Powerlink has provided this document to the AER for public disclosure. Confidential information has been redacted.

Limitation: These reports have been prepared for Powerlink for the purposes of establishment of project cost estimates for inclusion in their revenue proposal . The reports may be relied upon by Powerlink and the Australian Energy Regulator. The reports are not to be relied upon by any other person or for any other purpose. We accept no liability or responsibility whatsoever for or in respect of any use of or reliance upon these reports by any third party.

PSC Estimate

for

Northern Bowen Basin Augmentation

May 2011

Specialist Consultants
to the Electricity Industry

Contents

1. EXECUTIVE SUMMARY

1.1. Project Brief

The project scope shall have the following key elements:

PSC Australia (PSC) has been engaged by Powerlink to develop a high level concept scope and estimate for this project. The nature of this engagement is one of a "desktop" study that utilises the experience of PSC's personnel and PSC's own cost estimate "building blocks" to develop a scope and estimate independent of Powerlink.

1.2. Estimate Summary

The cost estimate for the project is $79.1 million, within an overall accuracy range of $60.7 – $97.4 million.

1.3. Major Dependencies

Major dependencies include global base metal prices (Copper and Aluminium) and foreign exchange rates (USD, Euro).

1.4. Major Assumptions

PSC has been engaged to undertake the scope and estimate based on the following general limitations:

- A low, likely and high cost shall be provided for the project, and the accuracy of the cost estimate will be limited to the order of ±20-30%.
- Any engineering or design required to develop the scope will be limited to that necessary to obtain the degree of cost estimate accuracy required and by the above requirements.
- Detailed drawings or sketches, including CAD drawings are not included in the scope of works.
- The cost estimate will cover the cost of design, procurement, project management, manufacture, delivery, construction, installation and commissioning.
- The overhead line and substations are in a remote area and as such a remote location premium of 10% (derived from regional indices for construction works in Rawlinsons 2011 handbook) has been applied to the total project cost, to account for increased costs associated with distance from main population centres.

1.5. Major Exclusions

Specifically excluded from this cost estimate are:

- Specification development and pre-award engineering;
- Development and permitting costs;
- Environmental costs;
- Easement and land acquisition; and
- Powerlink internal costs.

1.6. Major Risks

Not identified.

1.7. Consultant engagement

This report was developed in accordance with the Federal Court expert witness guidelines, specifically the document "Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia - Practice Direction" dated 5th May 2008.

PSC has worked previously for Powerlink, and specifically in the following context:

- Provision of SCADA and EMS support personnel in the Network Management System team as part of the Operations Business Unit group since 2006.
- Provision of strategic planning advice since 2010 to the Plant Strategies team as part of the Network Strategy and Performance Business Unit which has included development of the following items:
    - Substation telephony, and data network concept designs;
    - Power Systems Applications Strategy;

- Operational Data Management Strategy; and
- Substation Operational Local Area Network Design Standard.

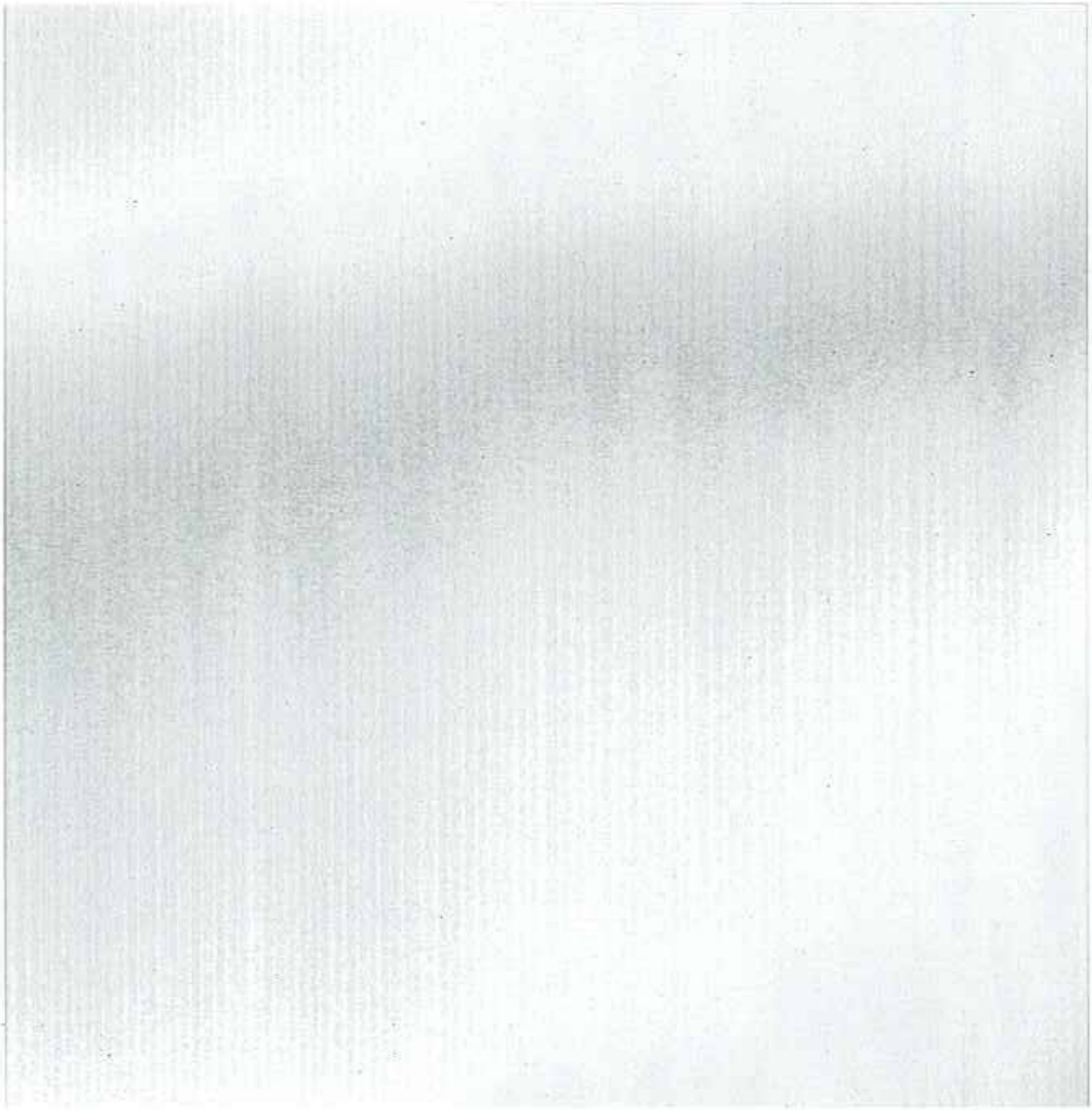
The author's of this report include:

- Les Brand – Electrical Engineering Manager, PSC Australia
- Andrew Robbie – Principal Engineer, PSC Australia
- Keith Fisk – Secondary Systems Engineer, PSC New Zealand
- John Hendriks – Senior Electrical Engineer, PSC New Zealand
- Rob Silcock – CEO, PBA New Zealand
- Soumya Bhattacharya – Transmission Lines/Civil Engineer, PSC New Zealand

CVs are provided in Appendix B of this report.

2. PROJECT SUMMARY

The site location of the proposed new substation is shown in Figure 1.



3. SCOPE AND ESTIMATE LIMITATIONS AND METHODOLOGY

3.1. Limitations

PSC has been engaged to undertake the scope and estimate based on the following general limitations:

- To perform an independent, high level, scope and estimate for the project without knowledge or use of the Powerlink Substation Design Manuals.
- Information provided by Powerlink shall be limited to a general scope description for the project, and any technical information related to existing facilities and plant that may be required by PSC.

- There will be no site visits.
- A low, likely and high cost shall be provided for the project, and the accuracy of the cost estimate will be limited to the order of ±20-30%.
- Any engineering or design required to develop the scope will be limited to that necessary to obtain the degree of cost estimate accuracy required and by the above requirements.
- Detailed drawings or sketches, including CAD drawings are not included in the scope of works.
- The cost estimate will cover the cost of design, procurement, project management, manufacture, delivery, construction, installation and commissioning. Specifically excluded from our cost estimate are:
    - Specification development and pre-award engineering;
    - Development and permitting costs;
    - Environmental costs;
    - Easement and land acquisition; and
    - Powerlink internal costs.

3.2. Methodology

The methodology applied by PSC to develop the scope and estimate is described as follows:

- PSC was provided with a copy of a Project Scope Report – Concept which describes the basic requirements for the project. PSC reviewed this report.
- The project was broken down into "building blocks", a combination of which can make up the scope of the project.
- The identified "building blocks" were developed in terms of scope and price estimates.
- Price estimates were obtained from any or all of the following:
    - PSC's experience and existing price information;
    - Budget material and equipment prices from suppliers;
    - Material and construction costs using the Rawlinson's Australian Construction Handbook ; and/or
    - Input from an experienced electrical construction contractor (PBA).
- The required number of "building blocks" was combined to create an overall scope and estimate of the project.
- Scoping and price information that cannot be broken into the "building blocks" e.g. design, project management, site specific contingency allowances, and remote location premiums, was then individually developed and added to the scope and estimate.
- An overall high level project timeline is developed.

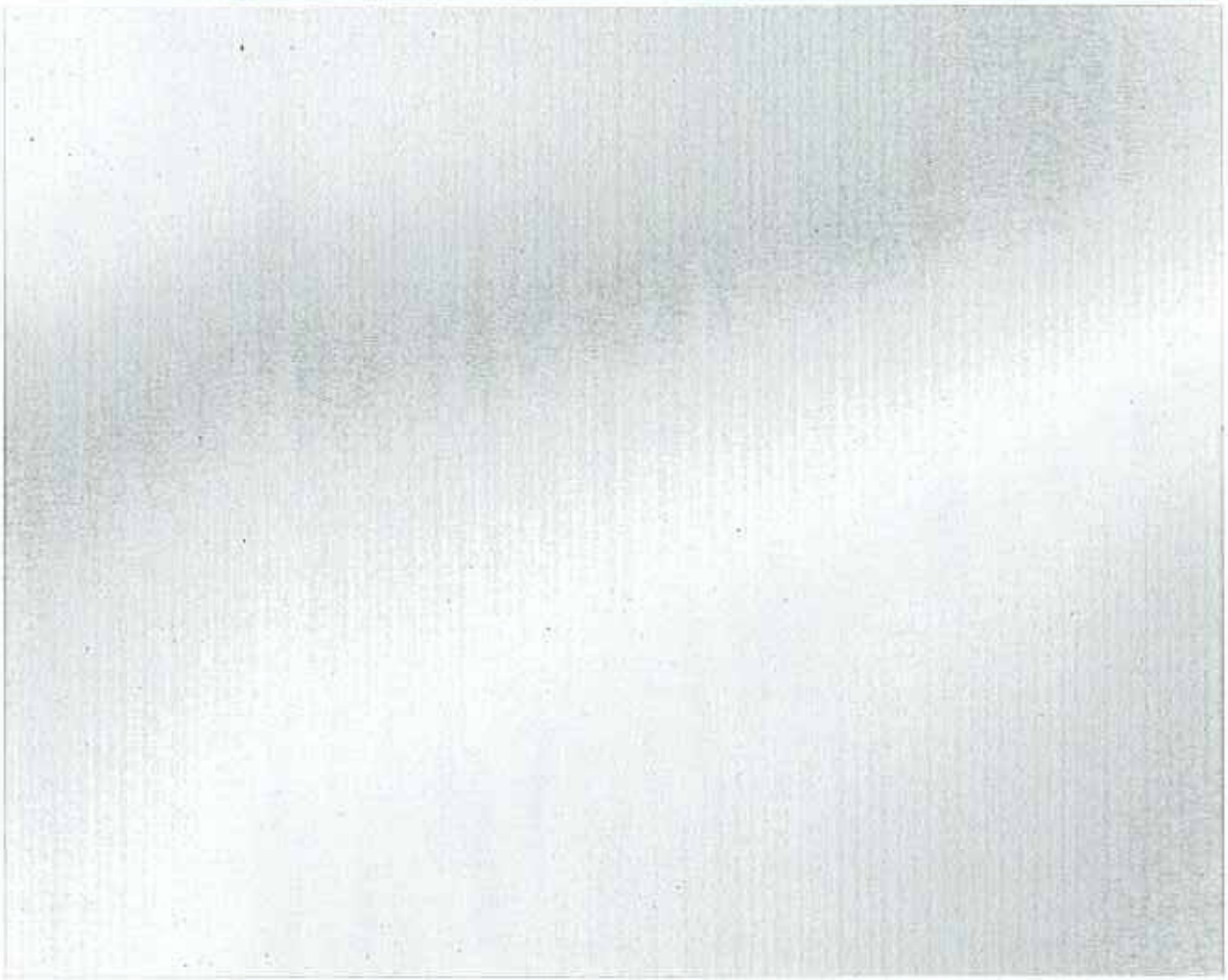
4. SCOPE AND ESTIMATE ASSUMPTIONS AND ALLOWANCES

The following assumptions and allowances have been made in determining the scope of work for this project:

4.1. General

- All costs provided are in current (April 2011) Australian dollars.
- Current exchange rates for AUD-USD and AUD-Euro are based on a monthly average for April 2011, obtained from http://www.x-rates.com,
- An allowance to cover off items that are site specific has been included of 10% - this applies across the whole of the estimate. This high level work did not include any site visits, and this allowance is intended to provide for various miscellaneous items that would normally be picked up during site visits/inspection.
- Base metal prices (sourced from Olex Cables Australia website) are based on the following:
- Costs in this report are based on the estimated cost for an Engineer, Procure and Construct (EPC) contract, and does not include overhead costs or Powerlink direct costs, including items such as pre-engineering works, approvals, planning, environmental management and Powerlink project management costs.

4.2. Overhead Transmission Line Works



5. SCOPE OF WORK

A high level concept scope of work was developed based on the information provided to PSC. The scope was developed using a "top down" approach rather than a "bottom" up engineering design.

The scope can be summarised in the project summary diagram of Figure 2.

