FINAL REPORT

GOYDER NORTH WIND FARM

AERONAUTICAL IMPACT ASSESSMENT

INCLUDING

AVIATION IMPACT STATEMENT

QUALITATIVE RISK ASSESSMENT

AND

OBSTACLE LIGHTING REVIEW

CCP12N

20 December 2023

NEOEN

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EXECUTIVE SUMMARY

The Goyder North project represents the next phase of the wider Goyder Renewables Zone project. The Goyder South phase is under construction.

The Goyder North Renewable Energy Project (GNREP) project area is located approximately 5km to the north of Burra and extends in a northerly direction to approximately 10km south-east of Hallett (on the Barrier Highway, A32). The overall project area is approximately 23km long by 13km wind and spans two key ridgelines that run north south within the project area. The project Overhead Transmission Line (OTL) and substation are likely to be in the centre of the project and the OTL will extend in a southerly direction to connect with Goyder South infrastructure.

The proposed wind farm will comprise of 138 turbines with a tip height of 240m Above Ground Level (AGL).

There are no Certified or Military aerodromes within 30nm (56km) of the boundary of the GNREP. There three known uncertified aerodromes within 30nm of the wind farm.

The AIS concluded that the GNREP will impact the GRID Lowest Safe Altitude (LSALT) east of 139^0 E and north of 34^0 S. The GRID LSALT will need to increase to 4000ft from 3800ft.

The AIS concluded that the GNREP will not impact upon the following:

- The Lowest Safe Altitude of nearby published air routes;
- The Obstacle Limitation Surface (OLS) of any certified aerodrome;
- The Procedures for Air Navigation Services ï Aircraft Operations (PANS-OPS) surfaces associated with the Instrument Approach Procedures at any Certified Aerodrome;
- The operation of the Uncertified Aerodromes at
  - Clare Valley
  - Jamestown; or
  - Peterborough;
- Restricted Area R265D;
- The performance of Communication, Navigation or Surveillance Facilities.

Airservices Australia advise that the GNREP will impact the GRID Lowest Safe Altitude east of 139 degrees longitude. This GRID LSALT will need to be raised from 3800ft to 4300ft

The GNREP sits near existing wind farms within Danger Area D258B, an area used for military flying training and may impact on its use.

The Qualitative Risk Assessment demonstrates that for the GNREP: -

- By day the wind turbines are conspicuous by their size and colour;
- Night operations of aircraft do not occur below protected airspace;
- Aerodromes equipped for night operations are sufficiently distant; and
- It is assessed as a LOW risk to aviation and is therefore not a hazard to aircraft safety.

The Obstacle Lighting Review for the GNREP finds that in accordance with the NASF Guideline D risk assessment:

- Obstacle lighting is not required as the risk to aviation is LOW and no additional mitigating strategies are necessary.

The GNREP wind turbines and meteorological monitoring masts are tall structures, therefore they must be reported in accordance with Advisory Circular AC 139.E-01 *Reporting Tall Structures* to the Vertical Obstacle Database, managed by Airservices Australia.

1. INTRODUCTION

Neoen Australia has requested Chiron Aviation Consultants to provide an Aeronautical Impact Assessment (AIA) for the proposed Goyder North Wind Farm project in South Australia.

1.1 Location

The Goyder North project represents the second phase of the wider Goyder Renewables Zone project. The Goyder South phase is under construction.

The Goyder North project area is located approximately 5km to the north of Burra and extends in a northerly direction to approximately 10km south-east of Hallett (on the Barrier Highway, A32). The overall project area is approximately 23km long by 13km wind and spans two key ridgelines that run north south within the project area. The project Overhead Transmission Line (OTL) and substation are likely to be in the centre of the project and the OTL will extend in a southerly direction to connect with Goyder South infrastructure.

The proposed wind farm will comprise of 138 turbines with a tip height of 240m Above Ground Level (AGL).

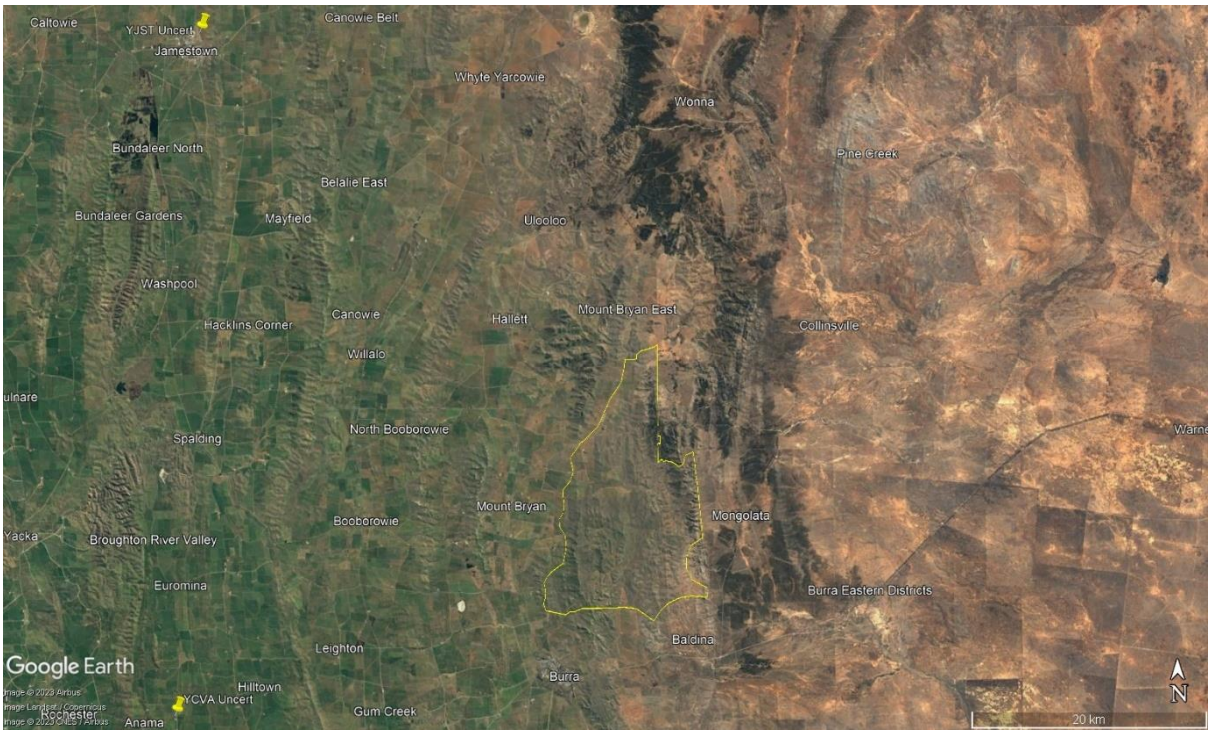

Figure 1 – Goyder North Renewable Energy Park Location and Turbine Layout.

1.2 Aerodromes and Airstrips

Aerodromes fall into three categories:

- Military or Joint (combined military and civilian);
- Certified;
- Uncertified or Aeroplane Landing Areas

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, certified under Civil Aviation Safety Regulation (CASR) 139.040, is available for Regular Public Transport and Charter operations and has a runway suitable for use by an aircraft having a maximum carrying capacity of more than 3,400kg or a passenger seating capacity of more than 30 seats, for example Adelaide Airport, and Port Augusta Airport.

An Uncertified Aerodrome is any other aerodrome or airstrip and is referred to as an Aeroplane Landing Area (ALA). 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.

Certified, and Military 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 (ALA) are not required to be listed in the AIP so information about them is not held in the public domain, is not available through aeronautical publications and charts and is not required to be reported. Where ALA information is published in the AIP it is clearly annotated that it is not kept current. A local example is Jamestown Airport. Consequently, 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 occasionally as an ALA is not usually discernable on satellite mapping services such as Google Earth.

Military, Joint, and Certified aerodromes have Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation ï Operations (PANS-OPS) surfaces defined to protect the airspace associated with published instrument approach and landing procedures. An Uncertified aerodrome or ALA does not have an OLS and cannot have a published instrument approach and landing procedure so cannot have associated airspace

[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

protected by PANS-OPS. All operations at an ALA 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 or Military aerodromes within 30nm (55.56km) of the GNREP.

There are three Uncertified aerodromes (ALA) within 30nm (55.56km) at

- Jamestown (YJST) 25.33nm northwest of turbine WTG_060;
- Clare Valley (YCVA) 18.59nm west southwest of WTG_005;
- Peterborough (YPTB) 27.58nm north northwest of WTG_012

1.4 Air Routes in the Area

The GNREP sits below air route H246 as shown in the table below.

Route	Segment	Direction	LSALT
GRID	138E to 139E	North of 34S	4500
GRID	139E to 140E	North of 34S	3800
H246	ORBUN to ISROV	Northbound	5100
W448	MEECE to WHYALLA		4500

1.5 Airspace in the Area

The GNREP is in Class G airspace with Class E airspace above having a lower limit of 8,500ft.

The GNREP sits within the military flying Danger Area D258B. D258B extends from the surface (SFC) to 9,500ft and is active during daylight hours Monday to Friday (except Public Holidays).

Restricted Area R265D, used for military flying, sits above the GNREP. R265D has a Lower Limit of 9,500ft and is activated by NOTAM.

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 ñcontrolled airspace extending upwards from a specified limit above the earth.[3]ò

A Danger Area is airspace within which activities dangerous to the flight of aircraft may exist at specified times[4].

A Restricted Area is airspace within which the flight of aircraft is restricted in accordance with specified conditions[5].

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 turbine tip height. For the GNREP, with a tip height of 240m (788ft), a VFR flight is required to maintain a minimum height of 788 + 500 = 1288ft Above Ground Level (AGL).

[3] AIP Enroute, ENR 1.4 ï 1, 1.1.1, dated 02 December 2021
[4] AIP Enroute, ENR 1.4 ï 6, 1.4, dated 30 November 2023
[5] AIP Enroute, ENR 1.4 ï 6, 1.4 dated 30 November 2023

2. SCOPE

To meet the requirements of Neoen Australia, the study required Chiron Aviation Consultants to examine the GNREP development in relation to any impacts on aviation activity in the area and undertake the following tasks.

2.1 Aviation Impact Statement (AIS)

Airservices Australia (AsA) require an Aviation Impact Statement (AIS) for wind farm developments. The Aviation Impact Statement is submitted to AsA and the Department of Defence 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 Statement

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 registered/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 GNREP potential impact on the items listed in Section 3. 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 Goyder North Renewable Energy Project (GNREP) represents the second phase of the wider Goyder Renewables Zone project. The Goyder South phase is under construction.

The Goyder North project area is located approximately 5km to the north of Burra and extends in a northerly direction to approximately 10km south-east of Hallett (on the Barrier Highway, A32). The overall project area is approximately 23km long by 13km wind and spans two key ridgelines that run north south within the project area. The project Overhead Transmission Line (OTL) and substation are likely to be in the centre of the project and the OTL will extend in a southerly direction to connect with Goyder South infrastructure.

4.2 Obstacles

The proposed wind farm will comprise of 138 turbines with a tip height of 240m (788ft) Above Ground Level (AGL).

The tallest turbine tip is WTG_014 at 976m (3202.06ft) AHD. Rounded up this gives a tip height of 3203ft; add the Minimum Obstacle Clearance (MOC) of 1000ft gives a LSALT of 4203ft. Rounded up to the nearest hundred the LSALT over the GNREP is 4300ft.

The turbine locations and elevations are shown at Appendix A.

4.3 Drawings

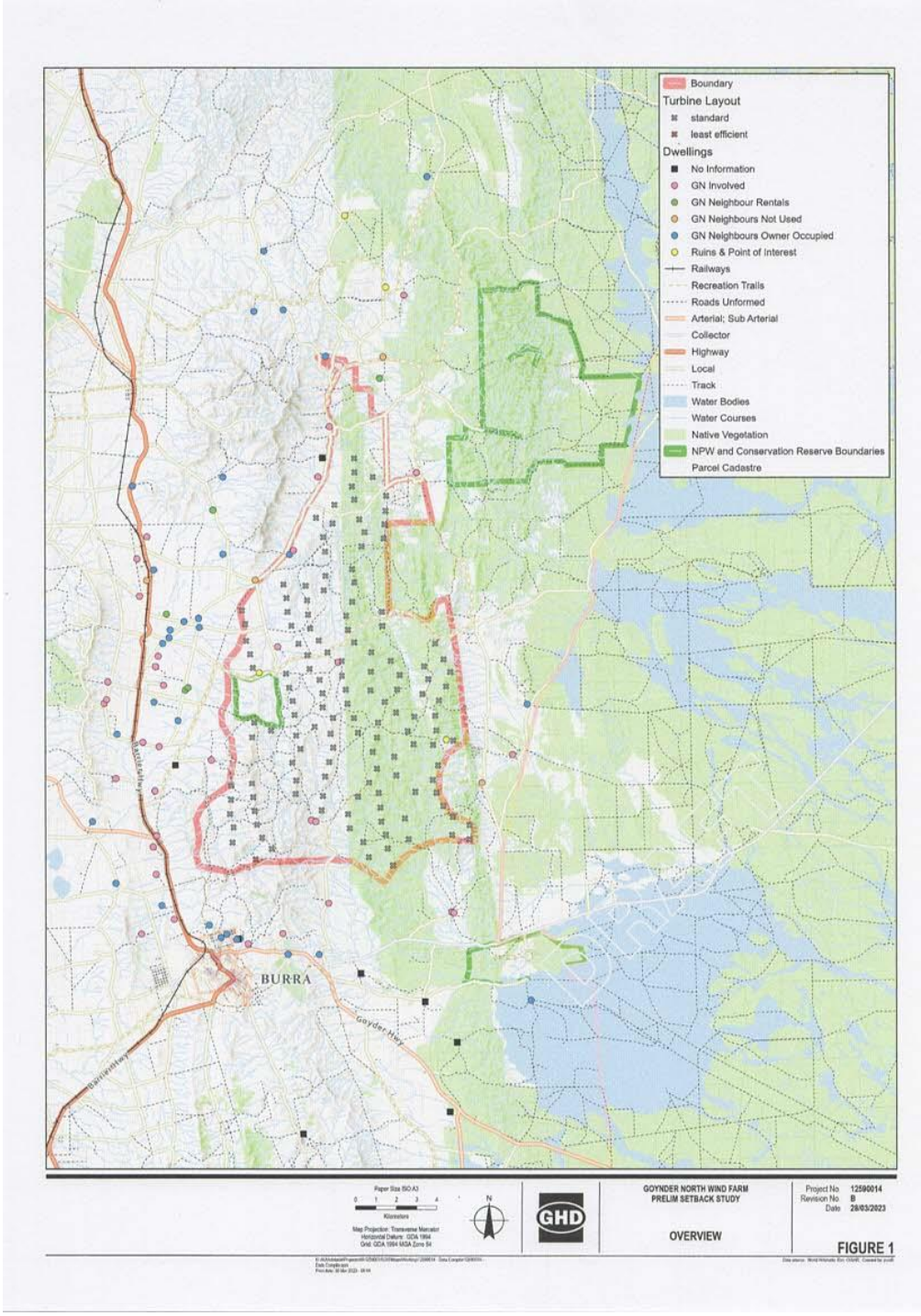

Figure 2 – Location of Goyder North Renewable Energy Park[6]

[6] Supplied by Neoen Energy

The drawing above shows the location of the GNREP is approximately 5km to the north of Burra and extends in a northerly direction to approximately 10km south-east of Hallett (on the Barrier Highway, A32).

4.4 Aerodromes within 30nm

There are no Certified or Military Aerodromes within 30nm (56km) of the proposed GNREP.

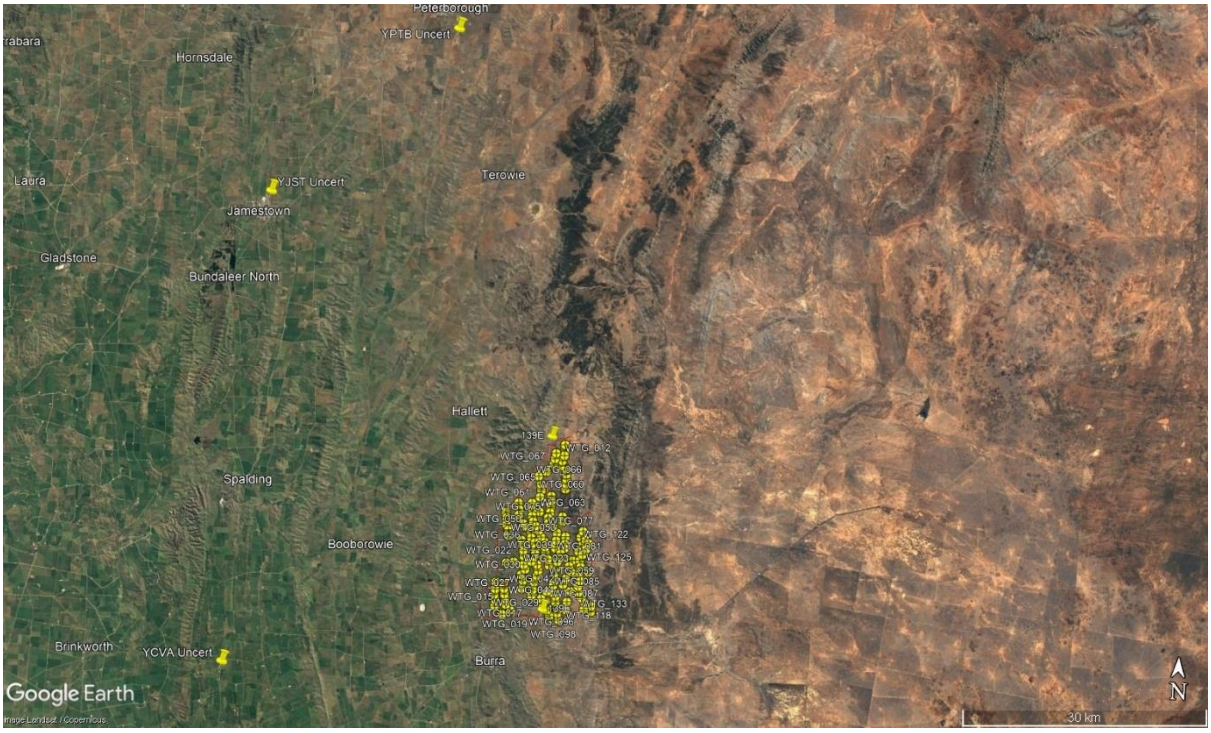

Figure 3 – Aerodromes with 30nm of GNREP

4.4.1 Other aerodromes and airstrips

There are three known Uncertified Aerodromes (Aeroplane Landing Area [ALA]) within 30nm (56km) of the GNREP at: -

- Clare Valley (YCVA) 18.59nm west southwest of WTG_005;
- Jamestown (YJST) 25.33nm northwest of turbine WTG_060;
- Peterborough (YPTB) 27.58nm north northwest of WTG_012.

The GNREP is sufficiently distant from each of these uncertified aerodromes for it to have no impact on their operations or aircraft safety.

4.4.2 Clare Valley (YCVA)

Clare Valley is an uncertified aerodrome operated by the Clare Valley Flying Group Incorporated and listed in ERSA. Runway 09/27 is 600m long unrated grass. Runway 17/35 is 1250m long, sealed and equipped with Low Intensity Runway Lighting that is Pilot Activated (PAL). The aerodrome has multiple hangars and a passenger/club rooms building.

4.4.3 Jamestown (YJST)

Jamestown is an uncertified aerodrome operated by the Northern Areas Council and listed in ERSA. Runway 16/34 is 1200m long, sealed and equipped with PAL.

4.4.4 Peterborough (YPTB)

Peterborough is an uncertified aerodrome operated by the District Council of Peterborough and is listed in ERSA. Runway 17/35 is 1500m long, sealed and equipped with PAL.

4.5 Air Routes and Lowest Safe Altitudes

The published air routes within 10nm of the GNREP and their LSALT are shown in Table 1 and Figure 6 below.

Route	Segment	Direction	LSALT
GRID	138E to 139E	N of 34S	4500
GRID	139E to 140E	N of 34S	3800
H246	ORBUN to ISROV	Northbound	5100
W448	MEECE to WHYALLA		4500

Table 1 – Published LSALT

The tallest turbine tip is WTG_014 at 976m (3202.06ft) AHD. Rounded up this gives a tip height of 3203ft; add the Minimum Obstacle Clearance (MOC) of 1000ft gives a LSALT of 4203ft. Rounded up to the nearest hundred the LSALT over the GNREP is 4300ft.

The GNREP sits across two GRID LSALT areas. The GRID LSALT west of 139^0 East, north of 34^0 South is 4500ft. The GRID LSALT east of 139^0 East, north of 34^0 South is 3800ft.

The tallest turbine, WTG_014 is located at 33^0 35.726S 138^0 57.056E in the 4500ft GRID area. Turbine WTG_014 does not impact the GRID LSALT.

Turbine WTG_057 is located at 33^0 33.636South 139^0 00.15 East in the 3800ft GRID area. Turbine WTG_057 has a tip height of 2961ft AHD, giving an LSALT of 4000ft. Turbine WTG_057 will require the 139^0 GRID LSALT to be raised from 3800ft to 4000ft.

The GNREP does not impact the published LSALT for any air route in the vicinity, however it will require the 139[0] GRID LSALT of 3800ft to be raised to 4000ft.

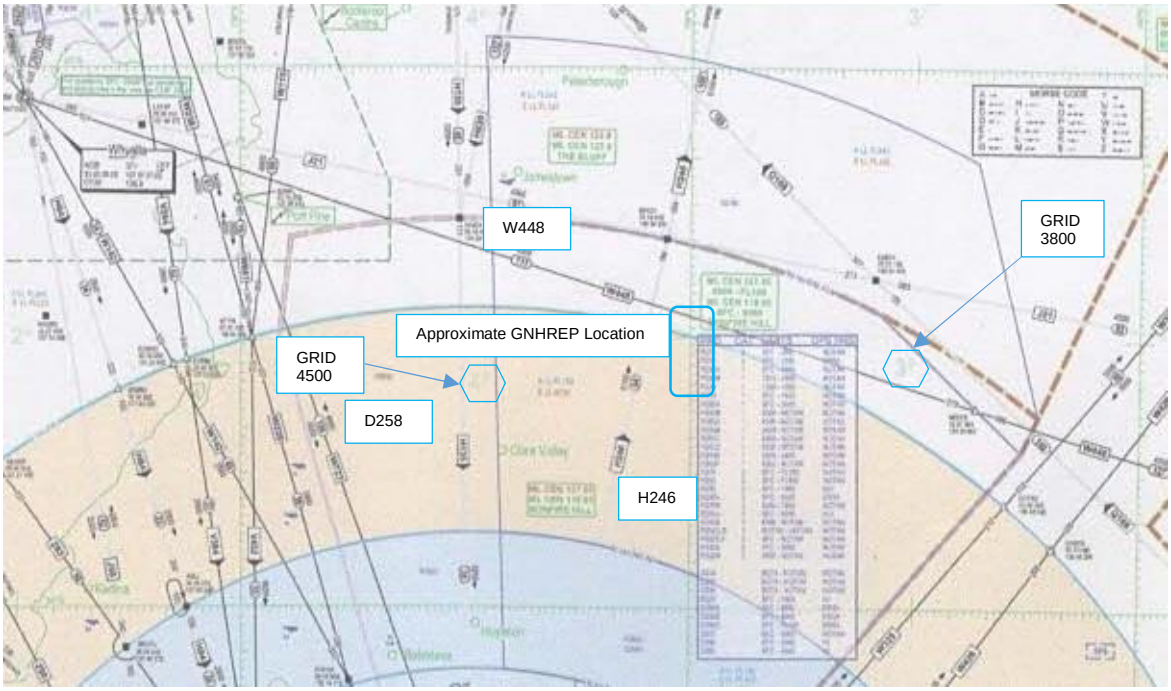

Figure 4 – Nearby Air Routes[7]

4.6 Airspace

The GNREP is in Class G airspace below Class E airspace with a lower limit of 8,500ft.

