Powerlink Queensland

June 2021

Preparatory Activities - CQSQ Transmission Link

Table of Contents

1 Executive summary

The 2020 Integrated System Plan (ISP) [1] defined the projects and timing of 18 network investments in the optimal development path (ODP). Future ISP projects are a subset of these projects that are not yet 'actionable' under the new ISP Rules, but are expected to become actionable in the future and are part of the ODP. Those projects categorised as 'future ISP projects' require the responsible TNSP to carry out preparatory activities including providing a report of these activities to the AEMO by 30 June 2021.

Appendix A3.5.2 of the 2020 ISP [2] describes the future ISP project associated with the Central to Southern Queensland Transmission Link as 'a new double circuit Calvale to Wandoan South 275kV line'. This report summarises the preparatory activities undertaken by Powerlink for this project for the purposes of the 2022 ISP.

2 Preliminary Engineering Design

2.1 Single Line Diagrams

The following diagram presents an overview of the proposed works as part of the future ISP project associated with the Central to Southern Queensland Transmission Link.

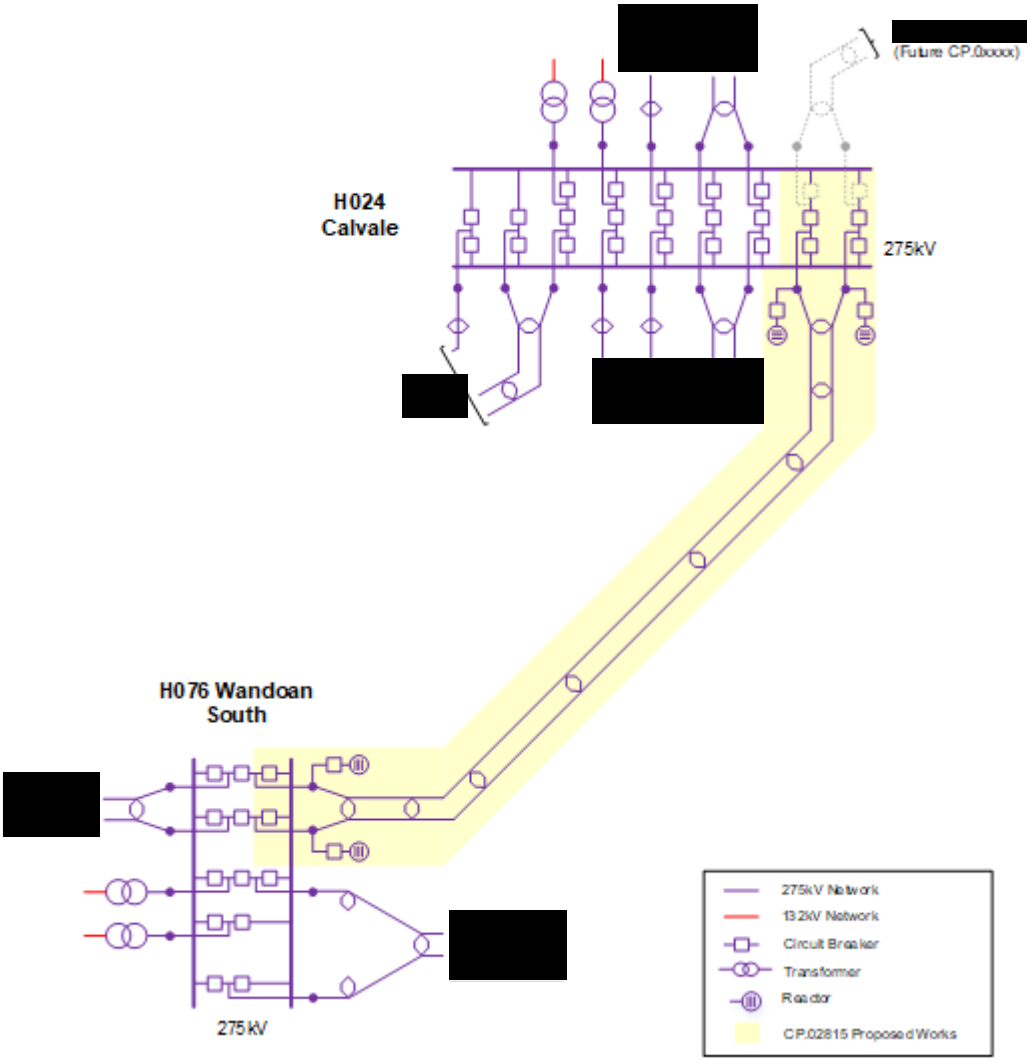

Figure 1 – Overview of proposed works

In addition to the overview presented in Figure 1, detailed single line diagrams have been prepared for each substation to inform estimating. These have been included in the report provided to AEMO, but are not included in the publicly available version of this report.

Figure 2 – Single Line Diagram for Calvale Substation

Figure 3 – Single Line Diagram for Wandoan South Substation

2.2 Site Layout

Indicative site layout (general arrangement) diagrams have been produced for both Calvale and Wandoan South substations to inform estimating. However, these have not been presented due to the complexity in the diagrams and the indicative nature of the layout.

2.3 Asset List

The total procurement costs for each broad asset grouping is provided in the cost estimate provided in Table 3. Powerlink does not present itemised costs for specific plant items to external parties, as this is commercially sensitive information subject to confidentiality.

2.4 Network Parameters and Transfer Limits

2.4.1 Network Parameters

Table 1 presents the electrical network parameters required to model the project when performing loadflow, fault level and dynamic analysis.

