COMMERCIAL IN CONFIDENCE

FINAL REPORT

Upper and Lower Tumut 330 kv transmission line relocation

Cost-benefit analysis

Prepared for
Riverview Developments (ACT) Pty Ltd for the Ginninderry Joint Venture

February 2024

THE CENTRE FOR INTERNATIONAL ECONOMICS
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Contents

BOXES, CHARTS AND TABLES

Summary

The Ginninderry development

Ginninderry is a 1600 hectare urban development area that stretches from the north western suburbs of Canberra (Holt and Macgregor) across the ACT/NSW border into the Yass Valley. It is bounded on two sides by the Murrumbidgee River and Ginninderra Creek.[1]

- Around half of the total area will be developed.
  - The development will form 4 new suburbs:
    - Strathnairn was the first new suburb developed
    - Macnamara will be the next new suburb developed
    - This will be followed by: another new suburb in the ACT; and a new suburb on the NSW side of the border.
  - The development will eventually include around 11,500 new homes and be home to around 30 000 residents.
  - Planned facilities include new schools, shops, halls, childcare centres and medical centres.[2]
- The remaining 800 hectares will be an open-space network created by a 596-hectare conservation corridor along the Murrumbidgee River and Ginninderra Creek[3] and a network of urban open spaces throughout the development area, including the regeneration of the 107 hectare Parkwood former landfill site.[4]

The development is a joint venture between ACT Government and Riverview Developments (ACT) Pty Ltd (Riverview) — the Ginninderry Joint Venture (GJV) — which was formed through a commercial agreement in 2016.[5]

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1 ACT Government Suburban Land Agency website, https://suburbanland.act.gov.au/en/ginninderry, accessed 15 November 2023.

2 ACT Government Suburban Land Agency website, https://suburbanland.act.gov.au/en/ginninderry, accessed 15 November 2023.

3 Riverview Group website, https://riverviewgroup.com.au/portfolio/ginninderry/, accessed 15 November 2023.

4 Information provided by Riverview Developments (ACT) Pty Ltd for the Ginninderry Joint Venture

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Proposed transmission line relocation

Two 330 kV transmission lines (the Upper and Lower Tumut transmission lines) pass through an area that has been identified for new residential development under future phases of the Ginninderry development. The current placement of the transmission lines:

- reduces the area that can be developed for residential use (therefore reducing the number of lots that can be sold) due to easements around the transmission lines
- is likely to reduce the value of other lots within the development, due to potential visual amenity impacts.

The GJV is proposing to relocate part of the two transmission lines to utilise the additional developable area, reduce impacts on conservation areas and balance the loads between the Stockdill and Canberra substations.

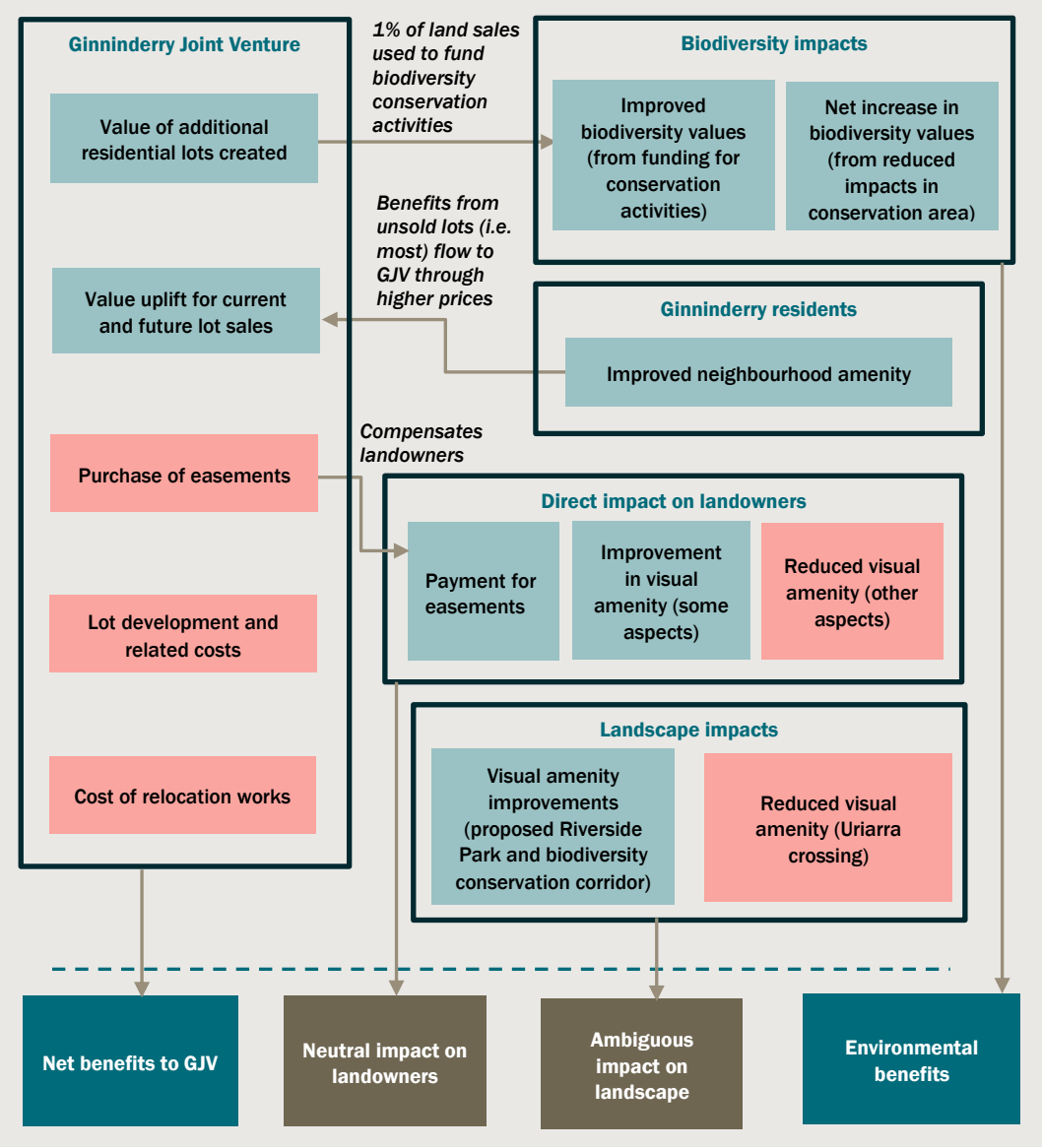
Costs and benefits of the proposal

The Centre for International Economics (CIE) has been engaged to prepare a communitywide cost-benefit analysis (CBA) of the proposed transmission line relocation, capturing (where possible) all economic, social and environmental costs and benefits.

Chart 1 summarises the main costs and benefits of the proposal (including inter-relationships between some costs and benefits) including:

- costs and benefits to the GJV
- costs and benefits to other members of the community, including: other landholders and users of recreational areas that will be affected by the proposed relocation.

1 Summary of costs and benefits



Note: Chart does not show heritage impacts and reduced infrastructure maintenance costs as these impacts were estimated to be small relative to the other costs and benefits.

Data source: CIE.

Note that part of the transmission lines that would be removed cross the ACT border into NSW.

Cost-benefit analysis

We estimate the proposed transmission line relocation would deliver a communitywide net benefit of around **$70.14 million** in net present value terms over the 50-year life of the new infrastructure, using a discount rate of 7 per cent (table 2).

The estimated benefit-cost ratio (BCR) is just under 2, indicating that the net benefits generated from the transmission relocation are close to double the cost of the relocation.

2 Net benefits from proposed transmission line relocation — summary

	Estimated benefits/costs
	$ million
Impact on the Joint venture	
Value of additional lots	174.67
Land production costs	- 53.36
Transmission line relocation costs	- 71.54
Value uplift on nearby lots [a]	15.31
Total impact on joint venture	**65.09**
Impact on other parties	
Net benefit/cost for landowners	0.00
Landscape amenity	3.85
Biodiversity impacts - increase in conservation land	0.32
Biodiversity benefits - funding for additional conservation activities	0.81
Impact on transmission infrastructure maintenance costs	0.07
Net benefit for external parties	**5.06**
Total net benefit	**70.14**
Benefit-cost ratio [b]	**1.98**

[a] Although these benefits were not included in the commercial business case, we have included them as a benefit to the GJV because most of the lots that would be affected by the value uplift have not yet been sold. [b] Defined as the total net benefit, excluding the cost of the transmission location works, divided by the cost of the transmission relocation works.

Note: Estimates are presented in net present value terms over the (assumed) 50 year life of the infrastructure. Totals may not add due to rounding.

Source: CIE estimates (see chapters 3 and 4 for further details).

As there is significant uncertainty around some of these estimates (particularly non-market benefits and costs, where we have relied on the benefit transfer approach), we also undertook sensitivity analysis to test the robustness of the key findings. We found that the proposal is estimated to deliver a net benefit to the community under all of the scenarios tested. This finding is therefore considered robust, despite the uncertainty around the magnitude of some of the non-market costs and benefits.

Distributional analysis

Once the profits to the GJV are distributed among the partners (with 60 per cent of profits going to the ACT Government and 40 per cent going to Riverview), the net benefits are distributed as shown in table 3.

- More than half of the benefits are estimated to be realised by the ACT community from the additional revenue received by the ACT Government via the GJV. This revenue will (presumably) be used to fund services that benefit the ACT community.
- Slightly more than one-third of the net benefits will go to the private partner in the Joint Venture, Riverview.
- The proposal is also estimated to deliver a net benefit (around $5 million or 7 per cent of the total net benefits) to the local community (defined as households that live in the

ACT and the Capital Region of NSW). However, this finding is sensitive to the approach used to value landscape amenity. Under some alternative approaches used in the literature, the proposal would result in a net cost to the local community (but still an overall net benefit).

3 Distribution of net benefits

	Estimated net benefit	Share of net benefits
	$ million	Per cent
Net benefits to private partner (Riverview) [a]	26.03	37.1
Benefits to ACT community (via the ACT Government) [b]	39.05	55.7
Benefits to the local community [c]	4.98	7.1
Benefits to Transgrid	0.07	0.1
Total	**70.14**	**100.0**

[a] Based on 40 per cent share of the GJV profits. [b] Based on 60 per cent share of GJV profits. [c] Includes landscape amenity and biodiversity net benefits.

Note: Net benefits presented in net present value terms over 50 year life of infrastructure, using a discount rate of 7 per cent. Totals may not add due to rounding.

Source: CIE estimates.

1 Background and introduction

The Ginninderry development

Ginninderry is a 1600 hectare urban development area that stretches from the north western suburbs of Canberra (Holt and Macgregor) across the ACT/NSW border into the Yass Valley. It is bounded on two sides by the Murrumbidgee River and Ginninderra Creek.[6]

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- The remaining 800 hectares will be an open-space network created by a 596-hectare conservation corridor along the Murrumbidgee River and Ginninderra Creek[8] and a network of urban open spaces throughout the development area, including the regeneration of the 107-hectare Parkwood former landfill site.[9]

The development is a joint venture between ACT Government and Riverview Developments (ACT) Pty Ltd (Riverview) — the Ginninderry Joint Venture (GJV) — which was formed through a commercial agreement in 2016.[10]

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6 ACT Government Suburban Land Agency website, https://suburbanland.act.gov.au/en/ginninderry, accessed 15 November 2023.

7 ACT Government Suburban Land Agency website, https://suburbanland.act.gov.au/en/ginninderry, accessed 15 November 2023.

8 Riverview Group website, https://riverviewgroup.com.au/portfolio/ginninderry/, accessed 15 November 2023.

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Proposed transmission line relocation

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The GJV is proposing to relocate part of the two transmission lines to utilise the additional developable area, reduce impacts on conservation areas and balance the loads between the Stockdill and Canberra substations.

This report

Riverview for the GJV has engaged the Centre for International Economics (CIE) to prepare a cost-benefit analysis (CBA) of the transmission line relocation proposal from a communitywide perspective.

The remainder of this report is set out as follows:

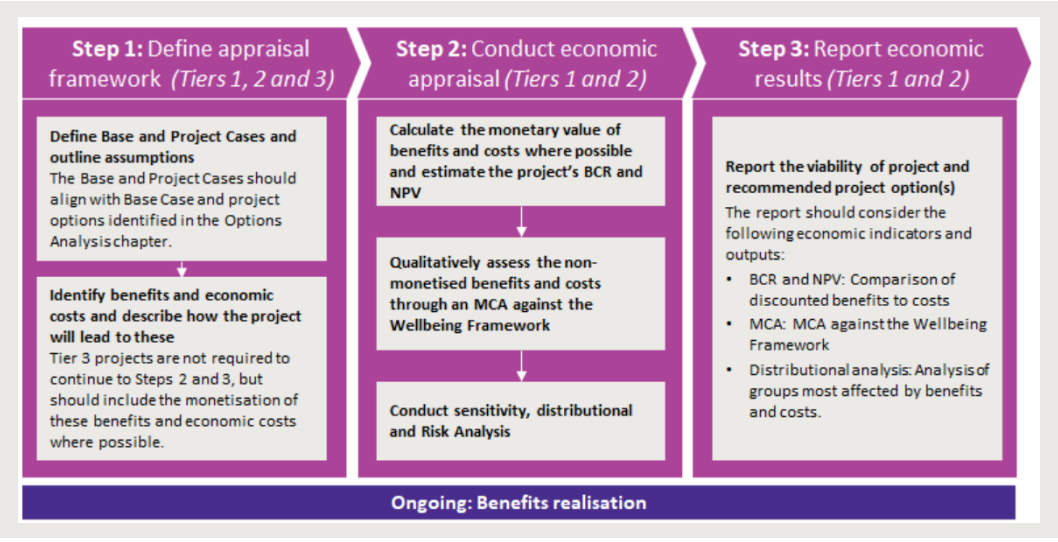
- Chapter 2 sets out the general approach to the CBA
- Chapter 3 estimates the impacts of the proposed transmission line relocation on the GJV
- Chapter 4 estimates the impacts of the proposed transmission line relocation on other parties
- Chapter 5 brings the impacts on the GJV and other parties together into a communitywide CBA.

2 Approach

The ACT Government economic appraisal framework

Our approach to the CBA is based on the ACT Government's economic appraisal methodology that forms part of its Capital Framework.[11] The Capital Framework (and therefore the economic appraisal methodology) applies specifically to ACT Government infrastructure projects so is not directly relevant to this situation. However, we are not aware of any ACT Government general CBA guidelines, and therefore consistency with the economic appraisal methodology is appropriate. The steps required for economic appraisal under the ACT Government's Capital Framework are summarised in figure 2.1.

2.1 Steps required for Economic Appraisal



Data source: ACT Government website, https://www.treasury.act.gov.au/capital-framework/prove/detailed-technical-guidance/economic-appraisal/appraisal-methodology#step-2, accessed 19 December 2023.

Defining the appraisal framework

The first step in the economic appraisal methodology (see figure 2.1 above) is to define the appraisal framework including: defining the base case and the project case(s).

[11] ACT Government website, https://www.treasury.act.gov.au/capital-framework/prove/detailed-technical-guidance/economic-appraisal/appraisal-methodology, accessed 14 November 2023.

Base case

The base case involves retaining the current placement of the two transmission lines through the Ginninderry development area. Under this scenario, the next proposed stage of the Ginninderry development would proceed around the existing transmission line easements.

Other developments linked to the Ginninderry development include:

- The creation of a 596 ha Conservation Corridor — the GJV is contributing 1 per cent of the revenue from sales of housing lots to provide funding for the Trust to:
  - conserve and improve biodiversity
  - develop walking trails within the corridor.
- The development of a new Riverfront Park.

These developments are not directly linked to the transmission line relocation (i.e. the developments will proceed regardless of whether the transmission lines are relocated) and as such, are included in the base case. Only incremental changes as a direct result of the transmission line relocation are included in the CBA.

Proposed transmission line relocation

Over a period of several years, Riverview has been investigating various options to address this problem, including:

- The option of undergrounding the transmission lines that run through the Ginninderry development was considered but was rejected by Transgrid due to issues associated with access for servicing, earlier replacement timeframe and engineering requirements associated with voltage drop across the lines.[12]
- Various options for relocating the transmission lines — several of these options were rejected by affected private landowners or as a result of heritage concerns.

The final proposal comprises the following activities within both NSW and ACT (see chart 2.2):[13]

- Installation of new towers and overhead transmission lines associated with the realignment of part of the existing Upper and Lower Tumut 330 kV transmission lines (Lines 1 and 7 respectively), including the construction of 10 new towers and 4 new poles for Line 1 and 11 new towers and 5 poles for Line 7. The towers would range in height from approximately 34 m to 40 m above ground, and the poles would be between 40 m and 56 m tall. The poles are proposed to be used on approach to the Stockdill Substation to minimise ecological impacts along this section (the poles are taller than the towers and require less vegetation clearance underneath the lines).

