

HumeLink CPA-2

Independent Verification and Assessment

Transgrid

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→ The Power of Commitment



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Executive Summary

HumeLink is a transmission network upgrade project connecting the Greater Sydney Load Centre with the Snowy Mountains Hydroelectric Scheme and Project EnergyConnect (PEC) in Southwest NSW. It will increase the transfer capacity and stability limits between the Snowy Mountains and major load centres of Sydney, Newcastle, and Wollongong and facilitates the development of renewable generation in high quality renewable resource areas in Southern NSW.

Transgrid submitted its Stage 1 Contingent Project Application (CPA-1) to the Australian Energy Regulatory (AER) in April 2022 covering the HumeLink early works. This CPA-2 submission outlines the remaining capital forecast required to deliver the project by July 2026, subject to feedback loop confirmation by the Australian Energy Market Operator (AEMO).

CPA-1 covering the HumeLink early works claimed \$380.8M (\$Real 2022-23) and the CPA-2 forecast for the project delivery element is \$4,279.1M, bringing the total HumeLink estimate to \$4,659.9M. Overall, GHD Advisory considers that the contracting approach adopted detailed below and capital forecast developed to be prudent and efficient having regard to current market conditions, and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.

GHD's verification approach is detailed in section 3 which reflects a bottom-up assessment of evidence that supports forecast elements and a supporting top-down assessment using the Transmission Cost Database (TCD), noting the limitations of this approach also detailed in section 3. These results are summarised in Table 1 below which indicate the presence of appropriate evidence to support the level of forecast element accuracy reasonably expected at this stage of the projects delivery and the estimates activities prudence and efficiency.

As outlined in the body of this report, the current electricity infrastructure sector is characterised by high demand, skilled labour shortages, inflationary pressures, low productivity growth and increasing contractor insolvency risks. The HumeLink project itself has been controversial, crossing a high number of impacted properties and difficult terrain, and has several internal and external interfaces and complexities that will contribute to the inherent project risks. For these reasons Transgrid has opted to deliver the project through a Design and Construct (D&C) Incentivised Target Cost (ITC) contracting model.

The ITC model involves the owner and the contractor sharing in the risk of cost overruns, or the benefit of savings, throughout the delivery of the project. This is often referred to as a pain-share / gain-share regime. The ITC model refocuses cost management from isolating individual risks and allocating them to one party, to managing and sharing risks on a whole of project basis.

Transgrid, through a tender process, has structured the contract around lump sum, reimbursable and incentive elements where the last two elements are based upon a gain / pain share arrangement. Lump sums cover design, preliminaries, substations, and other scope elements for which the cost certainty is relatively high. Reimbursable

components relate to the transmission line works and other provisional costs that are subject to risk provisioning. The incentive regime is intended to adjust the value of payments made to and from the Delivery Partner according to whether:

- The Actual Cost represents cost underruns or overruns against the Target Cost (Cost Incentive)
- The Date of Practical Completion occurs before or after the Target Date for Practical Completion (Program Incentive)
- The works are completed in accordance with various safety, cultural, environmental, community and stakeholder engagement and other objectives (KRA Incentive).

This model requires risk provisioning for the risks that Transgrid has retained centrally. As indicated below, Transgrid has followed AER guidance upon the development and presentation of risk provisioning. TCD modelling benchmarking performed by GHD Advisory indicates support for the overall forecast and the level of risk provisioning. This indicates that the total forecast is within the level of accuracy expected from an TCD estimate using the expected accuracy ranges set by the Association for the Advancement of Cost Engineering (AACE) methodology.

Transgrid engaged GHD Advisory to perform an independent assessment of the forecast cost included in CPA-2. Our verification process used to consider the costs included in CPA-2 is detailed in section 3 with GHD Advisory’s assessment summarised in the table below.

Table 1 *HumeLink independent verification and assessment conclusion*

CPA-2 forecast element	Conclusion
Delivery partner costs (Substations and transmission lines) \$2,604.1M (\$Real 2022-23)	<p>Under the DC ITC contract, Delivery Partners will deliver substations and transmission lines under different compensation models as follows:</p> <ul style="list-style-type: none"> - Fixed costs relates to scope elements for which the cost certainty is relatively high. For HumeLink this relates to design, preliminaries, and substations, which comprise approximately 42% of total Delivery Partner costs. - Reimbursable component relates to scope elements for which there is less cost certainty. For HumeLink, this relates to transmission lines, which comprises approximately 45% of Delivery Partner costs. The reimbursable component includes agreed target cost with incentive arrangements to encourage collaborative behaviours to drive contractor and subcontractor performance and ensure the successful delivery of the Project, further detailed in section 7. <p>Delivery Partner costs are based upon tender submission price schedules under a contract that includes a lump sum of approximately 42% covering design, preliminaries, substations, and other scope elements for which the cost certainty is relatively high. Plus a reimbursable component of approximately 45% that includes delivery of the transmission lines.</p> <p>Delivery Partner costs are supported by tender documentation (tender responses elements supplied by Transgrid prior to finalisation of the contracts). In considering the total cost we have also considered TCD benchmarking results detailed in section 8.1.4. These indicate that the total forecast is within</p>

CPA-2 forecast element	Conclusion
	<p>acceptable ranges provided by AACE's methodology for a TCD estimate, noting the limitations of this approach detailed in section 3.</p> <p>Allowances for risks held centrally are summarised below.</p>
<p>Other construction costs \$599.1M (\$Real 2022-23)</p>	<p>HumeLink is large-scale transmission project that is scheduled to be delivered in a timeframe where the infrastructure sector is subject to high demand, skilled labour shortages, low productivity growth, inflationary pressures, and elevated risk of contractor insolvency. The project itself has been controversial, crosses a high number of impacted properties, will experience difficult terrain and has several internal and external interfaces and complexities that will contribute to the inherent risk of the project.</p> <p>During Early Contractor Involvement (ECI) process it became evident that the D&C contractors were not willing to accept D&C lump sum contracting arrangements and an ITC contracting methodology evolved as a model better suited to current market conditions and the projects complexities. The D&C ITC contract model seeks to reduce contractor risk and contingency premiums though a shared risk approach. This approach is generally favourable where either the project scope is not well defined and/or the costs of materials and labour cannot be estimated with reasonable certainty, as this would otherwise result in higher risk premiums included in contractor costings.</p> <p>Whilst the ITC contracting model reduces the risk provisioning included within tendered prices, it requires higher risk provisioning by Transgrid, and its success will require more active project management by Transgrid and control over variations.</p> <p>Delivery contracts have been structured on lump sum, reimbursable and incentive arrangements based upon the projects risk exposures. Lump sums cover design, preliminaries, substations, and other scope elements for which the cost certainty is relatively high. Reimbursable components relate to the transmission line works and other provisional costs that are subject to risk provisioning. The incentive regime is intended to adjust the value of payments made to and from the Delivery Partner according to whether:</p> <ul style="list-style-type: none"> - The Actual Cost represents cost underruns or overruns against the Target Cost (Cost Incentive) - The Date of Practical Completion occurs before or after the Target Date for Practical Completion (Program Incentive) - The works are completed in accordance with various safety, cultural, environmental, community and stakeholder engagement and other objectives (KRA Incentive). <p>Based upon these contractual arrangements Transgrid has developed risk provisions though a process detailed in section 8.1.2.1. The AER's guidance note on the regulation of actionable Integrated System Plan (ISP) projects states that it can accept a project risk allowance for a contingent project where¹:</p> <ul style="list-style-type: none"> - Residual risks have been identified - The associated cost estimates of the residual risk are efficient i.e., the consequential cost adjusted to reflect the likelihood of occurrence.

¹ AER, **Guidance Note, Regulation of actionable ISP project**, March 2021

CPA-2 forecast element	Conclusion
	<p>To inform its assessment, the AER requires a comprehensive and transparent explanation of how the risks have been identified and costed, including²:</p> <ul style="list-style-type: none"> - Risk identification, i.e., clearly identifying the risk events - Risk cost assessment, i.e., estimating the potential cost impacts, the likelihood of occurrence, the consequential costs, and any mitigation/management strategies. <p>Through the Transgrid’s HumeLink CPA-2 Risk Report and the Direct Capex Forecasting Methodology Transgrid has been transparent with respect to risk provisioning. Based upon the assessment GHD Advisory has performed detailed in Appendix A Transgrid has met these requirements.</p> <p>To further test the level of risk provisioning included in the capital forecast, GHD Advisory has used the TCD model to benchmark the total forecast. This analysis indicates that the forecast is 21% higher than the TCD forecast, but within the level of AACE expected from a TCD forecast of L -10% to -20% H 10% to 30%, noting the limitations of this approach detailed in section 3.</p>
<p>Long-lead time equipment \$29.6M (\$Real 2022-23)</p>	<p>Long-lead Time Equipment (LLE) costs are based upon a combination of purchase orders placed with transformer and reactor suppliers less the amount claimed in CPA-1. This represents approximately 70% of LLE total costs and include the procurement leverage obtained from the Powering Tomorrow Together Program (PTTP) that aggregates spend across Transgrid’s major projects. The remaining elements are internal Transgrid estimations which in some cases are based upon quotes or rates from third parties.</p>
<p>Land and easements \$197.3M (\$Real 2022-23)</p>	<p>The forecast of \$197.3M for the land and easement acquisition component of the assessment is based on the Jones Lang LaSalle (JLL) HumeLink CPA-2, Land & Easement Cost Estimates for Project Implementation, dated 4 August 2023 and the Transgrid Direct Capex Forecasting Methodology, as at June 2023, based on the Green Hills alignment as the preferred alignment.</p> <p>JLL report considers the approved budget and status of the CPA-1 activities and sets out how the total cost of land and easement acquisition for CPA2 has been calculated.</p> <p>Transgrid is seeking to recover the HumeLink CPA-2 land and easement implementation costs which include:</p> <ul style="list-style-type: none"> - Compensation for acquiring easements over public/government and private landholdings - Stamp duty on land and easement acquisition costs - Compensation for timber plantation clearing - Substitute forestry land - Disturbance costs - Construction camps and laydown areas lease and rehabilitation costs - Statutory fees valuation and legal costs.

² AER, *Regulation of actionable ISP projects*, Guidance note, March 2021, p 17

CPA-2 forecast element	Conclusion
	<p>The Transgrid Capex forecast provides the estimates for the easements over public/government land and the lease of land for construction camps and laydown areas.</p> <p>JLL have adopted a sentiment based approach to assess the likely premium to be paid above the compensation assessed by the Transgrid valuer. The premium used for the CPA-2 assessment has been determined using evidence from the PEC project and HumeLink negotiations to date.</p> <p>In determining the likely premium, JLL have considered and allowed for the differing views of registered valuers engaged by landholders, compared to Transgrid's appointed valuer, particularly regarding the effect of construction and operation of the transmission line on the whole landholding', categorised as "injurious affection" under section 55 (f) of the Land Acquisition (Just Terms Compensation) Act (NSW).</p>
<p>Biodiversity offsets \$437.5M (\$Real 2022-23)</p>	<p>The biodiversity offset estimate is based upon the BDAR prepared by Niche that with the EIS was submitted to the NSW DPE in August 2023 and the Biodiversity Offset Delivery Strategy (BODS) also developed by Niche. Since this soft lodgement Niche has updated some of the assumptions underpinning this estimate reflecting the Green Hills route reduction and other changes detailed in section 10.</p> <p>The new forecast prepared by Niche is a mixed model that includes a number of cost reduction strategies including, additional survey work to confirm the absence of a range of species from target areas within the alignment and the purchase of Biodiversity Agreement land. The remaining liability would be settled through payment to the Biodiversity Conservation Fund (BCF).</p> <p>The Niche's forecast has been peer reviewed by WSP. WSP concluding their review indicates that - "review of the BODS and the comments provided, it is considered likely that the offset costs for the project under the Scenario 1, calculated at \$582M and Scenario 2 calculated at \$428M are reasonable conservative upper limit costs associated with the different delivery options under both scenarios³".</p>
<p>Labour and indirect costs \$407.1M (\$Real 2022-23)</p>	<p>Labour costs have been based upon a bottom-up build of Transgrid's project stream resources based upon the phased resources to support the delivery of the projects schedule.</p> <p>Indirect costs include activities to support the projects delivery and are supported by external quotations that GHD has considered on a selection basis.</p>
<p>Overall assessment</p>	<ul style="list-style-type: none"> – Given the inherent risks currently present in the infrastructure sector and the complex nature of the HumeLink project, GHD Advisory is of the view that the contracting approach adopted is appropriate – Based upon the information we have considered, the structure of the contract applies appropriate lump sum, reimbursable and incentive components based upon the capital components risk profile – Risk provisioning is appropriate and Transgrid has applied a rigorous approach to the qualitative risk assessment. This includes workshops and external risk advisors participation, analysis of contract clauses and the risks to approval delays that may eventuate or fall away over a short time frame

³ WSP HumeLink peer review of BODS 8th September 2023

CPA-2 forecast element	Conclusion
	<ul style="list-style-type: none"> – The overall cost for the project and the level of risk provisioning is supported by benchmarking against the TCD, with variances within the level of AACE expected accuracy range for a TCD generated estimate – Delivery Partner costs are supported by tender response schedules – LLE costs are supported by a combination of purchase orders placed with transformer and reactor suppliers less the amount claimed in CPA-1 – Land and easement forecasts are supported by an analysis prepared by JLL – Biodiversity forecasts have been prepared by Niche and peer reviewed by WSP – Labour and labour related costs are based upon actual costs extracted from Ellipse and bottom up build of the forecast by project stream based upon the phased resources required to deliver the project – Overall, GHD Advisory considers that the contracting approach adopted and capital forecast developed are prudent and efficient having regard to current market conditions, and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.2 and the assumptions and qualifications contained throughout the Report.

Glossary

AACE	Association for the Advancement of Cost Engineering
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BCF	Biodiversity Conservation Fund
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BSA	Biodiversity Stewardship Agreement
BoP	Basis of Preparation
BODS	Biodiversity Offset Delivery Strategy
BSS	Biodiversity Stewardship Sites
CIV	Capital Investment Value
COW	Cells on Wheels
CPA	Contingent Project Application
CSSI	Critical State Significant Infrastructure
DPE	Department of Planning and Environment
DAAB	Dispute Avoidance Board
D&C	Design and Construct
EPC	Engineer Procure Construct
EY	Ernst and Young
EOI	Expression of Interest
ECI	Early Contractor Involvement
EIS	Environment Impact Statement
FTE	Full Time Equivalent
ITC	Incentivised Target Cost
ISP	Integrated Service Plan
JLL	Jones Lang LaSalle
LLE	Long Lead- Time Equipment
OECC	Office of Energy and Climate Change
Niche	Niche Environment and Heritage
NPV	Net Present Value
PACR	Project Assessment Conclusions Report
PSCR	Project Specification Consultation Report
PADR	Project Assessment Draft Report

PEC	Project EnergyConnect
PTTP	Powering Tomorrow Together Program
REZ	Renewable Energy Zone
RIT-T	Regulatory Investment Test for Transmission
TNSP	Transmission Network Service Providers
TOC	Target Outturn Cost
TCD	Transmission Cost Database

Contents

1. Introduction	1
1.1 Purpose of this report	1
1.2 Scope and limitations	1
2. Background	2
3. Verification methodology	5
4. Scope definition	6
5. Capex forecast	7
6. Sourcing strategy and procurement	8
7. Delivery Partner costs	11
7.1 West delivery partner costs	12
Source: Transgrid Humelink Direct Capex Forecasting Methodology	13
7.2 East delivery partner costs	13
Source: Transgrid Humelink Direct Capex Forecasting Methodology	14
7.3 Delivery Partner costs conclusion	14
8. Other construction costs	15
8.1 Other construction cost verification	16
8.1.1 Contractual allocation of risks	16
8.1.2 Risk assessment	16
8.1.2.1 Qualitative risk assessment	17
8.1.2.2 Quantitative risk assessment	19
8.1.3 Structure of incentivised target cost clauses	20
8.1.4 ITC project risk provisioning benchmarking	23
8.2 Other construction cost conclusion	26
9. Long lead time equipment	28
9.1 Transformers	29
9.2 Reactors	29
9.3 Steel towers and conductors	30
9.4 Long lead time equipment conclusion	31
10. Land and easement	31
10.1 Land and easement compensation	33
10.2 Other costs	34
10.3 Overhead costs	35
10.4 Land and easement conclusion	36
11. Biodiversity offsets	37
11.1 Updated biodiversity offset costs estimate based upon payment into the BCF (Scenario 1)	38

11.2	Updated biodiversity offset costs estimate based upon a mixed model approach (Scenario 2)	39
11.3	WSP peer review	40
11.4	Project delay risk provisioning	40
11.5	Final biodiversity forecast included in CPA-2	40
11.6	Biodiversity offsets conclusion	41
12.	Labour and indirect costs	41
12.1	Basis of preparation and verification	42
12.2	Commercial	43
12.2.1	Commercial labour costs	44
12.3	Environmental offsets	44
12.4	Community & stakeholder engagement	45
12.4.1	Community & stakeholder engagement labour costs	45
12.5	Land and property	46
12.5.1	Land and property labour costs	47
12.6	Project controls	47
12.6.1	Project controls labour costs	48
12.7	Construction	49
12.7.1	Construction labour costs	49
12.8	Design	50
12.8.1	Design labour costs	51
12.9	Health, safety and environmental	51
12.9.1	Health, safety, and environmental labour costs	52
12.10	Project management	52
12.11	Program initiatives costs	53
12.12	Indirect costs	54
12.12.1	Commercial	54
12.12.2	Community and stakeholder engagement	55
12.12.2.1	Connectivity Regional Telecommunications	56
12.12.3	Environmental approvals	56
12.12.3.1	Amendment report	56
12.12.3.2	Environmental assessment fees	56
12.12.4	Project controls and management	57
12.12.4.1	Project site office costs from 1 July 2024 - 31 July 2026	57
12.12.5	Program initiatives	57
12.12.5.1	Origination function costs	59
12.12.6	Legal	59
12.12.7	Insurance	59
12.13	Labour and indirect costs conclusion	60
13.	Real input escalators	60

Table index

Table 1	HumeLink independent verification and assessment conclusion	ii
Table 2	HumeLink CPA-2 capital forecast (\$Real June 2023)	7
Table 3	HumeLink delivery partner costs (\$Real June 2023)	11
Table 4	Tendered HumeLink West delivery partner costs (\$Real June 2023)	12
Table 5	Tendered HumeLink West delivery partner costs by contract structure (\$Real June 2023)	12
Table 6	Tendered HumeLink East delivery partner costs (\$Real June 2023)	13
Table 7	Tendered HumeLink East delivery partner costs by contract structure (\$Real June 2023)	14
Table 8	Top 25 risks (\$Real 2022-23)	18
Table 9	Transmission Cost Database (TCD) benchmarking	25
Table 10	Summary of CPA-2 long lead time equipment forecast (\$Real 2022-23)	28
Table 11	Breakdown of transformer costs to be claimed in CPA 2 (\$Real 2022-23)	29
Table 12	Breakdown of reactor costs to be claimed in CPA 2	30
Table 13	Breakdown of tower steel and conductors costs to be claimed in CPA 2	30
Table 14	Land and easement cost summary	32
Table 15	Land and easement agreed and forecast compensation	33
Table 16	Other costs associated with land and easement acquisition	34
Table 17	Landholder disturbance costs	35
Table 18	Overhead costs associated with land and easement acquisition	36
Table 19	Original biodiversity offset forecast included in Transgrid's biodiversity offset delivery strategy	37
Table 20	Updated biodiversity offset costs estimate based upon payment into the BCF	38
Table 21	HumeLink biodiversity offset liability (Scenario 2)	39
Table 22	Forecast biodiversity offset costs	41
Table 23	Labour and indirect costs (\$Real 2022-23)	42
Table 24	Commercial labour and indirect costs	43
Table 25	Environmental offsets labour and indirect costs	44
Table 26	Community & stakeholder engagement labour and indirect costs	45
Table 27	Land and property labour and indirect costs	46
Table 28	Project controls labour and indirect costs	48
Table 29	Construction labour and indirect costs	49
Table 30	Design labour and indirect costs	50
Table 31	Health, safety and environmental labour and indirect costs	52
Table 32	Project management labour and indirect costs	53
Table 33	Program costs	53
Table 34	Indirect cost breakdown (\$Real 2022-23)	54
Table 35	Commercial indirect costs (\$Real 2022-23)	54
Table 36	Community and shareholder engagement indirect costs (\$Real 2022-23) >\$100K	55
Table 37	Environmental indirect costs (\$Real 2022-23)	56
Table 38	Recalculation of EIS application fee	56
Table 39	Project controls and management indirect costs (\$Real 2022-23) >\$100K	57
Table 40	Other construction cost provisioning greater than \$5M (\$Nominal)	61

Figure index

Figure 1	EY option modelling results PACR	3
Figure 2	HumeLink scope definition	7
Figure 3	Procurement evaluation and governance structure	10
Figure 4	Transgrid's risk process for HumeLink	15
Figure 5	Cost incentive payment structure	21
Figure 6	Program incentive payment structure	22
Figure 7	KRA incentive payment structure	23
Figure 8	AAACE cost estimation classification matrix for the process industries	26
Figure 9	HumeLink original route and Green Hills deviation	32
Figure 10	Commercial team FTE profile	44
Figure 11	Community and stakeholder engagement FTE profile	46
Figure 12	Land and property team FTE profile	47
Figure 13	Project control team FTE profile	48
Figure 14	Construction team FTE profile	50
Figure 15	Design team FTE profile	51
Figure 16	HSE team FTE profile	52
Figure 17	Program management indirect costs (\$Real 2022-23)	57
Figure 18	Transmission cost data base inputs / outputs	65
Figure 19	Standard estimate accuracy levels	68

Appendices

Appendix A	Other construction cost provisioning
Appendix B	Transmission cost database tool
Appendix C	Unit cost benchmarking methodology and assumptions

1. Introduction

1.1 Purpose of this report

The purpose of this report is to provide an independent assessment of the capital forecast to be included in Transgrid's CPA-2, which has been prepared for Transgrid to support their submission to the AER.