Table 1 – Loadflow and fault level electrical parameters (using 100MVA/275kV base quantities)

Circuit	R	X	B	R0	X0	B0
Calvale – Wandoan South 275kV feeder 1	1.042%	9.625%	75.087%	7.474%	29.106%	43.335%
Calvale – Wandoan South 275kV feeder 2	1.042%	9.625%	75.087%	7.474%	29.106%	43.335%

21MVAr line reactors are to be connected to each new circuit.

These parameters are consistent with a 250km twin sulphur 275kV double circuit line. Thermal ratings would be consistent with lines of similar construction in the zone such as a summer normal rating of 1,096MVA and summer emergency rating of 1,230MVA. Thermal ratings are not the relevant parameter to set the maximum transfer limits.

For the purposes of this assessment it is assumed that the coastal circuits approaching end of life would either be life extended or replaced on a like for like basis.

2.4.2 Existing Transfer Limits for DLT studies

Maximum power transfer capability during system normal conditions may be set by transient stability or voltage stability. Stability limits are highly dependent on the interactions between the properties of online generators, backbone transfers, load magnitudes and distribution, status of static reactive sources, etc. Limit equations are mathematical expressions, used to build

NEMDE's constraint equations, which maximise transmission capability available to electricity market participants under the prevailing system condition.

Table D.4 of Powerlink's 2020 Transmission Annual Planning Report [3] lists the existing limit equations for the Central to Southern Queensland grid section. For the purposes of ISP market modelling, which does not model the operation of reactive power dispatch, and can at best inform the needs of larger investments, Powerlink recommends the use of the upper limit of 2,100MW as the existing transfer limit for Detailed Long Term (DLT) studies set by transient (or angular) stability. This makes the implicit assumption that impediments to achieving this transfer due to voltage stability could be addressed by significantly lower cost investments.

2.4.3 Augmentation Transfer Limits

Powerlink has undertaken the assessment of over 160 system conditions to inform the impact a Calvale to Wandoan South 275kV double circuit transmission line would have on the CQSQ limit. Figure 4 illustrates the result of these transient stability limit studies.

