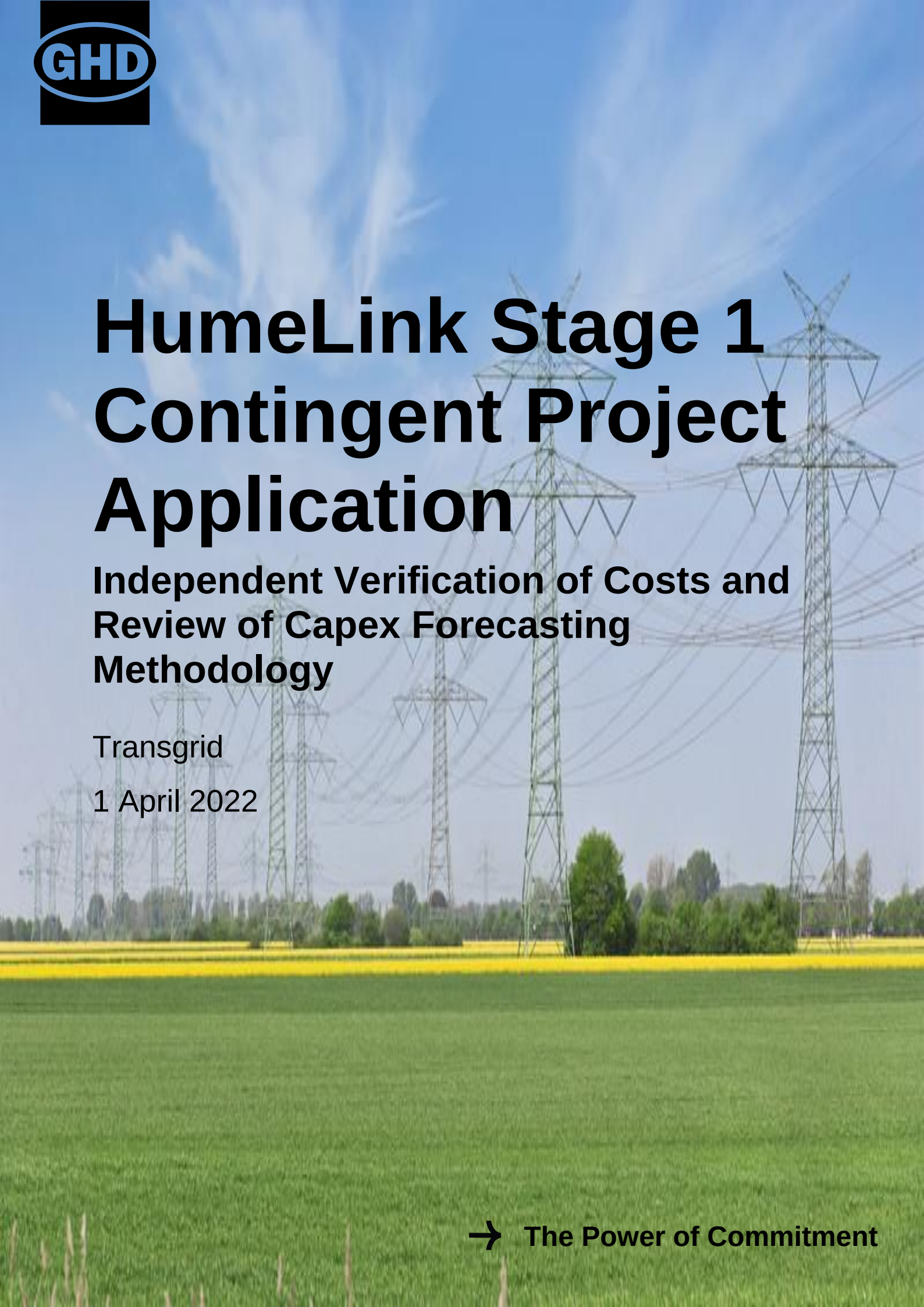

HumeLink Stage 1 Contingent Project Application

Independent Verification of Costs and Review of Capex Forecasting Methodology

Transgrid

1 April 2022

→ The Power of Commitment

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Printed date	1/04/2022 1:19:00 PM
Last saved date	1 April 2022 1:19 PM
File name	HumeLink Independent Verification of Costs
Author	Refer below
Project manager	Guy Debney
Client name	Transgrid
Project name	HumeLink Independent Verification of Costs
Document title	HumeLink Stage 1 Contingent Project Application | Independent Verification of Costs and Review of Capex Forecasting Methodology
Revision version	Rev 1
Project number	12554206

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
Final	1	Bruce Clarke Guy Debney David Chapple Peter Carson William Howard	Bruce Clarke		Bruce Clarke		01/04/2022

Executive summary

HumeLink is classed by the Australian Energy Market Operator (AEMO) as a “staged actionable project” in their 2022 Integrated System Plan (ISP). AEMO is responsible for determining the optimal development path that promotes the efficient development of the power system and this analysis is set out in their bi-annual ISP.

On the 29th of July, HumeLink published their Project Assessment Conclusions Report (PACR). The PACR outlines the results of credible option modelling and found that Option 3C detailed in the PACR, comprising of new 500 kV double-circuit lines in an electrical ‘loop’ between Maragle, Wagga Wagga and Bannaby, provides the greatest net benefits across all scenarios. Option 3C is found to have positive net benefits under all scenarios investigated, except for the slow-change scenario.

The PACR indicates that on a weighted-basis, Option 3C is expected to deliver approximately $491M of net benefits with an estimated capital cost of $3.3B.

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”.

As detailed in the PACR, Transgrid intends to submit two Contingent Project Applications (CPA)s to the Australian Energy Regulator (AER) in relation to the regulatory cost recovery for the project:

- Stage 1 – To recover costs to date and the cost of the works necessary to develop a robust cost estimate for the project based on the preferred option, the purchase of Long Lead Time Equipment (LLE), pre-construction works and land acquisitions. This represents actual costs to 31 December 2021 and a forecast of costs to 30 June 2024
- Stage 2 – This will seek cost recovery for the implementation costs, including construction cost of the project, once a final estimate is available (this CPA will cover the bulk of the project cost).

Transgrid has forecasted Stage 1 costs at $321.87M (Real 2017-18) excluding equity raising costs.

Transgrid engaged GHD Advisory to perform an independent assessment of the early works included in Stage 1 considering both reasonableness and sufficiency of the forecast to cover the Design and Approvals (D&A) phase, indirect costs required to develop a robust cost estimate and the direct costs procurement and land acquisitions included in Stage 1.

The verification process used to consider the costs included in Stage 1 is detailed in section 4.

GHD Advisory’s assessment is summarised below. In general:

- The activities forecasted are aligned with the definition of early works, representing the works necessary to develop a robust cost estimate for Stage 2, progress the regulatory, planning or environmental approvals before construction works are able to take place and to avoid delay to the project completion date
- GHD Advisory found that non-labour and external labour costs included in Stage 1 were appropriately supported by the results of tender processes, quotes and reasonable estimates that have been subject to either benchmarking or recalculation

- Internal labour costs are based upon actuals extracted from Transgrid's ERP system Ellipse and internal labour forecasted costs are based upon a team build up presented in section 9 as generated from their project portfolio management tool that applies schedule hours and role rates. GHD Advisory considers that the team structure and rates appear reasonable and the costs benchmark comparatively to other ISP projects and are supported by tender outcomes, quotations, and benchmarking
- GHD Advisory found that procurement costs are reasonable and are based on specialist advice
- The high-level timeline to enable project completion by Q4 2026/Q1 2027 is considered reasonable and demonstrates the need for a two stage CPA process to meet this project completion date
- GHD Advisory considers that Stage 1 project stream interdependencies have been appropriately scheduled to support the delivery of the project by 2026-27 subject to unforeseen risk factors that may impact the schedule
- Overall, GHD concludes that the Stage 1 (early works) costs are within a reasonable margin of its comparative estimates.

Conclusion

Table 1 HumeLink independent verification and assessment conclusion

Forecast element	Project element Stage 1 inclusion assessment	Conclusion
Procurement	Procurement activities relate to finalising transmission / substation designs and other pre-construction works to be delivered under awarded contracts, deposits for the purchase of LLE and completion of prototype tower tests. These activities are required in Stage 1 to support the critical path on the timeline to achieve commissioning of the HumeLink Project by Q4-2026/Q1-2027. The purchase of LLE reduces the risk of schedule delays caused by supply chain issues.	Procurement estimates from Stage 1 include design, pre-construction costs, prototype testing and the purchase of LLE. Pre-construction provisions have been based upon advice regarding similar other transmission and substation projects. GHD Advisory has compared the estimate for the substation design component against recent projects. Transgrid has used the same design estimate percentage for transmission lines and for substations. Whilst we would expect the costs for substations to be higher than transmission lines on a percentage basis, when combined costs are considered reasonable when compared with Project A HVAC design costs in total. Project A represents another ISP project where GHD Advisory has access to the D&A budget.

Forecast element	Project element Stage 1 inclusion assessment	Conclusion
Land acquisition	GHD Advisory understands the land acquisition costs detailed in Stage 1 will be incurred early in the project to facilitate timely access to new substation sites and security for acquiring easements though option agreements and to comply with Property Acquisition NSW Guidelines to undertake compulsorily acquisition in the event amicable agreement cannot be reached.	The land acquisition costs included in the Stage 1 have been prepared on a reasonable basis and the activities are considered prudent to facilitate timely access to new substation sites and to reduce the risks associated with acquisition of easements.
Project team resources	Various project streams hold different objectives that are required to be achieved to deliver the D&A outcomes and the direct cost early works. The different stream objectives and the resources that have been forecasted are detailed in section 9.	The forecast is based upon a detailed bottom-up build detailing positions required to complete project stream objectives, phased using reasonable base rates per position and applying the on-costs required as per Transgrid's other ISP projects.
Procurement transaction indirect costs	Represents the costs required to execute the Collaborative Contractor Engagement (CCE) procurement strategy. This is the same procurement approach Transgrid has applied to other ISP projects and includes various phases to inform bidders to improve their tender submissions, tender evaluations, and tender award. The forecast also includes bidder payments required to elicit the receipt of quality tender submissions and other support costs associated with tender processes.	The provision included in the estimate is considered reasonable, prudent, and consistent with past Transgrid ISP projects such as Project EnergyConnect (PEC).
Project development	The project management team are supported by external legal, engineers and other consultants to carry out activities to complete the D&A phase. These external resources include: • Legal support services to cover a range of aspects of the project development including permits, land acquisition	Project development costs are supported by quotes, the outcomes from competitive tender processes and reasonable estimation calculations. These external services are considered prudent as they are required to support the project management team in the delivery of D&A outcomes that reduce risk and

Forecast element	Project element Stage 1 inclusion assessment	Conclusion
	strategy, environmental and heritage issues, contract program, corporate and general legal support • Geotech services required in Stage 1 to enable contractor's to more accurately price foundation costs and assess the risk of varying geotechnical conditions • Project management and engineering services required to produce concept designs for the procurement of LLE, to manage the engineering work for the project, environmental approvals, and community and stakeholder engagement during the D&A phase • Owner engineering, risk, and cost control support.	improve the basis upon which tenders will be priced.
Land and environment	The land and environment forecast represents the actual costs to 31 December 2021 and forecast to 30 June 2024 to complete the Environmental Impact Statement (EIS), the associated EIS application fee and land valuation support services.	Land and environment forecasts are adequately supported by quotes / resource requirements to meet the scope and calculation of an EIS application fee. These costs are prudent as they will be incurred on the path to Final Investment Decision (FID) represented by the Stage 2 CPA.
Community and stakeholder engagement	Community and stakeholder engagement activities are a critical component of the Regulatory Investment Test for Transmission (RIT-T) process required to refine RIT-T submissions. It is also required to influence community attitudes and reduce risk.	The total community and stakeholder engagement forecast for Stage 1 benchmarks to other large ISP projects where GHD Advisory has access to D&A phase budgets. The forecast component relating to community engagement is appropriately supported by the external service providers forward cost estimates. The forecast component relating to social legacy initiatives is in its early stages of development. GHD Advisory given the state significant project status anticipate that Transgrid will further develop the program to better focus upon:

Forecast element	Project element Stage 1 inclusion assessment	Conclusion
		• Social mitigations aligned with the findings of the social impact assessment • Programs that address social attitudes with the view to the achievement of positive social outcomes resulting from power cost reduction and resilience.
Regulatory approvals and other support costs	This represents the historical costs incurred to 31 December 2021 to produce the required RIT-T documentation and the forecasts required to develop Stage 1 and Stage 2.	These costs and forecast to completion are required to comply with regulatory processes and benchmark well with those D&A costs forecast for another large ISP project “Project A”.