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

There is a Danger Area and a Restricted Area (PRD) overlying the GNREP.

- D258B SFC - 9500 ï JO/HJ or by NOTAM Military flying training[8].
- R265D 9500 to NOTAM[9].

4.6.1 Restricted Area R265D

The LSALT over the GNREP is below the Lower Limit of Restricted Area R265D, therefore does not impact R265D.

[7] AIP TAC 6 Adelaide, dated 15 June 2023
[8] AIP ERSA, PRD-10, dated 15 June 2023
[9] AIP ERSA, PRD-3, dated 15 June 2023

4.6.2 Danger Area D258B

Danger Area D285B is active Monday to Friday except on Public Holidays (JO) during daylight hours (HJ). The area is used for military flying training.

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

The GNREP is within D258B and **may impact** on its use for military flying training.

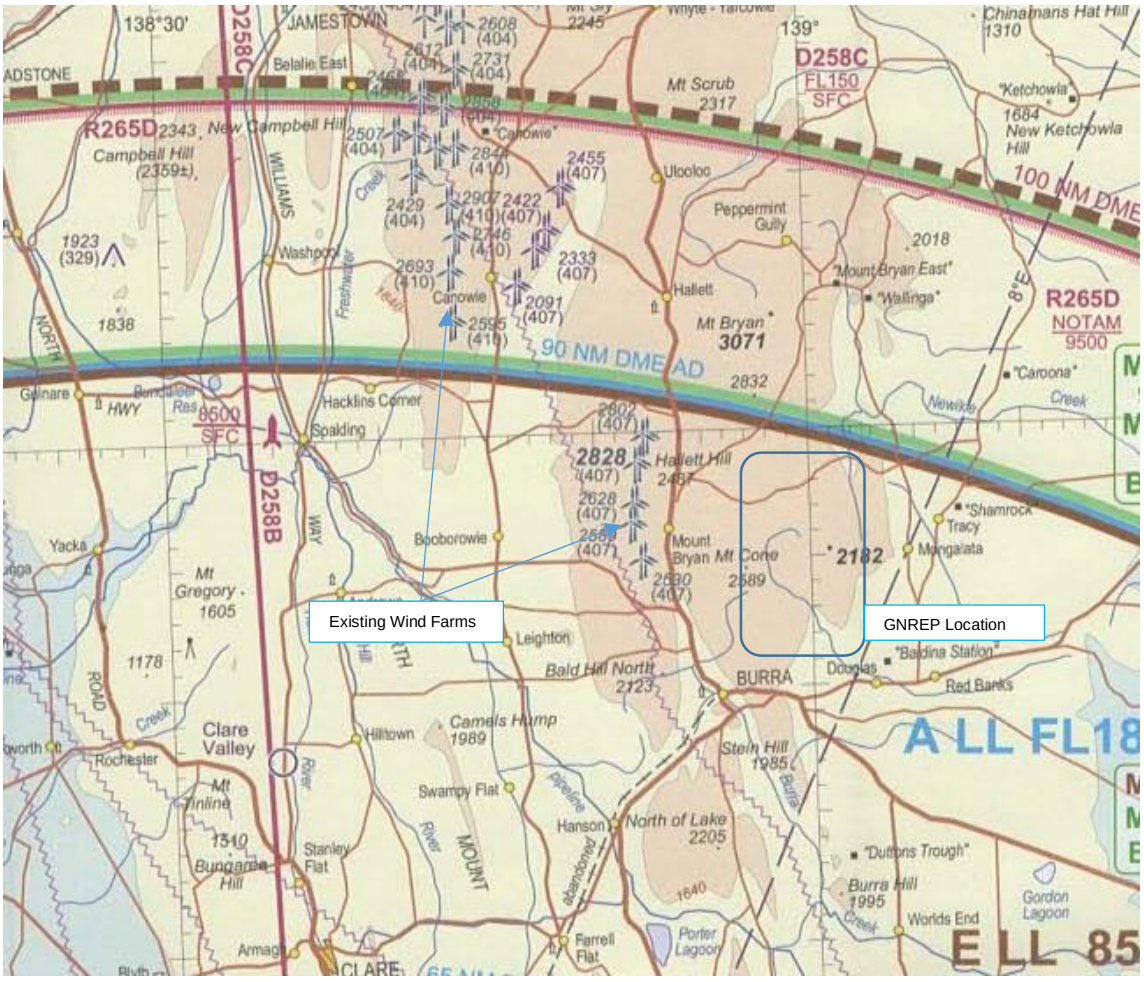

Figure 5 – GNREP Location in relation to D258B[10]

Note the existing wind farms in the vicinity

[10] AIP VNC Adelaide 15 June 2023

4.7 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*[11].

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.

4.7.1 Communications

There are no known civil or military ATC communications facilities around the GNREP.

4.7.2 Navigation

There are no known radio navigation aids around the GNREP.

4.7.3 Surveillance

There are no known civil or military surveillance facilities around the GNREP.

[11] Available at http://www.eurocontrol.int/sites/default/files/publication/files/20140909-impact-wind-turbines-sur-sensors-guid-v1.2.pdf

4.8 AIS Conclusions

The AIS concluded that the GNREP will require the GRID LSALT bounded by 33^0S, 34^0S, 139^0E and 140^0E of 3800ft to be raised to 4000ft.

The AIS concluded that the GNREP will not impact upon the following:

- The LSALT of any nearby published air routes;
- The OLS surfaces of any registered or certified aerodrome;
- The PANS-OPS surfaces associated with the Instrument Approach Procedures at Port Pirie;
- The operation of the Uncertified Aerodromes at
  - Clare Valley;
  - James Town; and
  - Peterborough
- Restricted Area R265D;
- The performance of Communication, Navigation and Surveillance Facilities.

The GNREP sits near existing windfarms within Danger Area D258B, an area used for military flying training and may impact on its use.

4.9 Airservices Australia Response

Airservices Australia analysis of the GNREP [SA-WF-024 - Wind Farm, Goyder North Wind Farm] received by email on 15/08/2023 advises that for the following: -

Airspace Procedures

With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a height of 987 m (3239 ft) AHD the wind farm will not affect any sector or circling altitude, nor any instrument approach, departure procedure at any aerodrome. The wind farm will not affect any air routes.

Note: Procedures not designed by Airservices were not considered in this assessment

Grid lowest safe altitude (LSALT)

The Grid LSALT assessment shows that the following wind farm will penetrate the published Grid LSALT:

- An increase in the LSALT value would be required.

Communications/Navigation/Surveillance (CNS) Facilities

We have assessed the proposal to a maximum height of 986 m AHD 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

Based on the above assessment, our view is that the proposed Goyder North Wind Farm would have an impact on Airservices designed Grid lowest safe altitude (LSALT).

Airservices agree to make the changes to accommodate the wind farm. All work will be conducted on a commercial basis.

4.10 Department of Defence Response

Department of Defence have indicated they have no objection to the GNREP. They do note that it sits within an Unexploded Ordinance (UXO) contaminated area. Defence records show the Burra UXO area was used between the 1940ĝs and 1950ĝs for the live firing of Mortars, Grenades and Anti-Tank Weapons. Further UXO site details are available at https://uxo-map.defence.gov.au

Due regard of the UXO area is required, particularly during construction excavations.

5. QUALITATIVE RISK ASSESSMENT

The expression ñn 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 or registered aerodrome.

The NASF Guideline D considers 30km (16.2nm) from a certified aerodrome to be ñn 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 Certified Aerodromes

There are no Certified or Military aerodromes within 30nm (55.56km) of the GNREP.

5.2 Uncertified Aerodromes

There are three known Uncertified Aerodromes (Aeroplane Landing Area [ALA]) within 30nm (56km) of the GNREP at: -

- Clare Valley (YCVA) 18.59nm west southwest of WTG_005;
- Jamestown (YJST) 25.33nm northwest of turbine WTG_060;
- Peterborough (YPTB) 27.58nm north northwest of WTG_012.

The GNREP is sufficiently distant from each of these uncertified aerodromes for it to have no impact on their operations or aircraft safety.

5.3 Airspace

The GNREP is in Class G airspace with Class E airspace above having a lower limit of 8,500ft.

The GNREP, along with existing wind farms, sits within Danger Area D258B. D258B, is used for military flying training, extends from the surface (SFC) to 9,500ft and is active during daylight hours Monday to Friday (except Public Holidays).

A Danger Area is airspace within which activities dangerous to the flight of aircraft may exist at specified times.

Approval for flight within an active Danger Area outside controlled airspace is not

required. However, it is the responsibility of the pilot in command to be aware of the dangerous activity and take appropriate precautions.

Restricted Area R265D, used for military flying, sits above the GNREP. R265D has a Lower Limit of 9,500ft and is activated by NOTAM.

5.4 Relevant Air Routes

The relevant published air routes are described in section 4.5. The GNREP does not impact the published LSALT for any air route in the vicinity. The GNREP does require the GRID LSALT of 3800ft to be raised to 4000ft.

5.5 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 GNREP, 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.

5.6 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 GNREP.

5.7 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.*

5.8 Approved Low Flying Activities

The GNREP 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).

5.9 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.[12]

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[13]."*

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."*[14]

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.

[12] http://www.aerialag.com.au/ResourceCenter/Policies.aspx
[13] Expert opinion obtained by the author during previous QRA work
[14] Stakeholder interview with aerial agricultural applications operator. Reiterated by other operators during additional interviews

5.10 Known Highly Trafficked Areas

There are no known highly trafficked areas in the vicinity of the GNREP

5.11 Emergency Services Flying

All Emergency Services flying is subject to ongoing dynamic risk assessment throughout the flight. The safety of the aircraft and its crew is paramount.

5.11.1 Police Air Wing

SA Police operate fixed wing aircraft and advise that the GNREP 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 GNREP will not impact on these operations. There are existing wind farms in the general area, so the pilots are familiar with operating near them.

5.11.2 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 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 NVG. Comment was also made about the need to suitably mark meteorological monitoring towers.

5.11.3 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 GNREP will not affect RFDS Air Ambulance operations due to the nature of the operations and the aircraft size.

The nearest suitable aerodrome to the GNREP is Clare Valley which is sufficiently distant from the wind farm for there to be no impact on aircraft operations at the aerodrome.

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

5.12 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[15]. Such conditions are dangerous for both large and small aircraft[16] and preclude the use of aerial firefighting.

5.12.1 Aerial Firefighting

At all times the pilot in command has the ultimate responsibility for the safety of the aircraft.[17]

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."[18]

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 ǵust another hazardôthat 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

[15] Flight Safety Australia, *Beware of Bushfire Clouds*, 9 January 2020
[16] Flight Safety Australia, *Turbulence on day of tanker crash,* 25 September 2020
[17] A point reiterated in an interview by the author with a Victorian Forest Fire Management Fire Ground Manager, 6 August 2019. This is part of the Civil Aviation Regulations 1988.
[18] NSW Rural Fire Service submission to the Senate Select Committee on Wind Turbines, 6 March 2015, page 2

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 very large aerial tankers (VLAT) operated by NSW RFS.

5.13 Topographical and Marginal Weather Conditions

The topography of the area of the GNREP is an extensive ridge on the eastern side of the Clare Valley. The area is generally avoided by light aircraft, particularly in marginal VMC, due to the high terrain and the associated cloud and turbulence. Access to the north is available via the Spencer Gulf coast.

VMC are the weather conditions required for VFR flight. At or below either 3000ft AMSL or 1000ft AGL, they are: -

- Clear of cloud;
- In sight of the ground or water; and
- With a forward visibility of 5000m[19].

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 LSALTÕs that are designed to keep the aircraft clear of obstacles and terrain.

Otherwise CASR 91.2767 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
- 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

[19] CASA Manual of Standards Part 91, Division 2.4, Table 2.07 VMC Criteria.

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[20].

5.14 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.

5.14.1 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 GNREP 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.

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

The risk assessment for the GNREP 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.*

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

> *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 GNREP turbines are conspicuous by their size and colour. The GNREP 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 GNREP 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 GNREP 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 GNREP 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 GNREP.

> *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 GNREP turbines will be appropriately painted to ensure they are conspicuous by day.

5.14.3 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 GNREP is not sited within the vicinity of any certified or registered 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.*

5.15 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. OBSTACLE LIGHTING REVIEW

6.1 Australian Regulatory Framework for Obstacle Lighting of Wind Farms

The Civil Aviation Safety Authority (CASA) has limited regulatory authority to require the lighting of obstacles (tall structures) away from an aerodrome. This is particularly applicable to wind farms, which are generally beyond the Obstacle Limitation Surface (OLS) of certified or registered aerodromes. It must be noted that Civil Aviation Safety Regulations (CASR) Part 139 ï Aerodromes are applicable to certified and registered aerodromes only [Military and Joint User apply the same general form].

CASA can only make recommendations regarding the lighting of wind farms, and not determinations/directions mandating lighting of wind farms that are not in the vicinity [beyond the OLS] of a certified aerodrome.

In my experience, CASA has emphasised that *ñit is a matter for the appropriate Land Use Planning Authority to consider the implementation of our recommendations*[21]*"* regarding aviation obstacle lighting of wind farms. This view is, in my opinion, reinforced by Advisory Circular AC139.E-05 v1.0.

6.1.1 Civil Aviation Safety Regulations

The Civil Aviation Safety Regulations (CASR) Part 139 ï Aerodromes, Section E contains the regulations governing obstacles. These regulations are applicable to the protection of airspace and aircraft operations in the vicinity of certified aerodromes. They are not applicable to obstacles that are beyond the vicinity of aerodromes; that is, beyond the OLS.

6.1.2 Manual of Standards Part 139

The Manual of Standards (MOS) Part 139 provides amplification and methods of compliance to the CASR Part 139 Aerodromes. As the GNREP is beyond the vicinity of any certified or military aerodrome MOS 139 does not apply.

6.1.3 National Airports Safeguarding Framework

The Australian National Airports Safeguarding Advisory Group (NASAG) produced a set of guidelines called the National Airports Safeguarding Framework (NASF) in 2012.

The purpose of the National Airports Safeguarding Framework (the Safeguarding Framework) is to enhance the current and future safety, viability and growth of aviation operations at Australian airports, by supporting and enabling:

- the implementation of best practice in relation to land use assessment and decision making in the vicinity of airports;
- assurance of community safety and amenity near airports;

[21] Correspondence from CASA to the Author

- better understanding and recognition of aviation safety requirements and aircraft noise impacts in land use and related planning decisions;
- the provision of greater certainty and clarity for developers and landowners;
- improvements to regulatory certainty and efficiency; and
- the publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports.

Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations [Wind Farms] / Wind Monitoring Towers* provides information regarding wind farms. This guideline provides the following information: -

> *20 When wind turbines over 150m above ground level are to be built within 30km (16.2nm) of a certified 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.*
>
> *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 GNREP is not sited within the vicinity of any certified or military aerodrome and does not penetrate any OLS or PANS-OPS airspace; consequently, it is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

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

6.2 Obstacle Lighting Summary

The GNREP, which is not sited within any OLS or PANS-OPS airspace does not require obstacle lighting as the risk to aviation is LOW and no additional mitigating strategies are required.

7. 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[22]

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.

It is generally considered by aerial applications pilots 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.

[22] Author photo, Yorke Peninsular SA.

7.1 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.*

7.2 Reporting of Tall Structures

The turbines proposed for the GNREP have a tip height of 240m (788ft) 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*[23].

Meteorological Monitoring Masts for the GNREP 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 a NOTAM or Aeronautical Information Circular (AIC) 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.

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

7.3 Recommendations

It is recommended that Neoen Australia Pty Ltd ensure the wind monitoring towers used in the GNREP are:

- Appropriately marked as per guidelines above except for strobe light;
- Reported as tall structures in accordance with AC139.E-01 v1.0;
- Notified to the Aerial Agricultural Association of Australia;
- Subject to a NOTAM or AIC specifying their location and height.

8. AERONAUTICAL IMPACT ASSESSMENT - CONCLUSIONS

8.1 Aviation Impact Statement

The AIS concluded that the GNREP will require the GRID LSALT bounded by 33^0S, 34^0S, 139^0E and 140^0E of 3800ft to be raised to 4000ft.

The GNREP development will not impact upon the following:

- The OLS and PANS-OPS surfaces published for any certified or military aerodrome;
- Any published air route Lowest Safe Altitudes;
- The operation of any Communications, Navigation or Surveillance facilities.

8.1.1 Airservices Response to AIS

Airservices Australia analysis of the GNREP [SA-WF-024 - Wind Farm, Goyder North Wind Farm] received by email on 15/08/2023 advises that: -

- The wind farm will not affect any air routes
- An increase in the GRID LSALT value from 3800ft to 4000ft would be required
- The wind farm will not affect any civil ATC CNS facilities

See section 4.9.

8.1.2 Department of Defence Response to AIS

The Department of Defence is yet to respond. Their assessment will be included in a supplementary report.

8.2 Risk Assessment

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

8.3 Obstacle Lighting

The GNREP turbines have a tip height of 240m 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 in the area of the GNREP is LOW. On this basis no further mitigation is required.

Obstacle lighting is not required.

8.4 Reporting of Tall Structures

The GNREP 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

Goyder Energy Park
Turbine Locations and Heights
240m Turbines

APPENDIX A

Name	Easting	Northing	Latitude WGS84	Longitude WGS84	Elevation (m)	Tip Height (m)	Tip Height (ft)	Add MOC	LSALT
WTG_001	308836	6280884	33°35'46.554"S	138°56'23.165"E	654.00	894.00	2933.04	3933.04	4000
WTG_002	308819	6280027	33°36'08.618"S	138°56'22.168"E	661.00	901.00	2956.00	3956.00	4000
WTG_003	308765	6279332	33°36'31.126"S	138°56'19.550"E	682.00	922.00	3024.90	4024.90	4100
WTG_004	308942	6278674	33°36'52.585"S	138°56'25.886"E	661.00	901.00	2956.00	3956.00	4000
WTG_005	308885	6277927	33°37'16.802"S	138°56'23.122"E	656.00	896.00	2939.60	3939.60	4000
WTG_006	309885	6277047	33°37'44.616"S	138°57'06.502"E	649.00	889.00	2916.63	3916.63	4000
WTG_007	309374	6289384	33°31'05.329"S	138°56'50.896"E	575.00	815.00	2673.85	3673.85	3700
WTG_008	309530	6288716	33°31'27.113"S	138°56'56.411"E	599.00	839.00	2752.59	3752.59	3800
WTG_009	309582	6287890	33°31'53.954"S	138°56'57.782"E	606.00	846.00	2775.56	3775.56	3800
WTG_010	309882	6287238	33°32'15.349"S	138°57'04.597"E	618.00	858.00	2814.93	3814.93	3900
WTG_011	309906	6286564	33°32'37.190"S	138°57'09.317"E	628.00	868.00	2847.73	3847.73	3900
WTG_012	315944	6297979	33°34'04.994"S	138°57'09.508"E	501.00	741.00	2431.07	3431.07	3500
WTG_013	309894	6283283	33°34'28.621"S	138°57'04.676"E	734.00	974.00	3195.50	4195.50	4200
WTG_014	309847	6280837	33°35'42.986"S	138°57'02.642"E	736.00	976.00	3202.06	4202.06	4300
WTG_015	309907	6280157	33°36'05.112"S	138°57'04.439"E	717.00	957.00	3139.73	4139.73	4200
WTG_016	309982	6279481	33°36'27.072"S	138°57'06.858"E	708.00	948.00	3110.20	4110.20	4200
WTG_017	310092	6278906	33°36'49.072"S	138°57'10.692"E	703.00	943.00	3093.79	4093.79	4100
WTG_018	310258	6278240	33°37'10.002"S	138°57'20.063"E	729.00	969.00	3179.10	4179.10	4200
WTG_019	310824	6277616	33°37'28.124"S	138°57'38.066"E	728.00	968.00	3175.81	4175.81	4200
WTG_020	310807	6283465	33°34'18.314"S	138°57'41.879"E	678.00	918.00	3011.77	4011.77	4100
WTG_021	311527	6286167	33°32'47.530"S	138°58'12.698"E	652.00	892.00	2926.47	3926.47	4000

Name	Easting	Northing	Latitude WGS84	Longitude WGS84	Elevation (m)	240m turbine	Tip Height (ft)	Add MOC	LSALT
WTG_022	311701	6285591	33°33'09.900"S	138°58'18.152"E	654.00	894.00	2933.04	3933.04	4000
WTG_023	311865	6284927	33°33'31.554"S	138°58'24.013"E	714.00	954.00	3129.88	4129.88	4200
WTG_024	311960	6284242	33°33'53.842"S	138°58'27.156"E	719.00	959.00	3146.29	4146.29	4200
WTG_025	312037	6283219	33°34'27.102"S	138°58'29.395"E	700.00	940.00	3083.95	4083.95	4100
WTG_026	312268	6282658	33°34'48.320"S	138°58'36.368"E	706.00	946.00	3103.64	4103.64	4200
WTG_027	311816	6281971	33°35'10.378"S	138°58'20.748"E	691.00	931.00	3054.42	4054.42	4100
WTG_028	312091	6281291	33°35'38.803"S	138°58'27.498"E	693.00	933.00	3060.99	4060.99	4100
WTG_029	312003	6280314	33°36'01.343"S	138°58'25.860"E	652.00	892.00	2926.47	3926.47	4000
WTG_030	312945	6283657	33°34'13.458"S	138°59'04.895"E	715.00	955.00	3133.16	4133.16	4200
WTG_031	310833	6290610	33°30'24.653"S	138°58'11.460"E	553.00	793.00	2601.67	3601.67	3700
WTG_032	310987	6289808	33°30'46.512"S	138°58'16.644"E	571.00	811.00	2660.73	3660.73	3700
WTG_033	310978	6289141	33°31'08.872"S	138°58'17.814"E	568.00	808.00	2650.89	3650.89	3700
WTG_034	311584	6288157	33°31'30.907"S	138°58'25.014"E	598.00	838.00	2749.31	3749.31	3800
WTG_035	312165	6287757	33°31'59.923"S	138°58'37.772"E	608.00	848.00	2782.12	3782.12	3800
WTG_036	312620	6287219	33°32'18.514"S	138°58'53.983"E	601.00	841.00	2759.15	3759.15	3800
WTG_037	312703	6286516	33°32'40.535"S	138°58'57.695"E	617.00	857.00	2811.65	3811.65	3900
WTG_038	313193	6285974	33°32'58.416"S	138°59'16.274"E	651.00	891.00	2923.19	3923.19	4000
WTG_039	313334	6285312	33°33'20.009"S	138°59'21.217"E	675.00	915.00	3001.93	4001.93	4100
WTG_040	313330	6284613	33°33'42.682"S	138°59'20.533"E	709.00	949.00	3113.48	4113.48	4200
WTG_041	313756	6284042	33°33'59.760"S	138°59'40.146"E	708.00	948.00	3110.20	4110.20	4200
WTG_042	313680	6283356	33°34'25.187"S	138°59'34.782"E	737.00	977.00	3205.34	4205.34	4300
WTG_043	313847	6282629	33°34'47.381"S	138°59'39.113"E	651.00	891.00	2923.19	3923.19	4000
WTG_044	313716	6281976	33°35'10.460"S	138°59'31.229"E	664.00	904.00	2965.84	3965.84	4000