1.2 Scope and limitations

Transgrid has requested an Independent Verification and Assessment over the final (Stage 2) HumeLink CPA-2. This CPA-2 submission seeks cost recovery for the implementation costs, including construction costs of the project.

The HumeLink Independent Verification and Assessment:

- Provides independent assessment of the historical costs included in CPA-2
- Assesses the Basis of Preparation (BoP) used in forecasting detailed in Transgrid's Capex Forecasting Methodology used to support forecasting accuracy
- Assesses whether the costs and forecasts included in CPA-2 are prudent / efficient and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.

This report: has been prepared by GHD for Transgrid and may only be used and relied on by Transgrid for the purpose agreed between GHD and Transgrid as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Transgrid arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Background

The inaugural AEMO 2018 ISP discusses Group 2 developments in the medium term to enhance trade between regions, provide access to storage, and support extensive development of Renewable Energy Zones (REZ). This group included the Snowy Link investment to increase transfer capacity of the shared network between the Snowy Mountains generation areas and major NSW load centres.

Transgrid's HumeLink Project Specification Consultation Report⁴ (PSCR), published in June 2019, restates this driver as:

“The identified need for this RIT-T is to deliver a net market benefit by:

- *Increasing the transfer capacity and stability limits between the Snowy Mountains and major load centres of Sydney, Newcastle, and Wollongong,*
- *This will enable greater access to lower cost generation to meet demand in these major load centres; and*
- *Facilitate the development of renewable generation in high quality renewable resource areas in southern NSW, which will further lower the overall investment and dispatch costs in meeting NSW demand whilst also ensuring that emissions targets are met at the lowest overall cost to consumers”.*

The PSCR considered 12 network options to deliver the investment need consisting of four alternative topologies for greenfield developments across three voltage configurations:

Topologies considered:

- A 'direct' path between Maragle and Bannaby
- A path between Maragle and Bannaby via Wagga Wagga that would enable additional capacity for new renewable generation in southern NSW which may provide greater market benefits
- A wider footprint via Wagga Wagga, that would enable both direct and additional capacity for new renewable generation in southern NSW, which may provide greater market benefits
- A wider Maragle-Wagga-Bannaby footprint plus additional capacity between Bannaby and Sydney, to further relieve constraints on that portion of the network.

Voltages considered:

- Construction and operation at 330kV with high-capacity conductor
- Construction to 500kV and initial operation at 330kV, with the optionality to augment substation equipment in the future to operate to 500kV
- Construction and operation at 500kV.

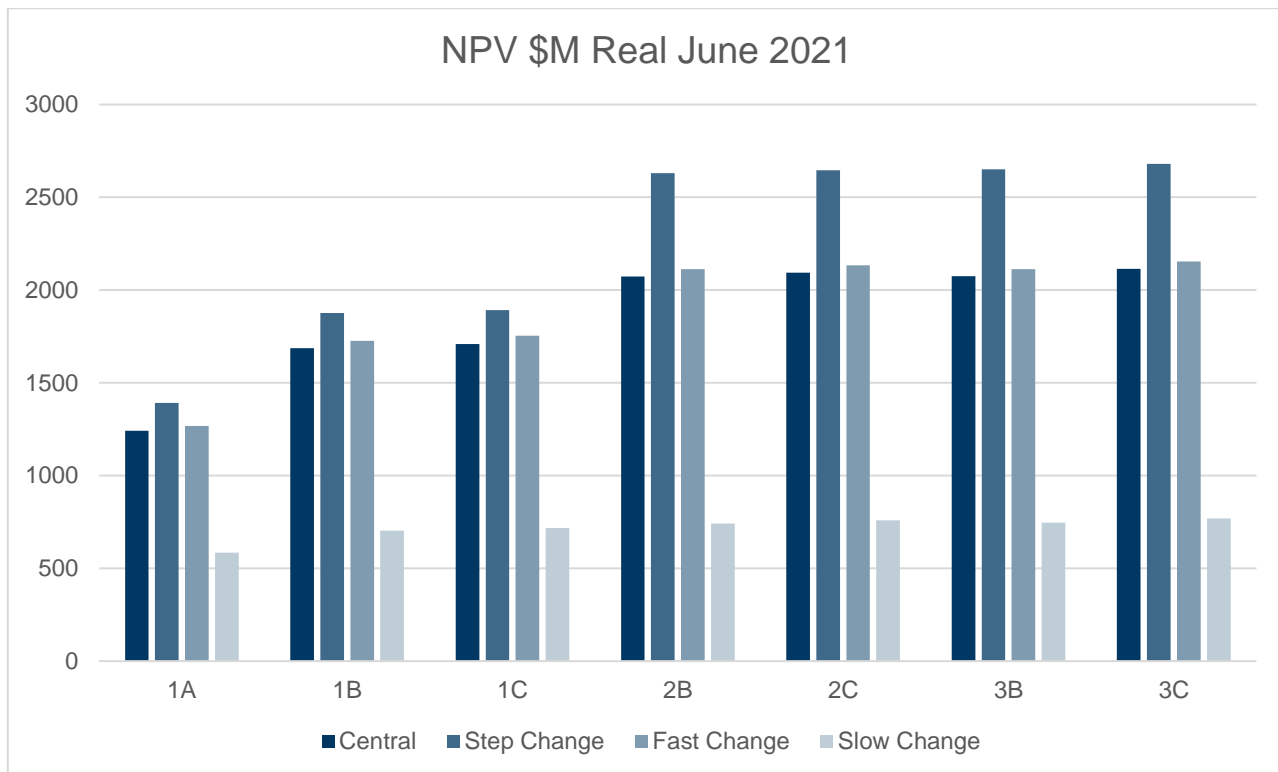
The PSCR also details options considered but not progressed including brownfield and high-voltage direct-current options. The PSCR sought submissions for feedback on the options considered.

⁴ https://www.transgrid.com.au/media/chvf0ahp/transgrid-pscr_reinforcing-nsw-southern-shared-network.pdf

Transgrid’s HumeLink Project Assessment Draft Report (PADR), published in 2020, found that the 500kV options going between Maragle and Bannaby via Wagga Wagga (i.e., Option 2C and Option 3C) provide the greatest net benefits of all options⁵. Option 3C was seen as the preferred option as it provides additional unquantified benefits over Option 2C on account of its topology involving more opportunity for route diversity. This conclusion was reached based upon market modelling performed by Ernst and Young (EY). The analysis includes that Option 3C provides the highest Net Present Value (NPV) using AEMO’s Central Case scenario, with Option 2C producing marginally higher NPV when considering the Step and Fast Change scenarios.

Transgrid published the HumeLink Project Assessment Conclusions Report (PACR) on 29 July 2021⁶ followed by the PACR Addendum on 17 December 2021⁷. Both documents identified Option 3C, comprised of new 500kV lines in an electrical ‘loop’ between Maragle, Wagga Wagga and Bannaby, as providing the greatest net benefit of all options considered, across all four scenarios investigated. The PACR considered seven options in total, supported by market modelling performed by EY. The results of the EY market modelling are provided below.

Figure 1 EY option modelling results PACR



Source: EY Reinforcing the NSW Southern Shared Network PACR Market Modelling Report 29 July 2020

The 2022 ISP notes:

“The identified need for this HumeLink project has not changed since the 2020 ISP or the Draft 2022 ISP:

⁵ <https://www.transgrid.com.au/media/xrzd0jv4/transgrid-hume-link-padr-amended.pdf>

⁶ <https://www.transgrid.com.au/media/rxancvmx/transgrid-humelink-pacr.pdf>

⁷ <https://www.transgrid.com.au/media/0ezampbw/humelink-rit-t-pacr-addendum.pdf>

To deliver a net market benefit by:

- Increasing the transfer capacity and stability limits between the Snowy Mountains and major load centres of Sydney, Newcastle, and Wollongong
- Enabling greater access to lower cost generation to meet demand in these major load centres; and
- Facilitating the development of renewable generation in high quality renewable resource areas in southern New South Wales, which will further lower the overall investment and dispatch costs in meeting New South Wales demand while also ensuring emissions targets are met at the lowest overall cost to consumers”⁸.

Transmission Network Service Providers (TNSPs) can progress contingent projects through the revenue determination process provided that certain trigger points are satisfied. These include the publication of the PACR and AEMO’s ISP classification as an “actionable project”.

The PACR indicates that Transgrid intends to submit two CPAs to the AER in relation to the regulatory cost recovery for the project. This Stage 2 CPA-2 will seek cost recovery for the implementation costs, including construction cost of the project.

AEMO’s Final 2022 Integrated System Plan (2022 ISP), has defined HumeLink as a staged actionable ISP project, without decision rules. The project stages and target timing identified in the 2022 ISP are⁹:

- Stage 1 – complete the early works by approximately 2024
- Stage 2 – deliver the Project by July 2026, subject to feedback loop confirmation by AEMO.

Transgrid’s CPA-2 details that AEMO intends to publish its feedback loop confirmation alongside its draft 2024 ISP in December 2023. AEMO’s draft 2024 ISP will consider the updated costs of HumeLink and all other major projects as well as the latest expected timing of wider developments in the NEM, including the revised delivery date for Snowy 2.0.

Transgrid submitted their initial CPA-1 in April 2022. CPA-1 sought \$321.9M¹⁰ (\$Real 2017-18) to recover costs to date (31 December 2021) and the cost of the works necessary to develop a robust cost estimate for the project based on the preferred option, the purchase of LLE, preconstruction works and land acquisitions. The AER published their determination in August 2022 approving the CPA-1 submission.

The capital forecast for HumeLink is represented by the sum of the CPA-1 and CPA-2 submissions.

⁸ <https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/2022-integrated-system-plan-isp.pdf?la=en>

⁹ AEMO, **2022 ISP**, June 2022, p. 67 and 68

¹⁰ The \$380.8M (\$Real 2022-23) is equivalent to \$321.9M (\$Real 2017-18) included in the AER’s decision.

3. Verification methodology

GHD Advisory has used several verification approaches to assess the accuracy of costs included in CPA-2 and supported by Transgrid's Capex Forecasting Methodology and to determine whether the expenditure is both prudent and efficient.

In considering the forecast, GHD relied upon a bottom-up assessment of forecast elements to determine the extent to which it is supported by appropriate evidence. This was followed by a supporting top-down assessment using the TCD model to determine whether the total forecast is within the acceptable ranges of accuracy provided by AACE's methodology.

The bottom-up approach considered the reliability of evidence used to support forecast elements and the approach applied depended on the nature of the cost element and included a combination of:

- Reliance on the results of Transgrid's competitive tendering processes supported by appropriate documentary evidence
- Reliance upon supporting contracts and purchase orders
- Reliance upon third party reports covering more complex estimates such as easement acquisition and biodiversity offsets which are based upon the best available information at the time the estimate was prepared. In these cases GHD considered the reasonableness of the underpinning assumptions used and whether or not the forecast was based upon the best available information at the time the estimate was prepared.
- Recalculation and validation against supporting evidence supplied by third parties. Including:
 - Verification of actual costs incurred and forecasted costs by reviewing supporting documentation on a selection basis to confirm the amount, period / scope covered and that the costs only relate to HumeLink
 - Verification of estimates based upon recalculation and verification of underlying assumptions to:
 - Regulatory charges where relevant
 - Cost estimates provided by third parties
 - Cost estimates which can be verified through benchmarking of cost elements included in the TCD model or other sources.
- Consideration of risk provisioning detailed in Section 8.1 to determine:
 - Alignment with the AER's guidance note on the regulation of actionable ISP projects¹¹
 - Alignment with retained risks under the ITC arrangement
 - Whether the associated cost estimates of the residual risk are efficient i.e., the consequential cost adjusted to reflect the likelihood of occurrence.
- Benchmarking – Where appropriate benchmarking references are available

¹¹ AER, [Guidance Note, Regulation of actionable ISP project](#), March 2021

- Whether internal labour costs can be considered prudent / efficient against the team structure, stream objectives, scheduled hours and position rates applied
- Comparison between the capex cost methodology, scope definition and cost forecasts supplied by Transgrid to ensure that cost forecasts accurately reflect the scope and the assumptions outlined in the Capex Forecasting Methodology

Across this bottom up approach, GHD has considered whether the:

- Costs are prudent and would be incurred by other TNSPs
- Costs relate to activities required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks to assess prudence and efficiency.

As a supporting assurance technique, GHD conducted a top-down assessment using the TCD model detailed in Appendix B. This assessment detailed in section 8.1.4 determines whether the total forecast falls within the accuracy limits expected from a TCD estimate based upon acceptable ranges of accuracy provided by AACE's methodology. Noting that Transgrid's estimate at a class 3 has a higher degree of accuracy.

This comparison has some limitations in that the TCD model is based upon past ISP projects that were delivered under EPC and D&C contracting models rather than ITC. HumeLink also has an accelerated schedule that would not be necessarily reflected in these past ISP projects and this requires higher risk provisioning.

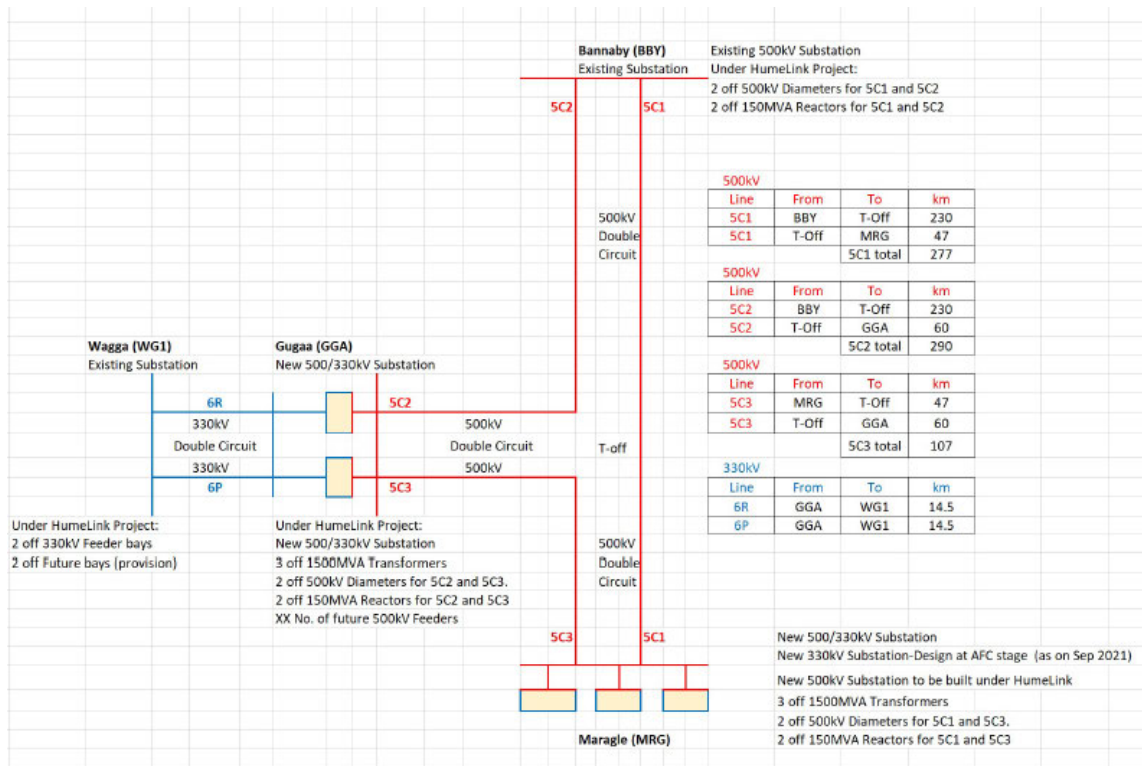
4. Scope definition

HumeLink is a proposed transmission network upgrade connecting the Greater Sydney Load Centre with the Snowy Mountains Hydroelectric Scheme and PEC in Southwest NSW. A high-level scope definition is presented in the figure below (HumeLink components shown in red).

The high-level scope includes:

- New Gugaa 500/330kV substation including two 500/330/33kV 1,500 MVA transformers
- New 500 kV Maragle switchyard adjacent to Snowy 2.0 Transmission Connection Project Maragle 330kV switching station to establish a combined Maragle 500/330kV
- Augment the existing Wagga Wagga 330kV and Bannaby 500kV substations to accommodate the additional transmission lines.
- Three 500kV transmission lines between:
 - Maragle and Bannaby 500kV substations (277 km)
 - Maragle and Gugaa 500kV substations (107 km)
 - Gugaa and Bannaby 500kV substations (290km)
- New double circuit 330 kV transmission line between Gugaa and Wagga Wagga 330kV substations (15km) Substation. This includes three 500/330/33kV 1,500 MVA transformers.

Figure 2 HumeLink scope definition¹²



5. Capex forecast

The HumeLink capex forecast is represented by combining the CPA-1 early works forecast and the CPA-2 forecast to complete the project. The CPA-2 forecast includes the following elements summarised in the table below:

- Delivery Partner costs (tendered design, substations, and transmission lines including access track works)
- Other construction costs which represent risk provisioning required under D&C ITC contracting arrangements
- LLE procured directly by Transgrid (based upon agreement with suppliers)
- Land and easement costs (based upon options agreements and an independent expert report from JLL)
- Biodiversity offsets (based upon a BODS prepared by Niche and peer reviewed by WSP)
- Transgrid labour and indirect costs – Bottom up build of Transgrid’s project team detailed in Section 12.

Table 2 HumeLink CPA-2 capital forecast (\$Real June 2023)

¹² RFQ Ref: No. HL-ENGG-RFQ-2 dated 11 January 2022, Transgrid

Forecast component	Section Reference	\$M
Delivery partner costs	Section 7	2,604.1
Other construction costs	Section 8	599.1
Long lead-time equipment	Section 9	29.6
Land and easements	Section 10	197.3
Biodiversity offsets	Section 11	437.5
Labour and indirect costs	Section 12	407.1
	Section 13	4.4
Total		4,279.1

6. Sourcing strategy and procurement

The traditional sourcing strategy for ISP projects has been based upon Engineer Procure Construct (EPC) or D&C lump sum projects arrangements. Under this approach contractors assume responsibility for defined risks with their tendered pricing including provisions for the risks transferred. Competitive tendering processes are relied upon to ensure that provisioning is market tested. In this environment the level of risk provision is not transparent.

The current infrastructure market is characterised as follows:

- The Infrastructure Australia 2022 Infrastructure Market Capacity report highlights several observable issues: unprecedented demand, insufficient market capacity, supply chain risks and increasing contractor insolvencies.
- Infrastructure Australia also observes that the contractor market in Australia is experiencing a ‘profitless boom’, with balance sheet risk and low margins posing a structural market risk¹³
- Inflationary pressures and supply chain disruption
- The Transgrid Direct Capex Forecasting Methodology also details contractor distress on recent traditional fixed price D&C lump sum projects which has shifted the risk appetite of the market including Snowy Hydro 2.0 and PEC.