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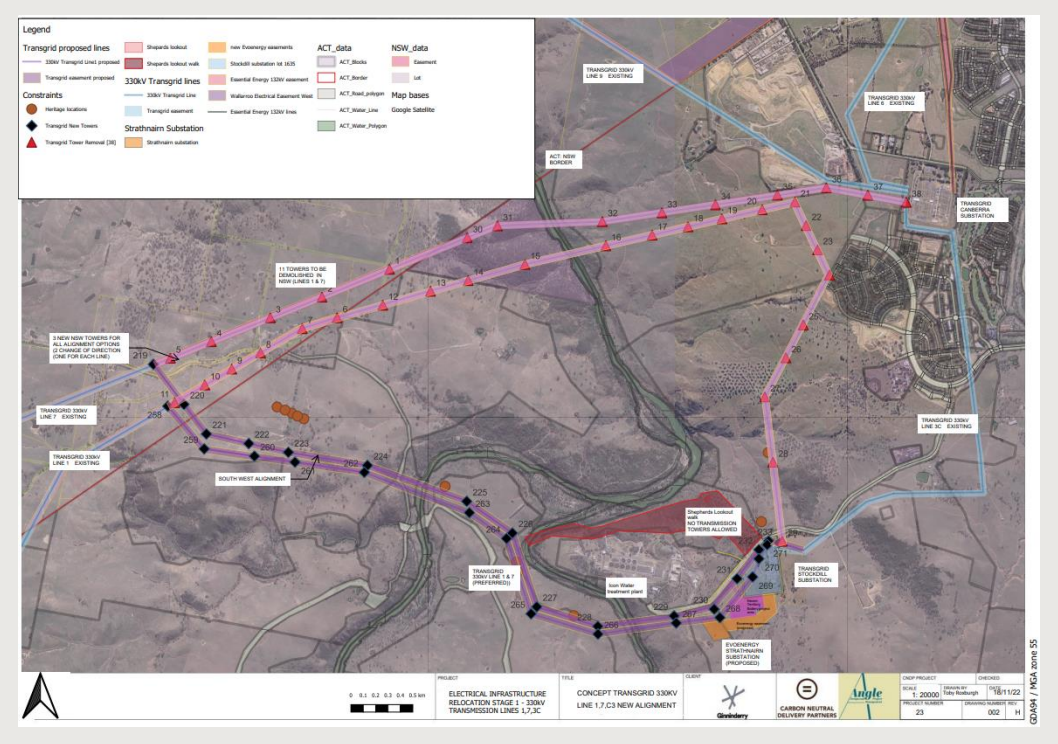
12 dsb Landscape Architects, Ginninderry ACT, *Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report*, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, p. 14.

13 dsb Landscape Architects, Ginninderry ACT, *Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report*, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, pp. 8-9.

Taller towers would generally be located adjacent to the river crossings to maximise transmission line heights, spans between towers and to avoid tree removal

- Electrical works to connect the new transmission lines to the existing transmission network
- Stringing of additional conductors along the part of Line 3C located between the Stockdill Substation and Canberra Substation
- Decommissioning and removal of part of the existing Lines 1 and 7, including:
  - Removal of 24 towers from Line 1, involving complete removal of 16 tower foundations with the remaining foundations to be left in situ to reduce the overall impact within conservation areas
  - Removal of 14 towers from Line 7, involving complete removal of 10 tower foundations with the remaining foundations to be left in situ.
- Civil works associated with construction of temporary construction access tracks (5 m-wide), involving vegetation removal and modification, levelling, and laying of sub-base and/or metal grids for access across wet areas, as required. Access would be from the existing road network including Stockdill Drive, Uriarra Road and Fairlight Road
- installation of temporary facilities associated with construction, including material laydown areas, construction compounds, carparking, and site office(s), all located within the laydown areas
- Civil works to prepare for construction of the new tower foundations, involving vegetation removal and modification where required, earthworks to level the site if required, and foundation preparation (excavation and/or boring, steel fabrication works and concrete pours)
- Transmission lines to be installed between adjacent towers / poles would be pulled by brake and winch machines or carried by drones to cross rivers or sensitive areas, e.g. those with heritage or ecology values
- Following completion of the construction works, the temporary construction areas (new access tracks, laydown areas etc.) would be rehabilitated.

2.2 Proposed relocation



Note: The red triangles represent the current placement of transmission towers that will be removed. The black diamonds represent new transmission towers under the proposed option.

Data source: Ginninderry Joint Venture.

Key parameters and assumptions

Key parameters for the analysis are as follows:

- Time period — under the economic appraisal guidelines, the appraisal period should be based on the expected life of the asset, typically between 30-50 years for infrastructure projects.[14] We use a time period of **50 years**, based on the (assumed) life of the new transmission infrastructure. Note that transmission infrastructure can often last significantly longer than 50 years, although extending the timeframe for the analysis would make little difference to the overall CBA results due to the discounting process.
- Discount rate — consistent with the economic appraisal guidelines, we apply a real discount rate of 7 per cent.[15]

[14] ACT Treasury website, https://www.treasury.act.gov.au/capital-framework/prove/detailed-technical-guidance/economic-appraisal/appraisal-methodology, accessed 15 November 2023.

[15] ACT Treasury website, https://www.treasury.act.gov.au/capital-framework/prove/detailed-technical-guidance/economic-appraisal/appraisal-methodology, accessed 15 November 2023.

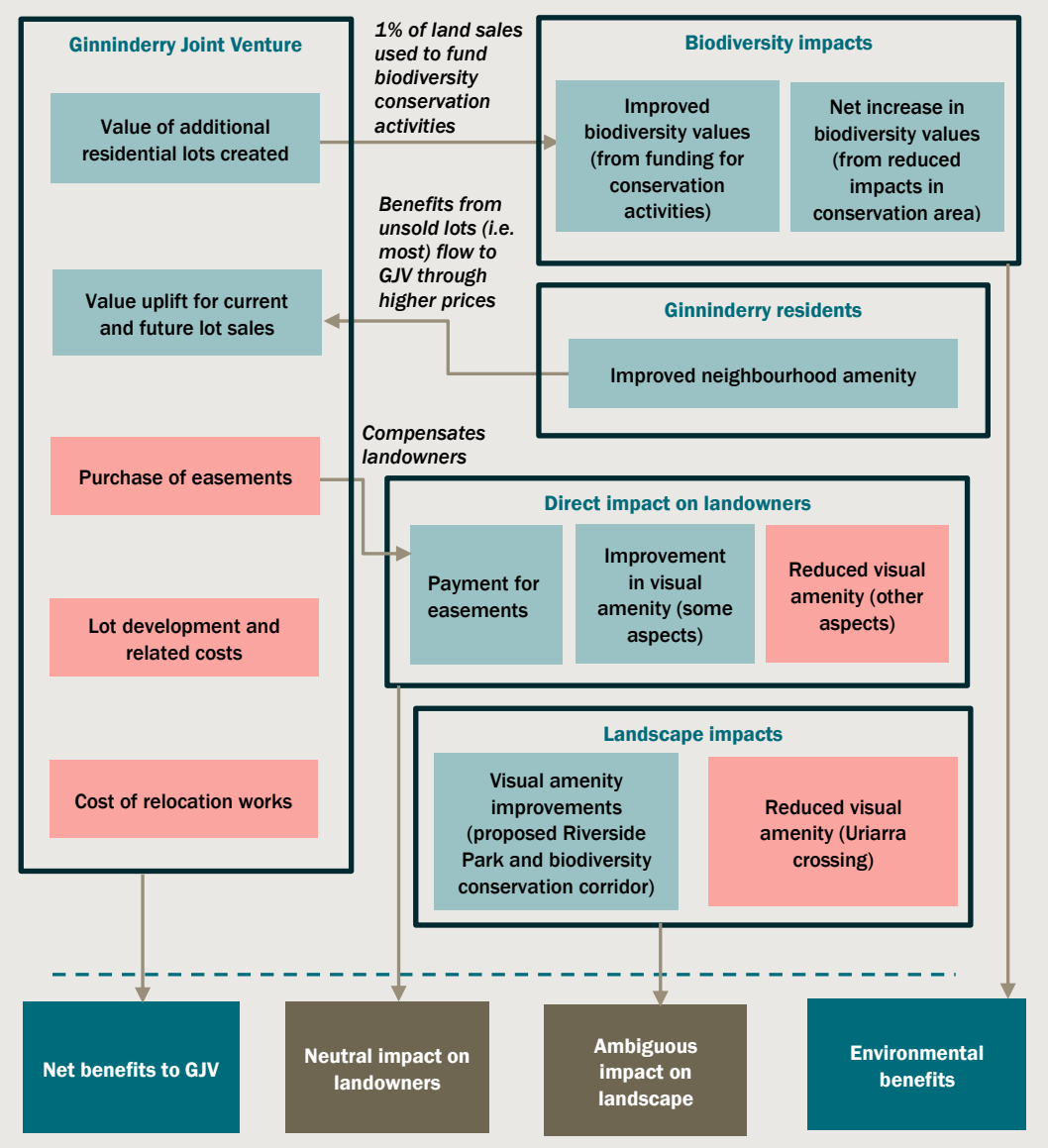
Benefits and costs

A communitywide CBA covers the costs and benefits (including economic, social and environmental costs and benefits) to all members of the community, including:

- the GJV
- other members of the community, including: other landholders and users of recreational areas that will be affected by the proposed relocation.

Chart 2.3 summarises the various costs and benefits on various parties, including showing the inter-relationships between some costs and benefits.

2.3 Summary of costs and benefits



Note: Chart does not show heritage impacts and reduced infrastructure maintenance costs as these impacts were estimated to be small relative to the other costs and benefits.

Data source: CIE.

Note that part of the transmission lines that would be removed cross the ACT border into NSW.

Costs and benefits to the Joint Venture

As the developer of the Ginninderry area, many of the costs and benefits of the proposal will fall on the GJV. The costs and benefits to the GJV will include:

- The benefits of the additional housing lots created as a result of the transmission line relocation
- A significant proportion of the costs involved with the relocation, including:
  - the direct costs associated with the relocation of the transmission lines
  - the costs associated with producing and selling the additional lots.

Costs and benefits on the GJV are discussed in detail in chapter 3.

Costs and benefits to other parties

In addition to the costs and benefits for the GJV, other costs and benefits could include:

- Changes to amenity, including:
  - neighbourhood amenity for future Ginninderry residents
  - amenity for other landowners affected by the relocation
  - landscape amenity
- Biodiversity impacts
- Cultural and heritage impacts
- Social impacts from the provision of additional housing, including affordable and community housing
- Impacts associated with transmission infrastructure maintenance costs.

Potential costs and benefits on other parties are discussed in detail in chapter 4.

Increases in economic activity

The activities associated with the proposed relocation — including the relocation works, lot development activities and subsequent housing construction — could also deliver some improved economic outcomes, including:

- increased economic activity
- creation of additional jobs.

These impacts are not straightforward to measure as additional demand generated from the relocation project and associated activities could simply displace economic activity and jobs elsewhere in the economy and therefore deliver limited net increase in economic activity and employment. This is more likely when the economy is operating at or near full capacity.

Furthermore, studies that seek to estimate changes in measures of economic activity (such as gross domestic product or employment) are referred to as an economic impact assessment (EIA). This is a different type of analysis to economic appraisal (which primarily focuses on CBA) that (according to ACT Government guidelines): serve different purposes and measure materially different impacts.[16] As such, these economic impacts are generally not included in CBA.

16 ACT Government website, https://www.treasury.act.gov.au/capital-framework/prove/detailed-technical-guidance/economic-impact-assessment, accessed 21 December 2023.

3 Benefits and costs on the Joint Venture

Summary

The estimated costs and benefits on the GJV are based on a commercial business case. Based on the costs and benefits included in the commercial business case, the proposed transmission line relocation is estimated to provide a net benefit of **$49.77 million** to the GJV in net present value (NPV) terms, using a discount rate of 7 per cent (table 3.1).

3.1 Estimated impacts on the Ginninderry Joint Venture

	Undiscounted estimated impacts	Estimated impacts: NPV[a]
	$ million	$ million
Value of additional lots	186.90	174.67
Land production costs	- 63.94	- 53.36
Net value of additional lots	**122.96**	**121.31**
Transmission line relocation costs	- 73.33	- 71.54
Net impact	**49.63**	**49.77**

[a] Presented in present value terms, using a discount rate of 7 per cent.

Source: Ginninderry Joint Venture, CIE.

Commercial business case

The purpose of a commercial business case is to test whether the private benefits to the GJV outweigh the private costs. That is, to test the commercial case to proceed with the transmission line relocation.

Net value from additional residential blocks

The primary reason for the relocation is to create additional residential development lots within the Ginninderry development. In total, the relocation of the transmission lines will enable the creation of an additional 430 residential lots, including:

- 297 additional lots along Line 1[17] ; and
- 133 additional lots along Line 7[18].

The net benefit to the GJV from these additional lots (excluding the costs associated with relocating the transmission lines) is estimated at **$122.96 million** (table 3.2).

17 Titled 'TLE easement A' in previous business case.

18 Titled 'TLE easement B' in previous business case.

- The additional lots are estimated to generate an additional **$186.90 million** in revenue.
- The associated costs (including production costs, marketing and sales-related costs and development management costs) are estimated at **$63.94 million**.

3.2 Net value of additional development lots

	Line1	Line 7	Total
	$ million	$ million	$ million
Estimated benefits			
Land sales revenue[a]	123.83	64.94	188.77
Less: GST on land sales	- 1.23	- 0.64	- 1.87
Total revenue	**122.61**	**64.30**	**186.90**
Estimated costs			
Project Wide Costs	5.05	2.41	7.46
Production Costs	28.74	13.85	42.59
Marketing and Sales Fee	2.87	1.51	4.38
Development Management Fee	4.79	2.51	7.30
Conservation Trust Contributions	1.23	0.64	1.87
Overhead Costs	0.24	0.11	0.35
Total costs	**42.92**	**21.02**	**63.94**
Net benefit	**79.69**	**43.27**	**122.96**

[a] Estimates include only revenue from the additional lots as a result of the transmission line relocation. The estimate does not include the potential uplift in value from other lots as a result of improved neighbourhood amenity. These benefits are likely to mostly flow to the GJV and have been included in the benefits to GJV in the overall CBA presented in chapter 5.

Note: Totals may not add due to rounding.

Source: Ginninderry Joint Venture.

Transmission line relocation costs

Costs directly related to the relocation of the transmission lines are estimated at **$73.33 million** (table 3.3).

3.3 Estimated transmission line relocation costs

	Estimated costs
	$ million
Environmental offset costs	0.30
Easement Acquisition Costs	4.87
Powerline Relocation Works	67.61
Other Costs	0.55
Total	**73.33**

Source: Ginninderry Joint Venture.

Timing of impacts

The commercial business case is currently presented in undiscounted terms. However, the ACT's economic appraisal methodology requires the cost-benefit analysis to be presented in net present value terms, using a discount rate of 7 per cent.

Current timeframes for the transmission line relocation are summarised in table 3.4.

3.4 Estimated timeframes

Phase	Expected milestone
Business case phase	
Options agreements signed	December 2023
Territory approval	March 2024
Approvals phase	
EPBC Act referral decision	March 2024
Submission of Draft EIS	February 2024
Draft EIS exhibition and approval	March 2024 — September 2024
Development approvals	September 2024 — December 2024
Acquisitions phase	
Settlements	December 2024
Delivery phase	
Procurement and civil works	November 2024 – April 2025
Construction and demolition works	February 2025 — August 2026
Easements released	October 2026

Source: Ginninderry Joint Venture.

Based on these estimated timeframes, we make the following assumptions in relation to the timing of the costs and benefits.

- The time period for the analysis commences in 2025.
- The acquisition of the easements occurs in 2025 (note this is scheduled to occur in December 2024)[19]
- The remainder of the transmission line relocation costs are spread over the period from January 2025 to August 2026
- The land development costs are incurred over a 2 year period from October 2026 to September 2028
- The value created from the additional residential lots is realised in 2028 (i.e. when the land has been developed).

[19] The net present value calculations implicitly assume the impacts occur at the start of the period.

4 Benefits and costs on other parties

Summary of benefits and costs on other parties

The proposed transmission line relocation will also result in additional benefits and costs not included in the commercial business case, including costs and benefits on a range of other parties outside of the GJV. We estimate that the proposed transmission line relocation will deliver additional net benefits of around **$20.37 million** in net present value terms over the (assumed) 50 year life of the infrastructure (using a discount rate of 7 per cent) in addition to the net benefits included in the commercial business case (table 4.1).

Note that the neighbourhood amenity benefits are likely to be reflected in an uplift in the value of lots close to the existing transmission lines. Although this value uplift was not included in the commercial business case, these benefits are likely to mostly flow to the GJV (as most of the affected lots have not yet been sold). When these benefits are assumed to accrue to the GJV, the net benefits to external parties are estimated at around **$5.06 million**.

4.1 Estimated impacts on other parties

	Estimated impacts not included in business case	Estimated impacts on parties outside GJV
	$ million	
Neighbourhood amenity benefits[a]	15.31	0.00
Net benefit/cost for landowners	0.00	0.00
Landscape amenity impacts	3.85	3.85
Biodiversity impacts - increase in conservation land	0.32	0.32
Biodiversity benefits - funding for additional conservation activities	0.81	0.81
Impact on transmission infrastructure maintenance costs	0.07	0.07
Total	**20.37**	**5.06**

[a] As the lots that would have been affected by the existing transmission lines (that would be removed) have mostly not yet been sold, most of these benefits will accrue to the Joint Venture.

Note: Impacts estimated in net present value terms over the (assumed) 50 year life of the transmission infrastructure, discounted back to 2025 using a discount rate of 7 per cent. Totals may not add due to rounding.

Source: CIE estimates.

Measuring non-market benefits and costs

A key challenge with CBA is estimating non-market values (such as environmental and social costs and benefits). As CBA involves placing a value on **all** of the impacts of a proposal (including environmental and social impacts), this involves estimating the value the community places on goods and services that are not traded in markets (for example, visual amenity or environmental values).

There are various approaches to valuing non-market impacts in a CBA context, including the following:

- **Replacement cost approach** — this approach is most commonly used for valuing lost environmental benefits. Under this approach, the cost of replacing lost environmental values (such as through offsets) is used as a proxy for the value.
- **Revealed preference studies** — the values the community places on particular outcomes can sometimes be inferred from behaviour (including market behaviour).
  - Amenity benefits are often reflected in property values (i.e. people are generally willing to pay more for a property that has a view or is close to a park or other community facilities). Hedonic pricing studies (where the impact of having a view or being in close proximity to a park on property prices, holding other factors constant) are often used to ascertain these values.
  - Another approach involves inferring people's preference for particular features based on their visitation and the travel costs incurred in getting there (the travel cost method).
- **Stated preference studies** — this approach essentially involves determining the value the community places on particular outcome from their 'willingness to pay', determined from their response to survey questions. There are several approaches to stated preference surveys, including:
  - Contingent valuation (CV) — the survey instrument describes a specific proposal and asks respondents whether they would be willing to pay for the proposal to be implemented at a specified price. The price is varied across respondents so that a large sample of survey responses can be used to estimate a demand curve (the distribution across consumers of willingness to pay) for the proposal. This approach is suitable when only a single option is being considered and when a large sample size is available.
  - Choice survey — this is a more sophisticated approach that asks survey respondents to choose between various 'choice sets' with multiple attributes to elicit people's preferences for each attribute. This approach is suitable when multiple options are being considered or when the results will be used to assess other options to be developed in the future.
- **Benefit transfer approach** — this approach generally involves extrapolating from the results of previous studies (such as stated preference or revealed preference studies) estimating 'willingness to pay' for similar environmental or social outcomes. As this approach does not require primary research to estimate environmental and social values, it is generally less costly. However, the validity of this approach depends on the availability of studies that are sufficiently similar to the outcomes being measured.