Name	Easting	Northing	Latitude WGS84	Longitude WGS84	Elevation (m)	240m turbine	Tip Height (ft)	Add MOC	LSALT
WTG_045	313454	6281203	33°35'33.418"S	138°59'22.780"E	655.00	895.00	2936.32	3936.32	4000
WTG_046	313342	6280226	33°36'05.036"S	138°59'17.700"E	587.00	827.00	2713.22	3713.22	3800
WTG_047	313275	6279524	33°36'27.781"S	138°59'14.572"E	595.00	835.00	2739.47	3739.47	3800
WTG_048	312474	6290713	33°30'27.522"S	138°58'53.440"E	566.00	806.00	2644.32	3644.32	3700
WTG_049	312590	6289898	33°30'50.720"S	138°58'55.873"E	576.00	816.00	2677.13	3677.13	3700
WTG_050	312608	6289134	33°31'13.703"S	138°58'56.921"E	610.00	850.00	2788.68	3788.68	3800
WTG_051	312778	6288478	33°31'36.088"S	138°59'00.488"E	617.00	857.00	2811.65	3811.65	3900
WTG_052	313155	6287915	33°31'55.409"S	138°59'16.249"E	637.00	877.00	2877.26	3877.26	3900
WTG_053	313542	6287448	33°32'14.618"S	138°59'32.356"E	631.00	871.00	2857.58	3857.58	3900
WTG_054	313877	6286668	33°32'28.946"S	138°59'59.435"E	608.00	848.00	2782.12	3782.12	3800
WTG_055	314297	6286173	33°32'52.656"S	138°59'59.215"E	596.00	836.00	2742.75	3742.75	3800
WTG_056	314493	6285493	33°33'14.857"S	139°00'06.293"E	614.00	854.00	2801.80	3801.80	3900
WTG_057	314573	6284790	33°33'37.721"S	139°00'08.856"E	657.00	897.00	2942.88	3942.88	4000
WTG_058	314888	6284086	33°34'00.768"S	139°00'20.549"E	633.00	873.00	2864.14	3864.14	3900
WTG_059	315086	6283360	33°34'24.434"S	139°00'27.691"E	630.00	870.00	2854.30	3854.30	3900
WTG_060	313035	6293970	33°28'38.852"S	138°59'16.156"E	577.00	817.00	2680.41	3680.41	3700
WTG_061	313385	6293013	33°29'10.111"S	138°59'28.993"E	555.00	795.00	2608.24	3608.24	3700
WTG_062	313478	6292304	33°29'33.180"S	138°59'32.071"E	550.00	790.00	2591.83	3591.83	3600
WTG_063	313381	6291473	33°30'12.154"S	138°59'31.672"E	499.00	739.00	2424.51	3424.51	3500
WTG_064	313454	6289710	33°30'35.194"S	138°59'27.676"E	550.00	790.00	2591.83	3591.83	3600
WTG_065	313939	6294601	33°28'18.934"S	138°59'51.644"E	593.00	833.00	2732.91	3732.91	3800
WTG_066	315944	6296681	33°28'48.475"S	138°59'47.238"E	502.87	742.87	2437.22	3437.22	3500
WTG_067	314923	6296904	33°27'04.813"S	139°00'31.457"E	592.00	832.00	2729.63	3729.63	3800

Name	Easting	Northing	Latitude WGS84	Longitude WGS84	Elevation (m)	240m turbine	Tip Height (ft)	Add MOC	LSALT
WTG_068	314828	6296217	33°27'27.324"S	139°00'31.428"E	591.00	831.00	2726.34	3726.34	3800
WTG_069	314721	6295525	33°27'49.878"S	139°00'25.949"E	598.00	838.00	2749.31	3749.31	3800
WTG_070	315587	6295389	33°28'11.230"S	139°00'30.290"E	526.21	766.21	2513.79	3513.79	3600
WTG_071	316358	6294453	33°28'42.697"S	139°00'38.920"E	488.98	728.98	2391.65	3391.65	3400
WTG_072	316011	6297355	33°29'03.203"S	139°00'47.923"E	505.00	745.00	2444.20	3444.20	3500
WTG_073	314761	6290328	33°29'25.786"S	139°00'41.886"E	556.00	796.00	2611.52	3611.52	3700
WTG_074	314738	6291699	33°30'02.171"S	139°00'22.928"E	541.00	781.00	2562.30	3562.30	3600
WTG_075	314819	6291097	33°30'23.785"S	139°00'26.917"E	550.00	790.00	2591.83	3591.83	3600
WTG_076	314748	6289707	33°30'54.583"S	139°00'21.935"E	575.00	815.00	2673.85	3673.85	3700
WTG_077	314531	6289039	33°31'16.957"S	139°00'09.742"E	597.00	837.00	2746.03	3746.03	3800
WTG_078	314604	6288421	33°31'39.389"S	139°00'12.622"E	615.00	855.00	2805.08	3805.08	3900
WTG_079	315199	6288048	33°31'59.516"S	139°00'24.232"E	610.00	850.00	2788.68	3788.68	3800
WTG_080	315747	6287339	33°32'15.738"S	139°00'56.261"E	603.00	843.00	2765.71	3765.71	3800
WTG_081	315727	6286377	33°32'46.936"S	139°00'54.760"E	636.00	876.00	2873.98	3873.98	3900
WTG_082	315701	6285459	33°33'16.722"S	139°00'53.089"E	621.00	861.00	2824.77	3824.77	3900
WTG_083	316069	6283851	33°34'09.102"S	139°01'06.172"E	628.00	868.00	2847.73	3847.73	3900
WTG_084	316009	6283119	33°34'32.822"S	139°01'03.284"E	647.00	887.00	2910.07	3910.07	4000
WTG_085	315798	6282416	33°34'55.510"S	139°00'54.594"E	641.00	881.00	2890.38	3890.38	3900
WTG_086	315999	6281672	33°35'22.592"S	139°01'02.060"E	617.00	857.00	2811.65	3811.65	3900
WTG_087	315769	6280940	33°35'44.984"S	139°00'46.746"E	616.00	856.00	2808.36	3808.36	3900
WTG_088	315083	6280182	33°36'07.556"S	139°00'25.178"E	591.00	831.00	2726.34	3726.34	3800
WTG_089	314461	6279258	33°36'34.927"S	139°00'05.328"E	570.00	810.00	2657.45	3657.45	3700
WTG_090	314712	6278602	33°36'57.690"S	139°00'07.819"E	541.00	781.00	2562.30	3562.30	3600

Name	Easting	Northing	Latitude WGS84	Longitude WGS84	Elevation (m)	240m turbine	Tip Height (ft)	Add MOC	LSALT
WTG_091	315330	6277947	33°37'20.262"S	139°00'33.124"E	534.00	774.00	2539.34	3539.34	3600
WTG_092	315603	6277208	33°37'44.411"S	139°00'43.132"E	519.00	759.00	2490.13	3490.13	3500
WTG_093	315783	6280087	33°36'02.347"S	139°01'04.501"E	584.00	824.00	2703.38	3703.38	3800
WTG_094	316174	6279655	33°36'25.351"S	139°01'07.115"E	584.00	824.00	2703.38	3703.38	3800
WTG_095	316229	6278964	33°36'47.794"S	139°01'08.731"E	555.00	795.00	2608.24	3608.24	3700
WTG_096	316435	6278309	33°37'09.199"S	139°01'16.216"E	551.99	791.99	2598.37	3598.37	3600
WTG_097	316527	6277631	33°37'31.246"S	139°01'19.319"E	532.00	772.00	2532.78	3532.78	3600
WTG_098	316788	6276799	33°37'58.393"S	139°01'28.808"E	504.00	744.00	2440.92	3440.92	3500
WTG_099	315737	6296023	33°27'35.366"S	139°01'06.132"E	525.47	765.47	2511.34	3511.34	3600
WTG_100	316319	6295029	33°28'05.938"S	139°01'31.001"E	523.01	763.01	2503.27	3503.27	3600
WTG_101	316397	6293881	33°28'29.881"S	139°01'28.888"E	506.30	746.30	2448.45	3448.45	3500
WTG_102	316400	6293287	33°28'51.208"S	139°01'26.382"E	467.61	707.61	2321.54	3321.54	3400
WTG_103	316376	6292670	33°29'13.902"S	139°01'24.276"E	477.76	717.76	2354.81	3354.81	3400
WTG_104	316273	6289330	33°31'11.460"S	139°01'18.113"E	533.92	773.92	2539.09	3539.09	3400
WTG_105	316330	6288741	33°31'34.036"S	139°01'18.390"E	539.00	779.00	2555.74	3555.74	3600
WTG_106	316825	6286946	33°32'30.023"S	139°01'32.894"E	572.00	812.00	2664.01	3664.01	3700
WTG_107	316815	6286085	33°32'53.113"S	139°01'49.498"E	606.00	846.00	2775.56	3775.56	3800
WTG_108	316843	6285534	33°33'16.139"S	139°01'44.036"E	610.00	850.00	2788.68	3788.68	3800
WTG_109	316401	6284880	33°33'35.942"S	139°01'19.776"E	629.00	869.00	2851.02	3851.02	3900
WTG_110	316956	6284351	33°33'53.438"S	139°01'40.901"E	626.00	866.00	2841.17	3841.17	3900
WTG_111	317858	6284146	33°34'00.638"S	139°02'15.713"E	570.00	810.00	2657.45	3657.45	3700
WTG_112	317525	6283434	33°34'23.538"S	139°02'02.306"E	633.00	873.00	2864.14	3864.14	3900
WTG_113	317813	6282796	33°34'44.458"S	139°02'12.966"E	628.00	868.00	2847.73	3847.73	3900

Name	Easting	Northing	Latitude WGS84	Longitude WGS84	Elevation (m)	240m turbine	Tip Height (ft)	Add MOC	LSALT
WTG_114	317266	6281915	33°35'03.836"S	139°01'35.566"E	595.00	835.00	2739.47	3739.47	3800
WTG_115	316962	6281164	33°35'34.048"S	139°01'38.982"E	573.00	813.00	2667.29	3667.29	3700
WTG_116	317899	6280423	33°36'01.501"S	139°02'14.564"E	533.55	773.55	2537.87	3537.87	3600
WTG_117	317593	6279100	33°36'43.524"S	139°01'53.616"E	510.00	750.00	2460.60	3460.60	3500
WTG_118	317563	6278094	33°37'16.860"S	139°01'59.826"E	486.00	726.00	2381.86	3381.86	3400
WTG_119	318681	6286989	33°32'39.829"S	139°02'36.226"E	547.20	787.20	2582.63	3582.63	3600
WTG_120	318808	6285971	33°33'00.576"S	139°02'44.236"E	567.30	807.30	2648.58	3648.58	3700
WTG_121	318542	6285292	33°33'24.300"S	139°02'32.168"E	574.67	814.67	2672.77	3672.77	3700
WTG_122	318905	6287754	33°32'03.631"S	139°02'58.639"E	551.78	791.78	2597.67	3597.67	3600
WTG_123	319312	6286727	33°32'29.249"S	139°03'14.231"E	584.85	824.85	2706.15	3706.15	3800
WTG_124	319693	6286325	33°32'49.963"S	139°03'26.172"E	605.30	845.30	2773.27	3773.27	3800
WTG_125	319434	6285653	33°33'12.712"S	139°03'17.917"E	597.14	837.14	2746.50	3746.50	3800
WTG_126	319043	6284925	33°33'34.996"S	139°03'03.938"E	584.72	824.72	2705.74	3705.74	3800
WTG_127	318776	6284228	33°33'59.569"S	139°02'56.047"E	591.17	831.17	2726.89	3726.89	3800
WTG_128	318939	6283441	33°34'23.192"S	139°02'57.160"E	603.99	843.99	2768.98	3768.98	3800
WTG_129	318782	6282765	33°34'46.045"S	139°02'50.521"E	567.00	807.00	2647.61	3647.61	3700
WTG_130	319025	6281751	33°35'19.097"S	139°02'59.194"E	522.00	762.00	2499.97	3499.97	3500
WTG_131	318765	6281031	33°35'42.281"S	139°02'48.592"E	528.00	768.00	2519.65	3519.65	3600
WTG_132	318948	6280379	33°36'03.578"S	139°02'55.216"E	487.00	727.00	2385.14	3385.14	3400
WTG_133	319369	6279662	33°36'24.768"S	139°03'07.844"E	485.00	725.00	2378.58	3378.58	3400
WTG_134	319751	6279191	33°36'42.620"S	139°03'25.499"E	476.00	716.00	2349.05	3349.05	3400
WTG_135	319706	6278304	33°37'11.374"S	139°03'23.098"E	465.00	705.00	2312.96	3312.96	3400
WTG_136	319893	6282881	33°34'39.814"S	139°03'29.257"E	560.28	800.28	2625.54	3625.54	3700

Name	Easting	Northing	Latitude WGS84	Longitude WGS84	Elevation (m)	240m turbine	Tip Height (ft)	Add MOC	LSALT
WTG_137	320572	6278784	33°36'56.326"S	139°03'57.042"E	500.00	740.00	2427.79	3427.79	3500
WTG_138	320565	6278092	33°37'18.768"S	139°03'56.257"E	494.75	734.75	2410.57	3410.57	3500

>139E GRID 3800	>139E Raise GRID

Note: *Tallest turbine is WTG_014 at 976m (3202ft) AHD.*

LSALT over GNREP is 4300ft.

.

APPENDIX B

Country Fire Service South Australia

Fact Sheet

Aerial Firefighting

APPENDIX B

CFS FACT SHEET

Aerial firefighting

Although aircraft are often the most visible part of the response to a fire, and therefore believed to be the most important, almost all fires are still extinguished by ground crews.

The Country Fire Service (CFS) currently has a base fleet of 26 aircraft which can be relocated across several airstrips across the state to offer aerial firefighting support to ground crews.

Aircraft are particularly valuable for fires in difficult terrain or fast moving fires that are too dangerous for ground crews to be placed in front of.

They may not be able to fly if wind speeds are too high, dust or smoke covers the fire, or when daylight is fading.

Firefighting aircraft will also be grounded if Remotely Piloted Aircraft (drones) are flown without permission over a fire ground.

Although other places in the world may be experimenting with night aerial firefighting, the Country Fire Service can only legally and safely operate during daylight hours.

Single Engine Air Tanker (SEAT)

The CFS currently contracts 14 SEATs, or fire bombers, throughout South Australia.

The SEATs can fly at almost 300kph and carry 3,200 litres of water and firefighting chemicals.

Tactical Coordination aircraft

Four helicopters and one airplane make up the CFS tactical coordination fleet.

These aircraft help to coordinate SEATs to specifically support firefighters at problematic parts of the fire ground where ground crews may not be able to access the fire, or where people, homes and buildings may be in danger.

Government of South Australia

South Australian Country Fire Service
cfs.sa.gov.au

Contact the Bushfire Information Hotline
1800 362 361 (TTY 133 677)
@Countryfireservice
@CFSalerts

CFS

Aerial firefighting

Crews can also help to advise bomber crews of the type of fire retardants best suited to the fire's behaviour and fuels.

Tactical and Strategic Overview aircraft

Four helicopters and two airplanes make up the CFS tactical and strategic overview fleet.

These aircraft are used to observe, collect information to help predict the path of the fire, gather and relay information, and map the perimeter of the fire.

Erickson Aircrane (S-64E)

The Erickson Aircrane can carry 7,500 litres of water and firefighting chemicals and can use its pump to refill from open water sources in just 45 seconds.

The Erickson is based in the Mount Lofty Ranges, where it is close to multiple open water supplies.

Large Air Tankers (LATs)

As part of a national firefighting agreement LATs may be requested from interstate.

LATs are currently operated by the New South Wales and Victorian firefighting organisations, and may carry up to 20,000 litres of water and firefighting chemicals.

CFS air support teams work with the support of the Royal Australian Air Force at Edinburgh to refill LATs at the airbase if multiple drops are required.

Cleaning up if firefighting chemicals are used on your property

The concentrations of chemicals used in drops are not harmful to animals or humans and are biodegradable.

It is recommended that you wash in cold water with a mild soap as a precaution to avoid possible skin irritation if you come in contact with the products.

If your house is doused and your gutters run off to a rainwater tank, you should drain and flush the gutters and tank, then refill with fresh water.

The concentrations of chemicals used by the CFS do not pose health risks but may change the taste and potability of drinking water.

Water mixed with aerial drops in rainwater tanks can still be used for cleaning and firefighting.

Animals, cars or buildings that are doused in firefighting drops can also be washed with water and appropriate shampoos or soaps to remove residue.

If fruit trees or vegetables are doused it is recommended they are washed thoroughly before consuming to remove any possible residue taste.

Government of South Australia

South Australian Country Fire Service
cfs.sa.gov.au

Contact the Bushfire Information Hotline
1800 362 361 (TTY 133 677)
@Countryfireservice
@CFSalerts

CFS

APPENDIX C

Stakeholder List

APPENDIX C
Stakeholder List

The following organisations were contacted.

Stakeholder	Contact
Clare Valley Flying Group	Secretary and Aerodrome Operator
Aerotech ï Aerial Agricultural Operator	Hoyleton Base - Senior Pilot
State Helicopter Rescue Service	Babcock Adelaide Base ï Senior Base Pilot
RFDS	Adelaide Base ï Senior Base Pilot
SA Police Air Wing	Officer in Charge

Stakeholder List.

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,òsuch 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 Governmentôs 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 ñInfrastructureò (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 E

Airservices Australia Response to the Aviation Impact Statement

APPENDIX E

ian_jennings@netspace.net.au

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Tuesday, 15 August 2023 2:52 PM
To: ian_jennings@netspace.net.au
Cc: 'Airspace Protection'
Subject: AIRSERVICES RESPONSE: SA-WF-024 - Wind Farm, Goyder North Wind Farm

Flag Status: Flagged

OFFICIAL

Hi there,

I refer to your request for an Airservices assessment of a wind farm at Goyder North Wind Farm.

Airspace Procedures
With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a height of 987 m (3239 ft) AHD the wind farm will not affect any sector or circling altitude, nor any instrument approach, departure procedure at any aerodrome. The wind farm will not affect any air routes.

Note: Procedures not designed by Airservices were not considered in this assessment

Grid lowest safe altitude (LSALT)
The Grid LSALT assessment shows that the following wind farm will penetrate the published Grid LSALT:

- An increase in the LSALT value would be required.

Communications/Navigation/Surveillance (CNS) Facilities
We have assessed the proposal to a maximum height of 986 m AHD 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
Based on the above assessment, our view is that the proposed Goyder North Wind Farm would have an impact on Airservices designed Grid lowest safe altitude (LSALT).

Airservices agree to make the changes to accommodate the wind farm. All work will be conducted on a commercial basis.

Vertical Obstacle Notification
As this proposed wind farm is in excess of 30m (99ft) AGL, we request that the proponent completes the Vertical Obstacle Notification Form for tall structures and submits it to VOD@airservicesaustralia.com as soon as the development reaches the maximum height.

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

Vertical Obstacle Notification Form:
ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf (airservicesaustralia.com)

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

Regards
Caleb Yip
Aerospace Design Support Officer

Alan Woods Building, 25 Constitution Avenue
Canberra ACT 2600
airservicesaustralia.com

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.

From: ian_jennings@netspace.net.au <ian_jennings@netspace.net.au>
Sent: Wednesday, May 31, 2023 12:17 PM
To: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Subject: Goyder North Wind Farm -Aviation Impact Statement

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.

Team,
Attached is the Aviation Impact Statement for Goyder North Wind Farm, located north of Burra 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 F

Department of Defence Response to the Aviation Impact Statement

APPENDIX F

Australian Government
Department of Defence

ID-EP-DLP&R/OUT/2023/ BS48671033

Ian Jennings
Chiron Aviation Consultants
27 Hilda Street
Essendon Victoria 3040

Dear Mr Jennings

RE: GOYDER WIND FARM PROJECT - AVIATION IMPACT STATEMENT

Thank you for referring the abovementioned wind farm proposal to the Department of Defence (Defence) for comment. Defence understands that this is a proposal for the construction and operation of a wind farm including up to 138 turbines with a maximum blade tip height of 250m Above Ground Level (AGL). The subject site is located approximately 130 kilometres north east from RAAF Base Edinburgh.

Unexploded Ordnance (UXO)
Defence notes that two registered UXO contamination areas are identified over the subject area and will need to be adequately considered as part of the proposal. The records indicate that this area was used for live firing of Mortars, Grenades and Anti-Tank Weapons during the 1940s and 1950s. Further UXO site details can be found on our website at https://uxo-map.defence.gov.au/, including points of contact.

Airservices Australia
AirServices Australia (AsA) have assessed the proposal and identified that the proposed Goyder North Wind Farm would have an impact on Airservices designed Grid lowest safe altitude (LSALT). AsA have advised that they agree to make the changes to accommodate the wind farm. AsA would need to be engaged to facility any chnges.

There is an ongoing need to obtain and maintain accurate information about tall structures so that this information can be marked on aeronautical charts. Marking tall structures on aeronautical charts assists pilot navigation and enhances flight safety. 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, the top of which is above:

a. 30 metres AGL, that are within 30 kilometres of an aerodrome; and

b. 45 metres AGL elsewhere.

The proposed 250 metres AGL turbines meet the requirements for reporting of tall structures. Defence therefore requests that the applicant provide ASA with "as constructed" details. For further information regarding the reporting of tall structures, please contact (02) 6268 5622, email VOD@airservicesaustralia.com or refer to the web links below:-

Civil Aviation Safety Regulation Part 175 — Airservices and You - Airservices
Vertical Obstacle Notification Form:
ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf (airservicesaustralia.com)

Should you wish to discuss the content of this advice further, my point of contact is Ben McLean at land.planning@defence.gov.au

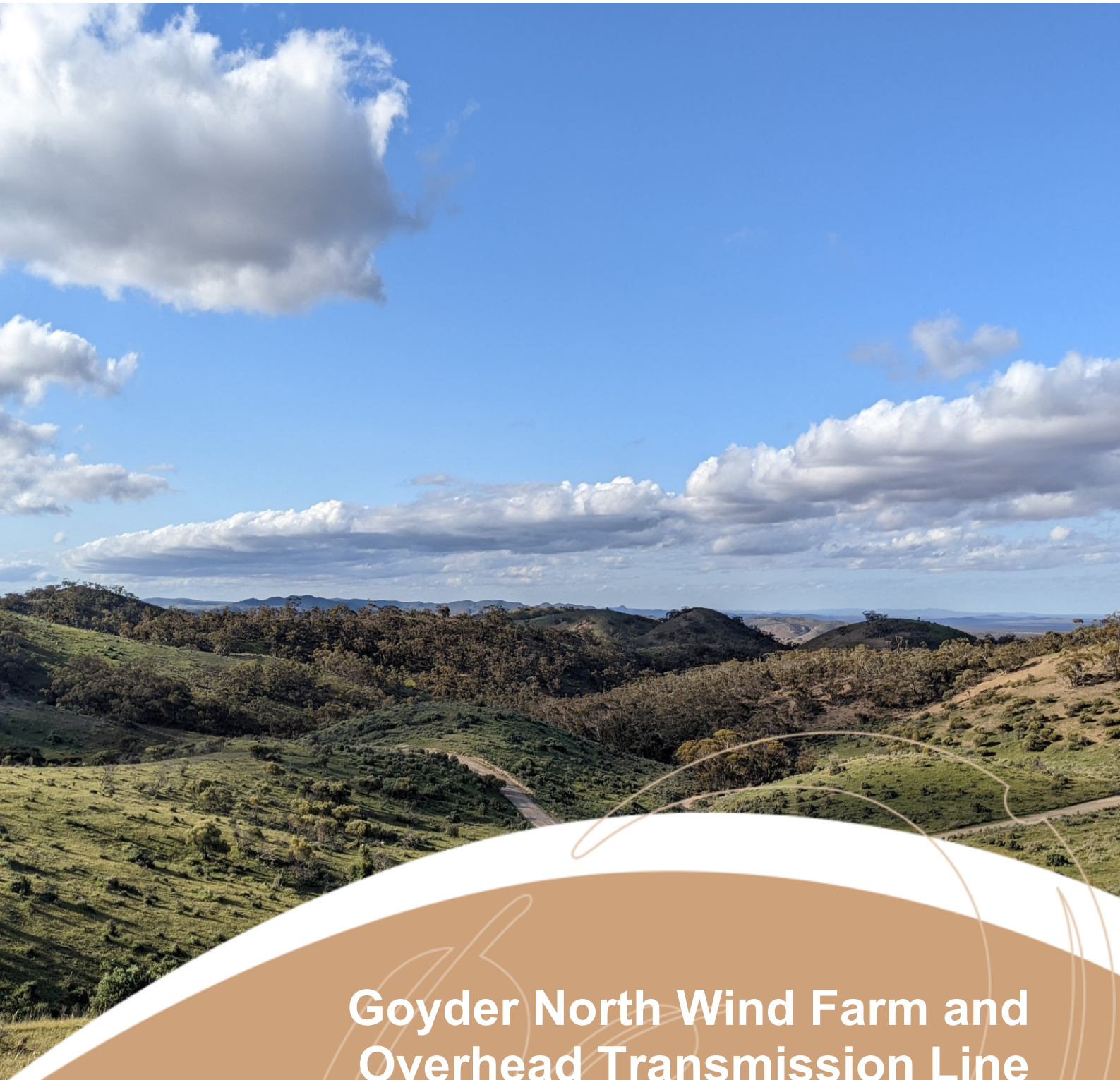
Yours sincerely,

Timothy HOGAN 2

Digitally signed by Timothy HOGAN 2
Date: 2023.12.04 14:13:14 +11'00'

Tim Hogan
Acting Director Land Planning & Regulation
Department of Defence
(02) 5109 7933
Timothy.hogan2@defence.gov.au

04 December 2023



Goyder North Wind Farm and Overhead Transmission Line

Ecological Risk Assessment Summary

Goyder North Wind Farm and Overhead Transmission Line Ecological Risk Assessment Summary

17 November 2023

Version 2.1

Prepared by EBS Ecology for Neoen

Document Control					
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2	15/11/2023	J. Skewes	A. Derry	15/11/2023	Final
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EBS Ecology Project Number: EX220711B

CITATION: EBS Ecology (2023) Goyder North Wind Farm and Overhead Transmission Line Ecological Risk Assessment Summary. Report to Neoen. EBS Ecology, Adelaide.