Because of the above issues and the need to manage the delivery of a portfolio of major projects, capture the benefit from bundling procurement across major projects and deliver a complex project such as HumeLink, Transgrid have selected a D&C ITC contracting model.

Under ITC contracting, contractors are incentivised to achieve cost savings, enabling a lower capital outturn cost. This contracting model is common and is used in the State of Victoria to deliver High Value High Risk projects and collaborative contracting is often applied during times of high demand.

The ITC model involves the owner and the contractor sharing in the risk of cost overruns, or the benefit of savings, throughout the delivery of the project. This is often referred to as a pain-share / gain-share regime. The ITC model

¹³ Infrastructure Australia’s A National Study of Infrastructure Risk October 2021 P31

refocuses cost management from isolating individual risks and allocating them to one party, to managing and sharing risks on a whole of project basis. This is beneficial on complex projects where there are unquantifiable or uncontrollable risks such as materials cost inflation, inflation pressures on other costs, and skills shortages, many of which may never materialise or may materialise in an unexpected way and result in disproportionate cost impacts.

As outlined in Transgrid's Risk and Contingency Report, the ITC model seeks to achieve an appropriate allocation of fixed pricing, where there is high scope and cost certainty and reimbursable pricing with shared risk, where there is more uncertainty. This is expected to achieve an efficient overall capex cost in the interest of consumers but does require close project management by Transgrid.

The addition of incentive payments in the commercial model can result in an efficient and prudent contract price that aligns with the interests of consumers, as the Delivery Partners are incentivised to maximise collaboration and certainty through:

- Cost incentives through a gain-share/pain-share mechanism whereby the Delivery Partners and Transgrid share the gain of total lower costs (gain-share) or the risk of higher costs (pain-share) than the total target cost, with the Delivery Partner pain-share risk exposure capped at its margin fee (11% of the contract value).
- Program incentives for the delivery of the project in the shortest possible duration, and by the AEMO target completion date of July 2026.
- Incentive payments and abatements for the delivery of the project in a high-quality manner, and achieving KPIs in safety, community engagement and legacy, and by exhibiting transparent and collaborative behaviours.

ECI is an approach that Transgrid has applied to past ISP procurement activities. ECI is used to refine the design and approach to scope, work packages and commercial model based on contractor feedback and is critical to ITC contracting models in risk identification.

Transgrid has adopted a packaged approach to deliver HumeLink, which involves splitting HumeLink into two geographic packages of similar sizes delivered by two separate delivery contractors. As outlined in Transgrid's HumeLink Direct Capex Forecasting Methodology, this approach:

- Provides a more manageable scope for contractors, aligned with market sounding
- Allows for the selection of contractors with capabilities best suited to the varied works required for the overall project.

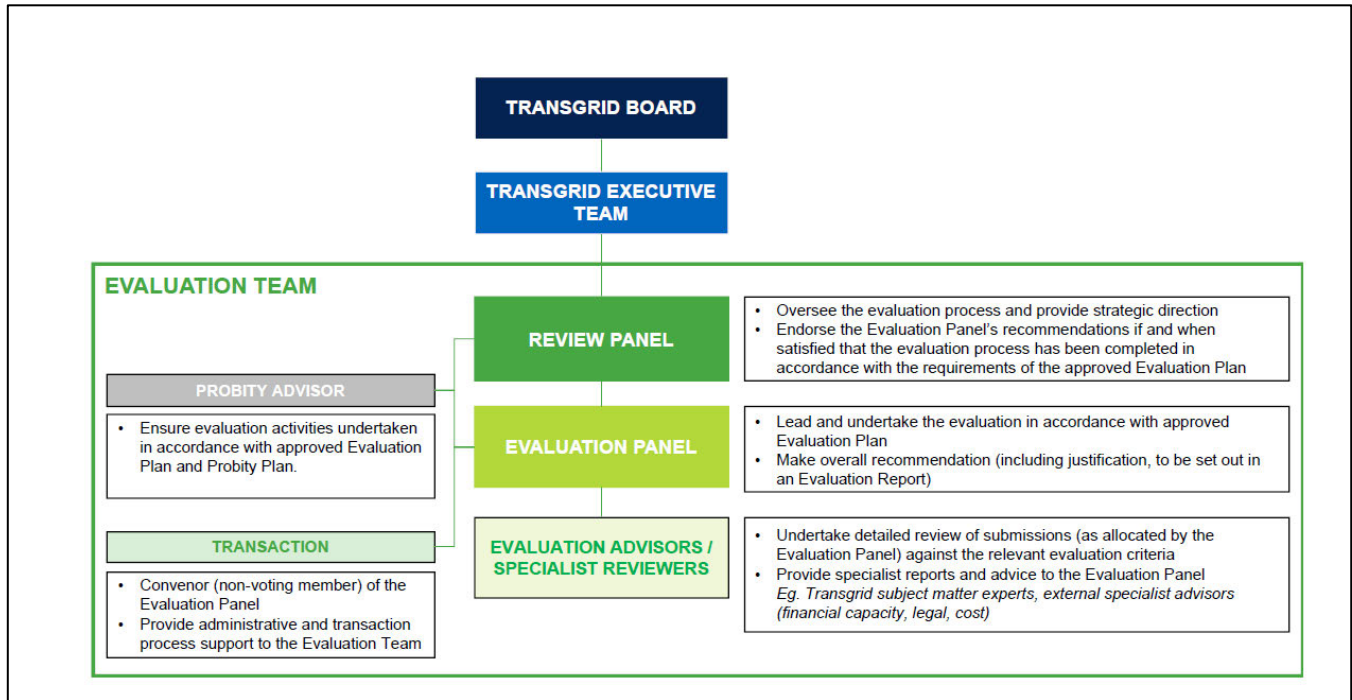
“The two contract packages are:

- HumeLink East: consists primarily of the transmission line works from the interface point to the eastern HumeLink terminus at Bannaby. This package spans a greater geographical area, with double the length of HV transmission lines (compared to West), while the substation works are relatively small (and predominately civil works rather than electrical works).
- HumeLink West: consists of the lines from the interface point south to the Snowy 2.0 connection at Maragle, and west to the HumeLink western terminus at Wagga Wagga. This package involves more substation works,

including interfaces at brownfield sites and construction of a new substation near Wagga Wagga, named Gugaa. The route involves more works within alpine regions, state forests and national parks¹⁴.

Across the procurement process Transgrid applied the following evaluation and governance structures.

Figure 3 Procurement evaluation and governance structure



Transgrid's procurement process involved a formal tender process structured in four phases:

- Phase 1 Market sounding from April 2022 to July 2022
- Phase 2 Expression of Interest (EOI) from August 2022 to October 2022
- Phase 3 ECI Stage 1 October 2022 to February 2023
- Phase 4 ECI Stage 2 March 2023 to August 2023

As indicated above, the ECI process was used to establish a collaborative contracting model where design, scope, risks, and opportunities were considered, and commercial and technical requirements optimised prior to the award of contracts.

The Transgrid's HumeLink Direct Capex Forecasting Methodology states that the EOI Stage 1 was used to narrow the three ECI Applicants to two parties based upon initial tender responses submitted in December 2022. ECI Stage 2 was used to determine the commitment of preferred ECI Tenderers to achieve the agreed outcomes for the HumeLink Project and program, optimise their offers for one construction package only – either the East or the West and to finalise delivery contracts.

¹⁴ Transgrid's HumeLink Direct Capex Forecasting Methodology

The Transgrid’s HumeLink Direct Capex Forecasting Methodology also outlines the collaborative procurement process in detail, which aligns with accepted industry practice.

7. Delivery Partner costs

Transgrid have adopted a D&C ITC contracting model splitting the project into two work packages. As advised by the Transgrid Direct Capex Forecasting Methodology, the contract has been structured as follows:

- Fixed costs (i.e., lump sum) relates to scope elements for which the cost certainty is relatively high. For HumeLink this relates to design, preliminaries, and substation works, which comprise approximately 42% of the Delivery Partner costs
- Reimbursable component relates to scope elements for which there is less cost certainty. For HumeLink, this relates to transmission lines, which comprises approximately 45% of the Delivery Partner costs. The reimbursable component includes agreed target cost with incentive arrangements to encourage collaborative behaviors to drive contractor and subcontractor performance and ensure the successful delivery of the Project. The incentive structure includes:
 - A cost incentive, known as a pain share/gain share mechanism whereby the contractor and Transgrid share the risk of total costs being lower (gain-share) or higher (pain-share) than the total target cost, with the contractor risk capped at its margin fee
 - A program incentive up to 2.5% of the total contract cost, payable where practical completion is achieved ahead of the target date
 - KRA incentives up to 1% of the total contract cost for achievement of key performance indicators in safety, retention of key personnel, and community/stakeholder outcomes
 - Standardised design, contract, and commercial structures to achieve efficiencies across the program that are internationally recognised and used in Australia.

The following table provides a summary of tender outcomes.

Table 3 HumeLink delivery partner costs (\$Real June 2023)

Forecast component	Section Reference	\$M
West Delivery Partner costs	Section 7.1	1,347.6
East Delivery Partner costs	Section 0	1,256.5
Total		2,604.1

7.1 West delivery partner costs

West Delivery Partner costs have been agreed to tender submission price schedules, subtracting the costs claimed in CPA-1, detailed in the table below.

Table 4 Tendered HumeLink West delivery partner costs (\$Real June 2023)

Forecast component	\$M
Tendered substations cost per submission price schedules	████
Less substation CPA-1 pre-construction development costs █████ (\$Real 2022-23) * West regional proportion █████	████
Preliminaries and design costs per submission price schedules	████
Provisional sums per submission price schedules	██
KRA incentives 1% of target cost	██
Pre agreed variation per submission price schedules	██
Substation total	████
Tendered transmission line cost per submission price schedules	████
Less transmission lines CPA-1 pre-construction development costs █████ (\$Real 2022-23) * West regional proportion █████	████
Less transmission lines CPA-1 tower prototype and design costs █████ (\$Real 2022-23) * West regional proportion █████	██
Less transmission lines CPA-1 Part 2 tower steel costs \$ █████ (\$Real 2022-23) * West regional proportion █████	████
Preliminaries and design costs per submission price schedules	████
Provisional sums per submission price schedules	██
KRA incentives 1% of target cost	██
Transmission lines total	████
IT cost per submission price schedules	██
IT total	██
Total west delivery partner costs	1,347.6

How this is structured under the contract is illustrated below.

Table 5 Tendered HumeLink West delivery partner costs by contract structure (\$Real June 2023)

D&C contract cost – West	Contract alignment	\$M	%
Target cost			
Transmission Lines	Reimbursable	████	41%
Substation Works	Fixed	████	46%
Preliminaries Fee	Fixed	████	
Design Fee	Fixed	██	
Margin fee	████ of target cost including margin	████	████

D&C contract cost – West	Contract alignment	\$M	%
Provisional Sums	Provisional	■	■
Total target cost		■	
KRA incentive			
1% of Target Cost		■	1%
Pre-agreed variations			
PAV4 ¹⁵ & PAV11A ¹⁶		■	■
Total		1,347.6	

Source: Transgrid HumeLink Direct Capex Forecasting Methodology

7.2 East delivery partner costs

East Delivery Partner costs have been agreed to tender submission price schedules, subtracting the costs claimed in CPA-1, detailed in the table below.

Table 6 Tendered HumeLink East delivery partner costs (\$Real June 2023)

Forecast component	\$M
Tendered substations cost per submission price schedules	■
Less substation CPA-1 pre-construction development costs ■ M (\$Real 2022-23) * East regional proportion ■	■
Preliminaries and design cost per submission price schedules	■
Provisional sums per submission price schedules	■
KRA incentives 1% of target cost	■
Substation total	■
Tendered transmission line cost per submission price schedules	■
Pre agreed variation 2 OSR2	■
Less transmission lines CPA-1 pre-construction development costs ■ M (\$Real 2022-23) * East regional proportion ■	■
Less transmission lines CPA-1 tower prototype and design costs ■ (\$Real 2022-23) * East regional proportion ■	■
Less transmission lines CPA-1 Part 2 tower steel costs \$ ■ (\$Real 2022-23) * East regional proportion ■	■
Preliminaries and design cost per submission price schedules	■
Provisional sums per submission price schedules	■
KRA incentives 1% of target cost	■
Transmission lines total	■
IT cost per submission price schedules	■

¹⁵ PAV4 is an approved variation for: Utilisation of IEC61850 Process Bus secondary systems at Gugaa Substation

¹⁶ PAV11A is an approved variation for: Installation of noise walls for reactor and transformer compounds – Gugaa Substation

Forecast component	\$M
IT total	█
Total East delivery partner costs	1,256.5

How this is structured under the contract is illustrated below.

Table 7 Tendered HumeLink East delivery partner costs by contract structure (\$Real June 2023)

D&C contract cost – East	Contract alignment	\$M	%
Target cost			
Transmission Lines	Reimbursable	█	50%
Substation Works	Fixed	█	37%
Preliminaries Fee	Fixed	█	
Design Fee	Fixed	█	
Margin fee	█ of target cost including margin	█	█
Provisional Sums	Provisional	█	█
Total target cost		█	
KRA incentive			
1% of Target Cost		█	1%
Pre-agreed variations			
OSR2 at Gadara Sub		█	
Total		1,256.5	

Source: Transgrid Humelink Direct Capex Forecasting Methodology

7.3 Delivery Partner costs conclusion

Delivery Partner costs are based upon tender submission price schedules under a contract that includes a lump sum of approximately 42% covering design, preliminaries, substations, and other scope elements for which the cost certainty is relatively high. 45% reimbursable relating to transmission lines.

Delivery Partner costs are supported by tender documentation (tender responses elements supplied by Transgrid prior to finalization of the contracts) when considering Delivery Partner costs. We have not sighted the full tender response information from the HumeLink East or West delivery partners. In considering the total cost we have also performed TCD benchmarking, with the results detailed in Section 8.1.4. This indicates that the total forecast is within acceptable ranges provided by AACE's methodology.

GHD Advisory considers that the contracting approach adopted, and capital forecast developed are prudent and efficient having regard to current market conditions, and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.

8. Other construction costs

Transgrid have selected a D&C ITC contracting model for the delivery for each contract package for HumeLink. The D&C ITC contract model seeks to reduce contractor risk and contingency premiums by a shared risk approach. This approach is generally advantageous where either the project scope is not well defined and/or the costs of materials and labour cannot be estimated with reasonable certainty, as this would otherwise result in higher risk premiums included in contractor costings.

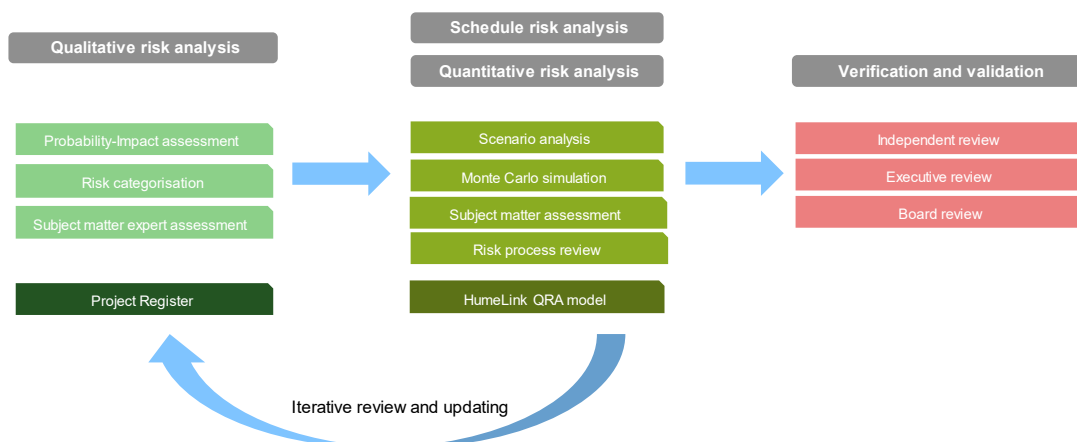
The Infrastructure Australia – Infrastructure Market Capacity 2022 Report highlights a high level of demand, inflationary pressures, and contractor distress, but specifically draws attention to poor productivity growth in the construction sector and the resulting demand for skilled labour. These macro issues are likely to see elevated cost and increased schedule risks. Whilst the ITC contracting model reduces the risk provisioning included within tendered prices, its success will require more active project management by Transgrid and control over variations.

The ITC commercial model seeks to achieve an appropriate allocation of fixed pricing, where there is high scope and cost certainty and reimbursable pricing with shared risk, where there is more uncertainty.

Forecast capex for risk costs associated with the delivery of HumeLink is \$599.1M. A breakdown of those risk elements greater than \$5M have been detailed [REDACTED]

As detailed in Transgrid’s HumeLink CPA-2 Risk Report, to identify and assess the risks to be costed, Transgrid have undertaken a series of risk workshops attended by internal and independent subject matter experts. A cumulative risk model was then developed with assistance from E3 Advisory, Fission and Broadleaf Capital, including risk assessment, cost analysis and impacts to project schedule. The figure below, extracted from the HumeLink CPA – 2 Risk Report summarises the process followed.

Figure 4 Transgrid’s risk process for HumeLink



8.1 Other construction cost verification

In considering the level of other construction costs, GHD Advisory has:

- Contract – Reviewed the proposed contract clauses to determine if the areas where risk provisioning takes place, rest with the Owner under the contract clauses
- Qualitative risk assessment - Considered each qualitative risk assessment element greater than \$5M for its prudence and efficiency
- Quantitative risk assessment – Considered the adequacy of the quantitative risk assessment performed
- Incentives – Considered the structure of the clauses relating to gain / pain sharing to determine its intended design effectiveness
- Performed project cost benchmarking using the TCD model to assess the accuracy of the total projects forecast, including risk provisioning, against the accuracy range that would be expected from AACE guidance.

8.1.1 Contractual allocation of risks

The contractual allocation of risks and their associated provisioning has been detailed [REDACTED] based upon the contract adjustment table provided by Transgrid. This analysis shows appropriate consideration of risks inherent and retained by Transgrid.

8.1.2 Risk assessment

The Department of Infrastructure and Regional Development, Australian Government provides guidance upon alliance contracting in their National Alliance Contracting Guidelines Guidance Note 5 Developing the Target Outturn Cost (TOC) in Alliance Contracting. Whilst the guidance relates to TOC it is still applicable to ITC contracting arrangements:

“The Owner should expect the Proponents to collectively share with it the management and consequence of all risks associated with the project and to do otherwise should be the exception rather than the rule. It is usually the case that not all information is available throughout the TOC process. This not only identifies issues for inclusion in the risk register but may encourage a ‘worst-case’ analysis of individual risks, e.g., worst case geotechnical conditions for the basis of design where limited information is available. By doing so, the risk is effectively not shared but is taken by the Owner through a conservative TOC. This is inconsistent with the principle of risk sharing and the definition of TOC, which is the most likely expected cost at completion¹⁷”.

As detailed in Transgrid’s HumeLink CPA-2 Risk Report, to identify and assess the risks to be costed, Transgrid have undertaken a series of risk workshops attended by internal and independent subject matter experts.

Whilst the actual detailed Monte Carlo model with the @risk level equations has not been sighted, the summarized input and output values have been sighted in the Transgrid Risk report. A spreadsheet with key assumptions and

¹⁷ National Alliance Contracting Guidelines Guidance Note 5 Developing the Target Outturn Cost in Alliance Contracting P36.

source likelihood and lower, most likely and upper-case values have been sighted and base assumptions have been noted from various workshops and interviews with associated personnel.

The guidance further recommends the use of qualitative and quantitative risk assessment methods including the use of Monte Carlo software simulations discussed below.

8.1.2.1 Qualitative risk assessment

Transgrid's qualitative risk assessment performed was based upon workshop outcomes drawing upon the following sources:

- Adjustment events as detailed in the contract
- The HumeLink project risk register
- Inherent risks typically associated with major projects.

Those risk provisions greater than \$5M have been considered [REDACTED]. In summary, by utilising this process and undertaking risk workshops Transgrid has considered the probability of events and has assessed consequences based upon a range from best-case to worst-case scenarios including the development of a deterministic point forecast.

Consequence calculations have been based upon a bottom-up build or have been based upon events that have occurred on other major projects such as Snowy 2.0 Connection Project and PEC. Some of the risks associated with EIS and other project approvals currently have a high probability and will either eventuate or fall away quickly (for example if the project approvals occur on time). These currently represent approximately [REDACTED] whilst other risk elements extend over the duration of the project.

