Appendix I

Aviation Impact Assessment

FINAL REPORT

WHYTE YARCOWIE
WIND FARM
AERONAUTICAL IMPACT ASSESSMENT

CCP59WF

Report to:

Whyte Yarcowie Wind Farm Pty Ltd
c/o Wind Prospect Pty Ltd
Gertrude Street
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14 November 2024

Chiron Aviation Consultants
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Australia

DOCUMENT RELEASE APPROVAL

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Date: 14 November 2024

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DOCUMENT CONTROL

Version	Description	Date	Author	QA
V0.1	Draft for Comment	23 Apr 2024	IJ	RJJ
V0.2	Editorial, minor turbine relocation	14 Nov 2024	IJ	RJJ

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EXECUTIVE SUMMARY

The proposed Whyte Yarcowie Wind Farm (WYWF) and battery project (the project) is located east and southeast of the Whyte Yarcowie township in the northern Mount Lofty ranges in South Australia within the Regional Council of Goyder. The project site is situated approximately 7 km north of Hallett, 6.5 km south of Terowie and 190 km north of Adelaide. It is located near to the Barrier Highway which provides good access to the project site.

The project will use 83 turbines with a tip height of up to 250m above ground level. The turbine locations have been micro sited (v046) since the original report (v040). The volume of airspace occupied by the WYWF has not changed, therefore the conclusions of the original report remain valid.

The Lowest Safe Altitude over the WYWF is 4,200ft. The published Lowest Safe Altitudes for overlying and nearby air routes and the GRID are 4,500ft or above. The WYWF will not impact any published Lowest Safe Altitudes.

There are no certified aerodromes and four known uncertified aerodromes within 30nm (56km) of the WYWF boundary. The WYWF boundary is beyond 14nm (26km), from these known uncertified aerodromes and will have no impact on their operation. There is a private aeroplane landing area (ALA) that will be impacted by the proposed 275kW overhead transmission line connecting the WYWF to the Battery Energy Storage System (BESS) terminal station at Belalie East.

The WYWF is in Class G airspace and within Danger Areas D258B and D258C. There are existing wind farms in the area, so it is considered that it will have no significant impact on the published use of these Danger Areas.

Airservices Australia advise that the WYWF will not impact any civil airspace, or communications, navigation or surveillance facilities.

Department of Defence advise that the WYWF will not impact any military low flying or communications, navigation or surveillance facilities. Defence advise that the WYWF is in an area that has the potential for containing unexploded ordnance.

1. Introduction

Whyte Yarcowie Wind Farm Pty. Ltd. has requested Chiron Aviation Consultants undertake an Aviation Impact Statement for the proposed Whyte Yarcowie Wind Farm in South Australia.

1.1 Location

The proposed Whyte Yarcowie Wind Farm (WYWF) and battery project (the project) is located east and southeast of the Whyte Yarcowie township in the northern Mount Lofty ranges in South Australia within the Regional Council of Goyder. The project site is situated approximately 7 km north of Hallett, 6.5 km south of Terowie and 190 km north of Adelaide. It is located near to the Barrier Highway which provides good access to the project site.

The project encompasses approximately 9,944 hectares of mostly cleared land, used for livestock farming, and is zoned Rural. The proposed 20km transmission line crosses similar, yet much flatter, country used for both cropping and grazing.

The project site has been selected for its strong wind resource, low proximity of dwellings to the project area and access to the existing grid.

The project is designed with 83 turbines with a nameplate capacity of approximately 560 MW. A 275 kV transmission line of approximately 20km will be required to connect the project to the grid. A Battery Energy Storage System (BESS) will also be included as part of the proposed project and the preferred location is currently being investigated.

The project will include the development of access tracks, underground and overhead electrical cabling, an onsite substation, operations and maintenance facilities and other ancillary infrastructure.

A Renewable Energy Infrastructure Licence will be sought for wind turbines that are up to 250m tall (to blade tip), with a rotor diameter of up to 190m, and minimum tip height of 40m. Hub heights will be approximately 130-155m.

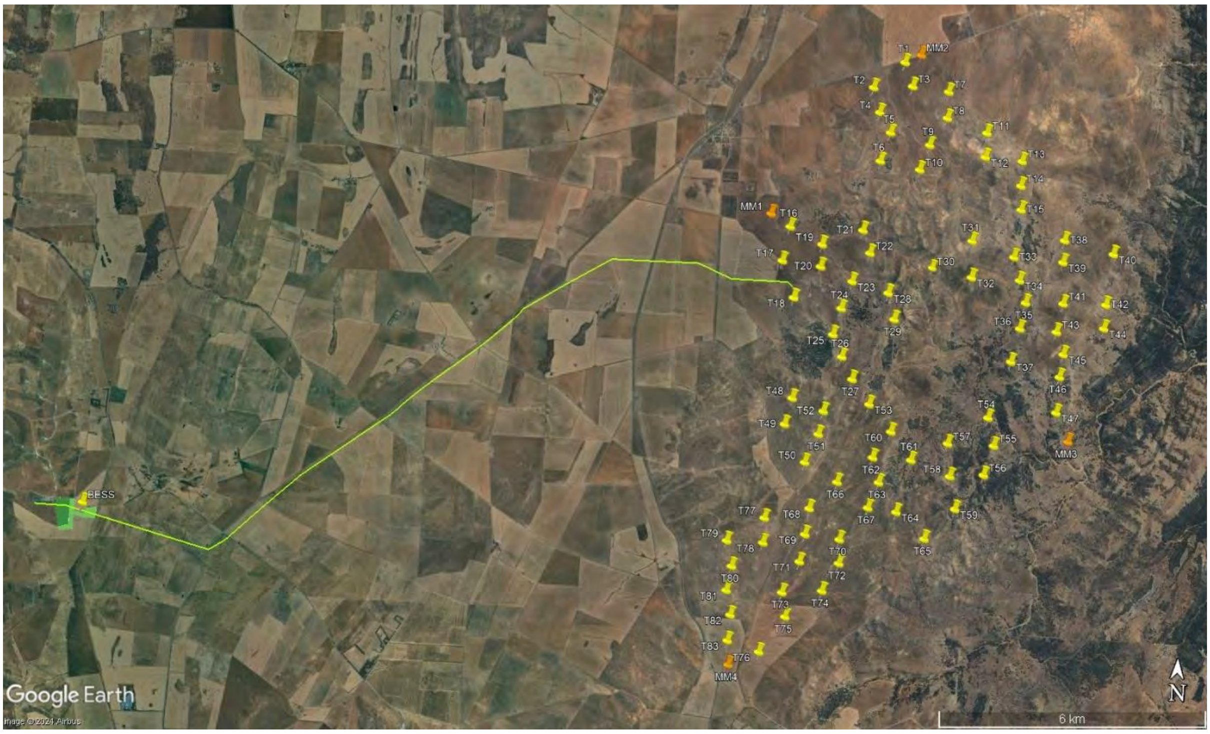

Figure 1 – Whyte Yarcowie Wind Farm Location including OHL (green) and BESS

1.2 Aerodromes and Airstrips

Aerodromes fall into three categories:

- Military or Joint (combined military and civilian)
- Certified and
- Uncertified

A Military aerodrome is operated by the Department of Defence and is suitable for the operation of military aircraft. A Joint User aerodrome is a Military aerodrome used by both military and civilian aircraft, for example Darwin International and Townsville International Airports.

A Certified aerodrome is regulated under Civil Aviation Safety Regulation (CASR) 139.030. An aerodrome with a published instrument flight procedure must be regulated.

An Uncertified aerodrome is any other aerodrome, Aeroplane Landing Area (ALA) or airstrip. These range in capability and size from having a sealed runway with lighting capable of accommodating corporate jet aircraft to a grass paddock that is smooth enough to land a single engine light aircraft or a purpose built aerial agricultural aircraft.

Military, Joint and Certified aerodromes are listed in the Aeronautical Information

Publication[1] (AIP) and are subject to a NOTAM[2] service that provides the aviation industry with current information on the status of the aerodrome facilities. This information is held in the public domain, is available through aeronautical publications and charts and is kept current by mandatory reporting requirements.

Uncertified aerodromes are not required to be listed in the AIP, although many are, so information about them is not necessarily held in the public domain, may not be available through aeronautical publications and charts and is not required to be reported. Where Uncertified aerodrome information is published in the AIP EnRoute Supplement Australia (ERSA)[3] it is clearly annotated that a *full NOTAM service is not available*.

The AIP Designated Airspace Handbook (DAH)[4], at Section 20, lists *Aeroplane Landing Areas (ALA) without an ERSA entry – verified*. This listing of verified ALA indicates that Airservices Australia have a registered responsible person providing verified information about the ALA. These verified ALA are also depicted on AIP Charts.

ALA can come into use and fall out of use without any formal notification to CASA or any other authority. Airstrips that appear on survey maps often no longer exist; others exist but do not feature on maps. Similarly, a grass paddock used as an ALA is not usually discernable on satellite mapping services such as Google Earth.

Military, Joint and Certified aerodromes usually have Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation Services ï Aircraft Operations (PANS-OPS) surfaces prescribed to protect the airspace associated with published instrument approach and landing procedures. An uncertified aerodrome cannot have a published instrument approach and landing procedure so does not have associated PANS-OPS protected airspace. An uncertified aerodrome is not regulated by CASR Part 139 and therefore is not protected by an OLS. All operations into uncertified aerodromes, therefore, must be conducted in accordance with the Visual Flight Rules (VFR) and in Visual Meteorological Conditions (VMC).

1.3 Aerodromes in the Area

There are no certified aerodromes within 30nm (56km) of the WYWF boundary.

There are four known uncertified aerodromes within 30nm (56km) of the WYWF boundary. These are Peterborough (YPTB), Jamestown (YJST), Clare Valley (YCVA) and Orroroo (YORR).

There is a private Aeroplane Landing Area near the intersection of Booborowie and Mitchells Road. This ALA is close to the overhead transmission line (OHL) easement from the WYWF to the Battery Energy Storage System (BESS) at Belalie East.

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[1] AIP; a mandatory worldwide distribution system for the promulgation of aviation rules, procedures, and information

[2] NOTAM (Notice to Airmen); a mandatory reporting service to keep aerodrome and airways information current and available to the aviation industry worldwide

[3] ERSA, part of the AIP that lists aerodrome information in accordance with standards and legislative requirements to ensure integrity.

[4] DAH, part of the AIP that lists the pertinent details of Australian airspace and aerodromes

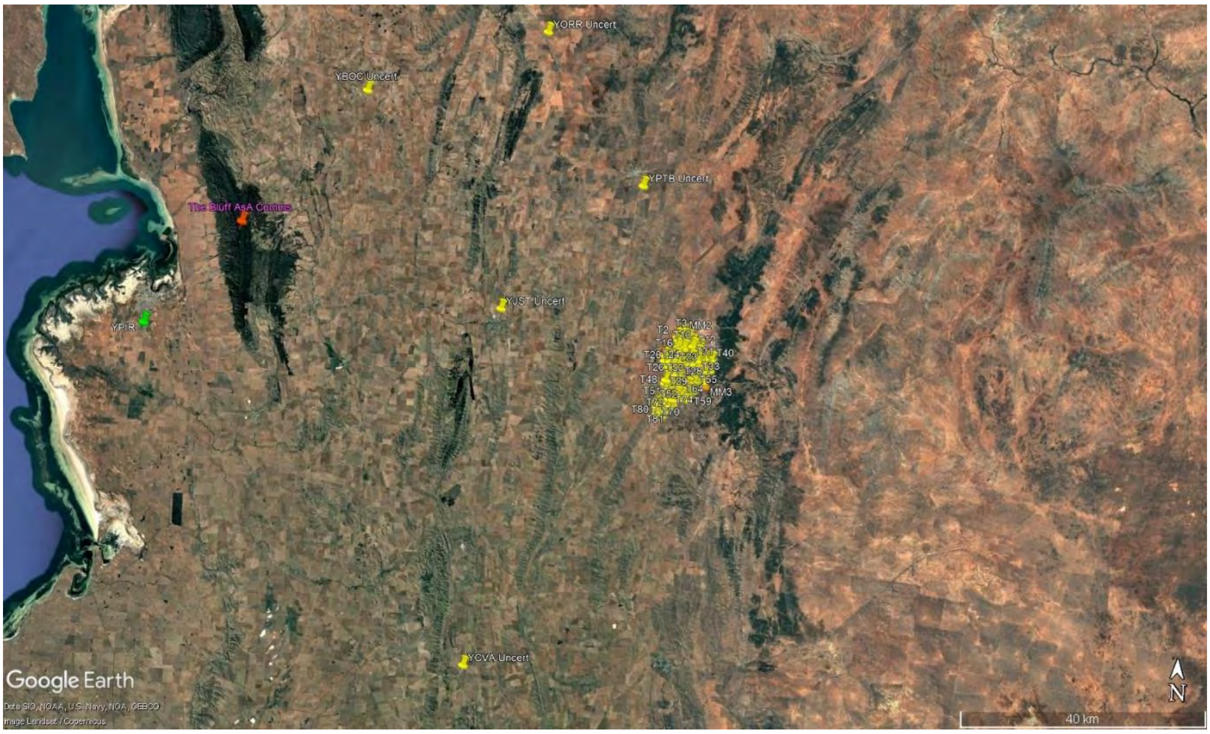

Figure 2 – Aerodromes in the Area

1.4 Air Routes in the Area

There are two air routes passing overhead the WYWF.

Figure 3 - Nearby Air Routes[5]

[5] AIP Map, ERC L2 30 November 2023

1.5 Airspace

The WYWF is in Class G airspace below Class E airspace with a lower limit of FL125 (12,500ft).

Class G airspace is non-controlled airspace where aircraft may operate without an Air Traffic Control (ATC) clearance. Aircraft may operate in accordance with both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) within Class G airspace.

Class E airspace is controlled airspace open to both IFR and VFR flights. IFR aircraft must have an ATC clearance and communicate with the ATC Centre.

A Control Area (CTA) is defined as a "controlled airspace extending upwards from a specified limit above the earth.[6]"

Within Class G airspace an aircraft flying in accordance with the Visual Flight Rules (VFR) away from a populous area is, when flying below 3000ft, required by Civil Aviation Safety Regulation (CASR) 91.267 to remain at 500ft above the highest point of the terrain and any obstacle on it within a radius of 300m from a point on the terrain directly below the aircraft. For a wind farm this equates to 500ft above the tallest turbine tip height, which for the WYWF this is 820 + 500 = 1320ft Above Ground Level (AGL).

The WYWF sits below Restricted Area R265D with a Lower Limit of 9500ft, and within Danger Areas D258B (surface to 9500ft) and D258C (surface to FL150 (15,000ft))

There are no published flying training areas in the vicinity of the WYWF.

[6] AIP Enroute, ENR 1.4 – 3, dated 30 November 2023,

2. SCOPE

To meet the requirements of Whyte Yarcowie Wind Farm Pty Ltd, the study required Chiron Aviation Consultants to examine the WYWF development in relation to any impacts on aviation activity in the area and undertake the following tasks.

2.1 Aviation Impact Statement

Airservices Australia (AsA) requires that all developers of proposed wind farms prepare an Aviation Impact Statement and submit this to AsA for evaluation and consideration.

The AIS required the following tasks to be undertaken: -

- Provide the coordinates and elevations of the Obstacles and associated topographical drawings;
- Specify all registered and certified aerodromes within 30nm (55.6km):
    - Nominate all instrument approach and landing procedures;
    - Confirm that the obstacles do not penetrate the Annex 14 OLS;
    - Confirm that the obstacles do not penetrate the PANS-OPS;
- Specify any published air routes over or near the obstacles
- Specify the airspace classification of the airspace surrounding the development
- Investigate any impact on aviation Communications, Navigation and Surveillance (CNS) facilities

Details of Aerodromes, OLS, PANS-OPS procedures, Lowest Safe Altitudes, Navigation and Airspace Surveillance facilities were obtained from the Australian Aeronautical Information Publications (AIP), AsA sources and CASA publications.

2.2 Qualitative Risk Assessment (QRA)

The QRA required the following tasks to be undertaken: -

- The identification and assessment of potential aviation risk elements through:
    - Reference to CASA publications;
    - Reference to the AIP;
    - Reference to the National Airports Safeguarding Framework (NASF) guidelines;
    - Consultations with key relevant stakeholders;
- Assessment of the perceived impacts of the turbines on the operation of aerodromes and airstrips in the immediate vicinity of the wind farm;
- Assessment of the perceived impacts of the turbines on aviation activity including:

  - General Aviation training;
  - Recreational/Commercial flying activity;
  - Air Ambulance Operations;
  - Police Aviation Operations;
  - Aerial Fire Fighting Operations;
  - Aerial Agricultural Operations;
  - Known highly trafficked VFR routes;
  - Night flying for light aircraft;

- Assessment of any implications for the above from topographical, weather and visibility issues;
- Assessment of other issues as identified through stakeholder consultations and the assessment process;
- Conclusions on the degree of aviation risk posed by the above described issues with commensurate recommendations on any mitigating actions; and
- An assessment of the need, against the outcomes of the Qualitative Risk Assessment, for obstacle lighting of the wind farm.

3. METHODOLOGY

The following methodology was used to complete the tasks outlined in the scope.

3.1 Aviation Impact Assessment

To meet Airservices Australia requirements for an Aviation Impact Statement the following methodology was used: -

- The obstacle (turbines and meteorological masts) coordinates and elevations were listed to the requisite accuracy and associated drawings and charts were obtained;
- The AIP was reviewed to determine;
    - All certified and military/joint aerodromes located within 30nm (55.6km) of the wind farm
    - Any associated Instrument Departure and Approach Procedures (DAP);
    - The extent of the OLS and PANS-OPS surfaces for the identified DAP;
    - Published air routes located over or near the wind farm;
    - The classification of the airspace surrounding the wind farm;
- Ascertain the locations of CNS facilities that may be impacted and analyse the impact on;
    - Communications facilities;
    - Navigation facilities;
    - Surveillance facilities (in accordance with EUROCONTROL Guidelines); and
- Compile a report for review by Airservices Australia and the Department of Defence.

3.2 Qualitative Risk Assessment

A Qualitative Risk Assessment is the analysis for risks, through facilitated interviews or meetings with stakeholders and outside experts, as to their probability of occurrence and impact expressed using non-numerical terminology; for example, low, medium and high. The basis for the QRA is ASNZS ISO 31000-2018 *Risk Management –Guidelines.*

The methodology for the Qualitative Risk Assessment was as follows:

- The Australian AIP and CASA documents were reviewed to identify relevant physical and operational aviation issues that may impact on the requirement for lighting of the wind farm;
- Current topographical maps were studied to assess the local terrain and identify any local airstrips and any other relevant features;

- Key stakeholders, including local operators, recreational aviation groups and State Government Police Air Wing, Air Ambulance and Fire Services, were identified, contacted and interviewed to ascertain the extent of local aviation activity in the vicinity of the proposed wind farm. See Appendix C for a Stakeholder List. This included any informal low flying areas and highly trafficked unpublished air routes that may exist within the vicinity of the proposed wind farm;

- Based on the above, the nature of any impacts as a consequence of the operation of the wind farm was considered and discussed in regard to;

  - General Aviation training;
  - Recreational and sport aviation activities;
  - Approved low flying activities (including aerial agricultural applications)
  - Any known highly trafficked VFR routes; and
  - Emergency Services (air ambulance, police and fire service);

- In addition, further consideration was given to the consequences (for the above elements) of the potential influence of topography and poor weather; and

Consideration of the NASF, Guideline D Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers in relation to the QRA findings.

4. AVIATION IMPACT STATEMENT

The Aviation Impact Statement meets the requirements of Airservices Australia for their assessment of the WYWF potential impact on the items listed in Section 3 above. The AIS is submitted to both Airservices Australia and the Department of Defence for assessment in relation to civil and military facilities.

4.1 Location

As noted in Section 1.1 the WYWF is situated approximately 7 km north of Hallett, 6.5 km south of Terowie and 190 km north of Adelaide. It is located near to the Barrier Highway which provides good access to the project site.

4.2 Obstacles

The WYWF will comprise 83 turbines with a tip height of 250m Above Ground Level (AGL). The tallest turbine is T28 at 953m (3125.84ft) AHD. Rounded up this gives a tip height of 3126ft, add the Minimum Obstacle Clearance (MOC) of 1000ft gives a height of 4136ft, rounded up gives an LSALT of 4200ft over the WYWF.

Turbine locations and elevations are shown at Appendix A.

4.3 Aerodromes within 30nm

There are no certified aerodromes within 30nm (56km) of the WYWF boundary.

There are four known uncertified aerodromes within 30nm (56km) of the WYWF boundary. These are Peterborough (YPTB), Jamestown (YJST), Clare Valley (YCVA) and Orroroo (YORR). See Figure 2. There is a private ALA at 33 28S 138 47E.

4.3.1 YPTB – Peterborough Uncertified

YPTB is 13.13nm (24.32KM) NNW of T1.

The aerodrome has a single sealed runway RWY 17/35, 1500m in length equipped with Low Intensity Runway Lighting (LIRL) activated by Pilot Activated Lighting (PAL). The District Council of Peterborough operate the aerodrome.

Peterborough uncertified aerodrome is considered sufficiently distant from the WYWF for there to be no impact on its operation.

4.3.2 YJST – Jamestown - Uncertified

YJST is 14.85nm (27.51km) WNW of T16.

The aerodrome has a single sealed runway RWY 16/34, 1200m in length equipped with

LIRL activated by PAL. The aerodrome is operated by the Northern Areas Council.

Jamestown uncertified aerodrome is considered sufficiently distant from the WYWF for there to be no impact on its operation.

4.3.3 YCVA – Clare Valley - Uncertified

YCVA is 27.42nm (50.79km) SSW of T83.

The aerodrome has two runways, RWY 17/35 and RWY 09/27. RWY 17/35 is sealed, 1250m in length equipped with LIRL activated by PAL. RWY 09/27 is grass, 600m in length and not equipped with lights. The Clare Valley Flying Group Inc. operate the aerodrome

Clare Valley uncertified aerodrome is considered sufficiently distant from the WYWF for there to be no impact on its operation.

4.3.4 YORR – Orroroo - Uncertified

YORR is 28.46nm (52.72km) NNW of T1.

The aerodrome has a single unrated gravel runway RWY 14/32, 1250m in length equipped with LIRL activated by PAL. The aerodrome is operated by the District Council of Orroroo/Carrietown.

Orroroo uncertified aerodrome is considered sufficiently distant from the WYWF for there to be no impact on its operation.

4.3.5 Private ALA

This private airstrip is located 5nm W of turbine T79 with a single unrated runway RWY 15/29 approximately 1400m in length. The proposed 275kW transmission line, on 50m tall towers, crosses the western end of the ALA. Operations at this ALA will be restricted by the transmission line.

It is recommended that the runway be reoriented to RWY04/22 [NNE/SSW] parallel to the transmission line and relocated 750m east.

4.4 Air Routes and Lowest Safe Altitudes

The LSALT over the WYWF is 4200ft. The air routes over the top of the wind farm, as shown in Figure 3, are J21 and H246. The WYWF is within the GRID bounded by 33S to 34S and 138E to 139E.

Route	Segment	LSALT
Grid		4500
J21	YWHA ï KABEK	4500
H246	ORBAN ï ISROV ï DAMOB	5100

Table 1 – Published LSALT

Air routes J21 and H246 are directly affected by the WYWF. The other routes, W448 and H135 are beyond the RNP 2 criteria and therefore not considered.

With a LSALT of 4200ft the WYWF is below the LSALT's shown in Table 1 and therefore does not impact any nearby air routes.

4.5 Airspace

The WYWF is in Class G airspace below Class E airspace with a lower limit of FL125 (12,500ft), and is within Danger Areas D258B (surface to 9500ft) and D258C (surface to FL150 (15,000ft)). These Danger Areas are active from sunrise to sunset (HJ) Monday to Friday (except Public Holidays) (JO) or as amended by NOTAM.

The WYWF sits below Restricted Area R265D with a Lower Limit of 9500ft.

There are no published flying training areas in the vicinity of the WYWF.

4.5.1 Overhead Transmission Line

A 275kW overhead transmission line will run from approximately turbine T18 to the Battery Energy Supply System (BESS) at Belalie East. The OHL will be supported on towers up to 50m in height. The majority of the OHL runs beside Mitchells Road.

As noted in 4.3.5 the OHL will impact on the private ALA.

4.5.2 Battery Energy Storage System

A BESS is proposed at Belalie East adjacent to an existing electricity transmission terminal station. The BESS will not be taller than the OHL towers.

4.5.3 Meteorological Monitoring Masts

Four permanent meteorological monitoring masts are proposed as part of the project. These masts will be up to 150m tall. Details are shown in Table 2.

Mast ID	Location		Elevation	Top Elevation	LSALT
MM1	32 14 43.43 S	138 53 55.63E	566m/1857ft	716m/2349ft	3400
MM2	33 12 42.55 S	138 55 57.93E	529m/1736ft	679m/2228ft	3300
MM3	33 17 16.36S	138 58 24.81E	506m/1660ft	656m/2152ft	3200
MM4	33 20 11.37S	138 53 40.80E	561m/1841	711m/2333ft	3400

Table 2 – Meteorological Monitoring Masts

The masts are more than 5nm from the known Uncertified aerodromes and will not impact operations at these aerodromes. Assuming the masts are erected before the turbines they will need to be marked and notified as per Sections 6 and 7 of this report.

4.6 Communications, Navigation and Surveillance

Wind turbines by their size and construction may cause interference to air traffic control communications, navigation and surveillance (CNS) facilities. Airservices Australia (AsA) recommends the use of the *EuroControl Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors*[7].

The CASR Part 139 Manual of Standards ï Aerodromes, Chapter 11, sets out the general requirements for navigation aid sites and air traffic control (ATC) facilities, including the clearance planes for planned and existing facilities.

4.6.1 Communications

There are Airservices Australia ATC communications facilities at *Bonfire Hill* and *The Bluff.* Bonfire Hill is 80nm (148km) south of the WYWF and at an elevation 1792ft (546m) AHD. The Bluff is 39nm (72km) west of the WYWF and at an elevation of 1942ft (592m) AHD. Both facilities are sufficiently distant and elevated for the WYWF to have no impact on their operation.

4.6.2 Navigation

There is a Non Directional Beacon (NDB) at YWHA 70nm (130km) WNW of WYWF turbine WTG_T1. This NDB has a range of 75nm day and night. Whilst the WYWF is within the published range of the NDB it is considered that it will have minimal impact on the operation of the navaid as any aircraft using it at maximum range over the WYWF will be at or above the published LSALT or at least 3326ft AHD (500ft above the tallest turbine).

There is an NDB at Parafield (YPPF) 88.6nm (164km) with a published range of 35nm day and night. The WYWF will not impact the YPPF NDB.

There is a TACAN and a DME (Distance Measuring Equipment) at Edinburgh Military Aerodrome (YEDN). These are VHF facilities operating within line of sight and located 83nm (153km) south of the WYWF WTG_T14. The WYWF is beyond the line of sight of these navaids due to high ground in between.

4.6.3 Surveillance

The Adelaide Primary Surveillance Radar is 98.75nm south of WYWF WTG_T14. Using the Eurocontrol *Guidelines for assessing the potential impact of wind turbines on surveillance sensors* puts the WYWF within the maximum instrumented range of 200nm but not within line of sight due high terrain between the radar and the WYWF, therefore no assessment is required.

[7] Available at http://www.eurocontrol.int/sites/default/files/publication/files/20140909-impact-wind-turbines-sur-sensors-guid-v1.2.pdf last accessed 10 January 2018

4.7 AIS Conclusions

The AIS concludes that:

- There are no certified aerodromes within 30nm (56km) of WYWF boundary
  - There is no impact on any OLS or PANS-OPS airspace associated with published instrument approaches at certified aerodromes
- The LSALT of 4200ft over the WYWF is below the published LSALT for the GRID, and air routes J21 and H246.
- There are four known uncertified aerodromes within 30nm of the WYWF boundary. The WYWF is considered sufficiently distant, that is, beyond 14nm (26km), from these known uncertified aerodromes to have no impact on their operation.
- The private ALA is impacted by the proposed OHL. It is recommended that this ALA be relocated.
- The WYWF is within Class G airspace. It is also within Danger Areas D258B and D258C. There are existing wind farms within these Danger Areas.
- There will be no impact on CNS facilities.

4.8 Airservices Australia Response

Airspace Procedures

With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a height of 953m (3126ft) AHD the wind farm will not affect any sector or circling altitude, nor any instrument approach or departure procedure at any aerodrome.

Note: Procedures not designed by Airservices at any aerodrome were not considered in this assessment.

Communications, Navigation and Surveillance

We have assessed the proposed activity to the above specified height for any impacts to Airservices Precision/Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections to it proceeding.

Air Traffic Control (ATC) Operations

There are no additional instructions or concerns from ATC

Summary

The proposed activity does not impact Airservices operations or facilities at any aerodrome.

4.9 Department of Defence Response

Defence advises that the WYWF will not impact on military flying operations or interfere with Defence communications and radar. Defence has no concerns with the WYWF.

Defence advise that the Unexploded Ordnance (UXO) Database indicates the potential for UXO within the area of the WYWF. See Appendix C.

5. QUALITATIVE RISK ASSESSMENT

The expression ñin the vicinity of the aerodromeòis considered by CASA to mean within the boundaries of either the OLS or the PANS-OPS surfaces for a certified aerodrome.

The NASF Guideline D considers 30km (16.2nm) from a certified aerodrome to be ñin the vicinity.ò

Planning Authorities generally refer to aerodromes within 15km (8nm) of a wind farm for consideration.

More generally the impact on any certified or military aerodrome within 56km (30nm) of a wind farm is considered, such that any protected airspace associated with published instrument approach procedures is captured.

5.1 Aerodromes and Airspace

The Aviation Impact Statement at Section 4.3 details the certified, military and uncertified aerodromes within 30nm (56km) of the WYWF boundary.

Section 4.4 details the published air routes and Lowest Safe Altitudes above the WYWF.

Sections 1.5 and 4.5 detail the airspace, both civil and military, surrounding the WYWF.

5.2 Night Flying

Aircraft flying at night, both IFR or VFR are protected by published or calculated LSALT. Descent below the LSALT for a VFR at Night flight is restricted to within 3nm (5.4km) of the aerodrome and with it in sight. Where an IFR aircraft is using a published instrument approach it is protected by PANS-OPS surfaces.

Given the location of the WYWF, away from any aerodromes and nearby to existing wind farms aircraft operating at night in the area will be flying at or above the LSALT.

5.3 General Aviation Flying Training

Wind turbines, by their size and colour are considered to be highly conspicuous and therefore not an issue for VFR flight by day. Flying training is conducted in accordance with VFR for a major part of the course. In the latter stages of training student airline pilots progress to night flying in accordance with VFR at Night procedures and then to IFR training. Flying training is usually conducted in light General Aviation (GA) aircraft such as Cessna C182 or Diamond DA40 aircraft. As discussed previously night flying is undertaken at or above the LSALT and therefore is above the WYWF.

The general area may be used for cross-country navigation training flights which will be appropriately flight planned and take into consideration the existing wind turbines.

5.4 Recreational and Sport Aviation

Recreational and Sport aircraft, particularly ultra-lights registered with Recreational Aviation Australia (RA-Aus) are limited to daytime flight in accordance with the Visual Flight Rules (VFR). This requires the aircraft to remain clear of cloud and a minimum of 500ft above the highest obstacle on the ground. Ultra-light aircraft have a Maximum Take-Off Weight (MTOW) of 600kgs or less. A small General Aviation aircraft such as a Cessna C172 has a MTOW of 1110kg. The cruising speed of these aircraft is generally lower than for a GA aircraft thus giving more time to see and avoid obstacles. *The photo shows an Australian built Lightwing ultra-light aircraft.*

5.5 Approved Low Flying Activities

The WYWF sits within the military flying Danger Area D258B and may impact on its use for military flying training. D258B extends from the surface (SFC) to 9,500ft and is active during daylight hours Monday to Friday (except Public Holidays).

There are existing wind farms within D258B near Mt Bryan and further north around Canowie (Hallett WF) continuing into D258C around Jamestown (Hornedale WF).

Department of Defence have advised that it has no concerns with the WYWF impacting low flying operations.

5.6 Aerial Agricultural Applications Activity

The Aerial Agricultural Association of Australia opposes wind farm developments unless the developer has (inter alia):

- Consulted in detail with local operators;
- Received independent expert advice on safety and economic impacts; and
- Considered the impacts on the aerial application industry.[8]

An aerial agricultural operator made the comment that *"the decision to host wind turbines is one made by the landholder who must accept that there will most probably be limitations to any aerial applications on the property[9]."*

[8] http://www.aerialag.com.au/ResourceCenter/Policies.aspx
[9] Expert opinion obtained by the author during previous QRA work

Another operator made the comment that *“wind farms are becoming common, they’re a fact of life, we know more about them and can operate safely in their vicinity.”*[10]

The author knows of areas where operators fly within the wind farm area.

All the operators consider meteorological monitoring masts to be ñkillersò because they are very difficult to see. The agreement amongst them was that as a minimum the masts should be marked in accordance with the NASF Guideline D, except for the strobe light, and that the base around the outer guy wires should be marked in a contrasting colour to the ground.

5.7 Known Highly Trafficked Areas

There are no known highly trafficked areas in the vicinity of the WYWF.

5.8 Emergency Services Flying

All Emergency Services flying is subject to continuous dynamic risk assessment throughout the flight. The Pilot in Command has the ultimate responsibility for the safety of the aircraft. The safety of the aircraft and its crew is paramount.