Cover photograph: View of area within Goyder North Wind Farm proposed Project Area.

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1 INTRODUCTION

Neoen Australia Pty Ltd (Neoen) is developing the Goyder North Wind Farm (GNWF) as a part of its wider Goyder Renewables Zone (GRZ) concept. As a part of this concept, the Goyder South Hybrid Renewables Energy Project was granted Development Approval in 2021 with construction of stage 1 beginning in 2022, including 412 MW of wind generation.

1.1 Project Background

During the planning phase, EBS Ecology (EBS) has been engaged by Neoen to undertake several ecological assessments with the objective of identifying broad vegetation associations present across the site, and potential ecological constraints for the Project. To date, EBS has undertaken the surveys and reports listed in Table 1.

Table 1. EBS work within the Project Area to date.

Project description	Year	Report / Survey Type	Citation	EBS Project No.
Mt Cone Wind Farm Flora and Fauna Assessment - Investec	October – November 2010	Flora survey and fauna assessment	EBS Ecology 2011	E00905
Mt Cone Targeted PBTL Surveys -Investec	April-May 2012	Flora survey and fauna habitat assessment	EBS Ecology 2012	E00905b
Goyder Renewables Zone – Goyder 2 (Mount Cone Wind, Solar and Storage)	2019	Flora and Fauna Assessment	EBS Ecology 2019b	E90101
Goyder North Wind Farm Flora and Fauna Assessment	2022	Flora and Fauna Assessment	EBS Ecology 2022 (Draft)	EX220711
Goyder North Overhead Transmission Line Desktop Flora and Fauna Assessment	2023	Desktop Flora and Fauna Assessment	EBS Ecology 2023a (Draft)	EX220711B
Goyder North Wind Farm Ecological Constraints Summary Letter	2023	Desktop Risk Assessment	EBS Ecology 2023b	EX220711B

Neoen has utilised the information presented by EBS to date to guide the current working layout for the Project. This short report presents the ecological risk assessment process (undertaken to date), and how it has contributed to the provision of the current working layout through application of the mitigation hierarchy, to minimise impacts in areas of potential ecological significance.

1.2 Project Area

The Goyder North Project Area is approximately (~) 19,237 hectares (ha) in size and begins ~4 kilometres (km) north-east of the township of Burra, extending ~25 km north towards to township of Hallett in South Australia's Mid-North region, within the Regional Council of Goyder. The proposed overhead transmission line (OHTL) route will connect a substation in Goyder North to ElectraNet's new Bundey Substation. The proposed OHTL route is ~47.58 km in length, and extends south of the Project Area, through the existing Goyder South Windfarm Project Area, west of Mimbara Conservation Park, to the intersection of Powerline Road and Sutherlands Road in Bundey, South Australia (Figure 1).

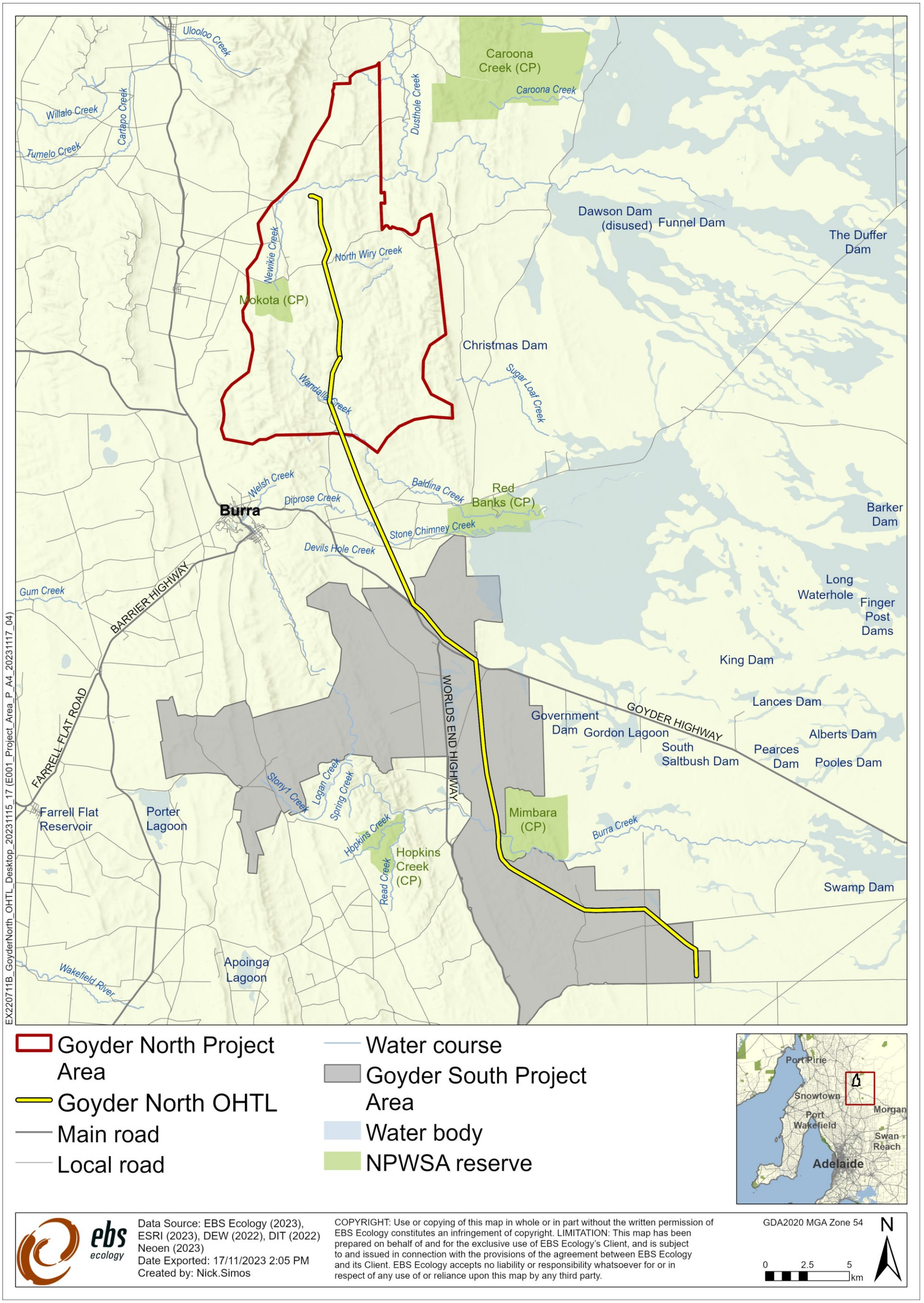

Figure 1. Goyder North Project Area and proposed overhead transmission line (OHTL) route.

1.3 Limitations

A field survey was undertaken by EBS ecology on 12 to 16 September 2022, prior to finalisation of the wind turbine layout. The recommendations provided to Neoen to guide design of the turbine layout were based on information collected at the time of the survey, which was not targeted to specific turbine locations. The survey was undertaken within the boarder Project Area which was mapped to help inform the turbine locations. A limitation to this dataset is the lack of on-ground verification at specific turbine locations for each of these identified constraints.

The ecological assessment undertaken by EBS was broad scope, and targeted surveys for Matters of National Environmental Significance (MNES) such as threatened flora, fauna and ecological communities were not undertaken.

Additional survey work will be undertaken to verify this mapping at the final turbine locations to inform the subsequent Native Vegetation Clearance Applications and EPBC Referrals. Similarly, on-ground assessments at each proposed location may reveal additional MNES which have not already been identified.

Additionally, the report has not included an assessment of the constraints associated with additional infrastructure such as access roads, nor the extent of substations or operations and maintenance facilities. These items will be assessed in detail in the subsequent environmental approvals (NVC, EPBC etc.)

EBS acknowledges that the design of a large-scale renewable energy project, particularly a wind farm, is an iterative process and typically goes through several stages of design and layout refinement. This report has been prepared at a point in time and reflects the level of project refinement that was available at the time of writing.

2 ECOLOGICAL FINDINGS AND CONSTRAINTS

Based on desktop and field assessments undertaken by EBS to date, several ecological constraints have been identified, presented in Table 2.

Table 2. Ecological constraints identified in previous studies.

Constraint	Description	Legislative approvals required
Threatened Ecological Communities (TEC)	Two potential TECs were identified during the field survey: • Iron-grass Natural Temperate Grassland of South Australia (INTG) (Critically Endangered); and • Peppermint Box Grassy Woodland of South Australia (PBGW) (Critically Endangered). A desktop assessment for proposed OHTL routes found the same TECs to potentially occur. Additionally, a section of the proposed OHTL may constitute: • Mallee Bird Community of the Murray Darling Depression Bioregion.	If a significant impact is considered likely to either of these vegetation communities an EPBC referral is required.
Nationally listed threatened fauna	No nationally listed threatened fauna species were observed during the field survey; however, habitat was broadly assessed as suitable for Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*) (PBTL) and Flinders Ranges Worm Lizard (*Aprasia pseudopulchella*) (FRWL) and there are known records of these species in the Project Area. Three State listed threatened bird species were detected including: • Black Falcon (*Falco subniger*; NPW Act: Rare); • Elegant Parrot (*Neophema elegans elegans*; NPW Act: Rare); and • White-winged Chough (*Corcorax melanorhamphos*; NPW Act: Rare). Other national and State listed threatened fauna species are likely to occur at the site and along the OHTL route. Additional survey work is required to determine their likely presence.	A significant impact self-assessment is required to assess the potential impacts of the Project on EPBC listed threatened flora and fauna. If a significant impact is considered likely to EPBC listed threatened fauna species an EPBC referral is required. Additional conditions are likely to be imposed which is likely to include (but not be limited to): • Extensive additional survey work. • Micro siting of infrastructure. • Possible relocation works for impacted fauna. • EPBC Offset.
Nationally listed threatened flora	A desktop assessment indicates that up to 34 threatened plant species may occur within the Goyder North Windfarm Project Area (seven EPBC Act listed and 27 NPW Act listed). Based on the habitat available and survey effort undertaken, up to 12 flora species are considered highly likely or known to occur in the Project Area including two EPBC listed plants, *Dodonaea procumbens* and *Senecio megaglossus*.	

Constraint	Description	Legislative approvals required
	The same two EPBC listed plant species are considered likely to occur on the OHTL route, along with seven additional EPBC listed flora species which are considered to possibly occur.	
Native Vegetation	Vegetation in the Project Area was dominated by mixed native and exotic grasslands in varying condition in the western and central parts of the Project Area, whilst Mallee vegetation dominated the eastern hills, slopes and plains, intermixed with less dominant associations such as chenopod shrublands. Fifteen native vegetation associations, including five dominant and ten minor associations, were identified throughout the Project Area during the field survey. On ground vegetation mapping has not been undertaken for most of the OHTL route. DEW mapping indicates five broad vegetation descriptions intersecting with the OHTL.	Approval to clear native vegetation is required under the *Native Vegetation Act 1991.* Proponents must demonstrate application of the mitigation hierarchy to avoid, minimise and mitigate impacts to native vegetation.
Southern Hairy-nosed Wombat	Evidence of Southern Hairy-nosed Wombats (*Lasiorhinus latifrons*) was observed during the field survey within the Goyder North Project Area, including large warren / burrow systems, fresh diggings and scats. Though not listed as threatened under national or State legislation, this species presents a constraint for the Project due to potential conflicts with construction and operation caused by their presence.	No approvals required. Avoidance of known warrens is recommended. A range of management measures may be implemented to manage the potential impacts caused by Southern Hairy-nosed Wombats.

3 RISK AVOIDANCE MEASURES

3.1 Risk Assessment

EBS conducted a risk assessment for the preliminary layout (PL), based on the desktop and field studies previously undertaken for the site. A risk assessment matrix was developed to guide the potential ecological risks associated with each Wind Turbine Generator (WTG) in the PL, as follows. For each proposed WTG a 100 m buffer was applied to each point to account for the size of the hard-stand and construction area and margin of error for broad vegetation mapping. Constraints occurring within the buffer were identified as a possible risk for the WTG. WTG points which only intersected a constraint within the buffer represented sites which could be readily micro-sited to avoid that constraint. Four classification levels are presented, and are displayed in Figure 2:

1. WTGs listed as (1) high risk intersect with at least one Matter of National Environmental Significance (MNES) such as listed Threatened Ecological Communities (TEC). These WTGs were identified as a priority to relocate to avoid unnecessary impacts where micro-siting is unlikely to be feasible.

2. WTG listed as (2) moderate risk intersect with known, likely, and possible PBTL habitat (and in some cases possible C Class INTG). In the first instance, EBS recommended a reduction of impacts in known habitat which is the highest risk area for PBTL. Careful micro siting can then be undertaken at each impacted location to determine if it can feasibly avoid impacts to local populations of PBTL. The current understanding of PBTL distribution and impacts means that micro siting can be successfully undertaken in many circumstances. This category includes ‘possible’ PBTL habitat, which is acknowledged as lower risk than other ‘known’ or ‘likely’ habitat, however, the moderate rating reflects that additional survey work is required to verify these locations and determine if PBTL occupy the areas.

3. WTG listed as (3) low risk intersect with protected native vegetation and is likely to support populations of national and State listed threatened fauna, and more common species. EBS recommended impacts in these areas should be minimized where possible.

4. WTG listed as (4) low risk intersect with non-native vegetation such as exotic grassland or cropping land. These areas present a low ecological risk and are recommended for larger infrastructure components such as sub-stations, site laydowns and facilities.

3.2 Preliminary layout

Constraints mapping using the preliminary layout (Figure 2) found:

- Up to 26 WTGs may impact on possible B class (or higher) Lomandra Iron grass Natural Temperate Grassland (INTG) TEC, including one in likely A class.
- One WTG (GN_006) is within possible Peppermint Box Grassy Woodland of South Australia TEC.
- Potential Pygmy Bluetongue Lizard (*Tiliqua adelaidensis*) (PBTL) habitat is widespread across the Goyder North Project Area.

  - Up to 29 WTGs are situated within (at least partially) ***known*** PBTL habitat.
  - Up to 68 WTGs are within (at least partially) mapped ***likely*** habitat.
  - Up to 25 WTGs are within (at least partially) mapped ***possible*** habitat.
- Up to 15 WTGs may impact C- class Lomandra grassland, which also constitutes likely and possible PTBL habitat (listed above).

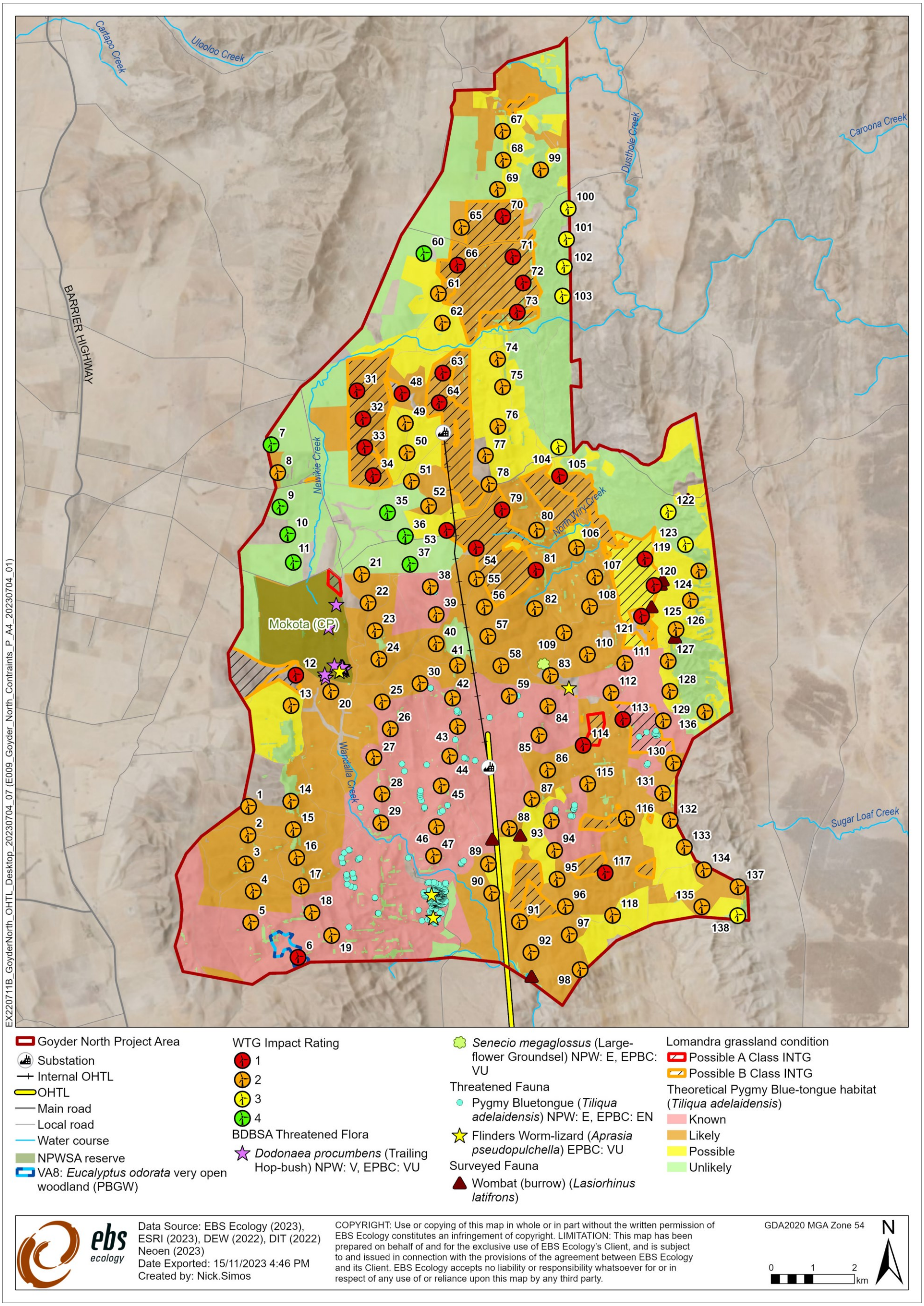

Figure 2. Preliminary WTG layout and risk assessment (provided by Neoen on 26/05/2023).

3.3 Current layout Goyder North Windfarm

The current layout has been revised to avoid and minimise impacts to potential MNES (Figure 3).

- The number of WTGs impacting possible B class (or higher) INTG was reduced to 0. Of these, 5 (PL: 26) are within the 100 m buffer used for the risk assessment only and are unlikely to impact the MNES. Additional survey work is required to confirm the presence and quality of INTG at these locations. These also intersect with likely and possible PBTL habitat.
- The WTG located in PBGW TEC (GN_006) was relocated to outside of this possible TEC, however, is still within 100 m and in Known PBTL habitat, and therefore rated as high risk. Careful micro-siting and PBTL surveys are required to avoid impacts to MNES at this location.
- Potential Pygmy Bluetongue Lizard (*Tiliqua adelaidensis*) habitat is widespread across the Goyder North Project Area. Where possible, WTGs have been relocated to reduce the requirement for additional detailed surveys. Where WTGs intersect with potential PBTL habitat, targeted searches can be used to microsite the infrastructure away from local populations.
    - Up to 26 WTGs (PL: 29) are situated within (at least partially) ***known*** PBTL habitat (four within 100m buffer only).
    - Up to 59 WTGs (PL: 68) are within (at least partially) mapped ***likely*** habitat (six within 100m buffer only).
    - Up to 19 WTGs (PL: 25) are within (at least partially) mapped ***possible*** habitat (two within 100m buffer only).
- Up to 16 WTGs may impact C Class Lomandra grassland, which also constitutes likely and possible PTBL habitat (listed above). Five of these are within the 100 m buffer only and can be micro-sited to avoid or reduce impacts. Additional surveys are recommended in these locations to verify the condition class of the grassland.
- 13 turbines have no or minimal ecological impact (increased from 8 in preliminary layout).
- 21 WTGs have impacts on native vegetation only, but no impacts to possible PBTL habitat or TECs (increased from 8). Impact footprints should be minimised in these areas.

Additional constraints include:

- The proposed southern substation is situated within ***known*** PBTL habitat. Additional survey work is required to determine the suitability of habitat at the proposed site, and microsite accordingly.
- The proposed northern substation is situated within Class B INTG and ***likely*** PBTL habitat. Relocating this facility to the west may reduce the impact. Additional survey work is required to determine a suitable location.
- Wombat warrens were identified near up to four turbine locations (GN_088, GN_120, GN_126, GN_127).
- State listed threatened plant species are widespread in grassland across the site and are likely to be impacted. No EPBC listed threatened plants have known records at any proposed turbine locations, however a population of *Dodonaea procumbens* (EPBC: VU; NPW: V) occurs in Mokota Conservation Park nearby to WTG 20.

- No changes have been proposed to the internal OHTL and impacts to INTG TEC and likely PBTL habitat are possible. Impacts to these constraints will be managed by careful micro siting to avoid areas of higher quality INTG and areas inhabited by PBTL.
- Native vegetation within the Project Area which does not constitute a TEC or habitat for PBTL is still protected under State legislation (i.e., the *Native Vegetation Act 2016*, and the *National Parks and Wildlife Act 1972*) and is likely to provide habitat for a range of other EPBC listed threatened bird and bat species including:
    - Southern Whiteface (*Aphelocephala leucopsis*);
    - Diamond Firetail (*Stagonopleura guttata*);
    - Hooded Robin (*Melanodryas cucullata*);
    - Major Mitchells Cockatoo (*Lophochroa leadbeateri*);
    - Blue-winged Parrot (*Neophema chrysostoma*);
    - Grey Falcon (*Falco hypoleucos*);
    - Plains Wanderer (*Pedionomus torquatus*) (some habitat mapped as 'likely' in northwestern area); and
    - Corbens long eared bat (*Nyctophilus corbeni*) – on edge of range and considered unlikely, but worth surveying woodland areas on far eastern range.
- *Note: There is no suitable wetland habitat nearby for migratory wetland bird species such as *Numenius madagascariensis, Calidris ferruginea or Rostratula australis.*

Table 3. WTG constraint summary based on likelihood of impacts to MNES.