The AER's guidance note on the regulation of actionable ISP projects states that it can accept a project risk allowance for a contingent project where¹⁸:

- Residual risks have been identified
- The associated cost estimates of the residual risk are efficient i.e., the consequential cost adjusted to reflect the likelihood of occurrence.

To inform its assessment, the AER requires a comprehensive and transparent explanation of how the risks have been identified and costed, including¹⁹:

- Risk identification, i.e., clearly identifying the risk events
- Risk cost assessment, i.e., estimating the potential cost impacts, the likelihood of occurrence, the consequential costs, and any mitigation/management strategies.

Throughout the Transgrid's HumeLink CPA-2 Risk Report and the Direct Capex Forecasting Methodology Transgrid has been transparent with respect to risk provisioning. Based upon the assessment GHD Advisory has performed detailed in Appendix A Transgrid has met these requirements.

¹⁸ AER, **Guidance Note, Regulation of actionable ISP project**, March 2021

¹⁹ AER, *Regulation of actionable ISP projects*, Guidance note, March 2021, p 17

Transgrid in their Direct Capex Forecasting Methodology has included a table of their top 25 risks, based upon the ITC contract structures detailed in Section 8.1.3 and time related risks. GHD Advisory has reproduced this here. Further details at a more granular level are provided in Appendix A.

Table 8 Top 25 risks (\$Real 2022-23)

Risk name	Description	Forecast capex (M)
Reimbursable		
ID47 – productivity	Lower productivity levels than planned and increased rework required in tower foundations and stringing for the Project. The Project is within a specialised sector where the current workforce is less experienced and amid skills shortage.	████
ID42 – Increase in Plant	Reimbursable plant and equipment costs above estimate for Transmission Line Works	████
ID57 – Tower Design Growth	Design refinement and growth of towers occurs during detailed design	████
ID40 – Increase in labour	Increase in Contractor reimbursable labour costs above EBA for Transmission Line Works	████
ID41 – Local Area Works	Additional Local Area Works during construction leads to increase in reimbursable costs. High construction road use could result in damage and repair requirements and issues in dealing with Councils and non-project contractors	████
Total reimbursable		57.11
Inherent		
71 – Uncertainty in the estimate of Owner’s non-labour costs for support, travel, legal, etc.	Owner’s non-labour costs that vary substantially depending on of events, time of year events occur, etc.	████
70 – Uncertainty in the estimate of Owner’s cost for labour and consultants	Uncertainty of the rates, numbers and employment ramp up and down rates.	████
72 – Uncertainty in the cost of OEM Transformers, reactors and conductor	Orders were placed for the transformers but not for reactors or conductors. Modifications to design may increase the costs of each unit and transportation costs may be incurred due to changed directions from Transgrid	████
74 – Uncertainty of final biodiversity offset cost	There are many variables in the Delivery Strategy and market that can vary the biodiversity offset cost substantially.	████
Total inherent risk		████
Variation		
ID68 – Delay Escalation	Contractor repricing arising from an employer driven delay to NTP2	████
ID13 – Inclement Weather	Claims for delay due to exceeding the inclement weather allowance in Contract plus disputes over what is inclement weather and what sites were impacted	████
ID65 – Tower Foundations	Increase in costs associated tower footings with Geotechnical conditions being substantially different from the conditions expected following investigation works leading to increased costs and adjustment event under the Delivery Contract	████
ID19 – Variations	Claims for variations due to changes in scope due to changes in design and construction manuals or Transgrid requirements	████
ID33 – Interface Contractor	Lack of coordination with Interface Contractors (OEM, East/West) resulting in design delays, construction delays, scope gaps, responsibility gaps and additional costs.	████

Risk name	Description	Forecast capex (M)
ID59 – Condition of Approval	Changes to Conditions of Approval from the baseline conditions are more onerous	████
ID22 – Fabricated Steel	Increase in supply cost for fabricated steel (Evaluated as an inherent risk with a range from possible cost reduction to cost increases)	████
Total variation risk		████
Total inherent and variation		245.30
Time		
ID2 – EIS Delay	Delay and cost claims from the Contractors due to delay in receiving planning approval	████
ID49 – Owner’s Cost	Transgrid Owner's Costs increase due to project duration extension. Note: contractor costs dealt with in specific risks.	████
ID5 – Site Access	Delays to and claims by the Contractor due to being unable to access the Site	████
ID35 – Reactor and Transformer Delays	Delays to Transgrid supplied reactors and transformers due to delayed overseas manufacturing and shipping timeframes	████
ID56 – Conductor Delay	Delays to Transgrid supplied conductor and OPGW from delayed overseas manufacturing and shipping timeframes	████
ID37 – Social License	Project loses support (social licence) that results in disruptions such as blockades, protests, legal challenges and other means of obstruction including councils	████
ID27 – Exceptional Events	Exceptional Events such as lockdowns, war, terrorism or natural disaster	████
ID6 – Reliance Info	Variation claims by Contractor due to changes in substation reliance information included in the Contract eg (General Arrangements, Single Line Diagrams, Existing assets, geotech substation sites UGL)	████
ID80 – Insolvency of a JV member	Insolvency of one of the JV members of the Delivery Partner	████
Total time risk		234.73
Total top 25 risks		537.15
Other 43 risks (Combined)	These remaining risks account for 10% of the contingency value.	61.93
Total Contingency		599.07

8.1.2.2 Quantitative risk assessment

Transgrid undertook a risk management process that conforms to the requirements of the Australian Standard AS/NZS ISO 31000:2009. They stochastically modelled the cost impact of treated risks and opportunities using Monte Carlo analysis along with the Hollmann approach, which uses database of projects and a questionnaire that places the current project in its database with empirical values of cost and schedule uncertainty.

The primary method they have used to combine the outcomes from the outcomes from the Trigen distribution is a Monte Carlo probability analysis. They have developed a cumulative cost risk model, ‘HumeLink QRA Register’, for the Project with assistance of E3 Advisory, Fission and Broadleaf Capital. This included:

- A qualitative analysis of each risk and inherent uncertainty
- A quantified cost risk analysis of both inherent cost uncertainty sourced from Fission and SMEs, and contingent risks sourced from our risk register; and
- An assessment of the Project's schedule delay risk, based on the schedule risk analysis developed by independent experts.

8.1.3 Structure of incentivised target cost clauses

As indicated in Section 7, the structure of the contract includes a lump sum for design, preliminaries, and substations, which comprise approximately 42% of the total Delivery Partners cost, and reimbursable and incentive components. The reimbursable component relating to transmission lines includes the agreed target cost with incentive arrangements.

According to Transgrid's Direct Capex Forecasting Methodology, the lump sum component of the target cost includes the following fees:

- Margin fee, which includes margins, overheads, corporate profit
- Preliminaries fee, which includes management and supervision staff, survey and personnel costs, site vehicles, establishment of site facilities, IT and communication systems, finance, management system and plans
- Design fee for all design works required complete all the Delivery Partner's design obligations including the independent verifier
- Substation works fee, which is the amount for the substation works and all related temporary works. This includes labour, construction plant and equipment, materials, consumables, commissioning spares and instruments.

The reimbursable cost estimate relates to:

- Transmission line works – this is the estimated cost for all labour, plant and equipment associated with access tracks, clearing, tower foundations, steel towers and stringing
- Provisional sum items -this is the estimate costs of unknown contamination, substation noise mitigation, architecture acoustic treatment works, post-practical completion support, unforeseen landholder costs, cultural heritage works, registered Aboriginal party costs, community options, local area works and insurance top ups.

The incentive regime is intended to adjust the value of payments made to and from the Delivery Partner according to whether:

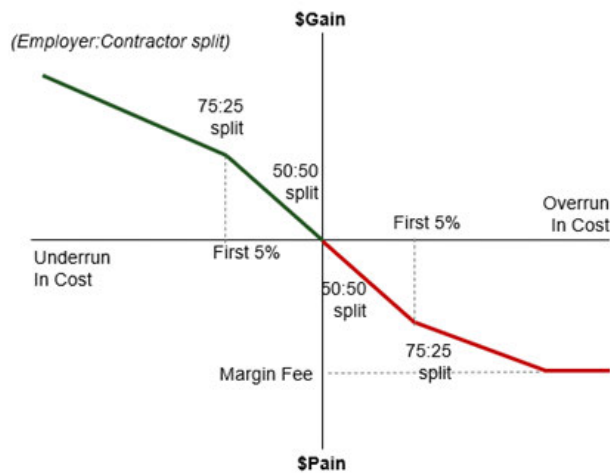
- The Actual Cost represents cost underruns or overruns against the Target Cost (Cost Incentive)
- The Date of Practical Completion occurs before or after the Target Date for Practical Completion (Program Incentive)
- The Works are completed in accordance with various safety, cultural, environmental, community and stakeholder engagement and other objectives (KRA Incentive).

Cost Incentive Payment

- Delivery Partners are incentivised to efficiently manage contractor and subcontractor performance of the reimbursable cost component within the allowance included in the initial target cost.
- The Delivery Partner is incentivised through a gain-share/pain-share mechanism whereby the Delivery Partner and Transgrid share the gain of total costs being lower (gain share) or the risk of higher costs (pain share) than the target cost.
- If the under/overrun is less than 5% of the target cost, it is split 50:50 between Transgrid and the Delivery Partner. If the under/overrun in cost exceeds 5% of the target cost, the split is 75:25 between Transgrid and the Delivery Partner. The Delivery Partners pain share risk exposure is capped at the margin fee (██████ the target cost). Therefore, any costs above ██████ over the target cost are born by the Delivery Partner.

This cost incentive payment structure is displayed graphically in the following figure.

Figure 5 Cost incentive payment structure²⁰

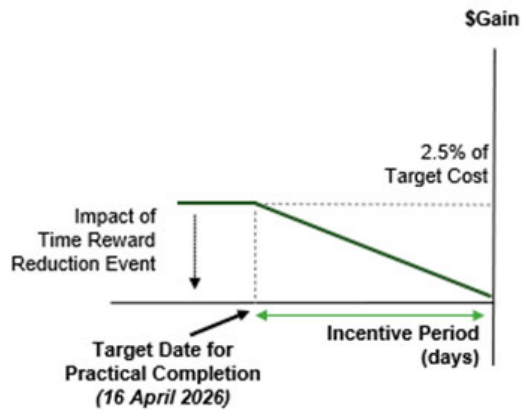


Program Incentive Payment

The program incentive is for the delivery of the project in the shortest possible duration, and by the AEMO target completion date of July 2026. The time reward percentage will be determined by the number of days early the project is delivered between July 2026 and the target date for practical completion of 16 April 2026. The maximum gain is capped at 2.5% of the target cost.

²⁰ Transgrid's Direct Capex Forecasting Methodology

Figure 6 Program incentive payment structure²¹



KRA Incentive Payment

The KRA incentive Payment is intended to reward the Delivery Partner's performance in outcomes in KRAs (other than cost and program), including to ensure high standards are maintained in these elements whilst achieving improvements in cost and program outcomes.

KRA reward amount of 1% of the target cost is for achieving KPIs in the areas of²²:

- KRA 1 – Community, Social License and Community Benefits (40% of KRA reward)
- KRA 2 – Workforce, Workforce Development and Industry Participation (40% of KRA reward)
- KRA 3 – Collaboration and culture (20% of KRA reward)

The Delivery Partner can incur a financial penalty of up to 1 per cent of the target cost for poor performance against the following KRAs²³:

- KRA 4 – Safety & Environment Lead Indicators (40% of KRA risk)
- KRA 5 – Retention of Key Personnel (40% of KRA risk)
- KRA 6 – Compliance with Open Book Basis (20% of KRA risk)

The KRA incentive payment structure is shown graphically in the following figure.

²¹ Transgrid's Direct Capex Forecasting Methodology

²² Transgrid's Direct Capex Forecasting Methodology

²³ Transgrid's Direct Capex Forecasting Methodology

Figure 7 KRA incentive payment structure²⁴



8.1.4 ITC project risk provisioning benchmarking

GHD Advisory has not been able to find benchmarking sources related to ITC risk provisioning. However, the TCD model does provide comparative cost benchmarking based upon past ISP projects that have been delivered under EPC contracts.

As discussed above EPC / D&C lump sum contractors include in their tendered prices provisioning for the risks they have taken on. Reliance is placed upon competitive tender processes to help ensure that these provisions are realistic. Collaborative models still include delivery partner risk provisioning for the risks that the ECI processes allocate based upon the delivery partners capabilities – best party to manage the risk. These are subject to competitive tender processes. Additional risk provisions are allowed for based upon the contractual and risk assessment processes detailed above. This component is subject to estimation rather than competitive tender.

From a high-level perspective, the systemic and project risks remain the same with collaborative contracting seeking to allocate the risk to the best party to manage it.

Given these circumstances GHD Advisory has used the TCD model to benchmark HumeLink's total forecasted cost. The TCD was developed by GHD Advisory in 2021 and updated by Mott MacDonald in 2023. The TCD is used by AEMO to estimate the cost of candidate future ISP projects at early stages of development, and to cross-check TNSP estimates of 'Actionable' and 'Preparatory Activity' projects and is publicly available on AEMO's web site.

The TCD generates Class 5/4 (early stage) project cost estimates in a deterministic fashion, compiling various cost components that make up the total cost. The TCD does this by assembling varieties of required asset building blocks from a comprehensive database to match the given scope of work and adjusts their costs to reflect project specific

²⁴ Transgrid's Direct Capex Forecasting Methodology

attributes and risk exposures based on user inputs. Class 4 estimates provide a L: -15% to -30% H: +20% to +50% range of accuracy²⁵.

The TCD model has some limitations:

- Biodiversity offsets – This is a forecasting area that has significant volatility. Rather than rely upon the TCD generate estimate the current CPA-2 estimate has been used.
- 500kV benchmarking sources – At the time the TCD model was built, limited benchmarking sources were available. However, to test the accuracy of the TCD estimate comparative estimates were run against the following estimates (AEMO has access to the confidential GHD report that includes the results of these comparisons):
 - Project 1 estimate consisted of 4 network elements, including station and overhead line categories, and voltage level from 220kV to 500kV. Both the unknown cost and scope risk factors were deemed to meet the criteria of Class 4 definition
 - Project 2 estimate consisted of 4 network elements, including station and overhead line categories, and voltage level from 220kV to 500kV. The unknown cost risk factors were deemed to meet the criteria of Class 3 definition and the unknown scope risk factor was deemed to meet the criteria of Class 5 definition
 - Project 3 estimate consisted of 5 network elements, including station and overhead line categories, and voltage level from 330kV to 500kV. Both the unknown cost and scope risk factors were deemed to meet the criteria of Class 3 definition
 - Project 4 estimate consisted of 3 network elements, including converter station and overhead HVDC line categories, at ±500kV. Both the unknown cost and scope risk factors were deemed to meet the criteria of Class 5 definition.

Scope and funding issues:

The VNI West project includes the cost of integrating the PEC 500kV enhancement with the Gugaa 500/330 kV Substation which is being built as part of HumeLink. Without these integration works, the PEC 500kV enhancement, and therefore VNI West, will not be connected to the wider transmission network. The integration works involve:

- Upgrading two 330kV transmission lines constructed by HumeLink to connect Gugaa and Wagga Wagga to 500 kV. This will connect the PEC 500kV enhancement, which finishes at Wagga Wagga, to Gugaa substation where it will interface with HumeLink.
- Expanding the size of Gugaa substation, allowing the connection of the two 500 kV transmission lines (the PEC upgrade) to Gugaa by adding:
 - Two new 500kV switchbays for the line connections and busbar sections

²⁵ AACE International Recommended Practice No. 18R-97

- A new 500kV transformer and associated switchbays

Given that the Gugaa substation upgrade costs are now included in VNI West, the TCD model excludes these upgrade costs.

Table 9 Transmission Cost Database (TCD) benchmarking

Benchmarking component	\$M
TCD generate forecast	
TCD forecast excluding biodiversity	3,256.8
Add biodiversity CPA-2 Estimate	437.5
TCD forecast including biodiversity	3,694.3
Transgrid forecast	
CPA-1 (\$Real 2022-23)	380.8
CPA-2 (\$Real 2022-23)	4,279.1
HumeLink capital forecast	4,659.9
Variance % - Transgrid estimate used as the base as it has a higher level of accuracy.	21%
TCD model assumptions:	
Scope based upon:	
<ul style="list-style-type: none"> - 2 winding Tx (3ph) 500/300kV 1500 MVA chosen for substation transformers. - Reactor 150MVAR - 4 x Orange DCST 6124 MVA conductor chosen for 500 kV overhead line. - Type 3 (4 x conductor/phase DCST) for 500 kV line diversion. - 2 x Olive DCST 2212 MVA 330 kV overhead line. 	
Key Project Attributes:	
<ul style="list-style-type: none"> - Contract delivery model – D&C contract (there is no ITC option) - location – regional - Wind loading zones – non-cyclone - Terrain – hilly/undulating - Delivery timetable – Optimum - Jurisdiction – NSW - Cultural Heritage – BAU - Geotechnical findings – BAU - Outage restrictions – BAU - Compulsory acquisition – High (for transmission lines) - Macroeconomic influence – Heightened uncertainty - Market Activity – Tight - Project Complexity – Highly complex 	

As indicated above the generates Class 5/4 (early stage) project cost estimate with according to the following has an expected accuracy range of L -15% to -30% H +20% to +50%. Compared to the Transgrid forecast that is a Class 3 with an expected accuracy range of L -10% to -20% H 10% to 30%.

Given that the TCD benchmarking is with the AACE expected accuracy range of +/- 50% (for a class 5b estimate) the difference of 21% is considered acceptable.

Figure 8 AACE cost estimation classification matrix for the process industries²⁶

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic			
	LEVEL OF PROJECT DEFINITION Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges [a]	PREPARATION EFFORT Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Notes: [a] The state of process technology and availability of applicable reference cost data affect the range marked. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.
 [b] If the range index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

8.2 Other construction cost conclusion

HumeLink is a large-scale transmission project that scheduled to be delivered in a timeframe where the infrastructure sectors are subject to high demand, skilled labour shortages, low productivity growth, inflationary pressures, and elevated risk of contractor insolvency. The project itself has been controversial, crosses a high volume of impacted properties, will experience difficult terrain, and has several internal and external interfaces and complexities that will contribute to the inherent risk of the project.

During the ECI process it became evident that the D&C contractors were not willing to accept D&C lump sum contracting arrangements and an ITC contracting methodology evolved as a model better suited to current market

²⁶ AACE 18R-97 Cost Estimate Classification Systems As Applied in Engineering, Procurement and Construction For The Process Industries Page 2

conditions and the project's complexities. The D&C ITC contract model seeks to reduce contractor risk and contingency premiums by a shared risk approach. This approach is generally advantageous where either the project scope is not well defined and/or the costs of materials and labour cannot be estimated with reasonable certainty, as this would otherwise result in higher risk premiums included in contractor costings.

Whilst the ITC contracting model reduces the risk provisioning included within tendered prices, it requires higher risk provisioning, and its success will require more active project management by Transgrid and control over variations.

Delivery contracts have been structured on lump sum, reimbursable and incentive arrangements based upon the projects risk exposures. Lump sums cover design, preliminaries, substations, and other scope elements for which the cost certainty is relatively high. Reimbursable components relate to the transmission line works and other provisional costs that are subject to risk provisioning. The incentive regime is intended to adjust the value of payments made to and from the Delivery Partner according to whether:

- The Actual Cost represents cost underruns or overruns against the Target Cost (Cost Incentive)
- The Date of Practical Completion occurs before or after the Target Date for Practical Completion (Program Incentive)
- The Works are completed in accordance with various safety, cultural, environmental, community and stakeholder engagement and other objectives (KRA Incentive).

Based upon these contractual arrangements Transgrid has developed risk provisions through a process detailed in Section 8.1.2.1. The AER's guidance note on the regulation of actionable ISP projects states that it can accept a project risk allowance for a contingent project where²⁷:

- Residual risks have been identified
- The associated cost estimates of the residual risk are efficient i.e., the consequential cost adjusted to reflect the likelihood of occurrence.

To inform its assessment, the AER requires a comprehensive and transparent explanation of how the risks have been identified and costed, including²⁸:

- Risk identification, i.e., clearly identifying the risk events
- Risk cost assessment, i.e., estimating the potential cost impacts, the likelihood of occurrence, the consequential costs, and any mitigation/management strategies.