Amenity benefits and costs

Transmission infrastructure can have significant amenity impacts on the community. As the proposal involves removing some existing transmission lines and building some new ones, there are likely to be both positive and negative amenity impacts, including:

- Neighbourhood amenity impacts for future Ginninderry residents — this could include changes to both:
  - Visual amenity, and
  - Amenity associated with noise created by transmission infrastructure.
- Visual amenity impacts for other landowners.
- Landscape amenity impacts for users of recreational areas such as the Uriarra Crossing picnic areas, the Ginninderry Conservation Corridor and the (proposed) new Riverside Park.

Neighbourhood amenity benefits for future Ginninderry residents

In addition to the benefits associated with additional lots in the Ginninderry development, removing the existing transmission lines will improve amenity for other residents (including some existing and future residents). These amenity impacts could include both improved visual amenity; and reducing any disamenity associated with the noise created by transmission lines.

These amenity improvements are likely to be reflected in a higher sale price of the lots that would be close to the transmission towers in the base case scenario (i.e. where the existing transmission lines do not move), but not under the proposed relocation.

Analysis of lot sales to date within the Ginninderry development that are adjacent to transmission towers suggests a 5 per cent discount relative to other properties. A summary of neighbourhood amenity impacts from transmission lines from the literature is provided in Appendix A.

The property value uplift is estimated based on price uplift values in Tatos (2020) which decline with distance up to 400 metres from transmission lines. The total property value uplift estimated is **$16.4 million** based on 1696 houses located within 400 metres of existing transmission lines, including:

- 5.1 per cent price uplift for properties within 50 metres of transmission lines prior to removal (consistent with observations from the Ginninderry development), equal to $5.0 million based on 224 houses within 50 metres of existing transmission lines.
- an additional $11.4 million based on a declining price uplift rate for 1472 houses within 50 to 400 metres of existing transmission lines (table 4.2).

We assume these benefits are realised from 2026 when the construction and demolition work is scheduled to be completed. In present value terms (discounted back to 2025 consistent with other costs and benefits), the total property value uplift is estimated at **$15.3 million** (using a discount rate of 7 per cent).

4.2 Estimate of property value uplift Proximity to transmission lines	Number of houses	Price uplift	Uplift per house	Value (Undiscounted)	Present value [a]
	No.	Per cent	$/house	$m	PV$m
0-50 metres	224	5.1	21 303	5.0	4.7
50-100 metres	134	2.91	12 414	1.7	1.6
100-200 metres	359	2.09	8 987	3.3	3.1
200-300 metres	489	1.85	7 974	4.0	3.7
300-400 metres	490	1.11	4 819	2.4	2.2
Total value				**16.4**	**15.3**

[a] As we assume these benefits would not be realised until 2026 (when the existing infrastructure has been removed), these benefits have been discounted back to 2025 (consistent with other costs and benefits), using a discount rate of 7 per cent.

Source: CIE.

As the lots that would experience a value uplift as a result of the amenity improvement have mostly not yet been sold, the benefits will mostly flow to the GJV (even though the new residents will be the ones to enjoy the amenity improvement, this will be offset by the higher price they pay). However, these potential benefits have not been included in the commercial business case and are therefore not included in the impacts on the GJV set out in chapter 3. These additional benefits have therefore been included as a benefit to the GJV in the overall CBA (see chapter 5 below).

Amenity benefits and costs for other landowners

There may also be some (net) amenity impacts for the other landowners affected by the relocation. In this regard, the GJV will pay affected landowners for the easements for the new transmission lines. As we understand the landowners have agreed to these amounts, this implies that these landowners would be now worse off taking into account the net impact on amenity and the easement payment to compensate them for any negative impacts.

Although it is possible that these other landowners are better off in net terms (the easement payment exceeded any net cost from the infrastructure relocation), it is reasonable to assume that the impact on other landowners is neutral (implying that the easement payment exactly offsets any net cost incurred by the landowner) for the purposes of the CBA.

Landscape benefits and costs for users of recreational areas

In addition to the amenity impacts on affected landowners, there is likely to be some broader visual amenity impacts on the landscape.

- The most significant (and relevant) negative visual impacts from the new infrastructure from the CBA perspective are those:
  - Around the Uriarra Crossing recreation area, including:
    - the Uriarra crossing picnic areas (east and west)
    - Uriarra Road

  - Along Stockdill Drive, including the Lower Molonglo Water Quality Control Centre (LMWQCC).
- Removing the existing infrastructure will also have some positive visual impacts around the Conservation Corridor, Shepherds Lookout, the proposed Riverside Park and urban parks within Strathnairn and Macnamara.

We have measured these landscape impacts using the benefit transfer approach. However, in general, there are relatively few source studies that seek to measure the community's willingness to pay (WTP) to avoid the loss of landscape visual amenity from transmission lines. The estimates should therefore be treated with some caution (see appendix B for further details).

Under our central case, the proposed transmission line relocation would result in a net benefit ranging between **$3.62 million** and **$3.85 million** in present value terms over 50 years, using a discount rate of 7 per cent (table 4.3). This net benefit result reflects a net reduction in the length of transmission line.

- These estimates are based on the results of a stated preference study (choice experiment) from the United Kingdom (NERA and explain, 2019). This study estimated that consumers were WTP the equivalent of:
  - around **$0.437** per km per household per year to avoid the impacts on the landscape of transmission line in areas with high visual amenity, including national parks, areas of outstanding natural beauty (AONB) and National Scenic Areas (NSAs); and
  - around $**0.411** per household per km per year to avoid the impacts on the landscape of transmission line in other areas.
- These estimates are aggregated up to communitywide visual amenity impact as follows.
  - The household-level estimates are aggregated across **278 233** households as follows:
    - As it is mostly ACT residents that use (or will use) the relevant recreational areas (a minority of visitors are expected to come from further interstate and overseas, who might be shown these sites by local friends and family),[20] the main population that would be WTP for improved visual amenity in these areas are ACT households. According to the 2021 Census, there were **187 147** households in the ACT.
    - Some households in the surrounding areas of NSW may also visit the affected areas and therefore may also be WTP for improved visual amenity (even if they do not actually visit the area). To reflect this, we also include the **91 076** households in the 'capital region' (SA4 region) of NSW (based on the 2021 Census).
  - These annual community level estimates are then converted to a present value estimate over the life of the infrastructure (assumed to be 50 years), using a

[20] Alluvium, 2020, *Western Edge Investigation Area — Water Values and Environmental Hydrology Assessment*, Technical report prepared for the ACT Government (EPSDD), Canberra, p. 53.

discount rate of 7 per cent, consistent with the ACT's economic appraisal guidelines.

4.3 Estimated visual amenity benefits

	WTP per household per Km per year[a]	Community WTP per Km over life of infrastructure (50 years)[b]	Community WTP to avoid proposed new infrastructure (12.4 Km)[c]	Community WTP to remove existing infrastructure (14.7 Km)[c]	Net benefit
	$	$	$ million	$ million	$ million
National parks, AONBs and NSAs	0.437	1 796 844	–20.77	24.62	3.85
Other areas	0.411	1 689 609	–19.53	23.16	3.62

[a] Based on: NERA Economic Consulting and explain market research, 2019, *Estimating Electricity and Gas Transmission Consumers' Willingness to Pay for Changes in Service during RII02*, Prepared for National Grid Gas Transmission, SP Transmission and Scottish Hydro Electricity Transmission, p. v. Estimates converted to Australian dollars using the average exchange rate since 2010 (GBP/AUD 1.75; and EUR/AUD 1.48); estimates are then inflated to 2023 dollars using the Australian National CPI. [b] Presented in present value terms of the life of the new infrastructure (assumed to be 50 years), using a discount rate of 7 per cent. Aggregated across 278 223 households, including: 187 147 households in the ACT; and 91 076 households in the 'Capital region' of NSW (SA4 region), based on the 2021 Census. [c] Community WTP per km multiplied by 12.4 km of new transmission line. Costs are assumed to commence in 2026, but are discounted back to 2025 for consistency with other costs and benefits. [d] Community WTP per km multiplied by 14.7 km of existing transmission line to be removed. Benefits are assumed to commence in 2026, but are discounted back to 2025 for consistency with other costs and benefits.

Source: CIE estimates.

One limitation of these estimates is they do not explicitly take into account the number of visitors to the relevant areas (i.e. those that would directly experience the visual amenity changes).

Using an alternative approach that takes into account different visitation numbers for the relevant sites implies a net landscape amenity cost of around **$13.61 million** in present value terms over 50 years (the assumed life of the infrastructure), using a discount rate of 7 per cent (see appendix B for details). This reflects higher (estimated) visitation in the areas that will experience a negative visual amenity impact (the area around the Uriarra Crossing recreation areas), compared with the areas where visual amenity will be improved (the Conservation Corridor, Shepherds Lookout, the proposed Riverside Park and urban parks within Strathnairn and Macnamara). However, the source study for this estimate: is not directly comparable to the proposed relocation, is now around 25 years old and uses a less robust methodology than the study used above. This estimate should therefore be treated with caution. The overall impact of using this approach is examined in more detail in the sensitivity analysis (see chapter 5).

We assume that these costs and benefits are realised from 2026, when the construction work is scheduled to be completed.

Biodiversity benefits and costs

The two biodiversity outcomes from the Project are:

- a net increase in conservation land from the relocation of transmission lines

- improvement in conservation outcomes in the GCC from additional funds paid to the Ginninderry Conservation Trust. There is uncertainty about the conservation outcomes which will be achieved by the additional funds. Two estimates of implied area of conservation used in the analysis are:
  - 40 hectares (lower bound), and
  - 318 hectares (upper bound) (see table 4.4C.7).

  The lower bound estimates are used in the central case analysis, and the upper bound estimates are tested in sensitivity analysis.

4.4 Physical change in biodiversity outcomes from the Project

Biodiversity outcome	Lower bound	Upper bound
	Ha	Ha
Net increase in conservation land	16	16
Estimated implied area of additional conservation in GCC	40	318

Source: Ginninderry Joint Venture and CIE estimates.

Value of biodiversity outcomes from the Project

The value of biodiversity outcomes from the Project are presented below. See Appendix C for further detail on the approaches used.

There is no specific biodiversity value directly applicable to the biodiversity outcomes of this Project. Alternative approaches and values are applied to estimate the range in value of the two biodiversity outcomes of the Project:

- For the **benefit transfer approach**, two alternative willingness to pay values are applied to 50 per cent of households in the ACT and the Capital Region (SA4):
  - WTP values for grassy woodlands as estimated by MacDonald and Morrison (2010)[21], and recommended by VGIPS for terrestrial biodiversity impacts, and
  - WTP values for Endangered Ecological Communities (EECs) as estimated by Gillespie Economics (2009b)[22].
- For the **replacement cost approach**, applying an undiscounted annualised value of $1 327 per hectare per year.[23]

Each of these values are applied as annualised values over 30 years to the lower and upper bound estimated physical change in biodiversity outcomes from the Project (see table 4.4).

The total present value of biodiversity outcomes applying the different approaches and values used ranges between:

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21 D. Hatton MacDonald and M.D. Morrison (2010), Valuing biodiversity using habitat type, Australasian Journal of Environmental Management, 17:4, 235-243, page 237

22 Gillespie Economics 2009b, Mount Thorley Warkworth Operations Choice Modelling Study of Environmental and Social Impacts, prepared for Coal & Allied Pty Ltd

23 Annualised value over 30 years based on present value of $20 401 per hectare.

- $0.07 million to $0.42 million applying a benefit transfer approach using the value for grassy woodlands
- $1.12 million to $6.75 million applying a benefit transfer approach using the value for EECs
- $1.13 million to $6.81 million applying a replacement cost approach using the average credit price from historical trades in the Murrumbateman IBRA subregion (table C.12).

The replacement cost approach is used for the central case analysis for the following reasons:

- there is direct link to the Project's region, being based on historical credit price data for the Murrumbateman IBRA subregion
- the value for grassy woodlands is likely to under-estimate the value of higher conservation flora and fauna being protected and enhanced by the Project
- similar biodiversity values are estimated when applying the WTP values for EECs and the replacement cost approach.

For the central case analysis, the lower bound estimation of conservation area and the replacement cost approach area used. The total present value of biodiversity outcomes from the Project is estimated to be $1.13 million, comprising:

- $0.32 million (in present value) for value of additional conservation land
- $0.81 million (present value) for value of additional conservation outcomes in the GCC.

4.5 Estimated value of biodiversity outcomes

Approach/value	Present value over 30 years	Value for additional conservation land	Value of additional conservation outcomes in GCC	Total value of biodiversity outcomes
	PV$/ha	PV$m	PV$m	PV$m
Benefit transfer approach – 50 per cent of households in ACT and Capital Region (SA4)				
Value for grassy woodlands	1 268	0.02	0.05 –0.40	0.07 – 0.42
Value for EECs	20 229	0.32	0.80 – 6.43	1.12 - 6.75
Replacement cost approach				
Murrumbateman IBRA subregion	20 401	0.32	0.81 -6.49	1.13 – 6.81

Source: CIE based on sources listed.

Health benefits

The Ginninderry Conservation Corridor will include approximately 20 kilometres of walking tracks in the ACT portion of the corridor where the lines are to be removed.[24]

24 Information provided by Ginninderry Joint Venture.

Use of walking tracks can have a positive impact on health and wellbeing through physical activity.

The existing transmission lines will cross the proposed walking tracks within the GCC. The extent to which relocation of the existing transmission lines will result in additional health benefits from the use of the walking tracks depends on:

- whether the relocation of existing transmission lines induces more people to use the tracks for physical activity (compared to usage that will otherwise happen in the base case), and
- whether this increased physical activity is additional (i.e. induces physical activity that would otherwise not happen), rather than transfers physical activity from a different location (i.e. the person would otherwise walk at a different walking track).

The induced *additional* physical activity at the tracks resulting from the relocation to the transmission lines is expected to be small and has not been quantified. People wanting to use the walking tracks in the GCC are likely to use them regardless of the presence of the transmission lines (although there may be some dis-amenity impacts as discussed separately). It is not expected that the relocation of the transmission lines will induce *new* physical activity.

Cultural and heritage impacts

Riverview Projects ACT Pty Ltd commissioned an Aboriginal Cultural Heritage Assessment (ACHA) for the proposed transmission line removal and relocation. The ACHA identified (see figure 4.6):

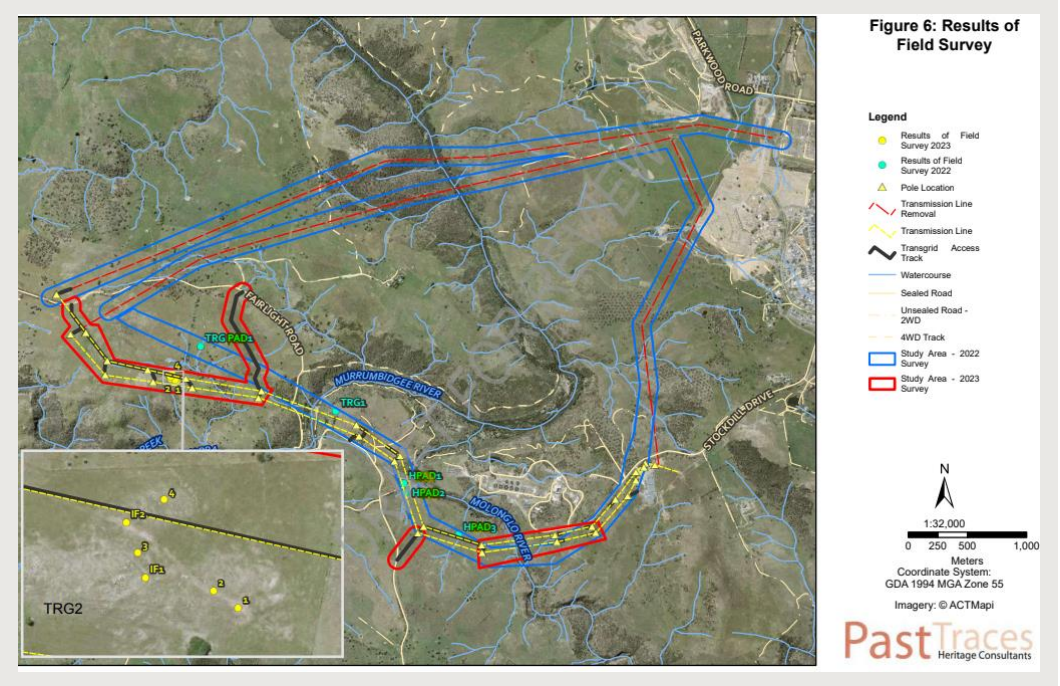
- two previously mapped cultural heritage sites (CR2 and RC48) located within the project area from a review of previous documents. However, neither of these sites are located on the existing track or areas of pole removal and will not be directly impacted by works.[25]
- two additional heritage site within the areas of the proposed relocation line easements through field surveys undertaken in 2022 and 2023. This site is on the northern boundary of the easement and is distant to works and will not be impacted.[26]

[25] Past Traces Heritage Consultants, *TransGrid Transmission Line Removal and Relocation, Molonglo West Belconnen — Aboriginal Cultural Heritage Assessment*, Draft Report Prepared for Riverview Projects ACT Pty Ltd, 1 May 2023, p. 21.

[26] Past Traces Heritage Consultants, *TransGrid Transmission Line Removal and Relocation, Molonglo West Belconnen — Aboriginal Cultural Heritage Assessment*, Draft Report Prepared for Riverview Projects ACT Pty Ltd, 1 May 2023, p. 22.