Impact Rating	Description	WTG ID	TEC	PBTL Habit
1	High risk – avoid or implement careful micro siting.	6	PBGW (100m buffer)	Known
		48	INTG (Class B) (100m buffer)	Likely
		81	INTG (Class B)	Likely
		113	INTG (Class B) (100m buffer)	Likely (100m buffer)
2	Moderate risk - known PBTL habitat and /or Class C INTG, or within 100m of INTG TEC	5	NA	Known
		8	INTG (Class C)	Likely
		25	NA	Known
		26	NA	Known
		27	NA	Known
		28	NA	Known
		29	NA	Known
		30	NA	Known
		38	NA	Known
		39	NA	Known
		43	NA	Known
		44	NA	Known
		45	NA	Known
		46	NA	Known
		47	NA	Known
		57	INTG (Class C)	Likely
		58	INTG (Class C)	Likely

Impact Rating	Description	WTG ID	TEC	PBTL Habit
		59	NA	Known
		62	INTG (Class C)	Possible
		63	INTG (Class B) (100m buffer)	Possible
		64	INTG (Class B) (100m buffer)	Likely (100m buffer)
		84	NA	Known
		85	NA	Known
		88	INTG (Class C)	Likely
		91	INTG (Class C)	Likely
		95	INTG (Class C)	Likely
		96	INTG (Class C)	Likely
		111	NA	Known
		112	NA	Known
		118	INTG (Class C)	Possible
		129	NA	Known
		131	NA	Known
		135	INTG (Class C)	Likely
2.2	Moderate risk - likely and possible PBTL habitat and / or within 100m buffer. Requires on site verification and micrositing.	1	NA	Likely
		2	NA	Likely
		3	NA	Likely
		4	NA	Likely
		12	NA	Likely
		15	NA	Likely
		16	NA	Likely
		17	NA	Likely
		20	NA	Likely
		21	NA	Likely
		22	NA	Likely
		23	NA	Likely
		32	NA	Likely
		40	NA	Likely
		41	NA	Likely
		42	NA	Known (100m buffer)
		51	NA	Likely
		52	NA	Likely
		55	NA	Likely
		56	INTG (Class C) (100m buffer)	Likely
		65	NA	Likely
		66	NA	Likely
		79	NA	Likely
		80	NA	Likely
		82	INTG (Class C) (100m buffer)	Likely
		83	INTG (Class C) (100m buffer)	Likely

Impact Rating	Description	WTG ID	TEC	PBTL Habit
		86	NA	Likely
		87	NA	Likely
		89	NA	Likely
		90	NA	Likely
		92	NA	Likely
		94	NA	Known (100m buffer)
		97	NA	Likely
		98	NA	Likely
		107	NA	Likely
		108	NA	Likely
		109	NA	Likely
		110	NA	Likely
		114	NA	Likely
		115	NA	Likely
		116	NA	Likely
		117	NA	Likely
		130	NA	Likely
		134	NA	Likely
		137	NA	Likely
		13	NA	Possible (100m buffer)
		14	NA	Likely (100m buffer)
		18	NA	Known (100m buffer)
		19	NA	Known (100m buffer)
		24	NA	Likely (100m buffer)
		49	NA	Possible
		50	NA	Possible
		53	NA	Possible
		54	NA	Likely (100m buffer)
		61	NA	Possible
		73	NA	Possible
		74	NA	Possible
		75	NA	Possible
		76	NA	Possible
		77	NA	Possible
		78	INTG (Class C) (100m buffer)	Possible
		93	NA	Possible
		105	NA	Possible
		106	INTG (Class C) (100m buffer)	Possible
		132	NA	Likely (100m buffer)
		133	NA	Possible
		136	NA	Possible (100m buffer)
3		67	NA	Unlikely

Impact Rating	Description	WTG ID	TEC	PBTL Habit
	Low risk - NV Act: vegetation impacts - minimise impacts.	70	NA	Unlikely
		71	NA	Unlikely
		72	NA	Unlikely
		99	NA	Unlikely
		100	NA	Unlikely
		101	NA	Unlikely
		102	NA	Unlikely
		103	NA	Unlikely
		104	NA	Unlikely
		119	NA	Unlikely
		120	NA	Unlikely
		121	NA	Unlikely
		122	NA	Unlikely
		123	NA	Unlikely
		124	NA	Unlikely
		125	NA	Unlikely
		126	NA	Unlikely
		127	NA	Unlikely
		128	NA	Unlikely
		138	NA	Unlikely
4	Low risk - no impacts to MNES or native vegetation.	7	NA	Unlikely
		9	NA	Unlikely
		10	NA	Unlikely
		11	NA	Unlikely
		31	NA	Unlikely
		33	NA	Unlikely
		34	NA	Unlikely
		35	NA	Unlikely
		36	NA	Unlikely
		37	NA	Unlikely
		60	NA	Unlikely
		68	NA	Unlikely
		69	NA	Unlikely

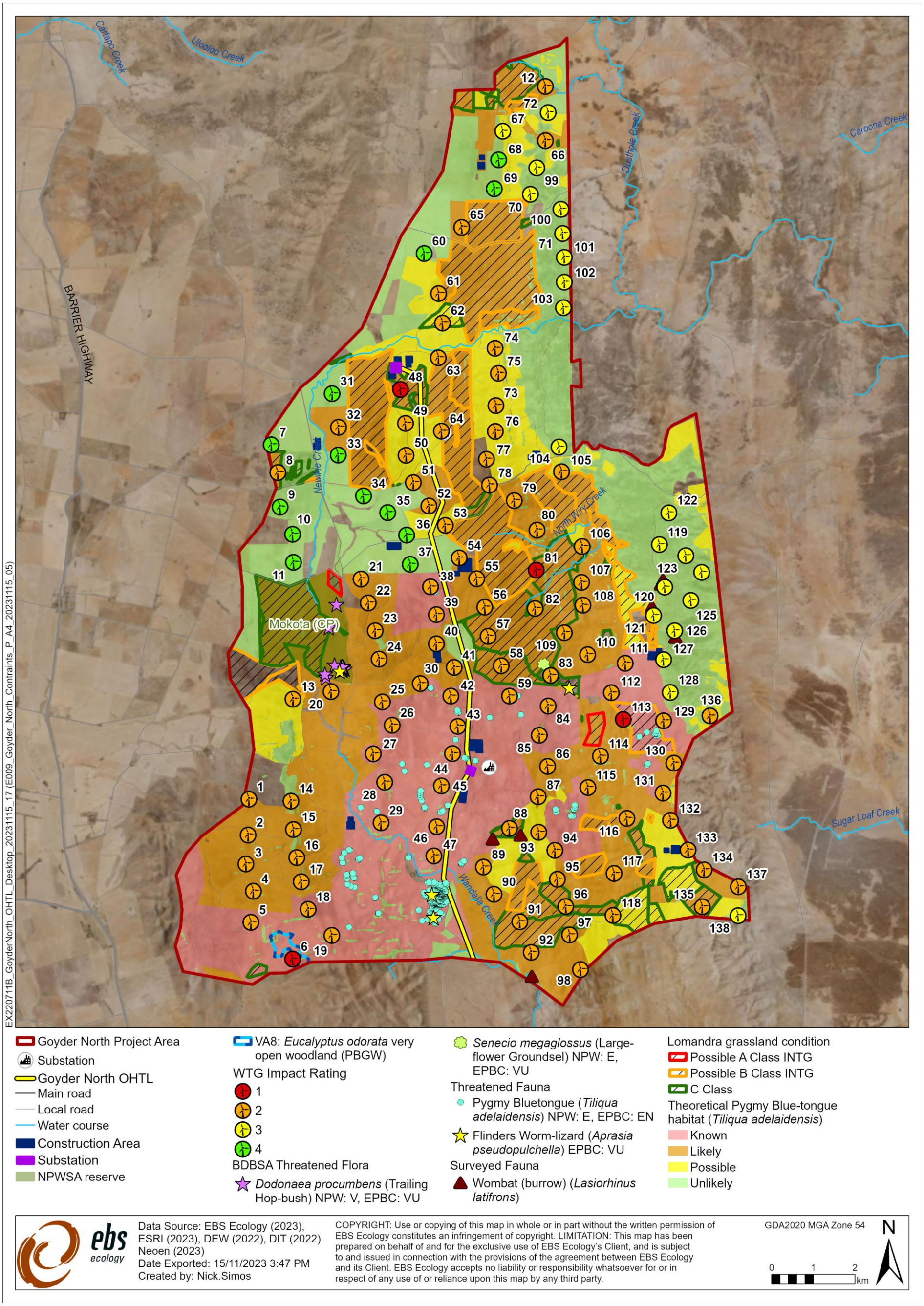

Figure 3. Current WTG layout for GNWF (supplied by Neoen on 30/08/2023).

3.4 Current layout of proposed overhead transmission line (OHTL)

- The proposed overhead transmission line (OHTL) intersects with native grassland which is within ***known*** and ***likely*** PTBL habitat close to the Nature Foundation Tiliqua Nature Reserve. The adjustment of the OHTL now avoids impacts to mapped C Class Lomandra grassland in this area.
- Vegetation associations have not been verified by on-ground surveys across much of the proposed OHTL route. Department for Environment and Water (DEW) as part of the Native Vegetation Information System (NVIS) floristic analysis and mapping found five broad vegetation associations intersecting with the route (Figure 4):
    - Eucalyptus mallee forest and woodland;
    - Mallee woodland and shrubland;
    - Sedgeland / Rushland;
    - Shrubland >1 m; and
    - Tussock grassland.
- This BDBSA mapping supplied by DEW also identifies the presence of two TECs:
        - Iron grass Natural Temperate Grassland TEC; and
        - Peppermint Box Grassy Woodland.
- Based on the broad DEW mapping and EBS verified on-ground mapping (Figure 5), the OHTL intersects with several potential MNES including:
    - Threatened Ecological Communities:
        - Lomandra grassland which may constitute Iron grass Natural Temperate Grassland TEC.
        - Mallee Bird Community of the Murray Darling Depression Bioregion TEC (within areas mapped as Mallee within the Murray Darling Depression Bioregion in the south of the OHTL).
        - (Peppermint Box Grassy Woodland TEC is not shown to intersect with the OHTL, however on ground verification of vegetation is required confirm this.)
    - Likely habitat for nationally threatened flora species including, but not limited to:
        - *Dodonaea procumbens* (Trailing Hop-bush) (EPBC: Vulnerable); and
        - *Senecio megaglossus* (Large-flower Groundsel) (EPBC: Vulnerable).
    - Likely habitat for nationally threatened fauna species including, but not limited to:
        - Southern Whiteface (*Aphelocephala leucopsis leucopsis*) (EPBC: Vulnerable);
        - Flinders Ranges Worm -Lizard (*Aprasia pseudopulchella*) (EPBC: Vulnerable);
        - South-eastern Hooded Robin (*Melanodryas cucullata cucullata*) (EPBC: Endangered);
        - Blue-winged Parrot (*Neophema chrysostoma*) (EPBC: Vulnerable);
        - Diamond Firetail (*Stagonopleura guttata*) (EPBC: Vulnerable); and
        - Pygmy Bluetongue Lizard (*Tiliqua adelaidensis*) (EPBC: Endangered).
    - Likely and possible habitat for several other State and nationally listed threatened flora and fauna species.

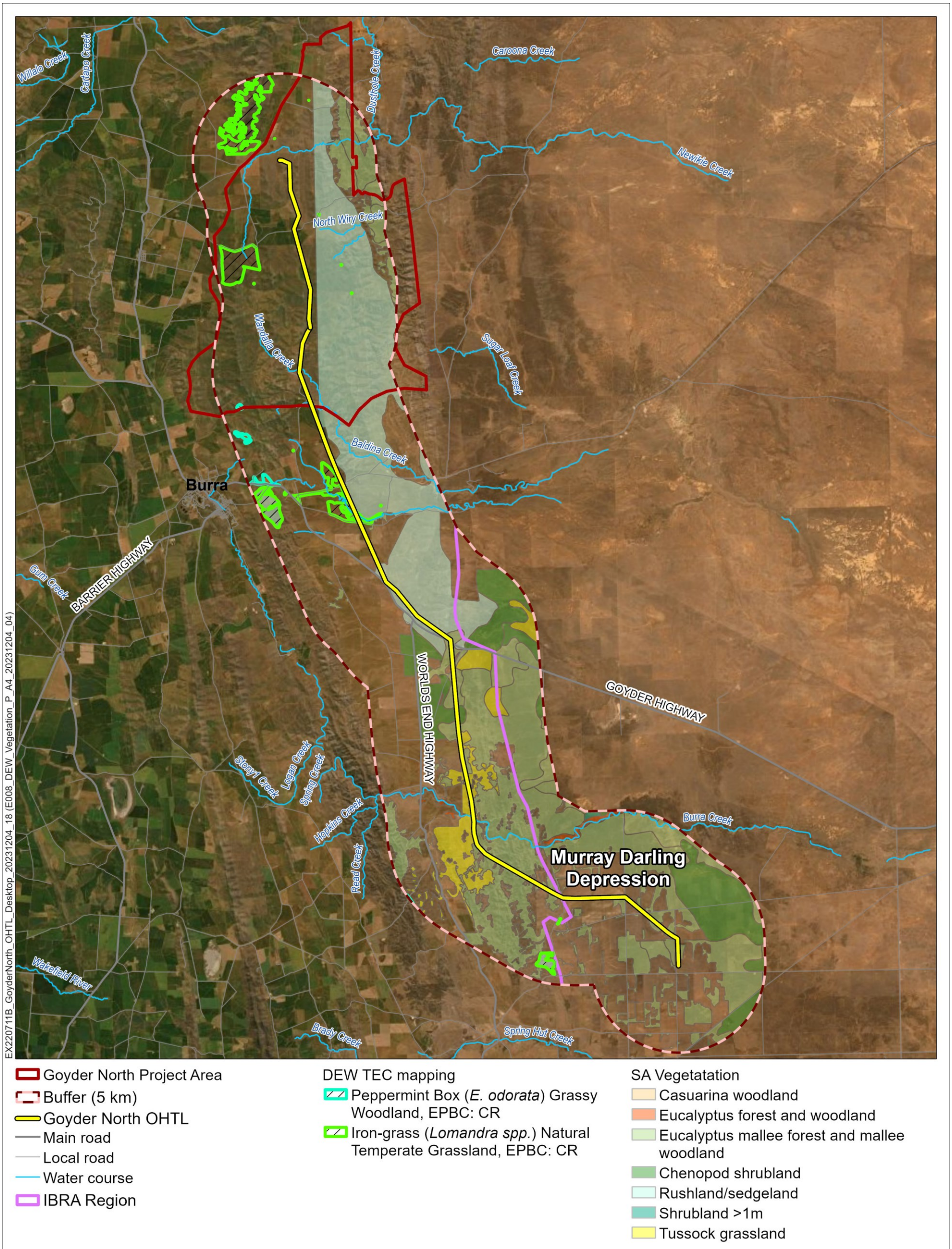

Figure 4. Proposed route of OHTL from Goyder North Windfarm and native vegetation (DEW, 2023) proposed to be impacted (not verified on ground).

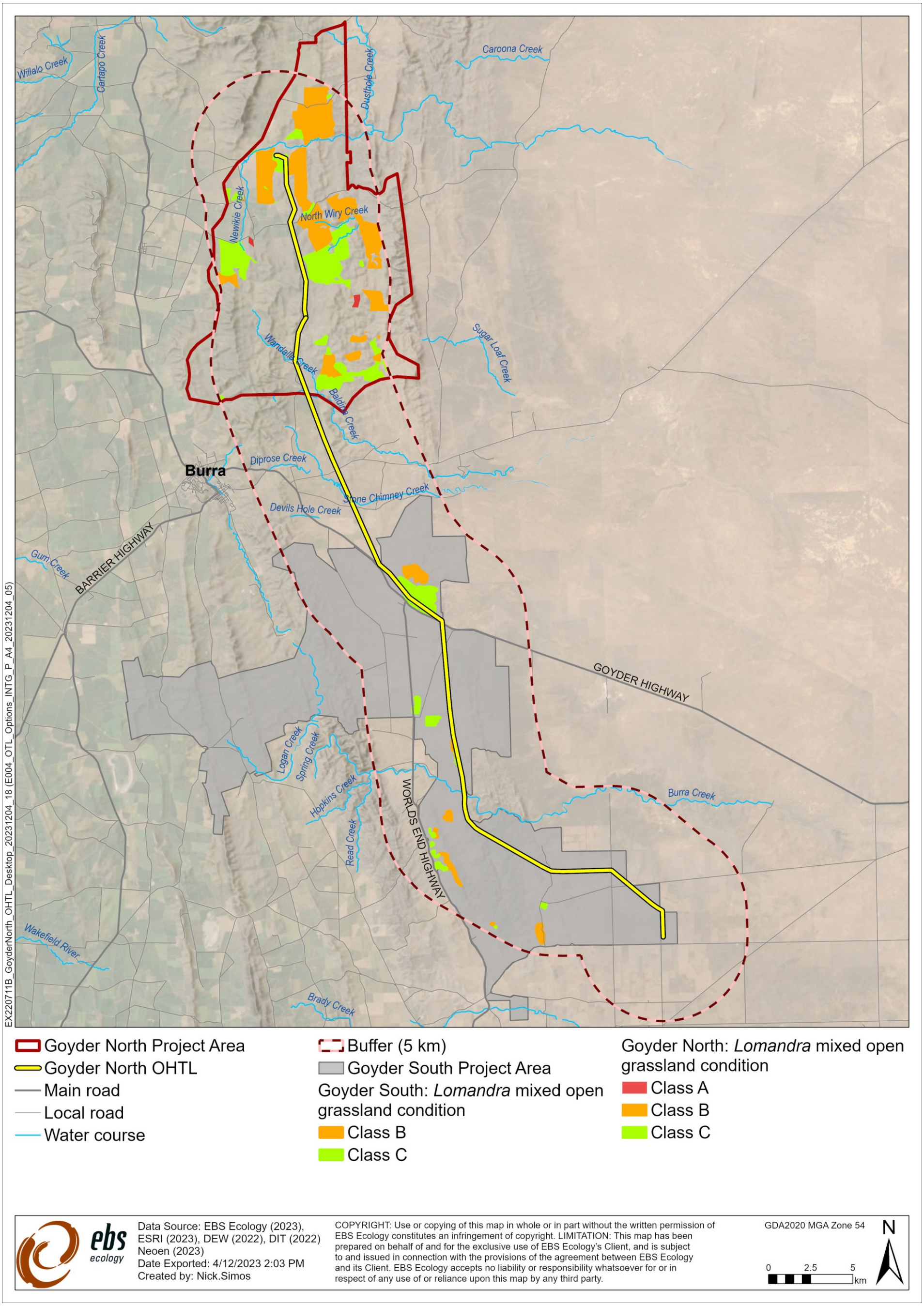

Figure 5. EBS verified TECs within the proposed OHTL.

4 LEGISLATIVE REQUIREMENTS

- Ecological impacts proposed as part of the Goyder North Windfarm development trigger legislative approval processes, including:
    - *Native Vegetation Act 1991* (NV Act) – clearance of native vegetation requires approval under the NV Act.
    - *Environment, Protection and Biodiversity Conservation Act 1999* (EPBC Act) – potential significant impacts to MNES require referral to the Commonwealth Government.
- To progress the Project through these legislative requirements, the proponent must:
    - Engage accredited consultant(s) to undertake a detailed vegetation survey in accordance with Native Vegetation Council methodology (Bushland Assessment Method [BAM], Scattered Tree Assessment Method [STAM]), to inform the SEB offset requirements for the Project.
    - The native vegetation clearance associated with the existing working layout and OHTL will be assessed as ***Level 4*** clearance which requires submission of a Native Vegetation Clearance Data Report to the Native Vegetation Council (NVC) to seek approval for proposed impacts. This level of clearance requires a 28-day consultation period and is delegated to the Native Vegetation Assessment Panel for review and approval.
    - Continue to apply the mitigation hierarchy to minimise ecological impacts at all stages of the Project, through micro-siting infrastructure based on the outcomes of further ecological surveys.
    - Undertake significant additional field surveys to determine the presence, extent and condition of MNES to contribute towards an EPBC referral and inform micro-siting decisions. Briefly, additional survey work includes:
        - Targeted surveys for Pygmy Bluetongue Lizard in suitable habitat proposed to be impacted.
        - Targeted surveys for Flinders Ranges Worm Lizard in suitable habitat proposed to be impacted.
        - Targeted bird surveys according to Mallee Bird Community TEC assessment criteria within the Murray Darling Basin Bioregion section of the Project Area.
        - Targeted spring Lomandra grassland assessments to determine condition and potential for EPBC listing status.
        - Targeted searches in proposed impact areas and an appropriate buffer to detect presence of threatened flora species considered to possibly occur.
    - An EPBC Referral to the Commonwealth Government will be required for this Project. A public consultation period of 10 business days is required as part of this process.

Neoen have endeavoured to minimise ecological impacts at this early stage based on the results of ecological (and other) field surveys and which have informed broad constraints. Neoen have utilised the information available to relocate infrastructure to minimise potential impacts in the first instance, noting however, that further refinement will be required through micro siting and the EPBC approval process as the project progresses.

Neoen are actively proceeding with the required ecological works, and have engaged EBS to undertake subsequent required ecological surveys in spring 2023 and early 2024, including:

- Native vegetation surveys in accordance with the Native Vegetation Council (NVC) approved Bushland and / or Scattered Tree Assessment Method.
- Field assessments suitable to inform EPBC self-assessment and subsequent Referrals (if required) for relevant Matters of National Environmental Significance (MNES) including:
    - Targeted Lomandra Grassland surveys to determine condition classes within the proposed impact areas (commencing November 2023 and spring 2024 if required).
    - Targeted Pygmy Bluetongue Lizard (*Tiliqua adelaidensis*) field surveys to determine the occupancy and abundance of PBTL across habitat identified as known, likely and possible in the Project impact area (commencing February 2024).
    - Seasonal Bird and Bat Utilisation Surveys (BBUS) to inform EPBC interim bird and bat wind farm guidelines (commencing November 2023).

Survey work will inform an ongoing commitment by Neoen to minimise ecological impacts through adaptive management of the Project and micro-siting of infrastructure components.