Transgrid has been transparent with respect to risk provisioning in their HumeLink CPA-2 Risk Report and the Direct Capex Forecasting Methodology. Based upon GHD Advisory's assessment detailed in Appendix A Transgrid has met these requirements.

²⁷ AER, **Guidance Note, Regulation of actionable ISP project**, March 2021

²⁸ AER, *Regulation of actionable ISP projects*, Guidance note, March 2021, p 17

To further test the level of risk provisioning included in the capital forecast, GHD Advisory has used the TCD to benchmark the total forecast. This analysis indicates that the forecast is 21% higher than the TCD forecast, within the level of AACE expected accuracy range for this stage of the project.

These risk provisions are required under the contracting model and their inclusion in the forecast is considered prudent and efficient to progress the projects delivery under current market conditions.

9. Long lead time equipment

The following table provides a summary of the LLE equipment forecast less than the amount previously claimed in CPA-1. LLE can take 12-18 months before delivery and delays can pose schedule and cost risks which is why it is directly procured by Transgrid.

The equipment and quantities are as follows:

- 6 x 500kV shunt reactors
- 16 x 500kV single phase power transformers
- 378 kms of aluminum conductors

Table 10 Summary of CPA-2 long lead time equipment forecast (\$Real 2022-23)

Forecast component	Section Reference	\$M
Transformers	Section 9.1	█
Reactors	Section 9.2	█
Steel towers and conductors	Section 9.3	█
Total		29.6

To help mitigate inflationary pressure and supply chain disruption Transgrid has worked with the Commonwealth Government to establish a programmatic approach to:

- Accelerate the delivery of transmission infrastructure
- Drive down costs through economies of scale and scope
- Improve certainty of deliverability in a highly constrained labour and equipment supply chain market.

This is known as the Powering Tomorrow Together Program (PTTP), which involves the integrated delivery of PEC, HumeLink and VNI West. This has involved:

- In February 2023, Transgrid entered into agreements with suppliers to purchase transformers and reactors
- In August 2023, Transgrid expect to execute an agreement with the preferred supplier for conductors
- Progressing similar procurement activities for tower steel.

9.1 Transformers

To minimise the risk of project delays due to late delivery of key construction elements Transgrid has placed orders for 16 500kV single phase transformers for [REDACTED]. GHD Advisory has sighted an extract of the contract from the manufacturer for this order²⁹.

Table 11 Breakdown of transformer costs to be claimed in CPA 2 (\$Real 2022-23)

Transformer cost estimate basis	\$M
Contract for 500kV transformers	[REDACTED]
Amount included in CPA1	[REDACTED]
HV testing [REDACTED] per transformer	[REDACTED]
Mobilisation costs [REDACTED] per transformer	[REDACTED]
Storage costs [REDACTED] per transformer	[REDACTED]
Total for CPA2	[REDACTED]

During the CPA1 submission Transgrid included an estimate for transformers for [REDACTED] based upon a high-level estimates of equipment costs from their MTWO data base as well as actual costs based on equivalent orders placed for PEC and Queensland NSW Interconnect. As this component has already been funded it needs to be excluded from the final submission.

Mobilisation (transport) costs of [REDACTED] are already included in the manufacture's contract price as sighted by GHD Advisory³⁰. It is expected that the transformers will need to be stored initially and moved a second time to site. Transgrid has used the current contract pricing includes a provision for storage and relocation.

The manufacturer's contract includes storage costs should there be delays. Based upon the contract clause the cost is estimated to be [REDACTED] per transformer assuming a [REDACTED]-week storage period³¹.

9.2 Reactors

The following reactors³² is required for the substations works:

- Bannaby Substation:
 - Two 500kV 181MVar line shunt reactors
- Maragle Substation:
 - Two 500kV 181MVar line shunt reactors

²⁹ Transgrid – Humelink – CPA2 – Direct Non-Labour Model – CONFIDENTIAL.xlsb

³⁰ Transgrid – Humelink – CPA2 – Direct Non-Labour Model – CONFIDENTIAL.xlsb

³¹ Transgrid – Humelink – CPA2 – Direct Non-Labour Model – CONFIDENTIAL.xlsb

³² BOE OFS-1901-3C-2 Snowy 2 Transmission Investment, Transgrid, page 26.

- Gugaa substation:
 - Two 500kV 181MVA line shunt reactors (plus 1 spare)

Table 12 Breakdown of reactor costs to be claimed in CPA 2

Reactor cost estimate basis	\$M
Transgrid Purchase Order (PO) for reactors – GHD sighted PO	█
Provisional sums	█
Freight	█
Reactor relation costs Transgrid internal estimate at █ per reactor	█
HV testing █ per reactor	█
Mobilisation costs █ per reactor	█
Storage costs █ per reactor	█
Less CPA-1 costs	█
Total for CPA2	█

Transport and storage cost have been estimated using the same methodology as used for transformers.

9.3 Steel towers and conductors

Conductor prices based on Transgrid SME advice based upon rates from a likely supplier:

- Lemon conductor
 - EXW - █/km @ 331 km = █
 - Transport – 20 trucks @ █ per truck = █
 - **Total = █**
- Earthwire
 - EXW - █/km @ 47 km = █
 - Transport – 4 containers @ █ per container = █
 - **Total = █**

Laydown facilities (storage) costs based on a recent quote.

- █ per drum per week @ 3,579 drums for █ weeks = █
- 20% Risk provision = █
- **Total = █**

Table 13 Breakdown of tower steel and conductors costs to be claimed in CPA 2

Steel towers and conductor cost estimate basis	\$M
Lemon ACSR/GZ Conductor	█
Earthwire SC/AC – 19/4.25 Conductor	█
Laydown facilities (storage)	█
Total	█

9.4 Long lead time equipment conclusion

LLE costs are based upon a combination of purchase orders placed with transformer and reactor suppliers less the amount claimed in CPA-1. This represents approximately [REDACTED] of LLE total costs and include the procurement leverage obtained from the Powering Tomorrow Together Program (PTTP) that aggregates spend across Transgrid's major projects. The remaining elements are internal Transgrid estimation which in some cases are based upon quotes or rates from third parties.

The purchase of LLE and the associated forecast are required to progress project completion and are considered prudent and efficient.

10. Land and easement

HumeLink requires the purchase of additional land at the Gugaa substation and the acquisition of easements along the route detailed conceptually in the figure below. As part of the early works activities claimed in CPA-1, Transgrid has commenced activities to secure land and easements, focused on valuations and undertaking the negotiation of option agreements with impacted private landholders and acquiring land for the Gugaa substation.

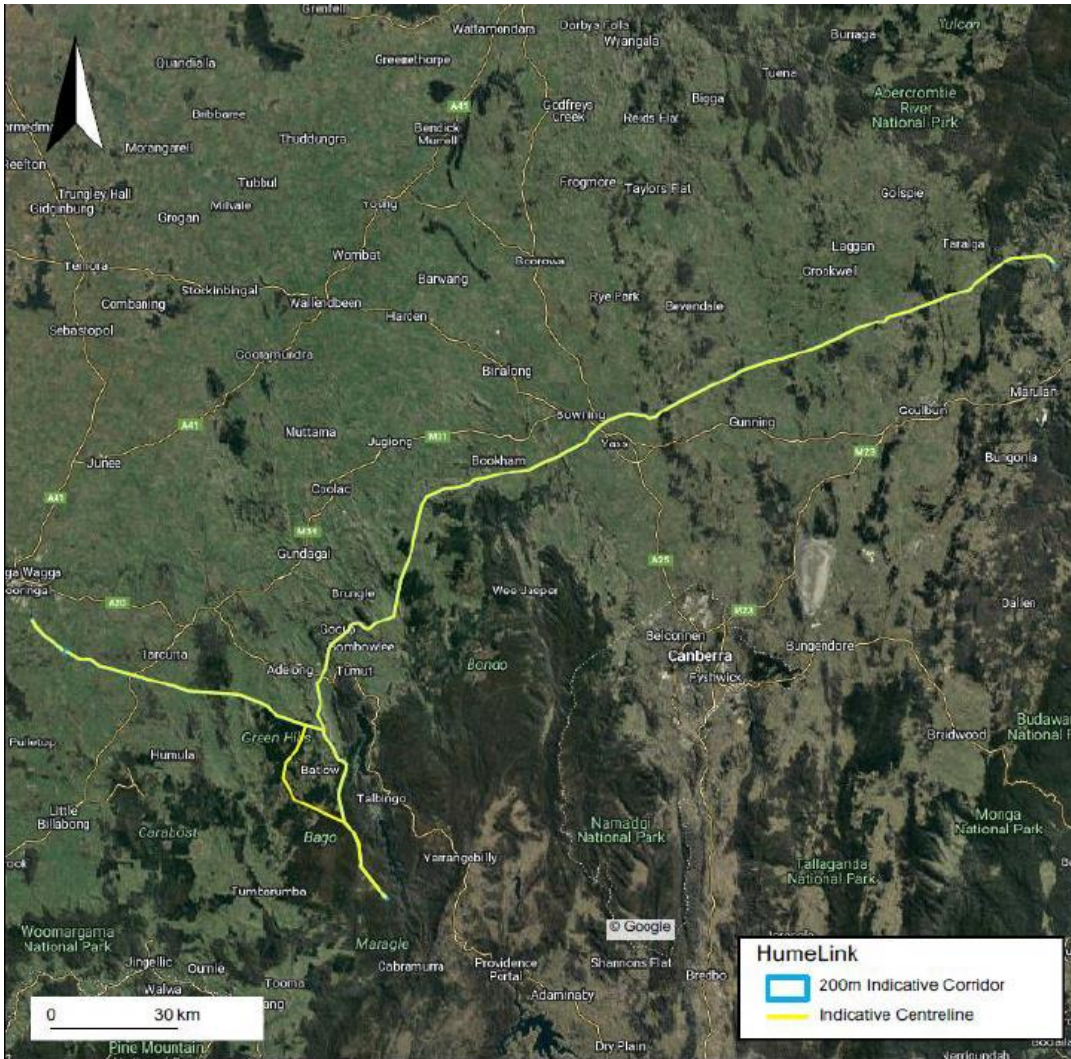
The route upon which the forecast developed by JLL is detailed in the following figure. Transgrid's Direct Capex Forecasting Methodology indicates that the Green Hills State Forest (Green Hill deviation), was chosen through the route selection process that concluded in August 2023. This route was selected after consultation with landowners and Forestry Corporation NSW and uses public land where possible.

Based on this route alignment, there are 270 private landholdings and 50 government landholdings, owned by government agencies and local authorities.

The Stage 2 forecast capex includes:

- Compensation for acquiring easements for public and private landholdings
- Stamp duty on land and easement acquisition costs
- Compensation for timber plantations
- Substitute forestry land
- Disturbance costs
- Construction camps and laydown area lease and rehabilitation costs
- Statutory fees, valuations, and legal costs.

Figure 9 HumeLink original route and Green Hills deviation



Source: JLL independent expert report from Jones Lang LaSalle

The table below summarises the land and easement forecast to be included in CPA-2 which has been based upon an independent expert report from valuers JLL, the HumeLink CPA-2 Land & Easement Cost Estimates for Project Implementation dated 4 August 2023.

Table 14 Land and easement cost summary

Forecast component	Section Reference	\$M
Land and easement compensation	Section 10.1	156.4
Other costs	Section 10.2	30.7
Overhead costs	Section 10.3	10.2
Total		197.3

10.1 Land and easement compensation

Based upon the Green Hill Route there are a total of 320 land holdings comprising 270 private land holdings and 50 government land holdings requiring the acquisition of a 70-meter-wide easement to accommodate the 500kV transmission line. These forecasted costs and the final in-principal agreement for the Gugaa substation land acquisition are summarised in the table below.

Table 15 Land and easement agreed and forecast compensation

Forecast element	\$M
Agreed compensation	████
Private landholders forecast compensation	████
Government landholders forecast compensation	████
Total	156.4

Based upon the updated information provided in JLL's report, as of June 2023 Transgrid has:

- Agreed compensation for 111 (41%) agreements for the Green Hills deviation
- Not agreed (in negotiation) 150 (55.6%) for the Green Hills deviation
- Early engagement: where an offer is yet to be made is 9 (3.3%) of private landholdings for the Green Hills deviation
- Valuations for public landholdings are yet to be completed

Agreed compensation

Based upon the JLL report, agreed compensation has been reached with 111 landholders for █████.

Private landholder forecast compensation

Forecast compensation in the JLL report for the Green Hill route is estimated at █████ for 150 private landholders, with whom agreement is yet to be obtained.

JLL advise that compensation paid for land and easement acquisition generally exceeds desktop and on-site valuations, resulting in a premium being paid for several reasons, including:

- Difference between desktop and site valuations
- Alignment changes or voluntary purchase of entire properties
- Commercial decisions influence the compensation paid i.e.
 - Counteroffer is marginally above the maximum negotiation threshold and less than the cost of compulsory acquisition.
 - The acquisition is project time critical, a higher amount is paid, considering consequential costs of delay to financial close and/or commencement of construction.
- Consideration of the long-term landholder relationship during construction, operation and maintenance

JLL has assessed landholder sentiment for reaching agreement in three categories, as, Likely, Possible and Unlikely, adopting a moderated sentiment premium of the three categories, and considering PEC data and HumeLink landholder negotiations to date.

Government / Public landholdings

The JLL report provides an estimate of ██████ for the 50 government landholdings. based on indicative compensation estimates for Government land prepared by Tran grid. Forest land estimates have been replaced by valuations prepared by Transgrid’s specialist forestry consultant, Indoor. Valuations for non-forest Government landholdings, yet to be completed, will provide a more reliable estimate for the non-forest Government landholdings.

10.2 Other costs

Other costs associated with land and easement acquisition are detailed in the following table and include:

- Stamp duty
- Timber clearing costs
- Substitute forest land costs
- Disturbance costs
- Construction camps & laydown areas

Table 16 Other costs associated with land and easement acquisition

Forecast element	\$M
Stamp duty	6.3
Timber	████
Substitute forest	██████
Disturbance cost	9.0
Construction camps & laydown areas	3.0
Total	30.7

Stamp Duty

JLL has estimated stamp duty costs based on agreed and forecast compensation using NSW Government 2023 rates at \$6.3M.

Timber

Cost estimates for the value of timber cleared provided by Transgrid’s specialist forestry consultant as detailed in the JLL report is ██████M.

Substitute forest

JLL’s report indicates that forest land and timber costs are based on estimates from Transgrid’s specialist forestry consultant. JLL notes that they have been instructed to provide for the possible requirement for substitute forest land used for renewable energy infrastructure to have an area at least twice as large as the area used for construction and operation, be of similar locational advantage to timber processors, have the same or greater productivity and average

annual rainfall in accordance with S59 Forestry Act 2012 (NSW). Additional provisions for substitute forest land of [REDACTED] have been made based on Transgrid’s specialist forestry consultant’s estimates for forest land to meet the possible legal requirement to provide an area at least twice as large as the area used for transmission infrastructure.

Disturbance costs

JLL’s report along with the Transgrid Direct Capex Forecasting Methodology, as of June 2023 forecast a cost of \$9.0M for disturbance summarised in the table below:

Table 17 Landholder disturbance costs

Disturbance type	\$M
Permanent disturbance – private and government/public land	[REDACTED]
Temporary disturbance – private land	[REDACTED]
Total	9.0

Permanent disturbance refers to disturbances and inconvenience caused by the easement acquisition, involving the time and effort required by landholders to review project documents, consider offers of compensation, engage valuers and lawyers, and meet and consult with acquiring authority representatives. JLL have allocated [REDACTED] per private landholding and [REDACTED] per government / public land landholding.

Temporary disturbance refers to as “construction disturbance” relating to farm management and productivity losses during the construction and rehabilitation period. JLL have assessed this compensation cost based on a lease of the disturbed land for 2 years @ [REDACTED]% of the market value of the land, not including the transmission line easement compensation.

Construction camps and laydown areas

Construction camp and laydown area cost estimates prepared by Transgrid and reviewed by JLL, using JLL precedent licence and lease information from recent linear projects in NSW, for a 2 + 1 year period for \$3.0M.

JLL confirmed that the estimate falls within the typical range, noting costs are dependent on size, location, utility, land use, term, and rehabilitation requirements.

10.3 Overhead costs

Forecast statutory fees, valuations, and legal costs have been estimated by JLL at \$10.2M

The JLL report together with the Transgrid Direct Capex Forecasting Methodology, as of June 2023 indicates the following: Based on a recent matter on the PEC project, where a landholder has disputed the valuation determined by the Valuer General for compulsory acquisition of the easement, as permitted under the Land Acquisition (Just Terms Compensation Act 1991 (NSW), the landholder has lodged an appeal in the Land & Environment Court. In such cases, the landholders’ costs together with the acquiring authority’s costs are paid by the acquiring authority. which are approximately [REDACTED] for each party, totaling [REDACTED] for the case. This precedent is being used as the basis for estimating the risk of compulsory acquisitions ending up in the Land and Environment Court.

Recent data from the Transgrid Direct Capex Forecasting Methodology, as of June 2023, anticipates 110 compulsory acquisitions will be required, with 60 of these requiring a valuation by the Valuer General at [REDACTED] each, where agreement is not reached during the compulsory acquisition notice period.

Table 18 Overhead costs associated with land and easement acquisition

Cost item	Number	Rate	\$M
Valuer General Fees	60	[REDACTED]	[REDACTED]
Risk of Court action	14	[REDACTED]	[REDACTED]
Total			10.2

10.4 Land and easement conclusion

The forecast of \$197.3M for the land and easement acquisition component of the assessment is based on the JLL HumeLink CPA-2, Land & Easement Cost Estimates for Project Implementation, dated 4 August 2023 and the Transgrid Direct Capex Forecasting Methodology, as at June 2023, based on the Green Hills alignment as the preferred alignment.

JLL report considers the approved budget and status of the CPA-1 activities and sets out how the total cost of land and easement acquisition for CPA2 has been calculated.

Transgrid is seeking to recover the HumeLink CPA-2 land and easement implementation costs which include:

- Compensation for acquiring easements over public/government and private landholdings.
- Stamp duty on land and easement acquisition costs.
- Compensation for timber plantation clearing.
- Substitute forestry land.
- Disturbance costs
- Construction camps and laydown areas lease and rehabilitation costs.
- Statutory fees valuation and legal costs.

The Transgrid Capex forecast provides the estimates for the easements over public/government land and the lease of land for construction camps and laydown areas.

JLL have adopted a sentiment based approach to assess the likely premium to be paid above the compensation assessed by the Transgrid valuer. The premium used for the CPA-2 assessment has been determined using evidence from the PEC project and HumeLink negotiations to date.

In determining the likely premium, JLL have considered and allowed for the differing views of registered valuers engaged by landholders, compared to Transgrid’s appointed valuer, particularly regarding the effect of construction and operation of the transmission line on the whole landholding’, categorised as “injurious affection” under section 55 (f) of the Land Acquisition (Just Terms Compensation) Act (NSW).

Land and easement activities and the associated forecast are required to progress project completion and are considered prudent and efficient.

11. Biodiversity offsets

The biodiversity offset estimate is based on the work performed by Niche in the development of the BDAR and Transgrid's BODS. This estimate summarised below was based upon payments to the BCF.

Table 19 Original biodiversity offset forecast included in Transgrid's biodiversity offset delivery strategy

Cost components for payment into BCF	\$M
Total species credit cost BCT estimate (base credit price)	520.1
Total ecosystem credit BCT estimate (base credit price)	65.9
Addition of risk premium (11.1%) current standard	65.0
Addition of delivery fee (10.5%) average of quotes to date	61.5
Total	712.6
Addition of contingency from key risks (add 16%)	826.6

Source: Transgrid Capex Forecasting Methodology

As advised by the Transgrid Capex Forecasting Methodology, Transgrid three main approaches by which credit liabilities can be satisfied or “acquitted”. In order of most to least expensive, these are:

- Paying directly into the BCF, noting payment into the fund at the nominated Biodiversity Conservation Trust (BCT) rate
- Purchasing existing credits from the biodiversity credit register or via the Biodiversity Credits Supply Fund and Taskforce. These are subject to market availability and can be more expensive than establishing Biodiversity Stewardship Sites (BSS)s.
- Establishing BSSs on lands with like-for-like biodiversity values to those impacted by the project, noting these can take several years to identify, assess, seek approval for and establish.