5.8.1 Police Air Wing

SA Police operate fixed wing aircraft and advise that the WYWF will not impact on these operations. Helicopter operations are provided by the State Rescue Helicopter Service. This service is operated by the same organisation providing the Helicopter Emergency Medical Service.

The operator of the State Rescue Helicopter Service, Babcock Australia, advise ñ*that most of the Police helicopter work is conducted in accordance with the VFR, and rarely at low level.”* As such the WYWF will not impact on these operations. There are existing wind farms in the general area, so the pilots are familiar with operating near them.

5.8.2 Helicopter Emergency Medical Services

The Helicopter Emergency Medical Service (HEMS) utilise helicopters capable of IFR flight. For low level night operations, the aircraft are equipped with Night Vision Imaging Systems (NVIS) enabling the pilot ñto seeò in reduced light conditions. All HEMS operations are subject to a dynamic risk assessment and the pilot in command has the

[10] Stakeholder interview with aerial agricultural applications operator. Reiterated by other operators during additional interviews

final say as to whether the operation is aborted due to the risk to the aircraft and crew.

It was also noted that any LED type obstacle lights need to be within a specific wavelength spectrum for successful use of NVIS. Comment was also made about the need to suitably mark meteorological monitoring towers.

5.8.3 Fixed Wing Air Ambulance

Fixed wing Air Ambulance operations in South Australia are contracted to the Royal Flying Doctor Service (RFDS) and are undertaken in turbo-prop aircraft in accordance with IFR.

The aircraft are usually single engine turbo-prop Pilatus PC12 which have a MTOW of 4740kg and use suitable aerodromes. RFDS also operate the Pilatus PC24 twin jet aircraft which have a MTOW of 8300kg and use suitable, usually sealed, aerodromes. The WYWF will not affect RFDS Air Ambulance operations due to the nature of the operations and the aircraft size.

The nearest suitable aerodromes to the WYWF are the Peterborough and Jamestown uncertified aerodromes which are sufficiently distant from the wind farm for there to be no impact on aircraft operations at the aerodrome.

The WYWF will not affect the operations of the fixed wing air ambulance aircraft.

5.9 Fire Fighting

Firefighting is a multi-faceted operation utilising multiple resources and equipment appropriate to the circumstances. A fire ground is a dynamic place where resources are continually being reassigned to have the best effect.

Aerial firefighting is just one of the available resources and its use may or may not be appropriate to the current fire ground situation. There will be times when aerial firefighting is not possible due to turbulence, smoke, strong winds or erratic fire behaviour. High atmospheric temperatures affect the performance of aircraft and reduce the load carrying capacity. Low relative humidity reduces the effectiveness of firebombing due to the rapid evaporation of the water as it is dropped. Intense fires create their own severe weather conditions with pyrocumulonimbus and severe turbulence[11]. Such conditions are dangerous for both large and small aircraft[12] and preclude the use of aerial firefighting.

5.9.1 Aerial Firefighting

At all times, the pilot in command has the ultimate responsibility for the safety of the aircraft.[13]

[11] Flight Safety Australia, *Beware of Bushfire Clouds*, 9 January 2020
[12] Flight Safety Australia, *Turbulence on day of tanker crash,* 25 September 2020
[13] A point reiterated in an interview by the author with a Victorian Forest Fire Management Fire Ground Manager. This is part of the Civil Aviation Regulations 1988.

Aerial firefighting flying is conducted at low level using specialist aircraft flown by appropriately rated pilots in accordance with the Visual Flight Rules. The pilot is required to maintain forward visibility with the ground; therefore, they will remain clear of smoke so that they can accurately and safely drop the fire retardant.

"It is important to remember that aircraft alone do not extinguish fires."[14]

From previous work undertaken by the author regarding firefighting within wind farms it is noted that the rural firefighting agencies in Victoria, New South Wales, South Australia and Western Australia all view wind turbines and wind farms to be 'just another hazard' that must be considered in the risk management process associated with aerial firefighting.

The photograph above shows an AT802 dropping retardant next to a power line.

At present only organisations operating suitably equipped helicopters are authorised by CASA to conduct aerial firefighting at night. These helicopter operators utilise specific helicopters equipped for night flight using night vision imaging systems (NVIS) that are flown as a two-pilot operation where both are appropriately rated. Night aerial firefighting is not currently undertaken by fixed wing aircraft, other than the large aerial tankers (VLAT) operated by *Coulson Aviation* for the Australian Government and the NSW RFS.

5.10 Topographical am Marginal Weather Conditions

The rules governing VFR flight require that pilots remain clear of cloud and not get into such situations by turning away from the low cloud and terminating the flight at the nearest suitable aerodrome.

Aircraft operating under Instrument Flight Rules (IFR) can operate in poor weather conditions and in cloud which precludes visual acquisition of obstacles and terrain. These operations are protected by PANS OPS surfaces and LSALT's that are designed to keep the aircraft clear of obstacles and terrain.

Otherwise CASR 91.265 states (in part) that an aircraft operating under VFR must not fly lower than 152m/500ft over a non-populated area being terrain or obstacles on that terrain and within 300m horizontally to the same, unless:

- Due stress of weather or any other unavoidable cause it is essential that a lower height be maintained; or
- It is engaged in approved low flying private or aerial work; or

[14] NSW Rural Fire Service submission to the Senate Select Committee on Wind Turbines, 6 March 2015, page 2

- It is engaged in flying training and flies over part of a flying training area in respect of which low flying is authorised by CASA under sub regulation 141(1); or
- It is undertaking a baulked approach; or
- It is flying in the course of actually taking-off or landing at an aerodrome.

Regarding the first bullet point above it is possible that due to lowering cloud base, and if through poor airmanship the aircraft had pressed on to the point that it was unable to execute a turn and fly away from the weather, an aircraft could find itself lower than 152m/500ft above the terrain or obstacles. The operative word is unavoidable. Flying into marginal or non VMC weather is entirely avoidable. It should be noted that a non-instrument rated pilot flying in cloud almost always has a fatal outcome[15].

5.11 NASF Guidelines

The National Airports Safeguarding Framework ï Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* provides guidance for the siting and marking of the turbines and meteorological monitoring towers associated with wind farms.

5.11.1 Notification to Authorities

Paragraph 20 of Guideline D advises that:

> *When wind turbines over 150m above ground level are to be built within 30km (16.2nm) of a certified or registered aerodrome, the proponent should notify the Civil Aviation Safety Authority and Airservices. If the wind farm is within 30km of a military aerodrome, Defence should be notified.*

The turbines are greater than 150m and are not within 30km of a military, certified or registered aerodrome.

The turbines and meteorological monitoring towers used in the WYWF must be reported to the vertical obstruction database held by Airservices Australia in accordance with AC 139.E-01 v1.0 Reporting *of Tall Structures* to ensure their position and height is marked on aeronautical charts and known to aviation industry.

5.11.2 Risk Assessment

The NASF Guideline has the following requirements for a risk assessment.

> *26. Following preliminary assessment by an aviation consultant of potential issues, proponents should expect to commission a formal assessment of any risks to aviation safety posed by the proposed*

15 Accidents involving Visual Flight Rules pilots in Instrument Meteorological Conditions, Australian Transport Safety Bureau, 22 August 2019

development. This assessment should address any issues identified during stakeholder consultation.

The risk assessment for the WYWF indicates that the overall risk to aviation is LOW. A risk assessment of LOW indicates that the wind farm is *'not a hazard to aircraft safety.'*

27. The risk assessment should address the merits of installing obstacle marking or lighting. The risk assessment should determine whether or not a proposed structure will be a hazardous object. CASA may determine, and subsequently advise a proponent and relevant planning authorities that the structures have been determined as:

(a) Hazardous but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or

(b) Hazardous and should not be built, either in the location and/or to the height proposed as an unacceptable risk to aircraft safety will be created; or

(c) Not a hazard to aircraft safety.

By day, the WYWF turbines are conspicuous by their size and colour. The WYWF does not impact on any LSALT in the area. Night operations for aircraft do not occur below the LSALT for IFR and VFR at night. IFR aircraft are protected by the LSALT and PANS-OPS prescribed airspace at each aerodrome. Where an approach to land is undertaken operating to VFR at night, descent below the LSALT does not occur until within 3nm of the airport and in VMC. The nearest aerodrome equipped for night operations is Port Pirie 54.61nm (101.13km) to the northwest.

Given the above, the WYWF does not require obstacle lighting as the risk to aviation is LOW and no additional mitigating strategies are required.

Overall, the risk assessment demonstrates that the WYWF is a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

28 If CASA advice is that the proposal is hazardous and should not be built, planning authorities should not approve the proposal. If a wind turbine will penetrate a PANS-OPS surface, CASA will object to the proposal. Planning decision makers should not approve a wind turbine to which CASA has objected.

The WYWF does not penetrate any OLS or PANS-OPS surfaces either civil or military, therefore CASA has no reason to determine that it is hazardous.

29 In the case of military aerodromes, Defence will conduct a similar assessment to the process described above if required. Airservices, or in the case of a military aerodrome, Defence, may object to a proposal if it will adversely impact on Communications, *Navigation or Surveillance (CNS) infrastructure. Airservices/ Defence will provide detailed advice to proponents on request regarding the requirements that a risk assessment process must meet from the CNS perspective.*

There is no civil or known military CNS infrastructure that will be impacted by the WYWF.

30 During the day, large wind turbines are sufficiently conspicuous due to their shape and size, provided the colour of the turbine is of a contrasting colour to the background. Rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study. Other colours are also acceptable unless the colour of the turbine is likely to blend in with the background.

The WYWF turbines will be appropriately painted to ensure they are conspicuous by day.

5.11.3 Lighting of Wind Turbines

33 Where a wind turbine 150m or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment.

34. The risk assessment, to be conducted by a suitably qualified person(s), should examine the effect of the proposed wind turbines on the operation of aircraft. The study must be submitted to CASA to enable an assessment of any potential risk to aviation safety. CASA may determine that the proposal is:

(a) hazardous, but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or

(b) not a hazard to aircraft safety.

The WYWF is not sited within the vicinity of any certified or military aerodrome, does not penetrate any OLS or PANS-OPS airspace and is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

The WYWF is not a hazard to aircraft safety, therefore aviation obstacle lighting is not required.

5.12 QRA Findings

Risk Element	Assessed Level of Risk	Comment
Aerodrome Operations	LOW	
Aircraft Landing Area Operations	LOW	Suitability for use is a pilot responsibility.
Known Highly Trafficked Routes	LOW	None identified
Published Air Routes	LOW	Nil impact
Restricted Airspace	LOW	Sits below and clear of R265D
Danger Area	LOW	Sits within D258B near existing wind farms
Promulgated Flying Training Areas	LOW	D258B for military flying. Nil for civil flying
GA Flying	LOW	
Night Flying	LOW	
Emergency Services Flying	LOW	
Commercial Flying	LOW	
Recreational and Sport Aviation	LOW	
Recreational Pilot Training (RA-AUS)	LOW	
GA Pilot Training	LOW	
Weather and Topographical Issues	LOW	

Table 2 – Risk Assessment Summary

6. WIND MONITORING TOWERS

Meteorological Monitoring Masts are very difficult to see due to their slender construction and thin guy wires. The masts are often a grey (galvanised steel) colour that readily blends with the background.

The photograph in Figure 7 shows a Meteorological Monitoring Mast as seen from the ground.

Figure 7 – A Meteorological Monitoring Mast photographed from the ground[16]

The aerial applications operators and the emergency services pilots all note the danger of meteorological monitoring masts to low flying aircraft. These pilots all made comment that ñmet masts are extremely dangerous.ò Each of these stakeholders requested that the NASF Guidelines, except for the strobe light, be used to make the masts more visible and that the markings be maintained in a serviceable condition.

The aerial applications pilots all requested that marker balls be placed on the bottom third of the outer guy wire and that the ground anchor points be painted a contrasting colour to enhance their visibility. When low flying, particularly when spraying, the pilot is looking at the ground as their reference point. The contrasting ground anchor point is the most valuable visual cue in this situation.

Aerial applications pilots generally consider that a flashing strobe light is ineffective and as such should not be used.

All the markings used to make the masts more visible must be maintained in a serviceable condition. This is particularly important for balls, flaps and sleeves that deteriorate due to wind and sun damage.

[16] Author photo, Yorke Peninsular SA.

6.1 NASF Guidelines – Marking of Meteorological Monitoring Towers

The NASF guideline also refers to the marking and lighting of wind monitoring towers. The relevant points are summarised as:

> *Wind monitoring towers are very difficult to see from the air due to their slender construction and guy wires. This is a particular problem for low flying aircraft, particularly aerial agricultural and emergency services operations.*
>
> *Measures to be considered to improve visibility include:*
>
> - *The top one third of wind monitoring towers be painted in alternating contrasting bands of colour. Examples can be found in the CASA MOS 139 sections 8 and 9;*
> - *Marker balls, high visibility flags or high visibility sleeves placed on the outer guy wires;*
> - *Ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground and vegetation; or*
> - *A flashing strobe light during daylight hours.*

7. REPORTING TALL STRUCTURES

The turbines proposed for the WYWF have a tip height of 250m (820ft) AGL; therefore, they must be reported as per CASR 175.480.

CASR Part 175E requires that obstacles having a height of 100m AGL (turbines and meteorological monitoring masts) be reported as tall structures for inclusion in the vertical obstacle database and on appropriate aeronautical charts.

The procedure for reporting tall structures is contained in Advisory Circular AC 139.E-01 v1.0 *Reporting of Tall Structures*[17].

Meteorological Monitoring Masts for the WYWF must also be reported as per AC 139.E-01 and to the Aerial Agricultural Association of Australia (admin@aaaa.org.au).

Consideration should be given to ensuring an Aeronautical Information Circular (AIC) or NOTAM that provides the height and location of the structure is issued. This is due to the current lead time between reporting tall structures and the information appearing on aeronautical charts.

[17] Advisory Circular AC 139.E-01 v1.0 8 December 2021

8. AERONAUTICAL IMPACT ASSESSMENT – CONCLUSIONS

8.1 Aviation Impact Statement

The AIS concludes that:

- There is no impact on any OLS or PANS-OPS airspace associated with published instrument approaches at certified aerodromes
- The LSALT of 4200ft over the WYWF is below the published LSALT for the GRID, and air routes J21 and H246.
- There are four known uncertified aerodromes within 30nm of the WYWF boundary. The WYWF is considered sufficiently distant, that is, beyond 14nm (26km), from these known uncertified aerodromes to have no impact on their operation.
- The WYWF is within Class G airspace. It is also within Danger Areas D258B and D258C. There are existing wind farms within these Danger Areas.
- There will be no impact on CNS facilities.

8.1.1 Airservices Assessment

The proposed activity does not impact Airservices operations or facilities at any aerodrome.

8.1.2 Department of Defence Assessment

Defence advises that the WYWF will not impact on military flying operations or interfere with Defence communications and radar. Defence has no concerns with the WYWF.

Defence advise that the Unexploded Ordnance (UXO) Database indicates the potential for UXO within the area of the WYWF.

8.2 Risk Assessment

The QRA demonstrates that the WYWF will *"not be a hazard to aircraft safety"* and therefore *"not of operational significance"* to aircraft operations.

8.3 Obstacle Lighting

The WYWF turbines have a tip height of 250m AGL and therefore can be regarded as an obstacle and be subject to a Risk Assessment to ascertain whether they constitute a hazard to aviation safety.

The Risk Assessment finds that the overall risk to aviation around the WYWF is LOW and therefore not a hazard to aircraft safety. On this basis no further mitigation is required.

Obstacle lighting is not required.

8.4 Reporting Tall Structures

The WYWF wind turbines and meteorological monitoring masts are considered to be tall structures, therefore they must be reported to the Vertical Obstacle Database, managed by Airservices Australia. The procedure for reporting tall structures is contained in Advisory Circular AC 139.E-01 v1.0.

Consideration should be given to ensuring a NOTAM or AIC that provides the height and location of the structure is issued.

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APPENDIX A

Turbine locations and heights

APPENDIX A

WTG_ID	Elevation LIDAR 1m	Easting GDA2020-Z54	Southing GDA2020-Z54	Latitude	Longitude	Tip Elev (m)	Tip Elev (ft)	MOC	LSALT
T43	532	306973.5954	6323218.404	-33.21272569	138.9288834	782	2564.96	3564.96	3600
T33	547	306319.4399	6322519.03	-33.21891293	138.9217195	797	2614.16	3614.16	3700
T46	542	307196.0599	6322661.99	-33.217781	138.931151	792	2597.76	3597.76	3600
T53	550	308003.0899	6322546.25	-33.21896797	138.9397814	800	2624	3624	3700
T35	558	306467.4699	6321983.71	-33.22376488	138.9231929	808	2650.24	3650.24	3700
T39	568	306803.2716	6321440.8	-33.22871883	138.9266789	818	2683.04	3683.04	3700
T54	585	308007.6341	6321983.994	-33.22403707	138.9397112	835	2738.8	3738.8	3800
T50	577	307679.9999	6321268.94	-33.23042443	138.9360459	827	2712.56	3712.56	3800
T48	589	307496.1899	6320639.56	-33.23606502	138.9339409	839	2751.92	3751.92	3800
T37	595	306554.3199	6320804.79	-33.23440734	138.9238732	845	2771.6	3771.6	3800
T60	614	308896.905	6321709.244	-33.22667138	138.949191	864	2833.92	3833.92	3900
T61	643	308910.0499	6321144.05	-33.2317685	138.949213	893	2929.04	3929.04	4000
T68	598	309735.1272	6321108.311	-33.2322363	138.9580554	848	2781.44	3781.44	3800
T67	631	309726.4699	6320540.01	-33.2373576	138.9578434	881	2889.68	3889.68	3900
T69	623	309808.1268	6320042.063	-33.24186063	138.9586149	873	2863.44	3863.44	3900
T74	564	310833.1799	6319446.78	-33.24740677	138.969487	814	2669.92	3669.92	3700
T83	518	311957.3642	6319278.293	-33.24912198	138.9815125	768	2519.04	3519.04	3600
T76	555	310859.0298	6318962.438	-33.25177732	138.9696633	805	2640.4	3640.4	3700
T71	615	309846.8333	6318418.819	-33.25649981	138.9586899	865	2837.2	3837.2	3900
T66	632	309704.5289	6318997.973	-33.25125408	138.9572846	882	2892.96	3892.96	3900
T62	656	309026.4309	6319329.94	-33.2481419	138.9500795	906	2971.68	3971.68	4000
T52	677	307902.5699	6318618.25	-33.25435779	138.937872	927	3040.56	4040.56	4100

WTG_ID	Elevation LIDAR 1m	Easting GDA2020-Z54	Southing GDA2020-Z54	Latitude	Longitude	Tip Elev (m)	Tip Elev (ft)	MOC	LSALT
T58	657	308804.4254	6318454.699	-33.25599221	138.9475133	907	2974.96	3974.96	4000
T73	609	310124.6713	6317901.985	-33.26120761	138.9615626	859	2817.52	3817.52	3900
T72	586	310028.7692	6317290.5	-33.26670282	138.9604054	836	2742.08	3742.08	3800
T70	606	309846.7	6316658.5	-33.27236774	138.9583191	856	2807.68	3807.68	3900
T80	527	311047.4138	6315610.273	-33.28202779	138.9709855	777	2548.56	3548.56	3600
T78	545	310981.6379	6316390.978	-33.27497876	138.9704425	795	2607.6	3607.6	3700
T79	574	311018.5	6316912.36	-33.27028532	138.9709468	824	2702.72	3702.72	3800
T75	545	310844.4387	6317363.5	-33.2661881	138.9691732	795	2607.6	3607.6	3700
T77	561	310936.9099	6318052.52	-33.25999326	138.9703091	811	2660.08	3660.08	3700
T81	499	311903.4706	6318093.773	-33.25979031	138.9806886	749	2456.72	3456.72	3500
T82	518	311946.4325	6317541.823	-33.26477329	138.9810351	768	2519.04	3519.04	3600
T64	557	309451.4228	6315364.106	-33.28396592	138.9538051	807	2646.96	3646.96	3700
T65	599	309607.5	6314730.394	-33.2897059	138.9553469	849	2784.72	3784.72	3800
T63	613	309428.1924	6314044.168	-33.29585998	138.9532779	863	2830.64	3830.64	3900
T59	664	308819.5069	6313324.159	-33.30224242	138.9465922	914	2997.92	3997.92	4000
T57	688	308649.7865	6314004.151	-33.29608276	138.9449141	938	3076.64	4076.64	4100
T56	615	308573.798	6314723.416	-33.28958571	138.9442506	865	2837.2	3837.2	3900
T30	611	306306.4353	6319312.566	-33.24781394	138.9208958	861	2824.08	3824.08	3900
T36	652	306477.5567	6318846.053	-33.2520498	138.9226321	902	2958.56	3958.56	4000
T18	593	305426.3666	6318933.709	-33.2510707	138.9113734	843	2765.04	3765.04	3800
T6	577	304547.2899	6318321.81	-33.25642751	138.9018106	827	2712.56	3712.56	3800
T16	596	305370.0426	6318356.625	-33.25626238	138.9106453	846	2774.88	3774.88	3800
T42	703	306960.6646	6317959.648	-33.26012644	138.9276263	953	3125.84	4125.84	4200

WTG_ID Not in order	Elevation LIDAR 1m	Easting GDA2020-Z54	Southing GDA2020-Z54	Latitude	Longitude	Tip Elev (m)	Tip Elev (ft)	MOC	LSALT
T29	634	306171.6563	6318183.787	-33.25796461	138.9192087	884	2899.52	3899.52	3900
T25	691	305944.6849	6317540.482	-33.26372258	138.9166358	941	3086.48	4086.48	4100
T13	620	305111.4369	6317507.003	-33.26387417	138.9076881	870	2853.6	3853.6	3900
T44	701	307126.5097	6317413.426	-33.26507979	138.9292895	951	3119.28	4119.28	4200
T24	664	305914.8032	6316998.505	-33.26860259	138.9161991	914	2997.92	3997.92	4000
T26	635	306082.1399	6316491.83	-33.27319986	138.9178863	885	2902.8	3902.8	4000
T32	642	306317.1399	6315983	-33.27782869	138.9202992	892	2925.76	3925.76	4000
T41	657	306927.8799	6315438.7	-33.28284456	138.9267374	907	2974.96	3974.96	4000
T47	660	307246.7305	6314921.336	-33.28756516	138.9300492	910	2984.8	3984.8	4000
T51	605	307774.983	6314341.309	-33.2928879	138.9355957	855	2804.4	3804.4	3900
T55	646	308192.3699	6312536.49	-33.30923107	138.9396931	896	2938.88	3938.88	4000
T49	617	307527.5567	6313187.711	-33.30324234	138.9326946	867	2843.76	3843.76	3900
T45	651	307145.3213	6313712.504	-33.29844349	138.9287032	901	2955.28	3955.28	4000
T40	663	306905.6899	6314291.6	-33.29318058	138.9262546	913	2994.64	3994.64	4000
T23	624	305740.8199	6315246.6	-33.28436291	138.9139565	874	2866.72	3866.72	3900
T12	642	304966.317	6315500.652	-33.28193307	138.9056991	892	2925.76	3925.76	4000
T11	620	304870.7853	6314790.926	-33.28831321	138.9045209	870	2853.6	3853.6	3900
T22	624	305662.8078	6314708.585	-33.2891985	138.9130038	874	2866.72	3866.72	3900
T17	610	305409.9478	6314060.933	-33.29499078	138.9101507	860	2820.8	3820.8	3900
T28	629	306164.9499	6313680.76	-33.29855371	138.9181731	879	2883.12	3883.12	3900
T38	637	306678.7782	6313051.538	-33.30431783	138.9235541	887	2909.36	3909.36	4000
T21	625	305590.0863	6313047.816	-33.30415546	138.9118665	875	2870	3870	3900
T8	584	304662.4878	6312748.02	-33.30668999	138.9018443	834	2735.52	3735.52	3800

WTG_ID	Elevation LIDAR 1m	Easting GDA2020-Z54	Southing GDA2020-Z54	Latitude	Longitude	Tip Elev (m)	Tip Elev (ft)	MOC	LSALT
T1	575	303822.2112	6312222.809	-33.31127144	138.8927101	825	2706	3706	3800
T2	580	303833.5199	6311691.89	-33.3160591	138.8927164	830	2722.4	3722.4	3800
T3	587	303873.9095	6311163.511	-33.32082916	138.8930353	837	2745.36	3745.36	3800
T5	575	304018.9312	6310544.3	-33.32643701	138.8944581	825	2706	3706	3800
T4	562	304000.1693	6309970.52	-33.33160553	138.8941322	812	2663.36	3663.36	3700
T10	563	304759.2762	6309865.455	-33.33269055	138.9022607	813	2666.64	3666.64	3700
T14	573	305245.7045	6310597.35	-33.32618149	138.9076418	823	2699.44	3699.44	3700
T15	577	305343.329	6311212.16	-33.32065732	138.9088225	827	2712.56	3712.56	3800
T19	591	305468.7372	6311848.636	-33.31494286	138.9103059	841	2758.48	3758.48	3800
T9	586	304671.3102	6312193.998	-33.31168546	138.9018194	836	2742.08	3742.08	3800
T20	609	305542.6571	6312465.818	-33.30939298	138.9112322	859	2817.52	3817.52	3900
T31	638	306313.2313	6312413.275	-33.31000545	138.9194934	888	2912.64	3912.64	4000
T34	604	306348.4206	6311879.471	-33.31482347	138.9197568	854	2801.12	3801.12	3900
T27	593	306101.1077	6311247.874	-33.32047213	138.9169662	843	2765.04	3765.04	3800
T7	574	304620.2655	6318962.658	-33.25066415	138.9027316	824	2702.72	3702.72	3800

Turbine WTG_T42 is the tallest turbine tip at 953m (3125.84ft) AHD.

WTG_ID	Old ID	New/old	ELE [m] LiDAR	Latitude S	Longitude E	TIP HEIGHT[m]	TIP HEIGHT [ft]	Add MOC	LSALT
T1	WTG_T43	moved	533.145	33.21349753	138.9289561	783.145	2569.373442	3569.373442	3600
T2	WTG_T33		547.016	33.21891293	138.9217195	797.016	2614.881973	3614.881973	3700
T3	WTG_T46	moved	542.178	33.21825779	138.9310741	792.178	2599.00927	3599.00927	3600
T4	WTG_T35	moved	556.525	33.22387725	138.9234931	806.525	2646.079481	3646.079481	3700
T5	WTG_T39	moved	564.282	33.22784213	138.9263345	814.282	2671.528957	3671.528957	3700
T6	WTG_T37	moved	594.307	33.23369455	138.924181	844.307	2770.036178	3770.036178	3800
T7	WTG_T53		549.837	33.21896797	138.9397814	799.837	2624.137223	3624.137223	3700
T8	WTG_T54	moved	587.146	33.22430782	138.9397456	837.146	2746.542083	3746.542083	3800
T9	WTG_T50	moved	572.994	33.22990125	138.935864	822.994	2700.111635	3700.111635	3700
T10	WTG_T48	moved	583.589	33.23497239	138.9337858	833.589	2734.872135	3734.872135	3800
T11	WTG_T60	moved	614.342	33.22687121	138.9493806	864.342	2835.767807	3835.767807	3900
T12	WTG_T61		642.277	33.2317685	138.949213	892.277	2927.418073	3927.418073	4000
T13	WTG_T68	moved	596.429	33.23209403	138.9582502	846.429	2776.99812	3776.99812	3800
T14	WTG_T67	moved	627.192	33.23707792	138.9581877	877.192	2877.926601	3877.926601	3900
T15	WTG_T69		622.406	33.24186063	138.9586149	872.406	2862.224501	3862.224501	3900
T16	WTG_T7	moved	573.228	33.24784323	138.9035223	823.228	2700.879352	3700.879352	3800
T17	WTG_T6	moved	576.686	33.25472744	138.9020659	826.686	2712.224496	3712.224496	3800
T18	WTG_T13	moved	600.731	33.26204648	138.9052512	850.731	2791.112294	3791.112294	3800
T19	WTG_T18	moved	592.551	33.2510707	138.9113734	842.551	2764.275023	3764.275023	3800
T20	WTG_T16	moved	597.678	33.25552059	138.9112862	847.678	2781.09589	3781.09589	3800
T21	WTG_T30		610.282	33.24781394	138.9208958	860.282	2822.447597	3822.447597	3900

WTG_ID	Old ID		ELE [m] LiDAR	Latitude S	Longitude E	TIP HEIGHT[m]	TIP HEIGHT [ft]	Add MOC	LSALT
T22	WTG_T36	moved	650.98	33.25231681	138.9228554	900.98	2955.971223	3955.971223	4000
T23	WTG_T29	moved	631.505	33.25817438	138.9189798	881.505	2892.076864	3892.076864	3900
T24	WTG_T25	moved	690.888	33.26372258	138.9166358	940.888	3086.902986	4086.902986	4100
T25	WTG_T24	moved	677.873	33.26901648	138.9150089	927.873	3044.202853	4044.202853	4100
T26	WTG_T26	moved	635.302	33.27335461	138.9175335	885.302	2904.534214	3904.534214	4000
T27	WTG_T32		641.08	33.27782869	138.9202992	891.08	2923.490907	3923.490907	4000
T28	WTG_T42		702.3	33.26012644	138.9276263	952.3	3124.343932	4124.343932	4200
T29	WTG_T44	moved	702.159	33.26530011	138.929401	952.159	3123.881334	4123.881334	4200
T30	WTG_T52		676.315	33.25435779	138.937872	926.315	3039.091305	4039.091305	4100
T31	WTG_T62		669.709	33.24872264	138.9471219	919.709	3017.418076	4017.418076	4100
T32	WTG_T58		656.857	33.25599221	138.9475133	906.857	2975.25272	3975.25272	4000
T33	WTG_T66	moved	635.236	33.2514489	138.9573993	885.236	2904.317678	3904.317678	4000
T34	WTG_T71	moved	620.701	33.25601879	138.9591788	870.701	2856.630669	3856.630669	3900
T35	WTG_T73	moved	600.686	33.26042378	138.9609596	850.686	2790.964656	3790.964656	3800
T36	WTG_T72	moved	584.792	33.26563065	138.9600129	834.792	2738.818985	3738.818985	3800
T37	WTG_T70		606.015	33.27236774	138.9583191	856.015	2808.448253	3808.448253	3900
T38	WTG_T74		564.032	33.24744397	138.9696506	814.032	2670.708747	3670.708747	3700
T39	WTG_T76		554.557	33.25181883	138.9696316	804.557	2639.622788	3639.622788	3700
T40	WTG_T83	moved	520.193	33.24957622	138.9818117	770.193	2526.880002	3526.880002	3600
T41	WTG_T77		559.576	33.26011038	138.9702338	809.576	2656.089324	3656.089324	3700
T42	WTG_T81	moved	498.675	33.2598104	138.9808098	748.675	2456.282887	3456.282887	3500
T43	WTG_T75	moved	550.264	33.26585377	138.9690454	800.264	2625.538142	3625.538142	3700
T44	WTG_T82	moved	515.266	33.26460837	138.9805482	765.266	2510.715303	3510.715303	3600

WTG_ID	Old ID		ELE [m] LiDAR	Latitude S	Longitude E	TIP HEIGHT[m]	TIP HEIGHT [ft]	Add MOC	LSALT
T45	WTG_T79		573.979	33.27028532	138.9709468	823.979	2703.343262	3703.343262	3800
T46	WTG_T78		544.95	33.27497876	138.9704425	794.95	2608.103758	3608.103758	3700
T47	WTG_T80	moved	521.149	33.28217301	138.970235	771.149	2530.016485	3530.016485	3600
T48	WTG_T12	moved	646.532	33.28226336	138.9062294	896.532	2941.378047	3941.378047	4000
T49	WTG_T11	moved	619.54	33.28757488	138.904795	869.54	2852.821614	3852.821614	3900
T50	WTG_T17		609.548	33.29497962	138.9101666	859.548	2820.03946	3820.03946	3900
T51	WTG_T22		623.003	33.28919572	138.913012	873.003	2864.183163	3864.183163	3900
T52	WTG_T23	moved	624.737	33.28453325	138.9138557	874.737	2869.872139	3869.872139	3900
T53	WTG_T41	moved	661.068	33.28262746	138.9247059	911.068	2989.068337	3989.068337	4000
T54	WTG_T64		556.344	33.28396592	138.9538051	806.344	2645.485649	3645.485649	3700
T55	WTG_T65	moved	597.154	33.28952953	138.9554053	847.154	2779.376729	3779.376729	3800
T56	WTG_T63	moved	609.466	33.29547694	138.9532946	859.466	2819.770431	3819.770431	3900
T57	WTG_T56		614.184	33.28958571	138.9442506	864.184	2835.249435	3835.249435	3900
T58	WTG_T57		686.999	33.29609126	138.9448998	936.999	3074.143799	4074.143799	4100
T59	WTG_T59	moved	666.503	33.30258085	138.9466556	916.503	3006.899703	4006.899703	4100
T60	WTG_T47	moved	661.537	33.28785108	138.9302933	911.537	2990.607051	3990.607051	4000
T61	WTG_T51	moved	606.316	33.29332464	138.9356029	856.316	2809.435785	3809.435785	3900
T62	WTG_T40		661.515	33.29322947	138.9263061	911.515	2990.534873	3990.534873	4000
T63	WTG_T45	moved	648.358	33.29813414	138.928067	898.358	2947.368861	3947.368861	4000
T64	WTG_T49	moved	611.868	33.30388457	138.9327878	861.868	2827.651009	3827.651009	3900
T65	WTG_T55	moved	643.237	33.30890792	138.9398212	893.237	2930.567679	3930.567679	4000
T66	WTG_T28		628.468	33.29855371	138.9181731	878.468	2882.112953	3882.112953	3900
T67	WTG_T38	moved	650.296	33.30332935	138.9258563	900.296	2953.727129	3953.727129	4000

WTG_ID	Old ID		ELE [m] LiDAR	Latitude S	Longitude E	TIP HEIGHT[m]	TIP HEIGHT [ft]	Add MOC	LSALT
T68	WTG_T21		624.337	33.30415546	138.9118665	874.337	2868.559803	3868.559803	3900
T69	WTG_T20		608.835	33.30939298	138.9112322	858.835	2817.700221	3817.700221	3900
T70	WTG_T31		637.296	33.31000545	138.9194934	887.296	2911.076209	3911.076209	4000
T71	WTG_T19		590.778	33.31494286	138.9103059	840.778	2758.458094	3758.458094	3800
T72	WTG_T34		603.53	33.31482347	138.9197568	853.53	2800.295365	3800.295365	3800
T73	WTG_T15	moved	573.996	33.32134623	138.9065728	823.996	2703.399037	3703.399037	3800
T74	WTG_T27	moved	590.426	33.32055045	138.9161187	840.426	2757.303238	3757.303238	3800
T75	WTG_T14		572.257	33.32618149	138.9076418	822.257	2697.693656	3697.693656	3700
T76	WTG_T10	moved	562.144	33.33355011	138.9018512	812.144	2664.514521	3664.514521	3700
T77	WTG_T8	moved	581.742	33.30659799	138.9013302	831.742	2728.812423	3728.812423	3800
T78	WTG_T9	moved	586.517	33.3115654	138.9013031	836.517	2744.478434	3744.478434	3800
T79	WTG_T1	moved	577.043	33.31158335	138.8926115	827.043	2713.395756	3713.395756	3800
T80	WTG_T2	moved	579.436	33.31663875	138.8940923	829.436	2721.246806	3721.246806	3800
T81	WTG_T3	moved	581.452	33.32152132	138.8931548	831.452	2727.86098	3727.86098	3800
T82	WTG_T5		574.885	33.32643701	138.8944581	824.885	2706.315703	3706.315703	3800
T83	WTG_T4		561.282	33.33160553	138.8941322	811.282	2661.686437	3661.686437	3700

Tallest Turbine is T28 [WTG_T42] at 952.3m AHD

APPENDIX B

Airservices Australia Response

ian_jennings@netspace.net.au

From:	Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent:	Thursday, 7 March 2024 10:40 AM
To:	ian_jennings@netspace.net.au
Cc:	Airspace.Protection@casa.gov.au
Subject:	AIRSERVICES RESPONSE: SA-WF-026 - Whyte Yarcowie Wind Farm

OFFICIAL

Hi there,

I refer to your request for an Airservices assessment of the proposed Whyte Yarcowie Wind Farm.