5.1. 275 kV Overhead Transmission Line Works

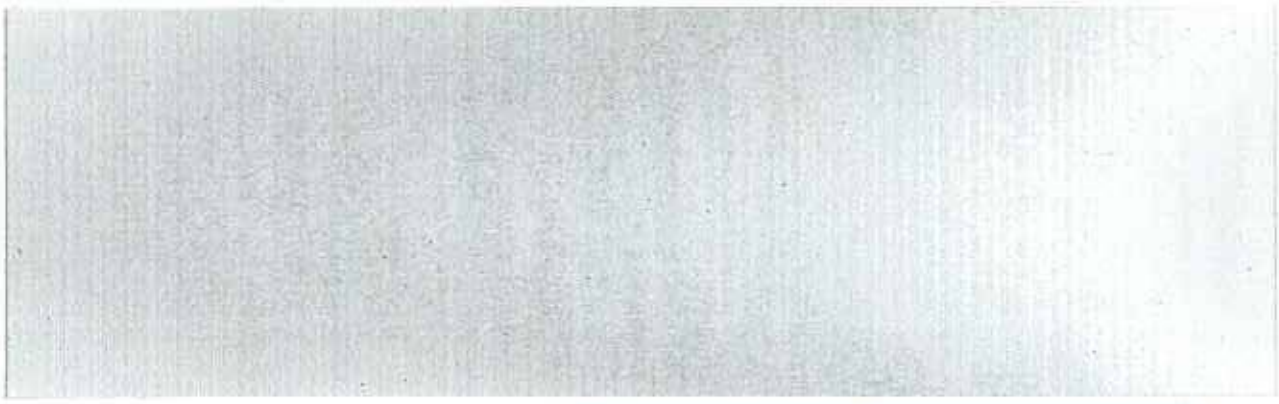
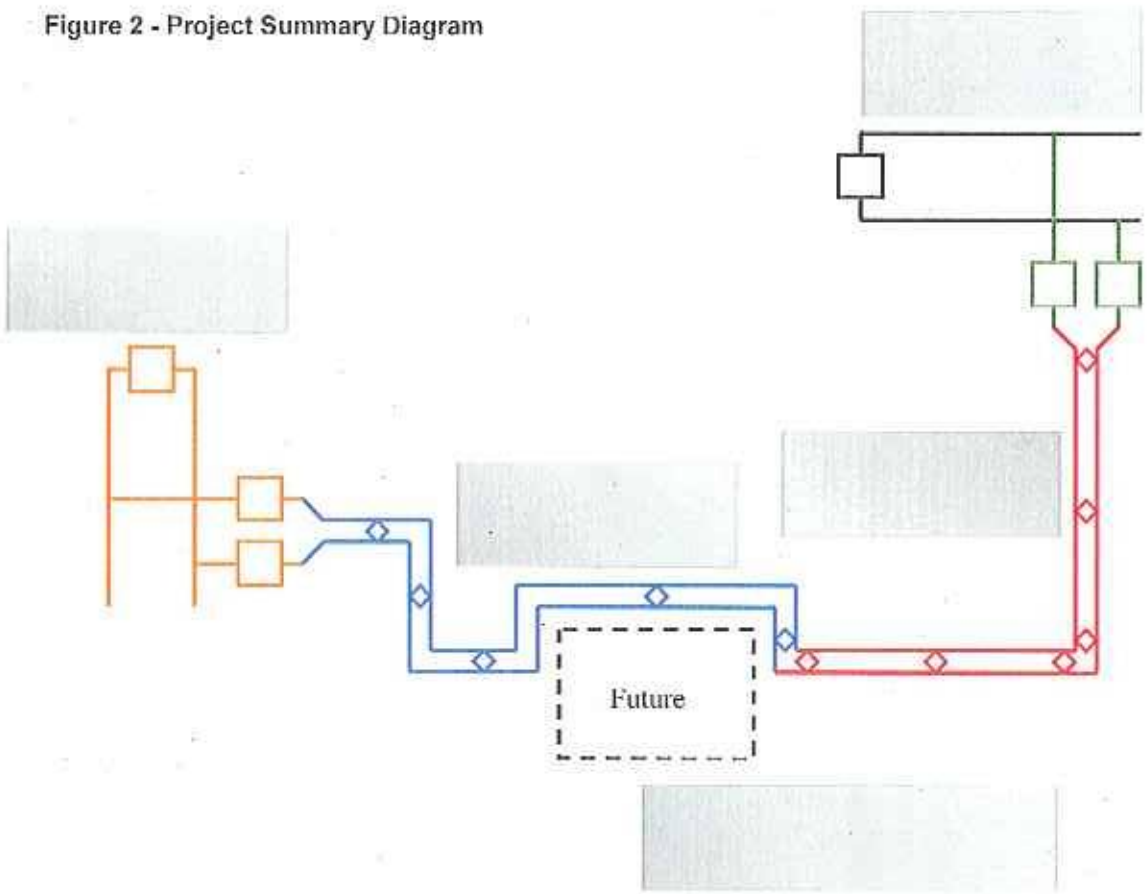


Figure 2 - Project Summary Diagram



5.2.

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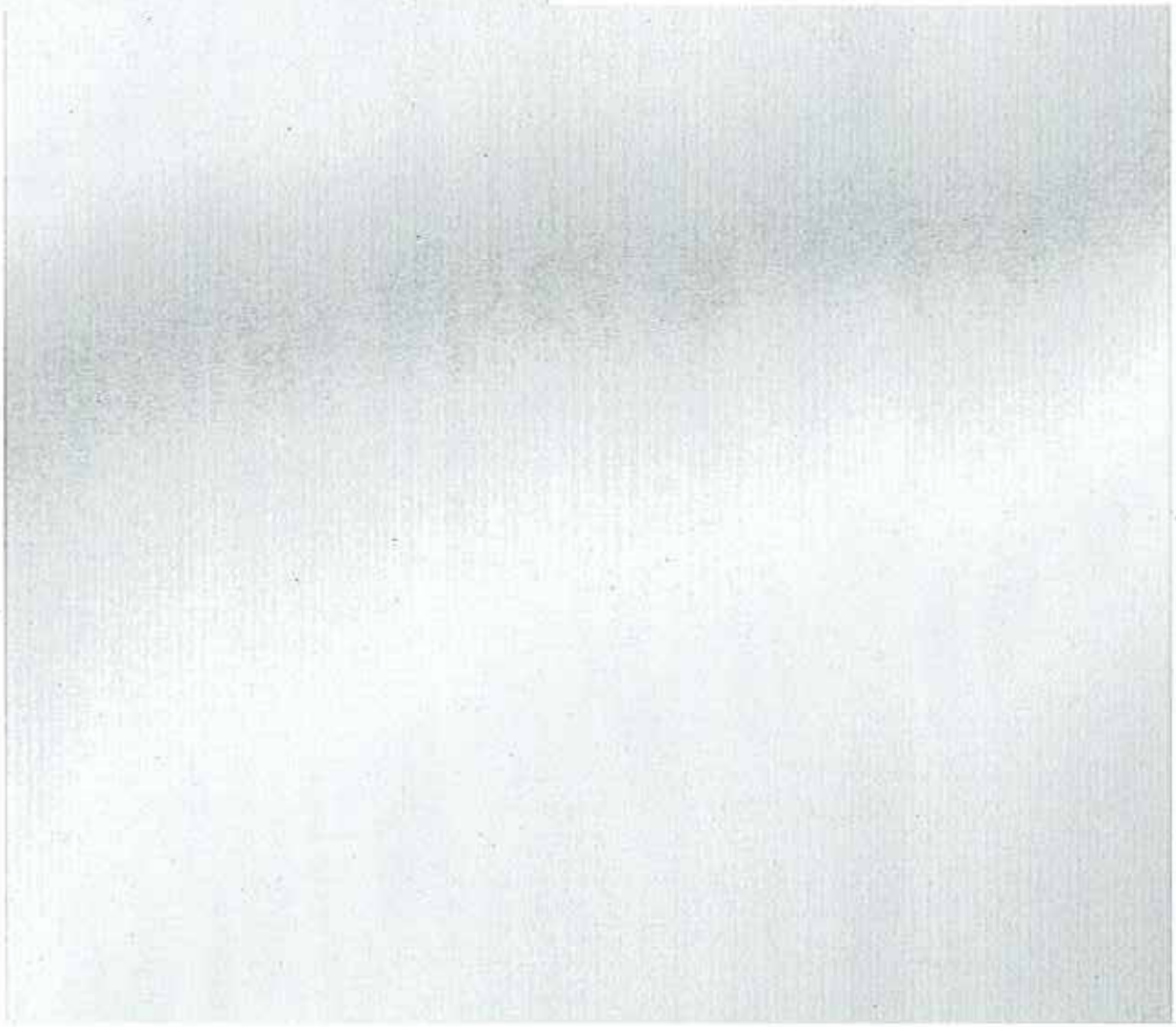


6. CONSTRUCTABILITY AND SITE SPECIFIC ISSUES

6.1. Site Specific issues

Not determined.

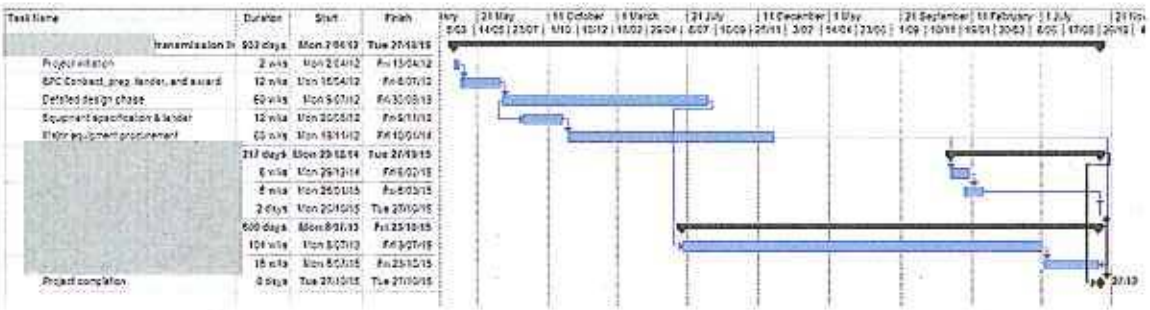
6.2. Staging of the Works

Two bus outages at to enable the new feeder bays to be connected and commissioned.

7. PROJECT TIMEFRAME AND KEY MILESTONES

The project timeframe and key milestones are shown in the Gantt chart in Figure 3.

Figure 3 - Project timeline



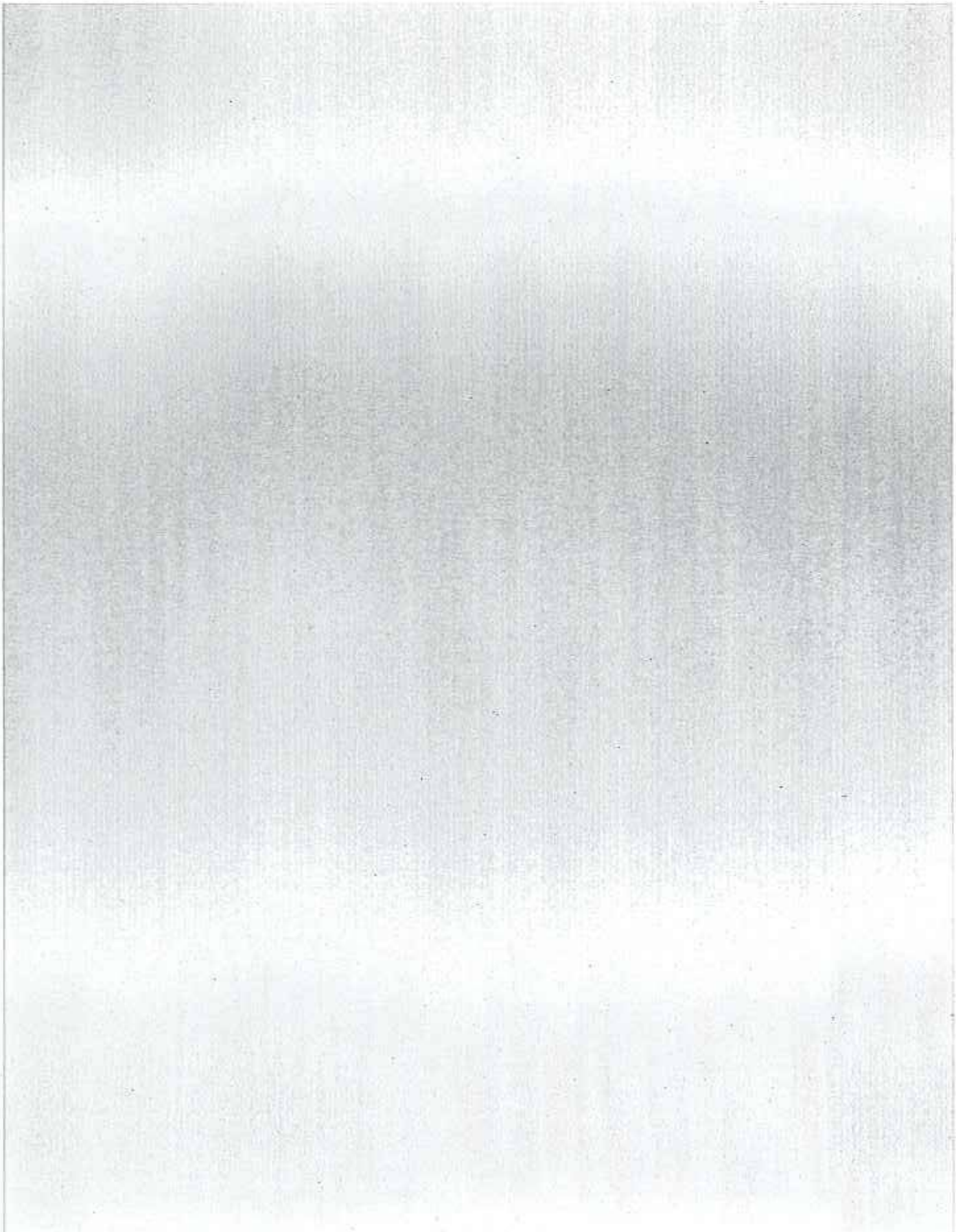
8. COST ESTIMATE

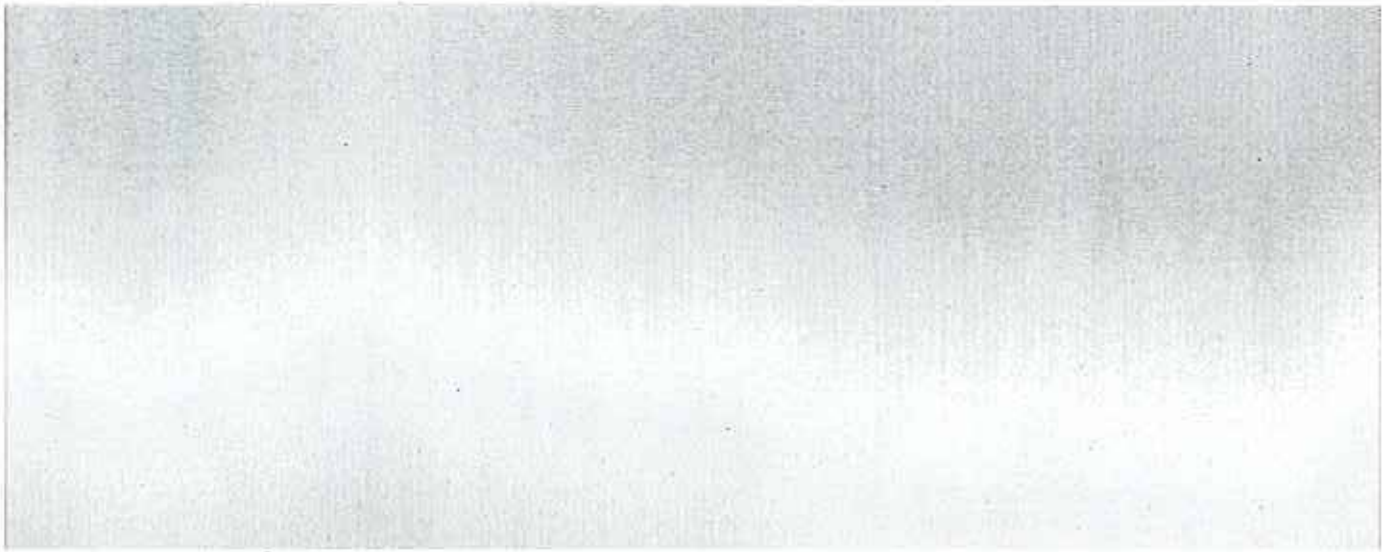
The cost estimate for the project is $79.1 million, within an overall accuracy range of $60.7 – $97.4 million. The detailed breakdown is shown in Appendix A.