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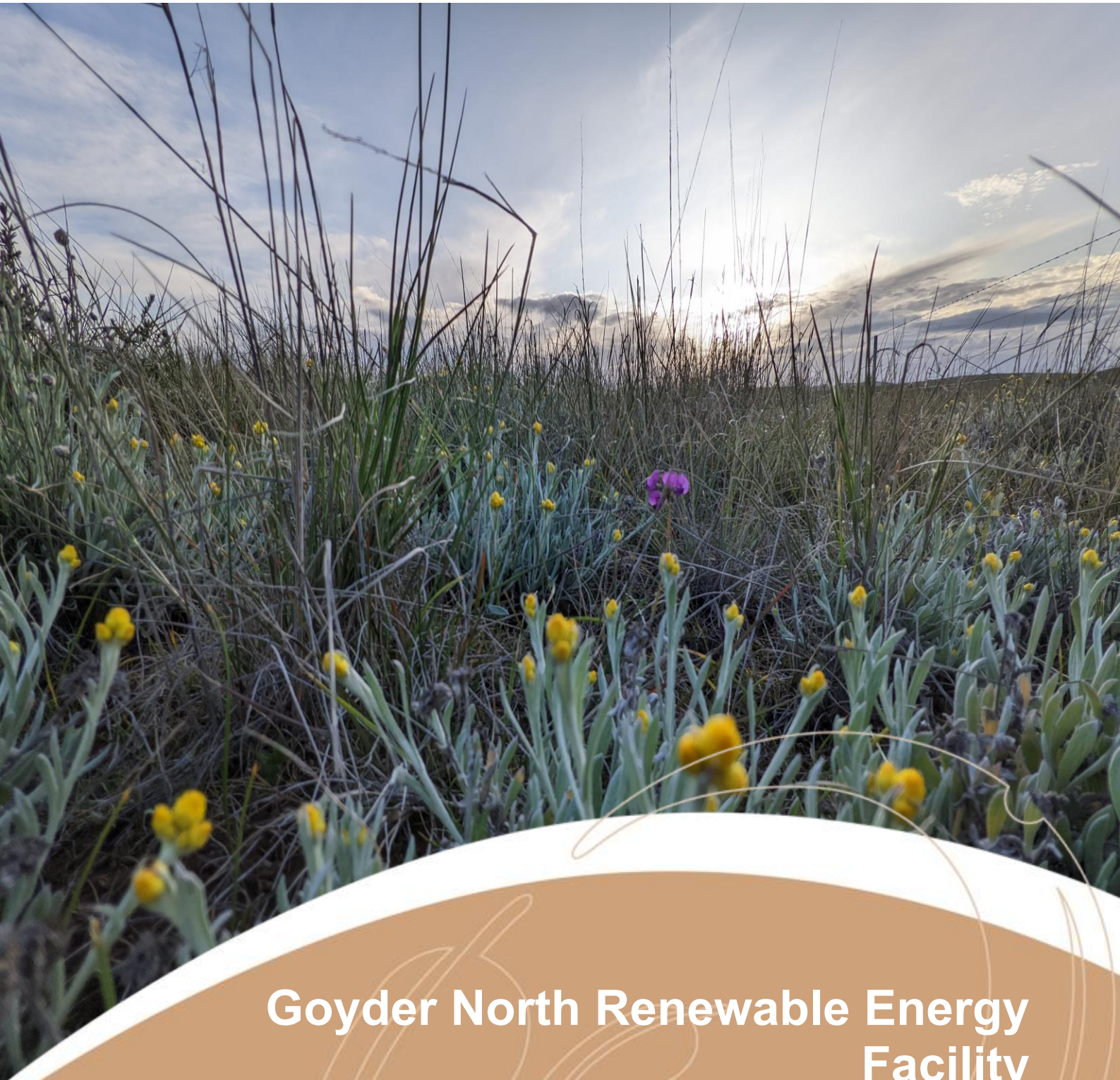

Goyder North Renewable Energy Facility

Flora and Fauna Assessment

Goyder North Renewable Energy Facility - Flora and Fauna Assessment

21 February 2024

Version 2

Prepared by EBS Ecology for Neoen

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Cover photograph: *Chrysocephalum apiculatum* (Common Everlasting) in 'Grassland Meadow' vegetation within the Project Area.

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GLOSSARY AND ABBREVIATION OF TERMS

BAM	Bushland Assessment Methodology
BDBSA	Biological Database of South Australia (managed by DEW)
CEC	Clean Energy Council
CP	Conservation Park
COEMP	Construction and Operational Environmental Management Plan
DA	Development Application
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DEW	Department of Environment and Water (South Australia)
EBS	Environmental and Biodiversity Services trading as EBS Ecology
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FRWL	Flinders Ranges Worm-lizard (Aprasia pseudopulchella)
GNREF	Goyder North Renewable Energy Facility
GRZ	Goyder Renewables Zone
GSHREP	Goyder South Hybrid Renewables Energy Project
Ha	Hectares (s)
IBRA	Interim Biogeographical Regionalisation of Australia
INTG	Iron-grass Natural Temperate Grassland Threatened Ecological Community
Km	Kilometres
kV	Kilovolt
LGA	Local Government Area
LSA Act	*Landscape South Australia Act 2019*
m	metre (s)
met mast	Meteorological mast (mast or tower equipped with instruments to measure windspeed and climatic conditions)
mm	millimetres
MNES	Matters of National Environmental Significance
Mt.	Mount
MW	Megawatts
MWh	Megawatt hour
Neoen	Neoen Australia Pty Ltd

NPW Act	*National Parks and Wildlife Act 1972* (South Australia)
NV Act	*Native Vegetation Act 1991* (South Australia)
NVC	Native Vegetation Council
NVF	Native Vegetation Fund
OMP	Offset Management Plan
PBTL	Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*)
PMST	Protected Matters Search Tool
Project Area	Goyder North Hybrid Renewable Energy Facility
SA	South Australia(n)
SEB	Significant Environmental Benefit
SHNW	Southern Hairy-nosed Wombat (*Lasiorhinus latifrons)*
SIG	Significant Impact Guidelines 1.1 for Matters of National Environmental Significance (DotE, 2013)
sp.	Species
spp.	Species (plural)
ssp.	Subspecies
TEC	Threatened Ecological Community
VA	Vegetation Association (s)
WTE	Wedge-tailed Eagle (*Aquila audax*)
WTG	Wind Turbine Generators

EXECUTIVE SUMMARY

Project Area and objectives

Neoen Australia Pty Ltd (Neoen) is developing the Goyder North Renewable Energy Facility (GNREF) as a part of its wider Goyder Renewables Zone (GRZ) concept. EBS Ecology (EBS) has been engaged by Neoen to undertake the initial ecological assessments, to contribute to the deliverables required for a Development Application, including to:

- Identify any potential ecological constraints such as national and State listed threatened species and / or threatened ecological communities.
- Broadly map vegetation including condition which may be relevant to the Project.
- Broadly map areas of important or significant fauna habitat.
- Provide recommendations in relation to the assessment process and assessment requirements for the Project as it progresses into the design phase.

Desktop assessment results

A report generated by the Protected Matters Search Tool (PMST) found three Matters of National Significance (MNES) relevant to the Project Area including threatened flora and fauna species, threatened migratory species, and Threatened Ecological Communities (TECs).

The PMST identified 13 flora and 12 fauna species listed as threatened under the EPBC Act as potentially occurring or having suitable habitat within 5 km of the Project Area. Of these, five plant species and two reptiles were found to have Biological Database of South Australia (BDBSA) records within 5 km of the Project Area.

The PMST also found eight listed migratory species to potentially occur within the Project Area, however none of these species had records nearby and no important habitat such as large waterbodies or wetlands occurs within or close to the Project Area. None of these species were deemed likely to occur within the Project Area or be impacted by project infrastructure.

Four EPBC listed Threatened Ecological Communities were identified as likely to occur within 5 km of the Project Area.

A BDBSA search found an additional 30 flora and 12 fauna species State listed under the *National Parks and Wildlife Act 1972* (NPW Act), to have records within 5 km of the Project Area.

Field survey results

Vegetation in the Project Area was dominated by mixed native and exotic grasslands in varying condition in the western and central parts of the Project Area, whilst Mallee vegetation dominated the eastern hills, slopes and plains, intermixed with less dominant associations such as chenopod shrublands.

Fifteen native vegetation associations, including five dominant and ten minor associations, were identified throughout the Project Area during the field survey. Two vegetation associations were assessed against criteria for listing as EPBC listed Threatened Ecological Communities including:

- Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia (PBGW); and
- Iron-grass Natural Temperate Grassland of South Australia (INTG).

The PBGW occurred in a small patch in the south of the Project Area, and did not meet criteria for listing, as it contained a largely non-native understorey. Approximately 59 percent (%) (2304.67 hectares) of a total 3929 hectares mapped as INTG, was found to be likely to comprise the EPBC listed INTG as either A-Class or B-Class.

A total of 202 flora species (155 native, 47 exotic) and 74 fauna species (66 native, 8 non-native) were identified within the Project Area. One nationally listed flora species and five State listed flora species were detected within the Project Area during the field survey.

No nationally listed threatened fauna species were observed during the field survey; however, habitat was broadly assessed as suitable for Pygmy Blue-tongue Lizard (PBTL) and Flinders Ranges Worm Lizard (FRWL) and there are known records of these species in the Project Area. Three State listed threatened bird species were detected including Black Falcon (*Falco subniger*; NPW Act: Rare), Elegant Parrot (*Neophema elegans elegans*; NPW Act: Rare) and White-winged Chough (*Corcorax melanorhamphos*; NPW Act: Rare).

The likelihood of occurrence assessment indicates that 49 national and / or State listed species may occur in the Project Area including 34 plants (seven EPBC Act listed and 27 NPW Act listed) and 15 fauna species (four EPBC listed and 11 NPW Act listed). Of these, 12 flora and five fauna species are considered highly likely or known to occur in the Project Area based on habitat types available, survey effort undertaken and the proximity and recency of historical records, including one plant (*Dodonaea procumbens*) and two reptiles (PBTL and FRWL) which are nationally listed.

Evidence of Southern Hairy-nosed Wombats (*Lasiorhinus latifrons*) was observed during the field survey, including large warren / burrow systems, fresh diggings and scats. Though not listed as threatened under national or State legislation, this species presents a constraint for the Project due to potential conflicts with construction and operation caused by their presence.

Avoidance and minimisation recommendations

Apply the mitigation hierarchy when planning infrastructure layout including:

- Avoid where possible, placing infrastructure in areas identified as comprising or containing MNES including:
    - Iron-grass Natural Temperate Grassland Threatened Ecological Community (VA6);
    - Peppermint Box Grassy Woodland (VA8) (*unlikely to meet EPBC listing status, however, amenable to rehabilitation and still containing important habitat features).
    - Known populations of PBTLs and areas mapped as likely and potential PBTL habitat.
    - EPBC listed threatened plant species.
    - Known or likely FRWL populations or habitat.
- Place construction exclusion buffers around all areas known to contain MNES.

- Avoid placing infrastructure in areas identified as comprising high quality habitat.
- Avoid placing infrastructure in areas protected for the local environmental significance.

Where impacts to MNES, State significant and landscape significant features cannot be entirely avoided, minimisation methods should be utilised to reduce impacts to these matters, including:

- Micro-site infrastructure prior to construction to minimise impacts on PBTL burrows and habitat and / or areas mapped as INTG.
- Undertake an EPBC Referral for all MNES likely to be impacted by the development.
- Ensure investigation works in the initial planning stages, including for access, geotechnical assessments and meteorological mast installation utilise minimal impact methods.
- Investigate opportunities to acquire suitable land for offsetting any impacts the Project may have.

Fauna management recommendations

General recommendations to minimise impacts to fauna occurring within the impact area includes:

- Engage qualified fauna spotter catchers, with appropriate relocation permits to undertake pre-construction searches and relocate any fauna occurring within the construction footprint.
- If possible, avoid undertaking construction works during spring when many birds are nesting.
- Avoid impacts to areas known to contain wombat warrens. If unavoidable, investigate alternative non-lethal methods to minimise their potential impact on the Project.

To mitigate the potential impacts of the Project on PBTL populations and PBTL habitat:

- Micro-site turbines within areas identified as ‘known’ PBTL habitat.
- Ensure a ‘STOP WORK’ procedure is in place in the event that a previously unknown population of PBTLs is discovered within the Project Area footprint during construction phase.
- Once the preliminary infrastructure layout is known:
    - Undertake detailed PBTL surveys in all likely and possible habitat and surrounding areas to enable micro-siting of infrastructure if PBTLs are found to occur; and
    - Ground truth areas mapped as unlikely habitat within the impact area.
- If the proposed infrastructure layout is modified, survey and ground-truth any new potential PBTL habitat which may be impacted by the new layout.
- If PTBL’s are found to occur within any area of the proposed infrastructure layout, and micro siting cannot avoid all impacts:
    - Consult with the PBTL Recovery Team regarding recommended actions around PBTL in the Project Area.
    - Engage an accredited environmental consultant to develop a PBTL Relocation Management Plan for PBTLs impacted by the construction footprint.

To mitigate impacts of the Project on FRWL populations and habitat EBS recommends:

- Targeted surveys any suitable habitat occurring within the proposed impact layout.

- If numerous individuals are detected in an area consider micro siting construction.
- Pre-clearance surveys should be undertaken by permitted fauna ecologists in all areas of potential habitat to catch and relocate FRWL encountered.

Next steps

As soon as possible:

- Develop a Construction, Environmental and Operational Management Plan (CEOMP).
- Commence 24-month seasonal bird and bat utilisation surveys as soon as possible.

Once a preliminary Project impact footprint is known (including all direct and indirect impacts):

- Undertake a detailed vegetation survey in accordance with Native Vegetation Council (NVC) methodology and submit a native vegetation clearance application to the NVC to seek approval for proposed impacts.
- Undertake a detailed significant impact assessment for all MNES occurring or potentially occurring within the Project Area.
- Commence EPBC referral process for all MNES for which there may be a significant impact caused by the Project.
- Undertake detailed assessments within proposed impact footprint during spring to confirm if areas mapped as Lomandra grassland qualify for listing as INTG TEC under the EPBC Act.
- Undertake detailed PBTL surveys in areas thought to be possible or likely habitat to inform micro-siting of infrastructure and / or instigate planning for PBTL relocation works.
- Undertake targeted surveys for FRWL and use results to micro-site infrastructure and / or instigate planning for a fauna spotter catcher to relocate animals during construction.
- Undertake targeted searches to detect active and dormant Wedge-tailed Eagle (WTE) nests. A one-kilometre buffer is recommended to be placed around WTE nests to avoid potential impacts from wind turbines to fledgling birds.
- Undertake targeted searches in proposed impact area (and appropriate buffer to enable micro siting) for nationally threatened species considered known or likely to occur.
- Determine the extent of the wombat warrens if they occur within proposed impact areas and confirm whether the warrens are currently active.

For a full list of detailed recommendations, refer to section 8.

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1 INTRODUCTION

Neoen Australia Pty Ltd (Neoen) is developing the Goyder North Renewable Energy Facility (GNREF) as a part of its wider Goyder Renewables Zone (GRZ) concept. As a part of this concept, the Goyder South Hybrid Renewables Energy Project was granted Development Approval in 2021 with construction of stage 1 beginning in 2022, including 412 MW of wind generation. The GNREF is likely to be developed in stages and will include approximately 1000 megawatts (MW) of wind generation including wind turbine generators (WTG), meteorological masts (met mast), buried collector cables, electrical substations, an operations and maintenance building and an overhead transmission line to connect the wind farm to the existing ElectraNet Transmission network. It is likely that the connection will extend to the south.

EBS Ecology (EBS) has been engaged by Neoen to undertake the initial ecological assessments, to identify any potential ecological constraints which occur within the Project Area, and to propose options and recommendations for mitigation where potential constraints have been identified.

1.1 Project objectives

The main objective of the ecological flora and fauna assessment report is to contribute to the deliverables required for a Development Application (DA). This includes:

- Identify potential ecological constraints for the Project, including:
    - Known locations of national and State listed threatened species and ecological communities;
    - Likelihood of national and State listed threatened species / communities being present within the Project Area;
    - Sensitive areas within the Project Area which may impact on matters of national or State significance.
- Undertake a broad vegetation assessment of the site, including where possible, vegetation surveys in accordance with the requirements of the *Native Vegetation Act 1991* and *Native Vegetation Regulations 2017* using methodology guided by the Bushland Condition Assessment Manual (BAM) and Scattered Tree Assessment Manual (STAM) implemented by the Native Vegetation Council (NVC).
- Broadly map vegetation across the site, including the condition of any patches of vegetation which may be relevant to the Project (such as the condition of areas identified as nationally threatened ecological communities).
- Broadly map areas of important habitat including:
    - Potential nesting habitat for raptor species (Wedge-tailed Eagle and Peregrine Falcon);
    - Likely and potential habitat for EPBC listed species known to occur in the Project Area such as Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*);
    - Wildlife refuge sites such as dams, creeks and watercourses, for migratory species; and

- Other important habitat features which may support a diversity of more common species.

- Provide recommendations in relation to the assessment process and assessment requirements for the Project as it progresses into the design phase.

1.2 Project Area

The proposed Goyder North development, herein referred to as the Project Area or Project, is approximately 19, 237 hectares (ha) in size, and begins approximately (~) 4 kilometres (km) north-east of the township of Burra, extending ~25 km north towards the township of Hallett in South Australia's Mid-North region, within the Regional Council of Goyder. From a transport and access perspective, the region is serviced by the Barrier Highway and the Burra-Morgan Highway (Goyder Highway) (Figure 1).

The Project Area is dominated by ridges, plains and undulating hills, located on the edge of Goyder's Line. Land use within the area is largely agricultural including marginal grazing for sheep and cattle and dryland cropping. The general region contains open, low hills with occasional rocky outcrops that fall away to low foot slopes and drainage channels at regular intervals. Native vegetation throughout the Project Area is comprised predominantly of grasslands, with large tracts of Iron-grass (*Lomandra* spp.) in the middle and eastern sections. Remnant mallee woodland associations occur along the eastern side of the site, where they grade into chenopod dominated plains.

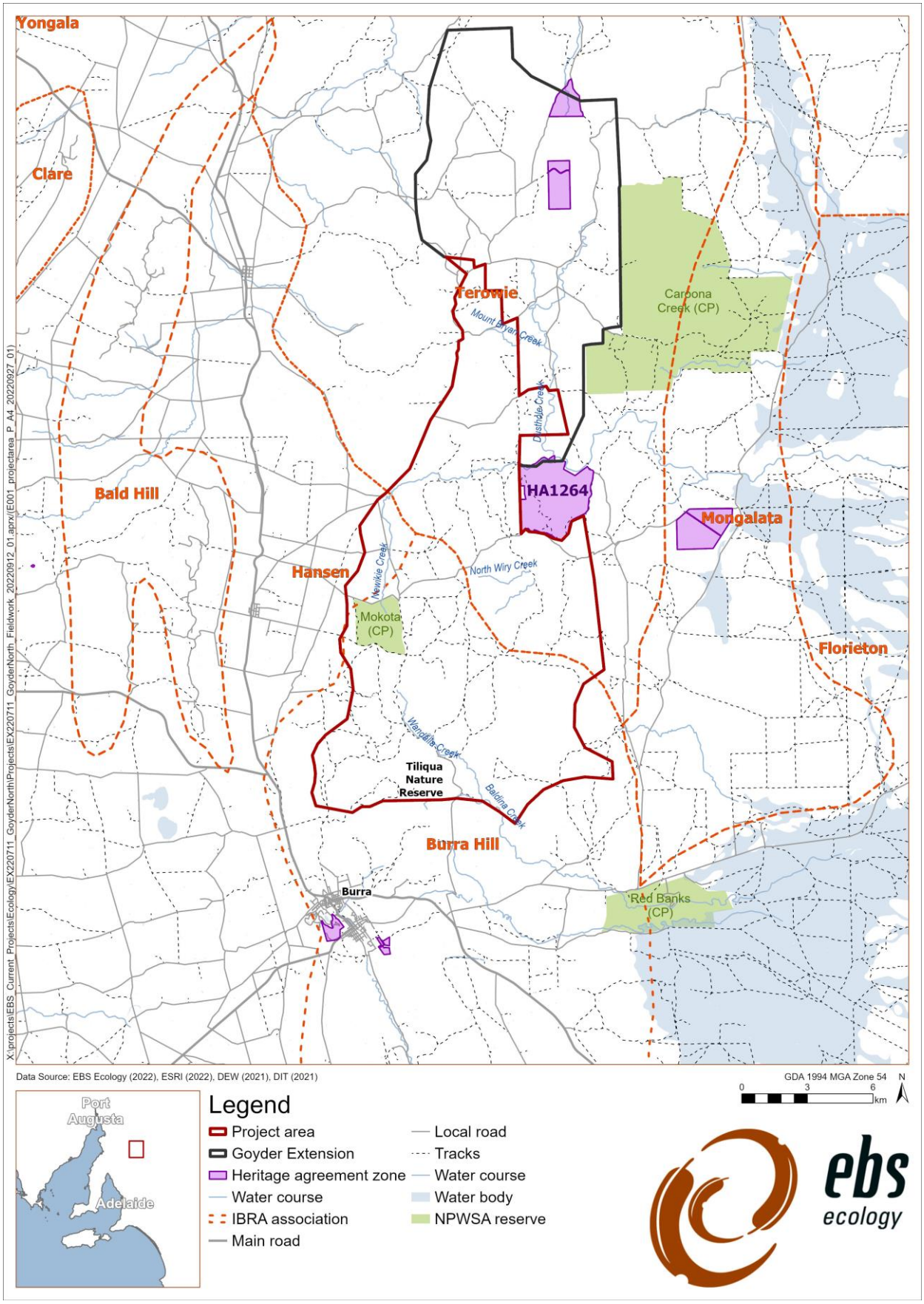


Figure 1. Project Area overview including IBRA boundaries, watercourses, major roads, conservation reserves and heritage agreements (HA).

1.2.1 Proposed Project specifications

A preliminary windfarm layout is currently under development and will be based on the outcomes of several background reports including heritage, visual impact and environmental and geotechnical assessments. In summary GNREF will comprise:

- Wind generation including wind turbines with a capacity of up to 1000MW
- Battery storage with a capacity of up to 900MW / 3,600MWh
- Several temporary and permanent meteorological masts.
- Substations, underground cabling and overhead transmission lines to connect the wind farm to the existing ElectraNet Transmission network.
- Permanent operations and maintenance compounds and access tracks to WTGs and facilities.
- Temporary construction facilities including compounds and laydown areas.

1.3 Previous surveys conducted

NEOEN have previously undertaken feasibility studies for the Goyder Renewables Zone development, which was separated into two projects to be developed and constructed separately. The first Project, Goyder South (previously, Stony Gap) is located south of Burra and is currently in the construction phase.

The second Project, originally known as Mount Cone Wind Farm is located north of Burra. Several surveys were previously conducted by EBS at the proposed Goyder North Mount Cone site, which are summarised in Table 1.

Following these feasibility studies, the Project Area was relocated to its current position and renamed 'Goyder North'. Some information collected from the previous studies is relevant to the current Project Area.

Table 1. Previous surveys conducted by EBS.

Project description	Year	Survey Type	Citation	EBS Project No.
Mt Cone Wind Farm Flora and Fauna Assessment - Investec	October – November 2010	Flora survey and fauna assessment	EBS (2011)	E00905
Mt Cone Wind Farm EPBC Referral -Investec	May 2011	EPBC referral was never completed	NA	E00905a
Mt Cone Targeted PBTL Surveys -Investec	April-May 2012	Flora survey and fauna habitat assessment	EBS (2012)	E00905b
Goyder Renewables Zone – Goyder 2 (Mount Cone Wind, Solare and Storage)	2019	Flora and Fauna Assessment	EBS Ecology 2019b	E90101

2 COMPLIANCE AND LEGISLATIVE SUMMARY

Impacts to biodiversity resulting from works on the GNREF Project, including clearing native vegetation, disturbance of threatened species and ecological communities, may be subject to Commonwealth and State Legislation listed in Table 2.

Table 2. Commonwealth and South Australian legislation relevant to the biodiversity impacts of the Project Area.

Authority	Legislation
Commonwealth	*Environment Protection and Biodiversity Conservation Act 1999*
South Australia	*Native Vegetation Act 1991* *National Parks and Wildlife Act 1972* *Landscape South Australia Act 2019*

A summary of relevant Commonwealth and State environment legislation is provided below.