Airspace Procedures
With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a height of 953m (3126ft) AHD the wind farm will not affect any sector or circling altitude, nor any instrument approach or departure procedure at any aerodrome.

Note: Procedures not designed by Airservices at any aerodrome were not considered in this assessment.

Communications/Navigation/Surveillance (CNS) Facilities
We have assessed the proposed activity to the above specified height for any impacts to Airservices Precision/Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections to it proceeding.

Air Traffic Control (ATC) Operations
There are no additional instructions or concerns from our ATC.

Summary
The proposed activity does not impact Airservices operations or facilities at any aerodrome.

Vertical Obstacle Notification
This proposed wind farm is more than 30m (99ft) AGL.

Please follow the below notification process:
1. Complete the Vertical Obstacle Notification Form: ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf (airservicesaustralia.com)
2. Submit completed form to: VOD@airservicesaustralia.com as soon as the development reaches the maximum height.

For further information regarding the reporting of tall structures, please contact the VOD team:
- Phone - (02) 6268 5622
- Email - VOD@airservicesaustralia.com
- Or refer to: Civil Aviation Safety Regulation Part 175 — Airservices and You - Airservices (airservicesaustralia.com)

If you have any further queries, please let our team know.

Kind regards,

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airservices australia | OneSKY AUSTRALIA

Alex Blight
Airspace Development & Protection Coordinator

M: +61 436 325 205
Alastair Hodgson Building – Building 330, Tower Road,
Melbourne Airport, Tullamarine VIC 3043
www.airservicesaustralia.com

in

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging.

OFFICIAL

From: ian_jennings@netspace.net.au <ian_jennings@netspace.net.au>
Sent: Wednesday, January 10, 2024 10:32 AM
To: Airport Developments <Airport.Developments@AirservicesAustralia.com>; Defence Land Management <land.planning@defence.gov.au>
Subject: Whyte Yarcowie Wind Farm AIS

CAUTION: This email was sent from an external email address. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Teams,
Please find attached for your assessment, the Aviation Impact Statement for the Whyte Yarcowie wind farm north of Hallett in South Australia.
Regards
Ian

Ian Jennings
Chiron Aviation Consultants
27 Hilda Street
Essendon Vic 3040
Australia
Mob +61 (0)402 025 223
E-mail ian_jennings@netspace.net.au
URL www.chironaviationconsultants.com.au

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APPENDIX C

Department of Defence Response

ian_jennings@netspace.net.au

From:	Murray, Adam MR 3 <adam.murray3@defence.gov.au>
Sent:	Tuesday, 16 April 2024 3:35 PM
To:	ian_jennings@netspace.net.au
Subject:	RE: Whyte Yarcowie Wind Farm AIS [SEC=OFFICIAL]
Attachments:	Capture.PNG

OFFICIAL

Dear Mr Jennings,

Thank you for referring the Whyte Yarcowie Wind Farm Project to the Department of Defence (Defence) for comment. Defence understands that this wind farm project is proposed to consist of a total of 83 wind turbines (of up 250m in height above ground level) with the highest turbine being 953 m (3125 ft) located near the township of Hallet, South Australia.

Defence has assessed the proposal for any impact on the safety of military flying operations and possible interference to Defence communications and radars. Defence can advise that it has no concerns with the Whyte Yarwowie Wind Farm at this time.

Air Services Australia (ASA) is responsible for recording the location and height of tall structures.
The information is held in a central database managed by ASA and relates to the erection, extension or dismantling of tall structures, RAAF requirements are:
a. 30 metres AGL, that are within 30 kilometres of an aerodrome, and
b. 45 metres AGL elsewhere.

In accordance with Advisory Circular 139.E-01 – Reporting of tall structures, Defence requests that the applicant is to provide Defence and Air Services Australia (ASA) "as constructed" details for the proposed structures so that they can be marked on aeronautical charts.
The details can be emailed to Defence at land.planning@defence.gov.au and ASA at vod@airservicesaustralia.com

The proponent is also to be aware that the Unexploded Ordnance (UXO) database indicates the potential for UXO (Category Other) within this area (see attached).

Should you wish to discuss the content of this advice further, please contact Matt Williams at land.planning@defence.gov.au

Kind regards,

Adam Murray
Assistant Director – Airspace Protection, Training Areas and Strategic Projects
Land Planning and Regulation
Estate Planning Branch / Infrastructure Division
Security & Estate Group

Department of Defence
BP26-1-A004 | Brindabella Business Park | Canberra Airport
T (02) 5109 5509 E adam.murray3@defence.gov.au

From: ian_jennings@netspace.net.au <ian_jennings@netspace.net.au>
Sent: Wednesday, 10 January 2024 10:32 AM
To: 'Airport Developments' <Airport.Developments@AirservicesAustralia.com>; SEG-

1

EstatePlanningBranchExternalLandPlanning&Regulation <land.planning@defence.gov.au>
Subject: Whyte Yarcowie Wind Farm AIS

⚠ **EXTERNAL EMAIL:** Do not click any links or open any attachments unless you trust the sender and know the content is safe. ⚠

Teams,
Please find attached for your assessment, the Aviation Impact Statement for the Whyte Yarcowie wind farm north of Hallett in South Australia.
Regards
Ian

Ian Jennings
Chiron Aviation Consultants
27 Hilda Street
Essendon Vic 3040
Australia
Mob +61 (0)402 025 223
E-mail ian_jennings@netspace.net.au
URL www.chironaviationconsultants.com.au

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Department of Defence – Unexploded Ordnance area (DoD source)

APPENDIX D

Glossary of Terms and Abbreviations

Appendix D
Glossary of Terms and Abbreviations

AERONAUTICAL STUDY GLOSSARY

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies. A full list of terms and abbreviations used in this report is included as an Appendix.

AC (Advisory Circulars) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

AHD (Australian Height Datum) is the datum to which all vertical control for mapping is to be referred. The datum surface is that which passes through mean sea level at the 30 tide gauges and through points at zero AHD height vertically below the other basic junction points.

AIP (Aeronautical Information Publication) is a publication promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. It contains details of regulations, procedures and other information pertinent to flying and operation of aircraft. In Australia, the AIP may be issued by CASA or Airservices Australia.

Air routes exist between navigation aid equipped aerodromes or waypoints to facilitate the regular and safe flow of aircraft operating under Instrument Flight Rules (IFR).

Airservices Australia is the Australian government-owned corporation providing safe and environmentally sound air traffic management and related airside services to the aviation industry.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

AMSL (Above Mean Sea Level) is the elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level datum. In aviation, the ellipsoid known as World Geodetic System 84 (WGS 84) is the datum used to define mean sea level.

ATC (Air Traffic Control) service is a service provided for the purpose of:

a. preventing collisions:

   1. between aircraft; and

   2. on the manoeuvring area between aircraft, vehicles and obstructions; and

b. expediting and maintaining an orderly flow of air traffic.

CASA (Civil Aviation Safety Authority) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation safety standards. As Australia is a signatory to the ICAO *Chicago Convention,* CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

CASR (Civil Aviation Safety Regulations) are promulgated by CASA and establish the regulatory framework *(Regulations)* within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

ICAO (International Civil Aviation Organization) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention.*

IFR (Instrument Flight Rules) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals. It is also referred to as, ña term used by pilots and controllers to indicate the type of flight plan an aircraft is flying,ò such as an IFR or VFR flight plan.

IMC (Instrument Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, less than the minimum specified for visual meteorological conditions.

LSALT (Lowest Safe Altitudes) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

MOS (Manual of Standards) comprises specifications *(Standards)* prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation.

NASAG (National Airports Safeguarding Advisory Group) set up in May 2010 to implement the Australian Governmentõs National Aviation Policy White Paper, *Flight Path to the Future* initiatives relating to safeguarding airports and surrounding communities from inappropriate development. NASAG comprises representatives from state and territory planning and transport departments, the Civil Aviation Safety Authority (CASA), Airservices Australia, the Department of Defence and the Australian Local Government Association (ALGA) and is chaired by the Department of Infrastructure and Transport (DoIT).

NASF (National Airports Safeguarding Framework) is the published guidelines from the NASAG.

NOTAMs (Notices to Airmen) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

Obstacles. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

OLS (Obstacle Limitation Surfaces) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

PANS-OPS (Procedures for Air Navigation Services - Aircraft Operations) is an Air Traffic Control term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) or Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS-OPS may vary from country to country.

PANS OPS Surfaces. Similar to an Obstacle Limitation Surface, the PANS-OPS protection surfaces are imaginary surfaces in space which guarantee the aircraft a certain minimum obstacle clearance. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to penetrate the OLS, they cannot be permitted to penetrate any PANS-OPS surface, because the purpose of these surfaces is to guarantee pilots operating under IMC an obstacle free descent path for a given approach.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Regulations (Civil Aviation Safety Regulations)

VFR (Visual Flight Rules) are rules applicable to the conduct of flight under VMC. VFR allow a pilot to operate an aircraft in weather conditions generally clear enough to allow the pilot to maintain visual contact with the terrain and to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima. If the weather is worse than VFR minima, pilots are required to use instrument flight rules.

VMC (Visual Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima

ABBREVIATIONS

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table:

Abbreviation	Meaning
AC	Advisory Circular (document support CASR 1998)
ACFT	Aircraft
AD	Aerodrome
AHD	Australian Height Datum
AHT	Aircraft height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALA	Aircraft Landing Area
Alt	Altitude
AMSL	Above Minimum Sea Level
A(PofA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DEVELMT	Development
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DITCRD	Department of Infrastructure, Transport, Cities and Regional Development
DIRDC	Department of Infrastructure, Regional Development and Cities. See DIRCRD above
DIRD	Department of Infrastructure and Regional Development. See DIRDC above
DoIT	Department of Infrastructure and Transport. Also called ñInfrastructure.ò (Formerly Department of Infrastructure, Transport, Regional Development and Local Government (DITRDLG) and previously the Department of Transport and Regional Services (DoTARS)). See DIRD above
DITRDLG	See DoIT above
DOTARS	See DITRDLG above
ELEV	Elevation (above mean sea level)

Abbreviation	Meaning
ENE	East Northeast
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
ft	feet
GA	General Aviation
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LSALT	Lowest Safe Altitude
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
SSR	Monopulse Secondary Surveillance Radar
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NDB	Non Directional Beacon
NE	Northeast
NM or nm	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	Northeast
NOTAM	NOtice To AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface

Abbreviation	Meaning
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services ï Aircraft Operations, ICAO Doc 8168
PRM	Precision Runway Monitor
PROC	Procedure
PSR	Primary Surveillance Radar
QNH	An altimeter setting relative to height above mean sea level
Rnnn	Restricted Airspace ï promulgated in AIP as R with 3 numbers
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes ð replaced by the MOS Part 139 ð Aerodromes
RPT	Regular Public Transport
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
SSR	Secondary Surveillance Radar
STAR	Standard ARrival
TAR	Terminal Area Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range

Appendix J

Landscape Character and Probable Visual Effect Assessment

Landscape Character and Probable Visual Effect Assessment

Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

WSP Australia Pty Limited on behalf of Whyte Yarcowie Wind Farm Pty Ltd

21 May 2026

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REVISION	DATE	AUTHOR	REVIEWER
C	21/05/2026	WK/BG	WK
B	24/02/2026	WK/BG	WK
A	04/02/2026	WK/BG	WK

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01 Scope of Assessment

1.1 Introduction

This report has been prepared by Warwick Keates of WAX Design in association with Dr Brett Grimm of Brett Grimm Landscape Architect (BGLA) for WSP Australia Pty Limited on behalf of Whyte Yarcowie Wind Farm Pty Limited. The purpose of the report is to assess the potential visual impact of the proposed Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System (the Project), which includes transmission line connections, BESS and associated infrastructure. In addition, this report evaluates the existing landscape character and the potential visual impacts likely to result from the Project in the regional locality.

The Landscape and Visual Impact Assessment (LVIA) comprises two separate assessments, a landscape character assessment and a visual impact assessment; these are interrelated processes as described in the Guidelines for Landscape and Visual Impact Assessment.[1] The landscape character assessment described in this report considers the existing character of the landscape surrounding the Project within a 10 kilometre radius. The site locality is defined as the area around the Project from which the associated infrastructure is likely to be visible in the landscape, as described in section 1.3 below. The visual impact assessment evaluates and describes the likely effects of the proposed development on the physical landscape, considering changes to its character and the resulting impact on visual amenity.

The potential visual impact will be assessed using the Grimke matrix methodology and digital mapping that considers the Zone Theoretical Visual Influence and the Visual Impact Magnitude, which involves on-site assessments, GIS modelling, the preparation of photomontages, and a detailed visual impact assessment to illustrate the predicted visual effect of the Project within the defined locality. The visual impact assessment forms the second stage of the LVIA process.

1.2 Project Description

The proposed infrastructure corridor will include a series of lattice towers or poles with a maximum height of 50m above ground level. The final tower design is still under consideration, however for the purpose of this assessment, 46.75 metre high lattice tower pylons with a base width of approximately 8 metres, tapering to approximately 2 metres at the top, have been considered as this presents a worst-case scenario regarding visual impacts. However, the final design (including tower heights, design and locations) will be finalised as part of the detailed design process.

The proposed transmission line provides a connection approximately 20 kilometres long connecting the Whyte Yacowie Wind Farm substation to the existing Belalie Substation. The suspension towers are located approximately 400m apart in a linear array. The suspension tower option would incorporate a 275kV circuit. The following images provide a visual reference of the scale, configuration, and dimensions of the proposed transmission line lattice towers used for the visual impact assessment.

1Swanwick, C. (2013). Guidelines for Landscape and Visual Impact Assessment. 3rd ed. United Kingdom: Landscape Institute and Institute of Environmental Management and Assessment.

01 Scope of Assessment

 

Figure 1: Example 275kV suspension tower

02 Introduction

02 Approach and Methodology

2.1 Visual Assessment Approach

The LVIA methodology aims to provide an objective, reliable, credible, replicable and measurable analysis of the potential visual impact when considered against the existing landscape character.

The process for the visual assessment is based on the recommendations of John Ginivan and Planning SA (2002)[2] This process is detailed in Figure 2.

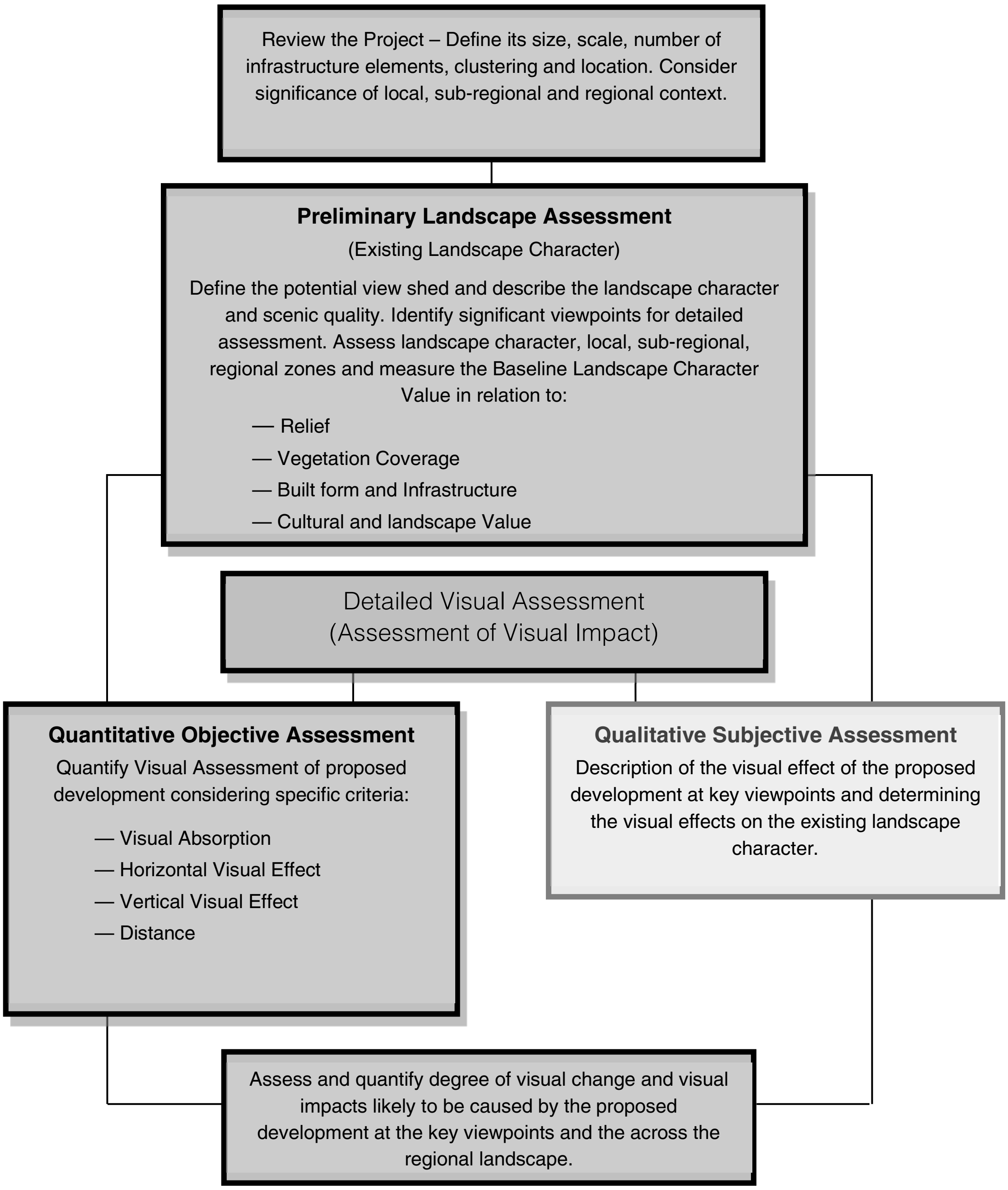

Figure 2: Detailed Visual Assessment Process

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2 Planning South Australia (2002). Advisory Notice Planning- Draft for Consultation 21 Wind Farms. S.A Adelaide

2.2 Guidance and Best Practice

Currently, there is no formalised standard visual assessment methodology at local, state or federal government levels. While various guidelines and frameworks have been developed, they do not provide a definitive methodology or technique to apply. A best practice methodology has been developed for the Project LVIA with reference to the following documents:

- Guidance Note for Landscape and Visual Assessment (2018), Australian Institute of Landscape Architects;
- Solar Energy Facilities Design and Development Guidelines, Department of Environment, Land, Water and Planning, August 2019;
- Environment Protection and Heritage Council (2010) National Wind Farm Development Guidelines;
- Grimm, B (2009). Quantifying the Visual Effects of Wind Farms; A Theoretical Process in an Evolving Australian Visual Landscape. PhD Thesis, Adelaide University;
- Visual Landscape Planning in Western Australia. (2007). A manual for evaluation, assessment, siting and design, Western Australian Planning Commission;
- Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia (2006);
- Lothian, A. (2008). Scenic perceptions of the visual effects of wind farms on South Australian landscapes. Geographical Research, 46:2, 196 – 207;
- Swanwick, C. (2013). Guidelines for Landscape and Visual Impact Assessment. 3rd ed. United Kingdom: Landscape Institute and Institute of Environmental Management and Assessment;

The best practice LVIA methodology utilised in this report has been applied to various projects by Warwick Keates and Dr Brett Grimm since 2011. The methodology has been developed to apply to a range of projects across different government jurisdictions, including South Australia, Victoria and the Northern Territory.

2.3 Definitions

The following definitions have been provided in the visual assessment report to ensure clarity, consistency, and accurate interpretation of the findings. Visual assessments often involve technical terms and subjective criteria that may be understood differently by various stakeholders. By clearly defining key terms, the report aims to reduce ambiguity and align the assessment methodology and findings.

Visual Effect:

This is the potential visibility of the proposed infrastructure within the existing landscape character. The visual effect describes the proposed infrastructure within the landscape. The description is a qualitative summary of the scale and visibility of the proposed infrastructure within the landscape, considering factors like its verticality, horizontal design layout, development form and distance from viewpoints, and how the existing environment may reduce or hide its presence through screening and landscape absorption.

Degree of Visual Change:

This describes the extent to which the proposed infrastructure alters the existing landscape character. The degree of visual change is calculated using the Grimke Matrix and expressed as a percentage change in landscape character.

Visual Impact:

This is a qualitative description of the proposed infrastructure in the existing landscape. The visual impact combines both the visual effect and the degree of visual change, offering a description of the visibility infrastructure and how it interacts with the landscape.

Other definitions are provided below;

Active Field of View:	The field of view excluding peripheral vision, which is described as 40° to each eye, within this zone, colour, shapes and forms are not registered. The active field of view removes the angle of peripheral vision from the field of view, producing an angle of 120 - 160°
Assessment (landscape):	An umbrella term for description, classification and analysis of landscape.
Depth of Field:	The distance between the nearest point (viewpoint) and the farthest objects (visual envelope) that are visible within the field of view.
Element:	A component part of the landscape or visual composition.
Effect (landscape or visual):	These occur as a broad culmination of one or more impacts, incorporating professional judgement to extrapolate and/or generalise on the nature of these.
Horizontal Visual Effect:	This term is used to describe the field of view occupied by the visible part of the infrastructure.
Impact (landscape or visual):	Impacts occur to a particular element of the environment, and they can be described factually by the nature and degree of change.
Landscape:	Human perception of the land is conditioned by knowledge and identity with a place.
Landscape character:	The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how people perceive this. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates a particular sense of place in different areas of the landscape.
Landscape feature:	A prominent eye-catching element, for example, a wooded hilltop, isolated trees or a grain silo.
Mitigation:	Measures, including any process, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual impacts of a development project.
Panorama:	A view covering a wide field of view.
Photomontage:	A visualisation based on the superimposition of an image onto a photograph for the purpose of creating a realistic representation of proposed or potential changes to a view. These are now mainly generated using computer software.
Sensitivity:	The extent to which a landscape or visual composition can accommodate a particular type and scale without adverse effects on its character or value.
Visual Amenity:	The value of a particular area or view in terms of what is seen.
Visual Envelope:	Extent of potential visibility to or from a specific area, viewpoint or feature.

2.4 Limitations and Exclusions

The scope of work and assessment were based on the Project's visual effect. The assessment methodology aims to provide a quantified, qualified measure of the degree of visual change.

The scope of work has been undertaken as a collaborative assessment between Warwick Keates and Dr Brett Grimm. The qualitative GrimKe assessment of the landscape was also reviewed and discussed on site to ensure that a balanced opinion was reached. This method provides a peer review of landscape character and visual effect assessments.

Limited reference was made to the viewer's potential responses or sensitivity to landscape changes from each assessed viewpoint, and to how this influences the perception of the visual effect. The degree of viewer sensitivity is a personal preference: whether the visual change is positive or negative. Accordingly, public perception surveys for each viewpoint did not form part of this process.

2.5 Methodology

The LVIA is based on two assessment stages with reference to the Guidelines for Landscape and Visual Impact Assessment, and is set out in Figure 2:

- Stage 1: Landscape Character Assessment identifies and assesses the importance of landscape characteristics and the existing landscape quality.
- Stage 2: The Visual Assessment aims to quantify the extent to which the development is visible and define the degree of visual change and the associated visual impacts using the photomontages, visual assessment mapping and the Grimke Matrix.

The completed Landscape Character Assessment and Visual Impact Assessment are used to draw several observations and conclusions about the likely magnitude of the proposed development's visual effects on the site locality.

Figure 3 below outlines a detailed description of each process conducted within the project assessment methodology.

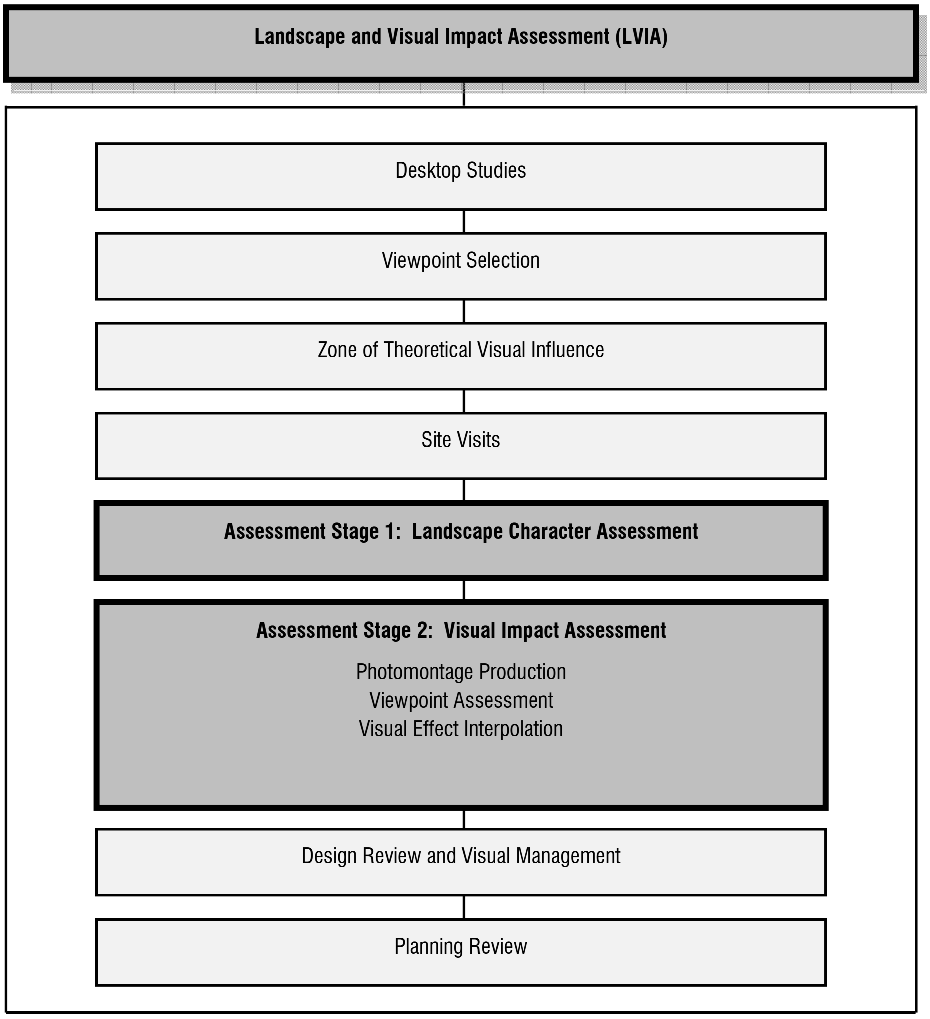

Figure 3: LVIA – Two Assessment Stages and Associated Tasks.

Desktop Studies

The Landscape Character Assessment for the Project includes reviews of the Project documentation, the proposed development location and the infrastructure associated with the proposed development. Analysis of GIS maps, landscape photography, aerial photographs, and supporting literature was conducted to establish a broad understanding of the Project's scope and the existing landscape character.

Zone of Theoretical Visual Influence

To understand where the Project will be visible, ZTVI maps were produced. The mapping provides an illustrative depiction of where the development may be seen within the landscape. The maps quantify how visible the proposed transmission line is likely to be.

The analysis uses a digital terrain model and computer-generated models of the suspension towers to illustrate how many individual towers may be visible from any location around the transmission line within the 10 kilometre regional landscape assessment area. It should be noted that the ZTVI does not account for the impact of local vegetation, buildings, or localised landforms, and is based on a 10 metre contour dataset.

This means that theoretically, the potential visual impact illustrated by the ZTVI of the transmission line is evaluated within a landscape devoid of any screening vegetation or other features and represents a ‘worst case’ scenario. In reality, existing screening vegetation, especially road reserves and property boundaries, as well as local landforms, mitigate the transmission lines' potential visibility.

Viewpoint Selection

Viewpoint selection was conducted by WAX Design and BGLA as part of a site visit on 29 November 2025 and interrogation of GIS desktop analysis mapping of topography, geographic features and public accessibility.

During the site visit, several viewpoints around the Project were selected to assess the likely visual impact. The ZTVI informed the viewpoint locations, validating the likely number of suspension towers visible within landscape character areas surrounding the Project site. Areas of visual intensity were assessed on-site for potential vegetation screening and/or open panoramic views toward the Project.

The selection of the viewpoints provides locations from which a detailed visual assessment of the potential visual effect can be made as part of the Stage 2 assessment.

Best-practice methodology requires that assessment viewpoints be selected based on the following criteria: each viewpoint is typical of the landscape character, publicly accessible, adjacent to areas of private land ownership, and where a large proportion of the development and associated infrastructure is visible. This approach means that the assessment of the Project's visibility seeks to highlight or amplify its potential visual effect, thereby increasing the degree of visual change and, consequently, making the assessment a conservative position regarding the Project’s visual impact.

02 Introduction

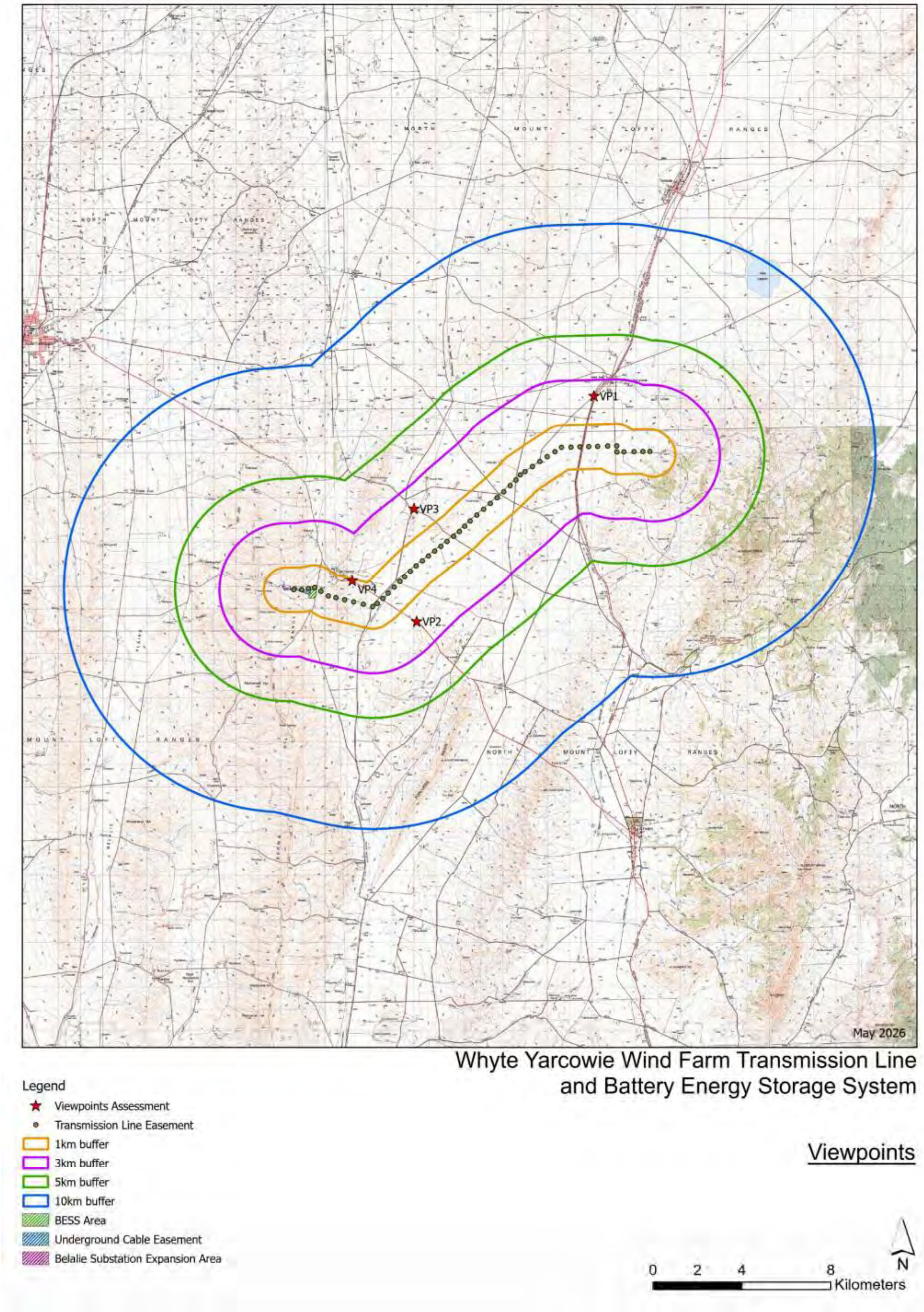

Figure 4: Viewpoint Locations

Assessment Stage 1: Landscape Character Assessment

The assessment includes identification and description of the existing landscape character, considering areas of defined landscape quality determined by topographic form, land use, and vegetation associations, including patterning, colouration and textural relief. In addition, special landscape features and settlements are identified. Mapping and photographic surveys are undertaken, and written commentary describes the locality and the existing landscape character of the site and its surrounds.