Item	Description	Base	Low	Likely	High
9	Total estimate for project		60,671,328	79,057,080	97,442,831

9. REFERENCES

Document name and hyperlink (as entered into Objective)	Version	Date
Project Scope Report – CP.01781, Northern Bowen Basin Augmentation – Concept, Powerlink document	N/A	11 February 2011





PSC Estimate

for

Switchyard Replacement

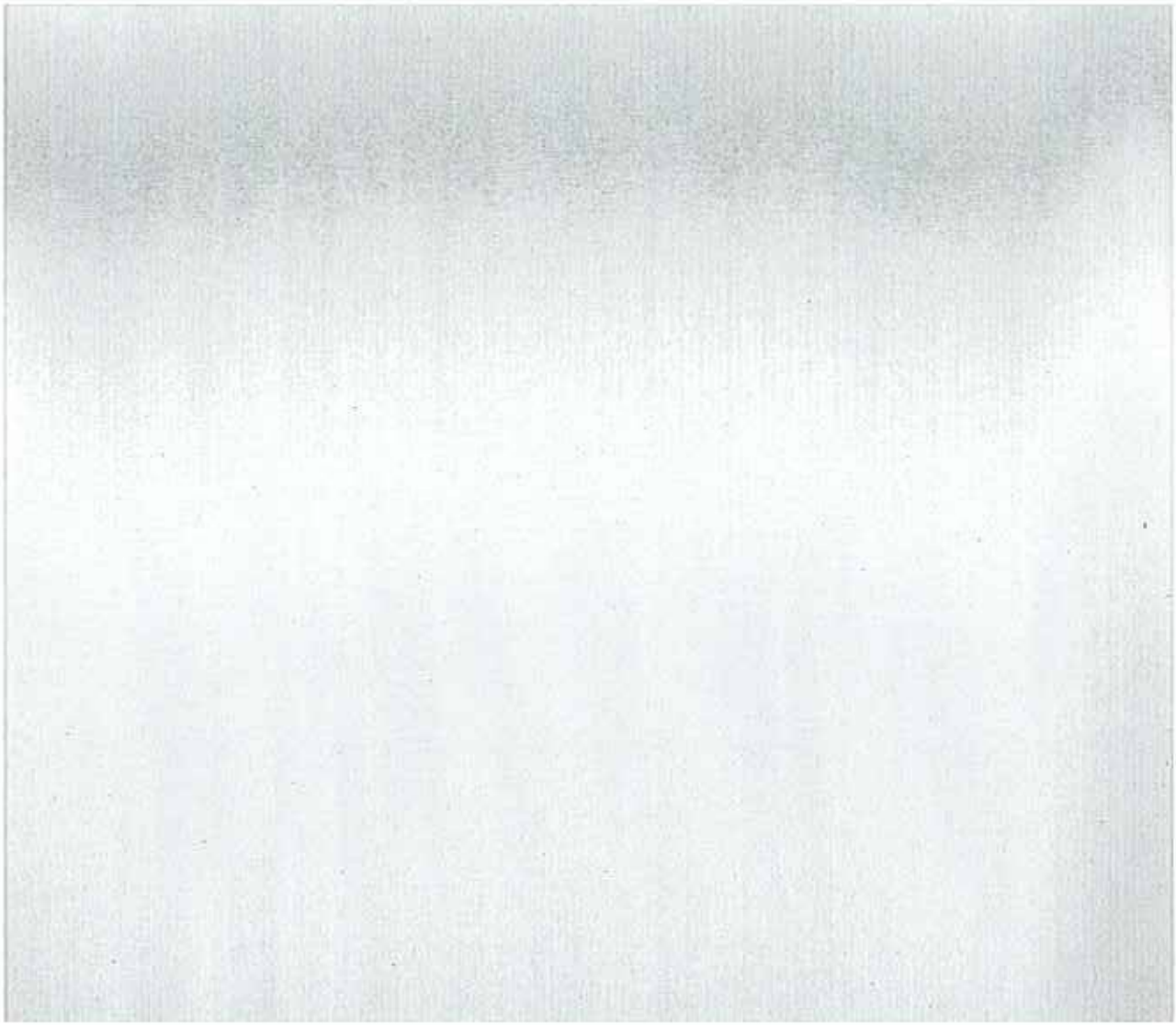
May 2011

Specialist Consultants
to the Electricity Industry

Contents

1. EXECUTIVE SUMMARY

1.1. Project Brief



PSC Australia (PSC) has been engaged by Powerlink to develop a high level concept scope and estimate for this project. The nature of this engagement is one of a "desktop" study that utilises the experience of PSC's personnel and PSC's own cost estimate "building blocks" to develop a scope and estimate independent of Powerlink.

1.2. Estimate Summary

The cost estimate for the project is $17.4 million, within an overall accuracy range of $13.3 – $21.6 million. The detailed breakdown is shown in Appendix A.

1.3. Major Dependencies

Major dependencies include global base metal prices (Copper and Aluminium) and foreign exchange rates (USD, Euro).

1.4. Major Assumptions

PSC has been engaged to undertake the scope and estimate based on the following general limitations:

- A low, likely and high cost shall be provided for the project, and the accuracy of the cost estimate will be limited to the order of ±20-30%.
- Any engineering or design required to develop the scope will be limited to that necessary to obtain the degree of cost estimate accuracy required and by the above requirements.
- There will be no detailed drawings or sketches, including CAD drawings.
- The cost estimate will cover the cost of design, procurement, project management, manufacture, delivery, construction, installation and commissioning.
- The substation are in a remote area and as such a remote location premium of 20% (derived from regional indices for construction works in Rawlinsons 2011 handbook) has been applied to the total project cost, to account for increased costs associated with distance from main population centres.

1.5. Major Exclusions

Specifically excluded from this cost estimate are:

- Specification development and pre-award engineering;
- Development and permitting costs;
- Environmental costs;
- Easement and land acquisition; and
- Powerlink internal costs.

1.6. Major Risks

Not identified.

1.7. Consultant Engagement

This report was developed in accordance with the Federal Court expert witness guidelines, specifically the document "Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia - Practice Direction" dated 5th May 2008.

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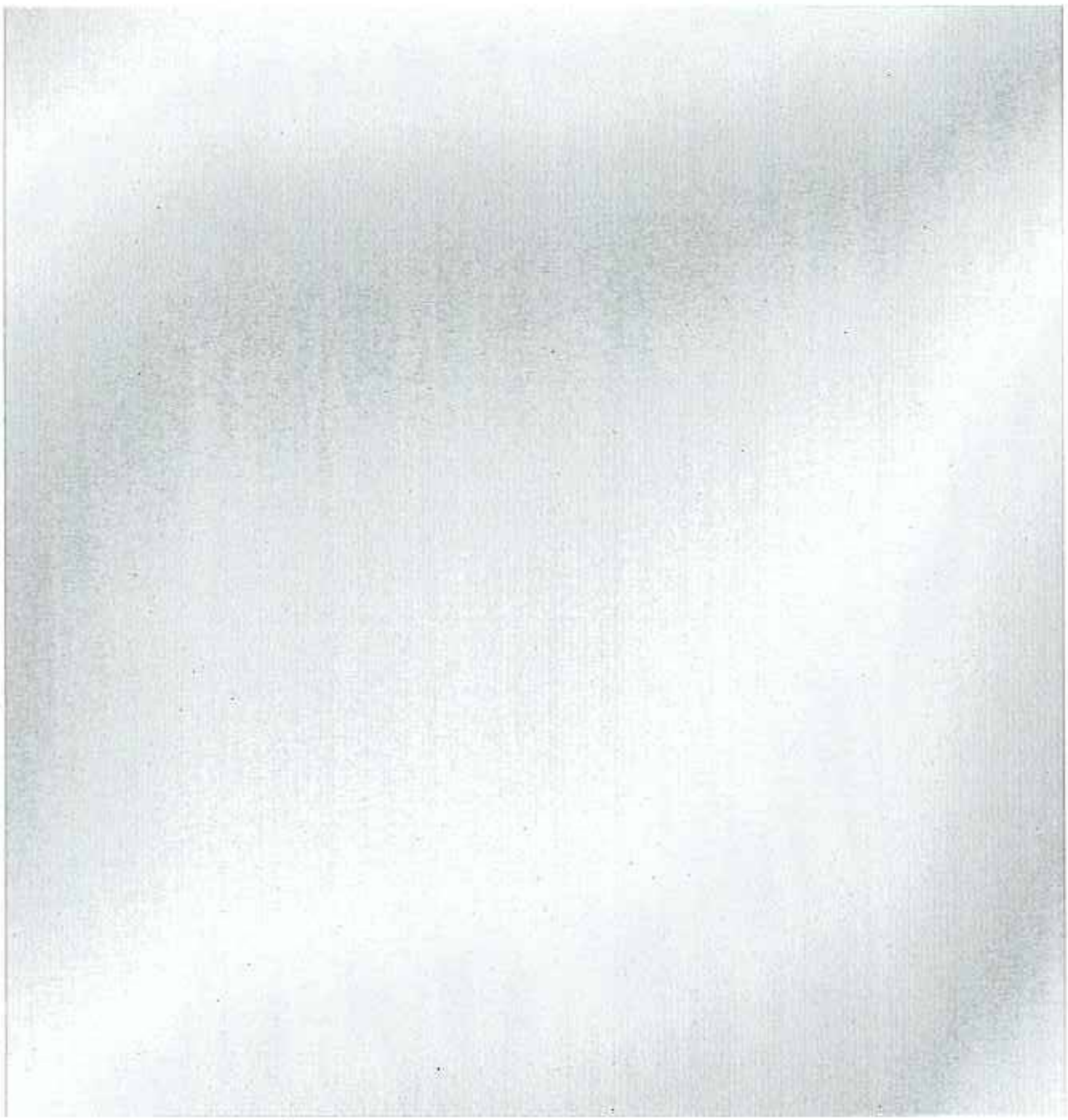
- Rob Silcock – CEO, PBA New Zealand
- Soumya Bhattacharya – Transmission Lines/Civil Engineer, PSC New Zealand

2. PROJECT SUMMARY



3. SCOPE AND ESTIMATE LIMITATIONS AND METHODOLOGY

3.1. Limitations

PSC has been engaged to undertake the scope and estimate based on the following general limitations:

- To perform an independent, high level, scope and estimate for the project without knowledge or use of the Powerlink Substation Design Manuals.
- Information provided by Powerlink shall be limited to a general scope description for the project, and any technical information related to existing facilities and plant that may be required by PSC.
- There will be no site visits.
- A low, likely and high cost shall be provided for the project, and the accuracy of the cost estimate will be limited to the order of ±20-30%.
- Any engineering or design required to develop the scope will be limited to that necessary to obtain the degree of cost estimate accuracy required and by the above requirements.
- Detailed drawings or sketches, including CAD drawings are not included in the scope of works.
- The cost estimate will cover the cost of design, procurement, project management, manufacture, delivery, construction, installation and commissioning. Specifically excluded from our cost estimate are:
    - Specification development and pre-award engineering;
    - Development and permitting costs;
    - Environmental costs;
    - Easement and land acquisition; and
    - Powerlink internal costs.

3.2. Methodology

The methodology applied by PSC to develop the scope and estimate is described as follows:

- PSC was provided with a copy of a Project Scope Report – Concept and a Concept Estimate report (without any pricings) which describe the basic requirements for the project. PSC reviewed this report.
- The project was broken down into "building blocks", a combination of which can make up the scope of the project.
- The identified "building blocks" were developed in terms of scope and price estimates.
- Price estimates were obtained from any or all of the following:
    - PSC's experience and existing price information;
    - Budget material and equipment prices from suppliers;

- Material and construction costs using the Rawlinson's Australian Construction Handbook ; and/or
- Input from an experienced electrical construction contractor (PBA).

- The required number of "building blocks" was combined to create an overall scope and estimate of the project.
- Scoping and price information that cannot be broken into the "building blocks" e.g. design, project management, site specific contingency allowances, and remote location premiums, was then individually developed and added to the scope and estimate.
- An overall high level project timeline is developed.

4. SCOPE AND ESTIMATE ASSUMPTIONS AND ALLOWANCES

The following assumptions and allowances have been made in determining the scope of work for this project:

4.1. General

- All costs provided are in current (April 2011) Australian dollars.
- Current exchange rates for AUD-USD and AUD-Euro are based on a monthly average for April 2011, obtained from http://www.x-rates.com,
- Allowance for remote area works of a 20% premium, applying to the whole estimate, has been included as the site is located over 600 km from Brisbane. Allowances for accommodating construction and site personnel seven days a week at or near site has been allowed for..
- An allowance to cover off items that are site specific has been included of 10% - this applies to the whole estimate. This high level work did not include any site visits, and this allowance is intended to provide for various miscellaneous items that would normally be picked up during site visits/inspection.
- Base metal prices (sourced from Olex Cables Australia website) are based on the following:
- Costs in this report are based on the estimated cost for an Engineer, Procure and Construct (EPC) contract, and does not include overhead costs or Powerlink direct costs, including items such as pre-engineering works, approvals, planning, environmental management and Powerlink project management costs.

4.2.

- The location of the substation has been identified by Powerlink as a high pollution area. No specific allowance for this has been made in the cost estimate.
- The Powerlink Project Scope Report refers to a requirement for a diesel generator, however PSC has since been advised that this is not required for this project and has not been included in this cost estimate.

4.3. Remote End Secondary Works

- This is assumed to be protection setting changes and communications modifications. No specific equipment or relay replacement is allowed for.

5. SCOPE OF WORK

A high level concept scope of work was developed based on the information provided to PSC. The scope was developed using a "top down" approach rather than a "bottom" up engineering design.

The existing arrangement of the 132kV yard [redacted] Substation is shown in the single line diagram of Figure 1.

Figure 1 - Project Single Line Diagram – Existing Arrangement of 132kV Yard

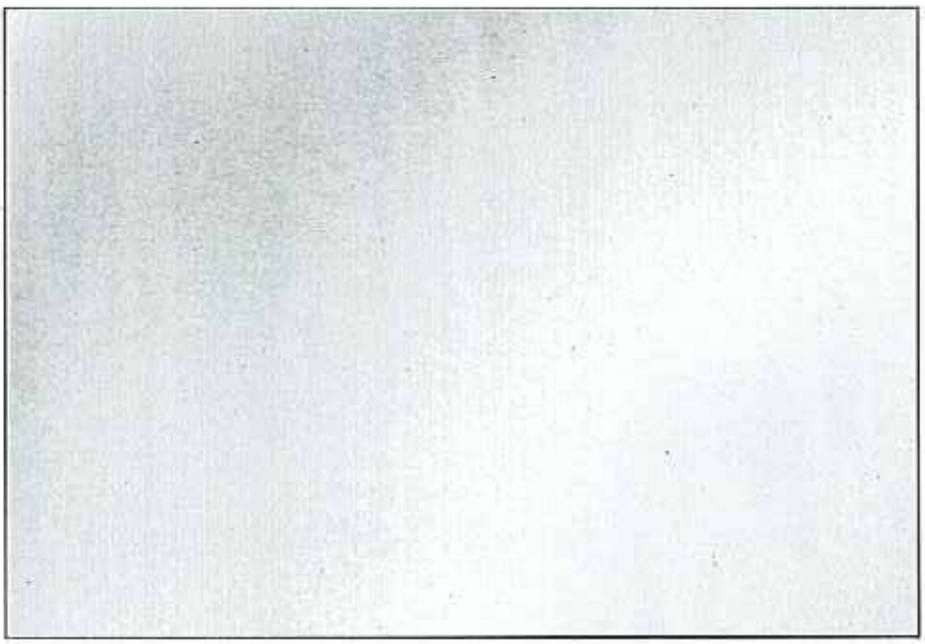


Figure 1 shows that there are currently three 132kV busbar arrangements, two main busbars ("1 BUS" and "2 BUS") and a third bus that appears to allow the substation to be bypassed ("3 BUS"). It is proposed in this project to replace the existing arrangement with the arrangement shown in Figure 2.