- three areas of potential archaeological deposits (PAD) within the project area (HPAD1-3) and one on the discarded 2022 alignment west of the Molonglo (TRGPAD1).[27] The scientific value of these sites was assessed as low.[28]

4.6 Heritage sites and sites with potential archaeological deposits



Data source: Past Traces Heritage Consultants, *TransGrid Transmission Line Removal and Relocation, Molonglo West Belconnen — Aboriginal Cultural Heritage Assessment*, Draft Report Prepared for Riverview Projects ACT Pty Ltd, 1 May 2023, p. 28.

In some cases, the ACHA recommended mitigation measures to avoid and minimise any harm. These measures included:

- avoidance of impacts through placement of access track alignment
- fencing of heritage sites; and
- mapping and avoidance of sites that are not in the vicinity of works in the event that the design alters.

Cultural and heritage impacts are therefore likely to be minimal.

Social benefits

In the event that the proposed relocation goes ahead, we understand that the GJV is proposing that:

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[27] Past Traces Heritage Consultants, *TransGrid Transmission Line Removal and Relocation, Molonglo West Belconnen — Aboriginal Cultural Heritage Assessment*, Draft Report Prepared for Riverview Projects ACT Pty Ltd, 1 May 2023, p. 25.

[28] Past Traces Heritage Consultants, *TransGrid Transmission Line Removal and Relocation, Molonglo West Belconnen — Aboriginal Cultural Heritage Assessment*, Draft Report Prepared for Riverview Projects ACT Pty Ltd, 1 May 2023, pp. 30-31.

- 15 per cent of the additional yield (65 additional residential dwelling sites) would be used for affordable residential dwellings — as these lots will be smaller, both land and construction costs will be lower and therefore more affordable; and
- 20 per cent of additional residential dwellings sites (86 additional sites) would be offered to eligible Community Housing Providers.

These lots will increase the availability of affordable and community housing in the ACT. This will benefit members of the community eligible for these schemes.

However, these lots will still be sold at the full market price. From a CBA perspective, the full value of the housing lots created are therefore reflected in the revenue received by the GJV. As such, there is no need to include an additional benefit to the recipient of these dwellings (or dwelling lots).

Reduced maintenance costs for Transgrid

As set out above, the proposed transmission line relocation will also result in less infrastructure in total, including:

- 2.3 km less line
- 8 fewer transmission towers
- 25.87 ha less area covered by easements.

In principle, this should reduce Transgrid's maintenance costs and improve network resilience. However, these cost savings are likely to be relatively modest.

As an indicative estimate, information from Transgrid's response to the Australian Energy Regulator's Regulatory Information Notice (RIN) suggests that on average Transgrid spent around $2 126 per km on maintaining 'lines and cable' and 'land and easement' in 2021/22 (table 4.7). This is based on the following information.

- Transgrid spent around $27.8 million in 2021-22 on maintenance of 'lines and cable' and 'land and easements'.[29]
- In total, Transgrid owned 13 075 km of overhead (12 9685 km) and underground (106.3 km) of various voltage.[30]

[29] See: AER website, Transgrid 2021-22 — Economic Benchmarking — RIN Response, Transgrid 2021-22 - Economic benchmarking RIN - Templates | Australian Energy Regulator (AER) Table 3.2, accessed 23 November 2023.

[30] AER website, Transgrid 2021-22 — Economic Benchmarking — RIN Response, Transgrid 2021-22 - Economic benchmarking RIN - Templates | Australian Energy Regulator (AER) Table 3.5, accessed 23 November 2023.

4.7 Average maintenance costs per kilometre of line

Maintenance category	Annual maintenance costs	Average per km
	$ million	$
Lines and cable	14.16	1 083
Land and easement	13.63	1 043
Total	**27.79**	**2 126**

Source: AER website, Transgrid 2021-22 — Economic Benchmarking — RIN Response, Transgrid 2021-22 - Economic benchmarking RIN - Templates | Australian Energy Regulator (AER), accessed 23 November 2023.

Note that maintenance costs could vary depending on a range of factors such as: whether a line is overhead or underground; the voltage of the line; the age of the assets; the composition of the assets (e.g. steel or timber poles); the number of towers or poles along any given section of transmission line; the remoteness of the assets; ruggedness of the landscape being managed (e.g. flat with high quality access tracks or hilly with 4WD gravel tracks); and vegetation management requirements for the section of transmission line. Furthermore, the marginal maintenance costs (i.e. the cost of maintaining each additional kilometre of lines and cables) could vary from the average. These cost estimates should therefore be considered indicative only.

Applying these average maintenance cost estimates to the 2.3 km reduction in total line implies an annual cost saving of around $4 889. This is around **$72 192** in present value terms over the assumed 50-year life, using a discount rate of 7 per cent.

We assume that these benefits would be realised from 2026 when the construction and demolition work is scheduled to be completed.

5 Communitywide net benefits

Summary of communitywide net benefits

Bringing together the benefits and impacts estimated in the preceding chapters, we estimate the proposed transmission line relocation would deliver a communitywide net benefit of around **$70.14 million** in net present value terms over the 50-year life of the new infrastructure, using a discount rate of 7 per cent (table 5.1).

Although there are various ways the benefit-cost ratio (BCR) could be defined, we define it as follows:

$$BCR = \frac{Total\ net\ benefits\ - Cost\ of\ relocation\ works}{Cost\ of\ relocation\ works}$$

Under this definition, the BCR is close to 2, indicating that the net benefits generated from the transmission relocation are nearly double the cost of the relocation.

Most of these net benefits would flow to the GJV. Although not included in the commercial business case, we have included the value uplift associated with the removal of the existing transmission lines on nearby lots as a benefit to the GJV as most of these lots have not yet been sold (although some of these benefits will flow to existing property owners in the Ginninderry development).

Based on our central case estimates, the proposal would also deliver a net benefit of around **$5.06 million** (also in net present value terms over the life of the infrastructure, using a discount rate of 7 per cent) to external parties, although this finding is sensitive to the approach used to valuing landscape impacts (see sensitivity analysis below).

5.1 Net benefits from proposed transmission line relocation — summary

	Estimated benefits/costs
	$ million
Impact on the Joint venture	
Value of additional lots	174.67
Land production costs	- 53.36
Transmission line relocation costs	- 71.54
Value uplift on nearby lots [a]	15.31
Total impact on joint venture	**65.09**
Impact on other parties	
Net benefit/cost for landowners	0.00
Landscape amenity	3.85

	Estimated benefits/costs
	$ million
Biodiversity impacts - increase in conservation land	0.32
Biodiversity benefits - funding for additional conservation activities	0.81
Impact on transmission infrastructure maintenance costs	0.07
Net benefit for external parties	**5.06**
Total net benefit	**70.14**
Benefit-cost ratio b	**1.98**

[a] Although these benefits were not included in the commercial business case, we have included them as a benefit to the GJV because most of the lots that would be affected by the value uplift have not yet been sold. [b] Defined as the total net benefit, excluding the cost of the transmission location works, divided by the cost of the transmission relocation works.

Note: Estimates are presented in net present value terms over the (assumed) 50 year life of the infrastructure, using a discount rate of 7 per cent. Totals may not add due to rounding.

Source: CIE estimates (see chapters 3 and 4 for further details).

Distributional analysis

Distributional analysis is an additional component of the economic appraisal requirements under the ACT Government's Capital Framework (see figure 2.1 above).

The presentation of the CBA results (see table 5.1) partly captures the distributional impacts, with the benefits to the GJV and other members of the community presented separately. The distributional analysis extends the summary analysis (above) by taking into account the distribution of profits among the GJV partners. Under the agreement, profits are shared as follows:

- 60 per cent of the profits go to the ACT Government
- 40 per cent of the profit go to the private partner (Riverview ACT Pty Ltd).

Once the profits to the GJV are distributed, the net benefits are distributed as shown in table 5.2.

- Around 56 per cent of the net benefits are estimated to be realised by the ACT community via the additional revenue received by the ACT Government. This revenue will (presumably) be used to fund services that benefit the ACT community.
- Around 37 per cent of the net benefits are estimate to go to the private partner in the Joint Venture, Riverview.
- Most of the remaining net benefits (around 7 per cent) are estimated to go to the local community (defined as households that live in the ACT and the Capital Region of NSW).

5.2 Distribution of net benefits

	Estimated net benefit	Share of net benefits
	$ million	Per cent
Net benefits to private partner (Riverview) [a]	26.03	37.1
Benefits to ACT community (via the ACT Government) [b]	39.05	55.7

	Estimated net benefit	Share of net benefits
	$ million	Per cent
Benefits to the local community [c]	4.98	7.1
Benefits to Transgrid	0.07	0.1
Total	**70.14**	**100.0**

[a] Based on 40 per cent share of the GJV profits. [b] Based on 60 per cent share of GJV profits. [c] Includes landscape amenity and biodiversity net benefits.

Note: Net benefits presented in net present value terms over 50 year life of infrastructure, discounted back to 2025 using a discount rate of 7 per cent. Totals may not add due to rounding.

Source: CIE estimates.

Sensitivity analysis

Although there is some uncertainty around all benefit and cost items, the key uncertainties relate to:

- the value uplift of housing lots as a result of improved neighbourhood amenity — in particular, there is conflicting evidence in the literature on the extent to which proximity to transmission lines affect residential property prices; and
- estimates of the non-market benefits — non-market valuation is challenging and may be subject to significant uncertainty, particularly when using the benefit transfer approach (rather than primary research to measure the specific benefits and costs of the specific scenario directly). It is therefore important to test the impacts of using alternative approaches on the overall outcomes.

Value uplift due to improved neighbourhood amenity

A benefit transfer approach has been used to estimate the property value uplift from removal of transmission lines. There are inherent uncertainties with the benefit transfer approach, primarily driven by differences between the original study site and the project site which values are being transferred to. For this study we have applied values from Tatos (2020)[31] in the central case analysis. As a sensitivity analysis we apply a property value uplift of 5 per cent for houses within 100 metres of the existing transmission lines.

Applying a flat 5 per cent uplift to houses within 100 metres has a present value of $7.34 million. This is lower than the property uplift value estimated in the central case of $15.31 million.

31 Tatos, T., 2020, Property value impacts from transmission lines, subtransmission lines, and substations

5.3 Net benefits/costs under conservation outcomes in the GCC

	Central case (40 hectares)	Sensitivity scenario 1 (318 hectares)
	$ million	$ million
Net benefits to Joint Venture		
Value uplift to nearby lots	15.31	7.34
Other benefits to Joint Venture	49.77	49.77
Total benefits to Joint Venture	**65.09**	**57.12**
Net benefits/costs to other parties		
Total net benefits/costs on others	**5.06**	**5.06**
Total net benefits/costs	**70.14**	**62.17**

Note: Totals may not add due to rounding.

Source: CIE.

Landscape amenity

As discussed above, there are a limited number of studies that measure WTP to avoid the visual impacts of transmission lines on the landscape. Furthermore, transfering the benefits from different studies to the Ginninderry transmission line relocation proposal produces significantly different results (see appendix B). For the purposes of sensitivity analysis, we consider the alternative scenarios as set out in table 5.4.

5.4 Summary of scenarios used for sensitivity analysis — landscape amenity

Scenario	Basis for valuing the landscape impacts
Central case	▪ NERA and explain (2019): Estimated WTP to underground transmission line from national parks, AONB and NSAs (based on transmission line length) ▪ Aggregated across households in the ACT and the Capital Region of NSW.
Scenario 1	▪ NERA and explain (2019): Estimated WTP to underground transmission line from other areas (based on transmission line length). ▪ Aggregated across households in the ACT and the Capital Region of NSW.
Scenario 2	Garrod and Willis (1998) based on estimated number of visitors to affected sites.
Scenario 3	Tempesta, Vecchiato and Girardi (2014): Estimates of WTP to remove transmission lines from mountain and hill rural areas outside of national parks (based on transmission line length).
Scenario 4	▪ NERA and explain (2019): Estimated WTP to underground transmission line from national parks, AONB and NSAs (based on transmission line length). ▪ Aggregated across households in the ACT only.

Source: CIE.

The CBA results under each of these scenarios is summarised in table 5.5.

- The main finding is that the alternative approach to measuring landscape impacts (based on the number of visitors, as tested in Scenario 2) implies a significant net reduction in landscape amenity (a cost of around **$13.61 million** compared to a

benefit of **$3.85 million** under the central case). This reflects the lower (estimated) number of visitors to the areas affected by the removal of the existing transmission lines (i.e. the Conservation Corridor, Shepherds Lookout, the proposed Riverside Park and urban parks within Strathnairn and Macnamara), compared with the areas affected by the new transmission lines (i.e. the area around Uriarra crossing) (see appendix B for further details).

  - Using this approach, the proposed relocation would result in a net cost of around **$12.40 million** to external parties (i.e. parties outside the GJV).
  - However, the net benefit to the GJV would still outweigh the losses to external parties resulting in a significant net benefit overall.
  - These estimates should be treated with caution as: there are significant differences between the impacts measured in the source study and the proposed relocation; the study is around 25 years old; and uses a less robust methodology than the study used in the central case.

- The other scenarios indicate the magnitude of the landscape amenity changes are relatively sensitive to the specific source studies (and definition of the catchment), the landscape amenity changes are generally sufficiently small that the key findings do not materially change.

5.5 Net benefits/costs under alternative landscape amenity scenarios

	Central case	Sensitivity scenario 1	Sensitivity scenario 2	Sensitivity scenario 3	Sensitivity scenario 4
	$ million	$ million	$ million	$ million	$ million
Net benefits to Joint Venture	65.09	65.09	65.09	65.09	65.09
Net benefits/costs to other parties					
Landscape net benefits/costs	3.85	3.62	- 13.61	0.58	2.59
Other impacts on other parties	1.20	1.20	1.20	1.20	1.20
Total net benefits/costs on others	**5.06**	**4.83**	**- 12.40**	**1.79**	**3.79**
Total net benefits/costs	**70.14**	**69.91**	**52.68**	**66.87**	**68.88**

Note: Net benefits presented in net present value terms over 50 year life of infrastructure, using a discount rate of 7 per cent.
Source: CIE estimates.

In summary, the impacts of transmission lines on landscape amenity has not been studied extensively. As such, there is significant uncertainty around estimates based on the benefit transfer approach (i.e. the approach used for this study).

Given this uncertainty, the finding that the proposed relocation will deliver a net benefit to external parties (as well as the GJV) is not considered robust. However, we can remain relatively confident that the relocation will deliver a net benefit overall.

Biodiversity

As discussed above the Project will increase the area of conservation and also improve conservation outcomes in the GCC.

There is uncertainty about the conservation outcomes that will be achieved in the GCC, both in terms of quantity and quality, as these are dependent on how the additional funds are spent by the Ginninderry Conservation Trust. An estimate of conservation area achieved by the additional funds to the Trust has been estimated using management costs per hectare from biodiversity stewardship agreements. Two estimates of implied area of conservation used are:

- 40 hectares (lower bound used in central case analysis), and
- 318 hectares (upper bound).

The lower bound has been used in the central case analysis. Here the upper bound estimate of 318 hectares of conserved land is used to test the sensitivity of the overall results to the assumed additional area of conservation.

The upper bound estimate is based on average BSA management costs per hectare in the Southern Eastern Highlands region. However, this value has not been used in the central case analysis because it is expected the average management cost per hectare spent by the Trust in the GCC will be substantially higher in order to achieve *additional* biodiversity outcomes of higher quality conservation value.

5.6 Net benefits/costs under conservation outcomes in the GCC

	Central case (40 hectares)	Sensitivity scenario 1 (318 hectares)
	$ million	$ million
Net benefits to Joint Venture	65.09	65.09
Net benefits/costs to other parties		
Biodiversity benefits – funding for additional conservation activities	0.81	6.49
Other impacts on other parties	4.25	4.25
Total net benefits/costs on others	**5.06**	**10.73**
Total net benefits/costs	**70.14**	**75.82**

Source: CIE.

Discount rate

Consistent with the recommendations set out in the ACT Government's appraisal methodology, we test the sensitivity of the results to alternative discount rates: 4 per cent and 10 per cent.

In general, the results are not particularly sensitive to the discount rate (table 5.7). This reflects the timing of the key benefits and costs; most are realised within a relatively short timeframe.

5.7 CBA results using different discount rates

Discount rate	Net present value	Benefit-cost ratio
	$ million	
4 per cent	73.51	2.02
7 per cent (central case)	70.14	1.98
10 per cent	67.75	1.96

Note: Benefits and costs are measured over the (assumed) 50 year life of the infrastructure.

Source: CIE estimates.

A Neighbourhood amenity impacts of transmission lines

Values in literature

The main amenity impacts associated with high-voltage overhead electricity transmission lines (HVOTLs) are visual impacts, but may also include noise or perceptions of health and safety risks (for example, due to electromagnetic fields or fire). The combination of these impacts would be manifested as a difference in prices between properties located near transmission line routes relative to properties without transmission line routes nearby.

Two types of properties require consideration for the proposed transmission line relocation project:

- properties receiving an uplift in value due to removal of existing transmission lines
- properties incurring a decrease in value due to installation of new transmission lines.

For this project, the decrease in property value for properties hosting the new transmission lines is offset by the easement acquisition costs paid by GJV to those landholders.

The property value uplift for properties located near the existing transmission lines being removed needs to be accounted for in the CBA. A number of studies has been conducted to assess the impact of HVOTLs on property prices. Estimates vary across studies, with some studies finding no impact and others finding considerable impacts. Many of the studies estimate impacts as a function of proximity to the HVOTL. The highest impacts have been observed at very close proximity lines, such as 10-20 metres.

Previous quantitative studies have found varying impacts on property values due to proximity to transmission lines, generally ranging between 0 and 10 percent decline in property value. In the majority of studies, the impact diminishes as distance from the property to the power lines increases.

For proximities between 50 and 100 metres, our review of the literature indicates that the impact of HVOTL would most likely be in the range 0 to 10 per cent of established house sale prices (see table A.1). Only one of the studies, by Sims and Dent (2005), finds an impact outside this range and our brief review of their paper raised concerns about the sample sizes and control variables used to develop their estimate. Most studies appear to find that proximity effects reduce to zero by 200 metres at the most.