This report is subject to, and must be read in conjunction with, the limitations set out in section 2 and the assumptions and qualifications contained throughout the report.

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1. Glossary

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CCE	Collaborative Contractor Engagement
CIV	Capital Investment Value
CPA	Contingent Project Application
D&A	Design and Approvals
EIS	Environment Impact Statement
FID	Final Investment Decision
FTE	Full Time Equivalent
ISP	Integrated Service Plan
LLE	Long Lead- Time Equipment
NEM	National Energy Market
PACR	Project Assessment Conclusions Report
PSCR	Project Specification Consultation Report
PADR	Project Assessment Draft Report
PEC	Project EnergyConnect
QNI	Queensland NSW Interconnect
SEAR	Secretary's Environmental Assessment Requirements
TNSP	Transmission Network Service Providers
RIT-T	Regulatory Investment Test for Transmission
TCD	Transmission Cost Database
VNIW	Victoria NSW Interconnect West

2. Introduction

2.1 Purpose of this report

The purpose of this report is to:

- Provide independent assessment of the historical costs included in the Stage 1
- Assess the reasonableness and sufficiency of the forecasts based upon the Capex Forecasting Methodology, included in the Stage 1
- Assess whether the costs and forecasts included in the Stage 1 are reasonable / prudent and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.

2.2 Scope and limitations

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 2.1 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.

3. HumeLink project status

Transgrid published the HumeLink PACR on the 29th of July 2021. This is the final stage of the RIT-T process and follows the publication of the following RIT-T submissions:

- Project Specification Consultation Report (PSCR), published in June 2019
- Project Assessment Draft Report (PADR), published in January 2020.

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:

- Stage 1 CPA – To recover costs to date and the cost of the works necessary to develop a robust cost estimate for the project based on the preferred option, to complete early works for the project to ensure commissioning can be achieved at by Q4 2026/Q1 2027 as required under the AEMO optimal development path. This represents actual costs to 31 December 2021 and forecast costs to 30 June 2024
- Stage 2 CPA – This will seek cost recovery for the implementation costs, including construction cost of the project, once a final estimate is available (this CPA will cover the bulk of the project cost).

Transgrid has engaged GHD Advisory to consider the reasonableness / sufficiency of costs they want to progress through the revenue determination process as detailed within Stage 1. These costs represent the early works for the project.

4. Verification process

GHD Advisory has used different verification approaches to assess the reasonableness / sufficiency of costs included in the Stage 1 and supported by Transgrid's Capex Forecasting Methodology. The approach applied depends on the nature of the cost element and included a combination of:

- Benchmarking – GHD Advisory has access to benchmarking data on ISP project cost elements based upon the work we completed for AEMO during the development of the Transmission Cost Database (TCD). (A full description of the TCD and the sources of the benchmarking data is included in Appendix A)

  Insights in terms of benchmarking covering D&A costs to achieve FID are limited as this information is not publicly available. However, GHD Advisory has access to other ISP project progressing through the D&A phase and has access to other Transgrid cost elements such as PEC.

  Where appropriate, we have compared costs included in Stage 1 to cost element benchmarking data included in the TCD or other sources as is detailed across the following sections
- Reliance on the results of Transgrid's competitive tendering processes supported by appropriate documentary evidence
- 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.

- Internal labour costs have been considered considering the reasonableness of the team structure, 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
- Consideration of whether costs that are prudent and would be incurred by other TNSPs
- Consideration of whether costs relate to activities required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.

5. Stage 1 CPA capex forecasting methodology

Transgrid has developed a Capex Forecasting Methodology to support the Stage 1 forecast which has been considered by GHD Advisory. The purpose of the methodology document is to:

- Provide an overview of the early works package and various cost components
- Provide justification for the methodologies used to determine the capex forecast
- Identify how Transgrid verified and validated the actual and forecast capex[1]

To develop their capex forecast Transgrid has adopted a number of forecasting techniques including:

- External market-based quotes
- Benchmarking with similar transmission projects such as PEC
- Bottom-up estimates based on unit rates in Transgrid's estimating database and using quantity requirements commensurate with actuals on past recent projects and where available industry market data.

The Capex Forecasting Methodology indicates that higher value components have market-based quotes and benchmarking applied to demonstrate the accuracy of the forecasting. The forecasting process is developed based on three stages detailed in the Capex Forecasting Methodology.

The Capex Forecasting Methodology indicates that Transgrid has applied a three stage process of reviewing direct costs (procurement and land acquisition) and labour and indirect costs to provide confidence of achieving an accurate estimate of costs. Labour and indirect costs are also compared to PEC and AEMO's TCD[2].

The specific forecasting methodologies that applied to the various cost components are reviewed in the following sections of this report.

[1] Capex Forecasting Methodology for HumeLink,p4.
[2] Capex Forecasting Methodology for HumeLink, p11

6. Stage 1 CPA costs

Table 2 details the forecasts included in Stage 1 at a summary level, these represent costs required to deliver the objectives of Stage 1.

Across the following sections, those material cost elements claimed in Stage 1 have been assessed according to the verification process detailed above.

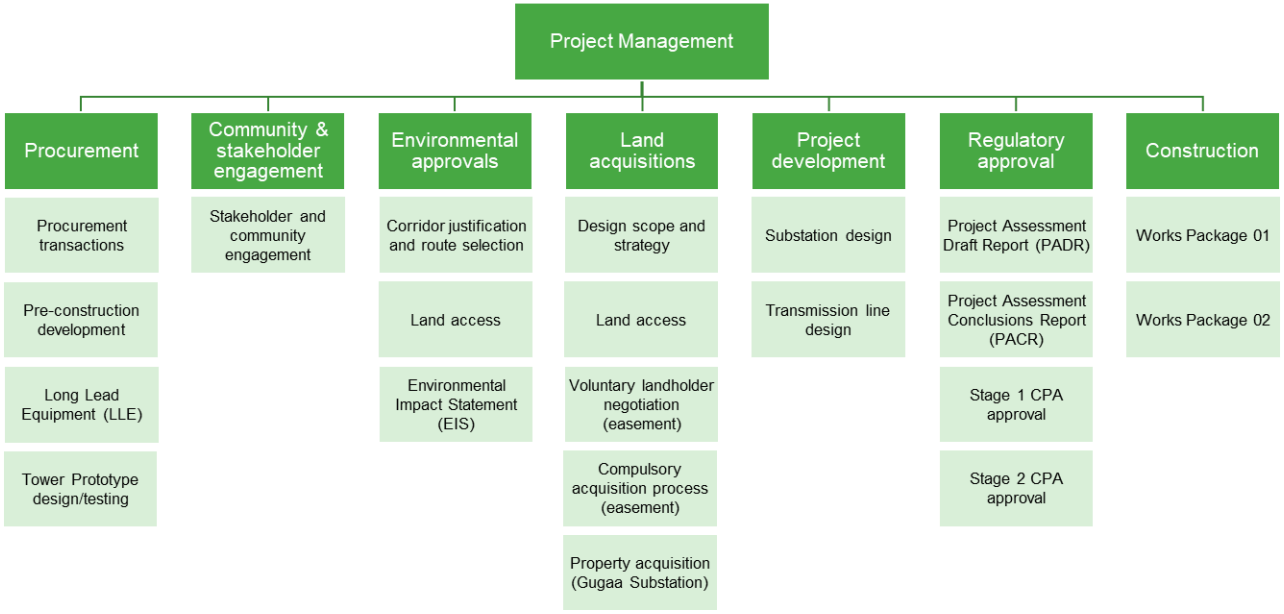
Table 2 Stage 1 CPA cost breakdown (Real 2017-18)

Category	Section reference	Capex $M
Procurement	Section 7	104.59
Land acquisition	Section 8	22.12
Project team resources	Section 9	75.45
Procurement transaction indirect costs	Section 10	27.55
Project development	Section 11	32.86
Land and environment	Section 12	28.85
Community stakeholder engagement	Section 13	18.56
Regulatory approvals and other support costs	Section 14	11.90
Total		**321.87**[3]

To further illustrate the Stage 1 estimate GHD Advisory has included the work breakdown structure of the forecast extracted from the Transgrid's A.2 Scope Definition document.

[3] Costs are rounded and as such do not equal the total amounts

Figure 1 Stage 1 work programs



7. Procurement

The following table details the procurement direct non-labour costs that are expected to be incurred in finalising transmission and substation designs and other pre-construction works as part of awarded contracts, deposits made for LLE production and orders placed for tower prototype testing.

Table 3 Procurement cost forecast (Real 2017-18)

Category	Section reference	Capex $M
Pre-construction development	Section 7.1	[redacted]
LLE substations, transformers and reactors	Section 7.2	[redacted]
Tower design and prototype testing	Section 7.3	[redacted]
Total		**104.59**[4]

7.1 Pre-construction development

The following table represents the forecast developed by Transgrid for the design and other pre-construction work costs. These activities represent the detailed design and pre-construction work awarded.

As detailed in section 16.1 these activities need to be completed in Stage 1 to support project delivery timeframes in Stage 2.

[4] Costs are rounded and as such do not equal the total amounts

Table 4 Pre-construction development forecast (Real 2017-18)

Category	Section reference	Capex $M
Transmission lines	Section 7.1.1	[redacted]
Substations	Section 7.1.2	[redacted]
Total		[redacted]

7.1.1 Transmission lines pre-construction costs

The transmission lines project scope is to construct three 500 kV double-circuit lines:

- Between Maragle and Bannaby 500 kV substations
- Between Maragle and Wagga Wagga 500 kV substation
- Between Wagga Wagga and Bannaby 500 kV substations.

The total distance of the 500kV transmission lines at this stage has been determined to be 365 km[5]. In addition, 15km of 330kV transmission lines will be built to connect new 500kV substations to existing 330kV substations at Wagga Wagga and Maragle. Transgrid have estimated that the total transmission line cost EPC project cost is to be [redacted][6] (Real 2019-20).

GHD Advisory have compared this cost estimate with a TCD benchmark cost estimate of [redacted]M which is within 2% of the estimated capex. As such we are satisfied that the Transgrid estimate of transmission line costs represents a reasonable basis upon which to estimate pre-construction costs.

The preconstruction activities consist of:

- Competing required design work
- Finalising the equipment specifications, and
- Identifying quantities of plant and materials required.
- Completing project documentation and obtaining work permits[7].

The transmission line pre-construction costs are estimated at [redacted] (Real 2017-18). This is based on a total capital cost estimate of [redacted] (Real 2019-20) for the transmission lines and then an estimate that the pre-construction component would be 4.43% of the capital cost of [redacted] (Real 2019-20), [redacted] (Real 2017-18). No bottom up estimate of the design cost has been undertaken at this stage.

The pre-construction works percentage forecast was submitted by an experienced design consultant familiar with Transgrid and with the HumeLink project.