2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as 'Matters of National Environmental Significance' (MNES). The nine MNES protected under the Act are:

1. World Heritage properties;
2. National Heritage places;
3. Wetlands of international importance (listed under the Ramsar Convention);
4. Listed threatened species and ecological communities;
5. Migratory species protected under international agreements;
6. Commonwealth marine areas;
7. The Great Barrier Reef Marine Park;
8. Nuclear actions (including uranium mines); and
9. A water resource, in relation to coal seam gas development and large coal mining development.

Three of the nine MNES protected under the EPBC Act are likely to be of relevance to the Project Area which are:

- Listed threatened species;
- Listed Threatened Ecological Communities (TEC's); and
- Migratory species protected under international agreements.

Any action that has, will have, or is likely to have a significant impact on MNES requires Referral under the EPBC Act. Substantial penalties apply for undertaking an action that has, will have, or is likely to have significant impact on a MNES without approval.

The *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013) (hereafter SIG), provide overarching guidance to help determine whether an action is likely to have a significant impact on a MNES.

2.2 Native Vegetation Act 1991

Native vegetation within the Project Area is protected under the *Native Vegetation Act 1991* (NV Act). This legislation is principally in place to provide incentives and assistance for the preservation and enhancement of native vegetation and to control the clearance of native vegetation.

Native vegetation refers to any naturally occurring local plant species that is indigenous to South Australia (SA), from small ground covers and native grasses to large trees and aquatic plants including marine vegetation. It also includes naturally occurring regrowth and in certain circumstances, dead trees (Department for Environment and Water, 2022).

Any proposed clearance of native vegetation in South Australia (unless exempt under the regulations) is to be assessed against the Principles of Clearance under the Act and requires approval from the Native Vegetation Council (NVC). Approval is generally conditional on achievement of a Significant Environmental Benefit (SEB) either though development of an approved SEB offset or through payment into the Native Vegetation Fund (NVF).

2.2.1 Native Vegetation Regulations 2017

The *Native Vegetation Regulations 2017* outline the circumstances where clearing native vegetation is permitted, outside of the clearance controls in the NV Act. The Regulations allow clearance for certain routine activities, such as for upgrading or establishing infrastructure.

The Regulations emphasise the requirement for proponents to apply the Mitigation Hierarchy, which requires that proponents consider all possible ways to avoid and minimise clearance of native vegetation, thus reducing the level of clearance and subsequent costs.

Part 3, Division 5, Regulation 12(34) – Infrastructure allows clearance of vegetation incidental to the construction or expansion of a building or infrastructure (and associated services) where the Minister has declared (in writing) that the clearance is in the public interest.

2.3 National Parks and Wildlife Act 1972

Native plants and animals in South Australia are protected under the *National Parks and Wildlife Act 1972* (NPW Act). It is an offence to take a native plant or protected animal without approval. Threatened flora and fauna species listed in Schedules 7 (Endangered species), 8 (Vulnerable species), or 9 (Rare species) of the NPW Act. Persons must not:

- Take a native plant on a reserve, wilderness protection area, wilderness protection zone, land reserved for public purposes, a forest reserve or any other Crown land;
- Take a native plant of a prescribed species on private land;
- Take a native plant on private land without the consent of the owner (such plants may also be covered by the *Native Vegetation Act 1991*);
- Take a protected animal or the eggs of a protected animal without approval;
- Keep protected animals unless authorised to do so; and

- Use poison to kill a protected animal without approval.

Conservation rated flora and fauna species listed on Schedules 7, 8, or 9 of the NPW Act are known to, or may occur within the Project Area. Persons must comply with the conditions imposed upon permits and approvals.

2.4 Landscape South Australia Act 2019

The *Landscape South Australia Act 2019* (LSA Act) repealed the *Natural Resources Management Act 2004*. Under the LSA Act, new regional landscape boards have been established. The aim is to deliver Landscape related services to regional communities, including effective water management, pest plant and animal control, soil and land management and support for broader sustainable primary production programs. Under the LSA Act, landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

3 ENVIRONMENTAL SETTING

3.1 Administrative Boundaries

The Project Area is located in the administrative regions of SA as indicated in Table 3.

Table 3. Administrative boundaries of the Project Area.

Administration	Region / boundary
State Government Region	Yorke and Mid North
Local Government Area	The Regional Council of Goyder
Landscape Management Region (LMR)	Northern and Yorke LMR
Soil Conservation District	Hummocks, West Brougton, Eastern Districts
Hundred (s)	Kingston, Burra, Baldina, Mongolata

3.2 Interim Biogeographical Regionalisation of Australia

The Interim Biogeographical Regionalisation of Australia (IBRA) is a landscape-based approach to classifying the land surface across a range of environmental attributes, which is used to assess and plan for the protection of biodiversity.

The Project Area falls within the Flinders Lofty Block bioregion, further split into smaller subregions of Broughton and Olary Spur, based on the local characteristics on the area. The Project occurs across three environmental associations, Burra Hill, Hansen and Terowie. The characteristic features of the bioregion, subregions and environmental associations for the Project Area are described in Table 4. Detailed information on Olary Spur sub-region and Terowie Environmental Association are limited due to changes in IBRA Version 7.0.

Table 4. IBRA bioregion, subregion, and environmental association environmental landscape summary.

IBRA Bioregions, subregions and environmental associations in the Project Area.
Flinders Lofty Block IBRA bioregion
Temperate to arid Proterozoic ranges, alluvial fans and plains, and some outcropping volcanics, with the semi-arid to arid north supporting native cypress, black oak (belah) and mallee open woodlands, *Eremophila* and *Acacia* shrublands, and *Maireana* spp. (Bluebush) / *Atriplex* spp. (Saltbush) chenopod shrublands on shallow, well-drained loams and moderately deep, well-drained red duplex soils. The increase in rainfall to the south corresponds with an increase in low open woodlands of *Eucalyptus obliqua* (Messmate stringybark) and *E. baxteri* (Brown Stringybark) on deep lateritic soils, and *E. fasciculosa* (Pink Gum) and *E. cosmophylla* (Cup Gum) on shallower or sandy soils.
Broughton IBRA subregion
This subregion is characterised by a series of wide undulating intra-montane basins with red duplex soils, separated by low but distinct northerly trending strike ridges. In the north the region leads into the Southern Flinders Ranges with no sharply defined landform boundary but a land use boundary marking the northern extremity of wheat cultivation. Due to widespread clearing for farming the only significant remnant of native vegetation is found in the Mt Remarkable area, where an open forest dominated by *Eucalyptus cladocalyx* (Sugar Gum) or by *E. goniocalyx* (Long-leaved Box) and *E. leucoxylon* (SA Blue gum) on reddish dense loams remains. Degraded remnants of *E. leucoxylon* and *E. odorata* (Peppermint Box) woodlands can still be found on stony crests and steep slopes.

IBRA Bioregions, subregions and environmental associations in the Project Area.	
Remnant vegetation	Approximately 10% (106,330 ha) of the subregion is mapped as remnant native vegetation, of which 3% (3,064 ha) is formally conserved
Landform	Hills and valleys; alternating subparallel hilly ridges and valleys with a general N-S trend in north. In south, hilly dissected tableland.
Geology	Dissected lateritized surface in south
Soil	Hard setting loams with red clayey subsoils, highly calcareous loamy earths, hard setting loams with mottled yellow clayey subsoil, coherent sandy soils, cracking clays.
Vegetation	Assumed native vegetation cover.
Conservation significance	55 species of threatened fauna, 113 species of threatened flora. 0 wetlands of national significance.
Burra Hill IBRA environmental association	
Remnant vegetation	Approximately 45% (32,624 ha) of the association is mapped as remnant native vegetation, of which 5% (1,786ha) is formally conserved
Landform	Steep strike ridge on metasediments with dissected foot slopes.
Geology	Metasediments and alluvium.
Soil	Reddish powdery calcareous loams, hard pedal red duplex soils and reddish calcareous earths.
Vegetation	Woodland *of E. leucoxylon ssp. pruinosa* (SA Blue Gum) and *E. odorata* (Peppermint Box)
Conservation significance	20 species of threatened fauna, 54 species of threatened flora. 0 wetlands of national significance.
Hansen IBRA environmental association	
Remnant vegetation	Approximately 3% (3,738 ha) of the association is mapped as remnant native vegetation, of which 1% (28 ha) is formally conserved
Landform	Gentle foot slopes forming extensive intra-montane plains, with occasional narrow strike ridges on metasediments.
Geology	Colluvium, metasediments and alluvium.
Soil	Hard pedal red duplex soils, reddish powdery calcareous loams, brown self-mulching cracking clays and black self-mulching cracking clays.
Vegetation	Low shrubland of samphire.
Conservation significance	24 species of threatened fauna, 43 species of threatened flora. 0 wetlands of national significance.
Olary Spur IBRA subregion	
Characterised by gentle foot-slopes and plains dominated by chenopod shrublands, hogback rides with Mallee in the south to mulga shrublands in the west. The sub-region consists of calcareous plains with low shrubland of *Maireana sedifolia* (pearl bluebush); plains of *Myoporum platycarpum* (Sugarwood) open woodland over *Atriplex vesicaria* (bladder saltbush) or *A. vesicaria* low shrubland with *Atriplex stipitata* (bitter saltbush); low hills of bladder	

IBRA Bioregions, subregions and environmental associations in the Project Area.	
saltbush low shrubland; watercourse plains of *Nitraria billardiera* (Nitre bush) and *Maireana pyramidata* (blackbush) with Eucalyptus camaldulensis (River Red Gum) creeks.	
Remnant vegetation	Approximately 0.94% (16,393 ha) of the subregion is formally conserved
Terowie IBRA environmental association	
Remnant vegetation	Approximately 1.69 % of 328,826 ha is formally conserved.
Landform	A series of deeply dissected northerly trending quartzite and siltstone ridges, separated by narrow pediments and colluvial plains
Geology	Quartzite, siltstone, colluvium and alluvium.
Soil	Powdery brown calcareous loams, brown calcareous earths, hard pedal red duplex soils and crusty red loams.
Vegetation	Tussock sedgeland of *Lomandra, Acacia* (Wattle), *Eremophila* spp. (Emubush), *Dodonaea* (hopbush) and *Senna* spp., tall shrubland of *Eremophila mitchellii* (False Sandalwood), open scrub of *E. socialis* (beaked red mallee) and *E. camaldulensis* (River Red Gum) woodland.

3.3 Climate

Climate data was sourced from the Clare High School Weather Station (site number: 021131), located approximately 40 km south of the southern boundary of the Project Area. The area surrounding Burra reaches relatively hot maximum temperatures in summer, with mean maximum temperatures highest in January (30.3 degrees) and February (29.6 degrees). The wettest months are June (67.2 millimetres (mm)), August (66.9 mm) and July (64.0 mm) (Commonwealth of Australia, 2019) (Figure 2).

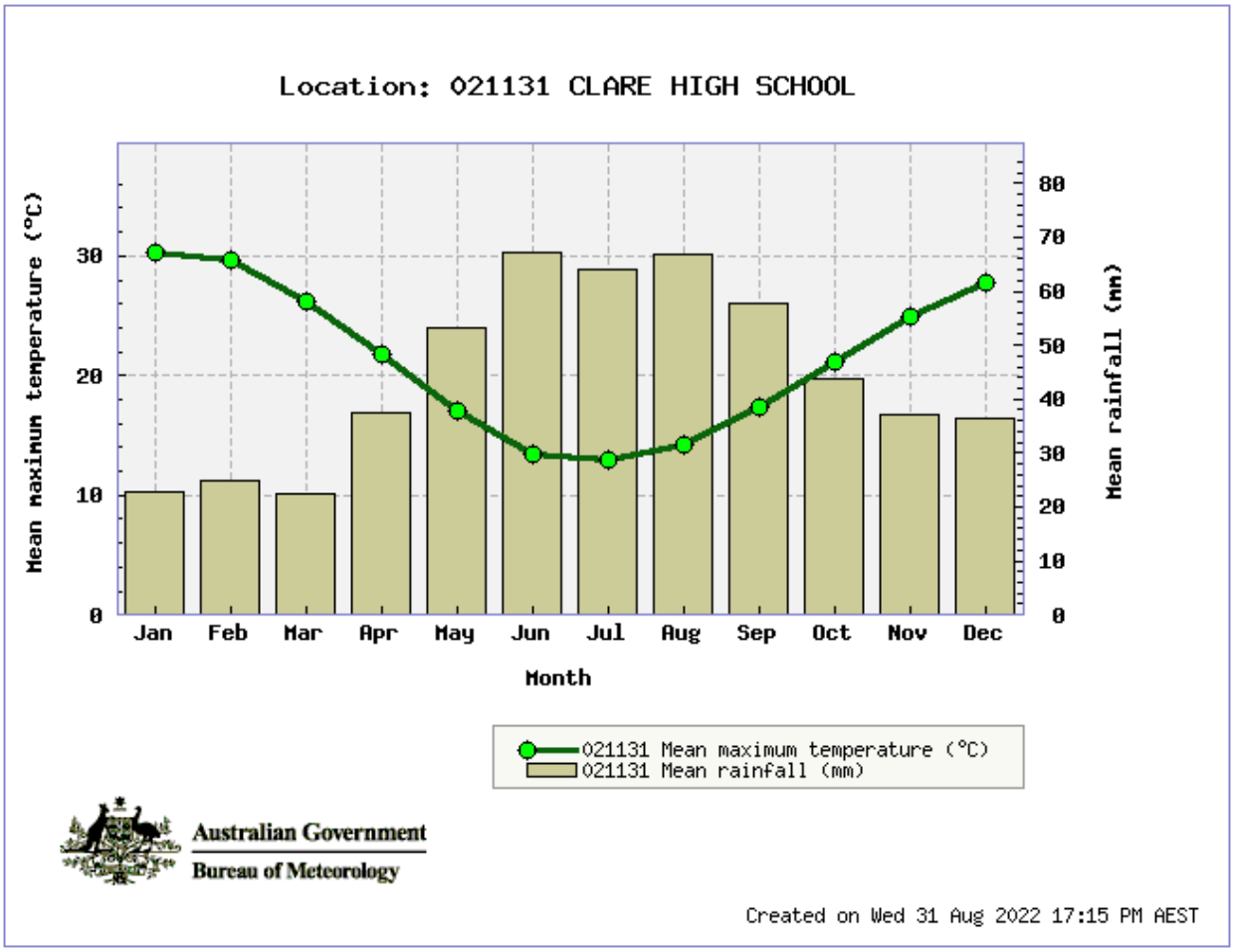


Figure 2. Mean maximum monthly temperatures and mean monthly rainfall recorded at Clare High School Weather Station (site number: 021131) from 1994 to 2022.

3.4 DEW vegetation mapping

Remnant vegetation has been mapped by the Department for Environment and Water (DEW) as part of the Native Vegetation Information System (NVIS) floristic analysis and mapping project. The NVIS mapping is based on interpretation of aerial photography or Landsat imagery and floristic data derived from Biological Survey of SA vegetation sites or field trips. Given the NVIS mapping is largely derived from remote assessment, it can be inaccurate. As part of the field assessments, EBS will verify previously mapped vegetation data.

NatureMaps was used to determine the broad vegetation types that occur within the Project area (DEW 2022). A total of four broad vegetation types and seven associations are mapped within the Project Area, detailed in Table 5 and Figure 3. More than half the Project Area was broadly mapped as 'Grassland' which

is not represented as a native vegetation association in DEW mapping as it may comprise both native and non-native grassland including crops.

Table 5. DEW Vegetation mapping across the Project Area.

Broad Description	Dominant Species Groups	Environmental Description	Representation in Project Area
Eucalyptus Woodland	*Eucalyptus leucoxylon ssp.+/- Eucalyptus odorata +/ -Amyema miquelii* mid woodland.	Hill slopes, foot-slopes, crests and plains on sandy clay to loam.	Minor
Mallee Woodland and Shrubland	*Eucalyptus brachycalyx +/- Eucalyptus oleosa ssp. ampliata +/- Eucalyptus gracilis* mid mallee woodland over chenopods.	Plains and hills, dunes and swales on sand to clay loam.	Dominant, eastern slopes
	Eucalyptus porosa mid mallee woodland over *Cassinia laevis* (mixed) low open shrubland and *Chrysocephalum semipapposum* (mixed) low sparse shrubland.	Ridges and hill slopes.	Dominant - eastern slopes
	Eucalyptus gracilis, Eucalyptus oleosa ssp. oleosa, Eucalyptus socialis ssp.+/- Eucalyptus dumosa mid mallee woodland.	Swales and sand plains.	Minor - eastern slopes
Grassland / Herbland / Sedgeland / Rushland	*Lomandra multiflora ssp. dura* (mixed) grassland.	Hill foot slopes, crests, slopes and ridges on sandy loam to clay.	Extensive
	Juncus kraussii, Cyperus gymnocaulos, Phragmites australis, Typha domingensis tall sedgeland +/- emergent *E. camaldulensis.*	Stream channels and swamps on loamy sand to clay.	Minor
	Lomandra sp. Low sedgeland	NA	Minor
Shrubland < 1m	*Cryptandra amara* var. low shrubland +/- emergent *Bursaria spinosa*.	NA	Minor

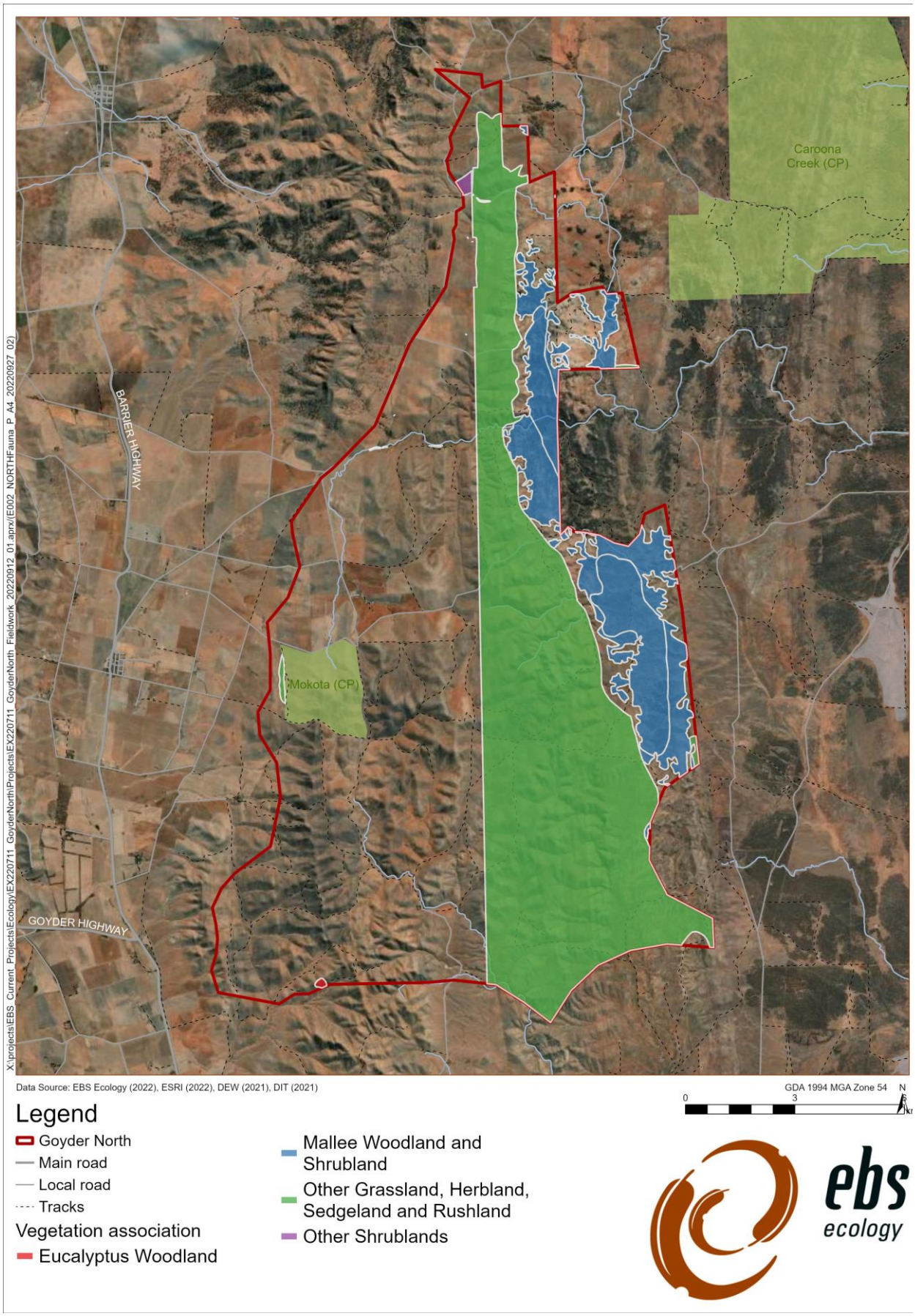


Figure 3. DEW vegetation mapping (DEW, 2022).

3.5 Watercourses and wetlands

The south-western extent of the Project Area is within the Upper Burra Creek surface water catchment area. No large natural water bodies occur in the Project Area; however, numerous constructed farm dams occur throughout the Project Area alongside an intersecting network of small named and unnamed ephemeral watercourses fed by runoff from ranges, with named watercourses including, from north to south:

- Dust Hole Creek – to the north of Caroona CP, flows east from the ranges to the plains.
- Deadmans Creek;
- Mount Bryan Creek;
- Wiry Creek;
- South Wiry Creek; and
- Wandilah Creek.

Approximately 5 km to the east of the Project Area, semi-arid chenopod floodplains dominate the landscape. To the north, approximately 23 kilometres from the northern boundary, lies a large seasonal wetland Hiles Lagoon (~295 ha in size).

3.6 Protected areas

Several formally protected areas occur within the vicinity of the Project Area (shown in Figure 1.), including:

- Three State protected Conservation Parks; and
- Eight privately managed Heritage Agreements / nature reserves.

3.6.1 Conservation Parks

One State protected Conservation Park (CP) occurs within the Project Area extent, Mokota CP. The 445-hectare park was gazetted in October 2000, with the aim to protect important native grassland vegetation. Mokota CP is known to contain over 150 native plant species, including 32 species of State conservation significance. The CP also provides habitat for up to 28 animal species including the nationally Vulnerable Flinders Ranges Worm Lizard (*Aprasia pseudopulchella*).

Caroona Creek CP occurs to the north of the Project Area and was proclaimed under the NPW Act in 2010 for its representative sample of the transitional zone between the rounded hills of the Mid North to the beginning of the rocky gorge country of the Flinders Ranges. It hosts a range of unique flora including the EPBC listed *Codonocarpus pyramidalis* (Slender Bell-fruit).

Red Banks CP occurs to the south east of the Project Area and conserves nationally listed threatened ecological communities including Iron-grass Natural Temperate Grassland (INTG) of South Australia and Plains Mallee Box Woodland of the Murray Darling Depression. It is also known to contain State listed threatened plant species and a rich palaeontological history.

3.6.2 Heritage Agreements

Eight Heritage Agreements have been listed as part of the Protected Matters Search Tool results within 5 kilometres of the Project Area. One of these Heritage Agreement areas occur within Project Area itself, Tiliqua Nature Reserve. The remaining seven areas are outside of the Project Area, including three which occur in an area mapped as Goyder North Extension (to the north). Heritage agreements intersecting with the Project Area and 5 km search area are detailed in Table 6.

Tiliqua Nature Reserve is a privately owned and managed reserve within the Project Area, dedicated to the protection of the Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*). The reserve is not officially listed on NatureMaps, but occurs in the south-central part of the Project Area on Wandilah Station, where it protects an 85-hectare area known to support a population of PBTL and is dedicated to protecting and researching the species through its long-running partnership with Flinders University.