Sensitivity analysis around the estimated impact is important, since precision is difficult due to:

- Contrasting findings in the literature as to the roles of proximity and visibility, whether they apply to pylons or lines, and whether the easement for the HVOTL can have positive impacts; [32]
- Differences in the housing stock, topography and demographics between project areas and the various case study areas;
- Uncertainties over the growth in values since when the case studies were conducted;[33] and
- Uncertainties over the rigour of the methods applied in the case studies.

A.1 Studies on neighbourhood amenity impacts — summary

Study	Details	Key findings
Tatos, T., 2020, Property value impacts from transmission lines, subtransmission lines, and substations	▪ General approach ▪ Location: Utah, USA ▪ Year of study: 2020 Estimates impact of different types of transmission lines on property prices	▪ Impact was assessed for different types of transmission line (345 kV, 138 kV, and 46kV) ▪ Impact was negative and statistically significant for all distances from the 138 kV line, with property values decreasing by: – 5.1 per cent for properties within 50 metres – 2.91 per cent for properties between 50 and 100 metres – 2.09 per cent for properties between 100 and 200 metres – 1.85 per cent for properties between 200 and 300 metres 1.11 per cent for properties between 300 and 400 metres
McNair, B., Abelson, P., Estimating the value of undergrounding electricity and telecommunications networks	▪ General approach: Hedonic study ▪ Location: Canberra ▪ Measured change in houses prices due to undergrounding of wires	▪ Presence of underground wires increases house prices by 2.9 per cent. ▪ 95% confidence interval is 0.3 per cent to 5.5 per cent

32 Des Rosiers (2002) found there may be a positive impact from being located one to two lots away from a HVOTL easement if not facing a pylon. Similarly, Sims and Dent (2005) found that "*closeness and the visual presence of HVOTLs from a residential property, particularly HVOTL towers, cause a reduction in value. In contrast, the presence of a line to the rear of the house can increase value because of positive externalities created by an easement*." In contrast, Callanan (2014) found that removing a HVOTL causes a price increase across the whole neighbourhood over 3-4 years, not just the properties adjacent to the HVOTL.

33 Some of these studies were conducted on property transactions that took place a few decades ago. Using the percentage impacts from these studies in the present study requires an assumption that the nominal dollar value of the impacts has increased over time in line with increases in house prices.

Study	Details	Key findings
McNair, B, Bennett, J., Hensher, D, 2010, Households' willingness to pay for undergrounding electricity and telecommunications wires	▪ General approach: Stated choice survey ▪ Location Canberra ▪ Measured average WTP for underground in established residential areas in Canberra	▪ Average WTP of $6838 per property to underground electricity and telecommunications wires.
Callanan J., 2013, A Contingent Valuation Approach to the Valuation of High Voltage Transmission Lines	▪ General approach: Sales analysis ▪ Location: Auckland, New Zealand ▪ Year of study: 2013 ▪ Measured impact of HVOTLs on property values	Property price decrease by distance: ▪ 20 per cent within 10 metres ▪ 5 per cent within 50 metres ▪ <1 per cent within 100 metres.
Jayatha, W.M., Abeydeera, L.H., 2020, Effects of High-Voltage Overhead Power Lines (HVOPLs) on Residential Property Prices	▪ General approach: Hedonic Pricing Model ▪ Location: Hong Kong ▪ Year of study: 2020 ▪ Impact of HVOPLs on the value of residential properties	Decrease in property value: ▪ 34.2 per cent for residual unit within 300 metres of power lines ▪ 18 per cent for a property located within 300 metres ▪ 8 per cent lower for properties facing power lines, compared to similar properties in the area
Tang, C.K and Gibbons, S., 2022, Power lines and negative externalities: evidence from the housing market	▪ General approach: Hedonic modelling ▪ Location: England and Wales ▪ Year of study: 2021 ▪ Estimated the monetary value of overhead powerlines and pylons on local housing values in England and Wales	▪ New overhead pylons reduce prices by 3.6 per cent for properties up to 1200 metres away ▪ Based on sample of property transactions around newly built power lines
Bond, S. and Hopkins, J, 2000, The impact of transmission lines on residential property values: results of a case study	▪ Location: Wellington, NZ ▪ Data period: 1983 – 1993 ▪	▪ Price impact of: – -5.4% for properties within 50m ▪ -2.7% for properties within 100m
Callanan, 2014, Assessing the Property Market Impact of Stigma Removal: High Voltage Overhead Transmission Lines Removal in Wellington, NZ	▪ Location: Wellington, NZ ▪ Data period: Mid-1990s	▪ Price impact of: – -5% for properties within 50m ▪ 0% for properties within 100m
Chalmers and Voorvart, 2009, High Voltage Transmission Lines: Proximity, Visibility, and Encumbrance Effects	▪ Location: Connecticut and Massachusetts, USA ▪ Data period: 1998-2007	▪ Price impact of: ▪ 0% for properties within 75m
Colwell, 1990, Power Lines and Land Value	▪ Location: Illinois, USA	▪ Price impact of: – --1% to -5% for properties within 50m ▪ 0% to -2% for properties within 100m
Des Rosiers, 2002, Power Lines, Visual Encumbrance and House Values: A Microspatial Approach to Impact Measurement	▪ Location: Brossard, Montreal ▪ Data period: 1991-96	▪ Price impact of: – -5% for properties within 3 lots from pylon

Study	Details	Key findings
		– 0% for properties facing pylon, 46m – +7% to +9% for properties 1-2 lots from pylon ▪ 0% to -2% for properties within 100m
Hamilton and Carruthers, 1993, The Effects of Transmission Lines on Property Values in Residential Areas	▪ Location: Vancouver, Canada ▪ Data period: 1985-1991	▪ Price impact of: ▪ --2% to -3% for properties within 120m
Hamilton and Schwann, 1996, Do High Voltage Electric Transmission Lines Affect Property Values?	▪ Location: Vancouver, Canada ▪ Data period: 1985-1991	▪ Price impact of: – -6.3% for properties within 100m ▪ -1.1% for properties within 200m
Ignelzi and Priestley, 1991, A Statistical Analysis of Transmission Line Impacts in Six Neighbourhoods.	▪ Location: USA ▪ Data period: 1976-1989	▪ Price impact of: ▪ --1% to -9% for properties within 100m
Sims and Dent 2005, High-Voltage Overhead Power Lines and Property Values: A residential Study in the United Kingdom	▪ Location: Scotland ▪ Data period: 2001-2002	▪ Price impact of: ▪ -11.5% for properties within 100m
Wolverton and Bottlemiller, 2003, Further analysis of transmission line impact on residential property values.	▪ Location: Oregon and Washington, USA ▪ Data period: 1989-1992	▪ Price impact of: ▪ 0% for properties within 100m

Note: Price impacts are on established house prices, as distinct from vacant land prices, unless otherwise noted.

Source: Various as listed

Property value uplift from removal of transmission lines

Table A.2 summaries the number of properties at varying distances from the existing transmission lines.

There are 60-metre-wide easements along each of the existing transmission lines[34] which do not contain housing.

A.2 Number of houses located near transmission lines to be removed

Distance band to transmission lines	Net number of houses impacted
	No.
0-30 metres (Easement)	0
30-50 metres	224
50-100 metres	134
100-150 metres	179

34 Information contained in Draft Business Case for Ginninderry Powerline Relocation

Distance band to transmission lines	Net number of houses impacted
150-200 metres	180
200-300 metres	490
300-400 metres	489
Total	**1696**

Note: Includes sold and yet to be sold homes in Macnamara and Strathnairn.

Source: Information provided by Ginninderry Joint Venture.

In our modelling, we apply the discount to land prices, prior to construction of dwellings. The weighted average land price in Line 1 and 7 is $439 000 for the additional properties sold after the removal of the transmission lines. This is the value of land sales assuming no transmission lines remain and hence already incorporates the price uplift.

A.3 Weighted average value of land sale in easements

Item	Unit	Line 1	Line 7
Number of lots	No.	297	133
Land sales revenue	$m	123.8	64.9
Land revenue per lot	$/lot	416 944	488 260
Weighted average across Line 1 and Line 7	**$/lot**	**439 002**	

Source: CIE based on information provided by GJV.

Property value uplift is estimated based on the values transferred from Tatos, 2020 (see table A.1) which decline with distance up to 400 metres from transmission lines. Total property value uplift is estimated as $16.4 million based on 1696 houses located within 400 metres of existing transmission lines, including:

- 5 per cent price uplift for properties within 50 metres of transmission lines prior to removal, equal to $5.0 million based on 224 houses within 50 metres of existing transmission lines.
- an additional $11.4 million based on a declining price uplift rate for 1472 houses within 50 to 400 metres of existing transmission lines (table A.4).

A.4 Estimate of property value uplift

Proximity to transmission lines	Number of houses	Price uplift	Uplift per house	Value
	No.	Per cent	$/house	$m
0-50 metres	224	5.1	21 303	5.0
50-100 metres	134	2.91	12 414	1.7
100-200 metres	359	2.09	8 987	3.3
200-300 metres	490	1.85	7 974	4.0
300-400 metres	489	1.11	4 819	2.4
Total	**1 696**			**16.4**

Source: CIE.

There is potential for an additional 820 blocks to be developed in the future to the north of the development. These additional blocks would be under and to the north of the

existing lines. Using the same valuation approach as above, the property value uplift for these additional blocks is $7.9 million should these be developed (table A.5).

As development of these additional 820 blocks is uncertain at this stage, this value is provided as sensitivity analysis only and is not included in the central case analysis.

A.5 Estimate of property value uplift — additional 820 blocks

Proximity to transmission lines	Number of houses	Price uplift	Uplift per house	Value
	No.	Per cent	$/house	$m
0-50	104	5.1	21 303	2.3
50-100	52	2.91	12 414	0.7
100-200	222	2.09	8 987	2.0
200-300	221	1.85	7 974	1.8
300-400	221	1.11	4 819	1.1
Total	**820**			**7.9**

Source: CIE.

B Landscape impacts

In addition to the neighbourhood amenity impacts, the transmission line relocation may have broader impacts on the landscape (e.g. impacts on members of the community outside current and future residents in the Ginninderry development).

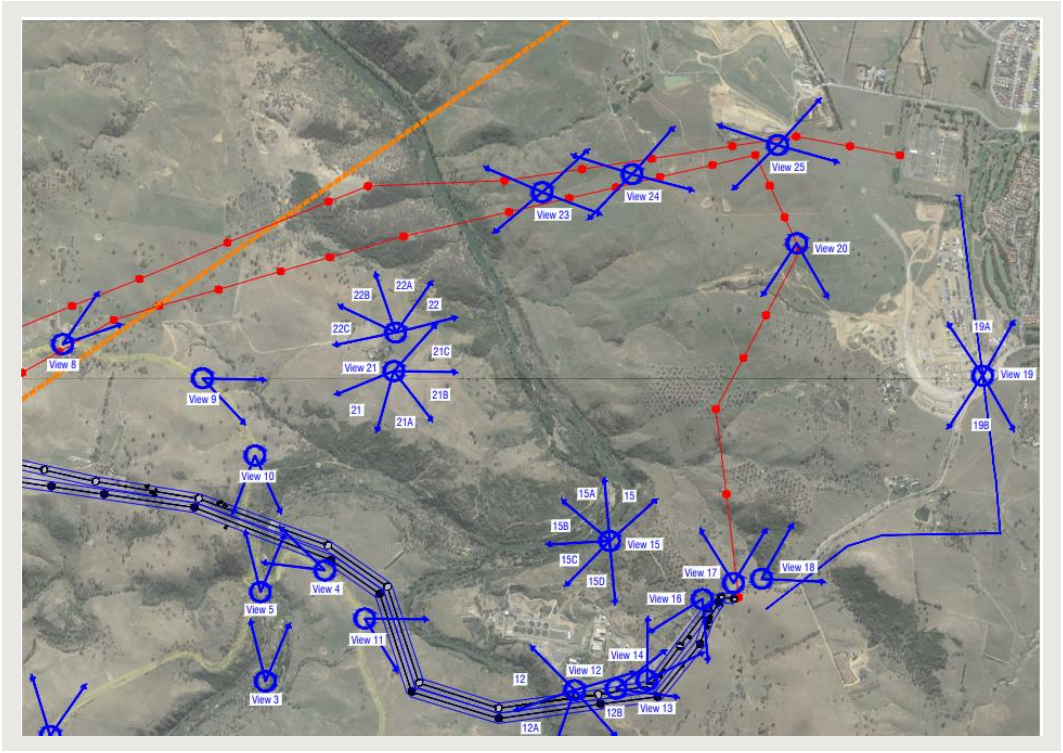
Visual impacts on the landscape

A detailed study to assess the visual impacts of the proposed transmission line relocation is currently being finalised.

View points

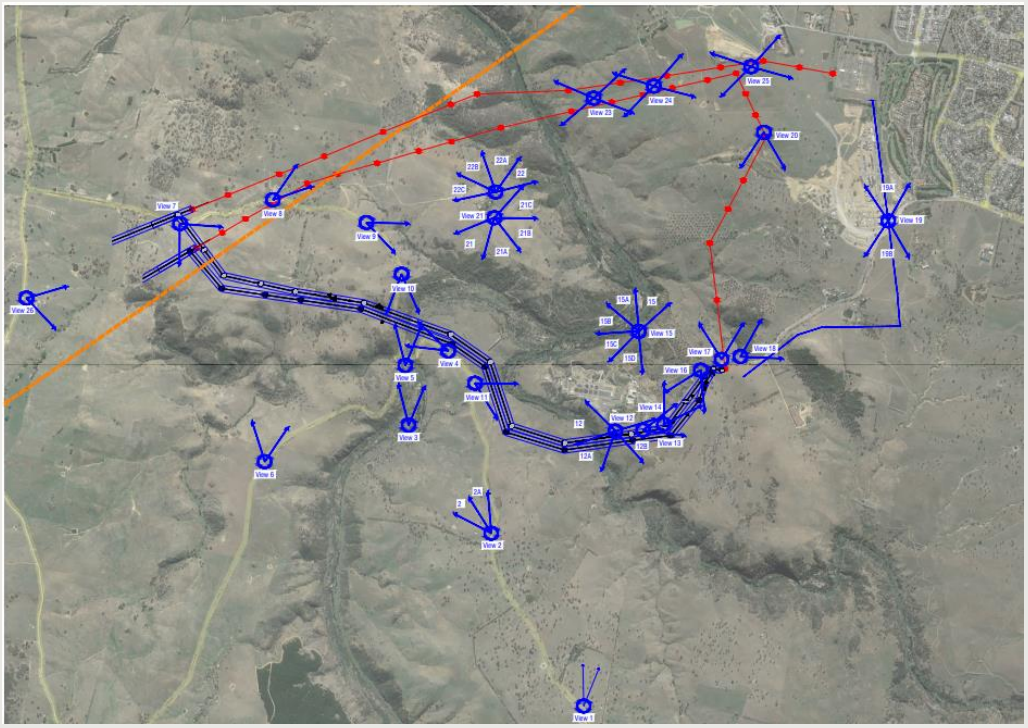
The visual impact study has assessed the visual impact of the proposed transmission line relocation from a range of view points, including from various directions where relevant. The view points are shown in charts B.1, B.2 and B.3.

B.1 Detailed view locations — subset A



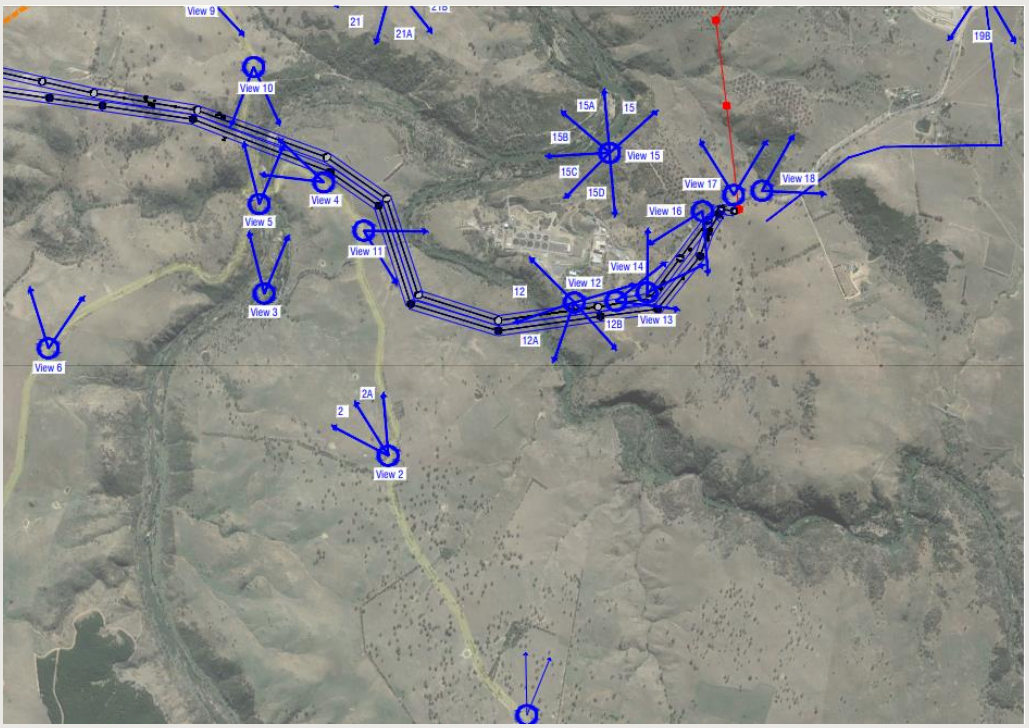
Data source: dsb Landscape Architects, Ginninderry Act, Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, p. 35.

B.2 Detailed view locations — subset B



Data source: dsb Landscape Architects, Ginninderry Act, Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, p. 36.

B.3 Detailed view locations — subset C



Data source: dsb Landscape Architects, Ginninderry Act, Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, p. 37.