Since the soft lodgement of the BDAR Niche has updated their forecasting assumptions as follows:

- “A 6% reduction in credit liabilities resulting from adopting the Greenhills route alignment (NB - not assessed in the current BDAR; will be assessed in the revised BDAR for the 2024 EIS Amendment Report)
- A 20% increase in credit liabilities (and associated costs) due to additional clearing impacts beyond those assessed in the BDAR, resulting from the need to accommodate additional access tracks, compounds and expansion of Hazard Tree Zones into Easement Clearance Zones,
- A 16% contingency for events that could increase our credit liabilities, or the cost of meeting credit liabilities including:
 - 6 per cent increase for credit prices increasing after EIS submission, comprising:

- 3 per cent increase for the removal of any price caps on credits that were >\$5,000/credit within the BOPC prior to its removal. These credits have been capped at a 20 per cent increase until October 2023. The 3 per cent assumes 50 per cent increase for the 6 per cent of credits affected by the cap. The 50 per cent increase is based on average observed increases in credit costs for PCTs that were not limited by the cap
- 3 per cent increase to allows for some credits to fluctuate in price based on updated data used by the BCT in their credit pricing models. A select number of species may experience changes in their categorisation or weighting values which are variables that feed into the pricing model used by the BCT. The percentage increase reflects Niche’s knowledge of the proportion of species likely to be impacted by change of categorisation and weighting within a relatively short time period of 6 months.
- 10 per cent increase to address the BCD not accepting our approach to count species and indirect impacts. The 10 per cent reflects a
 - 6 per cent of the current offset requirement being attributable to count plant species for which credit calculation methods are identified as particularly subjective.
 - recognition that there may some requirement to provide additional credits, including or predominantly ecosystem credits, based on indirect impacts from the project.

Niche has based the 10 per cent increase on its previous experience, noting that these impacts are difficult to quantify³³.

Niche have also developed two estimate scenarios:

- **Scenario 1** – an upper estimate for biodiversity offset costs of \$582.7M, which assumes that we acquit of all credit liabilities through payment into the BCF. This scenario also includes a contingency of 16% which is considered prudent and efficient
- **Scenario 2** – a lower estimate of \$428.42 million, which assumes successful implementation of the key Biodiversity Offset Delivery Strategy (BODS) initiatives

11.1 Updated biodiversity offset costs estimate based upon payment into the BCF (Scenario 1)

Based upon the updated assumptions, Niche now forecasts that the biodiversity offset cost estimate would be the following should it be satisfied by paying directly into the BCF.

Table 20 Updated biodiversity offset costs estimate based upon payment into the BCF

Staged cost estimate for payment into BCF	\$M
Species credit - BDAR submitted August 2023 (base price)	315.2
Ecosystem credit - BDAR submitted August 2023 (base price)	54.9
Species credit - Green Hills route reduction (6% reduction)	297.7

³³ Transgrid Capex Forecasting Methodology P46

Staged cost estimate for payment into BCF	\$M
Ecosystem credit - Green Hills route reduction (6% reduction)	50.9
Species credit - additional clearing (add 20%)	357.3
Ecosystem credit - additional clearing (add 20%)	61.1
Species credit - contingency addition (add 16%)	414.5
Ecosystem credit - contingency addition (add 6%)	64.7
Addition of risk premium (11.1%) current standard	53.2
Addition of delivery fee (10.5%) average of quotes to date	50.3
Total Scenario 1 BCF charge fee	582.7

Source: Niche

11.2 Updated biodiversity offset costs estimate based upon a mixed model approach (Scenario 2)

Scenario 2 represents the lower limit of the cost range for satisfying the HumeLink biodiversity offset liability and involves a reduction in the total costs to be paid into the BCF through the following:

- Review of existing data, consultation, and further survey
- Stewardship site creation
- Purchase of credits from the market

The step-by-step reduction in total costs to be paid into the BCF are outlined in the following table and discussed further in the following sections.

Table 21 HumeLink biodiversity offset liability (Scenario 2)

Stage of offset strategy	Liability – BCF values \$M	Budget outlay required \$M	Description
Starting obligation with contingency (16% for species and 6% for ecosystem credits)	582.7	N/A	Maximum value calculation based on BCF quote and payment to fund plus contingency fee per table above.
Revised obligation based on pre-consent survey	524.4	Not allocated to offset budget	10% reduction from above number. This assumes that additional survey and consultation will confirm the absence of a range of species from target areas within the alignment, which could result in complete or partial removal of certain species from the offset requirement.
Revised obligation based on post-consent survey	445.8	Not allocated to offset budget	15% reduction from above number. Post-planning approval review of existing data, consultation and further survey. The approach to additional surveys after EIS approval will be similar to pre-approval, however due to the extended timeframes and the certainty of complete access to all land from October 2024 (based on compulsory acquisition timetable) it is anticipated that a further 15% reduction in species credit costs will be achievable.
After Stewardship site creation (5 x sites)	396.4	37.0	This includes outlay for BSA lands (x5 @ 6M = 30M) and additional associated land (\$7M). The creation of BSSs is considered the cheapest way to satisfy an offset obligation. This involves the purchases of land and site setup in areas with similar biodiversity

Stage of offset strategy	Liability – BCF values \$M	Budget outlay required \$M	Description
			characteristics to those being impacted by the project to then generate species and ecosystem credits that offset the project liability. The creation of BSSs has been limited to five sites to ensure the sites can be established in accordance with the required timeline (i.e. project schedule) and because diminishing returns will occur progressively with BSS set-up as the highest cost species are removed from the offset liability first.
After market purchases at discount rates	376.6	14.9	5% of remaining credits at 25% discount. This option involves purchasing credits from the biodiversity credit register or via the Biodiversity Credits Supply Fund and Taskforce to offset the total project liability. Niche assert that credits can be purchased at a 25% discount compared with the costs of paying into the BCF, based on Niche experience in credit trading. It is assumed that 5% of the total project liability can be purchased at a 25% discount, resulting in savings of \$7M.
Payment to BCF		376.7	The residual amount to be paid into fund.
Total		428.4	

11.3 WSP peer review

WSP performed a peer review of Transgrid’s BODS and the estimates prepared by Niche. Their review indicates that the scenario 1 estimate at “\$583M, including the assumptions used to estimate the costs under the scenario to be appropriately conservative, generally clear and reasonable³⁴”

They also conclude that scenario 2 represents the most prudent approach, concluding their “review of the BODS and the comments provided, it is considered likely that the offset costs for the project under the Scenario 1, calculated at \$582M and Scenario 2 calculated at \$428M are reasonable conservative upper limit costs associated with the different delivery options under both scenarios³⁵”.

11.4 Project delay risk provisioning

Risk provisioning includes \$67.8M for delays in planning approval. These relate to contract penalties based upon agreed delay day rates of up to four months with one of the risk vectors relating to the delay in EIS approval.

11.5 Final biodiversity forecast included in CPA-2

The Stage 1 application did not include any forecast capex required for biodiversity offset costs for delivering HumeLink. The following table summarises the final forecast included in CPA-2.

³⁴ WSP HumeLink peer review of BODS 8th September 2023

³⁵ WSP HumeLink peer review of BODS 8th September 2023

Table 22 Forecast biodiversity offset costs

Forecast component	Section reference	\$M
Biodiversity Offset Delivery Strategy (Scenario 2)	Section 11.2	428.4
Bank guarantee		8.4*
Independent expert biodiversity panel	-	0.6
Total		437.5

*As part of this consent condition, Transgrid are required to provide a bond or bank guarantee for an amount equal to that required to pay the total credit liability to the BCF. In line with Part 7.14 of the BC Act, the bond/guarantee must be secured prior to construction.

11.6 Biodiversity offsets conclusion

The biodiversity offset estimate is based upon the BDAR and BODS prepared by Niche. Since the soft lodgement of the BDAR to the DPE, Niche has updated some of the assumptions underpinning this estimate reflecting the Green Hills route reduction and other changes detailed in Section 10

The new forecast prepared by Niche is a mixed model that includes a number of cost reduction strategies including, additional survey work to confirm the absence of a range of species from target areas within the alignment and the purchase of Biodiversity Agreement land. The remaining liability would be settled through payment to the BCF.

The Niche forecast has been peer reviewed by WSP. WSP concluding their “review of the BODS and the comments provided, it is considered likely that the offset costs for the project under the Scenario 1, calculated at \$582M and Scenario 2 calculated at \$428M are reasonable conservative upper limit costs associated with the different delivery options under both scenarios³⁶”.

An amended BDAR will be submitted to the DPE.

The payment of biodiversity offset is required to progress the project and the associated forecast is considered prudent and efficient.

12. Labour and indirect costs

The Stage 2 labour and labour-related costs relate to internal labour to support the delivery of the project and professional and consulting services. These costs include:

- Commercial costs related to managing the D&C ITCs and procurement and contract management of LLE items
- Labour costs related to environmental offsets such as establishing BSSs
- Labour and labour-related costs associated with consulting with stakeholders and the community about the project

³⁶ WSP HumeLink peer review of BODS 8th September 2023

- Costs associated with gaining environmental approvals for the project
- Land acquisition activities, including settlement negotiation with landowners and compulsory acquisitions where required
- Project cost, schedule, and risk management and controls
- Pre-construction and construction activities such as site investigations and construction management plans
- Internal and external labour for the review of contractor design
- Mandatory safety and environmental assurance and specialist consulting services
- Project management and governance
- Regulatory support
- Other costs (including Wagga Training Centre and Wagga Community Hub, legal costs, and insurance)

The Stage 2 labour and indirect costs are summarised in the following table.

Table 23 Labour and indirect costs (\$Real 2022-23)

Forecast component	Section reference	\$M
Labour and labour related direct costs		
Commercial	Section 12.2	19.4
Environmental offsets	Section 12.3	3.2
Community & stakeholder engagement	Section 12.4	22.3
Environmental approvals	-	0.9
Land and property	Section 12.5	8.1
Project controls	Section 12.6	22.8
Construction	Section 12.7	66.8
Design	Section 12.8	23.7
Health, safety and environmental	Section 12.9	10.8
Project management	Section 12.10	3.7
Regulatory	-	1.8
Program initiatives	Section 12.11	19.2
Legal	-	2.1
Indirect costs		
Indirect costs	Section 12.12	202.5
Total		407.1

12.1 Basis of preparation and verification

The Stage 2 labour and indirect costs have been based on a bottom-up build of costs over the period 1 July 2023 to 30 April 2027 (i.e., the project delivery date).

The labour components of the costs have been estimated based upon:

- The Full-Time Equivalents (FTE) profile and numbers required to deliver each project objective to support delivery
- The month-by-month FTE requirements for each role type to meet the project schedule
- Hourly labour rates for each role type (standard and overtime rates) including on-costs and support costs.

The indirect costs relate to professional and consulting services, license fees, site office costs, legal fees, and insurance premiums. In some cases, quotes for the cost of these services have been obtained. In others, the costs have been forecasted based on experience, market conditions and assumptions.

To independently verify and assess the Stage 2 labour and indirect costs, we have:

- Labour
 - Agreed with the forecast in the underlying spreadsheet used to generate labour costs
 - Extracted and analysed the phased FTE profile to consider the appropriateness of roles and numbers required to deliver the project stream objectives
 - Considered the reasonableness of hourly rates applied by role against market rates
 - Performed a simple extension of the phased FTE profile by the hourly rates to confirm the material correctness of the forecast generated from Transgrid’s project management tools.
- Indirect
 - Confirmed quoted costs to appropriate documentary evidence
 - Considered the of assumptions made in cost forecasting to support accuracy

In addition, we undertook a top-down assessment, where possible, to benchmark the labour and indirect costs to similar projects to further assess accuracy.

12.2 Commercial

The stage 2 commercial labour and indirect costs relate to oversight and contract management of the HumeLink delivery partners, equipment supply chain and other professional support services required to be performed under the D&C ITC contract (e.g., audits of reimbursable costs claimed, periodic credit ratings assessments).

The following table sets out the labour and indirect costs for commercial activities.

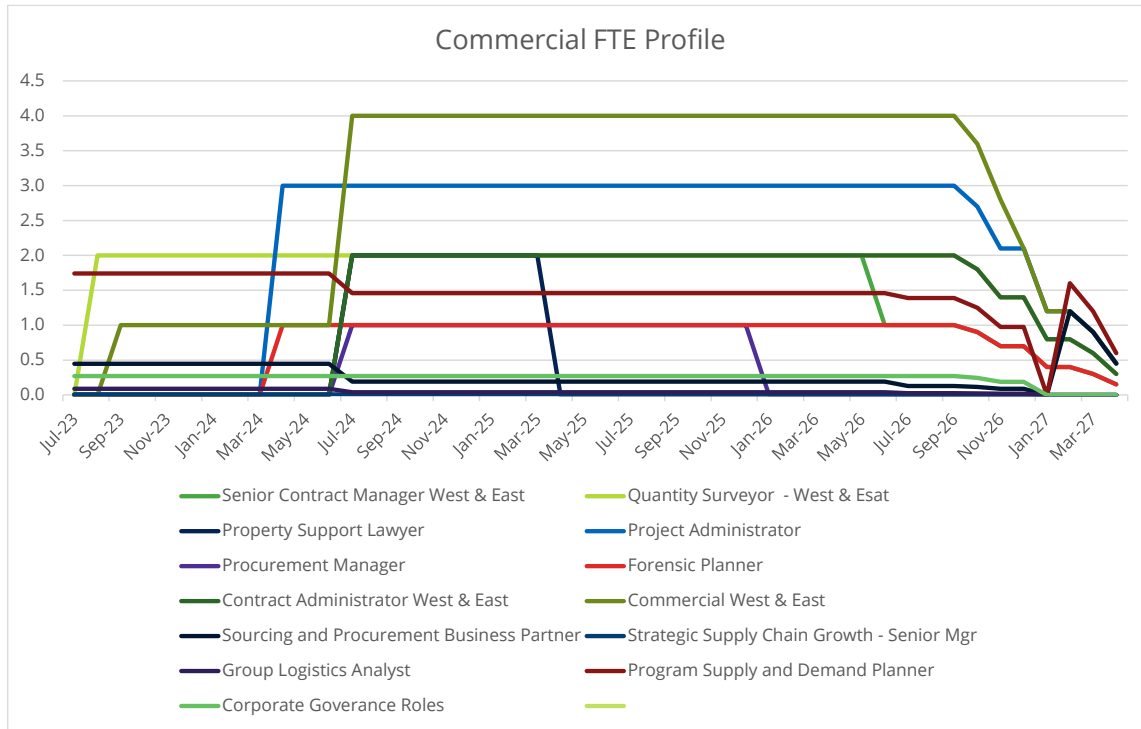
Table 24 Commercial labour and indirect costs

Category	Section reference	\$M
Labour	Section 12.2.1	18.6
Labour-related costs	-	0.8
Total		19.4

12.2.1 Commercial labour costs

The figure below details the commercial team involved in managing and administering the D&C ITC contracts during delivery. The Commercial team consists of 44 roles in total reflecting an average of approximately 13 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

Figure 10 Commercial team FTE profile



12.3 Environmental offsets

The stage 2 environmental offsets labour and indirect costs are required to support and facilitate the implementation of the BODS. This includes:

- Identification, assessment, and procurement of BSSs
- Purchasing and retiring existing biodiversity credits
- Making a payment into the BCF.

The following table outlines the labour and indirect costs for environmental offsets.

Table 25 Environmental offsets labour and indirect costs

Category	Section reference	\$M
Labour	-	3.2

Category	Section reference	\$M
Labour-related costs	-	< 0.1
Total		3.2

12.4 Community & stakeholder engagement

The stage 2 community and stakeholder engagement labour and indirect costs are required to obtain and maintain stakeholder acceptance for the delivery of the project through the implementation of the HumeLink Engagement Strategy and HumeLink Community and Stakeholder Engagement Plan.

The following table outlines the labour and indirect costs for community and stakeholder engagement.

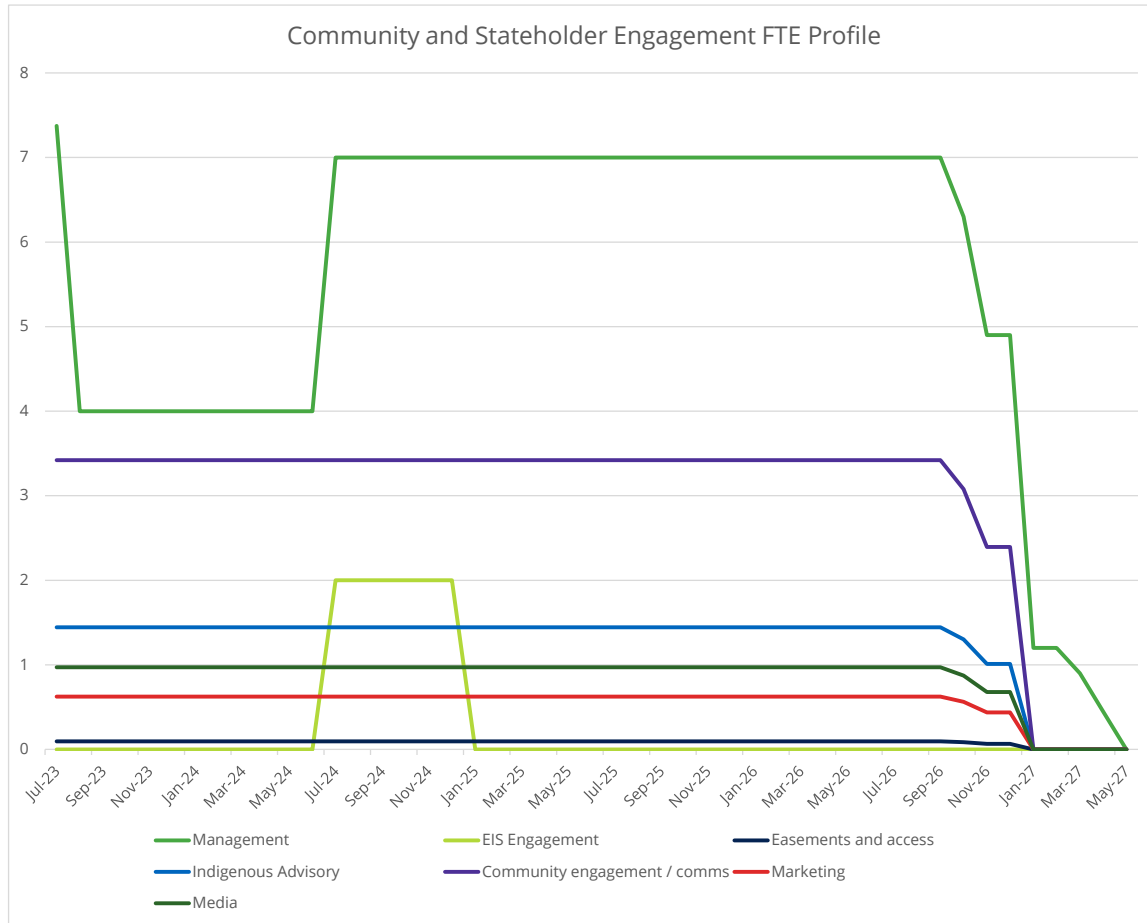
Table 26 Community & stakeholder engagement labour and indirect costs

Category	Section reference	\$M
Labour	Section 12.4.1	22.1
Labour-related costs	-	0.2
Total		22.3

12.4.1 Community & stakeholder engagement labour costs

The figure below details the Community and Stakeholder Engagement team required to undertake activities to obtain and maintain stakeholder acceptance for the project. The Community and Stakeholder Engagement team consists of 50 roles in total reflecting an average of approximately 16 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

Figure 11 Community and stakeholder engagement FTE profile



12.5 Land and property

The stage 2 land and property costs relate to the negotiation of property rights to secure access to the land required to enable construction. This includes:

- Compulsory acquisition of property
- Negotiation with landowners to reach settlements
- Mediation and preparation for Land and Environment Court hearings should landowners object to compensation
- Ongoing liaison with landowners to ensure contractors adhere to agreement terms and conditions.

The following table includes the labour and indirect costs for land and property.