GHD Advisory would expect that when considering transmission line pre-construction costs alone that transmission line component would a lower percentage than for the substation pre-construction costs. However, as

[5] HumeLink Capex Forecasting Methodology V06H 11/3/22, p.27
[6] HumeLink, PACR addendum NPV model, 17 December 2021
[7] HumeLink Summary Capex Basis and Drivers, p3

illustrated in section 7.1.3, when we combine transmission and substations costs and benchmark this to other ISP projects in their D&A forecast, the cost as a percentage of the total project cost aligns to an acceptable level.

The Stage 1 forecast capex for the pre-construction works for transmission lines, is considered reasonable based upon this combined transmission and substations costs benchmarking. The cost forecast methodology adopted by Transgrid of seeking a non-binding estimate from an experienced design consultant is considered reasonable.

7.1.2 Substation pre-construction costs

The substation project[8] scope consists of:

- A new Gugaa 500/330kV greenfield substation (including two new 500/330/33 kV 1,500 MVA transformers)
- Augmentation works at the existing Wagga Wagga 330kV substation to enable connections to the additional transmission lines
- A new 500 kV substation at Maragle (including three new 500/330/33 kV 1,500 MVA transformers)
- Augmentation works at the Bannaby substation to enable connections to the additional transmission lines.

The substation pre-construction cost is estimated at [redacted] (Real 2017-18). This is based on a total capital cost estimate of [redacted] (Real 2019-20) for the substation works and an estimate that the pre-construction component would be 4.43% of the capital cost [redacted] (Real 2019-20), [redacted] (Real 2017-18). No bottom up estimate of the design cost has been undertaken at this stage.

Again the pre-construction percentage forecast was developed by an experienced design consultant familiar with Transgrid and with the HumeLink project.

This design proportion was compared to the design proportion of recent transmission projects, which is shown in the table below. The five projects show for recent NSW contracted substation works that the design percentage varies between 2.9% and 8.5%. This is the design component only whereas the 4.43% estimate includes other pre-construction scope.

The 4.43% estimate is in the middle of these contracted substation projects, although for the larger transmission substations, Buronga and Dinawan, the percentages are lower (2.9% and 3.0%). This is likely due to the high-cost components of the synchronous condensers increasing the relative costs of those substations. We would expect that HumeLink project costs as a percentage will be lower than the two solar wind farm projects due to the economy of scale of the HumeLink project.

Table 5 Design proportion of the total estimated substation works (Real 2020-21)

Substation design component	D&C Subcontract value + HV equip $M	D&C sub design value $M	Design costs as percent of contracted value
Glenellen Solar Farm	14.1	1.2	8.5

[8] Transgrid BOE OFS 1901 3C2 Snowy 2 Transmission Investment, Rev 0, p.14

Substation design component	D&C Subcontract value + HV equip $M	D&C sub design value $M	Design costs as percent of contracted value
Avonlie Solar Farm	17.5	1.1	6.3
Kiamal	27.6	1.3	4.7
PEC (Buronga)	296.4	8.6	2.9
PEC (Dinawan)	151.6	4.5	3.0

GHD Advisory has reviewed the Option Feasibility Study which provides a breakdown of the substation quantities. The estimate capital cost was compared to the TCD database which produced a capital cost of [redacted] with is approximately 10% above Transgrid's cost estimate, however it is well within the level of accuracy for the extent of design undertaken (+/-30%).

On this basis the substation pre-construction cost which is based on a percentage of the substation capital cost is considered reasonable. The cost forecast methodology adopted by Transgrid of seeking a non-binding estimate from an experienced design consultant is considered reasonable.

7.1.3 Pre-construction cost benchmarking

The table below benchmarks design costs where GHD Advisory has access to D&A budgets. It also includes PEC design costs that represent the design components only based upon the tendered results for comparison purposes. The design cost estimate compares to Project A considering HVAC costs only.

Table 6 Design cost benchmarking D&A phase

Project	Project total costs	Design costs	Design costs as a % of relevant project costs
D&A phase			
Project A (HVAC only)	$0.5B	$11.8M	2.3%
HumeLink (PACR transmission lines and substations only)	$2.4B	$82.8M	3.5%
Total estimate			
PEC	$1.9B	$70.6M	3.7%

Project	Project total costs	Design costs	Design costs as a % of relevant project costs
		Includes design test and commissioning provisions.	

As the table demonstrates the pre-construction design activities for lines and substations for HumeLink is higher than for Project A however it is slightly lower as a percentage than PEC which is a more similar project to HumeLink than Project A.

7.2 LLE substations, transformers and reactors

To minimise the risk of project delays due to late delivery of key construction elements Transgrid has included an amount of [redacted] (Real 2017-18) for a down-payment of LLE items (transformers and reactors).

The following LLE equipment[9] is required for the substations works:

- Bannaby Substation:
    - Two 500kV 181MVAr line shunt reactors
- Maragle Substation:
    - Two 500kV 181MVAr line shunt reactors
    - Three 500/330kV 1500MVA transformer banks (each with 3 single phase units)
    - One auxiliary transformer
- Gugaa substation:
    - Two 500kV 181MVAr line shunt reactors (plus 1 spare)
    - Two 500/330kV 1500MVA transformer banks (each with 3 single phase units, plus 1 spare single-phase unit)
    - One Auxiliary transformer[10]

The estimate for substation LLE transformers and reactors is based upon a high-level estimates of equipment costs at [redacted] (Real 2017-18). Transgrid determined the capex forecast based on their MTWO data base as well as actual costs based on equivalent orders placed for PEC and Queensland NSW Interconnect (QNI)[11].

[9] BOE OFS-1901-3C-2 Snowy 2 Transmission Investment, Transgrid, page 26.
[10] BOE OFS-1901-3C-2 Snowy 2 Transmission Investment, Transgrid, page 11.
[11] Capex Forecasting Methodology for Humelink Stage 1 CPA, p18

Table 7 LLE forecasted cost (Real 2017-18)

Long Lead Time Equipment	Quantity	Unit cost $ M	Total $M
Three phase 500/330 1500 MVA transformers	5		[redacted]
500 kV 181MVar line shunt reactors	7	[redacted]	[redacted]
Total			[redacted]

The [redacted] cost estimate for substation LLE transformers and reactors equipment has been benchmarked against TCD cost elements and were found to be 20% below the estimate calculated by the TCD model. This however is still within the +/- 30% threshold we use for cost benchmarking and is therefore considered reasonable.

Based upon a review of other general conditions and commercial schedules which Transgrid and ABB have experienced recently for the procurement of a reactor for Armidale substation, a 10% payment (5% for design and 5% for partial coil manufacture) was required upon receipt of designs to progress acquisition[13].

The LLE booking fee amount of [redacted] (Real 2017-18) is 20% of the estimated capital cost of [redacted] (Real 2017-18).

Transgrid have determined a 20% amount is required for a booking fee based on independent advice from two suppliers, GE and Hyosung[14]. GE indicated that 10% was needed for the preliminary engineering work and a further 5% for booking a production slot for a total initial payment of 15% of the capital value. Hysosung indicated that less than 5% would be sufficient for design and a booking if the order was placed by Transgrid and up to 15% to 20% for an EPC contractor completely new to the market or with a poor credit rating[15]. Previously ABB had indicated, based on the Armidale substation that 10% would be sufficient for a production slot for the reactors[16].

The capex forecast methodology used to determine the LLE equipment costs by Transgrid is considered to be reasonable.

7.3 Tower design and prototype testing

Transgrid as part of their preliminary investigations on the line design have identified nine standard tower designs which will be required for the project. During the PSCR stage Transgrid identified approximately 39,000 tonnes of steel will be required for the construction of the transmission lines[17]. To reduce the risk of structural failure, compliance to standards and project delays with design or construction of the lines Transgrid has allowed for nine standard towers to be designed by the successful contractor as well as prototype testing of these tower designs in Stage 1.

[12] Unit costs are rounded and as such do not equal the total amounts
[13] Transgrid Memorandum, page 1
[14] Capex Forecasting Methodology for HumeLink Stage 1 CPA, p18
[15] Transgrid – HumeLink Direct Non-Labour Model, Long Lead Equipment Tab, excel spreadsheet
[16] Transgrid Memorandum, page 1
[17] BOE OFS-1901-3C-2 Snowy 2 Transmission Investment, Transgrid, page 7

The forecast capex for steel tower assembly design and prototype testing is [redacted] (Real 2017-18) which consists of:

- Tower design and detailed drawings [[redacted] + [redacted]] x # Towers [9] = [redacted] (Real 2021-22)
- Prototype erection of towers [[redacted] per MT] x 481 Metric Tonnes = [redacted] (Real 2021-22)
- Tower load testing [[redacted] per MT] x 481 Metric Tonnes = [redacted] (Real 2021-22)
- Allocation of supplier management costs = [redacted] (Real 2021-22)

This cost forecasting for the tower design and prototype testing was based on a quotation by a supplier. The Capex Forecasting Methodology documents states that this estimate is based on the lower of two steel supplier quotations. The quotation from Mitas Industry was adopted in the non-labour capex model. Given the small component of the overall Stage 1 capex forecast this quotation is considered a reasonable forecast capex methodology.

7.4 Procurement assessment conclusion

Stage 1 procurement estimates include design / pre-construction costs, prototype testing and the purchase of LLE.

As detailed in section 16.1 these activities need to be completed in Stage 1 to support project delivery timeframes.

Pre-construction provisions for transmission lines and substations have been based upon specialist advice regarding the percentage of EPC project costs that are applicable to the pre-construction work identified as needed in Stage 1. The total EPC cost for the transmission lines and substations has been benchmarked to the TCD model and is within acceptable variation to the benchmark.

Whilst we would expect the costs for substations to be higher and for transmission lines lower on a percentage basis, when combined costs are considered reasonable when compared with Project A HVAC design costs in total.

8. Land acquisition

GHD Advisory understands the land acquisition costs provided for in the Stage 1 will be incurred early in the project to facilitate timely access to new substation sites and provide adequate time to negotiate option agreements for the acquisition of land and easements, comply with Property Acquisition NSW Guidelines and if necessary, undertake compulsorily acquisition in the event amicable agreement cannot be reached.

The table below details the land acquisition costs claimed in Stage 1.

Table 8 Land acquisitions forecast (Real 2017-18)

Category	Section reference	$M
Property acquisition costs for the Gugaa substation	Section 8.1	[redacted]

Category	Section reference	$M
Landholder legal valuation	Section 8.2	6.70
Option fees	Section 8.3	[redacted]
Land valuation	Section 8.4	2.15
Valuer general fees	-	0.88
Cultural heritage assessment	-	0.53
Total		**22.12**[18]

8.1 Property acquisition costs for the Gugaa substation

The estimated property acquisition costs for the Gugaa substation are [redacted] (Real 2017-18). According to the Capex Forecasting Methodology, this has been based upon a valuation approach that incorporates the individual components of compensation (disturbance, potential for diminution of balance parcel and potential severance) in total under Section 55(f) Injurious Affection of the Land Acquisition (Just Terms Compensation) Act 1991 used by Knight Frank.

The current forecast makes an allowance for twice the sum of the costs below to achieve a final negotiated price for the acquisition of freehold land.

The calculation for required capex for the acquisition (Real $2017-18) is as follows:

- Section 55(1) Market Value - [redacted]
- Section 55(f) Injurious Affectation - [redacted]

Total assessed compensation: [redacted](allowance for negotiated settlement) - [redacted]

Transgrid also need to ensure that a suitable site is established for the Gugaa Substation should negotiations to acquire the preferred site does not proceed. The option fees for two other potential sites are estimated to cost [redacted] (Real 2017-18).

The total forecasted capex is then:

- [redacted] (Real $2017-2018).