The viewpoint selection was confirmed as part of the Landscape Character Assessment, and the base photography was taken to support the photomontage production.

Assessment Stage 2: Photomontage Production

Photomontages of the proposed development from each viewpoint were produced. The photomontages represent a 120-degree horizontal field of view with a 50mm lens digital equivalent photo capture. This has been proven to represent the human binocular field of view and represents a best practice approach with reference to 'Photography and photomontage in landscape and visual impact assessment' (2011), Landscape Institute (advice note 01/11).

The photomontage images were used to inform the detailed viewpoint assessment.

Assessment Stage 2: Visual Impact Assessment

The assessment of the visual impact includes the production of photomontages to assist in the quantification and qualification of the potential visual effect. The viewpoints identified during the preliminary assessment stages were evaluated against a set of landscape and visual criteria. The assessment results were then mapped and interpolated to demonstrate the likely visual impact of the Project across the regional landscape.

The Stage 2 assessment of the Project uses a combination of visual assessment measurements and descriptive text. This comprises an assessment of the prepared photomontages and a detailed assessment of the baseline landscape character and resulting visual impact.

A summary of the assessment process undertaken is included below. For further details on the methodology and how each quantified value is calculated, refer to Appendix D. Initially, the baseline landscape character for each viewpoint was assessed considering the following:

- Relief (the complexity of the land that exists as part of the underlying landscape character);
- Vegetation Cover (the extent to which vegetation is present and the potential to screen and filter views);
- Infrastructure and Built Form (the impact of development on landscape and visual character); and
- Cultural Sensitivity (existing cultural overlays, planning designations and any identified listing of heritage items and local sensitivities to landscape, such as scenic drives and viewpoints).

A numerical value was generated for the existing landscape between 4 and 20, relative to each viewpoint. This value formed the baseline assessment value, where higher values represent landscapes with increasing scenic landscape character or greater sensitivity to change. The impact of the development on the landscape modifies this baseline value, which in turn informs the degree of visual effect.

Following the landscape character assessment, each viewpoint was then assessed to understand the visual character when assessed against the following visual criteria to generate a value between 4 and 20, with higher values representing increasing visual impacts:

- Percentage of landscape absorption (the landscape's ability to absorb and screen the development form);
- Horizontal visual effect (percentage spread of the development in the field of view);
- Vertical visual effect (vertical scale of the development as a percentage of the existing landscape scale within the field of view); and
- Distance of visual effect (distance between viewpoint and development).

The landscape and visual assessment measurements were combined to produce a quantified value for the degree of visual impact (percentage of visual change) that resulted from the Project at each viewpoint.

The following Table 3 is a summary of the degree of visual impact classifications described in the GrimKe matrix with reference to the percentage of visual change; for further details, refer to Appendix D.

Percentage of Visual Change	Descriptive of Visual Impact	Descriptors – appearance in the central vision field	Comments
81-100%	**Extreme**	*Commanding, controlling the view*	*Extreme change in view: a change that is very prominent, involving the total obstruction of the existing view or a change in the character and composition of the landscape and view, through the loss of key elements or the addition of new or uncharacteristic elements that significantly alter the underlying landscape's visual character and amenity. The sensitivity of the underlying landscape character to change is unable to accommodate or mitigate the introduction of development, and the visual effect is highly adverse.*
61-80%	**Severe**	*Standing out, striking, sharp, unmistakable, easily seen*	*Severe change in view involving the obstruction of existing views or the alteration of the underlying landscape's visual character through the introduction of new elements. Change may differ in scale and character from the surroundings and wider setting, or involve a significant shift in the context of the existing landscape character.*
41-60%	**Substantial**	*Noticeable, distinct, catching the eye or attention, clearly visible, well defined*	*Substantial change in view: which may involve partial obstruction of existing view or alteration of underlying landscape visual character and composition through the introduction of new elements. The composition of the view will alter; however, the sensitivity of the underlying landscape character to change is low, and the landscape has the capacity to mitigate and absorb the visual effects.*

Percentage of Visual Change	Descriptive of Visual Impact	Descriptors – appearance in the central vision field	Comments
21-40%	**Moderate**	*Visible, evident, obvious*	*Moderate change in view: change will be distinguishable from the surroundings, while the composition and underlying landscape visual character will be retained. The sensitivity of the existing landscape to change is low.*
0-20%	**Slight**	*Lacking sharpness of definition, not obvious, indistinct, not clear, obscure, blurred, indefinite*	*Slight change in view: change barely distinguishable from the surroundings. The composition and character of the view are substantially unaltered.*

Table 1: Classification of Visual Impacts

Assessment Stage 2: Visual Effect Interpolation

The findings of the visual impact assessment for each viewpoint were used to calculate a percentage indicating the degree of visual change. Each viewpoint was mapped in GIS, and the values were used for weighted interpolation. The ZTVI was overlaid onto the visual effect interpolation map to define the extent of visibility. The combination of visual effect interpolation and ZTVI provided a map of the likely visual impact in the region resulting from the Project.

Design Review and Visual Management

As part of a design review process, the potential for visual management and mitigation is considered.

Planning Review

A review of the landscape and visual impacts of the Project from a planning context was also undertaken. In particular, the potential visual impact of the Project has been reviewed and discussed against the relevant desired character statements with specific reference to landscape and visual character.

03 Landscape Character Assessment

3.1 Project Locality

The Project site is situated north of Hallett, close to the Barrier Highway (A32), and is approximately 150 kilometres from Adelaide in the state's Mid North. The Project site is with the Regional Council of Goyder.

The locality associated with the Project site is defined by agricultural land uses, the topography of the Northern Mount Lofty Ranges and the township of Whyte Yarcowie to the northwest.

The Project site and broader regional context are bounded by various topographic forms associated with the northern extent of the Northern Mount Lofty Ranges. These include Willogoleche Hill and the Porcupine Range, with elevations of approximately 660m above Australian Height Datum (AHD). To the west, the Brown Hill Range forms a north-south-oriented ridge with a consistent elevation of 700 metres AHD. Mount Bryan, approximately 8km east, is a prominent landform with a summit elevation of 932 metres (AHD).

The locality of the Project site is defined by the containment created by these ridgelines, including Willogoleche Hill, Porcupine Range and Brown Hill Range. Together, they produce a series of visual envelopes that visually contain the wide agricultural plain where the transmission line and the project site are located.

Wind turbines associated with the Hallett and North Brown Hill Wind Farms are visible on the higher ridgelines and introduce a distinct infrastructure character to the wider landscape setting.

The proposed transmission line, associated BESS, and substation extensions are located within a broad, low-lying valley between the parallel north–south-oriented ridgelines of the northern Mount Lofty Ranges.

Figure 5: View looking west towards Michells Road

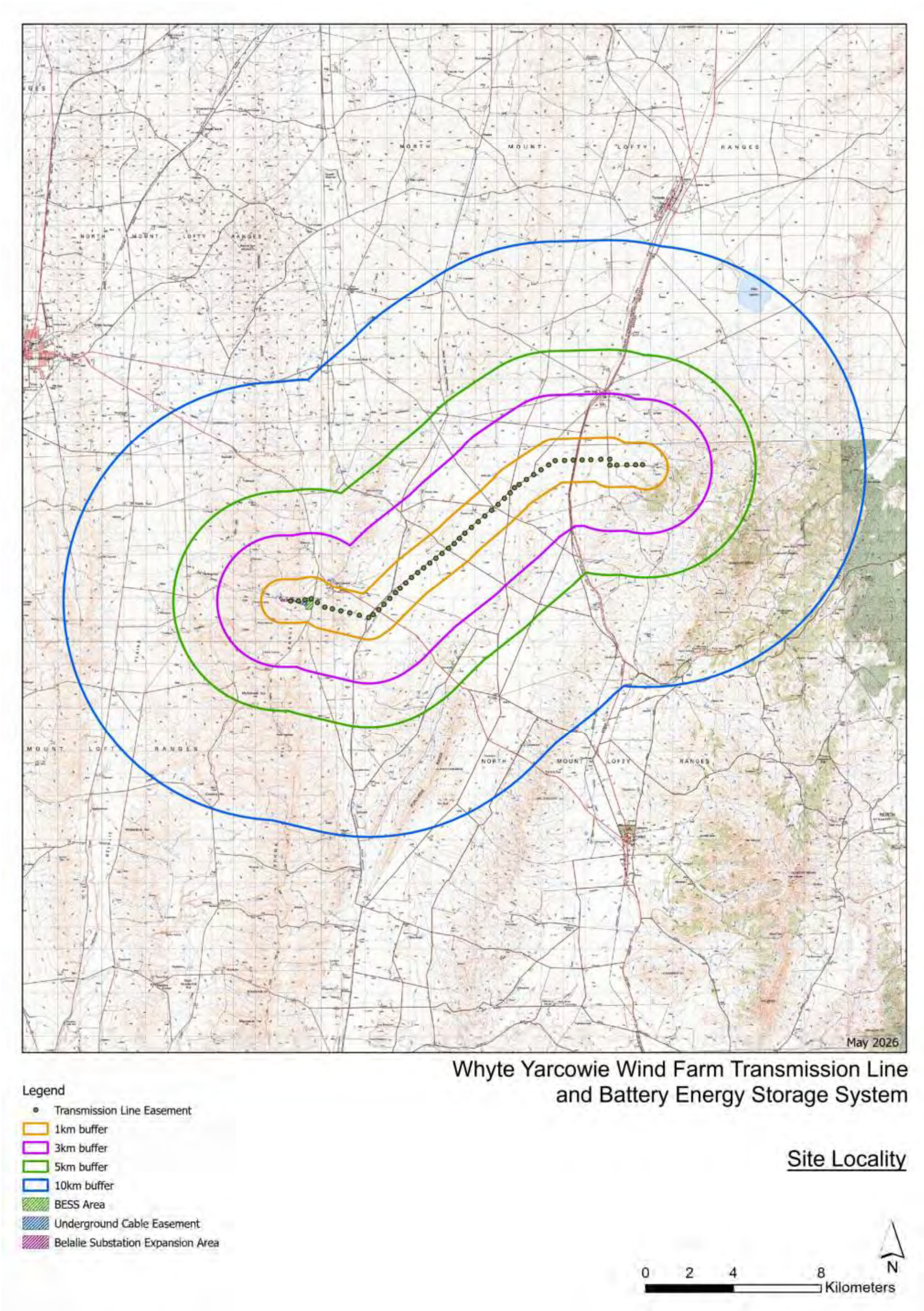

Figure 6: Proposed site location

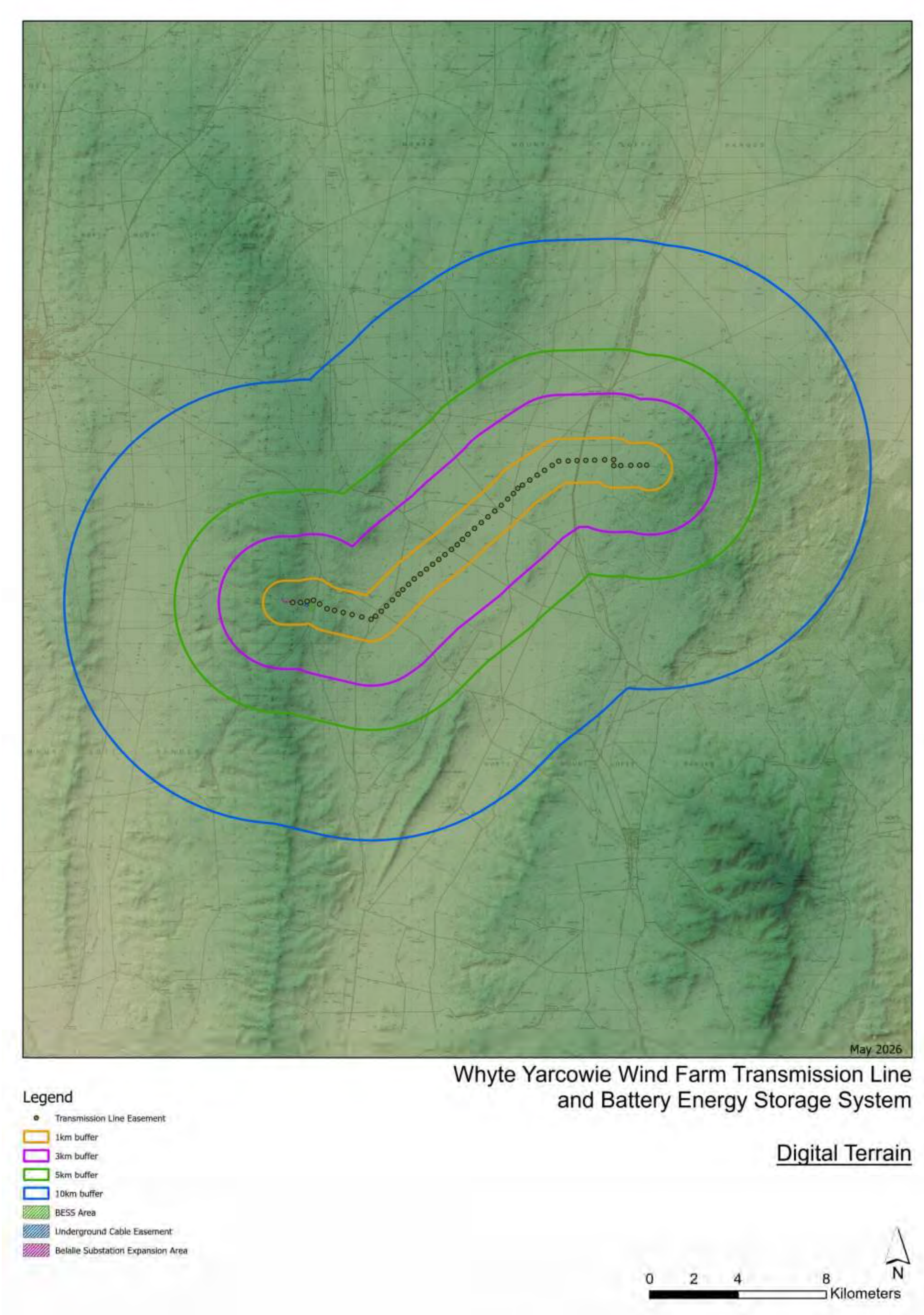

Figure 7: Topographic digital terrain model (10m contours)

3.2 Landform and Topography

Two primary landform components define the topography of the locality. These are regional ridgelines – prominent north–south that form the North Mount Lofty Ranges and extend along the eastern and western edges of the Project site's locality. These ridgelines, including the Brown Hill Range, Willogoleche Hill, and the Porcupine Range, form distinct visual envelopes to the south and west.

The other landform feature is a low-lying agricultural plain that forms a central landscape feature – a broad, gently undulating plain between the ranges, incorporating smaller local ridges and shallow valleys.

3.3 Land Cover and Land Use

The landscape character, land cover and land use associated with the locality are typical of agricultural and land management practices in the mid-north region. Land cover is dominated by large-scale arable cropping, generally uniform in character and arranged across large cadastral boundaries.

Belts of trees and small groups of isolated paddock trees reflect cadastral and property boundaries, road corridors, tracks and creek lines. This vegetation cover reinforces the underlying agricultural use, providing vegetated edges, screens and shelter belts across the locality.

Cropping and arable land uses are predominant across the lower-lying land between the ranges. Grazing is more prevalent on the escarpment slopes, where steeper topography limits cropping, producing a subtle change in texture and colour while maintaining the overarching rural land use.

Infrastructure elements within the rural setting of the locality include monopole and lattice transmission lines, rural road corridors, properties, auxiliary buildings and existing wind turbines on the local ridgelines. While the broader region already has wind and other renewable energy infrastructure, the Project site and the plains north of Willogoleche Hill have little infrastructure. Consequently, the proposed transmission line alignment will introduce a new infrastructure corridor into the agricultural landscape of the locality.

Figure 8: View looking south from Michells Road

3.4 Township and Settlement Pattern

Whyte Yarcowie is a small, isolated township located adjacent to the Barrier Highway. It comprises a main arterial road, a cluster of dwellings and rural properties with belts of mature trees providing local amenity to the area.

Tree planting along the edges of the township provides a degree of visual enclosure and screens views from the town to the south and west. This screening limits the visibility of the wind turbines on the surrounding ridgelines.

Beyond the township, the settlement pattern is characterised by widely spaced farmsteads and dwellings located along rural roads such as Mitchell's Road, Sunshine Road, Jones Road and the access roads to Old Canowie.

Several of the rural properties are surrounded by shelter belts and garden vegetation that provide enclosure and screening to the immediate vicinity. The historic settlement and farm complex associated with Old Canowie creates a distinct landscape character, with the interplay of valleys and ridgelines of the Brown Hill Range, producing a complex visual setting with focused views along local valleys to the heritage buildings of Old Canowie.

Figure 9: View looking north towards Sly Hill

3.5 Landscape Character

The following assessment considers the underlying landscape character surrounding the Project site. It considers the landscape and visual character to the north, east, south, and west.

3.5.1 Northern Regional Landscape (northeast and northwest)

To the north of the Project, the landscape is characterised by an open agricultural plain dominated by broad arable fields. Tree belts and isolated paddock trees are aligned to cadastral boundaries and farm access tracks, reinforcing the simple rectilinear pattern of land division.

Local undulating ridgelines associated with the Brown Hill Range create defined visual envelopes and provide elevated vantage points from which extensive views across the lower-lying agricultural landscape are present. Further north, Brown's Hill and Sly Hill produce distant visual envelopes.

3.5.2 Eastern Locality

The east and northeast of the Project site are impacted by localised landforms of Mount Scrub, Round Hill and Pigeon Box Creek. These landforms create a well-defined visual envelope and limit long-distance views further east.

Within this area, the landscape remains predominantly cropped with relatively sparse vegetation cover compared to other parts of the locality.

From eastern and north-eastern approaches, visibility of the proposed transmission line will generally be intermittent, filtered or screened by these landforms, with glimpsed views of pylon tops above ridges at greater distances.

Figure 10: View looking north from Yards Road across low lying rural landscape

3.5.3 Southern Locality

To the south of the Project site, including locations along the Barrier Highway, the landscape is characterised by lower-lying agricultural land with extensive open views northwards to the local ridgelines and the more elevated northern Mount Lofty Ranges to the north-west.

Vegetation cover to the south is relatively sparse, with fewer tree belts and isolated trees, resulting in an open visual character across the agricultural landscape to the surrounding ridgelines.

From these locations, the proposed transmission line will extend diagonally across the field of view from north-east to south-west, forming a prominent, continuous line of vertical infrastructure within the rural context. The visual prominence of the infrastructure is accentuated where the alignment tracks upslope towards Hill Range.

3.5.4 Western Locality

The western and northwestern locality incorporates the lower-lying plains and the rising foothills and escarpments of Brown Hill Range and Porcupine Range. Brown Hill Range, in particular, forms the western edge of the locality and is punctuated by numerous wind turbines, creating strong vertical elements along the elevated horizon line.

To the northwest, local ridgelines and valleys provide a more complex landform setting, with views opening and closing along road corridors such as Jones Road and around Old Canowie. From these locations, the visual character comprises three distinct elements, including low-lying arable plain, the rising ranges forming the North Mount Lofty Ranges, and the existing turbines on the ridgelines.

The proposed transmission line will be experienced as an additional infrastructure element crossing the plain and extending towards the escarpments. The proposed BESS and substation extension are located within discrete valley forms in the foothills of the Brown and Hill Ranges, where the surrounding topography provides a high level of visual containment and limits visibility across the wider landscape.

Figure 11: View of arable crop land use

Figure 12: View looking north from Booborowie Road across rural landscape

03 Landscape Character Assessment

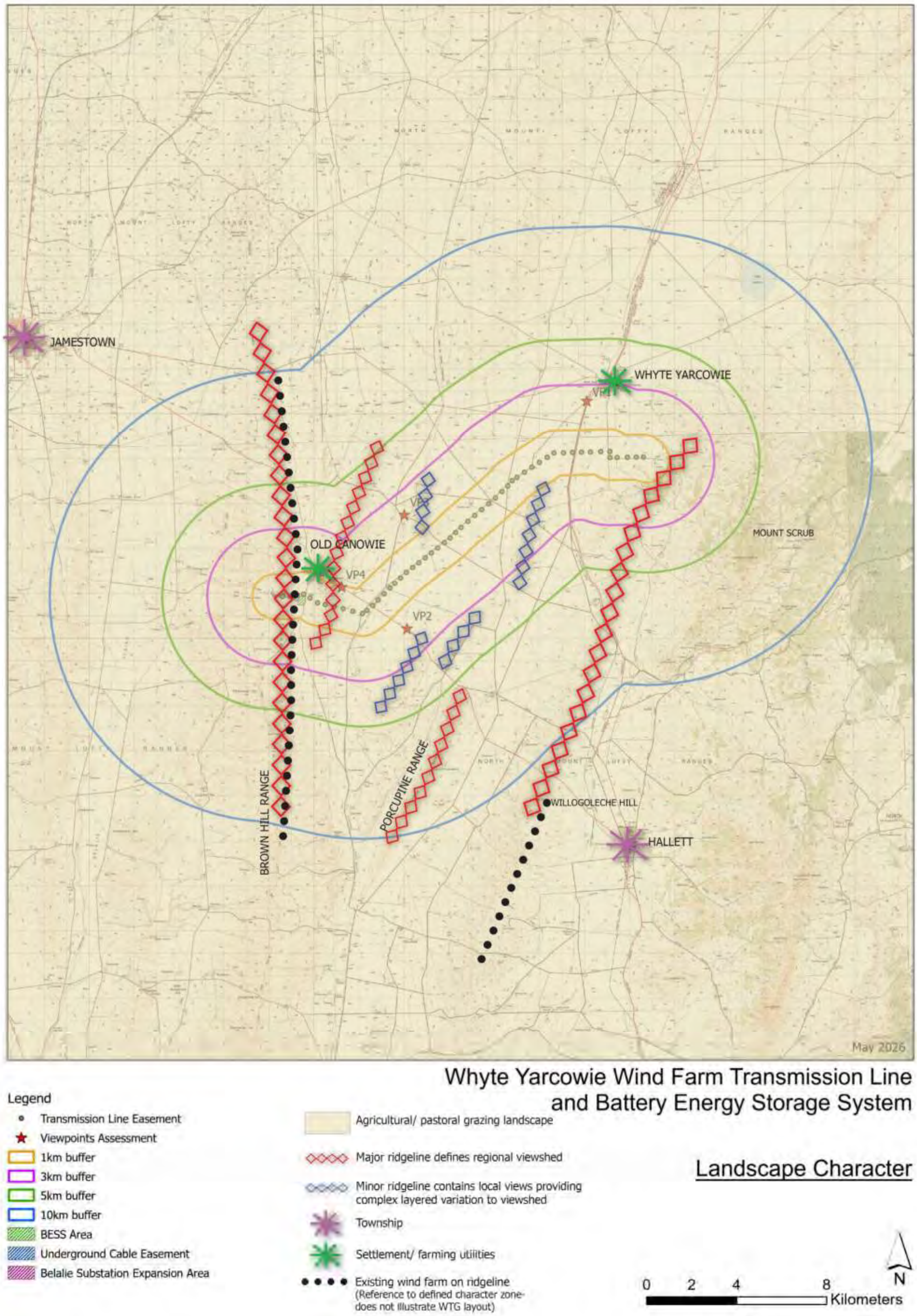

Figure 13: Landscape character mapping

05 Visual Impact Assessment

04 Theoretical Visual Impact Mapping

4.1 Zone of Theoretical Visual Influence (ZTVI) Methodology

The Zone of Theoretical Visual Influence (ZTVI) mapping illustrates the potential visibility of the suspension towers within the landscape. The mapping quantifies the number and extent of suspension towers likely to be visible in the broader landscape.

The ZTVI mapping is developed in GIS using 10 metre contour data for a 10 kilometre radius around the Project site. The ZTVI represents where the infrastructure will be visible and how many suspension towers will be seen. The methodology creates a 'worst case' scenario as it does not incorporate the screening provided by vegetation, built form, or localised screening effects.

4.2 Steradian Intensity Preliminary Assessment Method

This methodology provides a combined, quantitative assessment of visual occupancy by the infrastructure (solid angle/steradians) and view interruption (occlusion ratio) associated with the proposed development (e.g., transmission suspension tower) across the regional landscape.

The mapping uses computer-generated models, digital viewer environments (spherical), to assess the visual magnitude and digital terrain models to express the impact of topography. The resulting map is used to generate a preliminary baseline visual intensity map (heat map). This supports the delineation of zones of theoretical visual influence and the prediction of the likely magnitude of steradian-based visual occupancy from potential receiver locations.

This method is intended to support the broader assessment of landscape and visual effects, which is undertaken using the Grimm Matrix.

Inputs and modelling assumptions

- Geographic location and elevation of each structure (tower coordinates and base levels)
- Structure geometry: height, width/plan envelope, and representative projected silhouette (lattice/monopole typology as applicable)
- Alignment/layout and any alternative options tested

Terrain and observation parameters

- Digital Elevation Model (DEM) appropriate to the scale of assessment
- Observer height (typical: 1.5–1.7 m above ground level unless otherwise specified)

Steradian-based visual occupancy (solid angle) calculations

- Solid angle (Ω) quantifies the proportion of an observer's viewing sphere occupied by the development. It is expressed in steradians[3] (sr) and used as a proxy for visual presence or visual intensity.
- For each sampled receiver location (or viewpoint), the development is represented as a projected silhouette (or set of silhouettes per structure). The solid angle is estimated using a small-angle approximation:
- For multiple structures visible in the same view, steradian values may be calculated individually and then **summed** to provide a cumulative steradian occupancy value

[3] *A steradian is related to the surface area of a sphere in the same way a radian is related to the circumference of a circle; https://www.mathsisfun.com/geometry/steradian.html (accessed 03/02/26)*

for that receiver location (subject to avoiding double-counting where silhouettes overlap in projection).

Output

- Steradian outputs are spatially interpolated to produce a baseline visual intensity heat map, representing the theoretical spatial distribution of visual occupancy across the region. Results are presented using a logarithmic scale to improve interpretability and to distinguish meaningful gradients across the wider landscape, with high values near the development and rapidly diminishing with distance.

Baseline mapping

The combined method of ZTVI and Steradian Intensity mapping supports a structured interpretation as follows:

- Steradians quantify overall visual presence and support cumulative comparisons between options.
- ZTVI provides classification of the number suspension tower visible within the regional landscape and viewshed; it does not calculate the intensity of the viewer's field of view.

Limitations and interpretation notes

This modelling approach is intentionally conservative and is subject to the following limitations:

- The heat map and steradian modelling are based primarily on terrain and geometric relationships and are limited in interpreting vegetation or built form screening, including canopy density, seasonal variation, shelterbelts, buildings, and fine-grain local barriers.
- The outputs represent theoretical visual influence only. They do not by themselves describe landscape character, viewer sensitivity, or the acceptability of change.
- Steradian results are inputs to the magnitude of visual intensity. Overall significance is determined using the Grimm Matrix, which incorporates baseline landscape character, sensitivity, and the likely degree of visual change.
- Results are influenced by DEM resolution, the representation of structure geometry, receiver sampling density, and the assumptions used for silhouette area and viewing direction.

Accordingly, the heat map and associated mapped zones are presented as baseline visual-intensity outputs to guide analysis and viewpoint assessment and are interpreted alongside fieldwork verification and the Grimm Matrix assessment.

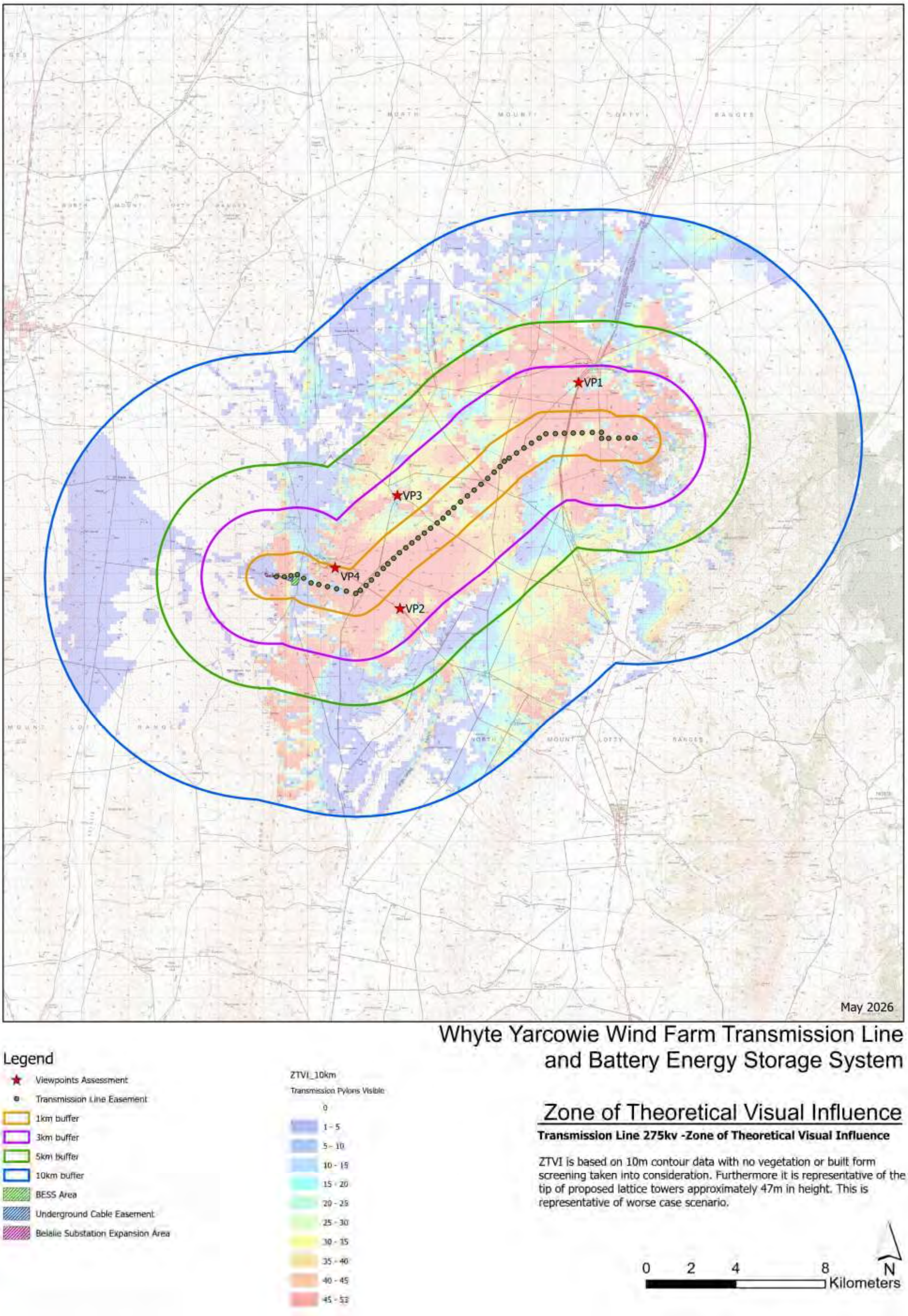

Figure 14: ZTVI map for the transmission line

05 Visual Impact Assessment

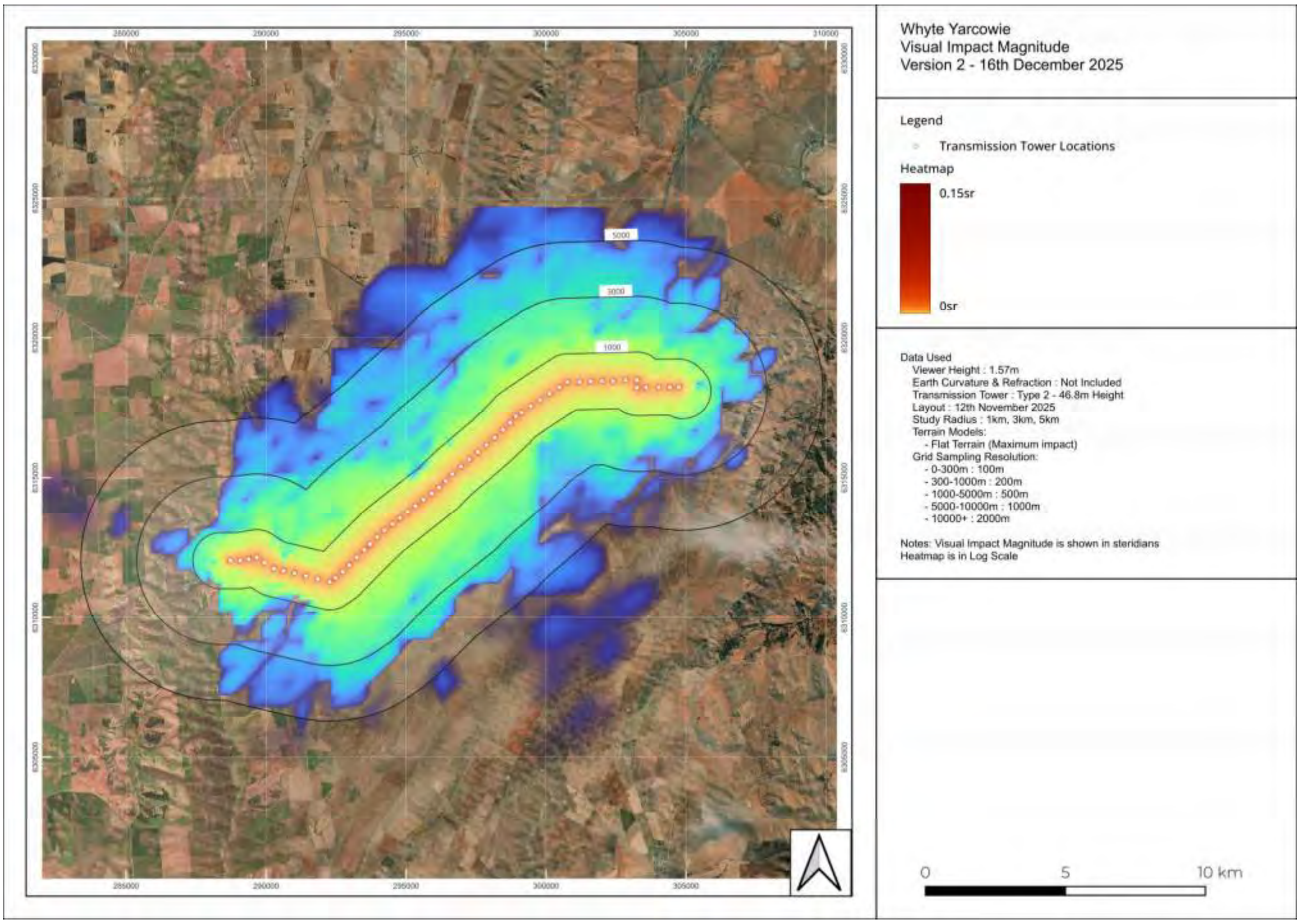

Figure 15: Mapping of visual impact magnitude using a heat map measurement of steradians (refer Section 4.2)

05 Visual Impact Assessment

5.1 Visual Impact Assessment

The Visual Impact Assessment was based on a 20 kilometre transmission line corridor within the site locality, as described in the Landscape Character Assessment, and was conducted within a radius of 10 kilometres from the centre of the Project site.