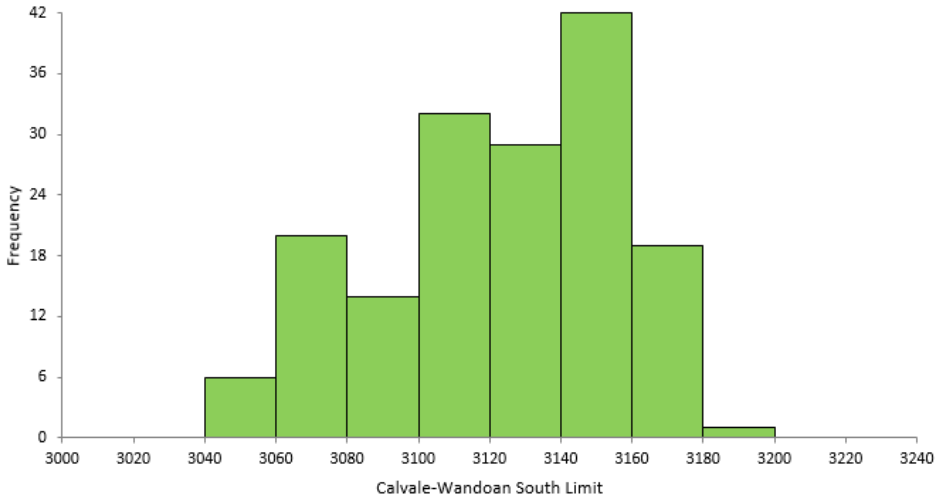

Figure 4 – Histogram of calculated transient stability limits across CQSQ

For the purposes of ISP market modelling, Powerlink continues to recommend an offset of 900MW (or a limit of 3,000MW) on the CQSQ grid section to incorporate the impact of the Calvale – Wandoan South 275kV double circuit line.