An earlier forecast verified by GHD advisory was based on a desktop estimate by Knight Frank and includes compensation in line with the Land Acquisition (Just Terms Compensation) Act 1991 (NSW) and Transgrid's Property Acquisition Compensation Principles for NSW Major Projects (The Guidelines). The Guidelines set out Transgrid's approach to assessing compensation when acquiring property for major projects.

[18] Costs are rounded and as such do not equal the total amounts

GHD Advisory notes that this represented an earlier forecasting approach. However, it still represents an alternative approach to assess reasonableness.

The table below set out the calculation performed by Transgrid to estimate the acquisition costs.

Table 9 Estimate Gugaa substation property acquisition costs (Real 2021-22)

Cost element	$M
1. Highest potential Market Value [redacted] Based upon Herron Todd White Valuers, assessment of compensation for sales in the area over recent years taking the highest cost per Ha at $32,000 X 90Ha = $2.9M	[redacted]
2. Disturbance (Cost of crop) = + [redacted] Disturbance 7.1(c) of Compensation Principles and s 55(d) of Just Terms Act. The definition for disturbance is broader than the items listed in the Transgrid Property Acquisition Compensation Principles for NSW Major Projects. It includes any ancillary costs or losses incurred as a direct result of the acquisition such as fees or loss of business profits. Estimate based upon crop loss estimate provided by landholder.	[redacted]
3. Potential for diminution of balance parcel = [redacted] A subset of 7.1(a) of Compensation Principles known as Injurious affection. Injurious affection is a subset of Market Value and represents compensation for partial purchase impacting overall value.	[redacted]
4. Potential Severance of 10Ha: [redacted] [redacted]Severance 7.1(d) of Compensation Principles and 55(c) of Just Terms Act x 10 HA = [redacted]	[redacted]
Total Estimate = [redacted] = [Sum of 1 to 4] x 2 [Basis: Transgrid Compensation Principles s 7.2] = [redacted] = [redacted]	[redacted]
Option Fees on 2 locations: [redacted]	[redacted]
Total (Real 2021-22)	[redacted]
Total (Real 2017-18)	[redacted]

GHD Advisory do not have access to a registered valuer at this time to review this estimate. Based on past experience in the management of land acquisition projects and the criteria used by Transgrid, GHD Advisory consider this estimate to be appropriate for Stage 1.

The capex forecasting methodology of utilising recent assessments of land compensation claims in the area from a land valuer is a reasonable approach for determining the likely land acquisition cost. The volume of land is the maximum likely footprint required for the substation based on an assessment of similar substation footprints which includes land outside the substation for transmission line cut-ins.

The other cost elements, disturbance of crops, diminution of parcel land and potential for severance of 10Ha have been estimated by Transgrid, however given the smaller quantities involved this is considered appropriate.

Given that our verified estimate is 12% higher than the current amount provided for and within the +/-30% allowance for forecasting accuracy, GHD Advisory accepts the reasonableness of the current forecast.

8.2 Landholder legal valuation

The Transgrid forecast is based on number of landholders multiplied by a fixed fee (362 X $20,000 = $7.2M) (Real 2021-22), $6.70M (Real 2017-18), noting there are 362 landholders for HumeLink (subject to further route refinement).

The $20,000 has been determined using Section 7.4 of the Property Acquisition Compensation Principles for NSW Major Projects.

Transgrid is required under the terms of the Land Acquisition (Just Terms Compensation) Act 1991 (NSW), to compensate landholders for their legal costs (to review contracts etc).

GHD Advisory understand that Transgrid in estimating the $20,000 fixed fee have allowed $10,000 for a landholder to obtain legal advice on the acquisition process and $10,000 to engage their own registered valuer to assess compensation on their behalf. Based on past experience in undertaking land acquisition projects GHD Advisory consider this estimate to be appropriate. On the signing of the Option Deed the landholders reasonable legal and valuation fees would be paid.

Given the landowner legal valuation fees is a typical budget allowance the cost methodology used is reasonable.

8.3 Options

The Transgrid Forecast capex is based on number of private landholders / properties. There are 287 private landholders within the HumeLink corridor (subject to further route refinement) i.e. 287 multiplied by a fixed rate of [redacted] = [redacted] (Real 2021-22), [redacted] (Real 2017-18).

The Direct Non-Labour Model refers to Transgrid's Property Acquisition Compensation Principles for NSW Major Projects Section 7.3 which states that a typical easement option fee is [redacted] and 10% of the property valuation for freehold land[19]. However, the Capex Forecasting Methodology document states that standard allowance for the Option Fee under section 7.3 Projects was amended to reflect [redacted] per property required for PEC and that

[19] Direct Non-Labour Model, Tab – Option Fees

this will be applied for HumeLink. The Property Acquisition Compensation Principles for NSW Major Projects document should be updated to reflect the current option fee allowance to resolve this the discrepancy.

Given the option fees is a standard allowance, which was applied to PEC as well, the cost methodology used is reasonable.

8.4 Land valuation

The valuation services estimate at $2.3M (Real 2021-22), $2.15M (Real 2017-18) is based upon a quote received from Knight Frank of $3.0M to $3.3M for 362 properties equates to a valuation fee of $6,000 per property.

The forecast for Stage 1 is based upon 362 landholders by $6,000 per property plus an allowance for desktop valuations of $150,000 = $2.3M (Real 2021-22).

The quotation provided by Knight Frank, an experienced property valuation consultant, is an appropriate cost forecasting method for land valuations. Given the land valuation cost forecast is small relative to the Stage 1 forecast cost the use of one quotation is considered sufficient.

8.5 Land acquisition conclusion

The land acquisition costs included in Stage 1 have been prepared on a reasonable basis and the activities are considered prudent to facilitate timely access to new substation sites and provide adequate time to negotiate option agreements for the acquisition of land and easements, comply with Property Acquisition NSW Guidelines and if necessary, undertake compulsorily acquisition in the event amicable agreement cannot be reached.

These acquisitions work is needed in Stage 1 to reduce risks later for Stage 2 and to meet the AEMO delivery target.

9. Project team resources

The project team is structured into different teams under a project director, with each team delivering outcomes that are aligned to complete the D&A activities required to reach the FID. The forecast for internal labour in each project stream is detailed in the table below.

Table 10 Project team resource forecast (Real 2017-18)

Project team streams	Section reference	Actual to 31 December 2021 $M	Forecast to 30 June 2024 $M	Total $M
Project management and development team	Section 9.1	9.01	30.66	39.67
Procurement team	Section 9.2	0.63	6.56	7.19

Project team streams	Section reference	Actual to 31 December 2021 $M	Forecast to 30 June 2024 $M	Total $M
Community and stakeholder engagement	Section 9.3	1.96	2.72	4.68
Land & environment team	Section 9.4	4.59	10.06	14.66
Corporate and other project team resources	Section 9.5	4.52	4.73	9.25
Total		**20.72**	**54.73**	**75.45**[20]

Across the following subsections covering each stream, internal project resources have been estimated based upon:

- The Full Time Equivalent (FTE) profile and numbers required to deliver each of the project streams objectives to support D&A delivery
- Standard labour and overtime rates
- On-costs applied to standard labour and overtime rates

The Capex Forecasting Methodology details that:

- Resources included in the forecast are incremental to Transgrid's business as usual activities and given the separate major project team and project size this is likely to be the case as required for a contingent project
- Standard labour rates included in the forecast use 30 June 2018 labour rates that have been calculated using standard rates as at 1 July 2021, which have been adjusted to 2017-18 rates through removing labour escalation and CPI inflation
- Labour rates and role classifications were aligned to Transgrid's 2021-22 Standard Labour rates[21], the Employee's Agreement[22] and assumptions on future increases. The Labour rates were restated to 30 June 2018 Labour rates using a discount factor to remove CPI inflation and real Labour escalation (as per the AER's Final Decision on the 2018-19 to 2022-23 Revenue Cap)
- External labour costs have been based upon quotes provided.

The Capex Forecasting Methodology is silent upon the on-cost methodology but refers to the supporting spreadsheet and document regarding the labour and labour related costs for HumeLink which indicates that on-costs assumptions include:

[20] Costs are rounded and as such do not equal the total amounts
[21] Labour and Support Cost Rates Effective July 2021.
[22] TransGrid Employees Agreement 2016.

- Uplift for support costs over base salary of 90% which is consistent with other Transgrid ISP projects such as VNI West (VNIW)
- Contract or Enterprise agreement on costs of 30.3% which is consistent with other Transgrid ISP projects such as VNI West
- Enterprise agreement on costs 30.3% this is consistent with other Transgrid ISP projects such as VNI West

9.1 Project management and development team

Based upon the allocation methodology described above, actual costs to 31 December 2021 are $9.01M and the forecast to FID is $30.66M totalling $39.67M (Real 2017-18).

The project management team represents with 39 positions in total reflecting an average of approximately 33 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The project management team is responsible for:

- Overall project management
- Governance
- Network planning
- Development of the transmission line routes and concept designs
- Substation concept designs and specifications
- Cost estimates.

Specialist staff from the core business (corporate services) have assisted and will continue to assist the development of the project throughout the remainder of the D&A phase.

The base rates for roles compare to those used in the forecast for VNIW early works. Because the role descriptions differ between projects this analysis has looked at role bands low to high which generally shows good alignment.

Benchmarking to PEC compares with the Stage 1 forecast when works project management (a Stage 2 cost element) is excluded from the comparison.

Table 11 VNIW early works project management cost benchmarking

Project	Project total costs	Project management labour costs	Project management labour costs as a % of relevant project costs
PEC	$1.9B	$23.1M (Project management and major projects team only	1.2%

Project	Project total costs	Project management labour costs	Project management labour costs as a % of relevant project costs
		excluding works project management)	
HumeLink	$3.3B	$39.7M	1.2%

9.2 Procurement team

Based upon the allocation methodology described above, actual costs to 31 December 2021 are $0.63M and the forecast is $6.56M for a total of $7.19M (Real 2017-18).

The procurement team represents with 12 positions in total reflecting an average of approximately 6.6 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The procurement team is required to engage early with contractors, prepare and manage the tendering process, establish and award contracts, and procure the early works to be undertaken. These activities need to be completed to inform the basis of the Stage 2 forecast and required to meet the projects time frames.

The same base rate review as performed above indicates the same results.

Benchmarking to other ISP projects where GHD Advisory has early works forecasting is detailed in the table below, benchmarks favourably with VNIW. The same can be concluded for Project A when external transaction costs for Stage 1 in section 10.2 is $4.72M and adding that to the direct costs below of $6.6M, the total resource is then $11.32M.

Table 12 Procurement labour cost benchmarking excluding forward production slot booking and bidder payments

Project	Project total costs	Procurement labour costs	Procurement labour costs as a % of total project costs
Project A	$3.5B	$14.5M	0.4%
VNIW[23]	$1.6B	$3.4M	0.2%
Hume Link	$3.3B	$6.6M	0.2%

9.3 Community and stakeholder engagement

Based upon the allocation methodology described above, actual costs to 31 December 2021 are $1.96M and the forecast to FID is $2.72M for a total of $4.68M (Real 2017-18).

[23] Source Transgrid's VNIW early works cost estimate

The community and stakeholder engagement team represents with 10 positions in total reflecting an average of approximately 7.8 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The community and stakeholder engagement team are responsible for development and implementation of the community engagement plan, the associated indigenous engagement plan, and social impact engagements. Engagement activity with government bodies, regulators and industry is conducted in liaison with the project and regulatory teams. Other work for the community and stakeholder team includes media engagements, running community events and implementing Social License and Local Community Partnership Initiatives.

These activities need to be conducted in Stage 1 to reduce project risks and costs from not achieving sufficient support from the general community, landholders and indigenous groups.

The same base rate review as performed above indicates the same results noting these are contracted services.

The table below benchmarks community and stakeholder engagement team costs to other projects where D&A budgets are available. In this case HumeLink benchmarks against PEC noting that the majority of engagement costs are incurred in Stage 1.