Using the visual assessment matrix as described in Appendix D, the potential degree of visual change and resulting visual impact of each viewpoint was measured using the following process and criteria:

- Baseline Landscape Character Value measures four relative values of the existing landscape character. Relief, vegetation cover, infrastructure, built form, and cultural sensitivity are measured using a range of 1 to 5. An aggregated value is expressed as a number between 4 and 20.
- Visual Assessment value measures the visibility of the Project in the landscape. The percentages of visual absorption, horizontal visual effect, vertical visual effect, and distance are calculated and rated on a scale of 1 to 5. The Visual Assessment value is aggregated and is expressed as a number between 4 and 20. This number represents the Visual Impact Value.
- Visual Impact Value summarises and describes the Visual Assessment, where 5-8 is Low, 9-12 is Medium, 13-16 is Medium (increasing), and 17-20 is High.
- Coefficient of Visual Impact is produced by dividing the Visual Impact Value by 20 to create a numerical value that represents the potential visual impact of the Project.
- Percentage of Visual Change measures the visual change on the existing landscape that results from the Project's development and is calculated using the Coefficient of Visual Impact Value multiplied by the Baseline Landscape Character Value and expressed as a percentage.
- Visual Effect is a qualitative description of the impacts resulting from the development of the Project in the existing landscape. The Visual Effect is a series of scaled descriptions that consider Slight (0-20%), Moderate (21-40%, Substantial (41-60%), Severe (61-80%) and Extreme (81-100%), as described in Table 2.

This visual assessment process provides a relative measure of the visual effect and considers the Percentage of Visual Change created by the Project on the Baseline Landscape Character Value. The visual assessment also includes a description of the viewpoint context in relation to the landscape character and the potential visual effects. Photomontages of the Project support this assessment, as do wireframe illustrations.

The viewpoints selected for the visual impact assessment are listed below:

1. Viewpoint 1 – Whyte Yarcowie, Barrier Highway (sub-regional - northeast)
2. Viewpoint 2 – Jamestown Hallet Road (sub-regional – south)
3. Viewpoint 3 – Common Boundary Road (sub-regional – north)
4. Viewpoint 4 – Old Canowie Station, Jamestown Hallet Road (sub-regional- northwest)

For clarity and legibility of the report, all reference maps and photomontages have been included in Appendix A and C at A3 paper size.

5.2 Viewpoint 1 – Whyte Yarcowie, Barrier Highway (sub-regional - northeast))

Viewpoint Context

Viewpoint 1 is located north of the Project site and represents typical views from the edge of Whyte Yarcowie, along the Barrier Highway, and within the surrounding agricultural landscape. The landscape is low-lying with gentle undulations, extensively cleared for cropping and with limited belts of vegetation.

From this viewpoint, the proposed transmission line will be clearly visible, with pylons forming a regular sequence of infrastructure elements across the visually open rural landscape. The alignment runs north-east to south-west across the field of view, creating a noticeable linear infrastructure corridor in an otherwise visually open panorama. Notwithstanding the openness, the absence of nearby dwellings and the presence of existing distant turbines mean that, while prominent, the infrastructure will be perceived within a modified rural landscape context.

Figure 16: Existing: Viewpoint 1

Figure 17: Digital Overlay showing the transmission line lattice towers: Viewpoint 1

Figure 18: Absorption Capacity Calculations: Viewpoint 1 (see Viewpoint Assessment below for details)

Viewpoint Assessment

Assessment	Value	Description
Relief	2	From Viewpoint 1, visual relief is perceived as limited to minor elements, characterised by gentle vertical complexity and subtle layering within the landscape. This effect is reinforced by the Western Brown Hill Range, which provides a strong sense of visual containment. The landform reads as cohesive rather than dramatic, with minor variations in elevation and form contributing to depth and legibility without creating pronounced contrast or visual disruption.
Vegetation Coverage	2	Vegetation coverage is generally sporadic and largely associated with road corridors and the surrounding built form of the Whyte Yarcowie Township. Vegetation is more evident on the eastern side of the viewpoint, where street trees and scattered plantings contribute to localised greening and visual softening. In contrast, the western plains exhibit limited vegetative cover, resulting in a more open landscape character, with views extending toward the Brown Hill Range, where landform rather than vegetation provides the primary visual structure.
Infrastructure and Built Form	3	Infrastructure and built form comprise isolated structures associated with the Whyte Yarcowie settlement and surrounding rural land uses. In addition, the existing wind farm along the Brown Hill Range ridgeline introduces larger-scale infrastructure into the landscape. This element contributes a degree of visual modification, with tall, linear forms reading against the ridgeline and establishing an established presence of infrastructure within the broader landscape context.
Cultural and Landscape Value	2	Cultural and landscape value is limited to the frequency and sensitivity of views experienced along the Barrier Highway and within the immediate surrounds of the township of Whyte Yarcowie. The township is a low-key settlement with a small population, and no notable cultural landmarks or formal heritage associations characterise the landscape. As such, the viewpoint's value is largely defined by its function as a transient viewing corridor and by its contribution to the local landscape character, rather than by any strong cultural or symbolic significance.
Baseline Landscape Character Value	**9**	
Landscape Absorption	3	From this viewpoint, there are limited topographic forms in the foreground and midground; however, vegetative screening is present in the foreground. The development is noticeable in the landscape, with moderate absorption of 51%. This equates to 832464 pixels, representing the development divided by the total area the development occupies, 1636493 pixels, as a percentage.
Horizontal Visual Effect	4	The horizontal visual effect is recorded at 96 degrees, representing 80 per cent of the field of view.

Vertical Visual Effect	1	The vertical scale of the existing landscape is referenced at an elevation of 600 metres, 4 kilometres away. The maximum elevation of the pylons is 613 metres at a distance of 14.2 kilometres from this viewpoint. The transmission line will have minimal visual vertical impact and will be seen relative to the existing vertical landscape scale. Tan α_1 = 0.018
Distance of Visual Effect	4	The closest pylon is approximately 2.3km at a bearing of 177 degrees
Visual Impact Value	**12**	**With moderate absorption and a relative vertical scale to the existing landscape, the proposed development will have a moderate visual effect.**
Coefficient of Visual Impact	0.6	
Percentage of Visual Change	**27%**	0.6x9= 5.4 (Landscape visual effect) 5.4/20= 0.27 (Degree of visual change) 0.27 x 100 = 27% visual change to the landscape
The visual effect is described as a Moderate change in view: the change will be distinguishable from the surroundings, whilst the composition and the underlying landscape visual character will be retained.		

5.3 Viewpoint 2 – Jamestown Hallet Road (sub-regional – south)

Viewpoint Context

Viewpoint 2 is located south of the proposed development and represents the low-lying agricultural landscape along the proposed transmission line alignment. The visual character is open, with expansive views northward to local ridgelines of the Brown Hill Range and other landforms associated with the North Mount Lofty Ranges.

From this viewpoint, the proposed transmission line will appear as a prominent, uniform series of suspension towers extending across the field of view from north-east to south-west. The vertical scale of the suspension towers is comparable to the elevation of the surrounding ridgelines. While the landform provides some visual mitigation, the proposed development will create a strong horizontal band of infrastructure, introducing a noticeable degree of visual change to the rural context. The prominence of the proposed transmission line increases to the northwest as the alignment follows the topography of the Brown Hill Range.

Figure 19: Existing: Viewpoint 2

Figure 20: Digital Overlay showing the transmission line lattice towers: Viewpoint 2

Figure 21: Absorption Capacity Calculations: Viewpoint 2 (see Viewpoint Assessment below for detail)

Viewpoint Assessment

Assessment	Value	Description
Relief	2	Slightly elevated vertical visual relief, most evident within the middle-ground landform, which transitions gently into the background. This elevation contributes to a degree of visual containment, effectively separating the immediate viewing envelope from longer-distance panoramic views. As a result, the overall visual experience is moderated, with the landform serving as a subtle screen that limits expansive vistas and reinforces a contained, locally focused landscape character.
Vegetation Coverage	1	Limited to isolated trees. The landscape is characterised by scattered scrub, low ground cover and open pastoral land associated with agricultural grazing. Vegetation structure is generally low in height and sparse in distribution, resulting in minimal interruption to views across the landscape and reinforcing the openness and exposure of the viewing environment.
Infrastructure and Built Form	3	Infrastructure and built form comprise isolated structures associated with the Whyte Yarcowie settlement and surrounding rural land uses. In addition, the existing wind farm along the Brown Hill Range ridgeline

		introduces larger-scale infrastructure into the landscape and establishes an infrastructure presence within the broader landscape context.
Cultural and Landscape Value	1	No known cultural heritage items or identified sensitivities present in the immediate viewing area. The landscape is predominantly rural and situated some distance from major transport corridors and established settlements. As a result, the area is not associated with frequent or sensitive viewing receptors, and cultural landscape values are considered low within the broader regional context.
Baseline Landscape Character Value	**7**	
Landscape Absorption	5	From this viewpoint, there are limited topographic forms or vegetative screening in the foreground. The development is noticeable in the landscape, with a minor absorption rate of 7 per cent. This equates to 160429 pixels, representing the development divided by the total area that the development occupies, 2346994 pixels, as a percentage.
Horizontal Visual Effect	5	Substantial horizontal visual impact. The development occupies the entire active field of view.
Vertical Visual Effect	1	An increase in the overall vertical visual effect experienced from the viewpoint as a result of the combined vertical visual effect of the existing landscape character and the proposed development. The vertical scale of the existing landscape is referenced to ridgelines adjacent with an elevation of 660 metres at a distance of 3.96 kilometres. The maximum elevation of the suspension towers is 667 metres, 3.7 kilometres from this viewpoint. There will be an increase in vertical visual impact from the development ($\alpha 2$ / $\alpha 1 > 1$), with an 11 per cent proportional increase, which is limited. Tan α_1 =0.034 Tan α_2 = 0.038 (0.038/0.034)- 1 x100= 11%
Distance of Visual Effect	5	The closest pylon is approximately 1.93km at a bearing of 312 degrees
Visual Impact Value	**16**	**High visual impact within the field of view**
Coefficient of Visual Impact	0.8	
Percentage of Visual Change	**28%**	0.8x7= 5.6 (Landscape visual effect) 5.6/20= 0.28 (Degree of visual change) 0.28 x 100 = 28% visual change to the landscape
The visual effect is described as a Moderate change in view: the change will be distinguishable from the surroundings, whilst composition and underlying landscape visual character will be retained.		

5.4 Viewpoint 3 – Common Boundary Road (sub-regional – north)

Viewpoint Context

Viewpoint 3 is located north of the proposed transmission line corridor, within a rural landscape typical of the wider locality. Local undulating ridges offer elevated vantage points overlooking the lower-lying agricultural plain.

The existing land cover comprises arable cropping with isolated areas of grazing on the ridges and escarpments. Farm buildings and sheds are scattered across the landscape, particularly around properties including Gap View, Rocky Glen and Restonvale, with isolated groups of trees providing amenity to the rural landscape.

From Viewpoint 3, the proposed transmission line will appear in the middle-distance set against the backdrop of the Brown Hill and Porcupine Ranges. The combination of low-lying rural land, foreground ridges, boundary vegetation along property boundaries, and the existing wind turbines to the west may reduce the visual prominence of the proposed transmission line.

While the existing landscape context provides some visual mitigation, the proposed transmission line is likely to introduce a prominent new infrastructure element in the locality.

Figure 22: Existing: Viewpoint 3

Figure 23: Digital Overlay showing the transmission line lattice towers: Viewpoint 3

Figure 24: Absorption Capacity Calculations: Viewpoint 3 (see Viewpoint Assessment below for details)

Viewpoint Assessment

Assessment	Value	Description
Relief	3	The visual relief is characterised by localised ridgelines and a complex layering of topographic forms, which together generate visual interest and spatial definition. The elevated landform to the east of the viewpoint provides visual containment, limiting long-distance views and reinforcing a sense of enclosure within the landscape. This is complemented by a foreground undulation to the west, which adds depth and reinforces the perception of a partially enclosed visual basin.
Vegetation Coverage	1	Vegetation cover at Viewpoint 3 is negligible, with no discernible canopy structure across much of the field of view. The landscape is predominantly characterised by an agricultural-pastoral setting, interspersed with areas of grazing, resulting in a largely open and exposed visual character. Vegetation is generally low-lying and utilitarian in nature, reflecting land-use patterns rather than forming visual screening or enclosure within the landscape.
Infrastructure and Built Form	4	Infrastructure and built form visible are generally sparse, comprising existing transmission lines, isolated rural structures, and delineation of property boundaries and fence lines across the agricultural landscape. In addition, an existing wind farm is located in proximity to the viewpoint, with turbines visible to the west of this view orientation. Consequently, this element contributes to the visual modification of the broader rural landscape pattern and introduces an energy-production context to the area.
Cultural and Landscape Value	1	The cultural landscape value is assessed as low to negligible, reflecting its isolated location away from established settlement patterns, transport corridors, and areas of concentrated activity. Situated within an open agricultural landscape, the viewpoint experiences a limited frequency of viewers and does not exhibit any identifiable cultural associations or known sensitivities relating to heritage values.

Baseline Landscape Character Value	**9**	
Landscape Absorption	2	From this viewpoint, there are limited topographic forms provide moderate screening in the foreground. The landscape provides an absorption of 78 percent. This equated as 1743253 pixels screening the development divided by the total area that the development occupies 2247659 pixels as a percentage.
Horizontal Visual Effect	1	The horizontal visual effect is recorded as 18 degrees, which represents 15 percent of the field of view. Limited effect due to the local ridgelines screening the development from this viewpoint
Vertical Visual Effect	1	The vertical scale of the existing landscape is referenced with an elevation of 580 metres at a distance of 530 metres. The maximum elevation of the suspension towers 571 metres at a distance of 2.2 kilometres from this viewpoint. The transmission line will have minimal visual vertical impact and will be seen relative to the existing vertical landscape scale. Tan α_1 = 0.035 Tan α_2 = 0.0177 (0.0177/0.035)- 1 x100= <1
Distance of Visual Effect	4	The closest pylon is approximately 2.08km at a bearing of 146 degrees
Visual Impact Value	**8**	**Moderate visual impact within the field of view**
Coefficient of Visual Impact	0.4	
Percentage of Visual Change	**18%**	0.4x9= 3.6 (Landscape visual effect) 3.6/20= 0.18 (Degree of visual change) 0.18 x 100 = 18% visual change to landscape
The visual effect is described as a Slight change in view: change will be distinguishable from the surroundings whilst composition and underlying landscape visual character will be retained.		

5.5 Viewpoint 4 – Old Canowie Station, Jameston Hallet Road (sub-regional- northwest)

Viewpoint Context

Viewpoint 4 represents the landscape character to the west, particularly, the visual character and potential visual effect that may be experienced from Old Canowie Station and by people travelling along the main road between Jamestown and Hallett.

The viewpoint is adjacent to the rural property at Old Canowie Station and is surrounded by extensive tree planting and vegetation. The landscape character is defined by the lower-lying agricultural plain between the ridgelines of the North Mount Lofty Ranges, with Brown Hill Range and Porcupine Range rising visual elements to the south and west.

From this location, the proposed transmission line is likely to be visible as a prominent visual element traversing the locality, north-east to south-west. Extensive belts of trees around the Old Canowie Station significantly reduce potential visual impact to the north-east. However, the proposed transmission line is likely to remain noticeable to the southwest as the alignment traverse the eastern escarpment of the Brown Hill Range.

The BESS and substation extension are located farther west, within the foothills and local ridges associated with the Brown Hill Range. The topography of this area has the potential to restrict visibility of the BESS and substation extension to the wider locality.

Figure 25: Existing: Viewpoint 4

Figure 26: Digital Overlay showing the transmission line lattice towers: Viewpoint 4

Figure 27: Absorption Capacity Calculations: Viewpoint 4 (see Viewpoint Assessment below for details)

Viewpoint Assessment

Assessment	Value	Description
Relief	3	The visual relief is characterised by moderate topographic complexity, with layering from the mid-ground to the foreground. Subtle undulations and locally elevated landforms contribute to visual interest and depth,

		while providing localised containment of views, particularly toward the southwest. This containment reduces the perception of expansive long-distance views, resulting in a more enclosed viewpoint.
Vegetation Coverage	3	Vegetation is dominated by a tree copse planted along the road reserve and associated farming property, providing a large-scale, linear vegetative element within the landscape. This vegetation forms a strong visual framework, effectively framing views and contributing to visual containment, particularly toward the south-eastern aspect of the viewpoint. The extent and maturity of this planting introduce a degree of enclosure that limits longer-range views and reinforces the localised landscape character.
Infrastructure and Built Form	3	Adjacent to Viewpoint 4, infrastructure and built form comprise moderate to larger-scale farming utilities and associated agricultural infrastructure that support ongoing production within the landscape. These elements are read as functional and locally characteristic features rather than visually dominant structures. Further to the north-west, the former township of Old Canowie is located in a lower-lying valley with complex topographic form, which provides a degree of visual enclosure and limits its prominence. Notwithstanding this containment, the settlement establishes a contextual relationship to historic urban settlement and built form within the broader landscape setting and local visual catchment.
Cultural and Landscape Value	3	Viewpoint 4 has a moderate level of cultural and landscape value, primarily associated with the heritage settlement of Old Canowie Station, located nearby. The surrounding landscape exhibits a layering of rural character that contributes to a distinct sense of place and provides a contextual reference to past settlement patterns. While no highly sensitive heritage receptors are directly present within the immediate view, the relationship between topography, agricultural land use and historic settlement introduces a degree of potential sensitivity to landscape change, informing the cultural values experienced from this location.
Baseline Landscape Character Value	**12**	
Landscape Absorption	3	From this viewpoint, the topography provides moderate foreground screening. The landscape has a 40 per cent absorption rate. This equated to 1424610 pixels, representing the development divided by the total area that the development occupies, 3554176 pixels, as a percentage.
Horizontal Visual Effect	3	The horizontal visual effect is recorded at 54 degrees, representing 40 per cent of the field of view. Moderate effect due to the local ridgelines and vegetation screening the development from this viewpoint
Vertical Visual Effect	1	The vertical scale of the existing landscape is referenced with an elevation of 6770 metres at a distance of 1.5 kilometres. The maximum elevation of the suspension towers is 616 metres at a distance of 970 metres from this viewpoint. The transmission line will have minimal visual vertical impact and will be seen relative to the existing vertical landscape scale.

		Tan α1 = 0.062 Tan α2 = 0.045 (0.045/0.062)- 1 x100= <1
Distance of Visual Effect	5	The closest pylon is approximately 941m at a bearing of 202 degrees
Visual Impact Value	**12**	**Moderate to increasing visual impact within the field of view**
Coefficient of Visual Impact	0.6	
Percentage of Visual Change	**36%**	0.6x12= 7.2 (Landscape visual effect) 7.2/20= 0.36 (Degree of visual change) 0.36 x 100 = 36% visual change to the landscape
The visual effect is described as a Moderate change in view: the change will be distinguishable from the surroundings, whilst the composition and underlying landscape visual character will be retained.		

5.7 Summary of Visual Impacts

The visual assessment of the four viewpoints demonstrates that the visual impacts will be experienced within the local, sub-regional, and regional landscapes surrounding the Project. The viewpoints are selected to represent locations from which the Project will be visible and to represent a worst-case scenario for the potential visual impacts of the development across various landscape character areas.

The two tables below illustrate the degree of visual change recorded at each viewpoint and the classification of potential visual effects. Key factors affecting the visual impact at each viewpoint and across the wider landscape are noted. They include:

- Existing landscape character value and the presence or absence of significant vegetation or scenic value, and or existing infrastructure;
- The degree of landscape absorption provided by the existing landscape;
- Degree of visual containment and resulting viewshed;
- Horizontal and vertical visual effects produced by the proposed development;
- Distance to the proposed development.

As shown in Table 2 below, there is a consistent level of visual effect resulting from the Project and is measured as moderate. The existing landscape character, while extensively rural, ranges from 7 to 12. This reflects the general uniformity of the existing landscape character of the area, with variations depending on the extent of vegetation and the cultural value of the existing landscape.

Viewpoints	Relief	Vegetation Coverage	Infrastructure	Cultural/Landscape Value	**Landscape Character**	Landscape Absorption	Horizontal	Vertical	Distance	**Visual Assessment**	**Degree of Visual Change**	Description of Visual Effect (sensitivity to Visual Change)
Viewpoint 1	2	2	3	2	**9**	3	4	1	4	**12**	**27%**	**Moderate**
Viewpoint 2	2	1	3	1	**7**	5	5	1	5	**16**	**28%**	**Moderate**
Viewpoint 3	3	1	4	1	**9**	2	1	1	4	**8**	**18%**	**Slight**
Viewpoint 4	3	3	3	3	**12**	3	3	1	5	**12**	**36%**	**Moderate**

Table 2: Summary of Visual Effects

Table 3 summarises the classifications described in the GrimKe matrix and provides additional information on potential visual effects.

Percentage of Visual Change	Descriptive of Visual Impact	Descriptors – appearance in the central vision field	Comments
80-100%	**Extreme**	*Commanding, controlling the view*	*Extreme change in view: a change that is very prominent, involving the total obstruction of the existing view or a change in the character and composition of the landscape and view, through the loss of key elements or the addition of new or uncharacteristic elements that significantly alter the underlying landscape's visual character and amenity. The sensitivity of the underlying landscape character to change is unable to accommodate or mitigate the introduction of development, and the visual effect is highly adverse.*
60-80%	**Severe**	*Standing out, striking, sharp, unmistakable, easily seen*	*Severe change in view involving the obstruction of existing views or alteration to the underlying landscape visual character through the introduction of new elements. Change may differ in scale and character from the surroundings and wider setting, or be a severe change within the context of the existing landscape character.*
40-60%	**Substantial**	*Noticeable, distinct, catching the eye or attention, clearly visible, well defined*	*Substantial change in view: which may involve partial obstruction of existing view or alteration of underlying landscape visual character and composition through the introduction of new elements. The composition of the view will alter; however, the sensitivity of the underlying landscape character to change is low, and the landscape has the capacity to mitigate and absorb the visual effects.*
20-40%	**Moderate**	*Visible, evident, obvious*	*Moderate change in view: change will be distinguishable from the surroundings, while the composition and underlying landscape visual character will be retained. The sensitivity of the existing landscape to change is low.*
0-20%	**Slight**	*Lacking sharpness of definition, not obvious, indistinct, not clear, obscure, blurred, indefinite*	*Slight change in view: change barely distinguishable from the surroundings. The composition and character of the view are substantially unaltered.*

Table 3: Classification of Visual Impacts

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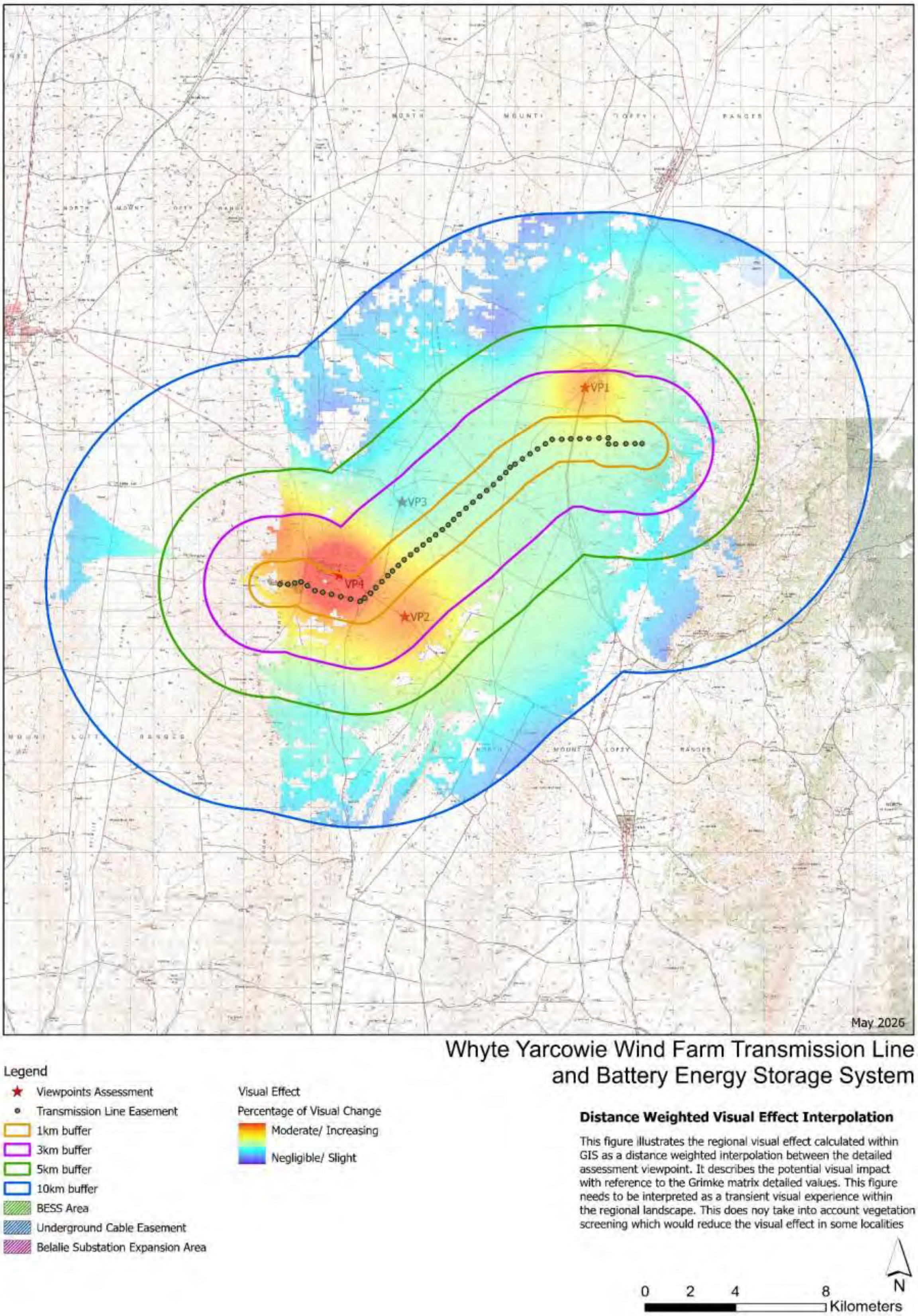

Figure 28: Summary of viewpoint visual effect

06 Infrastructure Assessment

The Project will include a range of associated infrastructure elements. This section discusses the infrastructure elements and their potential visual effects.

6.1 Battery Energy Storage System (BESS)

The Project includes a BESS, refer to Figure 36 for the location. This consists of the following key infrastructure elements.

- BESS hard standing area (with small areas of cut and fill)
- Approximately 270 megawatt / 8 hour duration battery storage container units of approximately 12 metres (40 feet) in length and 3 metres in height
- Access roads
- Substation utility area and operation and maintenance facility area.
- Chain mesh fence around the boundary

Figure 29: Image of typical layout of a BESS (Neoen-Tesla's Victorian Big Battery. Image: Victoria State government)

The BESS will appear as a collection of small infrastructure elements positioned across a level area of hard standing created by balanced cutting and filling of the proposed site. The BESS will be located adjacent to Canowie Road to the east and Gilfillan Road to the north, in the foothills of the Brown Hill Range. The underlying landscape character is rural, with an enclosed visual character defined by undulating landforms and local ridgelines.

The visual impact of the proposed BESS, including the battery containers, hard standing, road network, transformers, and other ancillary infrastructure, will be confined by the surrounding topography. The visibility of the BESS extends several hundred metres before local ridgelines create a defined visual envelope.

The low scale of the infrastructure and visual screening provided by the surrounding landforms of the Brown Hill Range result in limited visual impacts on the wider locality. In addition, the BESS and associated infrastructure will be seen within the context of the existing North Brown Hill Wind Farm substation to the west, the vertical scale of the existing wind turbines and transmission lines, which form prominent visual elements in the locality.

The BESS and the associated visual impacts will be experienced as a continuation of the existing infrastructure character of the local landscape. Given the scale of the development and the visual envelope created by local ridgelines and existing vegetation, there is a significant degree of visual mitigation of the potential visual impact. The potential for landscape treatments and mounding to the perimeter of the site will provide further screening within the locality.

Importantly, the location and surrounding ridgelines remove the potential for the BESS to visually impact Belalie East and the historic Old Canowie farmstead.

Rather than the BESS creating a new form of infrastructure in the locality, it can be seen as an extension of the existing renewable energy infrastructure. The Bess represents a small proportional increase in the potential visual impact, especially when considered in the context of the broader landscape character and extent of existing infrastructure.

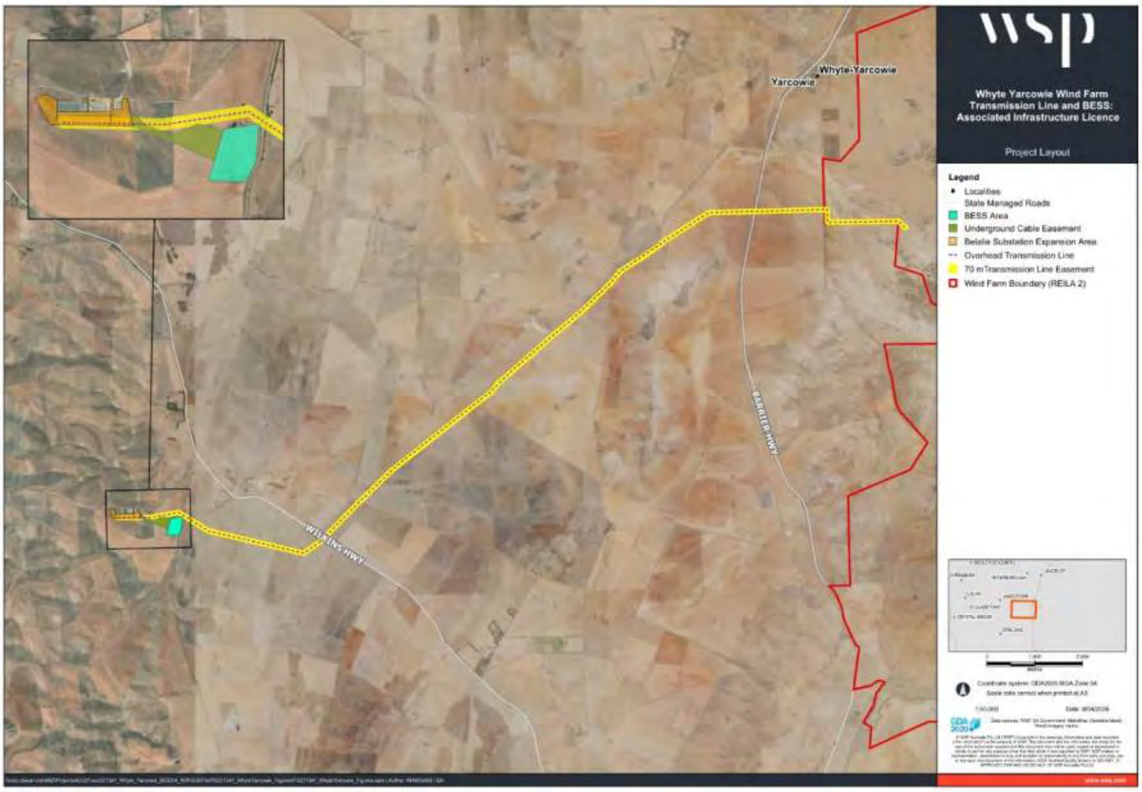

Figure 30: BESS Location

6.2 Site Substation, Control Buildings and Operational Maintenance Compound

07 Review of Planning and Design Code

7.1 Introduction

The Project will seek authorisation via Associated Infrastructure Licences under the Hydrogen and Renewable Energy Act 2023 (HRE Act).