Summary of visual impacts

The visual impact study gives Landscape Visual Impact Ranking (LVIR — see box B.4) from each of the specified view points, including from various directions (where relevant).

B.4 Landscape Visual Impact Rating[35]

The Landscape Visual Impact Rating (LVIR) rates the visual impact (low, medium or high) based on a number of criteria:

1 The number of viewers at a given location (the higher the numbers the greater the impact)
2 The proximity of the view location to the infrastructure (the closer the proximity the greater the impact)
3 The angle of the view to the predominant sightline or the predominance of the infrastructure in the view (straight ahead has greater impact than view at 90o)
4 New infrastructure or existing infrastructure being modified or existing infrastructure being removed:
   – New infrastructure has the greater impact and removed infrastructure has the lesser impact
   – New infrastructure has construction period impact and installed infrastructure impact
   – Modified or existing infrastructure removed has construction period impact only.

The LVIR from each view point is summarised in table B.5 (refer to the visual impact study for further details).

B.5 Summary of visual impacts

Viewpoint	Location	LVIR	Category	Impact on visual amenity
1	Uriarra Road	Medium	New infrastructure	Negative
2	Uriarra Road	Medium	New infrastructure	Negative
2A	Uriarra Road	High	New infrastructure	Negative

35 dsb Landscape Architects, Ginninderry Act, Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, p. 47.

Viewpoint	Location	LVIR	Category	Impact on visual amenity
3	Uriarra Crossing East Picnic Area	High	New infrastructure	Negative
4	Uriarra Road	High	New infrastructure	Negative
5	Uriarra Crossing West Picnic Area	High	New infrastructure	Negative
6	Uriarra Road	Medium	New infrastructure	Negative
7	Fairlight Road Crossover	High	New infrastructure	Negative
8	Fairlight Road, Fairlight Property	Medium	Infrastructure removed	Positive
9	Fairlight Road	Medium	New infrastructure	Negative
10	Fairlight Road	Medium(p. 68)/High	New infrastructure	Negative
11	Uriarra Road	High	New infrastructure	Negative
12	LMWQCC Stockdill Drive	High	New infrastructure	Negative
12A	LMWQCC Stockdill Drive	High	New infrastructure	Negative
12B	LMWQCC Stockdill Drive	High	New infrastructure	Negative
13	Stockdill Drive	High	New infrastructure	Negative
14	Stockdill Drive	High	New infrastructure	Negative
15	Shepherd's Lookout	Low	Infrastructure removed	Positive
15A	Shepherd's Lookout	Low	Infrastructure removed	Positive
15B	Shepherd's Lookout	Low	Infrastructure removed	Positive
15C	Shepherd's Lookout	Medium	New infrastructure	Negative
15D	Shepherd's Lookout	Medium	New infrastructure	Negative
16	Stockdill Drive	High	New infrastructure	Negative
17	Stockdill Drive	Low	Infrastructure removed	Positive
18	Stockdill Drive	Low	Existing infrastructure modified	Negative
19	Pro Hart Avenue Strathnairn Ginninderry	Low	Existing infrastructure modified	Negative
19A	Pro Hart Avenue Strathnairn Ginninderry	Low	Existing infrastructure modified	Negative
20	Bob Whan Street Strathnairn Ginninderry	Low	Infrastructure removed	Positive
21	Fairlight Residence	Medium	New infrastructure	Negative
21A	Fairlight Residence	Low	Infrastructure removed	Negative
21B	Fairlight Residence	Low	Infrastructure removed	Positive
21C	Fairlight Residence	Low	Infrastructure removed	Positive
22	Fairlight Residence	Low	Infrastructure removed	Positive

Viewpoint	Location	LVIR	Category	Impact on visual amenity
22A	Fairlight Residence	Low	Infrastructure removed	Positive
22B	Fairlight Residence	Low	Infrastructure removed	Positive
22C	Fairlight Residence	Low	Infrastructure removed	Positive
23-25	Macnamara Ginninderry	Low	Infrastructure removed	Positive
26	Mountain Creek Road Rural Residential	Low	New infrastructure	Negative

Note: View points with a High LVIR are highlighted in blue.

Source: dsb Landscape Architects, Ginninderry Act, Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, pp. 48-56.

The most significant (and relevant) visual impacts from the CBA perspective are those:

- Around the Uriarra recreation area, including:
  - the Uriarra crossing picnic areas (east and west)
  - Uriarra Road
- Stockdill Road, including the LMWQCC.

The new transmission infrastructure near the Uriarra Crossing East Picnic Area is shown in figure B.6.

B.6 Impact on Uriarra Crossing East Picnic Area

Data source: dsb Landscape Architects, Ginninderry Act, Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, p. 61.

The new transmission infrastructure near the Uriarra Crossing West Picnic Area is shown in figure B.7. See the visual impact study for assessments of the visual impacts for other view points.

B.7 Impact on Uriarra Crossing West Picnic Area

Data source: dsb Landscape Architects, Ginninderry Act, Upper and Lower Tumut 300kV Transmission Line Realignment, Landscape and Visual Impact Assessment Report, Draft Report, Prepared for Riverview Projects (ACT) Pty Ltd for the Ginninderry Joint Venture, November 2023, p. 63.

The following visual impacts are less significant (i.e. lower LVIR) and/or less relevant to the CBA.

- There are some impacts from Shepherd's lookout; however, these would largely be offset (i.e. there is a negative impact on the view in some directions, but a positive impact in others).
- Similarly, there are both positive and negative impacts on the Fairlight residence, which largely appear to offset. Any impacts on the residence would have presumably been taken into account in the payment for the easements.

Impacts on the proposed Riverside Park

The proposed relocation also involves removing transmission lines from the new Biodiversity Conservation Corridor and from the area near the proposed Riverside Park. As such, there would be a corresponding improvement in visual amenity for users of these new recreational areas.

Valuing landscape impacts

The landscape amenity impacts of transmission lines are generally estimated through stated preference studies. Although there are a reasonable number of studies estimating the amenity impacts of transmission lines on property values, there are fewer studies estimating the impact on the landscape (see table B.8 for a summary of the relevant literature).

As per the hedonic pricing studies, the context for many of these studies is to assess the potential benefits from undergrounding transmission lines. Although the option of undergrounding transmission lines is not explicitly being assessed for the Ginninderry case (as it had been ruled out early in the project's development — see section 2), these estimates are still relevant to the proposed transmission line relocation because one of the key benefits of undergrounding is the potential visual amenity benefits. This is discussed further below table B.8.

B.8 Studies on landscape impacts — summary

Study	Details	Key findings
NERA and explain 2019	▪ General approach: Stated preference survey ▪ Payment vehicle: electricity bills ▪ Country: UK ▪ Measured consumer willingness to pay for undergrounding (general)	Consumers WTP: ▪ £6.87 per year for 20 miles of additional undergrounding of OHTL in National Parks, AONB and NSAs ▪ £6.46 per year for 20 miles of additional undergrounding of OHTL in other areas.
Navrud, S. Ready, R.C. Magnussen, K. and Bergland, O. (2008)	▪ Country: Norway ▪ General approach: Contingent valuation ▪ CV scenario constructed to value visual intrusion only ▪ Impact of undergrounding cable on the urban environment (therefore less relevant to the Ginninderry case). ▪ Specific scenario: 5 km total line length	Mean WTP: ▪ NOK485 (Norwegian Krone) per HH per year for zone 2 (200m to 1Km) ▪ NOK 1660 per HH per year for zone 1 (<200m)
Garrod and Willis (1998)	▪ Country: UK ▪ Measured extent to which public service networks have adverse visual impacts, with a focus on canal users. ▪ General approach: Contingent rank study based on a survey of ~1000 canal users.	Canal users WTP to avoid encountering public infrastructure crossing canal estimated at: ▪ 9p to avoid a 1% reduction in electricity pylons ▪ 10p to avoid a 1% reduction in other cable crossings ▪ 5p to avoid pipeline crossings.
Tempesta, Vecchiato and Girardi (2014)	▪ Country: Italy ▪ Discrete choice experiment ▪ Estimates the WTP to eliminate the landscape impact of high voltage overhead transmission lines.	Average household WTP: ▪ €0.045 per household per year per km to remove transmission lines from mountain and hill areas within natural parks ▪ €0.0352 per household per year per km to remove transmission lines from mountain and hill rural areas outside of natural parks ▪ €0.028 per household per year per km to remove transmission lines from plain and coast areas in natural parks ▪ €0.0355 per household per year per km to remove transmission lines from plain and coast rural areas outside natural parks

Source: NERA Economic Consulting and explain market research, 2019, *Estimating Electricity and Gas Transmission Consumers' Willingness to Pay for Changes in Service during RII0*2, Prepared for National Grid Gas Transmission, SP Transmission and Scottish Hydro Electricity Transmission; Tempesta, T. Vecchiato, D. and Girardi, P. 2014, The landscape benefits of the burial of high voltage power lines: A study in rural areas of Italy, *Landscape and Urban Planning* 126, pp. 53-64; Navrud, S. Ready, R.C. Magnussen, K. and Bergland, O. Valuing the social benefits of avoiding landscape destruction from overhead power transmission lines — Do cables pass the benefit-cost test? Paper submitted to the 2nd Workshop on Landscape Economics, June 14-16th; Garrod, G. and Willis, K. 1998, Using Contingent Ranking to Estimate the Loss of Amenity Value for Inland Waterways from Public Service Utility Service Structures, Research note, *Environmental and Resource Economics* 12.

Benefit transfer using estimates from the literature

Based on the studies reviewed above, there are essentially two approaches used in the literature to value the impacts of transmission lines on the landscape that could be used as the basis for benefit transfer to the transmission line relocation:

- Community willingness to pay based on transmission line length — studies that used this approach include:
  - the study by NERA and explain (2019) for various UK transmission network service providers
  - Tempesta, Vecchiata and Girardi (2014)
- Users' willingness to pay to reduce the visual impacts of network infrastructure visible from recreation areas — the main study of this type is Garrod and Willis (1995).

Estimates of the potential amenity impacts of the proposed transmission line relocation based on the above literature are set out below.

Willingness to pay estimates based on transmission line length

One approach used in the literature to estimate the amenity impacts of HVOTLs has been to estimate the WTP to avoid the visual amenity impacts on the landscape of transmission lines (through undergrounding) per kilometre (or mile). There are two main relevant studies:

- In a study for four British transmission operators, NERA and explain (2019) estimated electricity customers' WTP for a range of attributes. Of most relevant to the transmission line relocation, NERA and explain (2019) found households would be WTP:[36]
  - £6.87 per household per year for 20 miles of additional undergrounding of HVOTLs in national parks, areas of outstanding natural beauty (AONBs) and national scenic areas (NSAs). This is equivalent to around A$14.10 in 2023 Australian dollar terms[37] (or A$0.437 per kilometre)
  - £6.46 per household per year for 20 miles of additional undergrounding of HVOTL in other areas (i.e. areas that are not national parks, AONBs or NSAs). This is equivalent to A$13.20 in 2023 Australian dollar terms (or A$0.411 per kilometre).

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[36] NERA Economic Consulting and explain market research, 2019, *Estimating Electricity and Gas Transmission Consumers' Willingness to Pay for Changes in Service during RII02*, Prepared for National Grid Gas Transmission, SP Transmission and Scottish Hydro Electricity Transmission, p. v.

[37] Converted to Australian dollars using the average exchange rate since 2010 (A$1.75 per pound) and inflated to 2023 dollars using the national CPI.

- Tempesta, Vecchiato and Girardi (2014) also used a stated preference survey (choice experiment) to estimate Italian households' WTP to remove the landscape impacts of transmission lines.[38] They found households are WTP:
  - €0.045 per household per year per km to remove transmission lines from mountain and hill areas within natural parks
  - €0.0352 per household per year per km to remove transmission lines from mountain and hill rural areas outside of natural parks
  - €0.028 per household per year per km to remove transmission lines from plain and coast areas in natural parks
  - €0.0355 per household per year per km to remove transmission lines from plain and coast rural areas outside natural parks.

These estimates are converted to a consistent WTP per household per year per km and then converted to an estimated communitywide WTP as follows (see table B.9).

- The community (or population) over which a household-level WTP estimate is aggregated can have a significant impact on the community's estimated WTP for non-market goods and services. We aggregate the household-level estimates across 278 233 households as follows:
  - As it is mostly ACT residents that use (or will use) the relevant recreational areas (a minority of visitors are expected to come from further interstate and overseas, who might be shown these sites by local friends and family),[39] the main population that would be WTP for improved visual amentiy in these areas are ACT households. According to the 2021 Census, there were 187 147 households in the ACT.
  - Some households in the surrounding areas of NSW may also visit the affected areas and therefore may also be WTP for improved visual amenity (even if they do not actually visit the area). To reflect this, we also include the 91 076 households in the 'capital region' (SA4 region) of NSW (based on the 2021 Census).
- These annual community level estimates are then converted to a present value estimate over the life of the infrastructure (assumed to be 50 years), using a discount rate of 7 per cent, consistent with the ACT's economic appraisal guidelines.

The community WTP per km of transmission line estimates vary significantly (reflecting the variation in the underlying WTP estimates), ranging between around **$216 000** per km and **$1.80 million** per km.

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[38] Tempesta, T. Vecchiato, D. and Girardi, P. 2014, The landscape benefits of the burial of high voltage power lines: A study in rural areas of Italy, *Landscape and Urban Planning* 126, pp. 53-64.

[39] Alluvium, 2020, *Western Edge Investigation Area — Water Values and Environmental Hydrology Assessment*, Technical report prepared for the ACT Government (EPSDD), Canberra, p. 53.

B.9 Community willingness to pay per Km of transmission line

	WTP per household per Km per year[a]	Community WTP per Km per year[b]	Community WTP per Km over life of infrastructure (50 years) [c]
	$A (2023)	$A (2023)	$A (2023)
NERA and explain (2019): National parks, AONBs and NSAs	0.437	121 681	1 796 844
NERA and explain (2019): Other areas	0.411	114 419	1 689 609
Tempesta, Vecchiato and Girardi (2014): Mountains - in nature parks	0.085	23 523	347 355
Tempesta, Vecchiato and Girardi (2014): Mountains - outside nature parks	0.066	18 400	271 709
Tempesta, Vecchiato and Girardi (2014): Plains and coast - in nature parks	0.053	14 636	216 132
Tempesta, Vecchiato and Girardi (2014): Plains and coast - outside nature parks	0.067	18 557	274 024

[a] Converted to Australian dollars using the average exchange rate since 2010 (GBP/AUD 1.75; and EUR/AUD 1.48); estimates are then inflated to 2023 dollars using the Australian National CPI. [b] Aggregated across 278 223 households, including: 187 147 households in the ACT; and 91 076 households in the 'Capital region' of NSW (SA4 region), based on the 2021 Census. [c] Presented in present value terms of the life of the new infrastructure (assumed to be 50 years), using a discount rate of 7 per cent

Source: CIE estimates based on: NERA Economic Consulting and explain market research, 2019, *Estimating Electricity and Gas Transmission Consumers' Willingness to Pay for Changes in Service during RII02*, Prepared for National Grid Gas Transmission, SP Transmission and Scottish Hydro Electricity Transmission, p. v; and Tempesta, T. Vecchiato, D. and Girardi, P. 2014, The landscape benefits of the burial of high voltage power lines: A study in rural areas of Italy, *Landscape and Urban Planning* 126, pp. 53-64.

Applying these estimates to the proposed new transmission lines (12.4 km) and the removal of existing transmission lines (14.7 km) implies a net landscape amenity benefit, reflecting the net reduction in the length of transmission line. The estimated net benefit ranges between **$0.46 million** and **$3.85 million** in present value terms over 50 years, using a discount rate of 7 per cent (table B.10).

B.10 Estimated net landscape amenity benefits

	Community WTP per Km over life of infrastructure (50 years)[a]	Community WTP to avoid proposed new infrastructure (12.4 Km)[b]	Community WTP to remove existing infrastructure (14.7 Km)[c]	Net benefit of proposed relocation[d]
	$	$	$	$
NERA and explain (2019): National parks, AONBs and NSAs	1 796 844	-20.77	24.62	3.85
NERA and explain (2019): Other areas	1 689 609	-19.53	23.16	3.62
Tempesta, Vecchiato and Girardi (2014): Mountains - in nature parks	347 355	-4.02	4.76	0.74
Tempesta, Vecchiato and Girardi (2014): Mountains - outside nature parks	271 709	-3.14	3.72	0.58
Tempesta, Vecchiato and Girardi (2014): Plains and coast - in nature parks	216 132	-2.50	2.96	0.46
Tempesta, Vecchiato and Girardi (2014): Plains and coast - outside nature parks	274 024	-3.17	3.76	0.59

[a] See table B.9 above. [b] Community WTP per km multiplied by 12.4 km of new transmission line. Costs are assumed to commence in 2026, but are discounted back to 2025 for consistency with other costs and benefits. [c] Community WTP per km multiplied by 14.7 km of existing transmission line to be removed. Benefits are assumed to commence in 2026, but are discounted back to 2025 for consistency with other costs and benefits. [d] Community WTP to remove existing infrastructure, less: Community WTP to avoid new infrastructure.

Source: CIE estimates.

On balance, the NERA and explain study is considered the most relevant to the Ginninderry case (implying a net benefit of between $3.62 million and $3.85 million).

- The NERA and explain study is designed to directly measure the visual amenity impact of transmission lines to inform actual choices and has been designed to be sufficiently generic to be transferable to other cases.
- The study is relatively recent (2019) and uses a robust methodology.

However, basing the visual amenity impacts entirely on a comparison of the length of infrastructure added vs removed does not take into account:

- the quality of the specific landscapes
- the number of people likely to experience the view of the landscape.

That said, we note that the NERA and explain (2019) survey suggests that community preference to underground transmission lines in 'other areas' (i.e. areas that are not national parks, AONBs or NSAs), is only slightly less (A$0.411 per household per kilometre) than in areas with high visual amenity (A$0.437 per household per kilometre in national parks, AONBs and NSAs).

There would still be a net benefit of around **$2.56 million**, even if: the higher unit value (A$0.437 per household per kilometre) were applied to the new infrastructure; and the lower unit value (A$0.411 per household per kilometre) were applied to the removal of existing infrastructure.