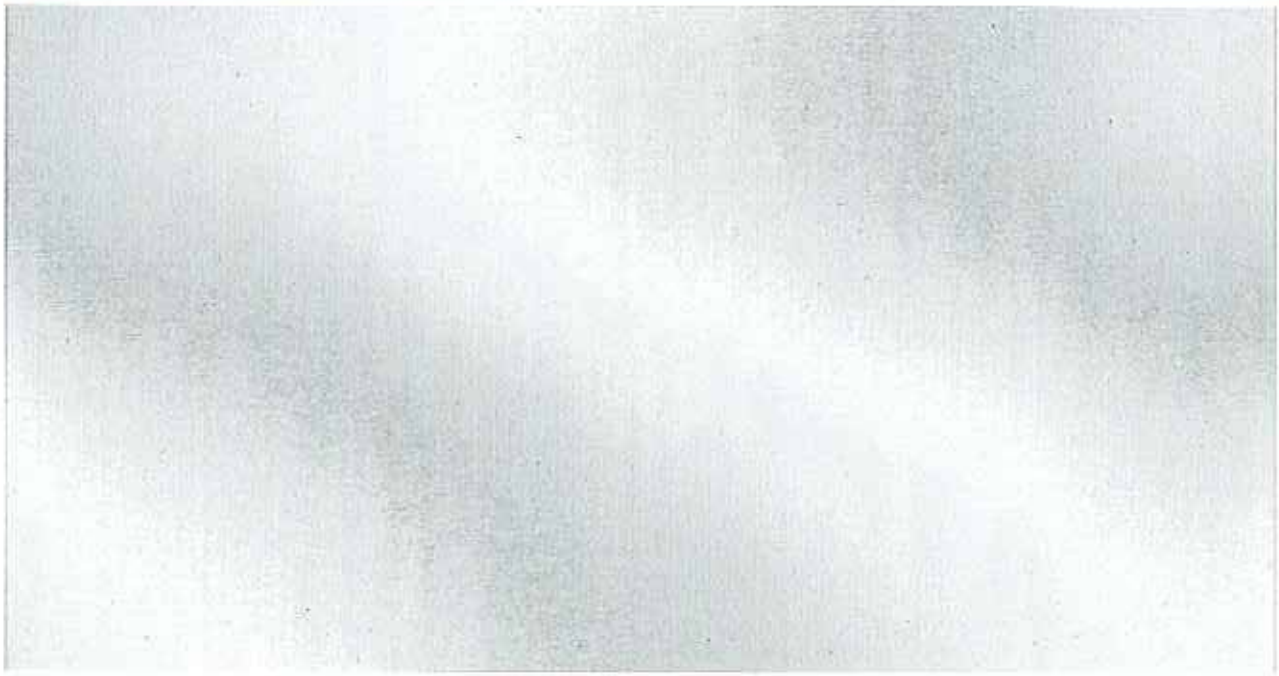
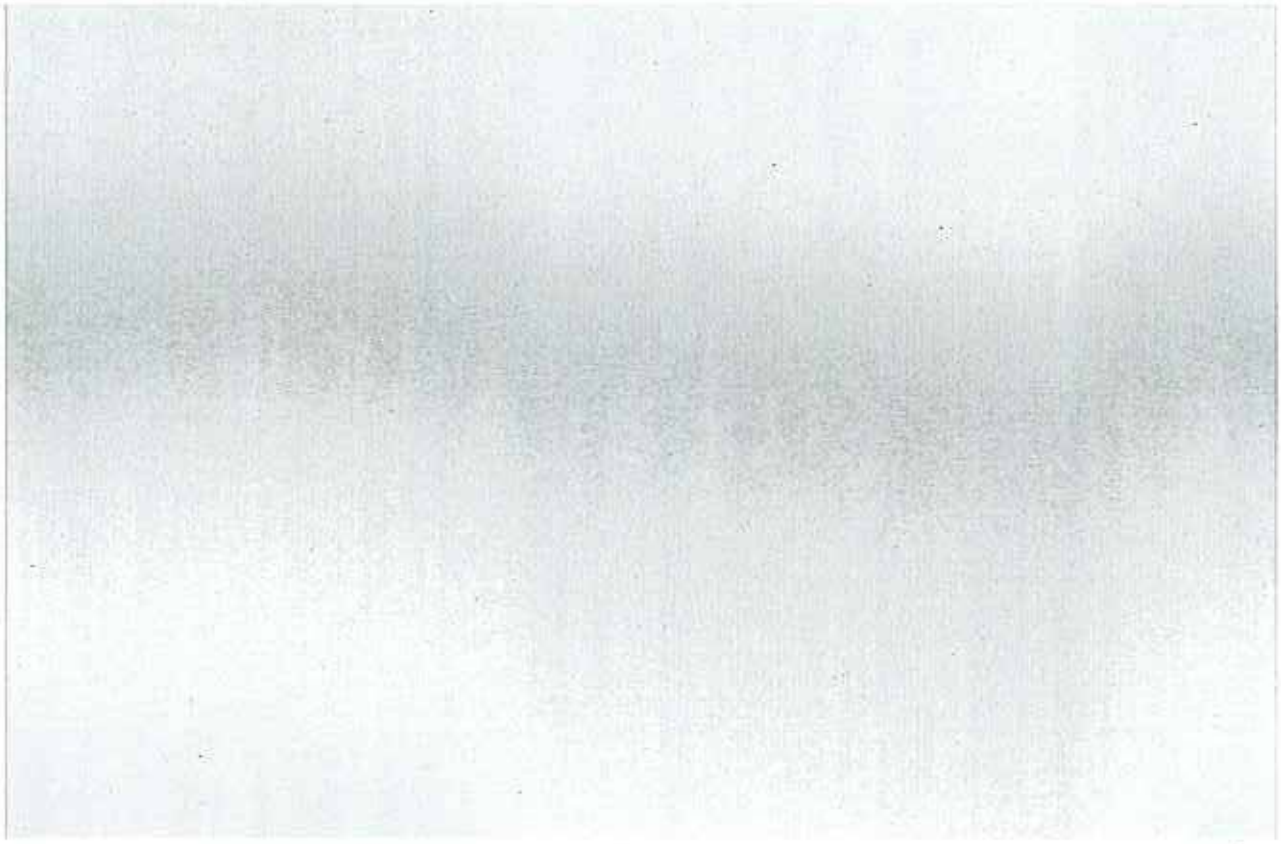


Figure 2 shows the proposed new double bus arrangement, with a bus coupler, but only single bus connections (i.e. no bus selection provision).

A layout drawing of the existing 132kV yard (located at the northern end of the yard) has been provided and is shown in Figure 3. This layout drawing shows the capacitors referred above (top-left corner). The scope of this project is to replace all equipment, structures and foundations above the row of transformers in Figure 3 (with the exception of the capacitor bank).



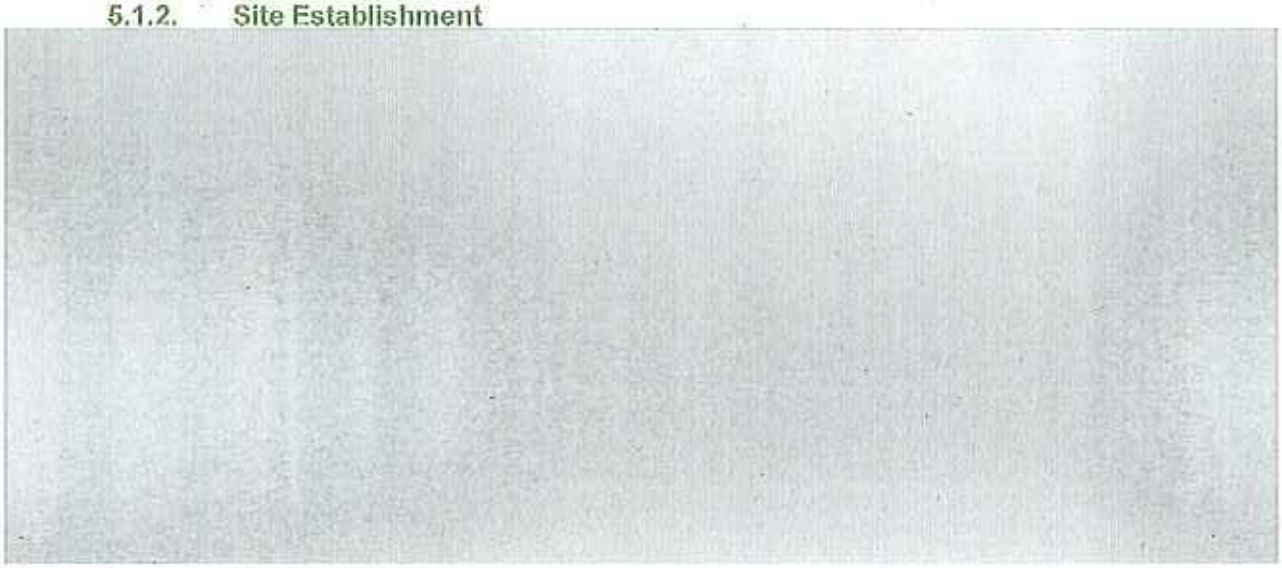
5.1. [redacted] Substation

Refer to Figure 2 for the single line diagram of the works and Figure 3 for the substation layout.

5.1.1. Line Diversion Works

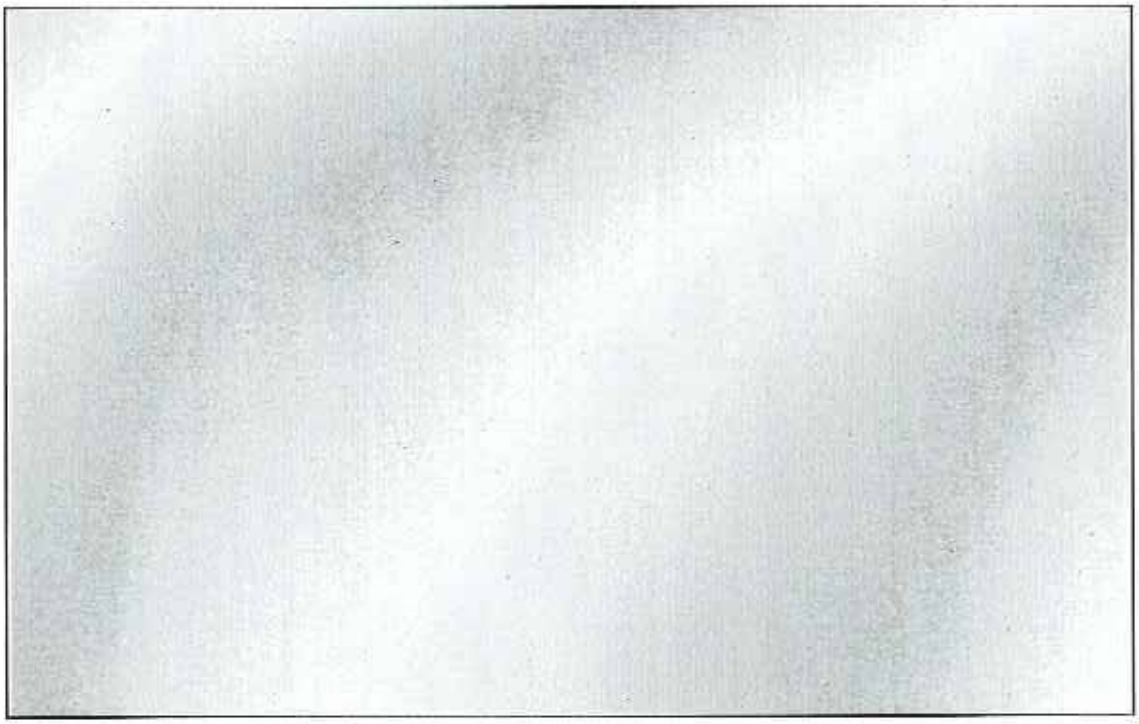
- Installation of five 132 kV strain poles to allow for the diversion of the existing feeders. The poles are to be located in their final positions within the yard. Two CVT's are included for line protection and power line carrier communication links.

5.1.2. Site Establishment

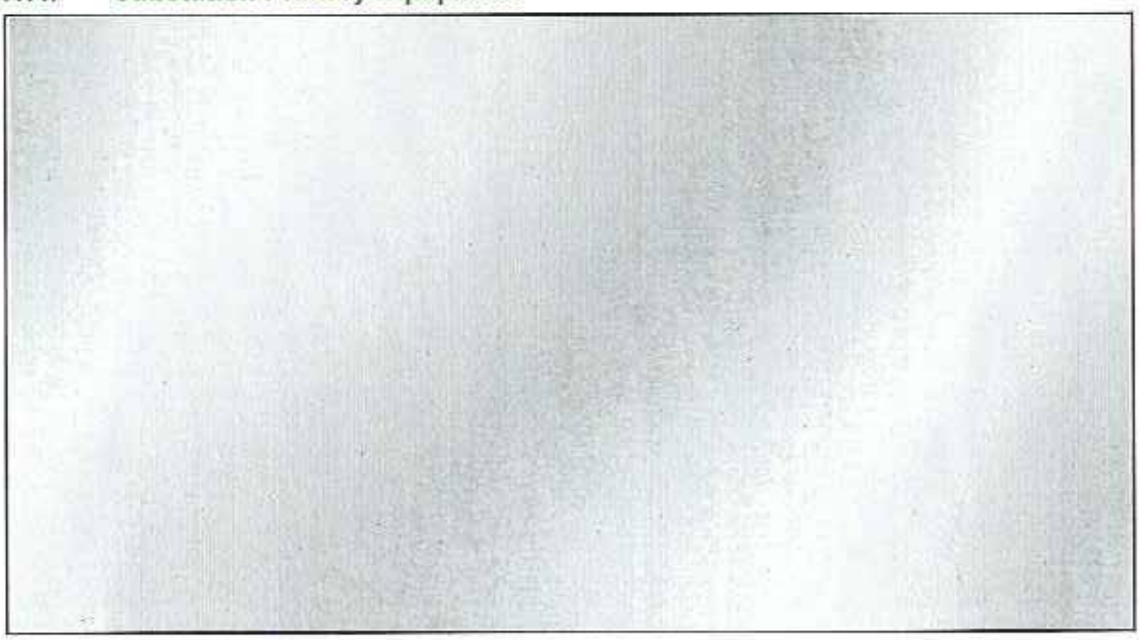


- Cable trenches using pre-cast concrete box culvert (600 x 450 mm), including excavation, installation, and backfilling.
- Concrete paving, kerbing, drainage etc.