The Code is not a statutory instrument under the HRE Act, and as such, the Project is not required to strictly comply with the policies under the Code. However, the Environmental Impact Assessment Criteria under the HRE Act requires that in the absence of strict policies under the Act, projects should be assessed against recognised industry documents, including, but not limited to, the Planning and Design Code (the Code).

Furthermore, in assessing whether to grant a licence, the Minister for Energy and Mining will refer the Project to the Department for Housing and Urban Development (DHUD) as a prescribed body under Section 73 of the HRE Act, as an administrative unit of the Public Service under a Minister responsible for the administration of the PDI Act. During this referral, it is understood that DHUD will provide comments on the Project against the Code for consideration in the Minister's assessment.

The Code is an instrument under the Planning, Development and Infrastructure Act 2016 (PDI Act), and has been used to assess the Project's suitability in relation to the anticipated effects on the landscape and visual character of the relevant Zones, the General Provisions relating to Infrastructure and Renewable Energy Facilities, and the potential management of visual impacts.

7.2 Proposed Development

Table 4: Planning and Design Code Details relevant to the Varied Project

Planning and Design Code Details	
Zone:	Rural
Overlays:	• Dwelling Excision • Hazards (Bushfire - Medium Risk) • Heritage Adjacency • Hazards (Flooding - Evidence Required) • Key Outback and Rural Routes • Limited Land Division • Murray-Darling Basin • Native Vegetation • Prescribed Water Resources Area • River Murray Tributaries Protection Area • State Heritage Place • State Significant Native Vegetation • Water Resources
Proposed Development:	Transmission Line and BESS
Assessment Pathway	Associated Infrastructure Licence under the HRE Act. Project would be considered as Performance Assessed Development under the Code
Assessment Authority	Minister for Energy and Mining. Project to be referred to Department for Housing and Urban Development for referral under Code Assessed – Impact Assessed, under the PDI Act

7.3 Planning Zone

Table 5: Rural Zone planning policies are considered as part of the LVIA

Policy Reference	Description
DO 1	A zone supporting the economic prosperity of South Australia primarily through the production, processing, storage and distribution of primary produce, forestry and the generation of energy from renewable sources.
DTS/DPF 1.1	Development comprises one or more of the following: (s) Renewable energy facility
PO 9.1	Renewable energy facilities and ancillary development minimise significant fragmentation or displacement of existing primary production.

The Rural Zone recognises transmission line infrastructure as part of the ancillary development required to support renewable energy facilities. PO 9.1 requires that renewable energy facilities and ancillary development minimise significant fragmentation or displacement of existing primary production. The proposed development has a limited impact on the existing rural land use, and the footprint and built form of each suspension tower are negligible and do not fragment or displace existing primary production.

The visual assessment (Section 6) highlights that the underlying landscape character that surrounds the Project is not significantly affected by the development, and the environmental qualities associated with the rural landscape will remain in and around the proposed tower, especially within the broader context of the Mid North and the surrounding renewable energy infrastructure within the locality.

7.4 General Provisions – Infrastructure and Renewable Energy Facilities

Ref	Description
DO 1	Efficient provision of infrastructure networks and services, renewable energy facilities and ancillary development in a manner that minimises hazard, is environmentally and culturally sensitive and manages adverse visual impacts on natural and rural landscapes and residential amenity.
PO 2.1	The visual impact of above-ground infrastructure networks and services (excluding high voltage transmission lines), renewable energy facilities (excluding wind farms), energy storage facilities and ancillary development is minimised from townships, scenic routes and public roads by: (a) utilising features of the natural landscape to obscure views where practicable

Ref	Description
	(b) siting development below ridgelines where practicable (c) avoiding visually sensitive and significant landscapes (d) using materials and finishes with low reflectivity and colours that complement the surroundings (e) using existing vegetation to screen buildings (f) incorporating landscaping or landscaped mounding around the perimeter of a site and between adjacent allotments, accommodating or zoned to accommodate sensitive receivers primarily.
PO 2.2	Pumping stations, battery storage facilities, maintenance sheds and other ancillary structures incorporate vegetation buffers to reduce adverse visual impacts on adjacent land.
PO 2.3	Surfaces exposed by earthworks associated with the installation of storage facilities, pipework, penstock, substations and other ancillary plant are reinstated and revegetated to reduce adverse visual impacts on adjacent land.

In relation to the potential visual effects of the Project, DO 1, PO 2.1, PO 2.2, and PO 2.3 of the General Provisions – Infrastructure and Renewable Energy Facilities are considered relevant, and a discussion is provided below identifying how the Project achieves the listed requirements.

PO 2.1 of the General Provisions – Infrastructure and Renewable Energy Facilities acknowledges the visual effects of wind farms and high-voltage transmission lines and that these forms of development will have visual impacts. The Project is likely to cause a degree of visual change to the locality's existing rural landscape character.

The landscape character assessment demonstrates that the Project is located in a rural landscape with a defined visual envelope and topography that contains potential visual impact on the wider region. These landforms provide screening and obscure sections of the transmission line, thereby meeting the general requirements of PO 2.1(b).

With reference to PO 2.1 (c), the locality does not contain areas that are visually sensitive or significant landscapes.

The assessment has considered a lattice tower design using a galvanised steel construction. The lattice tower enhances visual permeability, providing a degree of visual mitigation. If a monopole design is selected, it is expected that the structure would reduce in overall scale of the proposed infrastructure (height and width), further reducing potential visual impacts.

In addition, the galvanised steel materiality from either design would weather over time, providing a dull, non-reflective finish that complements the locality's agricultural context. Given the scale of the suspension towers and the length of the transmission line, the ability to meet the requirements of PO 2.1(f) are limited. However, the existing landscape character, trees and local landforms provide a degree of visual mitigation, particularly to locations and receivers at distances greater than 3 kilometres from the Project.

Section 6 of the report offers an infrastructure assessment of the BESS. As part of the development, landscape treatments and vegetation screening are proposed. This vegetation buffer will reduce the visual impact of the ancillary infrastructure and satisfy the requirements of PO 2.2 and PO 2.3.

08 Conclusion

The locality surrounding the Project comprises a wide, low-lying agricultural plain enclosed by the north-south ridgelines of the northern Mount Lofty Ranges. The proposed transmission line, together with the BESS and substation expansion, will introduce a new overhead transmission line infrastructure across a rural landscape.

The ZTVI and Visual Magnitude Mapping demonstrate the contained visual character of the locality, and the visibility of the Project reduces significantly at distances greater than 5 kilometres, becoming negligible beyond 10 kilometres.

Visual impacts are likely to be most pronounced along Michells Road, where the existing landscape character is visually open and sparsely vegetated, and the proposed transmission line alignment is in close proximity to sensitive residential receptors and the Old Canowie Station dwellings near Belalie East.

Across the locality surrounding the Project, the proposed transmission line will be perceived as a series of vertical infrastructure set against the backdrop of the surrounding ranges. While the suspension towers could be visually prominent in the landscape, their spacing and design mean the visual effect is spread across the locality. At the same time, the existing rural landscape character is not replaced by the Project. The landscape character will alter, and the Project and the surrounding locality are likely to be perceived as part of the wider renewable energy infrastructure across the mid-north region.

The introduction of the proposed transmission line into the existing landscape character could have a moderate visual impact in the vicinity of Michells Road. This visual impact is likely to occur within a range of 3 kilometres from the suspension towers due to the open visual character of the rural landscape and the variations in topography and vegetation.

At a distance of 4 to 5 kilometres from the proposed transmission line, the existing landscape character provides a high degree of visual mitigation through topography and increased vegetation. Local ridgelines associated with the Brown Hill Range, Willogoleche Hill, the Porcupine Range, and Mount Sly, as well as vegetation belts, limit the potential for the proposed transmission line to be a prominent visual element in the wider landscape. Furthermore, the presence of wind turbines and transmission lines to the south and west increases the existing visual impact associated with renewable energy regeneration in the region.

While the visual impact of the existing transmission line can be described as moderate in close proximity to the Project, the separation distances between the suspension towers mean that the visual effect is sporadic and spread across the locality. In addition, the materiality and design of the lattice towers create a recessive form of development when viewed against the backdrop of the Brown Hill Range. Consequently, when the lattice towers are set against local ridgelines, visual contrast decreases, and the visual impacts may be mitigated.

In conclusion, the visual assessment indicates that the transmission line is located within a defined rural landscape, bounded by prominent ridgelines that create a pronounced vertical scale around the Project. The proposed transmission line, by contrast, appears as a visually fragmented piece of infrastructure that extends across the valley floor between the Tothill Range and the Bluff Range before heading east to connect to the existing substation.

The presence of other infrastructure in the landscape reinforces the locality's energy production and modified context, while local landforms and tree groups provide visual screening and mitigation. This combination of factors reduces the impact of the Project, resulting in a moderate visual effect within a defined visual envelope.

08 Conclusion

The LVIA concludes that the visual effect is likely to be moderate, decreasing to slight, within the subregional areas, the visual impact is contained and mitigated by the vegetation and topographic attributes of the existing landscape and the uniformity of the agricultural land use. Consequently, the proposed Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System Project can be accommodated without significantly altering the underlying landscape and visual character.

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Landscape Character and Probable Visual Effect Assessment - Appendices

Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

WSP Australia Pty Limited on behalf of Whyte Yarcowie Wind Farm Pty Ltd

21 May 2026

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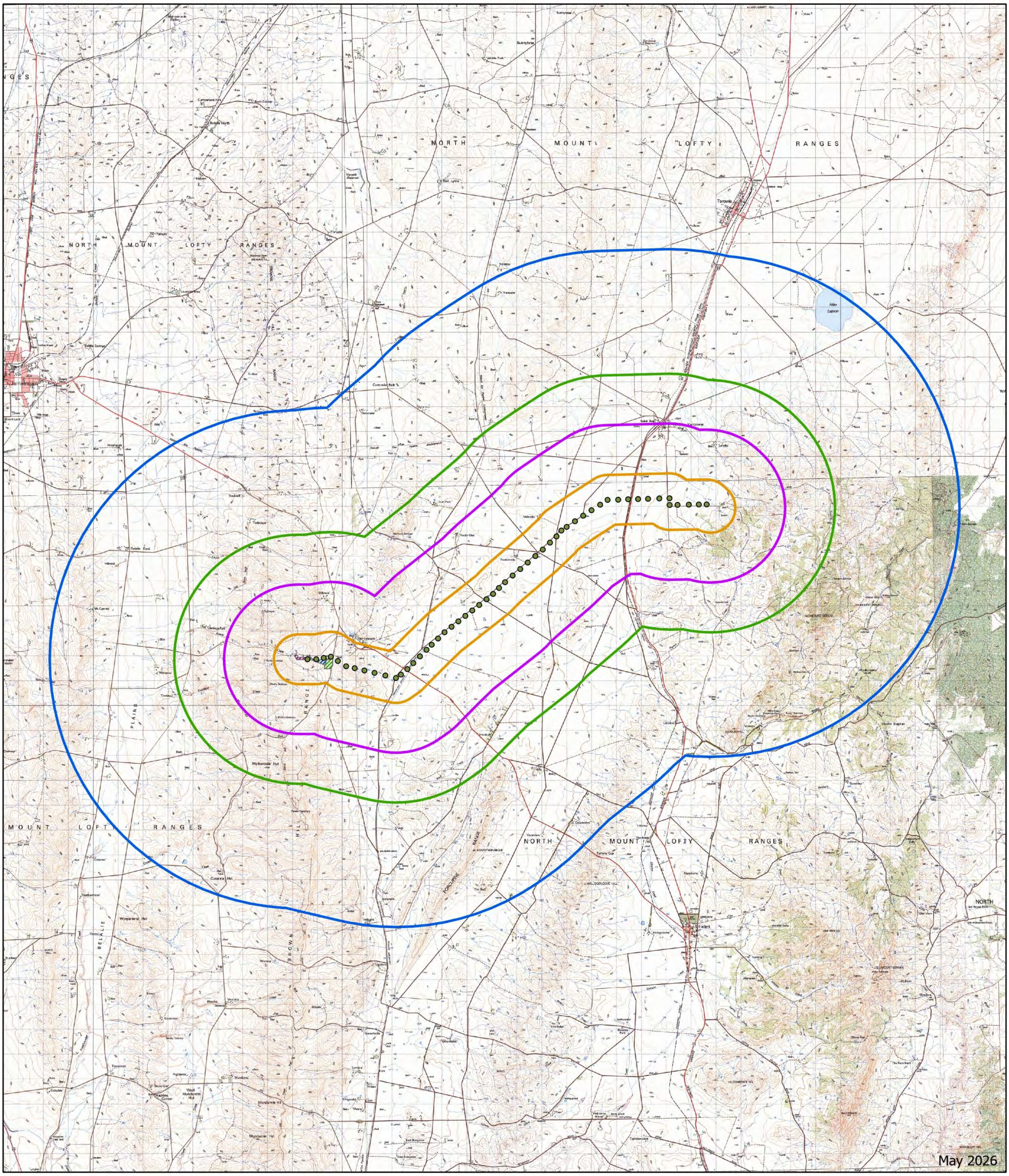
REVISION	DATE	AUTHOR	REVIEWER
C	21/05/2026	WK/BG	WK
B	24/02/2026	WK/BG	WK
A	04/02/2026	WK/BG	WK

Appendix A
Assessment Mapping



Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

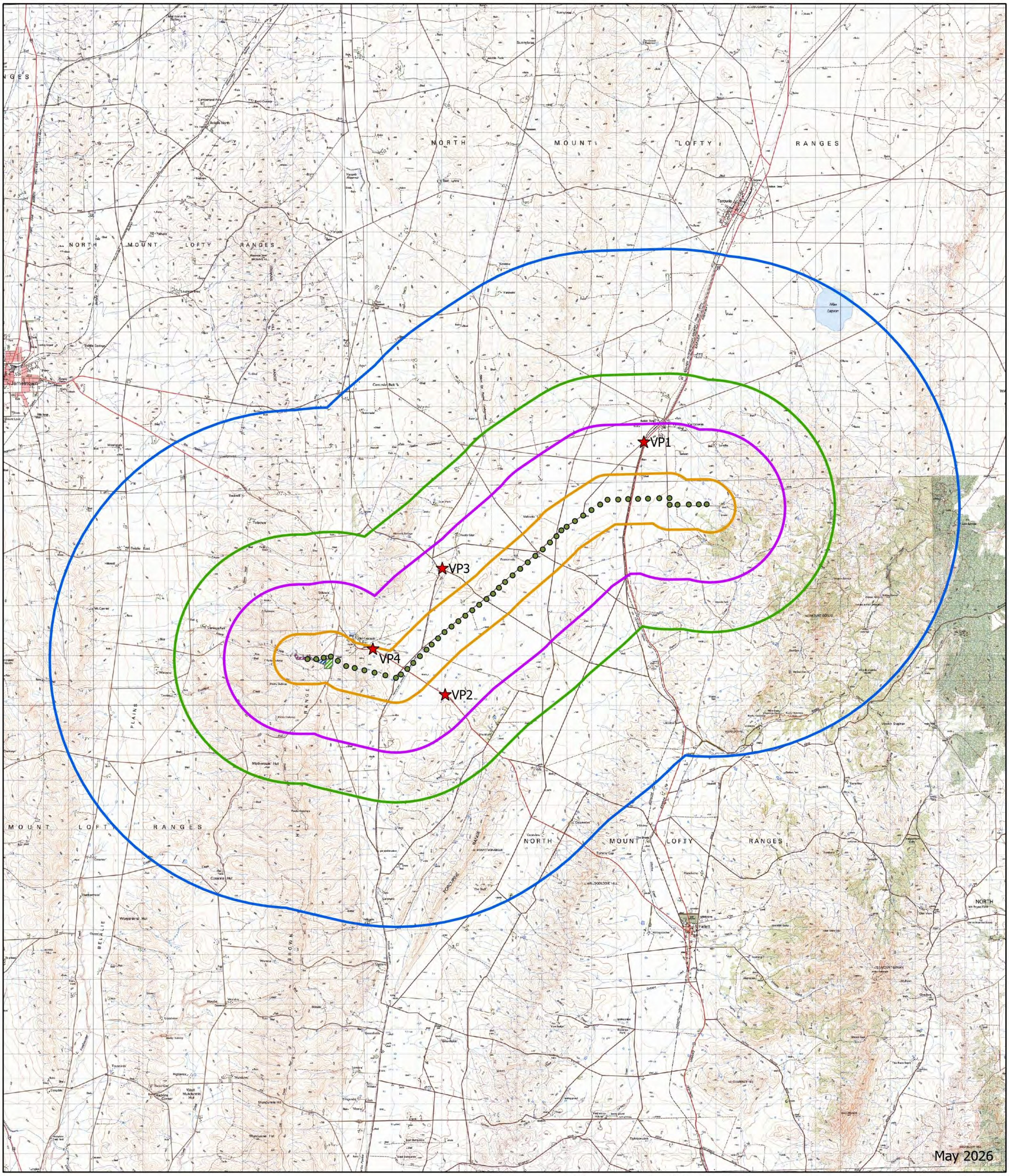
Site Locality

Legend

- Transmission Line Easement
- 1km buffer
- 3km buffer
- 5km buffer
- 10km buffer
- BESS Area
- Underground Cable Easement
- Belalie Substation Expansion Area

N

0 2 4 8 Kilometers



Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

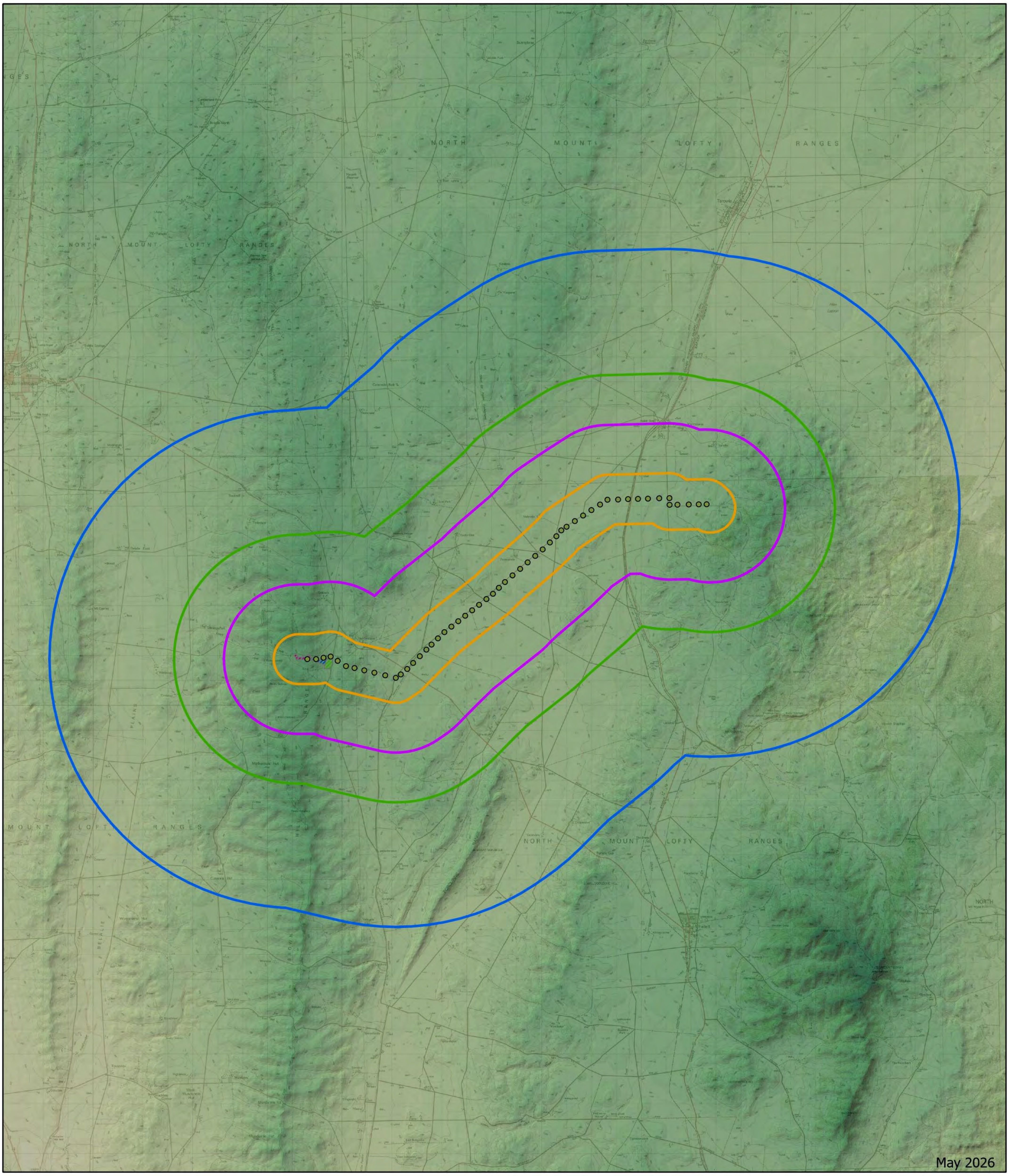
Legend

- Viewpoints Assessment
- Transmission Line Easement
- 1km buffer
- 3km buffer
- 5km buffer
- 10km buffer
- BESS Area
- Underground Cable Easement
- Belalie Substation Expansion Area

Viewpoints

0 2 4 8 Kilometers

N



Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

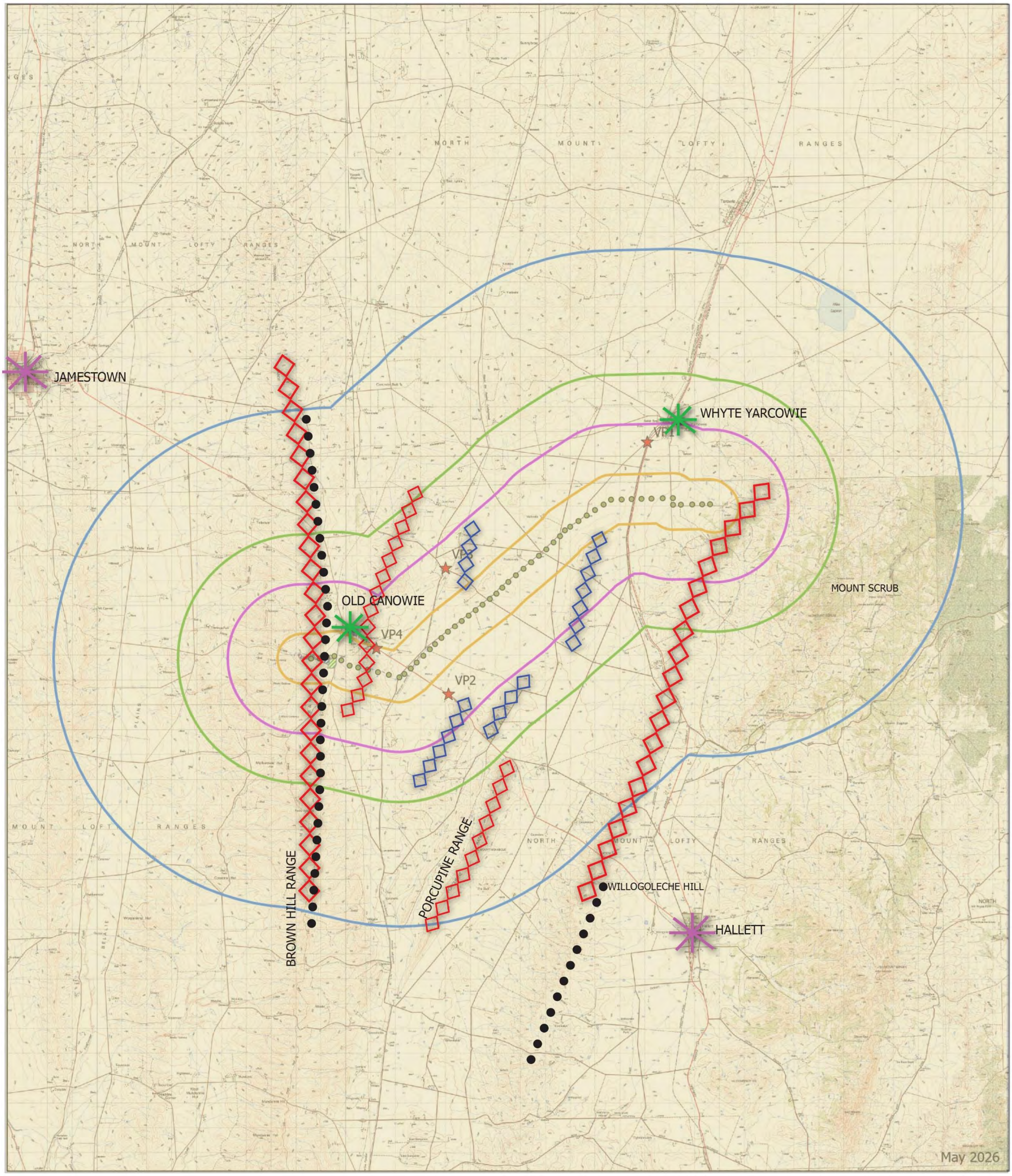
Digital Terrain

Legend

- Transmission Line Easement
- 1km buffer
- 3km buffer
- 5km buffer
- 10km buffer
- BESS Area
- Underground Cable Easement
- Belalie Substation Expansion Area

0 2 4 8 Kilometers

N



Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

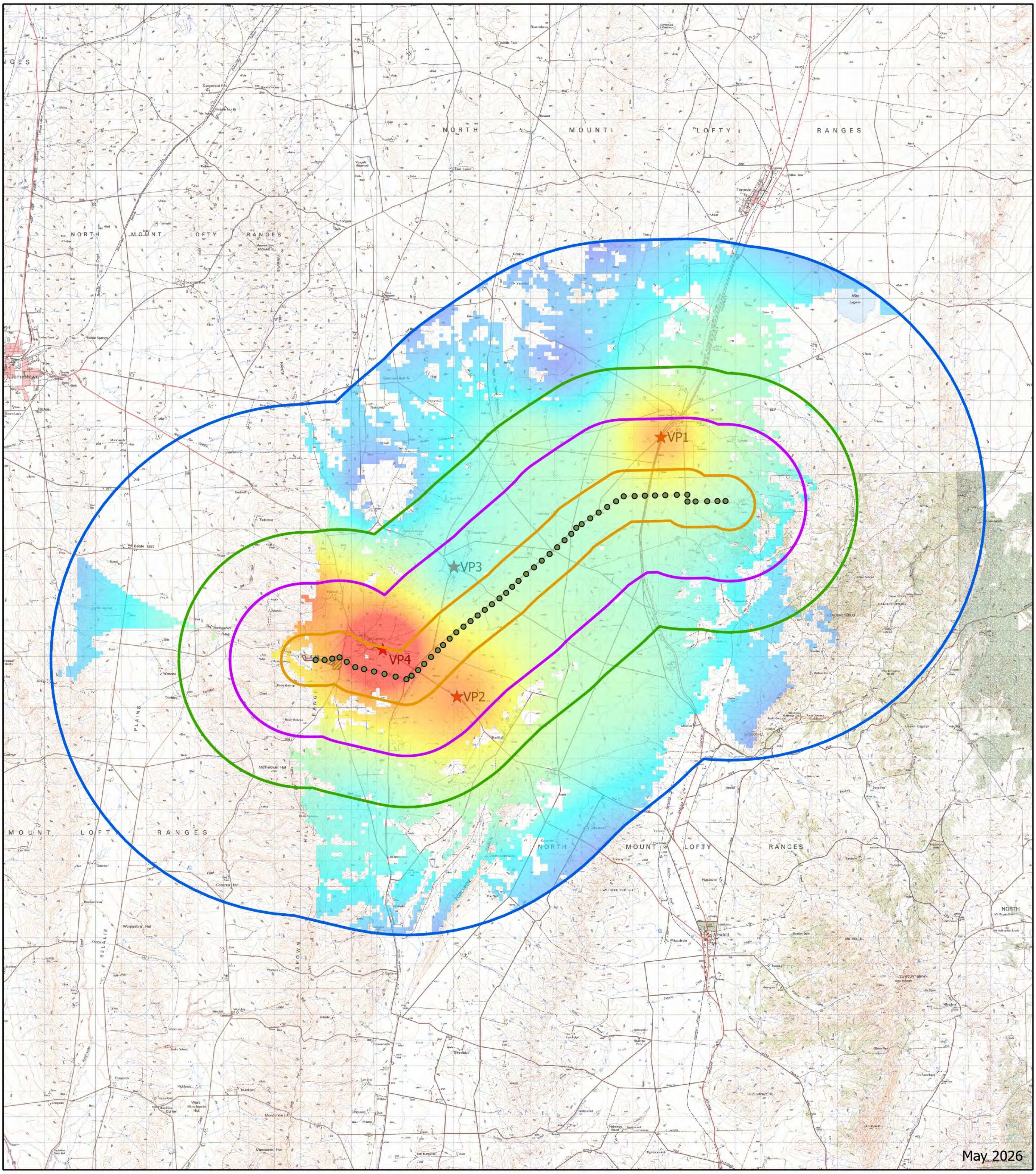
Landscape Character

Legend

- Transmission Line Easement
- Viewpoints Assessment
- 1km buffer
- 3km buffer
- 5km buffer
- 10km buffer
- BESS Area
- Underground Cable Easement
- Belalie Substation Expansion Area
- Agricultural/ pastoral grazing landscape
- Major ridgeline defines regional viewshed
- Minor ridgeline contains local views providing complex layered variation to viewshed
- Township
- Settlement/ farming utilities
- Existing wind farm on ridgeline (Reference to defined character zone- does not illustrate WTG layout)

0 2 4 8 Kilometers

N



Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

Legend

- Viewpoints Assessment
- Transmission Line Easement
- 1km buffer
- 3km buffer
- 5km buffer
- 10km buffer
- BESS Area
- Underground Cable Easement
- Belalie Substation Expansion Area

Visual Effect

Percentage of Visual Change

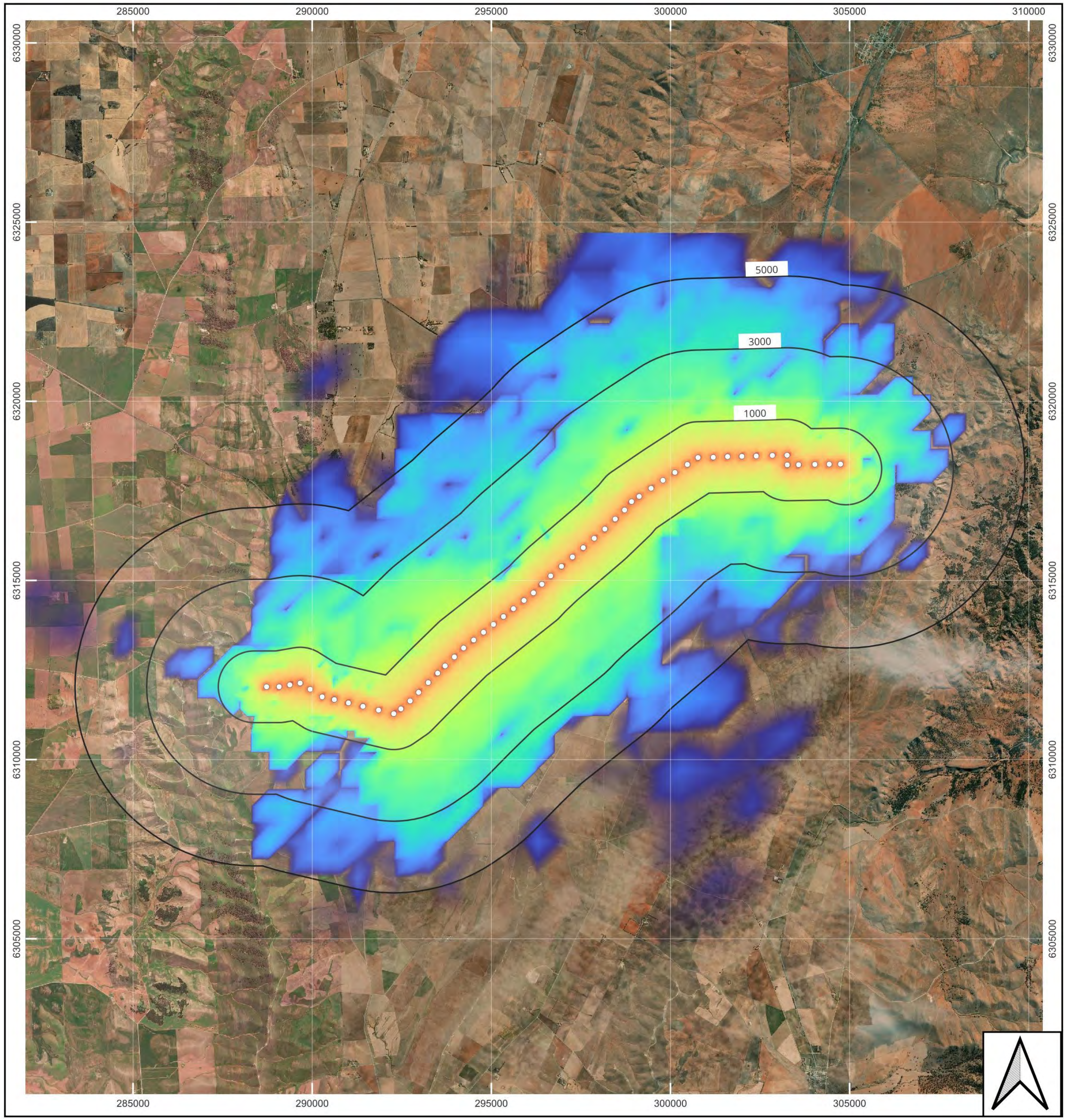
- Moderate/ Increasing
- Negligible/ Slight

Distance Weighted Visual Effect Interpolation

This figure illustrates the regional visual effect calculated within GIS as a distance weighted interpolation between the detailed assessment viewpoint. It describes the potential visual impact with reference to the Grimke matrix detailed values. This figure needs to be interpreted as a transient visual experience within the regional landscape. This does noy take into account vegetation screening which would reduce the visual effect in some localities

N

0 2 4 8 Kilometers



Whyte Yarcowie
Visual Impact Magnitude
Version 2 - 16th December 2025

Legend

○ Transmission Tower Locations

Heatmap

0.15sr

0sr

Data Used
- Viewer Height : 1.57m
- Earth Curvature & Refraction : Not Included
- Transmission Tower : Type 2 - 46.8m Height
- Layout : 12th November 2025
- Study Radius : 1km, 3km, 5km
- Terrain Models:
  - Flat Terrain (Maximum impact)
- Grid Sampling Resolution:
  - 0-300m : 100m
  - 300-1000m : 200m
  - 1000-5000m : 500m
  - 5000-10000m : 1000m
  - 10000+ : 2000m

Notes: Visual Impact Magnitude is shown in steridians
Heatmap is in Log Scale

0 5 10 km

Appendix B
Photomontage Methodology (produced by Convergen)

The method consists of 6 stages. The following summarises the stages;

1. Viewpoints are identified using a Zone of Theoretical Visibility map, site assessment and in consultation with the client and residents in the area. The viewpoints are selected to represent the worse case scenario i.e. the maximum number of infrastructure elements visible within the field of view. The locations of viewpoints are typically representative of the regional landscape character units or identified by residents. The locations represent a diverse range of views from around the BESS and transmission line at a variety of directions and distances.