Willingness to pay of direct users of recreation areas

Garrod and Willis (1998) estimated the extent to which public service networks create adverse visual impacts, with a focus on canal users (in the UK) using a contingent rank study. This study has some relevance to the visual amenity impacts around the Uriarra recreation area on the grounds that it measures the amenity impact of electrical infrastructure in the context of outdoor recreation sites.

- Garrod and Willis (1998) estimated that canal users are willing to pay around **£0.09** (i.e. 9 pence) per household per year (in 1995 terms) to reduce the number of electricity crossings by 1 per cent.[40]
- This is equivalent to around **A$0.3266** per year (i.e. 32.66 cents) in 2023 Australian dollar terms where:
  - the estimate is converted to Australian dollars using the average exchange rate since 2010 (A$1.75 to the pound)

40 Garrod, G. and Willis, K. 1998, Using Contingent Ranking to Estimate the Loss of Amenity Value for Inland Waterways from Public Service Utility Service Structures, Research note, *Environmental and Resource Economics* 12, p. 245.

- the estimate from 1995 is then inflated to 2023 dollars using the Australian national CPI.

A key issue with transferring the benefits from this study is that the way the WTP estimates have been framed may be less relevant to the visual impacts of the transmission line relocation in the Ginninderry context.

Framing the WTP estimates as a reduction in the percentage of electricity crossings makes sense in the context of canal users, as they will generally move along the canal and periodically encounter electricity (and other) infrastructure.

However, this makes less sense for users of recreation areas relevant to this project — such as picnic areas — where many users will have a static view of the infrastructure (although some will use the walking tracks in the area). In this regard, it would be reasonable to consider removing a static view of the infrastructure would be equivalent of reducing the electricity infrastructure by 100 per cent (i.e. removing it altogether).

Garrod and Willis (1998) note that their model is less useful for estimating WTP for non-marginal reductions in the number of service structure because it is based on a linear functional form that implies a constant marginal WTP for the removal of service structures. They argue that declining marginal WTP would be more realistic and assume a constant declining marginal WTP when aggregating up the household estimates to a communitywide estimate of the value of removing all service structures.[41]

Following this approach implies a WTP of around **$16.33** per household per year for avoiding the visual impacts of the proposed infrastructure for the recreation areas (i.e. the recreation areas around Uriarra crossing). This could equally be applied as an indicator of the amenity improvements for removing existing infrastructure visible from recreation areas (i.e. the Biodiversity Conservation Corridor and the proposed Riverside Park).

Furthermore, when aggregating up from their household-level estimate to the national level, Garrod and Willis (1998) aggregated across canal users only (i.e. direct users of the recreation areas), in contrast to the approach set out above (which applies the WTP across all households within the defined community).

- The number of users of the picnic areas around Uriarra crossing is estimated at around **271 300** per year based on the following.
  - Information provided to Riverview by ACT Parks and Conservation Service (PCS) indicates there are around 221 300 users of the Uriarra East recreation area (based on a 2011 estimate).
  - The number of users of the Uriarra West recreation area is not known. However, it is likely to be significantly lower than Uriarra East based on the relative volume and quality of the facilities provided (including car parks, toilets and picnic tables). Riverview suggests there could be around 50 000 users per year, which is broadly consistent with the number of users of Cotter Bend and Casuarina Sands recreation areas (based on estimates provided by PCS).

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41 Garrod, G. and Willis, K. 1998, Using Contingent Ranking to Estimate the Loss of Amenity Value for Inland Waterways from Public Service Utility Service Structures, Research note, *Environmental and Resource Economics* 12, p. 246.

- Riverview estimate that there will be around 120 000 users per year of: the Conservation Corridor (30 000 users per year); and the proposed Riverside Park (90 000 users per year).
- As the WTP estimates are at the household level, we divide these estimates of the number of visitors by the average number of people per household in the ACT (around 2.5 people per household). This implies:
  - around **108 520** households would be WTP to avoid the new infrastructure near Uriarra crossing (i.e. would incur a cost from the proposed relocation).
  - around **48 000** households would be WTP to remove the existing infrastructure around the Conservation Corridor and the Riverside Park (i.e. would benefit from the proposed relocation).

Using this approach, the relocation would reduce visual amenity by around **$0.99 million** per year (in net terms), or around **$13.61 million** in present value terms over the life of the infrastructure (assumed 50 years), using a discount rate of 7 per cent (table B.11).[42]

The net cost using this approach reflects the difference in the (estimated) number of users across the sites. In particular, the site negatively affected by the new infrastructure (the area around Uriarra crossing) receives more visitors per year than estimates for the sites that will be positively affected by the removal of existing infrastructure (the Conservation Corridor the proposed Riverside Park), although the changes in visual amenity across the two sites could encourage some switching (i.e. from the Uriarra recreation areas to the proposed new Riverside Park).

B.11 Estimated net impact on landscape

	Visitors to relevant sites	Number of households [c]	Annual WTP [d]	Present value over life of infrastructure [e]
	No.	No.	$'000	$ million
New infrastructure	271 300[a]	108 520	- 1 772	- 24.40
Old infrastructure	120 000[b]	48 000	784	10.79
Net impact			**-988**	**- 13.61**

[a] Assumes: 221 300 users of the Uriarra East recreation area (based on estimates provided by PCS to Riverview from 2011); and around 50 000 users of Uriarra West recreation area (which is broadly consistent with usage estimates for Cotter Bend and Casuarina Sands recreation areas). [b] Estimates provided by Riverview. [c] Total visitors divided the average number of people per household in the ACT (2.5) as reported in the 2021 Census. [d] Number of households multiplied by $16.33 per household, based on Garrod and Willis (1998). [e] In present value terms over 50 years, using a discount rate of 7 per cent. Costs are assumed to commence in 2026, but are discounted back to 2025 for consistency with other costs and benefits.

Source: CIE estimates.

A key advantage of this approach is that it captures differences in the number of users across the different sites affected, unlike the approach set out above.

42 Note that these annual benefits are assumed to commence in 2026, but are discounted back to 2025 for consistency with other costs and benefits.

On the other hand, this approach has several disadvantages (compared with the alternative approach set out above).

- The validity of the benefit transfer approach is critically dependent on the relevance of the source study to transfer case. Although there are some similarities (in particular, the source study is attempting to measure disutility from electrical and other infrastructure in recreational areas), the context is sufficiently different to be cautious about the validity of the benefit transfer. Most obviously, the focus on canal users (in the UK) in the source study is not directly related to the recreation areas affected by the proposed relocation.
- Furthermore, the source study is now around 25 years old and uses a less robust methodology than the studies referred to above.

C Biodiversity benefits and costs

The proposed relocation will lead to biodiversity benefits and costs through:

- a decrease in the number of towers, length of transmission line and area affected by the transmission line easements, with a significant proportion of these benefits on land with relatively high conservation value, and
- additional funds paid to the Ginninderry Conservation Trust to manage the Ginninderry Conservation Corridor (GCC).

Each of these are discussed below.

In addition, an allowance of $300 000 to offset impacts on biodiversity values associated with the relocation works (although it is not clear that these offsets would be required. The need for biodiversity offsets will be confirmed as the EIS and DA processes proceed).

Biodiversity benefits and costs from physical relocation

Chart C.2 shows the proposed change in transmission lines and poles. Overall, the proposed relocation will:

- reduce the length of transmission line by 2.3 km
- reduce the area affected by the transmission line easements by around 25.9 ha
- reduce the number of transmission towers (including poles) by 9 (see Table C.1).

The biodiversity benefits will depend on the relative environmental value of the additional land released from easements. In that regard, a disproportionate share of these net improvements occur on land which will be managed for conservation purposes by the Ginninderry Conservation Trust and therefore have higher environmental values than other land the transmission lines pass through (such as farmland). In particular:

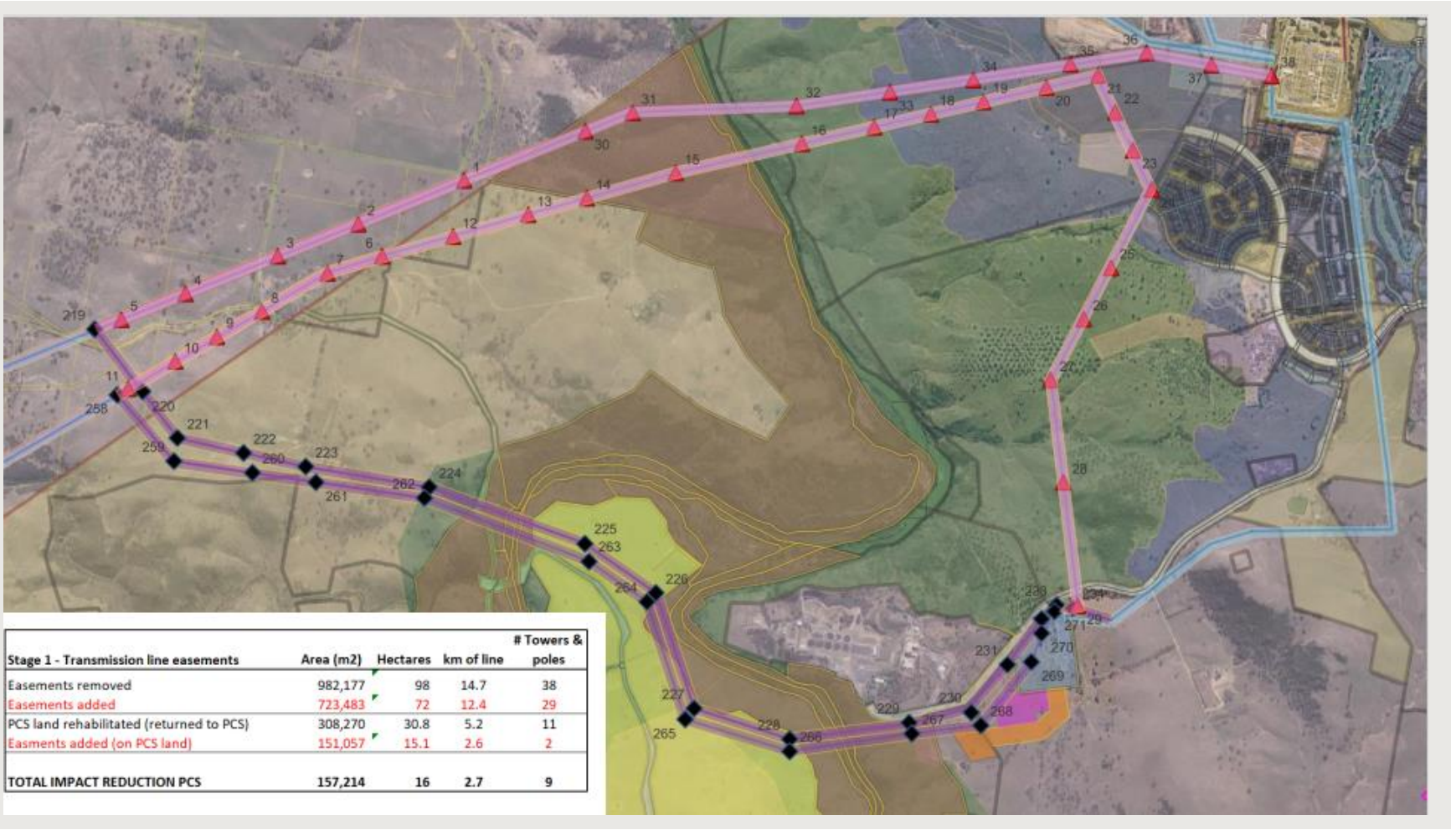
- 15.7 ha of the total reduction in the area covered by transmission line easements (61 per cent of the total) is on land managed for conservation (Table C.1)
- In total there is a net reduction of nine transmission towers. This net reduction occurs on conservation land (i.e. 11 transmission towers would be removed from conservation land and only 2 would be added).

C.1 Net environmental benefits & impacts

	Conservation Land			Total		
Area impacted by transmission lines	**Area**	**Line length**	**Transmission towers**	**Area**	**Line length**	**Transmission towers**
	Ha	Km	No.	Ha	Km	No.
Removed	- 30.8	- 5.2	- 11	- 98.2	- 14.7	- 38
Added	15.1	2.6	2	72.4	12.4	29
Change in impacted area	**- 15.7**	**- 2.6**	**-9**	**- 25.9**	**- 2.3**	**- 9**

Source: Ginninderry Joint Venture.

C.2 Change in transmission line easements



Stage 1 - Transmission line easements	Area (m2)	Hectares	km of line	# Towers & poles
Easements removed	982,177	98	14.7	38
Easements added	723,483	72	12.4	29
PCS land rehabilitated (returned to PCS)	308,270	30.8	5.2	11
Easments added (on PCS land)	151,057	15.1	2.6	2
TOTAL IMPACT REDUCTION PCS	**157,214**	**16**	**2.7**	**9**

[a] *Green area is the Ginninderry Conservation Corridor.*

Data source: Ginninderry Joint Venture.

Additional conservation outcomes in the Ginninderry Conservation Corridor

The Ginninderry Conservation Corridor (GCC) will increase the conservation of the existing land. The primary purpose of the GCC is to protect Matters of National Environmental Significance (MNES) values present within the project area. The corridor will also improve habitat connectivity values across the landscape for mobile woodland and riparian species.

As part of the approval, the Joint Venture will contribute 1 per cent of sales revenue to the Conservation Corridor Management Trust (the Trust). As a result of the proposed relocation of the transmission lines, the focus of this analysis, an additional $1.87 million will be paid into the CCMT. This is in addition to contributions made for the broader development project.

The Trust will spend funds on management activities to achieve the conservation, recreational, social and cultural values outlined above. Management activities in the conservation corridor will consist of:

- activities to protect and restore biodiversity and ecosystem functions and ecological connectivity across the regional landscape to the Murrumbidgee River Corridor and other reserves
- activities to manage the urban edge to protect both the values of the reserve and the amenity, health, and safety of the urban community
- provide quality recreation experiences for the enjoyment of visitors and local residents
- encourage active learning and engagement in management by the community, organisations, the local Aboriginal community, and research and educational institutions
- weed and pest control
- bushfire fuel management
- cultural heritage management, and
- an adaptive management framework will be applied to monitor, research and review the management plan.[43]

The GCC will eventually comprise a total area of 580 hectares – 360 hectares in ACT and 220 hectares in NSW.[44] The GCC currently supports the critically endangered ecological community, the 'Natural Temperate Grassland of the Southern Tablelands' (NTG-SEH). The NTG-SEH also provides habitat for the Pink Tailed Worm Lizard (PTWL). Chart C.3 includes four maps of current extent and condition for:

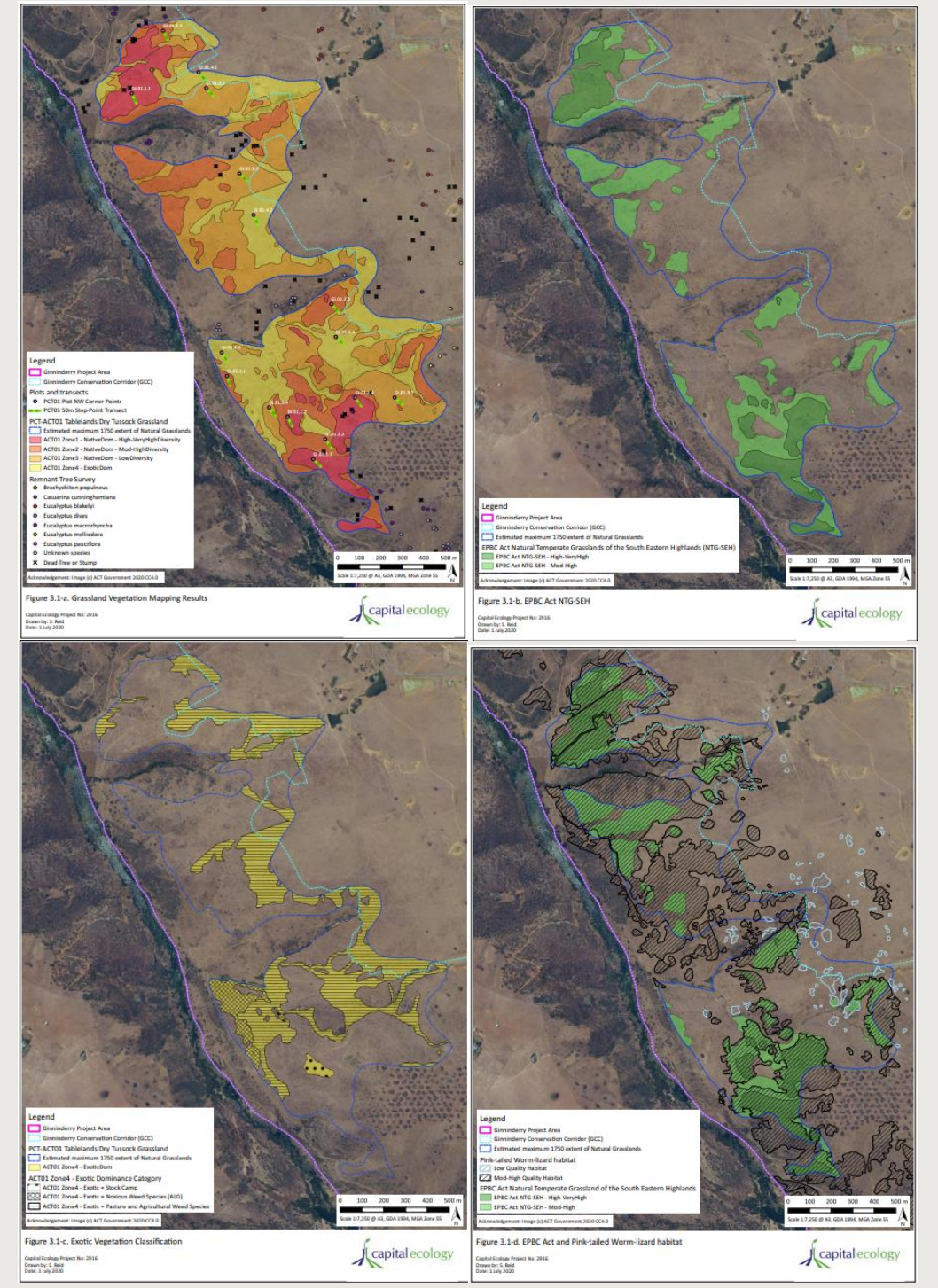
- extent and condition of grassland vegetation for PCT 'ACT01 Tablelands Dry Tussock Grassland' (top left and bottom left images)

43 https://ginninderry.com/wp-content/uploads/2021/08/TRC.-2014a-Conservation-area-management-options.pdf

44 Interim Management Plan – Ginninderry Conservation Corridor – June 2018

- extent and condition of EPBC Act Natural Temperate Grasslands of the South Eastern Highlands (NTG-SEH) (top right image)
- extent and condition of Pink-Tailed Worm Lizard (PTWL) habitat.