Table 27 Land and property labour and indirect costs

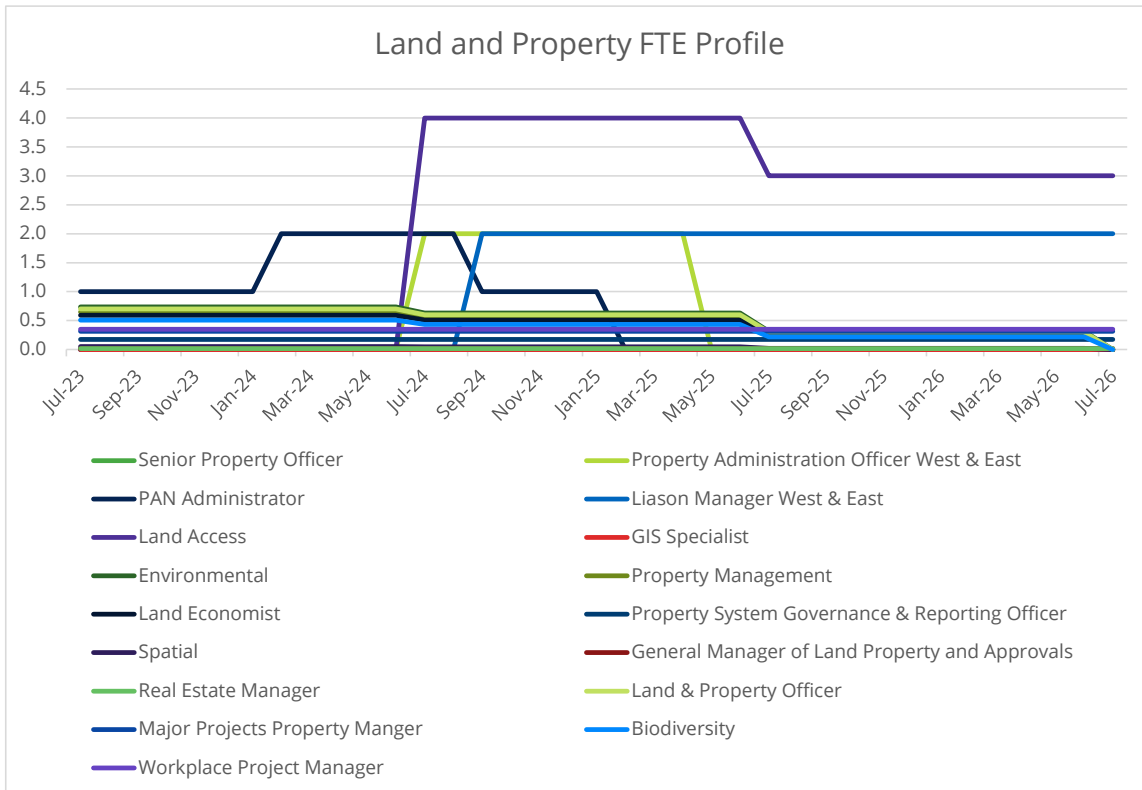
Category	Section reference	\$M
Labour	Section 12.5.1	7.8
Labour-related costs	-	0.3

Category	Section reference	\$M
Total		8.1

12.5.1 Land and property labour costs

The figure below presents the FTE profile required for land and property activities. The Land and Property team consists of 34 roles in total reflecting an average of approximately 6 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

Figure 12 Land and property team FTE profile



12.6 Project controls

The stage 2 project controls labour and indirect costs relate to the labour required for gathering, managing, and analysing project data to ensure the schedule, cost and quality of the project delivery is maintained. Activities include:

- Schedule monitoring program
- Cost control
- Risk management
- Quality control
- Document control
- Reporting

- Project coordination and administration
- Corporate support.

The following table outlines the labour and indirect costs for project controls.

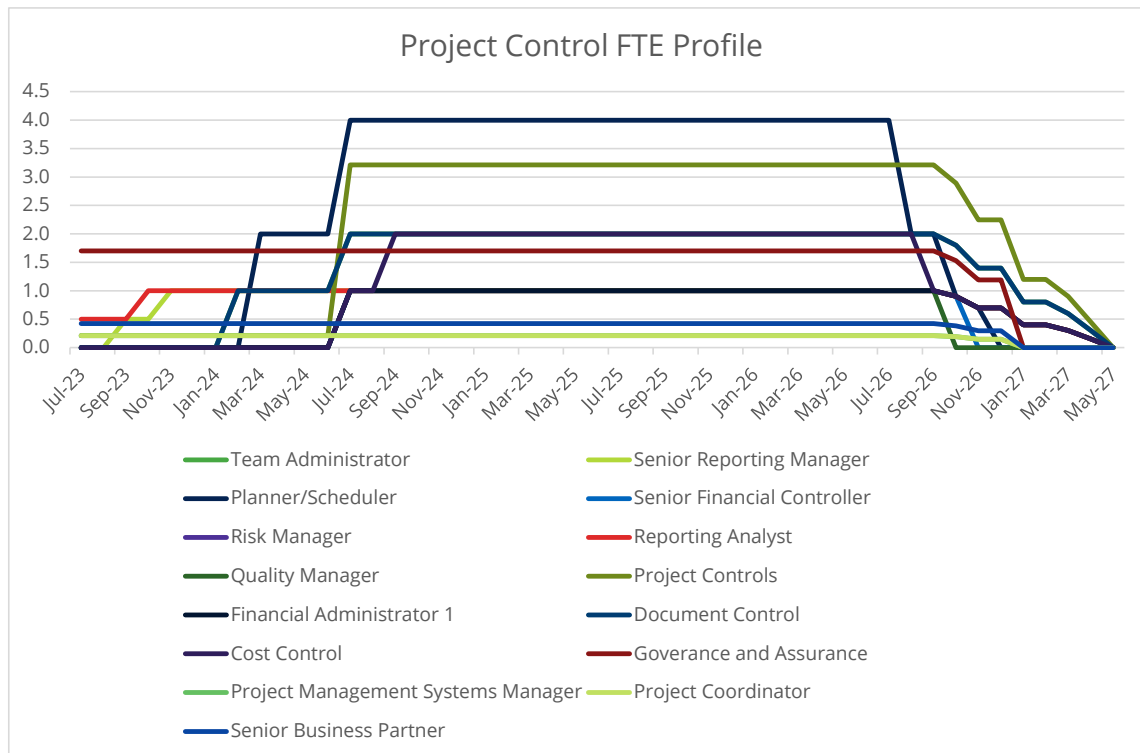
Table 28 Project controls labour and indirect costs

Category	Section reference	\$M
Labour	Section 12.6.1	22.3
Labour-related costs	-	0.5
Total		22.8

12.6.1 Project controls labour costs

The figure below presents the FTE profile required for project controls. The Project Controls team consists of 37 roles in total reflecting an average of approximately 16 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

Figure 13 Project control team FTE profile



12.7 Construction

The stage 2 construction labour and indirect costs are required to support HumeLink's delivery partner construction activities, including:

- Site investigations such as geotechnical assessments
- Access track investigations
- Constructability reviews
- Construction related management plans:
 - Construction and site management plan
 - Health and safety management plan
 - Outage plans
 - Waste management plan.
- Safety inductions, training, and onsite preparations
- Monitoring and measurements construction progress
- Site supervision.

The following table outlines the labour and indirect costs for construction.

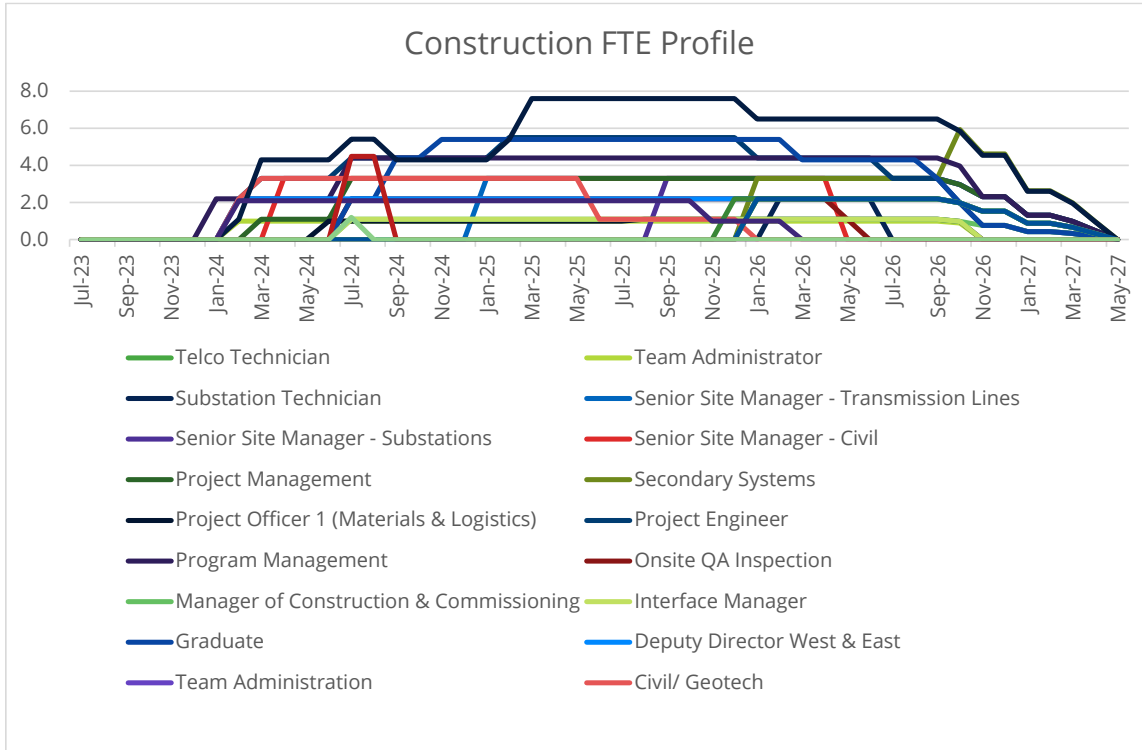
Table 29 Construction labour and indirect costs

Category	Section reference	\$M
Labour	Section 12.7.1	56.8
Labour-related costs	-	10.0
Total		66.8

12.7.1 Construction labour costs

The figure below presents the FTE profile required for construction activities including site supervision, site investigations and monitoring. The Construction team consists of 98 roles in total reflecting an average of approximately 33 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

Figure 14 Construction team FTE profile



12.8 Design

The stage 2 design labour and indirect costs includes both internal and external labour. Transgrid have engaged BECA as the Owner’s Engineer to review and provide quality assurance to contractor designs. Transgrid internal labour will manage the Owner’s Engineer as well as reviewing contractor designs. Contractor designs are submitted as packages during the following design phases:

- Concept design
- Safety in design
- Preliminary detailed design
- Final detailed design
- Issued for construction
- Works as executed.

The following table outlines the design labour and indirect costs.

Table 30 Design labour and indirect costs

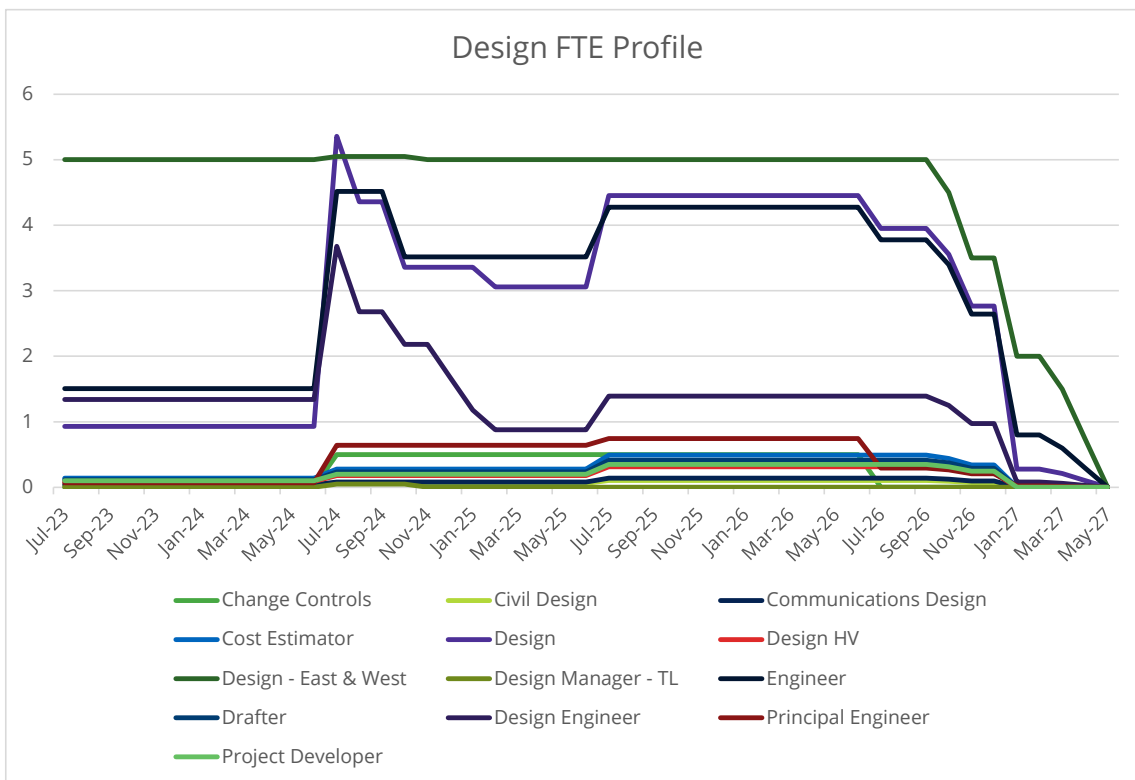
Category	Section reference	\$M
Labour	Section 12.8.1	23.2

Category	Section reference	\$M
Labour-related costs	-	0.5
Total		23.7

12.8.1 Design labour costs

The figure below presents the FTE profile required for project design. The Design team consists of 122 roles in total reflecting an average of approximately 13 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

Figure 15 Design team FTE profile



12.9 Health, safety and environmental

The stage 2 health, safety and environmental (HSE) labour and indirect costs relate to:

- Internal staff undertaking mandatory environmental control compliance inspections
- Health and safety staff providing assurance that contractor work is compliant with work, health, and safety legislation
- Independent site and incident investigations
- Protective clothing and equipment

- Implementation of HSE initiatives and training.

The following table outlines the HSE labour and indirect costs.

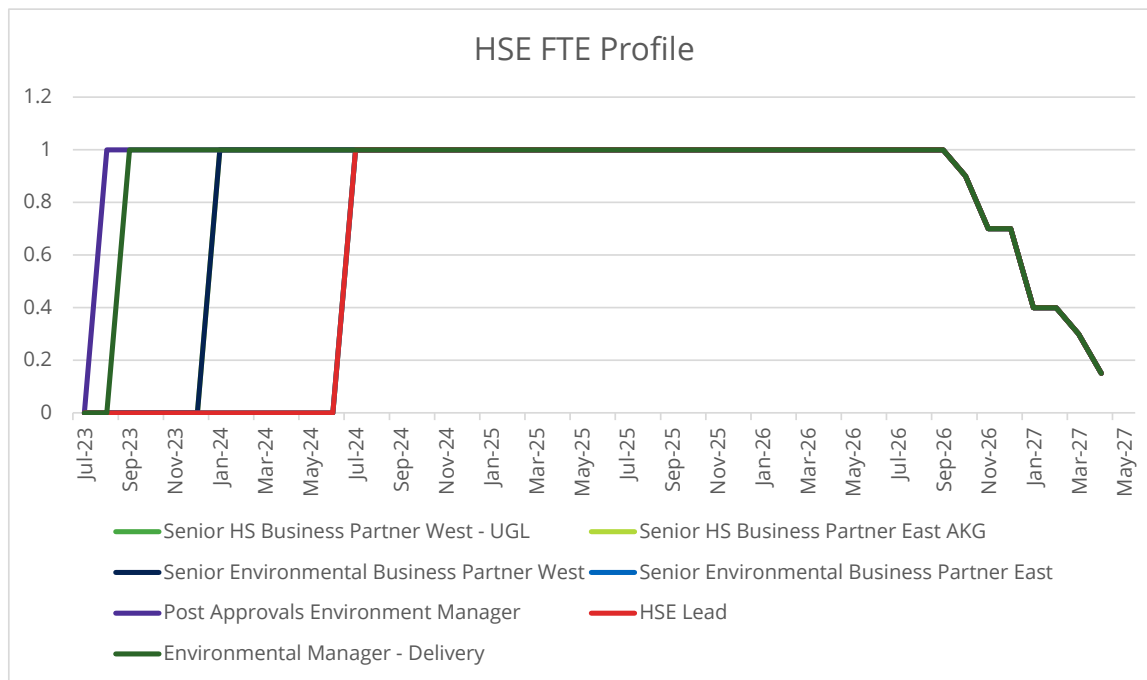
Table 31 Health, safety and environmental labour and indirect costs

Category	Section reference	\$M
Labour	Section 12.9.1	9.5
Labour-related costs	-	1.2
Total		10.8

12.9.1 Health, safety, and environmental labour costs

The figure below presents the FTE profile required for health, safety, and environmental activities. The Health, Safety, and Environment team consists of 7 roles in total reflecting an average of approximately 5 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

Figure 16 HSE team FTE profile



12.10 Project management

The stage 2 project management labour and indirect costs relate to managing and coordinating the project’s activities to deliver the project to scope, schedule, and budget. Project management resources include:

- Project Director
- Executive Management

- Independent auditors
- Corporate support.

The Project Management team consists of 8 roles in total reflecting an average of approximately 2 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

The following table outlines the project management labour and indirect costs.

Table 32 Project management labour and indirect costs

Category	Section reference	\$M
Labour	-	3.7
Labour-related costs	-	< 0.1
Total		3.7

12.11 Program initiatives costs

The stage 2 program labour and indirect costs relate to Transgrid's Powering Tomorrow Together program initiatives. This program initiative involves all major projects at a portfolio level that Transgrid are currently involved in. The stage 2 HumeLink costs have been allocated based on the expected benefit that the project will derive from the initiative. The benefits include:

- Streamlining and improving processes involved with document control, resource planning, coordination, and reporting
- Improving Transgrid's social licence and community engagement works
- Wagga Training Centre

The Program team consists of 193 roles in total reflecting an average of approximately 13 FTEs across the delivery period, based upon examination of the supporting spreadsheet to the forecast.

The following table outlines the labour and indirect program costs.

Table 33 Program costs

Category	Section reference	\$M
Labour	-	19.1
Labour-related costs	-	0.1
Total		19.2

12.12 Indirect costs

The stage 2 forecast for indirect costs has been based on a bottom-up build of costs over the project delivery period (i.e., 1 July 2023 to 30 April 2027). HumeLink indirect costs consist of a range of professional and consulting services, licence fees, project site office costs, legal fees, and insurance premiums.

The following table details the stage 2 indirect costs.

Table 34 Indirect cost breakdown (\$Real 2022-23)

Indirect cost component	Section reference	\$M
Commercial	Section 12.12.1	15.6
Community and stakeholder engagement	Section 12.12.2	15.6
Environmental approvals	Section 12.12.3	10.8
Project controls and management	Section 12.12.4	18.6
Construction	-	4.9
Design	-	2.4
Health safety and environment	-	1.4
Program initiatives	Section 12.12.5	21.9
Legal	Section 12.12.6	█
Insurance	Section 12.12.7	█
Total	-	202.5

12.12.1 Commercial

The stage 2 commercial indirect costs are detailed in the following table and include external services required to support the delivery of the HumeLink construction contracts. This includes:

- Audits of reimbursable costs claimed
- Periodic credit ratings assessment
- Dispute Avoidance Board (DAAB) costs
- Independent professional to fulfill the obligations of the Employer’s Representative under the contract, where required
- Commercial advisory
- Contract management software.

Table 35 Commercial indirect costs (\$Real 2022-23)

Other cost component	\$M	BoP and GHD Verification
Employers’ representative role	█	Based on a proposal from █ dated 31 May 2023 to provide project administration and contract management services.

Other cost component	\$M	BoP and GHD Verification
		GHD Advisory confirms alignment with the proposal based upon 2 employer's representatives (x1 for each the East and West portions of the HumeLink project) and 2 support teams are required for 3.5 years.
Software	■	Capex for ■ project enterprise cloud solution for construction contract management to administer the delivery partner contracts. GHD Advisory has verified against a quote from Oracle.
Commercial advisory	■	Agreed to ■ proposal for the provision of Commercial Advisory support services.
Credit rating assessments	■	-
DAAB	■	-
Financial audit	■	-
■ for independent estimator services during delivery phase	■	-
Total	15.6	

12.12.2 Community and stakeholder engagement

The stage 2 community and stakeholder engagement indirect costs are detailed in the following table. These costs have been determined through the HumeLink Engagement Strategy and the Community and Stakeholder Engagement Plan.