2. Photos are taken onsite using a 32mm lens digital SLR camera (50mm equivalent analogue). Numerous research papers have concluded that this is most representative of the human eye for depth of field. Photos are taken on a mounted tripod and the height recorded to eye level. In addition the elevation of the viewpoint is recorded Above Sea Level (ASL) using the barometric measure on a handheld GPS device. The weather and time of day are also recorded to enable computer model rectification in stage 4 and 6 of the process.

3. The centre of the field of view is equated onsite using a bearing compass and GPS to the projected centre of the development. A field of view of 60 degrees to either side of centre is established onsite to provide the full 120 degrees. The extent of the field of view is recorded and evaluated onsite using the GPS and bearing compass. 6 photos are taken for each viewpoint with 1/3 overlap of each to enable photo stitching. The bearing to centre of each photo is recorded to enable cross reference to the next phase of developing a computer model. During the site photography numerous fixed known visual markers are recorded with a GPS location and bearing from the viewpoint. These markers provide reference points within the computer modelling for due diligence.

4. To generate the panoramic photographs the individual photographs are stitched together using PTGui software.

5. The next stage of the process involves the computer generation of a wire frame perspective view of the infrastructure elements, which incorporates the topography from each viewpoint. Using the Wind Farmer™ software the wire frame is produced using a digital terrain model with 10 metre contour intervals. This creates the topography and positions the infrastructure elements at the correct coordinates and elevation within the wire frame. The correct field of view is established by matching the viewing centre of the view angle to the camera and lens used for the photography with the wire frame. This ensures that the image size and angle of view of the wire line matches the photos taken. The wire line is then superimposed on the stitched panoramic photograph and matched in accordance to reference markers and landscape features.

6. A second site visit is conducted with the preliminary wire lines to certify the correct locations of the infrastructure elements using a GPS and bearing compass. Minor alterations are marked up on the drafts to mitigate the effects of photographic warping to the periphery of the stitched panorama. Ground truthing the location of the infrastructure elements provides rigour to the process. Typically if any amendments are required, they are within 1-5 degrees.

7. Once the wire frame and photograph have been lined up the rendered image of the infrastructure elements are created. The rendered model is created in Wind Farmer™ using the correct sun angle for the date and time of the day that the photograph was taken. The

rendered model is exported to Photoshop™ for final matching with the photograph. The rendered image is edited, masking infrastructure elements or parts their of that are screened by vegetation and other elements to the foreground. Additional visual effects are applied to match the lighting effects of shadow imposed by vegetation etc.

Viewing of Photomontages

Given that the objectives of photography and photomontage are to produce printed images of a size and resolution sufficient for use in assessment work in the field, the exact dimensions of these images will depend on the characteristics of the field of view.

All photographs, whether printed or digitally displayed, have a unique, correct viewing distance - that is, the distance at which the perspective in the photograph correctly reconstructs the perspective seen from the point at which the photograph was taken. The correct viewing distance is stated for all printed or digitally displayed photographs and photomontages, together with the size at which they should be printed.

The viewing distance and the horizontal field of view together determine the overall printed image size.
Photographs and photomontages should be printed or published digitally at an appropriate scale for comfortable viewing at the correct distance, noting the limitations of the printing process particularly with regards to colour and resolution. Guidance is provided on viewing the image in order to best represent how the proposal would appear if constructed, such as the required viewing distance between the eye and the printed image. Panoramic images should be curved so that peripheral parts of the image are viewed at the same intended viewing distance. The ‘before’ photograph and the ‘after’ photomontage should be presented on the same page and/or at the same scale to allow comparison if practicable.

References

Landscape Institute Photography and photomontage in landscape and visual impact assessment (March 2011)

Landscape Institute and IEMA (2002) Guidelines for landscape and visual impact assessment (2nd ed). London: Spon.

Scottish Natural Heritage (2006) Visual representation of windfarms: good practice guidance. Inverness: Scottish Natural Heritage. SNH report no. FO3 AA 308/2

Appendix C

Photomontages

VIEWPOINT 1 – WHYTE YARCOWIE, BARRIER HIGHWAY (SUB-REGIONAL - NORTHEAST)

BASE PHOTOGRAPHY

OVERLAY

VIEWPOINT 1 – WHYTE YARCOWIE, BARRIER HIGHWAY (SUB-REGIONAL - NORTHEAST)

PHOTOMONTAGE

VIEWPOINT 2 – JAMESTOWN HALLET ROAD (SUB-REGIONAL – SOUTH)

BASE PHOTOGRAPHY

OVERLAY

VIEWPOINT 2 – JAMESTOWN HALLET ROAD (SUB-REGIONAL – SOUTH)

PHOTOMONTAGE

VIEWPOINT 3 – COMMON BOUNDARY ROAD (SUB-REGIONAL – NORTH)

BASE PHOTOGRAPHY

OVERLAY

VIEWPOINT 3 – COMMON BOUNDARY ROAD (SUB-REGIONAL – NORTH)

PHOTOMONTAGE

VIEWPOINT 4 – OLD CANOWIE STATION, JAMESTOWN HALLET ROAD (SUB-REGIONAL- NORTHWEST)

BASE PHOTOGRAPHY

OVERLAY

VIEWPOINT 4 – OLD CANOWIE STATION, JAMESTOWN HALLET ROAD (SUB-REGIONAL- NORTHWEST)

PHOTOMONTAGE

Appendix D
GrimKe Assessment Matrix

The GRIMKE Matrix has been based on the WAX (2006) and HASSELL Matrix (2005), and with reference to The Visual Management System (VMS) produced by Litton (1968) primarily used for the U.S. Forest Service (1973) and the US Bureau of Land Management (1980). These models are based on a professional consultant (Landscape Architect) quantifying potential changes to landscape composition through "forms, lines, colours and textures and their interrelationships"1. Other factors such as compositional qualities, dominance, variety, animation and sensitivity to potential receptors are also considered.

The extent of visual impact was identified on site, using a GPS with a Wide Area Augmentation System (WAAS) that provides positional accuracy to within 3 metres.i Using the GPS, the location and extent of the development was plotted as 'waypoints', using longitude and latitude, elevation and distances to provide geographic referenced data. The surrounding area was then surveyed with the GPS and a SILVAii bearing compass to calculate the bearing and distance between the viewpoint and the subject area. This methodology was used to assess where the development is in the landscape and whether it is visible.

The GrimKe Matrix considers two key aspects in terms of understanding visual impact and the resulting visual assessment. The initial assessment is a quasi-objective measurement, where a landscape architect considers the landscape character of the site and particularly in relation of this landscape to the viewpoints that have been selected as part of the assessment criteria. Each viewpoint is then assessed in terms of:

— Relief (the complexity of the land that exists as part of the underlying landscape character)

— Vegetation Cover (the extent to which vegetation is present and its potential to screen and filter views)

— Infrastructure and Built Form (the impact of development on landscape and visual character)

— Cultural and Landscape Value (quantification of recognised planning overlays)

Assessing each viewpoint and the regional context (cultural and landscape value) a quantified value is generated for landscape character. This value then forms the baseline assessment value, which will be modified by the impact of the development within the landscape, which in turn will be measured as part of the visual assessment.

This two-tiered assessment methodology ensures the degree of visual impact is assessed against a quantified landscape character value enabling, the GrimKe Matrix to accurately quantify the degree of visual impact that is experienced as a result of implementing the development.

The assessment considers the landscape as three distinct zones based on the distance from the proposed development. The three zones were defined as; local (0-1km), sub-regional (1-5km) and regional (5-30km). (Planning South Australia, 2002). Specific landscape characters are also identified to provide a complete assessment of the landscape context.

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[1] *Daniel, T C & Vining, J (1980) p49*

1. Landscape Character Assessment

1.1 Relief

This is an assessment of the landscape complexity in terms of the underlying topography. The relationship of relief assists in defining the landscape and the visual character of an area. This is relevant in terms of the position and elevation of a proposed development within the landscape and the viewpoint.

The topography is assessed both on site (from each viewpoint) and as part of a desktop review (topography mapping). The assessment considers the topographical complexity in terms of local, sub-regional and regional. Within each zone an assessment is made of the topography and the complexity of landscape features.

The assessment is concerned with landscape complexity and how it impacts on the visual character. The assessment considers landform patterns, dominant elements and other distinguishing topographical features that will impact on the visual context.

Relief (expressed as percentage)	Value	Description of Landscape Relief
80-100%	5	Substantial landscape relief. The landscape possesses significant topographic variations, features and prominent elements creating a dynamic landscape context.
60-79%	4	Increasing relief. Due to the scale of the topography and frequency of features.
40-59%	3	Moderate relief. Medium level of change to the landscape. Occasional landscape features and topographic variation.
20-39%	2	Limited relief. Small amount of topographic variation in the landscape.
0-19%	1	No or minor relief within the landscape. The landscape is considered feature less, without noticeable elements or patterns.

1.2 Vegetation Coverage

Vegetation coverage is a measurement of the extent, character and frequency of vegetation that exists at each viewpoint and within the local, sub-regional and regional zones. The extent of vegetation provides the potential for screening and to reduce the visual effect of development. Conversely, a lack of vegetation results in an increase in the visual significance of a development.

This measurement responds to the potential visual absorption of the landscape as measured by the visual matrix. Again, this assessment considers the dominant vegetation patterns within each zone and in relation to each viewpoint.

Vegetation Coverage (expressed as percentage)	Value	Description of Vegetation Coverage
80-100%	5	Natural or non-harvested commercial forests. Significant areas of treed vegetation creating an arboreal landscape.
60-79%	4	Bushland or woodlands. Major areas of vegetation that define the landscape character of an area
40-59%	3	Tree groups, copse, screens, shelter belts. Defined areas of vegetation creating a layered landscape character.
20-39%	2	Sporadic trees producing a punctuated vegetation character.
0-19%	1	No trees scrub or low ground cover. Limited vegetation cover.

1.3 Infrastructure and Built Form

This assessment considers the interrelationship of landscape character and human development. The assessment considers how development and infrastructure can create a counterpoint to the existing landscape character (vegetation and topography). Alternatively, development within the landscape may assist with the assimilation of development.

Infrastructure and Built Form (expressed as percentage)	Value	Description of Infrastructure and Built Form
0-19%	5	No objects within the landscape. The landscape has a high natural or remote rural character.
20-39%	4	Isolated objects in the landscape. Single elements with limited visual impact on the landscape. Small farm building, telephone towers or houses.
40-59%	3	Small clusters of development. Increasing presence of development within the landscape.
60-79%	2	Medium scale linear infrastructure or development. More significant development within the landscape. Minor roads, culverts, warehouses, transmission lines and residential areas.

80-100%	1	Large scale infrastructure. The landscape is significantly affected by development. Freeways, power stations and opencast mining

1.4 Cultural Sensitivity Value

The cultural and landscape value assessment is a survey of the regional area around the development up to 20 kilometres. The measurement considers the recognised cultural, heritage, natural and social overlays that exist within the landscape. This assessment is predominantly a desktop survey and only measures recognised designations.

The measurement is then represented as a percentage based of the area of designation compare to the area occupied by the regional zone.

The landscape value is the aggregate value from each of the assessment criteria. Either, as a value for each viewpoint or as a baseline value for the landscape surrounding the development. This Landscape Value in then used to assess the percentage of visual change created by the introduction of development within the landscape.

Cultural and Landscape (expressed as percentage)	Value	Description of Cultural and Landscape Value
80-100%	5	Majority of regional zone is affected by planning designations or overlays. Highly valued culture, natural and social landscape.
60-79%	4	Planning designations impacts a significant area of the regional zone. Valued culture, natural and social landscape
40-59%	3	Moderate impact from planning designations. Valued community or social landscape
20-39%	2	Limited effect
0-19%	1	None to negligible effect of planning designations

1.5 Landscape Character Assessment

The aggregate of relief, vegetation, infrastructure and cultural sensitivity values determines the base line landscape character value. The following table summarises the definition of Landscape Character Values

Landscape Character Value	Value	Description of Landscape Relief
16-20	High	Landscape quality is of high value with significant areas of scenic quality provided by varied

		topography, large areas of natural beauty and obvious presence of cultural sensitivity to change.
12-16	Moderate to increasing	Moderate to increasing landscape character value experienced through a layered landscape of natural qualities, scenic beauty and cultural sensitivity.
8-12	Moderate	Moderate landscape character value experienced by small clusters of natural landscape and cultural sensitivity.
4-8	Limited	Limited landscape character value experienced. The landscape is monotonous with little visual interest through topography or vegetation and heavily modified.

2. Visual Assessment

Each viewpoint was then assessed with respect to the following aspects of visual effect

- Percent of landscape absorption (the landscape's ability to absorb and screen the development form).
- Horizontal visual effect (percentage spread of the development in the field of view).
- Vertical visual effect (height of the development as a percentage of the field of view).
- Distance of visual effect (distance between viewpoint and development).

Using the following GRIMKE matrix formula, the development was quantified and aggregated to provide an assessment of the visual effect for each viewpoint.

2.1 Percent of Visual Absorption (PVA)

This is an assessment of the landscape's ability to absorb or screen the visual effect. Due to the comprehension of the landscape and infrastructure elements being holistic, the area that is visually affected includes the space between the infrastructure elements.

Using photomontages of the proposed development and Adobe Photoshop™ the amount to which the landscape screens the development is described as a percent of pixel absorption. Foreground contrasting pixels are selected within the vertical and horizontal extents of the development (area A), figure 6. This area is divided by the total area occupied by the development within the active field of view (area B) and expressed as a percentage of visual absorption. The assessment takes into consideration, visual sky lining and screening from existing vegetation and other physical forms.

Figure 1 Photo with wire line model draped on top. Courtesy Wind Farm Developments (2004)

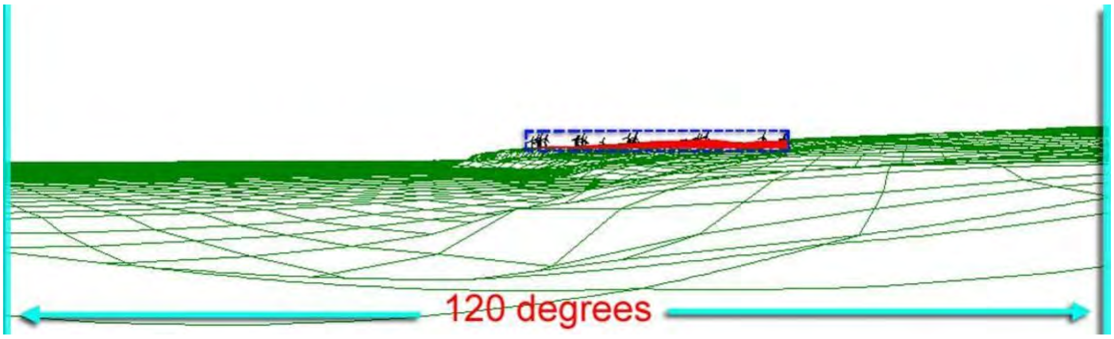


Figure 2 Wire line of showing extent of photomontage. Adapted from Wind Farm Development (2004)

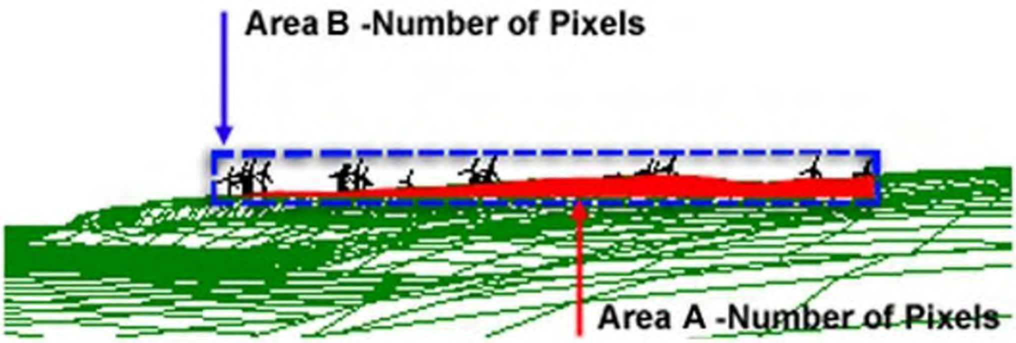


Figure 3 Detailed view of the landscape absorption (area A) and development extents (area B).

Adapted from Wind Farm Development (2004)

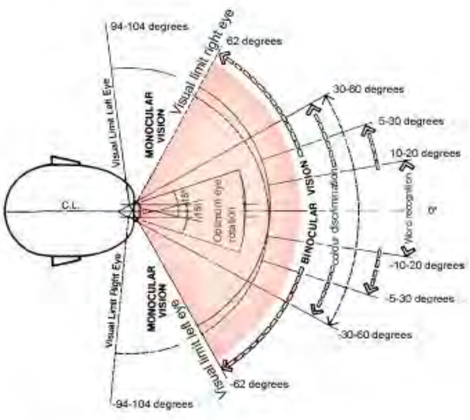
Percent of Visual Absorption (expressed as percentage of change)	Value	Description of Visual Absorption

80-100%	1	Substantial landscape absorption capacity. The landscape possesses sufficient vegetation and topography to screen any effect of the development, maintaining the visual character.
60-79%	2	Increasing absorption capacity. Due to the scale of the topography and density of vegetation the landscape is able to screen the development.
40-59%	3	Moderate absorption capacity. Medium level of change to the landscape. The landscape is less able to absorb change due to the scale, distance and extent of the development.
20-39%	4	Limited absorption. The development is noticeable within the landscape; however through vegetation and topography the landscape fragments and filters views of the development.
0-19%	5	No or minor absorption within the landscape. The development is considered to be prominent within the visual landscape.

2.3 Horizontal Visual Effect (HVE)

The field of vision (FOV) experienced by the human eye is described as an angle of 200-208 degrees horizontally[iii]. This field of view includes the peripheral (monocular) vision, which is described as 40 degrees to each eye; within this zone colour and depth of field are not registered. For the purposes of the assessment the angle of peripheral vision has been subtracted from the field of view producing a binocular, ‘active field of view’ of 120 degrees.

Using this fixed visual reference, an assessment of the possible impact of development within this measurable area is undertaken. The centre of the development is established and an angle of 60 degrees each side is defined. The overall assessment is made of the entire development, rather than of the individual objects that may form the proposal. The angle is measured using a GPS and a bearing compass with known waypoints (geographic coordinates). Using GPS the extent of the horizontal visual field is calculated by the difference in bearing between the widest waypoints from a particular viewpoint. This measurement of effect is then described as a percentage of the 120 degrees active field of



VISUAL FIELD IN HORIZONTAL PLANE

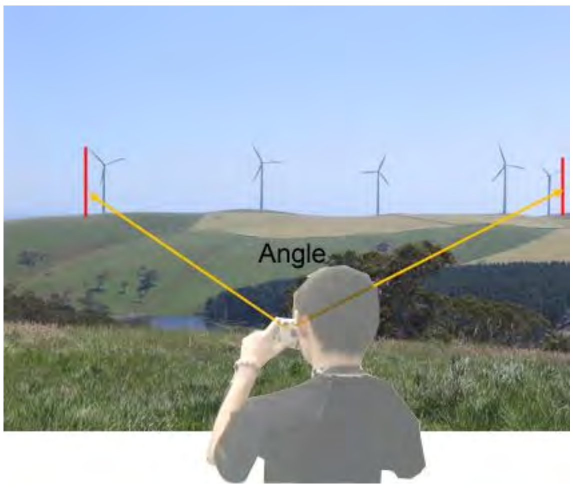


Figure 4 Active field of view is defined as the binocular field equating to 120-124 degreesiv. On the right is an illustration of horizontal measured angle as percent of active field 120 degrees. Photo Brett Grimm

Degree of Horizontal Visual Impact (expressed as an angle of impact and percentage of change)	Value	Description of Visual Modification
80-100% of the panorama measure at 120˚FOV)	5	Substantial horizontal visual impact. Visual impact throughout the entire active field of view.
60-80% of the panorama measure at 120˚FOV)	4	Increasing visual effect. A large proportion of the active field of view is affected.
40-60% of the panorama Measure at 120˚FOV	3	Moderate visual effect.
20-40% of the panorama measure at 120˚FOV)	2	Limited effect. The visual impact is a small part of the active field of view.
0-20% of the panorama measure at 120˚FOV)	1	No or minor visual effect.

2.4 Vertical Visual Effect (VVE)

The vertical visual effect evaluates the proportional scale of the development with reference to the vertical character of the existing landscape, as seen within the field of view of the assessed viewpoints.

The process of assessment is undertaken in 3 stages:

Stage 1:

The first stage of the process is to determine the vertical scale of the existing landscape. The baseline landscape scale is calculated using the photomontage viewpoint elevation (A) as a known reference height. The elevation of the viewpoint is recorded using a GPS. Using contour data, a second value (B) is recorded representing the highest topographic elevation within the field of view. Finally, the horizontal distance (C) between the viewpoint and the highest topographic feature is recorded. The vertical angle of view α_1 is then given as:

$\alpha_1 = \tan^{-1}((B-A)/C)$

as shown in Figure 6 below.

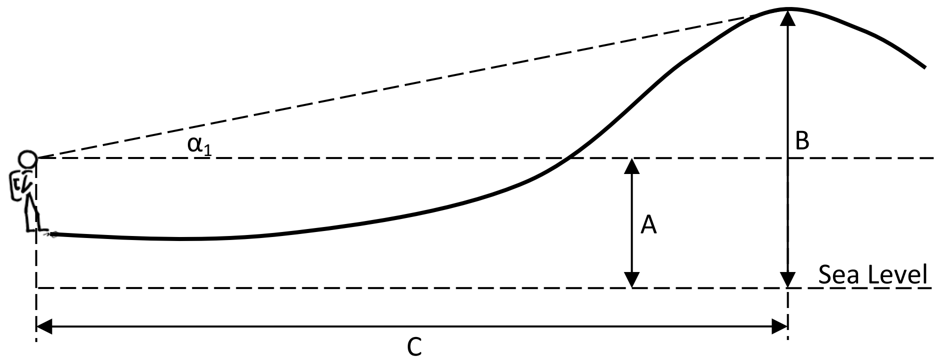


Figure 6: Vertical Scale of Existing Landscape

Stage 2:

The second stage of the process is to determine the vertical scale of the landscape modification, namely that of the apparent maximum height of the infrastructure elements as viewed from the viewpoint. Using the known infrastructure element height (E), ground elevation (F) and its distance from the viewpoint (G), the vertical angle of view α_2 is then given by:

$\alpha_2 = \tan^{-1}((E+F - A)/G)$

as shown in Figure 7 below.

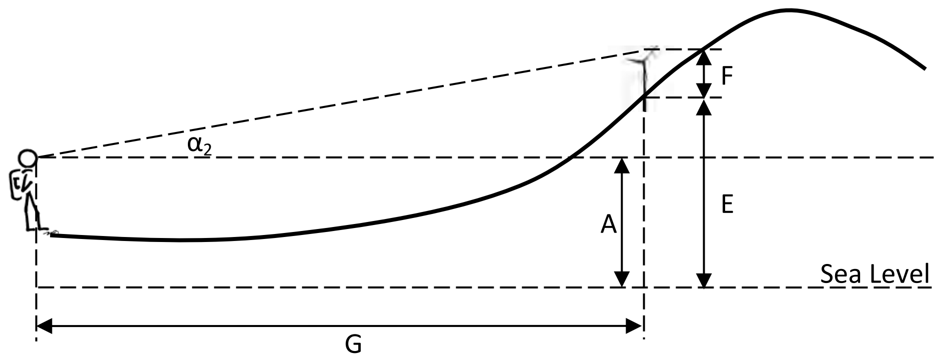


Figure 7: Vertical Scale of Landscape Modification

Stage 3:

The final stage of the process is to determine the overall proportion of the vertical scale of the development with reference to the existing landscape scale by taking the ratio of the two angles α_2 and α_1. Depending on the relative size of the vertical angles of view occupied by the existing and modified landscapes respectively, the ratio α_2 / α_1 will determine the nature and scale of the visual impact.

Depending on the relative scale of the angle of view occupied by the landscape and/or the development, the two vertical angles will depict whether there will be an increase in vertical visual impact created by the development ($\alpha_2 / \alpha_1 > 1$) or conversely the visual effect will be experienced as a vertical visual effect relative to the existing landscape scale ($\alpha_2 / \alpha_1 < 1$).

The vertical visual effect assessment will result in one of the following conditions:

- an increase in the overall vertical visual effect experienced from the viewpoint as a result of the combined vertical visual effect of the existing landscape character and the proposed development, or;

- a limited vertical visual effect as a result of the scale of the development being less than the existing landscape vertical scale when assessed from a viewpoint. This may be created by backdrop landforms or large ravines, valleys depicting a scale that within the field of view is greater than the development.

Either, the infrastructure elements or parts of the infrastructure elements are seen above ridgelines or landforms within the field of view and the effect will result in an increase in vertical visual effect, or the viewpoint contains large escarpments or deep valleys within the field of view and the vertical scale of the proposed infrastructure elements are likely to be seen as a proportion of the existing landscape scale resulting in a limited vertical visual effect.

In the first case (i.e. where $\alpha_2 / \alpha_1 > 1$), the proportional vertical visual impact should be assessed using Table 1 below. In the second case, the proportional vertical visual impact is considered minor and is assigned a value of 1.

Table 1 Proportional Vertical Visual Effect in existing landscape scale ($\alpha_2 / \alpha_1 > 1$)

Vertical Visual Impact (expressed as percentage increase ($\alpha_2 / \alpha_1 - 1$) x 100)	Value	Description of Visual Modification
80-100%	5	Substantial visual impact.
60-80%	4	Increasing visual impact
40-60%	3	Moderate visual impact.
20-40%	2	Limited impact
0-20%	1	No or minor visual impact within the landscape.

2.5 Distance of Visual Effect

This is a measurement of how visual impact is modified by distance. The effect of scale, topography, vegetation and weather, changes with distance, and in turn changes the degree of visual effect. The distance to the development from each viewpoint is recorded using the GPS. Standing onsite at each viewpoint the exact distance can be calculated by selecting the closest waypoint function (all the infrastructure element locations are stored as waypoints in the GPS).

The distance categories outlined in the table below have been based on empirical research University of Newcastle (2002), Sinclair (2001), Bishop (2002).

Location of Development (from viewpoint)v	Value	Description
0 to 4 km (80-100%)	5	Adjacent: Dominant impact due to large scale, movement, proximity and number
4 to 8 km (60-80%)	4	Foreground: Major impact due to proximity: capable of dominating landscape
8 to 13 km (40-60%)	3	Middle ground: Clearly visible with moderate impact: potentially intrusive
13 to 18 km (20-40%)	2	Distant middle ground: Clearly visible with moderate impact becoming less distinct
18 km and greater (0-20%)	1	Background: Less distinct: size much reduced

2.6 Landscape Absorption Assessment

The aggregate of landscape absorption, horizontal and vertical effects and distance values determines the base visual impact value form the viewpoint. The following table summarises the definition of Visual Impact values

Visual Impact Value	Value	Description of Landscape Relief
16-20	High	High visual impact within the field of view
12-16	Moderate to increasing	Moderate to increasing visual impact within the field of view

8-12	Moderate	Moderate visual impact within the field of view
5-8	Limited	Limited visual impact within the field of view

3. Degree of Visual Impact (Percentage of Visual Change)

Degree of Visual Impact

The degree of Visual Impact is expressed as a coefficient of visual change to the baseline Landscape Value (general or viewpoint specific). This calculation directly expresses the effect of the development on the landscape, the change to the visual character and the reciprocal visual impact.

— Baseline Landscape Character : express as a value between 4 and 20)

— Coefficient of Visual Impact : calculated as the 20 divided by visual assessment value

Calculation of degree of Visual Impact

Coefficient x landscape character value expressed as a percentage = Visual Impact on Landscape Character

Example:

(a) Visual Impact Assessment

Horizontal visual effect	3
Vertical visual effect	1
Absorption capacity	3
Distance	2
Total visual effect	9 (0.45)

*9/20 equated to a coefficient of **0.45***

(b) Landscape Character Assessment

Relief	3
Vegetation coverage	3
Infrastructure built form	2
Cultural landscape overlays	2
Total landscape character	10

(c) 10 x 0.45 = 4.5

(d) *4.5/20 = 0.225*

(e) *0.225 x 100 = 22.5% Visual Change to the Landscape*

3.1 Final Aggregated Visual Effect

Percentage Value of Visual Change	Descriptive Qualification of Visual Effect	Comments
80-100%	Extreme	Extreme change in view: change very prominent involving total obstruction of existing view or change in character and composition of view through loss of key elements or addition of new or uncharacteristic elements which significantly alter underlying landscape visual character and amenity
60-80%	Severe	Severe change in view involving the obstruction of existing views or alteration to character through the introduction of new elements. Change may be different in scale and character from the surroundings and the wider setting. Resulting in a perceived increase in proportional change to the underlying landscape visual character.
40-60%	Substantial	Substantial change in view: which may involve partial obstruction of existing view or alteration of character and composition through the introduction of new elements. Composition of the view will alter. View character may be partially changed through the introduction of features.
20-40%	Moderate	Moderate change in view: change will be distinguishable from the surroundings whilst composition and underlying landscape visual character will be retained.
0-20%	Slight	Very slight change in view: change barely distinguishable from the surroundings. Composition and character of view substantially unaltered.

Appendix F
Glossary

Active Field of View:	The field of view excluding peripheral vision, which is described as 40° to each eye, within this zone colour, shapes and forms are not registered. The active field of view removes the angle of peripheral vision from the field of view producing an angle of 120 - 160°
Assessment (landscape):	An umbrella term for description, classification and analysis of landscape.
Depth of Field:	The distance between the nearest point (viewpoint) and farthest objects (visual envelope) which is visible within the field of view.
Element:	A component part of the landscape or visual composition.
Effect (landscape or visual):	These occur as a broad culmination of one or more impacts, incorporating professional judgement to extrapolate and/or generalise on the nature of these.
Horizontal Visual Effect:	This term is used to describe the field of view occupied by the visible part of a infrastructure elements.
Impact (landscape or visual):	Impacts occur to a particular element of the environment and they can be described factually by the nature and degree of change.
Landscape:	Human perception of the land conditioned by knowledge and identity with a place.
Landscape character:	The distinct and recognizable pattern of elements that occurs consistently in a particular type of landscape, and how people perceive this. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape.
Landscape feature:	A prominent eye-catching element, for example, wooded hilltop, isolated trees or grain silo.
Mitigation:	Measures, including any process, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual impacts of a development project.
Panorama:	A view, covering a wide field of view.
Photomontage:	A visualisation based on the superimposition of an image onto a photograph for the purpose of creating a realistic representation of proposed or potential changes to a view. These are now mainly generated using computer software.
Sensitivity:	The extent to which a landscape or visual composition can accommodate of a particular type and scale without adverse effects on its character or value.
Visual Amenity:	The value of a particular area or view in terms of what is seen.
Visual Envelope:	Extent of potential visibility to or from a specific area, viewpoint or feature.