C.3 Extent and condition of grassland vegetation in GCC



Data source: Capital ecology, 2020, The Extent and Condition of Natural Temperate Grassland of the South Eastern Highlands in the Ginninderry Project Area.

The Ginninderry Conservation Corridor 2018-23 Management Plan notes that the corridor will be established in stages. Indicative stages for the development of the Corridor are:

- Stage 1 (years 1-5) — initial development of the Corridor and its opening to the public (2020) in the south-eastern ACT portion
- Stages 2a, 2b and 2c (years 5 to 10) — extension of Corridor development and public access will extend to and across the ACT/NSW border and into the north.
- Stages 3 to 6 (years 10 to 20) — gradual development of the Corridor along the Murrumbidgee River and Ginninderra Creek. [45]

Creation of the conservation corridor will provide:

- biodiversity protection and enhancement, including conservation of critically endangered communities and species
- provision of recreational facilities, and
- urban amenity for the community.

Key conservation outcomes are outlined in box C.4.

45 Ginninderry, 2018, *Ginninderry Conservation Corridor 2018-2023: Management Plan,* https://ginninderry.com/wp-content/uploads/2021/08/ginninderry-conservation-corridor-management-plan.pdf

C.4 Conservation outcomes of the Ginninderry Conservation Corridor

Conservation outcomes sought include:

- Protection of Matters of National Environmental Significance
- A conservation area that include 100 per cent of identified box gum woodland (70.7 hectares to be protected)
- Preservation and enhancement of woodland habitats
- Establishment of a land management governance regime
- Maintenance and enhancement of connectivity between Box Gum Woodland habitat areas, with no appreciable long-term net reduction in total Box Gum Woodland habitat areas
- Protect habitat from domestic predators
- Ongoing monitoring of impacts on habitat
- A conservation area that includes 90 per cent of identified Pink-tailed Worm Lizard (PTWL) habitat (144.7 hectares to ultimately be protected)
- Preservation and enhancement of PTWL habitats
- Establishment of aa land management governance regime
- Maintenance and enhancement of connectivity between PTWL habitat areas, with no appreciable long-term net reduction in PTWL habitat areas
- Pink Tailed Worm Lizards are protected from domestic predators
- Ongoing monitoring of impacts on PTWL habitat
- Establishment of a process of independent third party review[46]

Benefit of additional contribution to the Ginninderry Conservation Corridor

The additional funds paid into the Trust will be used to improve conservation outcomes in the Ginninderry Conservation Corridor. Benefits of this additional funding are dependent on the management actions undertaken by the Trust and the resulting conservation outcomes, both of which are uncertain at this stage.

The management costs and biodiversity outcomes achieved through Biodiversity Stewardship Agreements (BSAs)[47] under the NSW Biodiversity Offsets Scheme (BOS)[48] can be used as proxies to estimate potential biodiversity outcomes of the additional funding into the Trust.

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46 Ginninderry, 2018, *Ginninderry Conservation Corridor 2018-2023: Management Plan,* https://ginninderry.com/wp-content/uploads/2021/08/ginninderry-conservation-corridor-management-plan.pdf

47 Biodiversity Stewardship Agreements (BSAs) are voluntary agreements between the NSW Biodiversity Conservation Trust (BCT) and private landholders to permanently protect and manage an area of land to improve its biodiversity values.

48 BSAs established through the NSW Biodiversity Offsets Scheme.

Landholders establishing a BSA determine the cost to manage the site into perpetuity, which determines the total fund deposit payable per hectare. The following publicly available information on total fund deposits related to BSAs is available:

- Table C.5 summaries the average total fund deposit and typical range per hectare for existing BSA sites. These estimates have been compiled from 255 existing BSA sites established between 2010 and 2023.
  - There is a large range in TFD per hectare by size of BSA. In Non Sydney, the average TFD is $47 100 per hectare for a BSA less than 30 hectares, decreasing to $2 700 per hectare for a BSA greater than 500 hectares.
- Table C.6 summaries the average cost per hectare of land under a BSA for Greater Sydney, Non Sydney and the Southern Eastern Highlands IBRA region (which contains the Project area and Ginninderry Conservation Corridor).
  - There is a large range depending on the location of the BSA, from an average cost of $31 836 per hectare in Greater Sydney to $5 881 per hectare in the Southern Eastern Highlands IBRA region.

C.5 Average total fund deposit per hectare and typical range for existing BSA sites

Geographic Region		Size of biodiversity stewardship agreement (BSA)					
		<30ha	30-50ha	50-100ha	100-200ha	200-500ha	500+ha
Greater Sydney	Average	$127 000	$82 200	$40 200	$29 300	NA	NA
	Typical range	$63-190k	$41-125k	$20-60k	$20-40k		
Non Sydney	Average	$47 100	$21 400	$14 000	$9 700	$5 300	$2 700
	Typical range	$23-70k	$10-32k	$7-21k	$6-13k	$4-7k	$2-4k

Source: NSW Biodiversity Conservation Trust, *Biodiversity Conservation Fund Charge System,* https://www.bct.nsw.gov.au/info/biodiversity-conservation-fund-charge-system

C.6 Estimating the average cost per hectare for different regions

	Greater Sydney	Non Sydney	Southern Eastern Highlands IBRA Region
Number of BSAs	201	548	91
Total cost ($m)	502	1 184	118
Total hectares	15 759	299 876	20 136
Average cost per hectare ($/ha)	**31 836**	**3 948**	**5 881**

Source: NSW Biodiversity Conservation Trust, *Public register of private land conservation agreements,* https://www.bct.nsw.gov.au/public-register-private-land-conservation-agreements

The implied area of additional conservation achieved by the additional funds paid to the Trust is estimated as the additional funds payable to the Trust ($1.87 million) divided by the average management cost per hectare. Table C.7 shows the implied area of conservation for three different estimates of average management cost based on:

- 91 BSAs in the Southern Eastern Highlands IBRA
- BSAs in non-Sydney of land less than 30 hectares
- BSAs in non-Sydney of land greater than 500 hectares

Given the conservation outcomes to be achieved through GCC from the additional funds is highly uncertain, a conservative estimate of conservation area is used. The conservative estimate is 40 hectares, which is based on the average management cost for a BSA site in non-Sydney consisting of less than 30 hectares. It is expected that a higher management cost per hectare will be required to achieve *additional* conservation outcomes in the GCC given there is currently a moderate level of biodiversity already located on the site.

C.7 Implied conservation area for alternative management cost estimates

Average management cost	Value	Implied area of conservation
	$/Hectares	Hectares
Non-Sydney site less than 30 hectares	47 100	40
Southern Eastern Highlands IBRA	5 881	318
Non-Sydney site greater than 500 hectares	2 700	693

Source: NSW Biodiversity Conservation Trust, *Biodiversity Conservation Fund Charge System,* https://www.bct.nsw.gov.au/info/biodiversity-conservation-fund-charge-system and NSW Biodiversity Conservation Trust, *Public register of private land conservation agreements,* https://www.bct.nsw.gov.au/public-register-private-land-conservation-agreements

Approaches to valuing biodiversity

Biodiversity creates value because of the services it provides and non-use value people place on the conservation of biodiversity. Broadly there are two approaches to valuing biodiversity:

- benefit transfer approach — transfers estimated values of biodiversity from previous non-market valuation studies
- replacement cost approach — estimates the value of biodiversity based on the cost of replacing it with a substitute.[49]

Benefit transfer approach

A range of non-market valuation studies of biodiversity and ecosystem services were reviewed for the purpose of identifying parameter values for biodiversity in the NSW Framework for Valuing Green Infrastructure and Public Spaces (FVGIPS). Table C.8 summarises key non-market valuation studies which value native vegetation and Endangered Ecological Communities (EECs).

- The FVGIPS recommends parameter values for terrestrial biodiversity based on the values from MacDonald and Morrison (2010) for scrubland, grassy woodland and wetlands. However it is noted these values may not be directly applicable to the higher value and endangered flora and fauna being conserved in the GCC.
- The present values per household per hectare from MacDonald and Morrison (2010) (ranging between $0.004 and $0.008) are of a similar magnitude to the present value

49 NSW Department of Planning and Environment, 2023, *Framework for Valuing Green Infrastructure and Public Spaces: Technical appendices for recommended approaches.*

per household per hectare estimated in Hatton et al. (2011) ($0.008) and Mazur and Bennett (2009) ($0.003).

- The values by Gillespie Economics (2009b) are presented here as they applied to Endangered Ecological Communities (EECs) which are relevant to the endangered flora and fauna being conserved in the Ginninderry Conservation Corridor. The values estimated by Gillespie Economics (2009a) and (2009b) are between 25 and 100 times the values from the other studies listed. It is noted in the VGIPS that caution should be taken if applying the values from the Gillespie Economics (2009b) in other CBAs limited because the attribute valued was unique and iconic, and the study was conducted for the specific context of mining.

C.8 Non-market valuation studies valuing native vegetation and EECs

Study	Attribute valued	Original WTP value ($ per household per unit)	WTP value in 2023 dollars ($ per household per unit)	Payment frequency	Present value ($2023 per household per ha)
Native vegetation					
Hatton MacDonald et. al. (2011)	Healthy vegetation (ha)	0.0008	0.0011	Annual payment per household for 10 years	0.008
Mazur and Bennett (2009)	Native vegetation in good condition (ha)	0.0006	0.0009	Annual payment per household for 5 years	0.003
Gillespie Economics (2009a)	Native vegetation protected (ha)	0.3	0.43	Once-off payment	0.43
Hatton MacDonald and Morrison (2010)	Scrubland (per 1,000 ha)	0.72	0.99	Annual payment per household for 5 years	0.004
	Grassy woodland (per 1,000 ha)	1.06	1.46	Annual payment per household for 5 years	0.006
	Wetlands (per 1,000 ha)	1.36	1.86	Annual payment per household for 5 years	0.008
Endangered Ecological Communities (EECs)					
Gillespie Economics (2009b)	Avoid EECs from being cleared (ha)	0.41	0.58	Once-off payment	0.58
	EEC planted in the region (ha)	0.1	0.15	Once-off payment	0.15
	Protect existing EEC in the region (ha)	0.28	0.39	Once-off payment	0.39

Source: NSW Department of Planning and Environment, 2023, *Framework for Valuing Green Infrastructure and Public Spaces: Technical appendices for recommended approaches. Individual sources are:*

Hatton MacDonald, D., Morrison, M., Rose, J., and Boyle, K., 2011, Valuing a multistate river: the case of the River Murray, The Australian Journal of Agricultural and Resources Economics, 55, pp. 374 – 392

Mazur and Bennett 2009, Location differences in communities' preferences for environmental improvements in selected NSW catchments: A Choice Modelling approach

Gillespie Economics 2009a, Bulli Seam Operations Socio-Economic Assessment, prepared for Illawarra Coal Holdings.

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The household willingness-to-pay (WTP) values from the non-market studies are applied to the households in the project catchment. The FVGIPS recommends WTP values are applied to 50 per cent of the households in the project catchment.[50]

For this Project, the project catchment could be defined in numerous ways, including:

- households in ACT — approximately 175 000 households
- households in ACT and NSW — approximately 3 175 000 household
- households in ACT and Capital Region SA4 — approximately 260 000 households (see table C.9).[51]

In simple terms, the larger the number of households the WTP value is applied to, the larger the total value of the asset valued.

C.9 Number of households

Region	All households (2021)	50 per cent of households
ACT	168 400	84 200
NSW	3 000 000	1 500 000
Capital Region (SA4)	91 076	45 538

Source: ABS, 2021, *Household and families: Census,* Household and families: Census, 2021 | Australian Bureau of Statistics (abs.gov.au)

The following two WTP values are included in this analysis for the following reasons:

- WTP for grassy woodlands by MacDonald and Morrison (2010) because it is the parameter value recommended in the VGIPS Framework for terrestrial biodiversity
- WTP for EECs by Gillespie Economcis (2009b) because it values higher conservation outcomes, which aligns to the conservation outcomes expected to be achieved by the Project on the conservation land and within the Ginninderry Conservation Corridor.

There is a substantial range in the present value per hectare of biodiversity using the grassy woodlands WTP value from MacDonald and Morrison (2010) and the WTP for EECs from Gillespie Economics (2009b) for alternative project catchments (table C.10).

C.10 Value per hectare of biodiversity for alternative project catchments

Asset type	Study	ACT	ACT plus Capital Region SA4
		PV$	PV$
Grassy woodlands	MacDonald and Morrison (2010)	769	1 185
Endangered Ecological Communities	Gillespie Economics (2009b)	12 270	18 905

Note: Applying 7 per cent discount rate.

Source: CIE using sourced discussed above.

50 Aggregation factor of 50 per cent is based on response rates for non-market valuation studies. For further information see page 40 of NSW Department of Planning and Environment, 2023, *Framework for Valuing Green Infrastructure and Public Spaces: Technical appendices for recommended approaches.*

51 Based on 2021 ABS household data

Replacement cost approach

The NSW Biodiversity Credit Scheme (BOS) establishes a credit market to offset unavoidable impacts on biodiversity from development. The credit prices represent a replacement cost for biodiversity. These credit prices for biodiversity are differentiated by Interim Biogeographic Regionalisation for Australia (IBRA) subregion, where data are available. However, the credit prices are not differentiated by species or PCT.

The NSW FVGIPS includes parameter values for biodiversity for the replacement cost approach based on credit prices from historical credit transactions in the NSW BOS.

The Project is located within the Murrumbateman IBRA subregion. The replacement cost parameter value for biodiversity for the Murrumbateman IBRA subregion, based off historical credit price data, is present value of $20 401 per hectare, which is equivalent to an undiscounted annualised value of $1 327 per hectare per year.[52]

Value of biodiversity outcomes from the Project

The two biodiversity outcomes from the Project are:

- a net increase in conservation land from the relocation of transmission lines
- improvement in conservation outcomes in the GCC. There is uncertainty about the conservation outcomes which will be achieved by the additional funds. Two estimates of implied area of conservation are used in the analysis:
  - 40 hectares (lower bound), and
  - 318 hectares (upper bound) (see table C.11C.7).

  The lower bound estimates are used in the central case analysis, and the upper bound estimates are tested in sensitivity analysis.

C.11 Physical change in biodiversity outcomes from the Project

Biodiversity outcome	Lower bound	Upper bound
	Ha	Ha
Net increase in conservation land	16	16
Estimated implied area of additional conservation in GCC	40	318

Source: Ginninderry Joint Venture and CIE estimates.

There is no specific biodiversity value directly applicable to the biodiversity outcomes of this Project. Alternative approaches and values are applied to estimate the range in value of the two biodiversity outcomes of the Project:

- For the benefit transfer approach, two alternative willingness to pay values are applied to 50 per cent of households in the ACT and the Capital Region (SA4):
  - WTP values for grassy woodlands as estimated by MacDonald and Morrison (2010), and recommended by VGIPS for terrestrial biodiversity

52 See Table 5.7 of NSW Department of Planning and Environment, 2023, *Framework for Valuing Green Infrastructure and Public Spaces: Technical appendices for recommended approaches.*

  - WTP values for EECs as estimated by Gillespie Economics (2009b).
- For the replacement cost approach, applying an undiscounted annualised value of $1 536 per hectare per year.[53]

Each of these values are applied as annualised values over 30 years to the lower and upper bound estimated physical change in biodiversity outcomes from the Project (see table C.11). It is assumed the biodiversity impacts of the Project start in 2026.

The total present value of biodiversity outcomes applying the different approaches and values used ranges between:

- $0.07 million to $0.42 million applying a benefit transfer approach using the WTP value for grassy woodlands
- $1.12 million to $6.75 million applying a benefit transfer approach using the WTP value for EECs
- $1.13 million to $6.81 million applying a replacement cost approach using the average credit price from historical trades in the Murrumbateman IBRA subregion (table C.12).

The estimates applying the replacement cost approach are included in the central case analysis for the following reasons:

- the value for grassy woodlands is likely to under-estimate the value of the higher conservation flora and fauna being protected and enhanced by the Project
- there is direct link to the Project's region, being based on historical credit price data for the Murrumbateman IBRA subregion
- similar biodiversity values are estimated when applying the WTP values for EECs and the replacement cost approach.

For the central case analysis, the lower bound estimation of conservation area and the replacement cost approach area used. The total present value of biodiversity outcomes from the Project is estimated to be $1.13 million, comprising:

- $0.32 million (in present value) for value of additional conservation land
- $0.81 million (present value) for value of additional conservation outcomes in the GCC.

C.12 Estimated value of biodiversity outcomes

Approach/value	Present value over 30 years	Value for additional conservation land	Value of additional conservation outcomes in GCC	Total value of biodiversity outcomes
	PV$/ha	PV$m	PV$m	PV$m
Benefit transfer approach – 50 per cent of households in ACT and Capital Region (SA4)				
Value for grassy woodlands	1 268	0.02	0.05 –0.40	0.07 – 0.42
Value for EECs	20 229	0.32	0.80 – 6.43	1.12 - 6.75
Replacement cost approach				
Murrumbateman IBRA subregion	20 401	0.32	0.81 -6.49	1.13 – 6.81

Source: CIE based on sources listed.

53 Annualised value over 30 years based on present value of $20 401 per hectare.

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