Table 13 Community and stakeholder enguagement cost benchmarking during the D&A phase

Project	Project total costs	Engagement costs	Engagement costs as a % of total project costs
VNIW[24]	$1.6B	$2.8M	0.2%
PEC	$1.9B	$2.9M (Internal costs only)	0.1%
HumeLink	$3.3B	$4.7M	0.1%

9.4 Land & environment team

Based upon the allocation methodology described above, actual costs to 31 December 2021 are $4.59M and the forecast to FID is $10.06M for a total of $14.66M.

The land and environment team represents with 25 positions in total reflecting an average of approximately 13 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The deliverables of the land acquisition process for Stage 1 are:

- Ensure landholders have been satisfactorily engaged and are agreeable with the outcomes of negotiations
- Early option agreements are established for transmission line easements and that any necessary compulsory acquisitions have been established prior to Final FID
- The site for the new Gugaa substation has been acquired

[24] Source Transgrid's VNIW Early Works cost estimate

- Cultural heritage surveys and plans meet the requirements of the relevant government agencies and indigenous stakeholders.

All these activities reduce schedule and cost risks and are required in Stage 1 to ensure the project can be delivered by 2026-27. The table below benchmarks the land and environment team costs to other ISP projects where GHD Advisory has access to D&A budgets. This analysis indicates alignment.

Table 14 Environmental cost benchmarking excluding biodiversity costs

Project	Project total costs	Environmental costs	Environmental costs as a % of total project costs	Environmental notes
Project A	$3.5B	$19.1M	0.5%	Complex scope across different jurisdictions.
VNIW[25]	$1.6B	$5.5M	0.3%	Only includes early works environmental costs.
HumeLink	$3.3B	$14.7M	0.4%	

9.5 Corporate and other project team resources

Based upon the allocation methodology described above, actual costs to 31 December 2021 are $4.52M and the forecast to FID is $4.73M for a total of $9.25M (Real 2017-18).

The corporate and other project team represents 51 positions in total reflecting an average of approximately 5.6 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The team provides support across D&A phase of work and for the early works on the HumeLink Project. Support is required from internal engineering and design, network planning and development teams, and from corporate support for health and safety, legal, risk and audit, and regulatory activities.

9.6 Project team resources conclusion

Each project stream holds objectives requiring activities and related costs in Stage 1 to either support early FID, reduce schedule and cost risks and to deliver the project by 2026-27.

The forecast is based upon a detailed bottom-up build detailing positions required to complete project stream objectives, phased using reasonable base rates per position and applying the on-costs required as per Transgrid's other ISP projects.

[25] Source Transgrid's VNIW Early Works cost estimate

10. Procurement transaction indirect costs

The table below presents bidder payments required to elicit the receipt of quality tender submissions and other support costs associated with tender processes. These are required to ensure market testing is robust.

Table 15 Bidder payments and facility cost forecast (Real 2017-18)

Forecast element	Section reference	$M
Bidder payments	Section 10.1	22.22
Transaction procurement support	Section 10.2	4.78
Data room	-	0.56
Total		**27.55**[26]

10.1 Bidder payments

To encourage the competitive participation of multiple bidders, bidder payments are normally made to guarantee the quality and quantity of bidders and submissions provided. This is typically a component of the procurement strategy and was deployed successfully on PEC.

The Stage 1 CPA forecast indicates that Transgrid intends to follow a similar procurement process as PEC with early engagement in accordance with the Major Infrastructure Projects Practice Note[27] to:

- Ensure greater cost certainty to support Stage 2 forecast
- Improve project definition and site information, discuss innovations, design completeness, develop program assumptions, progress EIS, identify risks and opportunities.

Multiple contractors [redacted] will be engaged to diversify capacity risk and increase competitive tension.

The payment of bidder payments is in line with NSW Government policy[28], supporting the reimbursement of up to 50% of the expected bid costs for projects exceeding $100 million. The estimate of [redacted] per bidder is considered reasonable and is similar with the bidder payments made on PEC. (The bidder payments are higher as a percentage of EPC project costs for HumeLink with two packages intended to be awarded and this is recognising the current market expectations for higher reimbursement of bidder costs[29]).

[redacted] discounted to $22.22M (Real 2017-18).

[26] Costs are rounded and as such do not equal the total amounts
[27] Major Infrastructure Projects Practice Note, Australian Constructors Association, 2019
[28] Bid Costs Contribution Policy, NSW Treasury, 2018
[29] Advice from Pro[2] Infrastructure Consultants

10.2 Transaction procurement support

This represents the cost of external resources required during the CCE, which as described is similar to the procurement approach employed on PEC.

The total forecast capex is based on:

- Actual costs of $0.23 (Real 2017-18) to 31 December 2021.
- Forecasted costs to 30 June 2024 of $4.55M (Real 2017-18) for external labour resources and other indirect costs

The total forecast capex with historical costs is $4.78M (Real 2017-18).

Table 16 Forecasted transaction procurement support to June 2024 (Real 217-18)

CCE phase	Details	$M
Actual Costs	Costs to 31 Dec 2021	0.23
Phase 1 and 2	The Capex Forecasting Methodology indicates that this represents strategy support and costs reviews for the current and remaining transaction stages and transaction management support for further market sounding, requests for capability submissions and evaluation.	0.43
Phase 3	The Capex Forecasting Methodology indicates that this represents critical pre-tender engagement with shortlisted companies that aims to improve project definition and the tender process.	1.81
Phase 4	The Capex Forecasting Methodology indicates that this represents the preparation of documentation for a competitive tender and issuing tenders at the conclusion of the stage and managing the tender process to final tenders are submitted.	1.62
Phase 5	The Capex Forecasting Methodology indicates that this represents transaction management support for tender clarification and evaluation and commercial advisory services and independent expert review pre-award.	
Other support costs (such as staff travel and accommodation)		0.69
Total		**4.78**

GHD Advisory does not have benchmarking data available at this level of granularity to be able to support these estimates. However, based upon observations of the PEC procurement process these activities and our comparison of costs made in section 9.2 these external resources are required to manage the transactions with bidders and to ensure robust submissions, support tender evaluation and to finalise award.

10.3 Procurement transaction indirect costs conclusion

The provision included in the estimate is considered reasonable, prudent and consistent with past Transgrid ISP projects such as PEC.

These activities are required to improve the quality and competitiveness of tender responses and the robustness of the Stage 2 forecast and is required in Stage 1 to appoint contractors for the early works that in turn need to be completed prior to Stage 2.

11. Project development

The project management team are supported by external legal, engineers and other consultants to carry out activities to complete the D&A activities. The forecast for these costs has been detailed in the table below.

Table 17 Project development forecast (Real 2017-18)

Category	Section reference	Actual to 31 December 2021 $M	Forecast to 30 June 2024 $M	Total $M
External legal costs	Section 11.1	0.54	16.09	16.63
Geotech and surveys	Section 11.2	0.05	5.48	5.53
Project management / concept engineering	Section 11.3	1.91	2.95	4.86
Owners engineer	Section 11.4	0.02	2.60	2.63
Risk analysis, reporting and cost control support	Section 11.5	0.02	1.46	1.48
Travel and accommodation	-	0.09	1.03	1.12
Specialist studies	-	0.24	0.12	0.35
Other	-	0.24	0.02	0.26
Total				**32.86**

11.1 External legal costs

Transgrid utilises external legal support services to cover a range of aspects of the project development including permits, land acquisition strategy, environmental and heritage issues, contract program, corporate and general legal support. The total forecast capex is $16.63M (Real 2017-18) with a breakdown provided in the table below.

Table 18 External legal cost forecast (Real 2017-18)

External Legal Support Services	$M
Actual costs to date 31 December 2021	0.54
Development permits and connection agreements	0.39
Land acquisitions	3.80
Environmental and heritage	1.10
Contract program	5.40
Corporate and general legal support	5.40
Total (Real 2017-18)	**16.63**

The Capex Forecasting Methodology document states that the forecasted external legal costs are based on competitive submissions from legal service providers against a scope of issues and legal support anticipated for each work program. The cost forecast is the fee breakdown of the successful legal entity. Transgrid have also indicated that they have compared the cost forecast to costs on PEC and other major projects[30].

GHD Advisory has agreed the forecast to the quote provided by the external service provider.

11.2 Geo-tech and survey costs

Geotechnical reports are required in Stage 1 to enable contractor's to more accurately price foundation costs and assess the risk of varying geotechnical conditions. Transgrid has forecast $6M (Real 2021-22) $5.53M (Real 2017-18), for geotechnical and survey costs as outlined in the table below.

The following table details geo-tech and survey costs claimed in Stage 1.

Table 19 Geo-tech and survey cost forecast breakdown (Real 2021-22)

Geo-tech and survey costs elements	$M
Geotech transmission lines	5.1

[30] HumeLink Capex Forecasting Methodology, p.37

Geo-tech and survey costs elements	$M
Geotech substations	0.4
Other studies	0.3
LiDAR surveys	0.2
Total (Real 2021-22)	**6.0**
Total (Real 2017-18)	**5.53**

Transgrid has developed the cost forecasts for transmission line geotechnical investigations at $5.53M (Real 2017-18) have been determined based on unit rates for tests conducted on PEC as follows:

- [$4,400] for # tension towers [179] + [$2,700] for # suspension towers [748] = $2.8M (Real 2021-22)
- An allowance for wet weather and additional testing of 25% - $0.7M (Real 2021-22)
- Supervision of drilling plus surveys of line route required to support environmental studies, land access and community engagement, and external resources for project oversight:
    - Supervision of drilling for cultural heritage oversight - $0.7M (Real 2021-22)
    - Survey costs to support land access, environment, and community engagement - $0.8M (Real 2021-22)
    - External project oversight - $0.12M (Real 2021-22)

The above cost factors appear reasonable.

11.3 Project management / concept designs

External design specialists from Aurecon have been contracted to produce concept designs for the procurement of services for detailed design and ordering of long lead time equipment and materials. The external services also include project managers and (up to five in total) over the forecast period to manage the engineering work for the project, environmental approvals, and community and stakeholder engagement during the D&A Phase.

The project management forecast has been determined based on a bottom-up estimate a quote provided by Aurecon for project management services through to June 2024 taking into account the costs incurred to 31 December 2021.

Table 20 Breakdown of project management forecast (2017-18)

Cost element	Total $M
Costs to 31 December 2021	1.91

Cost element	Total $M
Aurecon concept design	0.20
Aurecon project management	2.46
Aurecon additional engineering scope	0.29
Total	**4.86**

The forecasted costs are based on achieving an accurate estimate through a bottom-up estimate of required technical and management resources and from the three progressive revisions of hours needed to meet the scope of work. The expected costs are also supported by comparison with PEC. This cost forecasting methodology appears reasonable supported by Aurecon quotation sighted by GHD Advisory.

11.4 Owner engineer costs

Stage 1 forecasts owner engineering costs to be $2.8M (Real 2021-22), $2.63M (Real 2017-18).

This forecast has been based upon the results of a competitive tender process supported by quotes received from the winning tenderer with utilisation fluctuating for each identified resource based upon effort required on a monthly basis. These calculations are contained in the Owners Engineer - GHD - Forecasted Spend spreadsheet which details a forecast of $4.1M. Once this is adjusted for delayed start the estimate approximates to $3.3M (Real 2020-21).

11.5 Risk analysis, reporting and cost control support

To address the scale, complexity and costs to deliver HumeLink requires external scheduling, cost control and risk services to build a robust forecast and to equally apply sophisticated quantitative risk analysis over the whole project. Transgrid have engaged an international specialist services company to provide project scheduling, cost control and risk assessment services. This company previously provided advice on PEC and GHD Advisory has validated the forecast to quotes provided.

Stage 1 forecasts this scope of work to cost $1.48M (Real 2017-18).