Appendix G
Endnotes

[i] The GPS used was a Garmin X12 which differential-ready 12 parallel channel receiver continuously tracks and uses up to twelve satellites to compute and update a position

[ii] The SILVA precision M80 with a parallax free prismatic magnification-bearing compass. A magnetic bearing compass with a $\pm$ 0.5˚ from true magnetic course.

[iii] Pirenne, M.H. (1967). Vision and the Eye. London: Chapman and Hall

[iv] Panero, J. & Zelnik, M. (1979) Human Dimension & Interior Space- A source Book of Design Reference Standards. The Architectural Press Ltd. London.

[v] The distance zones have been developed Sinclair Thomas Matrix, which has cited field observations of the visual extents. The classification zones have been based on projected 90-100m high infrastructure elements.

Appendix K

High-level BESS Hazard Assessment

Design
for a better
future /

Whyte Yarcowie Wind Farm Pty Ltd

Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System

High-level BESS Hazard Assessment

June 2026

Question today
Imagine tomorrow
Create for the future

Whyte Yarcowie Wind Farm Transmission Line and Battery Energy Storage System
High-level BESS Hazard Assessment

Whyte Yarcowie Wind Farm Pty Ltd

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Rev	Date	Details
0	03/03/2026	Draft
A	17/06/2026	Updated to address client comments

	Name	Date	Signature
Prepared by:	Bill Schmidt	17/06/2026	
Reviewed by:	Segar Manoharan	17/06/2026	
Approved by:	Tenille Anderson	17/06/2026	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Abbreviations

a.c.	Alternating current
AIL	Associated Infrastructure Licence
BESS	Battery energy storage system
BMS	Battery Management System
eBoP	Electrical Balance of Plant
FFR	Fast frequency response
HRE Act	*Hydrogen and Renewable Energy Act 2023*
km	Kilometre
kV	Kilovolt
m	Metre
MW	Megawatt
MWh	Megawatt hour
LFP	LiFePO4 chemistry
LiFePO4	Lithium Iron Phosphate
OTL	Overhead transmission line
OTR	Office of the Technical Regulator
PCS	Power Conversion System
SOC	State of charge
WSP	WSP Australia Pty Limited
WTG	Wind turbine generators

1 Introduction

1.1 Project overview

Whyte Yarcowie Wind Farm Pty Ltd are proposing to develop the Whyte Yarcowie Wind Farm. The proposed wind farm is located along the east and south of the town of Whyte Yarcowie, approximately 180 kilometres (km) north of Adelaide, South Australia.

To support the wind farm, Whyte Yarcowie Wind Farm Pty are proposing to develop a battery energy storage system (BESS) with a capacity of up to 270 MW/2160 MW hours (MWh), as well as an approximately 19.5 km long, dual-circuit 275 kilovolt (kV) overhead transmission line (OTL) to connect the internal wind farm substation to ElectraNet's existing Belalie East Substation (the Project).

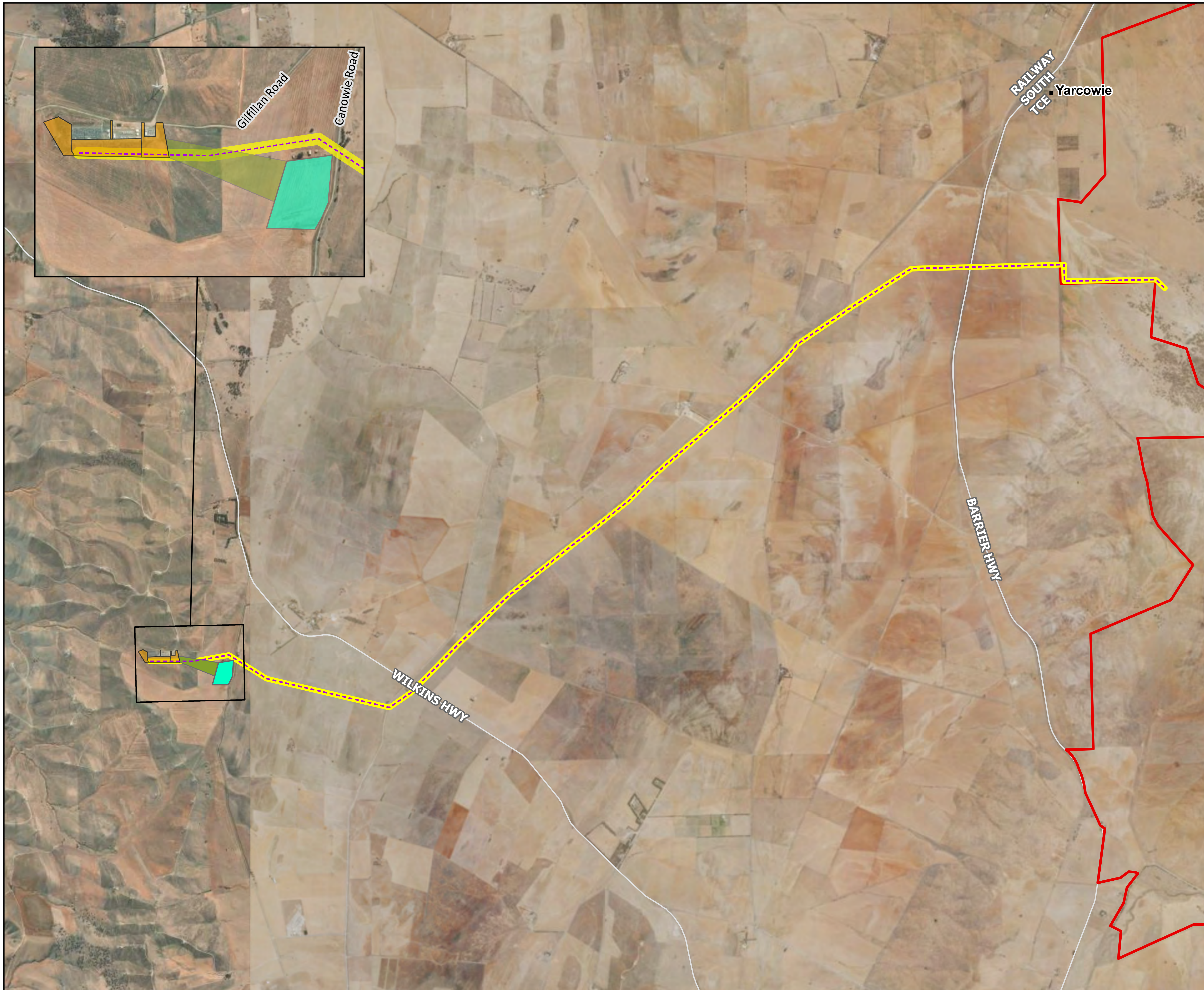
The BESS will be developed to provide Fast Frequency Response (FFR) services to support grid stability and 'firming' capacity for the wind farm and renewables connected to the grid. The final capacity of the BESS is still to be determined but will be a minimum of 200 MW/400 MWh to meet the Office of the Technical Regulator's (OTR's) FFR requirements for the wind farm and no more than 270 MW/2160 MWh.

The OTL will be located within a 70 m wide easement and supported by transmission towers with a maximum height of 50 m tall and spaced approximately 400 m apart. The works will also include a necessary expansion of the Belalie Substation and supporting connection works to enable the OTL to connect to the substation.

The indicative layout for the Project is shown overleaf in Figure 1.1. An Associate Infrastructure Licence (AIL) is being sought for construction, operation and eventual decommissioning of the BESS, OTL and Belalie East Substation expansion under the *Hydrogen and Renewable Energy Act 2023* (HRE Act).

WSP Australia Pty Ltd (WSP) have been engaged by Wind Prospect Group Ltd on behalf of Whyte Yarcowie Wind Farm Pty Ltd to prepare the AIL application and supporting documentation.

The BESS model, capacity, and layout; final transmission tower design and height, tower locations and spacing; and footprint of the Belalie Substation expansion will be subject to detailed design. To support the AIL application, supporting documentation has accommodated for a worst-case scenario of a maximum BESS capacity of 270 MW/ 2160 MWh and OTL design incorporating 50 m tall lattice towers. Furthermore, documentation has considered an extended investigation area for the Belalie Substation expansion, though it is expected that the final design will require a smaller footprint.

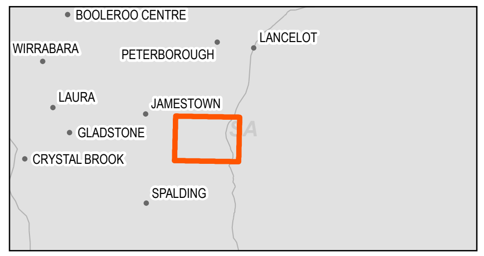


PS221341
Whyte Yarcowie Wind Farm BESS and OTL: Associated Infrastructure Licence

Figure 1.1
Project Layout

Legend

- Localities
- State Managed Roads
- BESS
- Underground Cable Easement
- Belalie East Substation Expansion
- Transmission Line
- 50m Transmission Line Easement
- Wind Farm Boundary (REIL 2)



0 1,000 2,000
Metres

Coordinate system: GDA2020 MGA Zone 54
Scale ratio correct when printed at A3

1:60,000 Date: 16/12/2025

Data sources: WSP, SA Government, World Imagery Earthstar Geographics
MetroMap (Australia latest)

1.2 Project area

The Project Area is located between Belalie East and Whyte Yarcowie, approximately 180 km north of Adelaide, and is situated within the traditional lands of the Ngadjuri Peoples. The Project locality is shown in Figure 1.2.

The Project Area encompasses approximately 122.34 ha and is situated on farmland, largely consisting of cropping and sheep grazing.

There are no major watercourses or water bodies within the Project Area, though there are a number of minor flow paths intersecting the site.

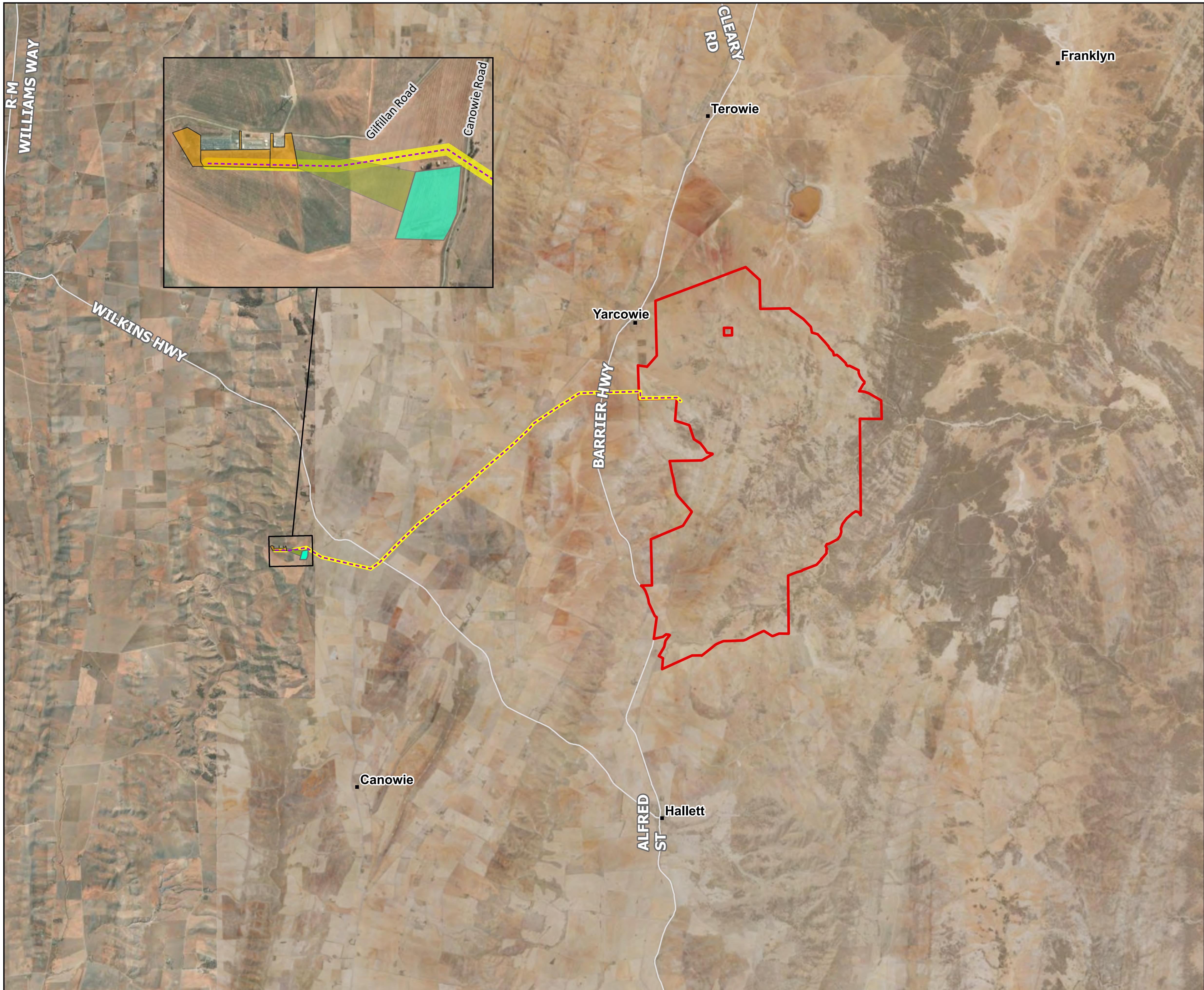
The OTL will be located within an approximately 19.5 km long, 70 m wide easement connecting the internal Whyte Yarcowie Wind Farm substation to the west to the existing Belalie Substation to the east of the easement. The easement will be located primarily within free hold agricultural land; traversing linear road corridors where possible, to minimise fragmentation of the land. The easement will have road crossings on Pigeon Box Road, Barrier Highway, Jones Road, Wilkins Highway, Booborowie Road, and Canowie Road.

The existing Belalie Substation will be expanded accommodate connection works. The substation is located off Gilfillan Road and is surrounded by WTGs associated with the Hallet Wind Farm. The investigation area for the substation expansion is located on agricultural land situation directly to the east, west and south of the substation.

The BESS site is located within freehold cropping land adjacent to Canowie Road and will connect to the Belalie East Substation expansion via an approximately 655–1,200 m long easement (to be determined based on the final location of the substation works). Native vegetation within the site has predominantly been cleared for agricultural use; with only small amount of native vegetation located in the adjacent road reserve and cable easement. Access to the site will be via two proposed new access points from Canowie Road.

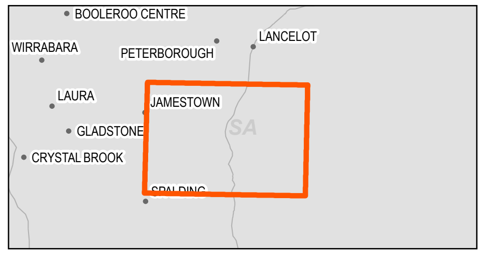
PS221341
Whyte Yarcowie Wind Farm BESS and OTL: Associated Infrastructure Licence

Figure 1.2
Project Locality



Legend

- Localities
- BESS
- Transmission Line
- State Managed Roads
- Underground Cable
- Belalie East Substation Expansion
- 50mTransmission Line Easement
- Wind Farm Boundary (REIL 2)



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Scale ratio correct when printed at A3

1:150,000 Date: 16/12/2025

Data sources: WSP, SA Government, World Imagery Earthstar Geographics
MetroMap (Australia latest)

1.3 Scope of report

WSP has undertaken a high-level assessment of BESS-specific hazards, to support the AIL application under the HRE Act. The assessment outlines potential design and operational risks of the BESS and provides recommendations for risk mitigation, to be considered in the further design for the Project.

The assessment is based on a preliminary layout of the BESS, which will be subject to change during the detailed design stage of the Project.

1.4 Legislative and policy requirements

WSP has outlined key standard documents with which the Project (being a BESS) is expected to be compliant in Table 1.1.

Table 1.1 Key standards

Standard Number	**Title**
AS/NZS 3000	*Electrical Installations – Wiring Rules*
AS/ NZS 2067	*Substations and high voltage installations exceeding 1 kV a.c.*[1]
AS/ NZS 5139	*Electrical installations – Safety of battery systems for use with power conversion equipment*
AS 1670	*Automatic fire detection and alarm systems*
AS 61439	*Low voltage switchgear and control gear assemblies*
IEC60364	*Low Voltage Installation*
AS60076	*Power Transformer*
NFPA855	*Standard for the installation of stationary energy storage system*
UL9540A	*Test Method for Battery Energy Storage Systems*
UL1973	*Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications*
N/A	*Design Guidelines and Model Requirements for Renewable Energy Facilities* (Country Fire Authority, 2025)

1 Alternating current (a.c.)

2 Risk analysis and assessment

2.1 Whyte Yarcowie Wind Farm BESS

A BESS with a capacity of up to 270 MW/2160 MWh is proposed to support the to support the Whyte Yarcowie Wind Farm.

The BESS will be developed to provide FFR services to support grid stability and 'firming' capacity for renewable energy in the electricity grid. The final capacity of the BESS is still to be determined but would be no more than 270 MW /2160 MWh.

The preliminary design of the project BESS has used a CATL TenerS containerised battery unit and a Power Electronics 'HEM-PCSM Gen3' inverter. WSP understands that the supply of individual components of the BESS is subject to a commercial process that is ongoing.

2.2 Assumptions

In the absence of commitments from the Client regarding specific equipment suppliers to be used for the project, WSP has assumed the following for the purpose of this assessment:

- The BESS will have a maximum capacity of 270 MW, 8-hour duration.
- The Battery Chemistry will be the current industry typical – LiFePO4 (Lithium Iron Phosphate)
- The basic AC energy Power Conversion System (PCS) consists of:
  - A MV RMU, 2 isolation switches and an MV CB and protection relay
  - A single two winding transformer, MV/LV, configuration
  - A four-quadrant inverter
  - The BESS will connect to a single 320 MVA transformer, via a MV reticulation system
  - The MV reticulation system will be based on radial feeders with a maximum of 25 MVA load per feeder
  - The BESS POC will be at Belalie Substation after the ~1 km of OHL or underground cable.
- Fire fighting
  - The BESS battery container will not be fitted with active firefighting systems
  - The BESS fire strategy will be to let a container burn until it self-extinguishes
  - The BESS will be designed to passively limit the fire spread
  - Firefighting water storage is provided on site to support the prevention of fire spread per CFS requirements.
- WSP assume functionality is limited to:
  - Fast Frequency Response (FFR)
  - Energy arbitrage.
  - System Strength Services.

2.2.1 BESS technology

2.2.1.1 Battery standards and certifications

UL 1973 is a standard for batteries used in light electric vehicles, and includes aspects related to the safety and performance of batteries. The standard covers safety requirements, performance testing, durability and reliability, marking and labelling and regulation compliance.

UL 9540A is a standard for batteries focused on energy storage systems (ESS), and includes aspects related to the safety of ESS and their installations, particularly for stationary applications such as grid-connected energy storage systems. The standard covers Fire Safety, evaluated at cell, module, unit and installation levels, Electrical Safety, Environmental Testing, Installation Requirements, Failure Modes and Effects Analysis, Code Compliance, US codes only.

UL 9540A includes a series of progressively larger fire tests, beginning at the cell level and progressing to the module level, unit level, and finally the installation level. The fourth edition, Nov 2019, of UL 9540A includes criteria introduced to the cell level, module level, and unit level tests that identify when progressively larger tests are unnecessary.

2.2.1.2 Battery chemistry/cell level

WSP assume a LiFePO4 chemistry (LFP) is intended for this BESS[2]. LFP cells are industry standard and present a medium fire risk. UL testing demonstrate that these cells will flame and discharge gas when set to thermal runaway. When mitigated by suitable battery module design and fire containment systems WSP consider this risk reduced to low level.

Recommendations

- The detailed design should incorporate suitable battery module design and fire containment systems to mitigate thermal runaway risks e.g. cell thermal barriers, rack segregation, gas detection, and explosion venting.
- Any change to BESS chemistry in detailed design from LiFePO4 will require re-evaluation of runaway fire risk.

2.2.1.3 Battery management systems

No details have been provided for the Battery Management System (BMS). The BMS provides cell and module monitoring of voltage, current, temperature, rates of charge and discharge. When any of these parameters' cross preset thresholds, the BMS will initiate isolation of the module to mitigate thermal runaway.

The BMS calculates the state of charge, a key control variable used by the overall system PPC to regulate the plant output.

More advanced systems will also implement cell balancing routines, via the BMS, to maintain the long-term health of the battery cells. Over time the internal resistance of the cells increases with aging. Resistance changes are non-uniform and occur due to minor variations from manufacture and/or thermal experience[3] of the cell during its life. Cells within a module receive a uniform charging voltage but the amount of charge they accept is a function of their internal resistance. Cell balancing routines identify cells in a module that have higher voltage levels, indicative of higher SOC and then discharge these slightly. The module is then recharged, over a number of these cycles all cells in the module should come to the same SOC.

BMS architecture and functionality is critical in the mitigation of thermal runaway, control, and long-term safe operation of any BESS plant.

---

[2] The noise report references a CATL test result for the battery container (XiangYu(VP), 2025), our assumption is based on CATL's most common product.

[3] The physical construction of cells and modules dictates that cyclic cooling and heating is not uniform.

Recommendations

- Once the BESS BMS has been identified, the system should be subject to evaluation of the architecture and functionality, to ensure it provides the safety features discussed above as well as a level of reliability acceptable to the project.
- It should be noted that a BMS with reduced functionality may be acceptable if supplemented with additional fire detection and suppression systems.

2.2.1.4 AS3000 and compliance to standards

The Technical Specification for the Project has not yet been produced.

WSP recommend that all BESS equipment, at a minimum, be certified to AS3000, GB/T 36276-2023, IEC62477-2022, IEC62619-2022, IEC63056-2020, NFPA68-2023, NFPA69-2019, NFPA855-2023, UL1973-2022, UL50E, UL9540-2023, UL9540A-2019, and UN38.3.

Standard	Description of Standard	Risk mitigated
AS3000	Australian standard for the design, construction, and verification of electrical installations.	Reducing the risk of delays in achieving a certificate of safety and authority to energise the Project.
GB/T36276-2023	Chinese standard for battery manufacture.	Ensuring batteries achieve acceptable quality and safety standards.
IEC62477-2022	International standard relevant to inverters safety.	Ensuring inverters are built to recognised standards.
IEC62619-2022	International standard for lithium battery construction.	Ensuring batteries are built to recognised standards.
IEC63056-2020	International standard for lithium battery used in BESS construction.	Ensuring batteries are built to recognised standards.
NFPA68-2023	US standard for explosion protection by deflagration venting.	Ensuring venting system(s) are built to recognised standards.
NFPA69-2019	US standard for explosion prevention systems.	Ensuring explosion system(s) are built to recognised standards.
NFPA855-2023	US installation standard for BESS.	Ensuring system(s) are installed to a recognised standard.
UL1973-2022	US and Canadian standards for the evaluation of battery safety mechanisms.	Ensuring battery safety system(s) operate as required.
UL50E	US and Canadian standards for electrical equipment enclosures.	Ensuring electrical enclosures are built to recognised standards.
UL9540-2023	US and Canadian standards for system-level safety standard for BESS.	Ensuring BESS safety system(s) operate as required.
UL9540A-2019	US and Canadian standards for testing methods for the evaluation of thermal runaway fire propagation	Ensuring battery thermal runaway potential is tested to recognised standards and to inform fire and safety design requirements for BESS.
UN38.3.	United Nations manual for transportation testing for lithium batteries.	Ensuring batteries will be suitable for overseas transport.

Recommendations

- WSP recommend the inclusion of a requirement for standards certification be included in the BESS technical specification.

2.2.1.5 Inverters

The primary risk of inverters to the project is in terms of performance specifically in the areas of, noise generation, harmonic response, voltage control, PQ envelope, fault current contribution and ride through capability, grid stability, control, and achievement of AEMO acceptance and registration in the national electricity market.

WSP assume the use of PE HEM-PCSM Gen3 inverters[4], these have been used in a number of Australian BESS projects and is considered by WSP to be a low technical risk product.

WSP note that the final inverter size, model, and supplier are yet to be determined.

Recommendations

WSP recommend identification of the proposed BESS Inverters and:

- Confirmation that their noise signature is less than or equal to the PE HEM-PCSM Gen3 inverter to ensure noise study is valid.
- A thorough evaluation of the functionality offered to ensure compatibility with the requirements of the agreed GPS.

2.3 Balance of Plant, electrical

The provided information on electrical Balance of Plant (eBoP) for this Project is minimal and limited to the following documents:

A proposed layout drawing for a 270 MW/2160 MWh (EDF power solutions, 2026).

2.3.1 BESS general arrangement

The preliminary layout for the BESS (shown in Figure 2.1) identifies an area for the BESS substation. Single line diagrams confirming how the BESS connects to the system have not been provided, meaningful comment in regard to the layout area for the substation cannot be provided at this stage of the Project.

WSP assume a HEM-PCSM Gen3 INVERTER will be used for the BESS. These units can support up to a 4.2MVA load (Power Electronics, 2025). The layout shows a total of 72 PCSs, based on the footprint used, 6m x 3.5 m it appears that the PCS configuration is based on a single inverter as outlined in the assumptions above. It should be note that this is not current industry practise and will provide an area of opportunity to minimise the site capital expenditure.

WSP note noting that the final inverter size, model and supplier is yet to be determined.

The preliminary BESS layout does not show any firefighting facilities beyond water storage. Current industry practise is to provide a hydrant system feed from an onsite pumping station and site water storage. The hydrant system is provided to ensure fire responders can provide water to all areas of the yard for the purpose of preventing fire spread.

The separation distances used in the layout drawing seem typical of industry practise, although these should be compared to the UL9540A test results which will establish the minimum clearance required to prevent fire propagation between BESS containers.

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[4] Assumption based on provided noise assessment report (Martinez, 2024)

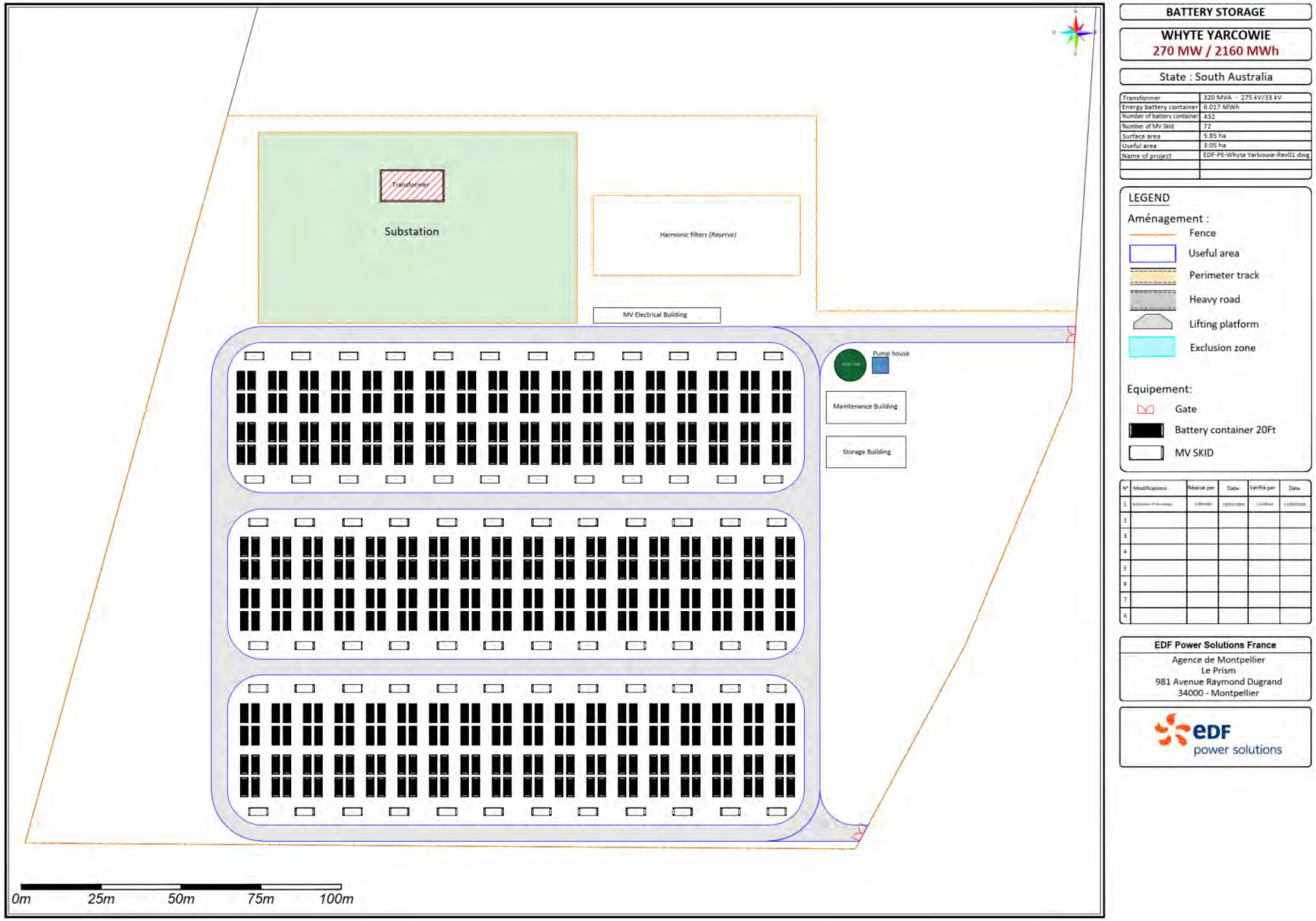

Figure 2.1 Preliminary BESS layout (Martinez, 2024)

2.3.2 BESS MV collector system

No details have been provided for the collector system. WSP have speculated on what this might look like in Section 2.3.1 above.

Details of the proposed PCU/step-up transformers, 33 kV reticulation switchgear, and cabling have not been made available for review, however these items are established technology and WSP considers these to represent a low technical risk to the Project.

The underground cable and overhead conductor sizing calculation has not been provided. However, it is expected these details are to be developed in the future design stages.

2.3.3 BESS aux power systems

No details have been provided for the BESS auxiliary power systems. Typically, these would be sourced from the local 33 kV buses via suitably sized transformers. These items are established technology and WSP considers these to represent a low technical risk to the Project.

2.3.4 Recommendations

- Confirm BESS and wind farm HV connection requirements to ensure EBOP design is suitable. PCA, ACA and MCA define NSP requirements and from key inputs to eBOP design phase.
- The detailed design should be reviewed to ensure the minimisation of installed capacity and maximisation of equipment utilisation.
- Auxiliary supplies for the BESS should be designed to provide high reliability required to meet BESS supply commitments and maintain BESS units safely in event of prolonged outage of primary connections.
- The detailed design should incorporate fire clearances in accordance with UL9540A test results to ensure minimisation of fire propagation risk.
- Engage with the local firefighting authority to determine the minimum firefighting facilities required for the Project, to be incorporated into the detailed design. This should the following minimum requirements:
  - Installed pumping station and water storage
  - Minimum water storage capacity
  - Installed hydrants and pipework.

3 Summary and recommendations

3.1 Typical hazards

This high-level hazard assessment for the BESS component of the Project was based on a preliminary design with limited technical information available at this stage. The assessment has identified typical hazards that should be considered for all BESS projects, and provides recommendations for inclusion as the design progresses, to minimise risks that may be posed by the BESS. Risks considered in this assessment include:

- Thermal runaway
- Fire propagation
- Electrocution – floating DC and AC systems provide increased risk requiring design resolution
- Maintainability/Handling hazards – the smallest battery module unit that requires handling is often around 300 kg and may require
  - specialist handling equipment
  - engineered surfaces
- Water damage/fire due to site flooding
- Harmonic emissions into grid
- GPS compliance
  - low ride through capacity
  - fault contribution
  - stability
  - poor FCAS performance – all issues can arise depending on inverter technology selected.
- Low reliability leading to long outages and reduced commercial performance. Can arise from both technical specification of equipment and system configuration.

3.2 BESS technology

Recommendations

- Evaluation and review of the BESS chemistry to establish thermal runaway risk, alternative chemistries require alternative safety solutions.
- Identification of the proposed BESS BMS – allows review of BESS functionality in detail and mitigates against error in safety system requirements.
- Evaluation and review of the functionality or proposed BESS BMS – key safety component required to mitigate thermal runaway risk.
- Inclusion of a requirement for standards certification be included in the BESS technical – risk of non-conformance to AS3000 delaying project energisation due to certificate of safety issues.
- Identification of proposed BESS Inverters required for GPS application and assessment.
- Evaluation and review of the functionality or proposed BESS Inverters, required to minimise mismatch between noise studies and GPS assessment.

3.3 Electrical Balance of Plant

Recommendations

- Confirm Auxiliary supplies for the BESS will be designed to provide high reliability required to meet BESS supply commitments and maintain BESS units safely in event of prolonged outage of primary supplies. This may be mitigated by ensuring is no gap between owner's requirements and the provided concept designs.
- Confirm fire clearances of the final design are based on UL9540A test results to ensure minimisation of fire propagation risk.
- Confirm South Australian Country Fire Service (CFS) minimum requirements for firefighting facilities are included in the concept design documents. This may be mitigated by ensuring is no gap between the owners' requirements and the provided concept designs. Typical requirements include:
  - installed pumping station and water storage
  - minimum water storage capacity
  - installed hydrants and pipework.

4 Limitations

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