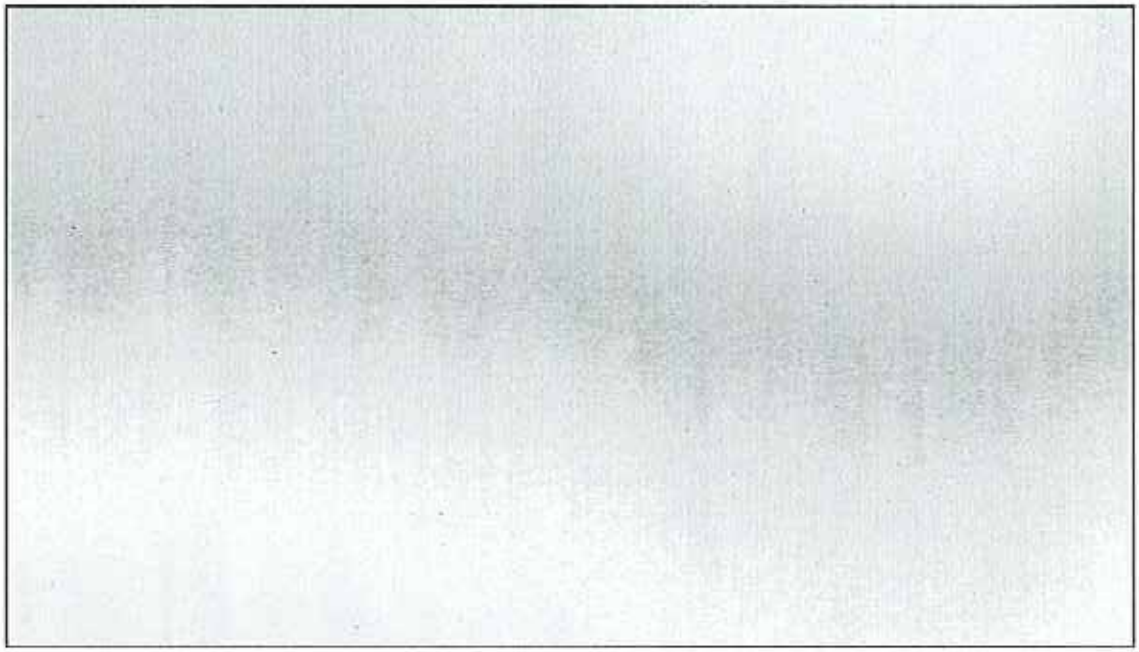
5.1.3. Civil Works and Building Services



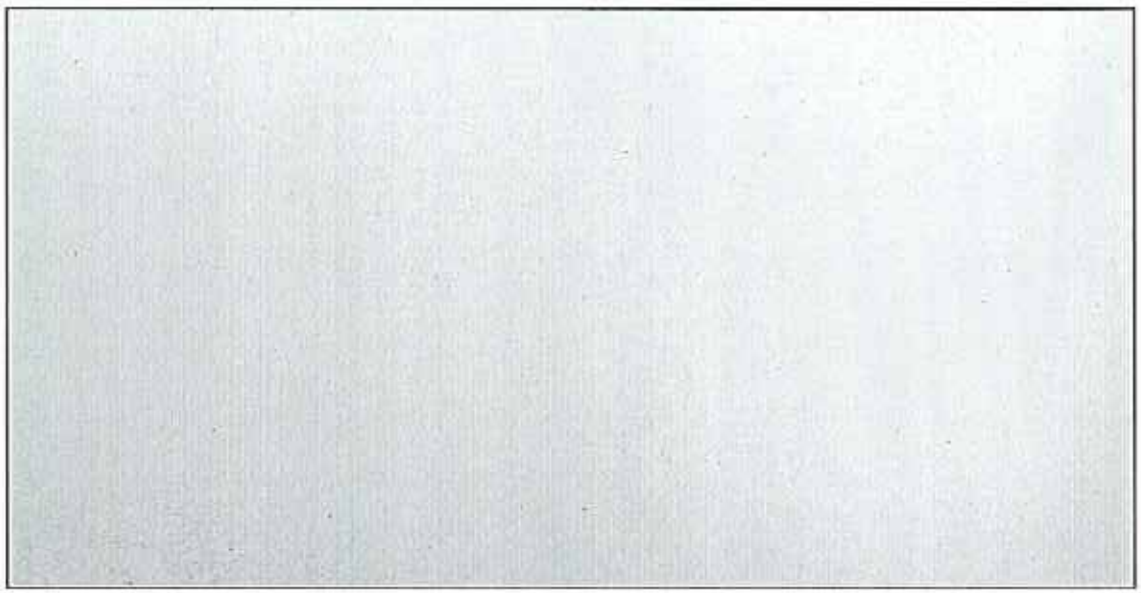
5.1.4. Substation Primary Equipment

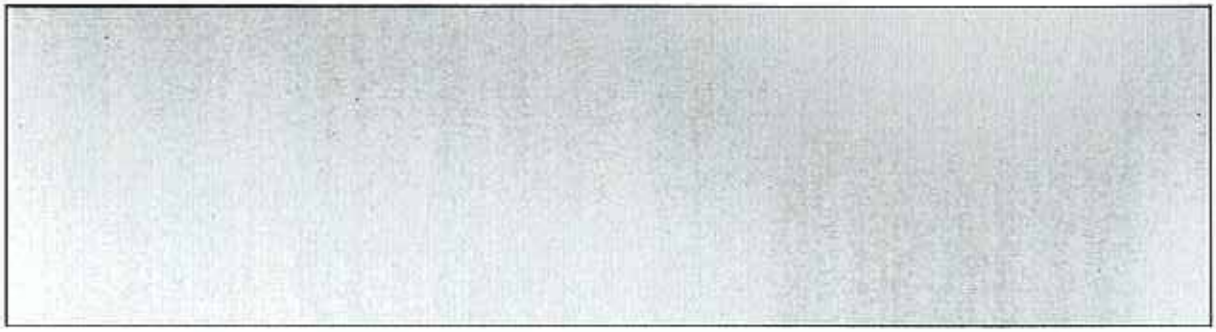


5.1.5. Secondary Equipment



5.1.6. Telecommunications





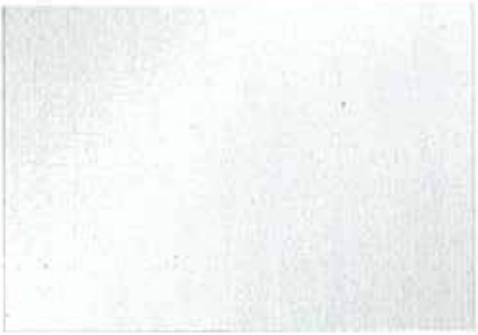
6. CONSTRUCTABILITY AND SITE SPECIFIC ISSUES

6.1. Site Specific issues

No site specific issues have been determined (excluded from scope).

6.2. Staging of the Works

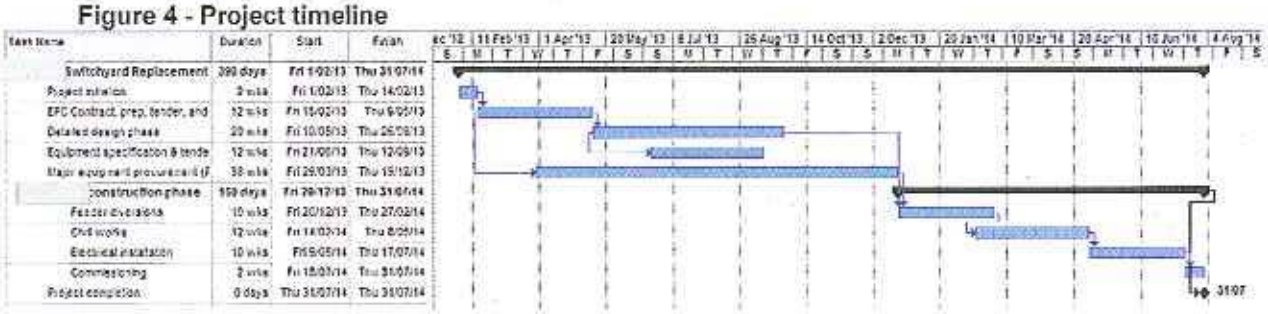
The works consist of eight main stages:



7. PROJECT TIMEFRAME AND KEY MILESTONES

The project timeframe and key milestones are shown in the Gantt chart in Figure 4.

Figure 4 - Project timeline



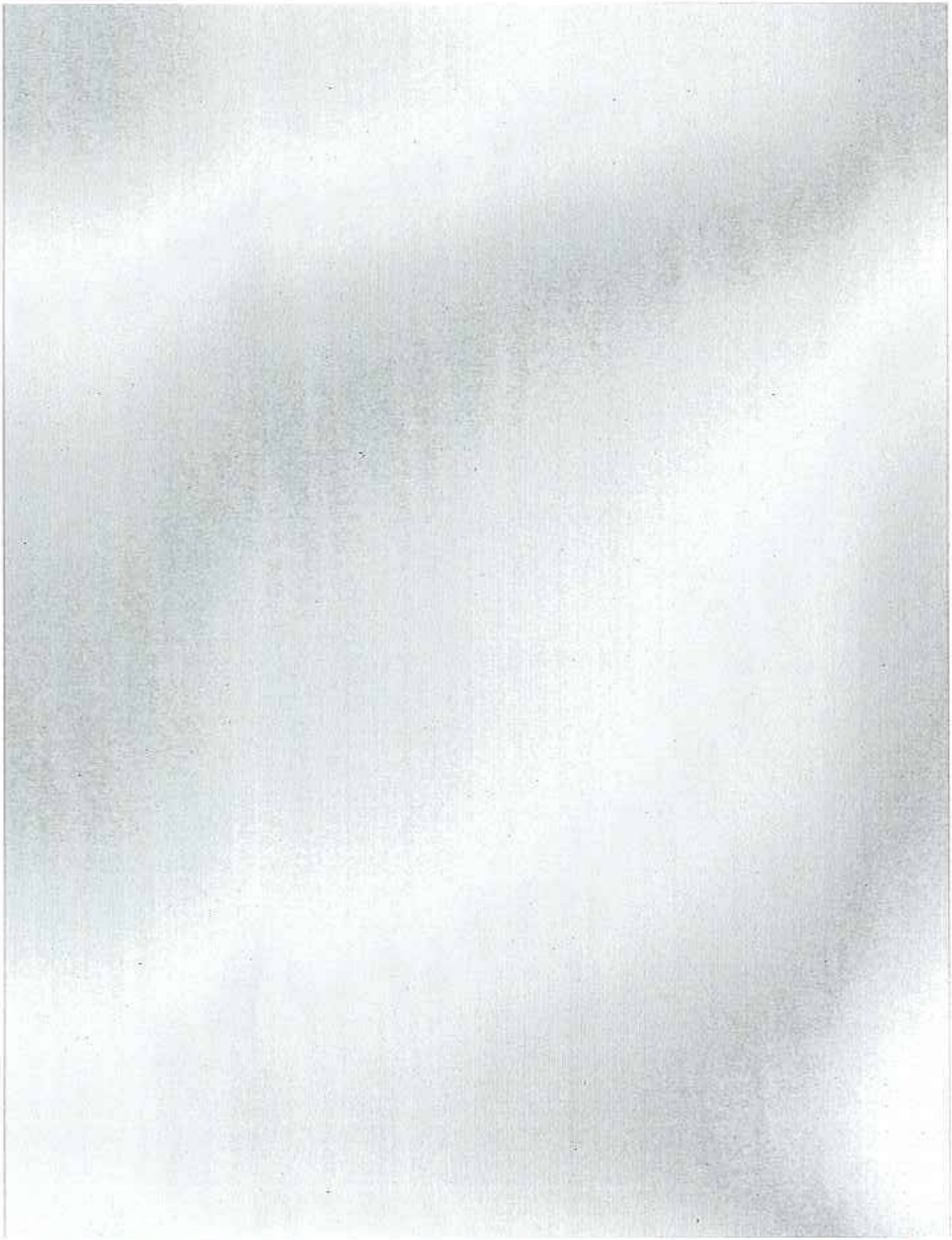
8. COST ESTIMATE

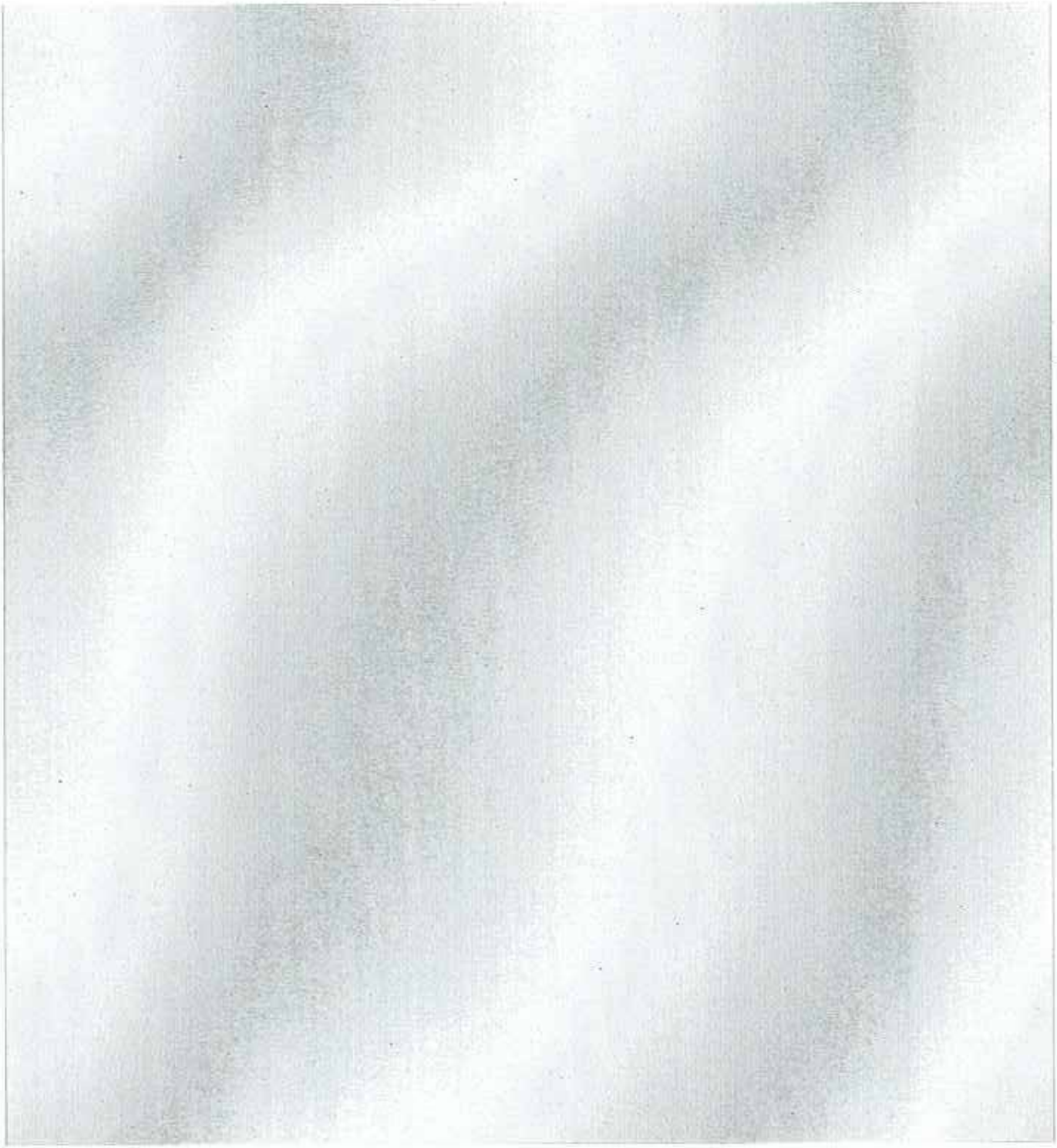
The cost estimate for the project is $17.4 million, within an overall accuracy range of $13.3 – $21.6 million. The detailed breakdown is shown in Appendix A.