The expected costs are based on an agreed work scope and resources support during Stage 1, and at agreed rates and hence given the experience of this service provider the approach and costs are considered reasonable.

11.6 Project development benchmarking

The table below benchmarks project development forecasts for projects in their D&A phase. These forecasts represent the external costs required to support the project management team.

Few benchmarks at the D&A phase are available. However, benchmarking at a high level indicates alignment with Project A.

Table 21 D&A phase project development cost benchmarking

Project	Project total costs	Project development costs	Project development costs as a % of total project costs
Project A	$3.5B	$29.0M (Legal and program management services only)	0.8%
HumeLink	$3.3B	$29.5M	0.9%

11.7 Project development conclusion

Project development costs are supported by quotes, the outcomes from competitive tender processes and reasonable estimation calculations. These external services are considered prudent as they are required to support the project management team in the delivery of D&A outcomes that reduce risk and improve the basis upon which tenders will be priced.

12. Land and environment

The following table details the forecast land and environment forecasted costs included in Stage 1. These represent activities that need to be completed in Stage 1 to gain the necessary approvals to avoid risk to schedule delays and support Stage 2 forecasts.

Table 22 EIS cost forecast (Real 2017-18)

Category	Section reference	$M
EIS forecast to complete	Section 12.1.1	18.79
Land agents	Section 12.1.2	6.64
EIS application fee	Section 12.1.3	2.58
Other	-	0.85
Total		**28.85**[31]

12.1.1 Environmental impact statement

The works undertaken to develop the EIS is well underway with $6.96M out of the forecast total $18.79M already spent up to 31 of December 2021. The remaining works includes:

[31] Costs are rounded and as such do not equal the total amounts

- Undertake targeted threatened species surveys and heritage surveys
- Providing technical assessments for the EIS and input to route option assessments
- Complete of EIS documentation

Examination of the supporting estimate details and the evidence available to support the evidence is indicated in the table below.

Table 23 EIS forecast to complete (Real 2017-18)

Cost element	$M	GHD Advisory assessment
Actuals to 31 December 2021	7.0	-
EIS preparation	2.2	Agreed to monthly budget provided by Aurecon. On this basis the estimate should be $2.6M (Real 2021-22) / $2.5M (Real 2017-18), the difference is not considered material
Spring ecological services	0.8	Agreed to quote provided by Aurecon less $1.7M (Real 2021-22) costs incurred to date
EIS work to complete	4.3	Agreed to quote provided by Aurecon
Construction support	0.7	Agreed to external quote
Submission report	0.9	Agreed to quote provided by Aurecon
Support	0.3	Agreed to external quote
Technical peer review	0.1	Not material
Route options validation assessment	0.3	Not material
Digital EIS	0.3	Agreed to quote provided by Aurecon
Targeted species survey	1.4	Agreed to quote provided by Aurecon
Offset broker	0.3	Agreed to quote provided by Aurecon
Sustainability strategy	0.2	Agreed to quote provided by Aurecon
Total	**18.8**	

12.1.2 Land agents

This cost covers the costs of four Land Agents, two Property Administrators, and a Property Projects Officer which will be provided over the period of January 2022 to June 2024 to lead the engagement with landholders for the negotiations to establish options to acquire easements, the Gugaa substation site acquisition, and land subject to compulsory acquisition of easements. The estimate has been agreed to the quote provided by Knight Frank. The land agent fees for PEC are comparable to the scheduled costs for HumeLink with a relative increase due to the number of landholders and the number of transactions expected. The cost forecasting methodology for the land agent fees is considered reasonable.

12.1.3 EIS application fee

The EIS application fee $2.58M (Real 2017-18) has been recalculated based on the requirements outlined in Division 1AA of the EP&A Regulation 2000 and the NSW Planning Circular of 2010 defining capital investment value. According to the Capex Forecasting Methodology, the fee estimate has been based upon a Capital Investment Value (CIV) of $2.82B. The $2.82B has been based upon P50 estimate used in the PACR.

The total estimated EIS application fee of $2.58M consists of the following elements:

- A base fee of $1.27M
- A planning reform fee of $1.27M
- CSSI and EIS exhibition fees totalling $0.05M.

These elements align with the definition of the CIV confirmed with a planning circular issued 10 May 2010 by the Department of Planning NSW. Use of these assumptions in a calculation of the application fee as illustrated in Table 24 supports an estimate of $2.6M.

GHD Advisory has used estimates from section 7 that breakdown into the following:

- Substations $476M (2019-20) refer section 7.1.2
- Transmission Lines $1,393M (2019-20) refer section 7.1.1

GHD Advisory has calculated the EIS application based on the project costs for HumeLink benchmarked against the AEMO TCD model. The resulting calculation is $2.4M (Real 2020-21) which aligns to the $2.58M (Real 2017-18) forecast used in the Capex Forecasting Methodology taking into account +/- 30% accuracy expected for forecasts at this stage of development.

Table 24 EIS application fee recalculation (Real 2020-21)

Category	Details	$M
Base fee	Maximum base fee $256,000* Plus $0.64 for each $1,000 over $400 million $1,548,852* * As per Environmental Planning and Assessment Regulation 2000 Section 256F	1.2

Category	Details	$M
Additional fees	Critical State significant infrastructure fee $50,000 EIS exhibition fee $2,830 Planning reform fee $1,632,741** ** As per Environmental Planning and Assessment Regulation 2000 Section 256L	1.2
Total (Real 2020-21)		**2.4**

The estimate recalculated is materially consistent with the provision included in the Stage 1 forecast.

12.2 Land and environment conclusion

Land and environment forecasts are adequately supported by quotations with rates and schedules against required work scopes, and calculations of the EIS application fee.

These costs are prudent and to a scope of work that is required to be completed prior to FID and Stage 2 to avoid risk to schedule delays and support Stage 2 forecasts.

13. Community stakeholder engagement

Stakeholder engagement is an important and mandatory requirement of the RIT-T process. As detained in the Capex Forecasting Methodology a HumeLink Engagement Plan has been developed that includes the following specific action plans:

- Landholder engagement – narrowed corridor plan
- Community engagement, events, and media plan
- Indigenous engagement plan
- Social legacy plan
- EIS exhibition and engagement plan

The table below details the total community and stakeholder engagement costs, excluding labour costs of the community stakeholder engagement team included in Stage 1.

Table 25 Community stakeholder engagement forecast (Real 2017-18)

Category	Section reference	Actual to 31 December 2021 $M	Forecast to 30 June 2024 $M	Total $M
Community engagement services	Section 13.1	2.44	6.13	8.57
Social legacy initiatives	Section 13.2	-	7.58	7.58
Travel and accomodation	-	0.32	0.40	0.72
Media and events	-	0.13	0.45	0.58
Community strategy development	-	0.13	0.45	0.58
Community Grants	-	0.01	0.56	0.57
Total		**3.10**	**15.46**	**18.56**[32]

13.1 Community engagement

The community engagement forecast has been agreed to a quote provided by Aurecon for community engagement services through to June 2024.

Table 26 Breakdown of community engagement services (Real 2017-18)

Cost element	$M	GHD assessment
Actual cost to 31 December 2021	2.44	Refer section 15
Support costs	5.76	Agreed to Aurecon forward cost estimates.
Consultation Manager	0.18	Agreed to external quote adjusted for time difference
Other	0.19	-
Total	**8.57**	

13.2 Social legacy initiatives

In addition to the community engagement forecast detailed above, the Capex Forecasting Methodology also includes a $7.58M (Real 2017-18) provision for social legacy initiatives.

[32] Costs are rounded and as such do not equal the total amounts

The social legacy program, in its early stages of development have identified and costed nine separate initiatives based upon interaction with various interested parties. GHD Advisory given the state significant project status anticipate that Transgrid will further develop the program to better focus upon:

- Social mitigations aligned with the findings of the social impact assessment
- Programs that address social attitudes with the view to the achievement of positive social outcomes resulting from power cost reduction and resilience.

The inclusion of this provision brings total community engagement spend during the D&A phase in line with other ISP projects where GHD has access to their D&A budget.

13.3 Community stakeholder engagement benchmarking

There are few publicly available sources of information the capture community stakeholder engagement activities for early works. GHD Advisory has access to a small number of other TNSP project forecasts at the D&A phase indicated in the table below. The current forecast benchmarks comparatively with Project A.

Table 27 Community and stakeholder engagement cost benchmarking

Project	Project total costs	Engagement costs	Engagement costs as a % of total project costs	Engagement notes
Project A	$3.5B	$22.7M	0.6%	Significant complex issues across multiple jurisdictions accounting for the higher costs.
VNIW[33]	$1.6B	$2.8M	0.2%	Only includes early works scope as defined by Transgrid. As this estimate was prepared for the purposes of the underwriting agreement the forecast aligns with the definition of permitted expenditure in this agreement. This limits overhead allocations.
HumeLink	$3.3B	$18.6M	0.6%	-

[33] Source Transgrid's VNIW Early Works cost estimate

13.4 Community and stakeholder engagement conclusion

The total community and stakeholder engagement forecast for Stage 1 benchmarks to other large ISP projects where GHD Advisory has access to D&A phase budgets. The forecast component relating to community engagement is appropriately supported by the external service providers forward cost estimates. The forecast component relating to social legacy initiatives in its early stages of development. GHD Advisory given the state significant project status anticipate that Transgrid will further develop the program to better focus upon:

- Social mitigations aligned with the findings of the social impact assessment
- Programs that address social attitudes with the view to the achievement of positive social outcomes resulting from power cost reduction and resilience.

14. Regulatory approvals and other support costs

The following table details the cost forecast for regulatory approval processes. These costs have either been incurred through RIT-T stages or represent forecasted activities required to support FID achievement.

Table 28 Regulatory approval process forecast (Real 2017-18)

Category	Section reference	Actual to 31 December 2021 $M	Forecast to 30 June 2024 $M	Total $M
Stage 2 CPA submission	Section 14.1.1	-	3.50	3.50
Corporate support and systems	Section 14.1.2	0.40	2.92	3.33
RIT-T documentation	Section 14.1.3	2.07	0.08	2.15
Market benefits modelling	Section 14.1.4	-	1.11	1.11
Snowy II and HumeLink Board Meetings	-	0.81	0.02	0.84
Independent external validation PACR	-	0.60	-	0.60
Stage 1 CPA submission	-	0.09	0.25	0.34

Category	Section reference	Actual to 31 December 2021 $M	Forecast to 30 June 2024 $M	Total $M
Total				**11.90**[34]

14.1.1 Stage 2 CPA submission

As detailed in the executive summary, Transgrid is going to produce two CPAs. The Stage 1 CPA is being prepared by a small team of regulatory and external teams of technical and economics regulatory specialists. The Stage 2 CPA submission is more onerous requiring additional documentation and activities. These include:

- Project scope and specification
- Capex forecasting methodology
- Economic model
- Post tax revenue model

The estimate for final documentation has been built from the bottom up reflecting external costs from various consultants and based upon the costs incurred on the PEC CPA and are considered reasonable based upon this past experience as detailed in the following table.

