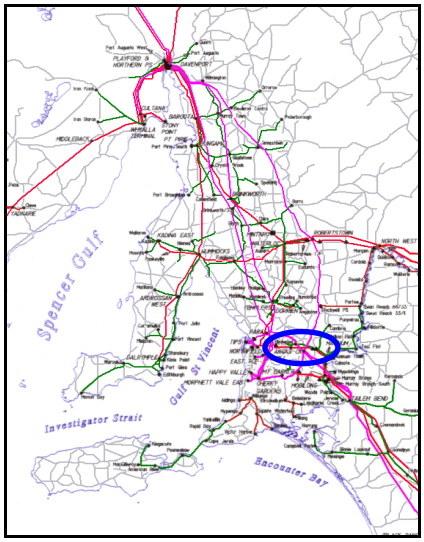
- Upgrade and install appropriate communications and protection systems to facilitate the three-way line connection.

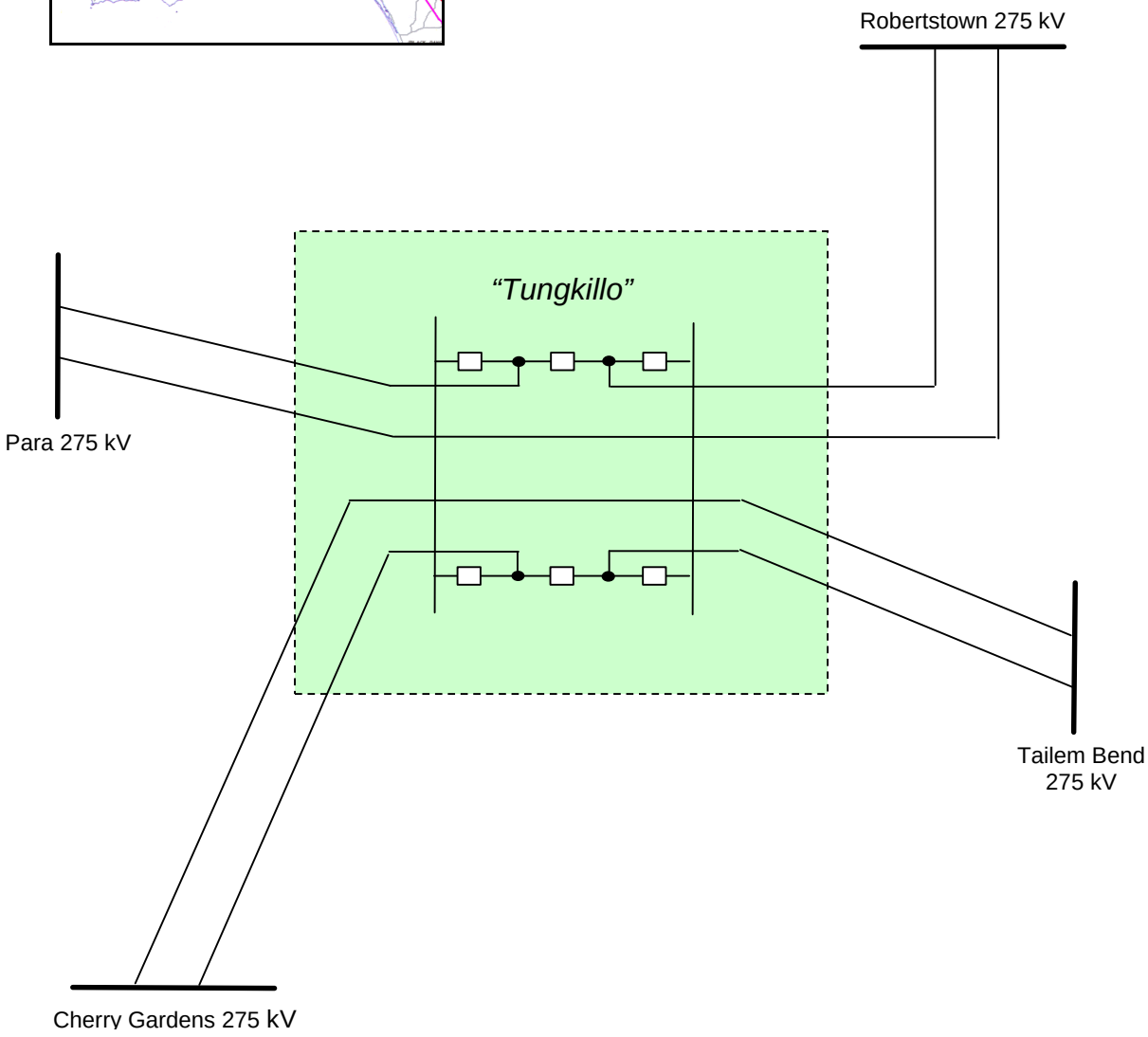
At the remote ends of the three-way tie (Tungkillo, Happy Valley and Magill)

Install appropriate communications and protection systems to facilitate the three-way line configuration.