Item	Description	Low	Likely	High
3	Total estimate for project	13,291,622	17,445,517	21,599,211

9. REFERENCES

Document name and hyperlink (as entered Into Objective)	Version	Date





PSC Estimate

for

New 275/110kV Substation

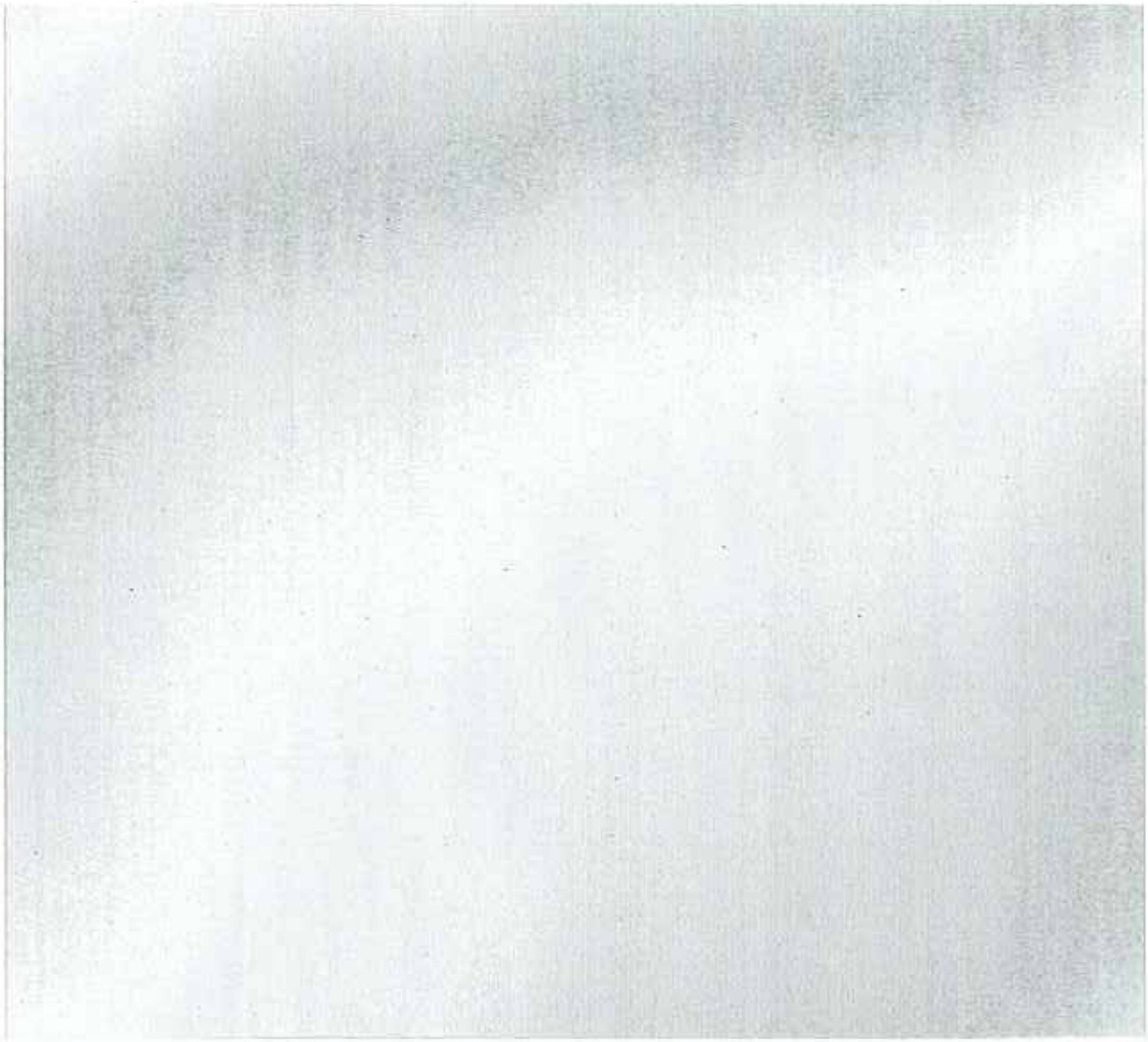
May 2011

Specialist Consultants
to the Electricity Industry

Contents

1. EXECUTIVE SUMMARY

1.1. Project Brief



PSC Australia (PSC) has been engaged by Powerlink to develop a high level concept scope and estimate for this project. The nature of this engaged is one of a "desktop" study that utilises the experience of PSC's personnel and PSC's own cost estimate "building blocks" to develop a scope and estimate independent of Powerlink.

1.2. Estimate Summary

The cost estimate for the project is $54.2 million, within an overall accuracy range of $41.8 – $66.6 million.

1.3. Major Dependencies

Major dependencies include global base metal prices (Copper and Aluminium) and foreign exchange rates (USD, Euro).

1.4. Major Assumptions

PSC has been engaged to undertake the scope and estimate based on the following general limitations:

- A low, likely and high cost shall be provided for the project, and the accuracy of the cost estimate will be limited to the order of ±20-30%.
- Any engineering or design required to develop the scope will be limited to that necessary to obtain the degree of cost estimate accuracy required and by the above requirements.
- There will be no detailed drawings or sketches, including CAD drawings.
- The cost estimate will cover the cost of design, procurement, project management, manufacture, delivery, construction, installation and commissioning.
- The overhead line portion of this project is of a comparatively short length (5km). Top down, per kilometre unit rates used for the cost estimate are based on longer lines (> 50km). It is acknowledged that shorter lines incur a higher cost per kilometre than longer lines due to the higher unit rates for materials and the fixed costs associated with the design and construction of the project. In this estimate a 2.0 multiplier has been applied to the overhead line and OPGW portions of the work to allow for the short line length.

1.5. Major Exclusions

Specifically excluded from this cost estimate are:

- Specification development and pre-award engineering;
- Development and permitting costs;
- Environmental costs;
- Easement and land acquisition; and
- Powerlink internal costs.

1.6. Major Risks

Not identified.

1.7. Consultant Engagement

This report was developed in accordance with the Federal Court expert witness guidelines, specifically the document "Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia - Practice Direction" dated 5th May 2008.

PSC has worked previously for Powerlink, and specifically in the following context:

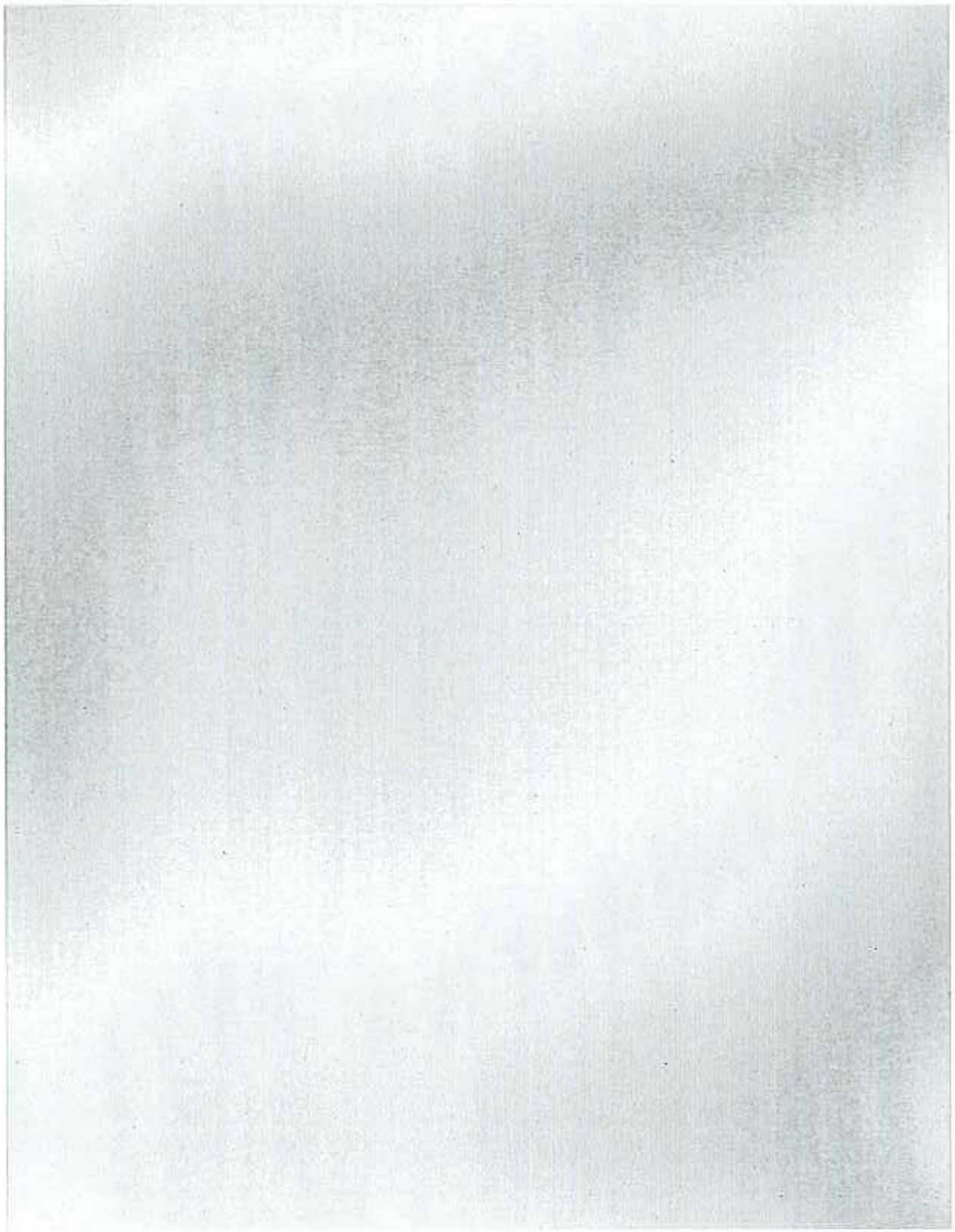
- Provision of SCADA and EMS support personnel in the Network Management System team as part of the Operations Business Unit group since 2006.
- Provision of strategic planning advice since 2010 to the Plant Strategies team as part of the Network Strategy and Performance Business Unit which has included development of the following items:
    - Substation telephony, and data network concept designs;

- Power Systems Applications Strategy;
- Operational Data Management Strategy; and
- Substation Operational Local Area Network Design Standard.

The author's of this report include:

- Les Brand – Electrical Engineering Manager, PSC Australia
- Andrew Robbie – Principal Engineer, PSC Australia
- Keith Fisk – Secondary Systems Engineer, PSC New Zealand
- John Hendriks – Senior Electrical Engineer, PSC New Zealand
- Rob Silcock – CEO, PBA New Zealand
- Soumya Bhattacharya – Transmission Lines/Civil Engineer, PSC New Zealand

2. PROJECT SUMMARY



3. SCOPE AND ESTIMATE LIMITATIONS AND METHODOLOGY

3.1. Limitations

PSC has been engaged to undertake the scope and estimate based on the following general limitations:

- To perform an independent, high level, scope and estimate for the project without knowledge or use of the Powerlink Substation Design Manuals.
- Information provided by Powerlink shall be limited to a general scope description for the project, and any technical information related to existing facilities and plant that may be required by PSC.
- There will be no site visits.
- A low, likely and high cost shall be provided for the project, and the accuracy of the cost estimate will be limited to the order of ±20-30%.
- Any engineering or design required to develop the scope will be limited to that necessary to obtain the degree of cost estimate accuracy required and by the above requirements.
- Detailed drawings or sketches, including CAD drawings are not included in the scope of works.
- The cost estimate will cover the cost of design, procurement, project management, manufacture, delivery, construction, installation and commissioning. Specifically excluded from our cost estimate are:
- Specification development and pre-award engineering;
- Development and permitting costs;
- Environmental costs;
- Easement and land acquisition; and
- Powerlink internal costs.

3.2. Methodology

The methodology applied by PSC to develop the scope and estimate is described as follows:

- PSC was provided with a copy of a Project Scope Report – Concept which describes the basic requirements for the project. PSC reviewed this report.
- The project was broken down into "building blocks", a combination of which can make up the scope of the project.
- The identified "building blocks" were developed in terms of scope and price estimates.

- Price estimates were obtained from any or all of the following:
  - PSC's experience and existing price information;
  - Budget material and equipment prices from suppliers;
  - Material and construction costs using the Rawlinson's Australian Construction Handbook ; and/or
  - Input from an experienced electrical construction contractor (PBA).
- The required number of "building blocks" was combined to create an overall scope and estimate of the project.
- Scoping and price information that cannot be broken into the "building blocks" e.g. design, project management, site specific contingency allowances, and remote location premiums, was then individually developed and added to the scope and estimate.
- An overall high level project timeline is developed.