Table 29 Stage 2 CPA forecast breakdown (Real 2017-18)

Cost element	GHD Advisory assessment	Total $M
Capex forecast methodology	Considered a reasonable estimate	0.3
Economic model and draft support	Considered a reasonable estimate	0.4
Independent verification economic benefits	Consistent with PEC	0.4
Independent verification	Independent verification of the need for the project scope of work, the effectiveness of the scope and the efficiency of project costs and delivery of the works. Consistent with PEC	0.4
Indirect costs	Not material	0.2
Insurance costs	These costs relate to contract works insurance for the direct early works and the calculation based on costs incurred for PEC and adjusted for capital value is reasonable.	1.3
Reg other contracts	Not material	0.2

[34] Costs are rounded and as such do not equal the total amounts

Cost element	GHD Advisory assessment	Total $M
Project specification and scope	Considered a reasonable estimate	0.2
Other	Not material	0.1
Total		**3.5**

14.1.2 Corporate support and systems

Table 30 Corporate support and systems forecast breakdown (Real 2017-18)

Cost element	GHD Advisory assessment	Total $M
Actuals to 31 December 2021	Costs to date	0.40
PMO indirect expenses	This provision represents the anticipated costs of improved project controls. As advised by Transgrid this will involve new systems and systems integration for cost control, scheduling, contract management, document control, reporting and assurance.	2.64
Direct support provided from internal Corporate Services, Legal, Governance & Risk Groups	Not material	0.28
Total		**3.33**[35]

14.1.3 RIT-T documentation

The forecast includes specialist consultants engaged to prepare the PSCR, PADR and PACR. Actual costs to 31 December 2021 are $2.07M (Real 2017-18) with a small provision to take the forecast to $2.15M (Real 2017-18).

14.1.4 Market benefits modelling

The cost of market benefit modelling required to support the Stage 2 CPA submissions is based upon an indicative quotation of 0.75M (Real 2021-22) sighted by GHD Advisory and a general provision to take the estimate to $1.11M (Real 2017-18).

14.1.5 Regulatory approvals cost benchmarking

The following table benchmarks the regulatory approval work component of these costs where GHD Advisory has access to D&A forecasts. HumeLink's costs benchmark well against Project A.

[35] Costs are rounded and as such do not equal the total amounts

Table 31 Early works RIT-T estimate benchmarking

Project	Project total costs	RIT-T costs	RIT-T costs as a % of total project costs	RIT-T notes
Project A	$3.5B	~$7M to $10M	0.2% to 0.3%	Greater complexity in revenue determination process
HumeLink	$3.3B	$12.4M less corporate support systems $3.3M	0.3%	

14.2 Regulatory approvals and other support costs conclusion

This forecast represents costs to 31 December 2021, including the costs to develop RIT-T documents already published. It includes the forecast to develop the Stage 1 CPA and an estimate to complete the supporting documentation, benefits modelling, and assurance activities required to complete the Stage 2 CPA. These activities are required to progress to FID and are consistent with other ISP projects.

15. Historical labour and indirect capex

The following table has been prepared by KPMG and has been replicated from the Capex Forecasting Methodology.

Table 32 Historical labour and indirect capex

Capex category	2017-18 $M	2018-19 $M	2019-20 $M	2020-21 $M	2021-22 $M	Total $M
Labour and Labour-related	**-**	**0.35**	**5.75**	**9.18**	**5.44**	**20.72**
Project team resources	-	0.24	2.71	3.46	2.61	9.01
Transaction procurement support	-	-	-	0.42	0.21	0.63
Community and stakeholder engagement	-	0.0	0.32	1.05	0.59	1.96
Land and environment.	-	0.07	1.23	2.13	1.16	4.59
Other support and corporate roles	-	0.04	1.50	2.12	0.86	4.52

Capex category	2017-18 $M	2018-19 $M	2019-20 $M	2020-21 $M	2021-22 $M	Total $M
Non-Labour	**0.38**	**0.28**	**2.89**	**6.41**	**7.93**	**17.89**
Project team resources	-	-	0.05	1.65	1.40	3.10
Transaction procurement support	-	-	-	-	0.23	0.23
Community and stakeholder engagement - *Note 1*	-	-	0.16	1.36	1.58	3.10
Land and environment - *Note 2*	-	0.12	1.48	2.42	3.42	7.45
Other support and corporate roles – *Notes 3 & 4*	0.38	0.16	1.20	0.98	1.30	4.02
Total	**0.38**	**0.64**	**8.64**	**15.59**	**13.37**	**38.61**

GHD Advisory has performed some selection testing of historical costs with the coverage detailed below.

Note 1 - In addition to actual labour costs actual costs includes $1.2M of third-party charges. 80% of actual costs to date have been verified back to supporting third party documentation as relating to HumeLink based upon selection testing.

Note 2 - In addition to actual labour costs, actuals includes $3.8M of third-party land and environment charges. GHD Advisory made a selection of actual costs making up the $3.8M and verified 49% of costs back to supporting invoices.

Note 3 – In addition to actual labour costs includes $1.2M of third-party project management changes. A selection of actual costs to 30 June 2021 has been made a verified back to third party documentation to verify that the charges relate to HumeLink project management.

Note 4 - In addition to actual labour costs includes $1.5M in costs across the development of the PSCR, PADR and PACR. GHD Advisory had a selection of transactions making up the $1.5M and verified back to invoices to confirm that the costs relate to the HumeLink project. This selection testing verified 68% of the $1.5M.

16. Project timing and allocation of costs to Stage 1 CPA

As indicated in section 3 Transgrid intends to submit two CPAs to the AER in relation to the regulatory cost recovery for the project with:

- Stage 1 CPA seeking to recover costs to date and the costs to develop a robust cost estimate for the project and for procurement of necessary early works and property acquisitions
- Stage 2 CPA will seek cost recovery for the implementation costs, including the construction cost of the project.

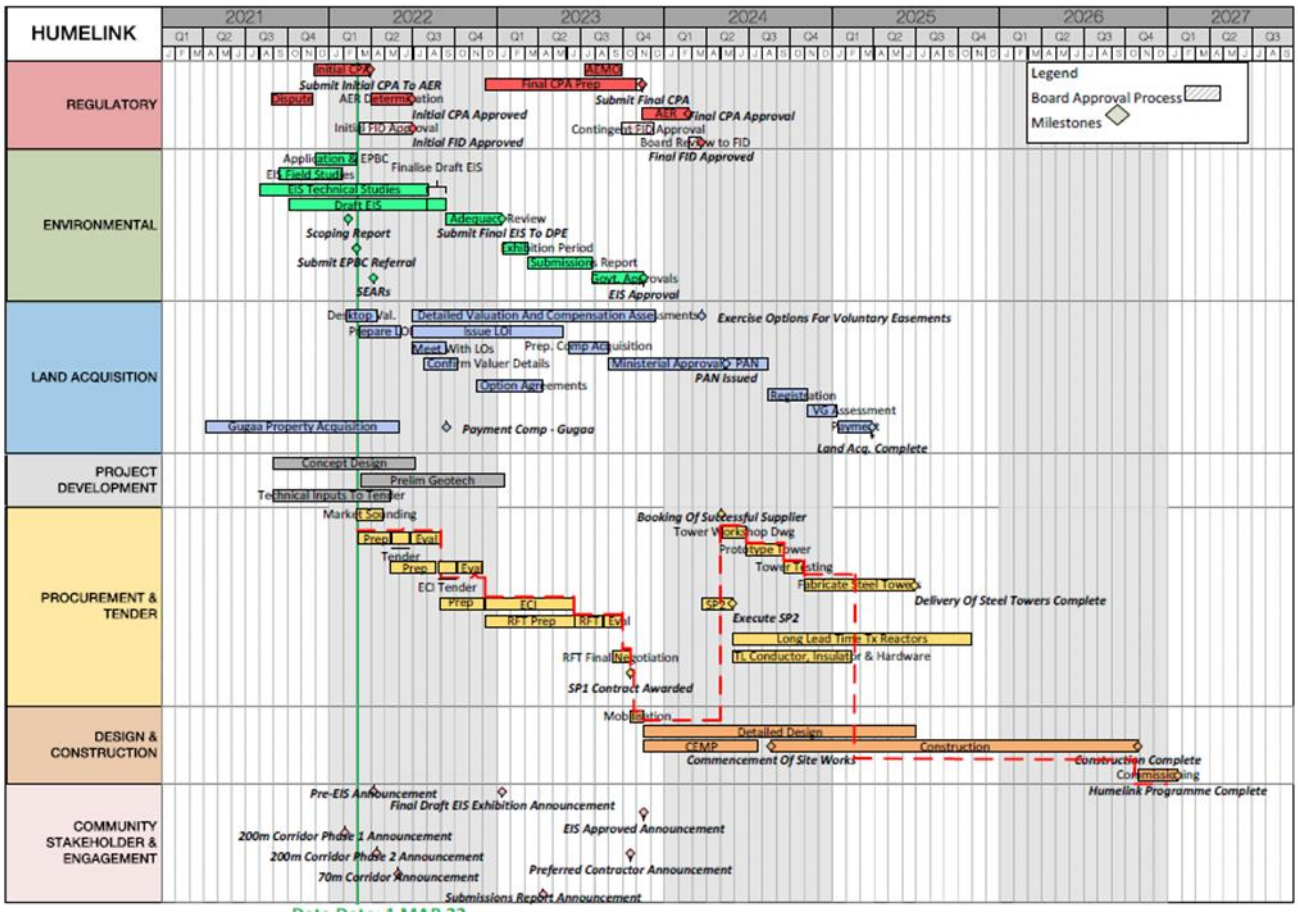
Stage 1 is intended to cover the costs to the 30th of June 2024 and Stage 2 to cover the costs till the completion of the project. Stage 1 should also only include the necessary early works to provide a robust estimate for the implementation of the project in Stage 2 and to ensure the project can be commissioned in time to meet the earliest optimal development path required by AEMO.

This section reviews the reasonableness of the proposed project timing as well the justification for the necessity to include each of the cost elements in Stage 1 rather than in Stage 2.

16.1 Project timing review

Transgrid as part of the Capex Forecasting Methodology have developed a high-level program, shown in the figure below[36]. The timeline is broken down into the key milestones for each of the main project activities including regulatory, environmental, procurement, tender, project development, land acquisition, design and construction and community and stakeholder engagement.

Figure 2 HumeLink high level timeline



[36] Transgrid HumeLink Capex Stage 1 Forecasting Methodology, p.8

The high-level program indicates that to meet the end of 2026 project completion date a number of milestones are required to be completed prior to the approval of the total project capex. Therefore, it is considered reasonable to for Transgrid to submit two CPAs for the works to enable the project completion date to be achieved.

A summary of the assessment of the reasonableness of the timeline is included in the following table.

Table 33 Assessment of project timeline activities

Category	Commentary
Regulatory	From Q3 2021 to Q1 2024. Includes milestones for approval of CPA Stage 1 and Stage 2 (development, submission, initial determination and approval). A reasonable time allocation is allowed for approval of CPAs. CPA 2 is required to be approved before FID and construction begins on Stage 2.
Environmental	From Q3 2021 to Q4 2023. Includes line corridor works, EIS development and approval. The time allocation is similar to other transmission projects. EIS approval is required before construction works commence.
Procurement & Tender	From Q1 2022 to the end of Q4 2025. Procurement activities includes market sounding and EOI/Market Capability assessments for the first two stages of the CCE process. The time allocation is similar to other transmission projects. These stages of the procurement process are required to be completed before final tendering can commence. Tender activities includes collaborative contractor engagement, tender and award of LLE items, tender and award of SP1 and conditional award of SP2 works. The length of times for procurement and tender are considered reasonable.
Project development	From Q3 2021 to the end of 2022. Includes previous PACR design and development, transmission line and substation concept design, technical specifications for LLE and preliminary Geotech. The length of time is considered reasonable.
Land acquisition	From Q2 2021 to Q1 2025. Includes EIS, CSE commencement, letters of intent, options agreements, ministerial approvals, compulsory acquisitions, easement registration and compensation. This is longest phase and delays to this phase will delay the project. Whilst the timeframes are considered reasonable this phase has a greater risk of project delays. The land acquisitions must be in place before construction is able to take place.
Design and construction	From Q4 2023 to Q1 2027. Includes detailed design, construction and commissioning of the substation and line works. Whilst the timeframes are considered reasonable this phase has the potential for project delays due to delays

Category	Commentary
	from other phases, weather, resource constrained contractors or delays in the delivery LLE equipment.
Community stakeholder engagement	The community and stakeholder engagement takes place from Q1 2022 to Q4 2023. The works includes engagement around the transmission line corridors. The timeframes are relatively short but are already underway.