Option 1: 275 kV augmentation at Tungkillo and related works





Option 1: Proposed layout of Tungkillo 275 kV switching station

APPENDIX 2

Financial Analysis Summary

15 Year Analysis Period

Discount rate 10%	**Scenario A** *Low load Growth*		**Scenario B** *Medium load Growth*		**Scenario C** *High load Growth*	
	PV ($M)	Rank	PV ($M)	Rank	PV ($M)	Rank
Tungkillo Network Solution	$28.98	1	$27.69	1	$26.87	1
Tailem Bend to Cherry Gardens 275kV line	$64.16	2	$63.46	2	$62.22	2

Scenario A — *Low load Growth*

Option 1 — Establish Tungkillo switching station

Establish Tungkillo switching station		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
=> TUOS		4.855	4.759	4.662	4.565	4.469	4.372	4.275	4.179	4.082	3.985	3.889	3.792	3.695	3.599	3.502
==> PV of TUOS	$33.05															
Relative Losses		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
* Losses $		-0.410	-0.437	-0.480	-0.497	-0.514	-0.532	-0.551	-0.570	-0.590	-0.611	-0.632	-0.654	-0.677	-0.701	-0.726
=> PV of Losses	-$4.07															
Total for Option 1	**$28.98**															

Option 2 — Construct twin dual cct 275kV line from Tailem Bend to Cherry Gardens

Construct twin dual cct 275kV line from Tailem Bend to Cherry Gardens		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
=> TUOS		10.639	10.427	10.215	10.003	9.791	9.579	9.368	9.156	8.944	8.732	8.520	8.309	8.097	7.885	7.673
==> PV of TUOS	$72.41															
Relative Losses		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
* Losses $		-1.043	-1.066	-1.071	-1.076	-1.081	-1.086	-1.091	-1.096	-1.101	-1.107	-1.112	-1.117	-1.122	-1.128	-1.133
=> PV of Losses	-$8.26															
Total for Option 2	**$64.16**															

Scenario B — *Medium load Growth*

Option 1 — Establish Tungkillo switching station

Establish Tungkillo switching station		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
=> TUOS		4.855	4.759	4.662	4.565	4.469	4.372	4.275	4.179	4.082	3.985	3.889	3.792	3.695	3.599	3.502
==> PV of TUOS	$33.05															
Relative Losses		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
* Losses $		-0.425	-0.471	-0.536	-0.576	-0.620	-0.666	-0.716	-0.770	-0.828	-0.890	-0.956	-1.028	-1.105	-1.188	-1.277
=> PV of Losses	-$5.36															
Total for Option 1	**$27.69**															

Option 2 — Construct twin dual cct 275kV line from Tailem Bend to Cherry Gardens

Construct twin dual cct 275kV line from Tailem Bend to Cherry Gardens		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
=> TUOS		10.639	10.427	10.215	10.003	9.791	9.579	9.368	9.156	8.944	8.732	8.520	8.309	8.097	7.885	7.673
==> PV of TUOS	$72.41															
Relative Losses		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
* Losses $		-1.062	-1.107	-1.123	-1.140	-1.157	-1.174	-1.191	-1.208	-1.226	-1.244	-1.262	-1.281	-1.300	-1.319	-1.338
=> PV of Losses	-$8.95															
Total for Option 2	**$63.46**															

Scenario C — *High load Growth*

Option 1 — Establish Tungkillo switching station

Establish Tungkillo switching station		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
=> TUOS		4.855	4.759	4.662	4.565	4.469	4.372	4.275	4.179	4.082	3.985	3.889	3.792	3.695	3.599	3.502
==> PV of TUOS	$33.05															
Relative Losses		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
* Losses $		-0.433	-0.488	-0.566	-0.619	-0.678	-0.743	-0.813	-0.891	-0.975	-1.068	-1.169	-1.281	-1.402	-1.536	-1.682
=> PV of Losses	-$6.18															
Total for Option 1	**$26.87**															

Option 2 — Construct twin dual cct 275kV line from Tailem Bend to Cherry Gardens

Construct twin dual cct 275kV line from Tailem Bend to Cherry Gardens		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
=> TUOS		10.639	10.427	10.215	10.003	9.791	9.579	9.368	9.156	8.944	8.732	8.520	8.309	8.097	7.885	7.673
==> PV of TUOS	$72.41															
Relative Losses		05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
* Losses $		-1.081	-1.149	-1.189	-1.230	-1.273	-1.317	-1.363	-1.410	-1.459	-1.510	-1.562	-1.616	-1.672	-1.731	-1.790
=> PV of Losses	-$10.19															
Total for Option 2	**$62.22**															