4. SCOPE AND ESTIMATE ASSUMPTIONS AND ALLOWANCES

The following assumptions and allowances have been made in determining the scope of work for this project:

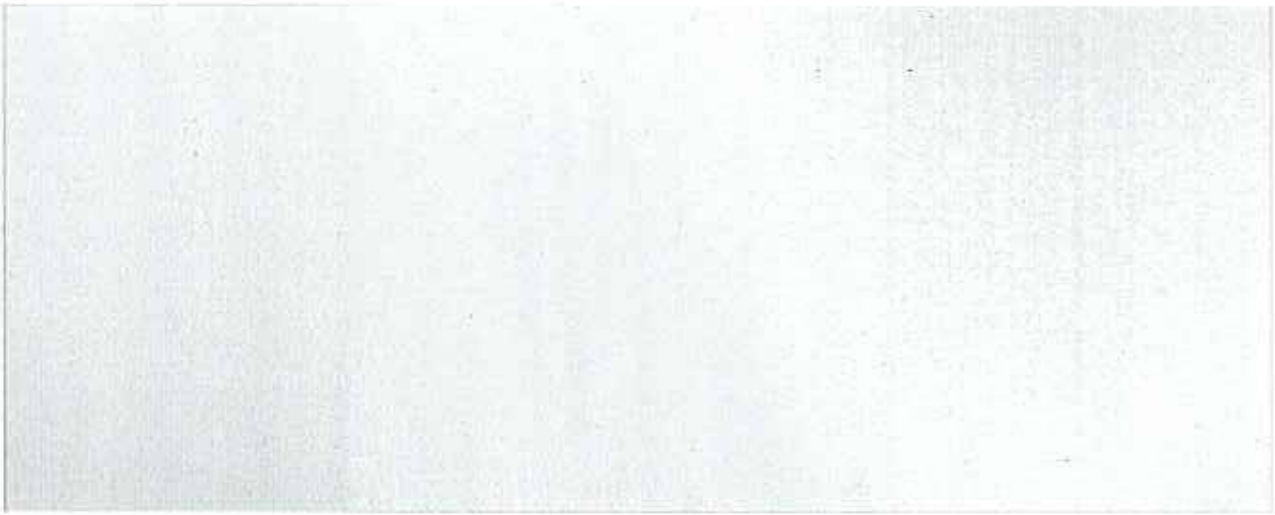
4.1. General

- All costs provided are in current (March 2011) Australian dollars.
- Current exchange rates for AUD-USD and AUD-Euro are based on a monthly average for February 2011, obtained from http://www.x-rates.com,
- No allowance for remote area works has been included as the site is located in south east Queensland near/within major metropolitan areas, although accommodating construction and site personnel during week days at or near site has been allowed for.
- An allowance to cover off items that are site specific has been included of 10% - this applies to the whole estimate. This high level work did not include any site visits, and this allowance is intended to provide for various miscellaneous items that would normally be picked up during site visits/inspection.
- Base metal prices (sourced from Olex Cables Australia website) are based on the following:

- Costs in this report are based on the estimated cost for an Engineer, Procure and Construct (EPC) contract, and does not include overhead costs or Powerlink direct costs, including items such as pre-engineering works, approvals, planning, environmental management and Powerlink project management costs.

4.2. Overhead Transmission Line Works

- The overhead line route selected for the 110kV line is based on a direct route along the edge of Paradise Road in Larapinta. This is a straight route and minimises the number of strain structures required, but assumes that adequate clearances are available and approvals can be obtained.
- A high water table is assumed, and ground soil conditions are assumed unfavourable. The foundations for the transmission lines assume drilled caisson type and/or pile type.
- No reuse of existing string insulator assemblies, conductor fittings, or tower steelwork is assumed.
- The overhead line portion of this project is of a comparatively short length (5km). Top down, per kilometre unit rates used for the cost estimate are based on longer lines (> 50km). It is acknowledged that shorter lines incur a higher cost per kilometre than longer lines due to the higher unit rates for materials and the fixed costs associated with the design and construction of the project. In this estimate a 2.0 multiplier has been applied to the overhead line and OPGW portions of the work to allow for the short line length.
- A multiplier of 1.2 has been applied to the overhead line and OPGW portions of the work to allow for the increased cost of performing overhead line works in a suburban area. This covers off various additional items, including environmental/permit compliance, traffic control and the cost of night works.



4.4. New Substation

- The information provided states that the site has been benched by the developers of the estate. Therefore it is assumed no bench works are required.
- The control buildings and substation yard are sized to accommodate the ultimate site arrangement.

- If diversity does not exist it can mean the development of telecoms infrastructure that would affect the estimate by more than a few percent, and could easily be $1-2m more depending on circumstances.
- It is assumed not necessary at to cut-in to DWDM (Dense Wave Division Multiplex) systems. These would add significant additional costs.
- Remote end line protection and new line protection at and is assumed to have direct interface to telecommunications, with no protection signalling interface required. These would add significant additional costs to each line protection.
- It is assumed that both fire and noise walls are required around/in the proximity of the transformer.

4.5. Remote End Secondary Works

- No allowance has been made for the installation of new relays at the remote ends (Substations).
- The network changes needed at the Control Centres and in the wider communications network are minor configuration and wiring changes and do not entail significant design, equipment or documentation costs.
- Communication network changes sometimes made to facilitate other requirements or future changes in the telecommunications network are not known and are hence not provided for.

4.6. Substation Works

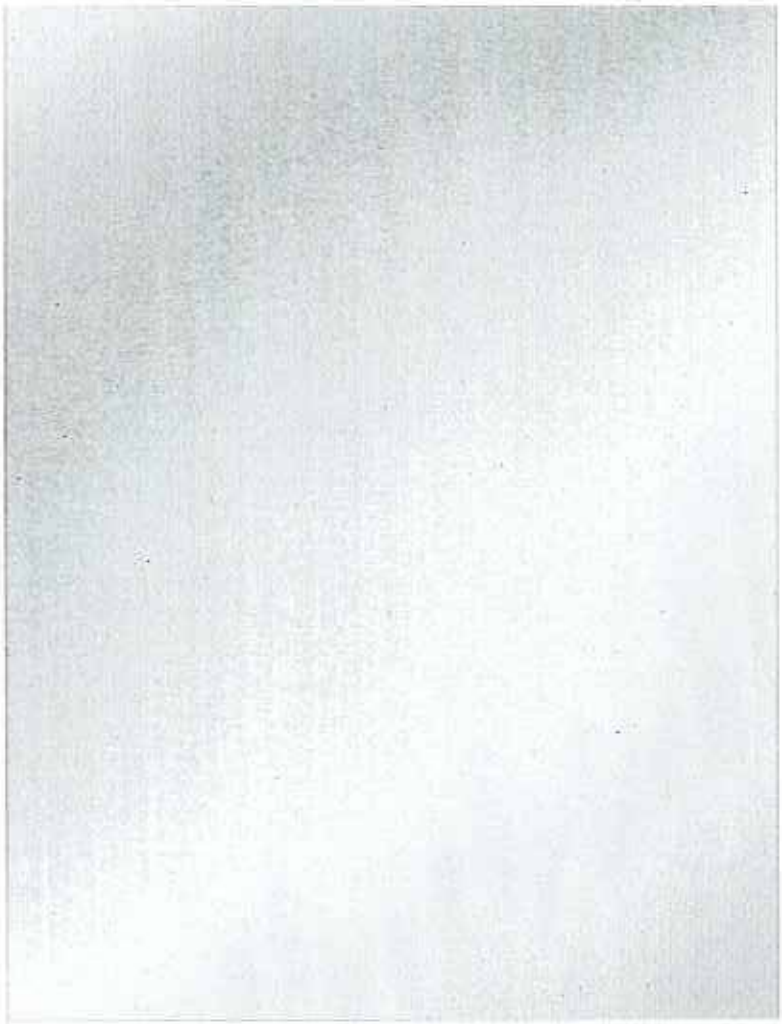
- Existing site infrastructure for substation floodlighting, lightning protection, AC/DC supplies is assumed adequate, with no modifications required.
- No geotechnical survey for substation is required (existing site information is assumed available).
- Sufficient panel space in the control/relay room is assumed available for a new protection relay panel.
- Communications will be installed in a new cabinet in an existing space and that that existing DC and cabling infrastructure is adequate.

5. SCOPE OF WORK

A high level concept scope of work was developed based on the information provided to PSC. The scope was developed using a "top down" approach rather than a "bottom" up engineering design.

The scope can be summarised in the single line diagram of Figure 2.

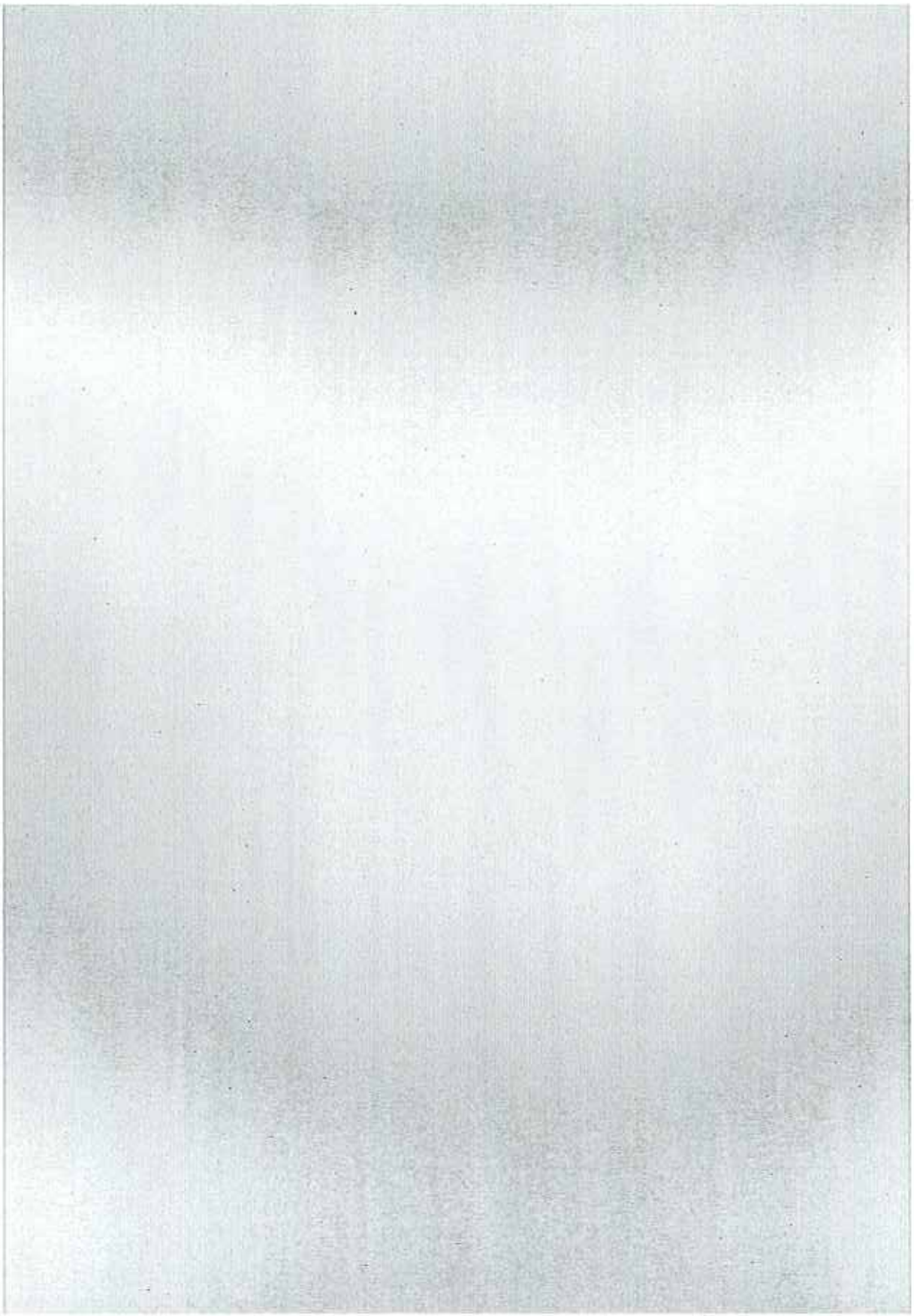
Figure 2 - Project Single Line Diagram



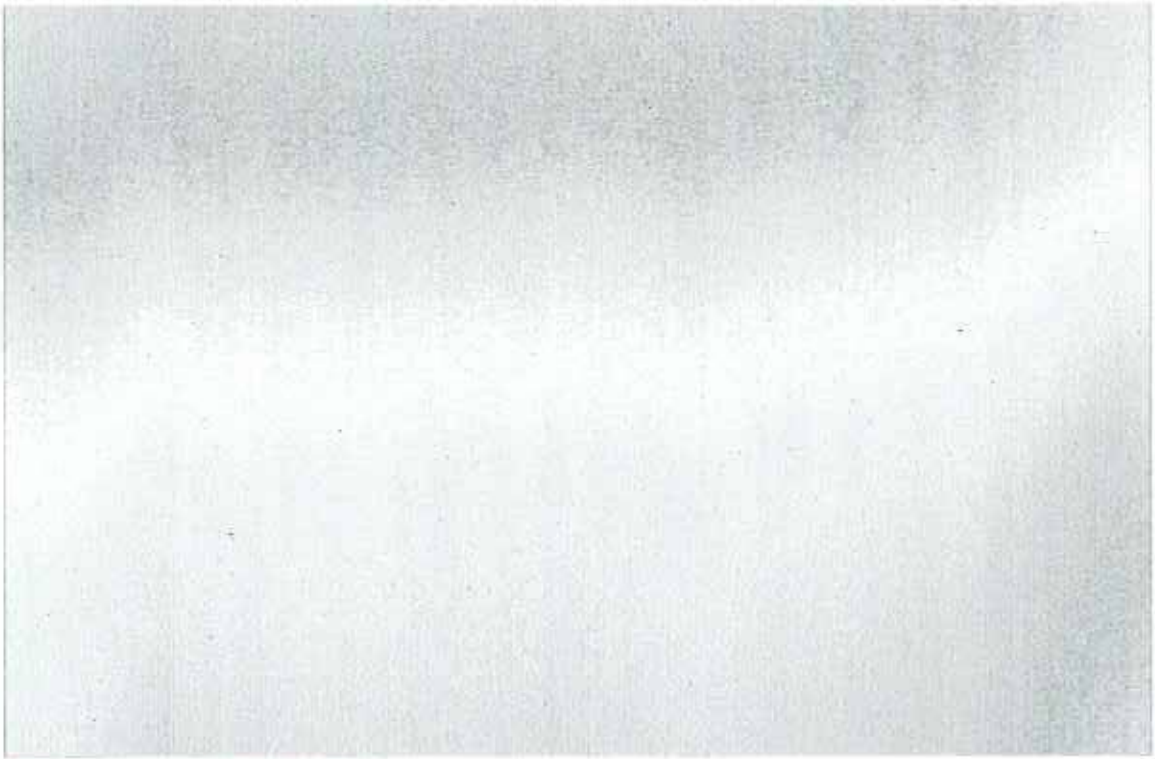
5.1. 275kV Overhead Transmission Line Works

To achieve the 275 kV line cut in the following works are required:

-
-



- Stringing of line with twin "Sulphur" conductor for each circuit and a single OPGW. Both circuits are bonded together at each end to form one electrical circuit.