16.2 Review of the Inclusion of costs in Stage 1 CPA

Each of the cost elements described in the above sections are reviewed to be determine whether they are necessary to be included in the Stage 1 CPA. For a cost element to be reasonable to be included in the Stage 1 CPA at least one of the following conditions must be met:

- The works are necessary to develop a robust cost forecast for Stage 2 CPA
- The works are necessary to progress the regulatory, planning or environmental approvals before construction works are able to take place
- The works are necessary to avoid delay the project completion date.

The following table summarises the assessment of Stage 1 CPA cost inclusions:

Table 34 Assessment of Stage 1 inclusion

Category	Main cost element	Assessment of inclusion in Stage 1 CPA
Procurement	Pre-construction development	Required to enable designs for transmission towers to be completed, specifications for LLE to be completed, and readiness activities for construction to begin (in Stage 2) as early as necessary to meet the commissioning date for the Project in Q4 2026/Q1 2027.
	LLE substations, transformers and reactors	Required to meet the project delivery timelines.
	Tower design and prototype testing	Required to meet the project delivery timeline and readiness for steel orders to places early in Stage 2
Land acquisition	Property acquisition costs for the Gugaa substation	Required to enable the detailed design work to proceed as part of the pre-construction work above for Gugaa Substation.

Category	Main cost element	Assessment of inclusion in Stage 1 CPA
	Landholder legal valuation	Required to progress the land acquisitions (or options) to ensure definite easements and access is obtained for the transmission lines to be designed and constructed.
	Option fees	Required to progress the land acquisitions to ensure definite easements and access is obtained for the transmission lines to be designed and constructed.
	Land valuation	Required to progress the land acquisitions to ensure definite easements and access is obtained for the transmission lines to be designed and constructed.
Project team resources		Internal Transgrid resources required to be achieved to deliver the D&A outcomes and to purchase LLE. The different stream objectives and the resources that have been forecasted are detailed in section 9. These costs are necessary to enable Transgrid to manage and progress all the other elements of the Stage 1 CPA.
Bidder payments and other procurement costs		Represents the costs required to execute the CCE procurement strategy. This is the same procurement approach Transgrid has applied to other ISP projects and includes various phases to inform bidders to improve their tender submissions, tender evaluations and tender award. Without these payments Transgrid may not get a robust competitive bidding process for the packages of work.
Project development	External legal costs	The project management team are supported by external legal, engineers and other consultants to
	Geotech and surveys	

Category	Main cost element	Assessment of inclusion in Stage 1 CPA
	Project management / concept engineering	carry out activities to complete the D&A phase. These external resources include: • Legal support services to cover a range of aspects of the project development including permits, land acquisition strategy, environmental and heritage issues, contract program, corporate and general legal support • Geotech services are required in the Stage 1 CPA to enable contractor's to more accurately price foundation costs and assess the risk of varying geotechnical conditions • Project management services required to produce concept designs and specifications in tenders documents and project managers to manage the engineering work for the project, environmental approvals, and community and stakeholder engagement during the D&A phase • Owner engineering, risk and cost control support is needed for Transgrid to appropriately manage the project risk, budget and schedule.
	Owners engineer	
	Risk analysis, reporting and cost control support	
Land and environment		The Land and environment forecast represents the actual costs to 31 December 2021 and forecast to 30 June 2024 to develop and complete the EIS, undertake seasonal surveys, and includes the provision of land valuation support services. This work is necessary to obtain the environmental approvals necessary to enable the project to be constructed.
Community stakeholder engagement		Community and stakeholder engagement activities are a critical component of the RIT-T process required to refine RIT-T submissions. It is also required to influence community attitudes and

Category	Main cost element	Assessment of inclusion in Stage 1 CPA
		reduce risk especially around land acquisition and project construction.
Regulatory approvals and other support costs		This represents the historical costs incurred to 31 December 2021 to produce the required RIT-T documentation and the costs required to develop the Stage 1 CPA and the Stage 2 CPA. The project is unable to progress without approval of the project capex.

16.3 Project timeline and cost inclusions conclusion

The high-level project timelines are considered reasonable however requires two CPAs to enable the project to be completed by 2026.

The costs elements to be included in Stage 1 CPA are considered necessary to enable the project to progress on time, ensure a robust cost estimate and manage the project risks.

Appendix A

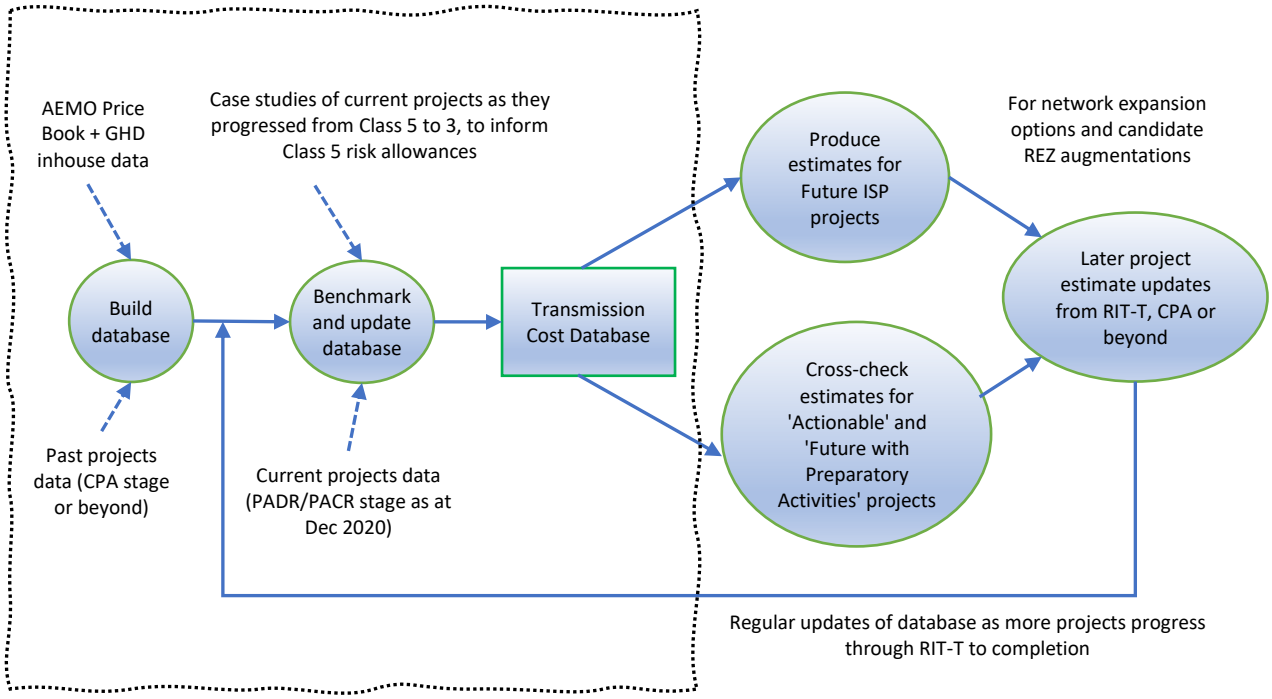
Transmission cost database tool

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.

Figure 3 illustrates the benchmarking data used to cost asset building blocks which includes allowances for indirect costs.

Figure 3 ***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 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 B

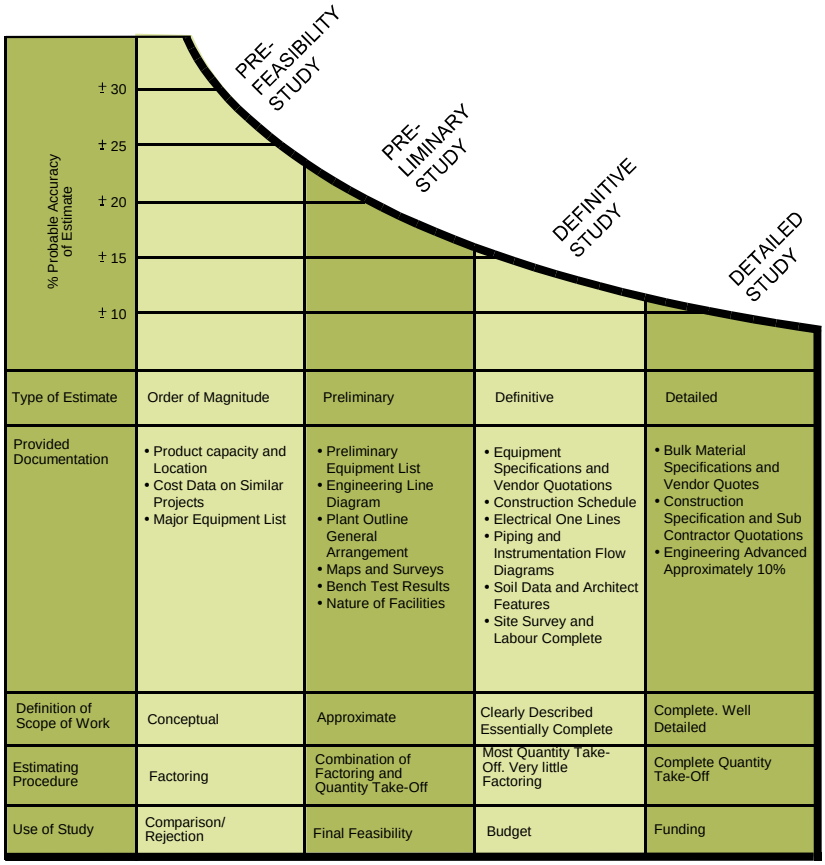
Unit cost benchmarking methodology and assumptions

B-1 Estimate accuracy for assessment

In assessing forecasts included in Stage 1 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 4 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 4 ***Standard estimate accuracy levels***



Type of Estimate	Order of Magnitude	Preliminary	Definitive	Detailed
Provided Documentation	• Product capacity and Location • Cost Data on Similar Projects • Major Equipment List	• Preliminary Equipment List • Engineering Line Diagram • Plant Outline General Arrangement • Maps and Surveys • Bench Test Results • Nature of Facilities	• Equipment Specifications and Vendor Quotations • Construction Schedule • Electrical One Lines • Piping and Instrumentation Flow Diagrams • Soil Data and Architect Features • Site Survey and Labour Complete	• Bulk Material Specifications and Vendor Quotes • Construction Specification and Sub Contractor Quotations • Engineering Advanced Approximately 10%
Definition of Scope of Work	Conceptual	Approximate	Clearly Described Essentially Complete	Complete. Well Detailed
Estimating Procedure	Factoring	Combination of Factoring and Quantity Take-Off	Most Quantity Take-Off. Very little Factoring	Complete Quantity Take-Off
Use of Study	Comparison/ Rejection	Final Feasibility	Budget	Funding

Table 35 shows the classification of estimates as defined in the AACE International *Recommended Practice No. 17R-97 Cost Estimating Classification System*.

Table 35 AACE IRP No. 17R-97 generic cost estimate classification matrix37

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 +/- range relative to best index of 1 (a)	**Preparation effort** 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%.

B-2 Unit cost and capex forecasting assessment methodology

GHD has adopted a nominal criterion of ±20% as the first pass for comparing the Transgrid estimates with our reference comparative estimates for similar projects as a test for reasonableness.

Where there are is a variance between the Transgrid allowance for a network capacity augmentation project and our comparative estimate of less than ±20%, GHD will consider the Transgrid estimate to be reasonable and realistic, and no further detailed assessment will be undertaken.

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

For those Transgrid estimates where the variation is outside our nominal range, GHD has reviewed any known project specific issues to identify the potential reasons.

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