2.5 Corridor / Route Selection

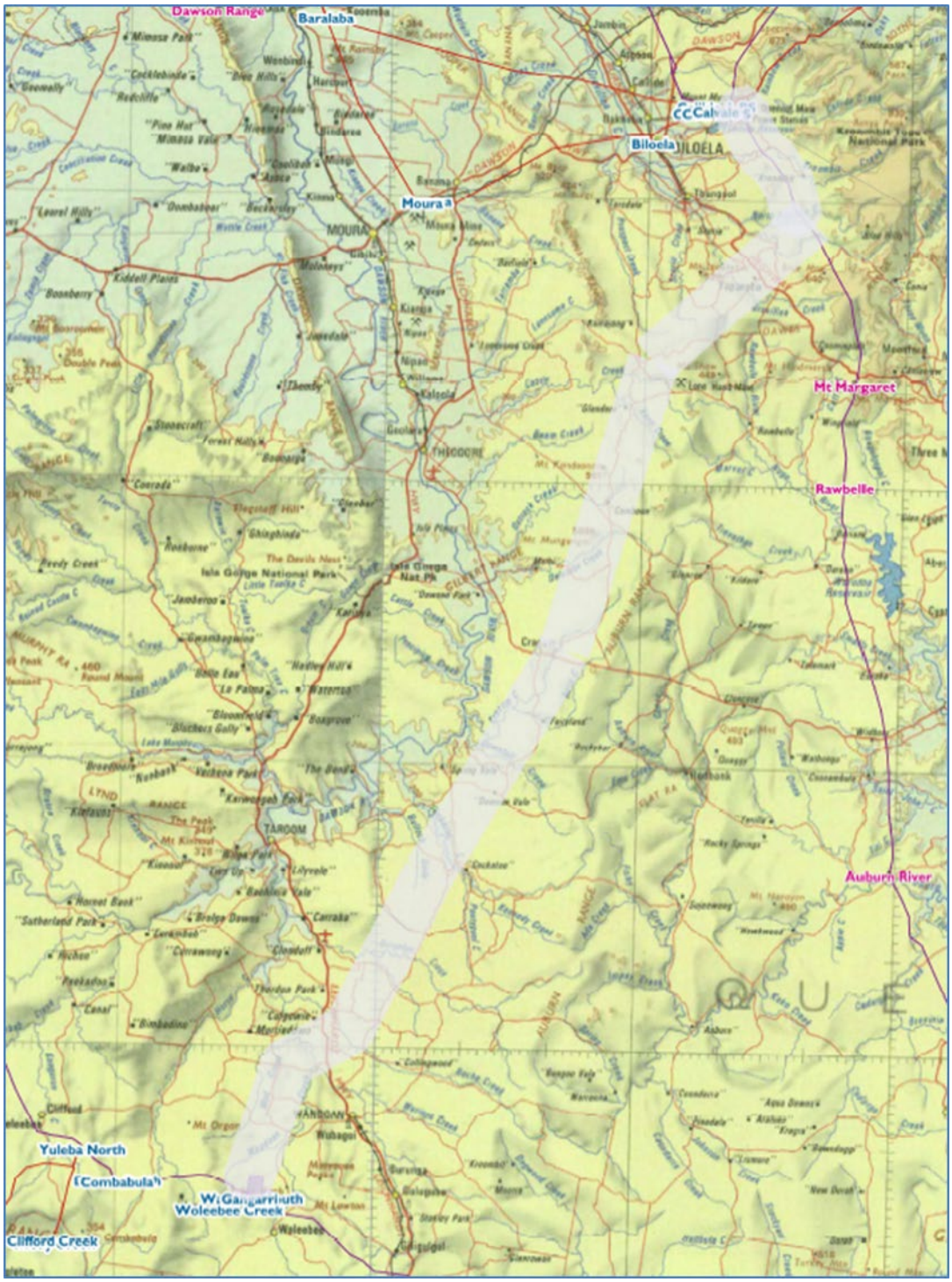

Figure 5 – Indicative alignment[1]

A high-level desktop assessment has been conducted, exploring potential transmission line route options between Calvale and Wandoan South substations. It is concluded that selecting a

[1] This indicative alignment is based on a desktop assessment for the purposes of identifying a feasible route length to inform the estimate for line works only.

route to the west of the Calvale – Tarong 275kV is the preferred option, as it is the most direct and is likely to be the lowest cost alternative, both for acquisition and construction phases.

The indicative alignment shown in Figure 5 has been located for good access to regional towns and major roads, notably the towns of Biloela, Theodore, Taroom and Wandoan, and the Burnett Highway and Leichardt Highway.

No provision is made for land acquisition at either Calvale or Wandoan South substations. Both existing sites have vacant area available for the required expansion.

2.6 Project schedule and staging

A high level staging plan for an assumed commissioning date of December 2028 is presented in Table 2.

Table 2 – High level schedule and staging

Activity	Target Completion
Project Approval – Property Acquisition	June 2023
Project Approval – Delivery	July 2025
Substation Site Access	November 2026
Transmission Line Site Access	June 2026
Substation Construction Complete	February 2028
Transmission Line Construction Complete	November 2028
Commissioning Complete	December 2028

3 Cost estimates

The cost estimate is presented in Table 3. This has been assessed as a class 5 estimate.

Table 3 – Estimate breakdown

Calvale to Wandoan South 275kV DCST Transmission Line Class 5	Base Cost $k, real 2020
Overheads	**39,564**
Project Management, Coordination and Other Support	15,399
Property Acquisition, Environmental & Cultural Heritage	19,165
Environmental Offsets	5,000
Transmission Lines	**285,306**
Design	13,619
Procurement	48,874
Construction	220,607
Commissioning	-
Post Commissioning	2,206
Substations	**24,667**
Design	1,126
Procurement	13,435
Construction	8,439
Commissioning	1,605
Post Commissioning	62
Telecoms	**191**
Network Operations	**185**
Estimate Allowances	**15,982**
Estimate Total (include Project Allowance)	**365,895**
Total Contingency	**109,769**
Mitigated Risk (Known Risk)	18,229
Contingency (Unknown Risk)	91,540
Estimate Total (include Project Allowance, Risk & Contingency)	**475,664**

A summary of the risks considered and included in the estimate are presented in Figure 6. Note that the risk costs are presented in real, 2021 dollars, and have been deescalated to real, 2020 dollars for inclusion in the project cost estimate.