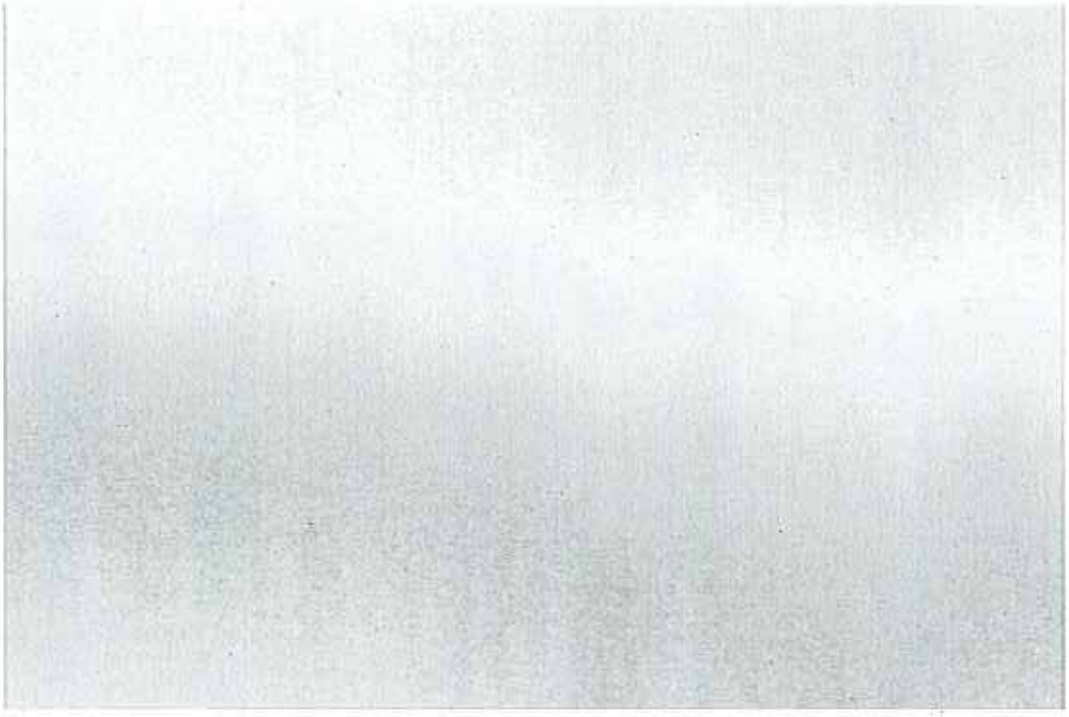
5.4. New Substation

Refer to Figure 2 for the single line diagram of the works and Figure 3 for the substation layout.

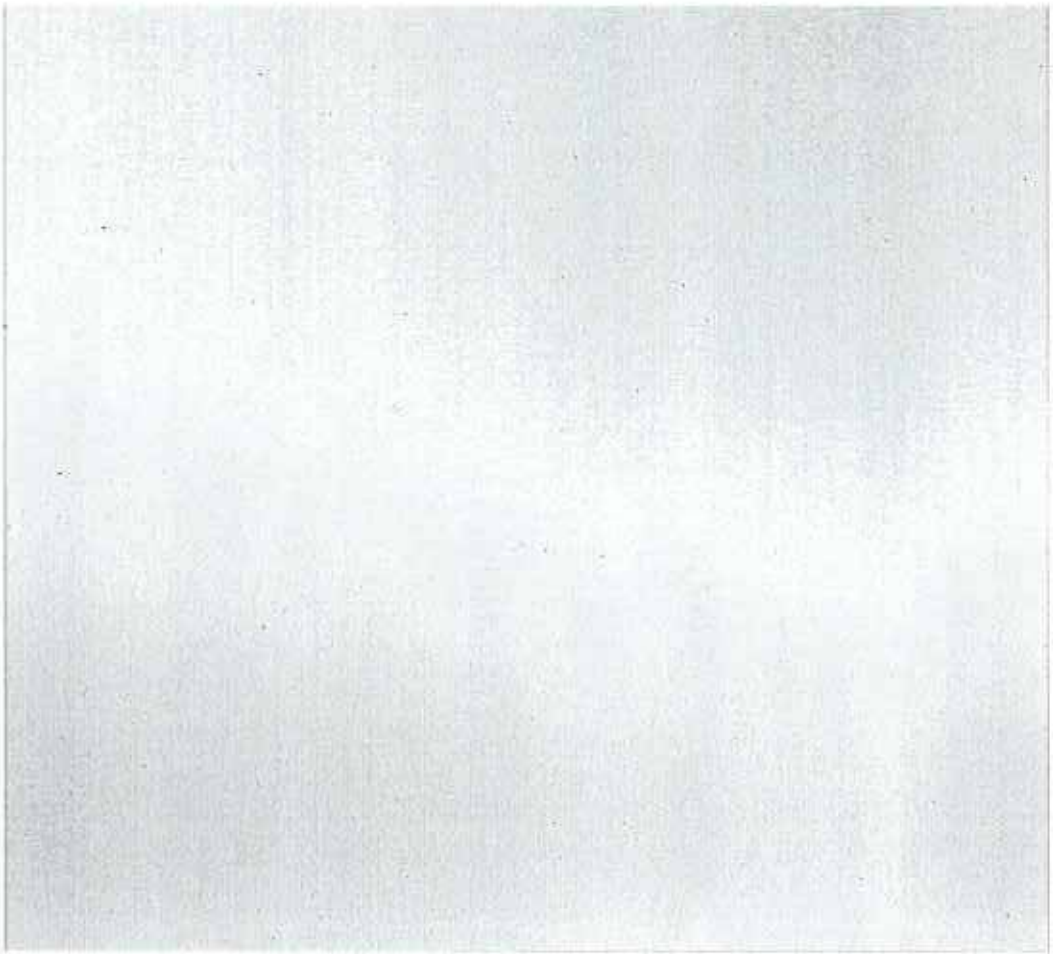
5.4.1. Site Establishment

- Concrete paving, kerbing, drainage etc.

5.4.2. Civil Works and Building Services



5.4.3. Substation Primary Equipment



5.4.4. Secondary Equipment

275 kV Control Building

- [redacted]

110 kV Control Building

- [redacted]

Site

- Eight marshalling boxes (five in 275 kV switchyard, three in 110 kV switchyard), and associated control cable sets to control/relay room, installed.

5.4.5. Telecommunications

The following telecommunications equipment has been allowed for:

- [redacted]

- [redacted]

5.5. [redacted] Substation

The works include the following:

- Protection setting changes.
- Communication equipment setting changes.

5.6. [redacted] Substation

The works include the following:

- Protection setting changes.
- Communication equipment setting changes.

5.7. [redacted] Substation

The 110 kV bus No.2 at the south side of the switchyard is to be extended by one bay to accommodate the new [redacted] 110 kV circuit.

The works include the following:

- [redacted]

6. CONSTRUCTABILITY AND SITE SPECIFIC ISSUES

6.1. Site Specific issues

The site is directly under a 275 kV double circuit transmission line. Initial construction works will deviate both circuits around site to allow construction on a 'green field' site. A double circuit outage of may be required to achieve this.

At an outage of Bus no.2 will be required to connect the new section of busbar associated with the new circuit bay.

6.2. Staging of the Works

In order to minimise the outage durations the 275 kV circuits will be deviated around site to provide a greenfield construction area, and facilitate removal of redundant suspension tower in the 275 kV switchyard area.

The majority of the initial 275 kV works (including construction of new termination towers and poles for north and south deviations around site) can be carried out with the existing double circuit 275 kV line in service.

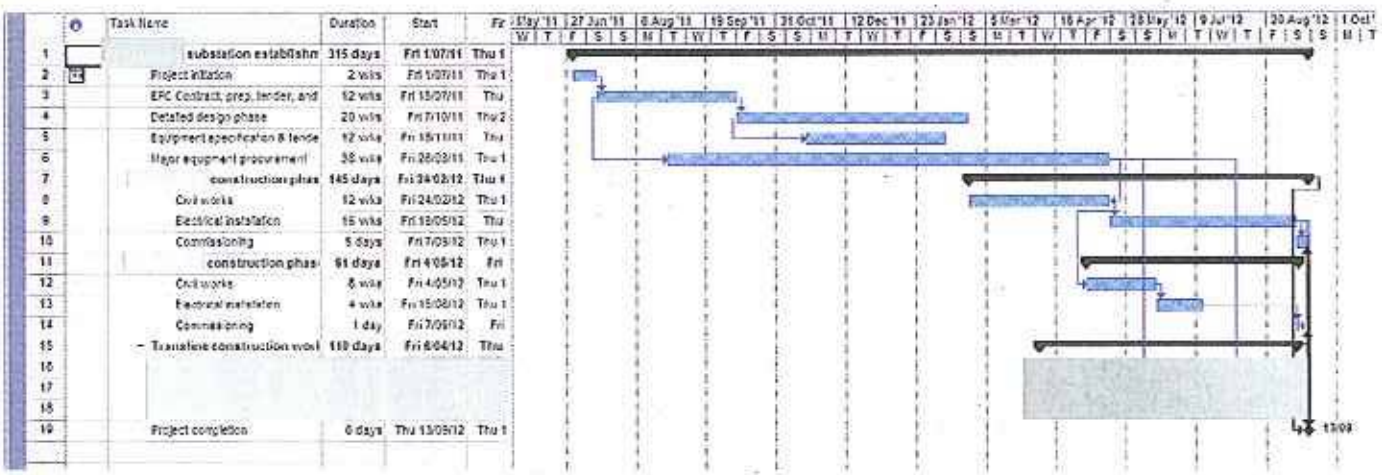
Once the deviations are in place the substation works can proceed.

Final cut-in to substation landing gantries would occur towards the end of the construction period, prior to commissioning of the substation.

7. PROJECT TIMEFRAME AND KEY MILESTONES

The project timeframe and key milestones are shown in the Gantt chart in Figure 4.

Figure 4 - Project timeline



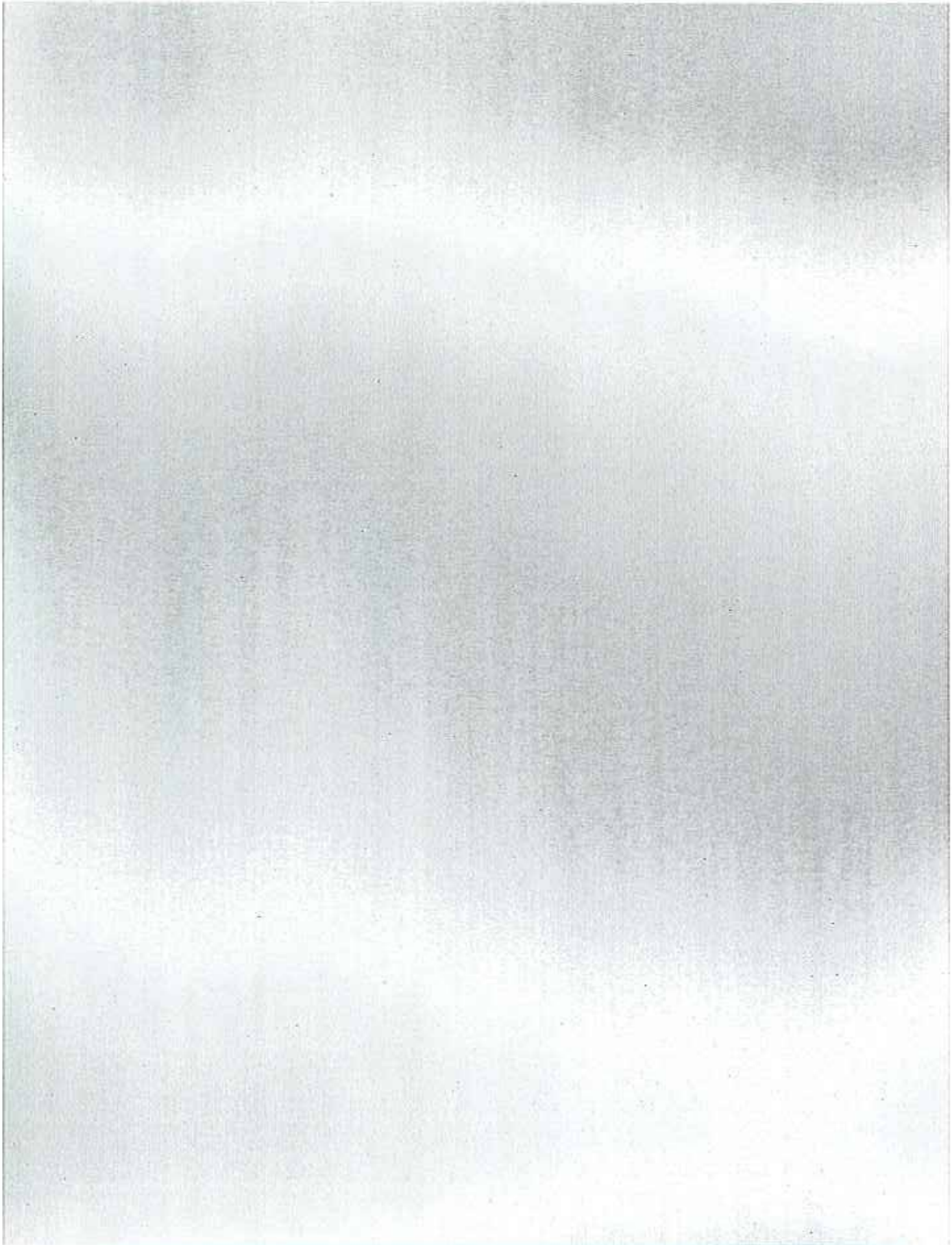
8. COST ESTIMATE

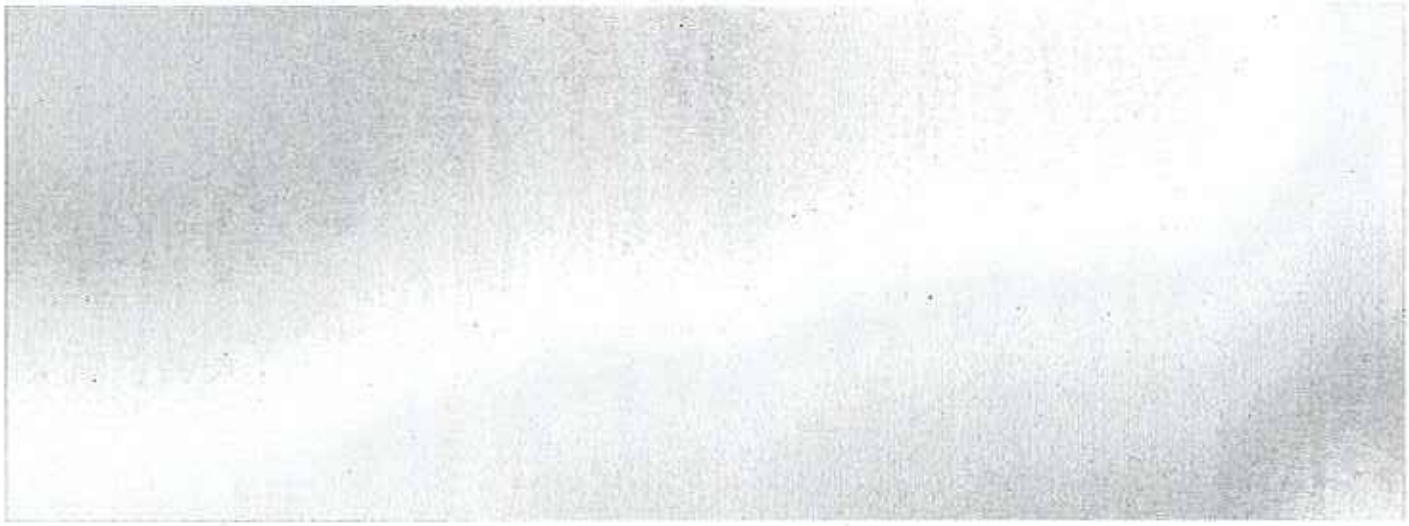
The cost estimate for the project is $54.2 million, within an overall accuracy range of $41.8 – $66.6 million. The detailed breakdown is shown in Appendix A.

Item	Description	Low	Likely	High
6	Total estimate for project	41,755,339	54,177,069	66,598,800

9. REFERENCES

Document name and hyperlink (as entered into Objective)	Version	Date
Project Scope Report 275/110kV Substation Establishment – Concept, Powerlink document	N/A	12 January 2011





APPENDIX B – CVs