Table 36 Community and shareholder engagement indirect costs (\$Real 2022-23) >\$100K

Indirect cost component	Section reference	\$M
■ CCG Chair and Secretariat services (July 2024 - Dec 2026)	-	■
CSE Engagement - Distribution Costs	-	■
Familiarisation opportunities	-	■
"Connectivity" CPP Grants	-	■
"Connectivity" Community Giving - ad hoc requests	-	■
"Connectivity" Regional Telecommunications Temporary COW Cost for 8 sites	Section 12.12.2.1	■
"Connectivity" Mental Health and Community Resilience Training	-	■
Opportunity for all Strategic Workforce Development Partnership	-	■
Accessible Accommodation Cost of repurposing workers accommodation	-	■
Care for Country - Tree Planting	-	■
Total		15.6

12.12.2.1 Connectivity Regional Telecommunications

Cells on Wheels (COWs) have been used by Telstra and other organisations to temporarily resolve black spot issues. Transgrid has developed a business case that includes internal cost estimates for the purchase of sites and COW equipment that appear both prudent and efficient. GHD Advisory has reviewed this business case.

12.12.3 Environmental approvals

The stage 2 environmental approvals indirect costs relate to the finalisation of the environmental impact statement and payment of the assessment fee calculated by the Department of Planning and Environment. External consulting fees are also required to prepare the Response to Submission and Amendment reports due to be lodged in 2024.

The environmental indirect costs are detailed in the following table.

Table 37 Environmental indirect costs (\$Real 2022-23)

Indirect cost component	Section reference	\$M
Amendment report	Section 12.12.3.1	█
Environmental assessment fees	Section 12.12.3.2	█
Total		10.8

12.12.3.1 Amendment report

The estimated capex for the Response to Submissions and Amendment report is █M which is based on a fee proposal from █ that GHD Advisory has sighted.

The Response to Submissions and Amendment Report is a regulatory requirement under the EP&A Act and involves assessment and reporting activities by Aurecon.

12.12.3.2 Environmental assessment fees

The HumeLink CPA-1 submission included an EIS fee of █ (\$Real 2022-23) based upon the Capital Investment Value (CIV) of █ (\$Real 2017-18). Based upon the current CIV, GHD calculates that the fee would be \$5.9M based on the requirements outlined in Division 1AA of the EP&A Regulation 2000 and the NSW Planning Circular of 2010 defining CIV. The difference is █ which coincides with the estimate developed by Transgrid.

Table 38 Recalculation of EIS application fee

Category	Details
Application fee	<p>Capital Investment Value (CIV) = █</p> <p>Application fee = base fee + █ for every █, or part █, by which estimated costs exceed █ million.</p> <p>Base fee █</p> <p>Plus █ for each █ over █ M █ × (█ M - █ /1000</p> <p>= █ M + █ M</p> <p>= █ M</p>
Additional fees	<p>Additional fees consist of:</p> <ul style="list-style-type: none"> - Approval of critical State significant infrastructure █

Category	Details
	<ul style="list-style-type: none"> - Making an EIS publicly available [REDACTED] - Planning reform contribution [REDACTED] X CIV, divided by 1000 - Total [REDACTED]

12.12.4 Project controls and management

The stage 2 project controls and management indirect costs relate to establishing the required tools/systems, software licenses, and risk management/assurance activities. These costs are listed in the following table.

Table 39 Project controls and management indirect costs (\$Real 2022-23) >\$100K

Indirect cost component	Section reference	\$M
Team costs	-	[REDACTED]
Board meeting room hire		[REDACTED]
Document system licence	--	[REDACTED]
Assurance Audits - Line 2		[REDACTED]
Line 1 reviews	-	[REDACTED]
Dashboarding and other reporting tools - initial setup and troubleshooting	-	[REDACTED]
Quantitative Risk Analysis	-	[REDACTED]
Risk software licence	-	[REDACTED]
Smart tracking tech licence -transmission lines & subs	-	[REDACTED]
Earned Value Analysis	-	[REDACTED]
Project Site Office costs from 1 July 2024 - 31 July 2026	Section 12.12.4.1	[REDACTED]
Helicopter Costs	-	[REDACTED]
y & assurance		[REDACTED]
Governance reviews		[REDACTED]
Internal audit fees, charged by [REDACTED]		[REDACTED]
Total		18.6

12.12.4.1 Project site office costs from 1 July 2024 - 31 July 2026

Agreed to office space estimate provided by [REDACTED] dated 16 August 2023.

12.12.5 Program initiatives

The stage 2 indirect costs for Transgrid's Major Projects Program Initiatives are detailed in the following table.

Figure 17 Program management indirect costs (\$Real 2022-23)

Indirect cost component	Section reference	\$M
Origination function costs	Section 12.12.5.1	[REDACTED]
Wagga Training Centre	Refer comments below the table	[REDACTED]
[REDACTED] Integration and Implementation costs		[REDACTED]

Indirect cost component	Section reference	\$M
Incurred by PTT function, to set up function, dashboarding and resourcing		█
Wagga Hub		█
█ Licence	-	█
Project Benchmarking	-	█
Sponsorships (Telegraph Bush Summit)	-	█
holder engagement consultants	-	█
Total		21.9

*Potentially already claimed in the VNI West CPA-1 submission.

The VNI West CPA-1 submission already includes this cost noting that the cost does not specifically relate to either VNI West or HumeLink, but rather major projects generally. In total the VNI West CPA-1 submission includes indirect labour costs █ represent an allocation described as “broader review and rollout for project governance and assurance implementation including consultants and systems rollout for cost control, scheduling, contract management, document control and reporting (█) and governance”³⁷.

In total the VNI West CPA-1 labour and indirect costs includes █ for new activities that are required to support the delivery of all Transgrid’s Major Projects and include:

- █ for non-labour relating to Wagga training centre, Origination, █ Integration, Implementation and Licence costs, Wagga Hub, PTT function dashboarding and resourcing
- █ for internal labour charges that supports Major Projects including PTT, Project Governance and Assurance, Origination, Major Project Finance.

The Wagga training centre is supported by a business case for █ based upon a MOU entered into by Transgrid, Charles Sturt University, Thomson Bridge and Ironbark. The training centre, based upon the details provided in the business case would provide training the core skills required for meeting industry demand during the sectors transition.

Transgrid also has a business case for the implementation of fit for purpose Project Governance, Project Assurance and Enterprise Project Management System for all Transgrid projects. This includes:

- External costs of █ for the implementation of the █ project tools
- Internal implementation resources of █
- Ongoing program of Independent Assurance Reviews █
- Project management framework further development and project benchmarking

Based upon the above there is potential for double counting by including these costs in both the VNI West CPA-1 and in the HumeLink CPA-2. GHD has already reviewed the business cases underpinning these cost estimates during our

³⁷ Labour and Indirect Capex Forecasting Methodology P 48

assessment of the VNI West CPA-1 submission and confirm that they are supported by internal Transgrid business cases with a high level cost estimate contained within.

12.12.5.1 Origination function costs

Based upon the Transgrid business case that supports the Origination's team, the total cost of the initiative is \$27.9M. Origination team's accountability covers all development activities for major projects prior to contract award. Activities we will be undertaking which is directly related to the project includes:

- Development and coordination of design inputs
- Coordination and support in specialist studies including but not limited to EIS, property, and bio-diversity
- Development of commercial strategies and models
- Compilation and validation (benchmarking) of project estimates
- Undertaking and facilitating Safety in Design / Constructability reviews and validation
- Coordination and support in regulatory, legal, and market inputs

As such the initiative does not specially relate to HumeLink, but rather all major projects. For the purposes of CPA-2 HumeLink has been allocated 20% of the costs at \$5.5M.

12.12.6 Legal

Corrs Chambers Westgarth has been retained to support the HumeLink project. The forecast of [REDACTED] has been based upon a detailed analysis of potential legal issues, expected hours and the rates applicable to the staff level required to address that GHD has reviewed. As such the forecast represents a provision of likely costs, broken down as follows:

- [REDACTED] for land access matters
- [REDACTED] for interface agreements
- [REDACTED] for environmental & heritage issues
- [REDACTED] for general legal advice
- [REDACTED] for legal advice for major contracts
- [REDACTED] for defending contractor claims and proceedings

12.12.7 Insurance

There are several risks across the HumeLink project where it is appropriate to obtain insurance coverage. Transgrid has engaged [REDACTED] to analyse these risks and to prepare cost estimation for the coverage. GHD has reviewed their consulting advice and their cost estimate of [REDACTED]M. The estimate can be broken down as follows:

- [REDACTED] Professional Indemnity
- [REDACTED] for Marine Cargo
- [REDACTED] for Marine Cargo – Extended Storage
- [REDACTED] for Contractors Pollution Liability.

- ██████████ for Construction All Risks
- ██████████ for Construction TPL - Primary
- ██████████ for Construction TPL – Excess

12.13 Labour and indirect costs conclusion

Labour costs have been based upon a bottom-up build of Transgrid's project stream resources based upon the phased resources to support the delivery of the projects schedule.

Indirect costs include activities to support the projects delivery and are supported by external quotations / quotes that GHD has considered on a selection basis.

Project control costs potentially include approximately ██████████ of costs that have already been claimed in the VNI West CPA-1 submission.

13. Real input escalators

Real input escalators \$4.4M (\$Real 2022-23) based upon multiplying the projected labour components of forecast capex by the real labour cost escalators approved in the AER's 2023-28 Revenue Determination for Transgrid.

Appendix A

Other construction cost provisioning

■ [REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Risk	Residual risk	Likelihood	Best case \$M	Most likely \$M	Worst case \$M	Deterministic \$M	GHD Advisory assessment
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]

Risk	Residual risk	Likelihood	Best case \$M	Most likely \$M	Worst case \$M	Deterministic \$M	GHD Advisory assessment
[Redacted]							
[Redacted]	■	■	■	■	■	■	[Redacted]
[Redacted]	■	■	■	■	■	■	[Redacted]
[Redacted]	■	■	■	■	■	■	[Redacted]
[Redacted]	■	■	■	■	■	■	[Redacted]
[Redacted]	■	■	■	■	■	■	[Redacted]
[Redacted]	■	■	■	■	■	■	[Redacted]
[Redacted]	■	■	■	■	■	■	[Redacted]

Risk	Residual risk	Likelihood	Best case \$M	Most likely \$M	Worst case \$M	Deterministic \$M	GHD Advisory assessment
[Redacted]							
[Redacted]	■	■	■	■	■	■	
[Redacted]	■	■	■	■	■	■	[Redacted]
[Redacted]	■	■	■	■	■	■	[Redacted]

Appendix B

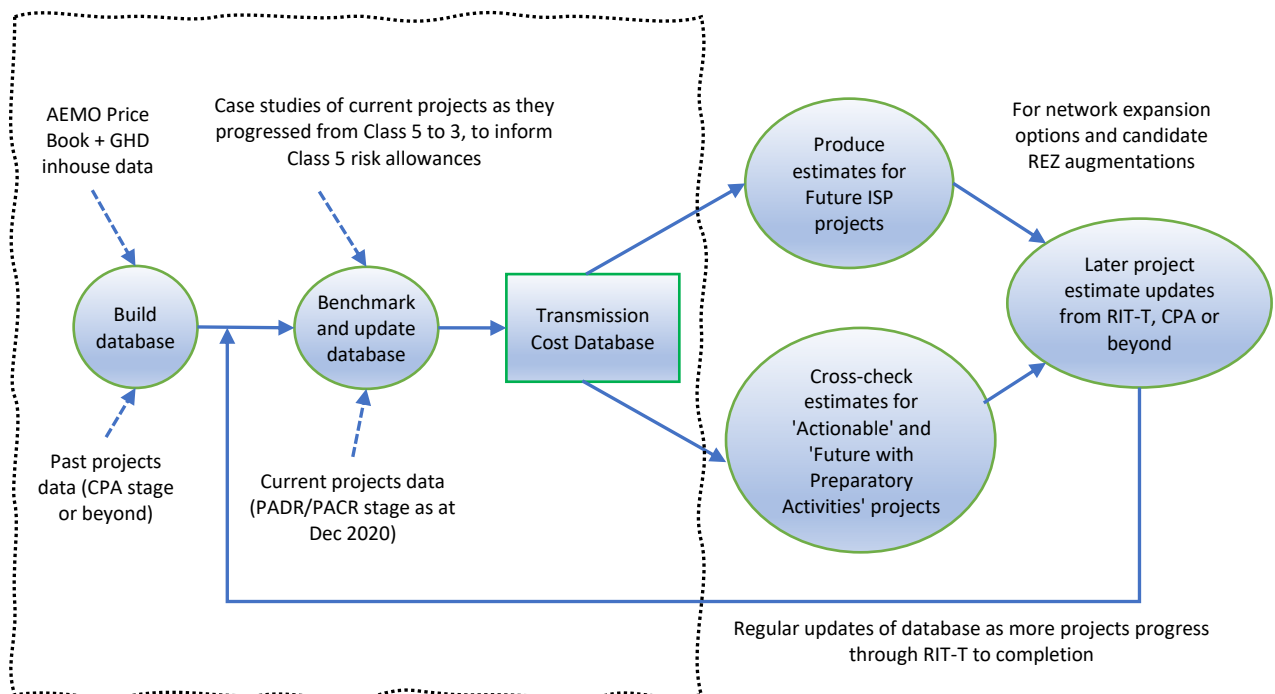
Transmission cost database tool

The TCD is used by AEMO to estimate the cost of candidate future ISP projects at early stages of development, and to cross-check TNSP estimates of 'Actionable' and 'Preparatory Activity' projects and is publicly available on AEMO's web site.

The TCD generates Class 5/4 (early stage) project cost estimates in a deterministic fashion, compiling various cost components that make up the total cost. The TCD does this by assembling varieties of required asset building blocks from a comprehensive database to match the given scope of work and adjusts their costs to reflect project specific attributes and risk exposures based on user inputs.

The figure below illustrates the benchmarking data used to cost asset building blocks which includes allowances for indirect costs.

Figure 18 Transmission cost data base inputs / outputs



The breakdown structure of the building block is aligned to the AEMO's specification. In general, the unit rate estimates for these building blocks were derived from various sources and our experience as listed below:

- GHD’s electricity network project bottom-up cost estimation model that uses various sources such as Rawlinson civil construction handbook, labour hours, contractor cost allocation and original equipment manufacture’s material procurement quotes
- Publicly available cost estimate information for given scopes of work in the NEM during the revenue reset and RIT-T determination process
- Independent verification of various major transmission projects that GHD Advisory has recently undertaken in Australia enabling us to appreciate the build-up of costs including assets of various type, contractor costs, mobilisation costs and fixed cost structures
- Leveraging our multidisciplinary skill sets to understand the nuances of environmental regulatory requirements, associated offset costs and how it may impact in various NEM jurisdictions for different types of projects

Indirect costs represent all not covered by the contractors or suppliers and within the model it is broken down into the following six cost components to match the various functions and cost centres within the owners’ business.

- Project development (costs incurred to perform feasibility studies, option analysis, regulatory investment tests etc.)
- Works delivery (cost incurred to perform preliminary investigations, site inspections, survey, conceptual design work, site supervision, safety assurance, contract management, commissioning etc.)
- Land and environment (management and administration costs to procure easement right of way, land and environmental offsets)
- Stakeholder and community engagement (management and administration costs to liaise and engage with various project stakeholders and impacted communities)
- Procurement costs (management and administration costs to organise, tender, evaluate and award contracts)
- Insurance (costs incurred to obtain project insurance).

Indirect costs are applied after all the network elements of the project are estimated with their respective project attribute and risk factors. Indirect costs are applied to the total network element costs considering economies of scale and are dependent on the overall project attribute choices of green/brownfield nature, stakeholder engagement level and contract delivery model. As such the indirect costs are estimated using a ‘top-down’ percentage of project cost and are driven by these dependent variables.

The percentage for the indirect cost and its breakdown component factors is derived based on GHD’s project owner cost model and benchmarked against recent transmission projects in the NEM. It is also based on our understanding on other infrastructure project owner costs, international experience and knowledge of how the business units and various functions within TNSPs in the NEM are generally structured and the nature of activities carried out to develop and deliver projects across the business.

It represents the owner internal costs to identify the need for the project, preliminary investigations, option analysis, project development, procurement, contract management, administration and insurance. The total indirect cost ranges

from ~6.5% to 16% of the total network element cost and is broken down into six cost descriptions to match with the usual internal costs observed by TNSPs.

Where appropriate building block rates have been used to benchmark capital equipment costs where these have been used support forecast calculations. Indirect cost comparisons have not been used as within the TCD model they represent the total cost rather than the costs to be incurred in the D&A phase.

Appendix C

Unit cost benchmarking methodology and assumptions

C-1 Estimate accuracy for assessment

In assessing forecasts included in the Stage 2 CPA that are based upon capital network components, consideration must be given to the level of accuracy that can be achieved in generating indicative cost estimates for the network augmentation work packages identified.

The graph shown in Figure 19 indicates the levels of accuracy that can be expected for estimates prepared for capital works at various stages of a project development. Due to the different levels of engineering input, and completeness in the design, there are various levels of accuracy that can be reasonably expected.

Figure 19 Standard estimate accuracy levels

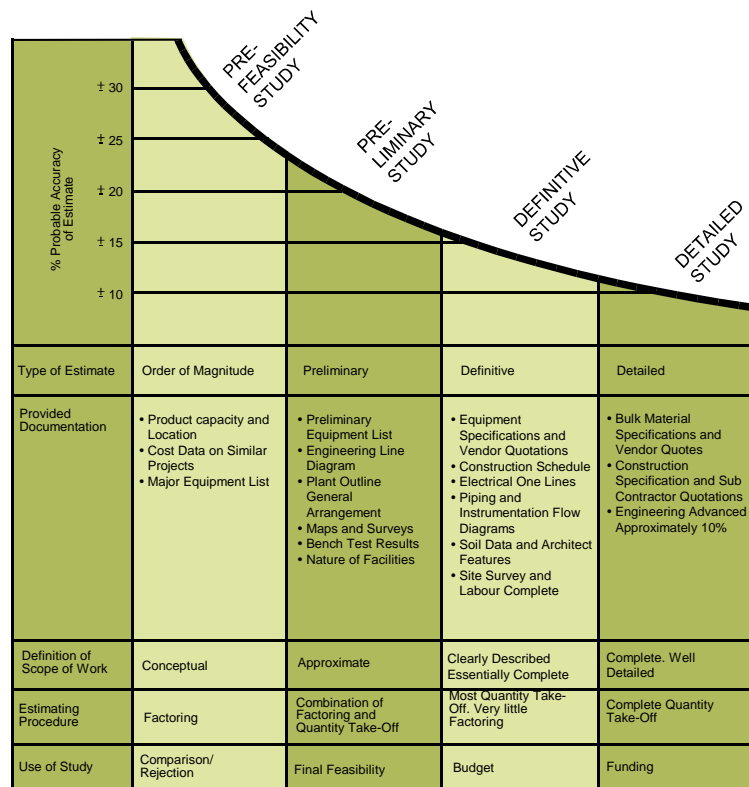


Table 41 shows the classification of estimates as defined in the AACE International *Recommended Practice No. 17R-97 Cost Estimating Classification System*.

Table 41 AACE IRP No. 17R-97 generic cost estimate classification matrix³⁸

Estimate class	Primary characteristic		Secondary characteristic		
	Level of project definition	End usage	Methodology	Expected accuracy range	Preparation effort
	Expressed as % of complete definition	Typical purpose of estimate	Typical estimating method	Typical +/- range relative to best index of 1 (a)	Typical degree of effort relative to least cost index of 1 (b)
Class 5	0% to 2%	Screening or Feasibility	Stochastic or judgement	4 to 20	1
Class 4	1% to 15%	Concept Study or Feasibility	Primarily stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget, Authorisation or Control	Mixed, but primarily stochastic	2 to 6	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Primarily deterministic	1 to 3	5 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Deterministic	1	10 to 100

a. If the range index value of 1 represents +10/-5%, then an index value of 10 represents +100/-50%

(a) If the cost index of 1 represents 0.005% of project costs, then an index value of 100 represents 0.5%

The level of information available to us for assessing the augmentation work packages was typical of concept study level. Therefore, we consider our comparative estimates are based on 1% to 15% project definition and should be classified as Class 4 estimates with an accuracy of ±30%.

³⁸ AACE International, *Recommended Practice No. 17R-97: Cost Estimating Classification System (TCM Framework: 7.3 – Cost Estimating and Budgeting)*, 12 August 1997, p. 2