Risk type	Risk Cost Estimate (Pessimistic - no factoring applied)	Risk Cost Estimate (after Likelihood factoring applied)	Impact To Project (UNTREATED)	Risk Treatment Cost (Additional cost to administer Risk)	Mitigated Risk (Known Risk)	Project Cost -direct transfer to estimate (Estimate Allowance)	Impact To Project (AFTER RISK TREATMENT)
Commercial & Legal			Significant				Moderate
Finance & Economic			No impact				No impact
People / Human Resources			No impact				No impact
Natural Events			Minor				Minor
Environmental			Minor				Minor
Health & Safety			No impact				No impact
Project Management			No impact				No impact
Interfacing Management			No impact				No impact
Community Issues			Moderate				Minor
Design			Minor				Minor
Delivery			Moderate				Minor
Completion			No impact				No impact
TOTAL	$ 131,828,691.55	$ 77,217,085.66		$ 7,138,000.00	$ 18,976,072.60	$ 16,637,420.25	

Figure 6 – Risk summary

4 Approvals and stakeholders

4.1 Stakeholder engagement plan

Powerlink is committed to genuine and timely stakeholder engagement that leads to improved decision-making and better outcomes for our stakeholders. A detailed stakeholder engagement plan will be developed prior to engagement activities commencing, which will apply the principles established in our Stakeholder Engagement Framework [4]. Key stakeholders include customers, consumer advocacy groups, landholders, Traditional Owners, our Customer Panel, State and Local Government representatives.

Early engagement is anticipated with the key stakeholders, with a Project Participation and Access Allowance being made available to eligible landholders, in accordance with normal Powerlink practice. Engagement is expected to predominantly take the form of presentations and briefings, community briefings and one on one meetings. Powerlink will work with stakeholders to identify engagement preferences.

4.2 Stakeholder assessment

The majority of land use along the proposed corridor is cattle grazing on large holdings. It is anticipated that landholder issues can be identified at an early stage and accommodated during the route finalisation process. As portions of the route have limited access, improvements made for construction may be welcomed by landholders.

Consultation with the Traditional Owners is a significant component of the route selection process. Powerlink will engage and establish relationships with the relevant Traditional Owners and develop a Cultural Heritage Management Plan / Agreement in conjunction with the identified groups. This will also include a comprehensive on-site Cultural Heritage Survey conducted with the Traditional Owners. Measures will be implemented for the avoidance of impacts or management of Aboriginal Cultural Heritage.

Investigations into historical heritage will be conducted, and measures established to avoid impact on historic or other heritage.

4.3 Relevant planning overlays

The Department of Environment and Science will be engaged in respect of protected areas. The protected areas closest to the indicative alignment are:

- Isla Gorge National Park
- Precipice National Park
- Devils Nest National Park
- Waterton State Forest.

Detailed geospatial data and planning overlays are not available at this stage of development. This information will be made available as the route alignment becomes more firm following appropriate engagement with landholders, Traditional Owners and relevant State and Local Government representatives.

4.4 Estimate of planning approval complexity

Planning approval for the transmission line will be facilitated under the Ministerial Infrastructure Designation process, per the Queensland Government's *Planning Act 2016*. No planning approval is required for the proposed substation works. Overall the project has been assessed as having medium planning approval complexity, due to the number of stakeholders to be engaged, but risk of delays can be mitigated through early and effective engagement on the route selection.

5 References

1. 2020 Integrated System Plan, July 2020, https://aemo.com.au/-/media/files/major-publications/isp/2020/final-2020-integrated-system-plan.pdf?la=en, accessed 16 June 2021, Australian Energy Market Operator.

2. 2020 ISP Appendix 3. Network Investments, July 2020, https://aemo.com.au/-/media/files/major-publications/isp/2020/appendix--3.pdf?la=en, accessed 16 June 2021, Australian Energy Market Operator.

3. 2020 Transmission Annual Planning Report, October 2020, https://www.powerlink.com.au/sites/default/files/2020-10/Transmission%20Annual%20Planning%20Report%202020%20-%20Full%20report.pdf, accessed 16 June 2021, Powerlink Queensland.

4. Stakeholder Engagement Framework, https://www.powerlink.com.au/engagement-framework, accessed 28 June 2021, Powerlink Queensland.