A Heritage Agreement is a conservation area on private land, which is established by agreement (or contract) between a landholder and the Minister for Sustainability, Environment and Conservation, under the *Native Vegetation Act 1991.* Agreements are ongoing or perpetual and are binding on future landholders. Even if the property is sold or ownership is transferred, the conservation status of the land under agreement will continue. Native plants and animals within the specified Heritage Agreement area must be protected from the time the agreement is made. If an activity could adversely impact native flora and/or fauna in a Heritage Agreement area, then the Minister will need to grant approval before it can be performed.

Table 6. Heritage Agreements relevant to the Project Area.

Heritage Agreement ID #	Date	Area (ha)	Location within Project Area
Tiliqua Nature Reserve	2010	85	Wandilah Station (not marked), owned and managed by Nature Foundation.
HA 1221	2001	25.509	East of Burra township.
HA 1264	21/3/2002	913.53	Central (eastern outskirts, overlaps with Project Area for Goyder North Extension.
HA 1551	11/5/2016	44.00, 168.60	Goyder North Extension (two polygons).
HA 1562	21/11/2016	62.91	Burra township.
HA 656	18/06/1992	231.71	To the east of the Project Area.
HA 707	29/10/1992	151.12	To the east of the Project Area.
HA 277	14/7/1989	152.59	Goyder North Extension.

Source: NatureMaps *Heritage Agreements* layer (DEW 2022).

4 METHODS

4.1 Desktop assessment

A desktop assessment was conducted to determine the potential for any threatened and protected species (both Commonwealth and State listed) to occur within the Project Area. This was achieved by undertaking database searches using a 5 km buffer from the boundary of the Project Area, in line with standard requirements under Native Vegetation Council (NVC) for projects within agricultural areas.

4.1.1 Protected Matters Search Tool (PMST)

A Protected Matters Search Tool (PMST) report was generated on 13 October 2022 to identify MNES under the EPBC Act relevant to the Project Area (DCCEEW 2022). The PMST is maintained by the Department of Climate Change, Energy, Then Environment and Water (DCCEEW) and was used to identify flora and fauna species and ecological communities of national significance that may occur or have suitable habitat within the Project Area.

4.1.2 Biological Database of South Australia (BDBSA)

An extraction from the BDBSA was obtained to identify flora and fauna species that have been recorded within 5 km of the Project Area boundary (DEW, 2022) (accessed 02/09/2022, record set number *DEWNRBDBSA220902-2*). The BDBSA is comprised of an integrated collection of species records from the South Australian Museum, conservation organisations, private consultancy companies, Birds SA, Birdlife Australia and the Australasian Wader Study Group, which meet DEW standards for data quality, integrity and maintenance. Threatened species (both Commonwealth and State listed), highlighted within 5 km of the Project Area, are summarised within section 5.

4.1.3 Limitations

Flora and fauna records were sourced from the BDBSA. The BDBSA only includes verified flora and fauna records submitted to DEW or partner organisations. It is recognised that knowledge is poorly captured, and it is possible that threatened species occur that are not reflected by database records. Although much of the BDBSA data have been through a variety of validation processes, the lists may contain errors and should be used with caution. DEW gives no warranty that the data are accurate or fit for any particular purpose of the user or any person to whom the user discloses the information.

BDBSA flora and fauna records were limited to a 5 km buffer around the Project Area boundary. The reliability of the BDBSA data ranges from 100 m to over 100 km, though only species with a spatial reliability of less than (<) one kilometre have been assessed as part of this report. Fauna species, in particular birds, can traverse distances more than the 5 km search buffer, and therefore, additional species may occur. It is also acknowledged that the presence of species may not be adequately represented by database records. Hence, the BDBSA results that have been clipped to a 5 km buffer of the Project Area may not highlight all potential threatened flora and fauna species that may occur in the Project Area.

The findings and conclusions expressed by EBS are based solely upon information in existence at the time of the assessment.

4.2 Field survey

Field surveys were undertaken between 12 and 16 September 2022 by four EBS Ecologists. The aim of the field survey was to broadly map vegetation associations across the Project Area including assessing and mapping condition of vegetation and identifying any ecological constraints including threatened flora and fauna species within the Project Area.

4.2.1 Vegetation associations and condition

The broad vegetation survey focused on validating and building on from the broad DEW floristic mapping, to obtain a greater understanding of the vegetation communities within the Project Area. This involved surveying all areas of native vegetation and recording the following:

- Location of vegetation associations;
- Species list for each vegetation association;
- Location and extent of declared and serious environmental weed species;
- Flora species of conservation significance; and
- Ecological communities of conservation significance.

A selection of sites in each vegetation association were assessed in accordance with the requirements of the NV Act, utilising methodology as guided by the Bushland Condition Assessment Manual (BAM) implemented by the Native Vegetation Council (NVC). A total of 20 BAMs were undertaken across the site within major vegetation associations, at sites which were representative of the condition observed across the sites.

The BAM is derived from the Nature Conservation Society of South Australia's Bushland Condition Monitoring methodology (Croft et al. 2007, 2008a, 2008b, 2009; Milne and Croft 2012; Milne and McCallum 2012) and is used to assess areas of native vegetation requiring clearance and calculate the SEB requirements.

Where minor vegetation associations occurred, such as in small, isolated patches or in areas which were unable to be adequately accessed, a rapid survey of vegetation was undertaken on foot, using a ramble method to collect a flora species list. Comments were made on the condition and any relevant condition or habitat features.

Opportunistic observations of flora were made while traversing the site by vehicle and on foot, with species recorded outside of dedicated BAM sites recorded on a site wide flora species list. Flora specimens which could not be identified in the field were collected as voucher specimens for identification at a later date.

4.2.2 Threatened flora

Targeted threatened flora surveys were not within the scope of the assessment, however, all threatened flora species observed while traversing the site or completing BAM or ramble vegetation assessments, were recorded including a GPS location and approximate abundance.

4.2.3 Fauna

Fauna surveys undertaken within the Project Area were done in accordance with the *Clean Energy Council* (CEC) *Best Practice Guidelines* (CEC, 2018). According to the guidelines, the aim of the fauna habitat survey should be to identify significant habitats and habitat components on the site, including:

- Vegetation communities that support a particular suite of fauna e.g., native grassland species and specific fauna species e.g., Pygmy Blue-tongue Lizard;
- Trees with hollows which provide shelter sites for arboreal mammals, nest sites for birds and roost / maternity sites for bats; and
- Lakes, dams, ponds and streams that may provide habitat for water birds, frogs and migratory species.

General fauna

All native and exotic fauna species opportunistically encountered were recorded across the Project Area during the field survey. For each fauna opportunistic observation, the species, number of individuals, GPS location, detection methodology (sight, sound or sign) and habitat were recorded, resulting in a general species list for the Project Area.

The Project Area was searched for other signs of animal presence including scats, burrows, nests, diggings and other traces. Habitat was broadly assessed for suitability for species, including presence of hollows, leaf litter, food resources and refuge structures. Particular attention was paid to identifying habitat for threatened species.

Pygmy Blue-tongue Lizards (PBTL)

Detailed PBTL surveys using specialised scope equipment were not within the scope of the assessment. Instead, habitats present within the Project Area were assessed for suitability based on:

- The number of spider burrows within native and mixed native / exotic grasslands on red-brown earth on the foot slopes of hills;
- The composition of grassland vegetation including presence of perennial tussocks and open spaces (dense ground cover vegetation is not suitable habitat);
- Lack of previous ground disturbance due to cropping (e.g., tilling) or intensive agriculture (e.g. livestock trampling compaction).

Birds

Targeted 20 minute 2-ha bird surveys were undertaken at seven sites in dominant vegetation associations during the field survey.

Data collected for each point count observation were as follows:

- Species observed;
- Number of individuals;
- Behaviour:

- Flying in a single direction – FLM;
- Flying (hovering or circling) over or around a single point – FLH;
- Foraging (feeding) on ground – FOG;
- Perching/resting/walking on ground – ROG;
- Perching/resting/climbing on trees or shrubs – ROT; and
- Direction and height of flight where possible.

If birds were heard or observed outside the search area, they were recorded as opportunistic observations. Bird activity (e.g., flying overhead, flying over circling, resting or foraging on tree/shrub/ground), number of individuals and any other notable observations were recorded.

4.2.4 Likelihood of occurrence assessment

An assessment to determine the likelihood of occurrence for threatened species and ecosystems within the Project Area was conducted. Each of the threatened species and ecosystems identified by the PMST and BDBSA data extract were assigned a rating (highly likely / known, likely, possible and unlikely), which described their likelihood of occurrence with the Project Area. The assessment was undertaken according to the framework shown in Appendix 1. The following criteria were considered when assigned a likelihood rating:

- Date of the most recent record (taking into consideration the date of the last surveys conducted in the area);
- Proximity of the records (distance to the Project Area);
- Landscape location of the records, vegetation remnancy and vegetation type of the record location (taking into consideration the landscape, remnancy and vegetation type of the Project Area, with higher likelihood assigned to species that were found in similar locations/condition/vegetation associations);
- Knowledge of the species; habitat preferences, causes of its decline, the conspicuousness of the species and local population trends; and
- An on-ground assessment of suitable habitat and resources.

A detailed description of criteria utilised in the likelihood assessment is presented in Table 7.

Table 7. Likelihood rating and criteria for the presence of threatened species.

Likelihood	Criteria
Highly Likely / Known	Recorded in the last 10 years within 5 km of the Project Area, the species does not have highly specific niche requirements or suitable habitat is present and the site falls within the known range of the species distribution, or: The species was recorded as part of field surveys.
Likely	Recorded in the last 20 years within 5 km of the Project Area, the area falls within the known distribution of the species and the area provides suitable habitat or feeding resources for the species.
Possible	Recorded in the last 20 years within 5 km of the Project Area, the area falls inside the known distribution of the species, but the area provides limited habitat or feeding resources for the species, or:

Likelihood	Criteria
	Recorded within 40 years, survey effort is considered adequate, habitat and feeding resources present and species of similar habitat needs have been recorded in the area.
Unlikely	No historical records within 5 km of the Project Area; or Recorded within 40 years within 5 km of the Project Area; however, suitable habitat does not occur, and species of similar habitat requirements have not been recorded in the area, or: No records despite adequate survey effort.

4.2.5 Limitations

Desktop assessment

Flora and fauna records were sourced from the BDBSA. The BDBSA only includes verified flora and fauna records submitted to the Department for Environment and Water (DEW) and partner organisations such as Bird Life Australia. It is recognised that knowledge is poorly captured, and it is possible that threatened species occur that are not reflected by database records. Although much of the BDBSA data have been through a variety of validation processes, the lists may contain errors and should be used with caution. DEW gives no warranty that the data are accurate or fit for any particular purpose of the user or any person to whom the user discloses the information.

BDBSA flora and fauna records were limited to a 5 km buffer around the Project Area boundary. The reliability of the BDBSA data ranges from 100 m to over 100 km. Only records with a spatial reliability of less than (<) 1 kilometre were included as part of the desktop assessment. Fauna species, in particular birds, can traverse distances more than the 5 km search buffer, and therefore, additional species may occur. It is also acknowledged that the presence of species may not be adequately represented by database records. Hence, the BDBSA results that have been clipped to a 5 km buffer of the Project Area may not highlight all potential threatened flora and fauna species that may occur.

Field survey

Due to the vast size of the Project Area, not all areas were searched in detail for flora, fauna or habitat features. The BAM method utilised collected detailed information for only a small area (~1-ha) of each vegetation association, and the condition represented in the BAM is not necessarily representative of the whole site. The data collected was not sufficient for a Native Vegetation Clearance report to cover the whole Project Area, and additional surveys in accordance with NVC methodology will be required once the impact footprint is known.

The survey was carried out in spring and did not allow for seasonal variation in flora and fauna presence, such as migratory species which may only be present at select times of the year. Cryptic fauna and flora species or those difficult to detect may not have been observed or identified, since time did not allow targeted surveys for these species.

Due to these limitations, it is likely that the number of flora and fauna species present in the Project Area is more extensive than that recorded. Some threatened species assessed as possible, likely or highly likely to occur may not have been detected.

Bird surveys undertaken within the Project Area were not undertaken at pre-determined, evenly spread survey locations and therefore were not sufficient to inform required bird utilisation surveys for a Project Area of such a vast area. Additional bird utilisation surveys in line with the *Climate Energy Council (CEC) Best Practice Guidelines* should be undertaken at Goyder North, commencing as soon as possible to allow two-years' worth of seasonal bird surveys prior to wind farm construction.

Impact to threatened species and ecological communities was unable to be assessed, as the impact area is not currently known. As such, the report does not address the Significant impact guidelines for MNES. Should any disturbance of vegetation or other activity occur that might result in a direct or indirect impact to a threatened species or ecological community be proposed, additional assessment of impacts will be required.

The findings and conclusions expressed by EBS are based solely upon information in existence at the time of the assessment.

5 DESKTOP ASSESSMENT RESULTS

5.1 Matters of National and State Environmental Significance

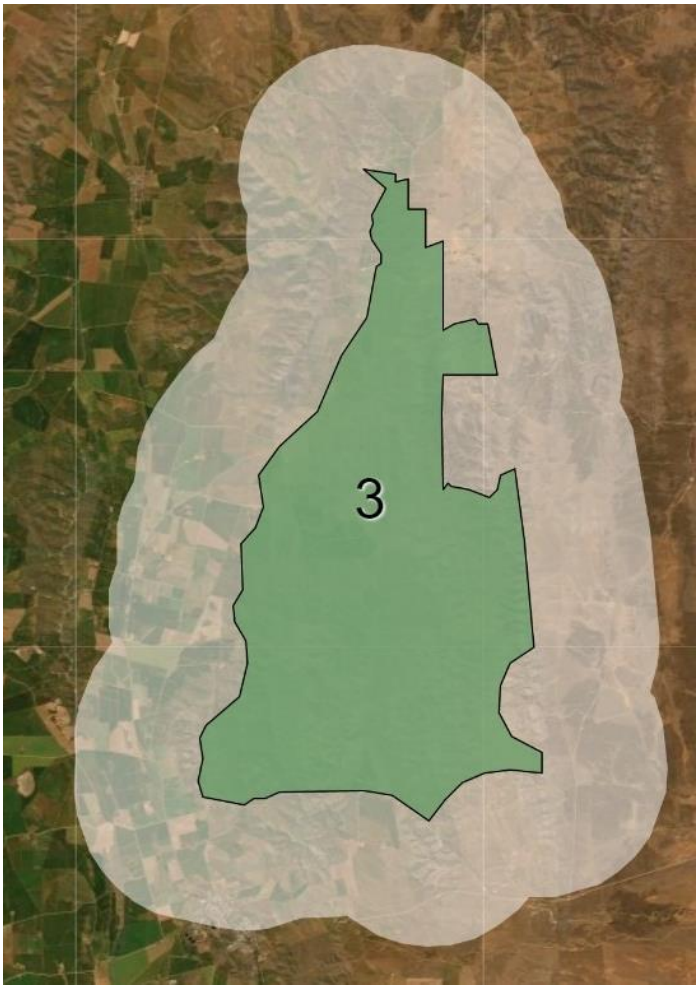
The results of the PMST report (with a buffer of 5 km from the boundary of the Project Area), including other matters protected by the EPBC Act are summarised in (Table 8) (DCCEEW, 2022). The PMST identified six MNES that might occur in the Project Area or Project Area buffer including:

1. National Heritage Places
2. Wetlands of International Importance – 150 to 200 km upstream from the Coorong and Lakes Alexandra and Albert Wetland (Ramsar site number 25);
3. Listed Threatened Ecological Communities;
4. Listed Threatened Species;
5. Listed Migratory Species; and
6. Listed Marine Species.

Of these, MNES 3, 4, and 5 are of relevance to the Project Area. Species listed as marine under the EPBC Act were excluded since the protection afforded to these species is restricted to within Commonwealth marine areas which do not occur in the Project Area.

The relevant MNES, other matters protected under the EPBC Act, and threatened species listed under the NPW Act with records in the search area are discussed in detail in the following sections.

Table 8. Summary of the results from the Protected Matters Search.

Search area (5 km buffer)	Matters of National Environmental Significance	Number
	World Heritage Properties	None
	National Heritage Places	1
	Wetlands of International Importance	1
	Great Barrier Reef Marine Park	None
	Commonwealth Marine Areas	None
	Listed Threatened Ecological Communities	4
	Listed Threatened Species	25
	Listed Migratory Species	10
	Listed Marine Species	16
	Whales and Other Cetaceans	None
	Other Matters Protected by the EPBC Act	
	Commonwealth Heritage Places	None
	Critical Habitats	None
	Commonwealth Lands	None
	Commonwealth Reserves Terrestrial	None
	Commonwealth Reserves Marine	None
	Extra Information	
	State and Territory Reserves	10
	Regional Forest Agreements	None
	Nationally Important Wetlands	None
	Key Ecological Features	None
	EPBC Act Referrals	5
	Biologically Important Areas	None

5.1.1 National Heritage Place

The Australian Cornish Mining Site at Burra was identified within the PMST results as being a National Heritage Place within the Project Area 5 km buffer. The Australian Heritage Database describes this Heritage Listing as Place ID106304. This site is outside of the Project Area boundary and will not be impacted by the Project.

5.1.2 Wetlands of International Importance

The Coorong, and Lakes Alexandrina and Albert Wetland was identified within the PMST results as being a wetland of national importance, although its proximity to the Project Area was described as 150 – 200 km upstream. The Coorong and Lakes Alexandrina and Albert Ramsar site is located at the downstream end of the Murray River, in south-east South Australia. The Murray River flows into Lake Alexandrina and out to the Southern Ocean through the Murray Mouth Estuary. Lake Albert is a terminal lake connected to Lake Alexandrina by a narrow channel. Its primary source of water is from Lake Alexandrina, supplemented by groundwater discharge and surface water runoff.

The Coorong, and Lakes Alexandrina and Albert Wetland will not be impacted upon by any proposed development in the Project Area.

5.1.3 EPBC Act Threatened Ecological Communities

Four Threatened Ecological Communities (TEC's) were identified by the PMST report as likely to occur within 5 km of the Project Area, discussed in Table 9.

Table 9. Threatened Ecological Communities potentially occurring within the Project Area.

Threatened Ecological Community	Commonwealth Rating	PMST Likelihood	Likelihood in Project Area
Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia	Critically Endangered	Community likely to occur in feature area.	Known to occur outside of the Project Area to the south and may occur in small pockets – though not detected during field survey.
Iron-grass Natural Temperate Grassland of South Australia	Critically Endangered	Community likely to occur in feature area.	Known to occur throughout the Project Area.
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur in buffer area only.	This community does not occur within the Project Area as it is not within the MDDB.
Mallee Bird Community of the Murray Darling Depression Bioregion (MDDB).	Endangered	Community likely to occur in buffer area only.	This community does not occur within the Project Area as it is not within the MDDB.

5.1.4 EBPC Act listed threatened species

A PMST report identified 13 flora and 12 fauna species listed as threatened under the EPBC Act as potentially occurring or having suitable habitat within 5 km of the Project Area. The report identified eight species as 'known' to occur. All species identified in the PMST search are listed in Table 10.

Searches of BDBSA and BirdLife Australia Atlas indicate that historical records of five nationally threatened plant species and two reptiles occur in the Search Area, indicated in Table 10 with the location of those species records indicated on the maps in Figure 4 to Figure 6.

Table 10. Threatened flora species identified in the PMST report (1) and BDBSA (2) as potentially occurring within 20 km of the Project Area.

Scientific name	Common name	Conservation status		Presence Type	Year of last record	Data source
		EPBC Act	NPW Act			
FLORA						
Acacia glandulicarpa	Hairy-pod Wattle	VU	E	May		1
Acacia menzelii	Menzel's Wattle	VU	V	Known		1
Acacia spilleriana	Spiller's Wattle	EN	E	Likely		1
Caladenia tensa	Greencomb Spider-orchid	EN		Known		1
Codonocarpus pyramidalis	Slender Bell-fruit	VU	E	Known	2003	1
Dodonaea procumbens	Trailing Hop-bush	VU	V	Known	2021	1
Dodonaea subglandulifera	Peep Hill Hop-bush	EN	E	Likely		1
Olearia pannosa subsp. pannosa	Silver Daisy-bush	VU	V	Known	1993	1

Scientific name	Common name	Conservation status		Presence Type	Year of last record	Data source
		EPBC Act	NPW Act			
Pterostylis despectans	Lowly Greenhood	EN	E	Likely	2007	1
Pterostylis xerophila	Desert Greenhood	VU	V	May		1
Senecio macrocarpus	Large-fruit Fireweed	VU	V	May		1
Senecio megaglossus	Superb Groundsel	VU	E	Likely	1993	1
Swainsona pyrophila	Yellow Swainson-pea	VU	R	May		1
FAUNA						
Aprasia pseudopulchella	Flinders Ranges Worm-lizard	VU		Known	2016	1
Calidris ferruginea	Curlew Sandpiper	CE, Mi(W)	E	May		1
Falco hypoleucos	Grey Falcon	VU	R	Likely		1
Galaxias rostratus	Flathead Galaxias	CE		May		1
Grantiella picta	Painted Honeyeater	VU	R	May		1
Maccullochella peelii	Murray Cod	VU		May		1
Numenius madagascariensis	Eastern Curlew	CE, Mi(W)	E	May		1
Nyctophilus corbeni	Corben's Long-eared Bat	VU	V	May		1
Pedionomus torquatus	Plains-wanderer	CE	E	Known		1
Pezoporus occidentalis	Night Parrot	EN	E	May		1
Rostratula australis	Australian Painted Snipe	EN	E	May		1
Tiliqua adelaidensis	Pygmy Blue-tongue Lizard	EN	E	Known	2019	1,2

EPBC Act: National (*Environment Protection and Biodiversity Conservation Act 1999*). NPW Act: South Australia (*National Parks and Wildlife Act 1972*). Conservation status codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable, R: Rare, Mi (W): Migratory Wetlands Species, Mi (T): Migratory Terrestrial Species, Mi (M): Migratory Marine Species.
Presence Type: As identified in the PMST Report
Year of last record: Historical records within 5 km of the Project Area, obtained from BDBSA and Bird Life Australia – Bird Atlas Database (BDBSA Recordset number: *DEWNRBDBSA220902-2)*
Source of Information:
1. **EPBC Act Protected Matters Report (DCCEEW 2022) – 5 km buffer applied to Project Area boundary.**
2. **BDBSA data (DEW 2022a) - 5 km buffer applied to Project Area.**

5.1.5 EBPC Act listed migratory species

Excluding species also listed as threatened, the PMST report (DCCEEW, 2022a) identified eight species listed as migratory under the EPBC Act that might occur or have suitable habitat within 5 km of the Project Area. These species are listed in Table 11. Note that migratory species that also have a threatened status are listed in Section 5.1.4. No migratory species were found to have records within 5 km of the Project Area.

Table 11. Listed migratory species potentially occurring within 5 km of the Project Area.

Scientific name	Common name	Conservation status		Presence Type	Year of last record	Data source
		EPBC Act	NPW Act			
Actitis hypoleucos	Common Sandpiper	Mi (W)	R	May		1
Apus pacificus	Fork-tailed Swift	Mi (M)		Likely		1
Calidris acuminata	Sharp-tailed Sandpiper	Mi (W)		May		1

Scientific name	Common name	Conservation status		Presence Type	Year of last record	Data source
		EPBC Act	NPW Act			
Calidris melanotos	Pectoral Sandpiper	Mi (W)	R	May		1
Gallinago hardwickii	Latham's Snipe	Mi (W)	R	May		1
Motacilla cinerea	Grey Wagtail	Mi (T)		May		1
Motacilla flava	Yellow Wagtail	Mi (T)		May		1
Myiagra cyanoleuca	Satin Flycatcher	Mi (T)	E	May		1

EPBC Act: National (*Environment Protection and Biodiversity Conservation Act 1999*). NPW Act: South Australia (*National Parks and Wildlife Act 1972*). Conservation status codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable, R: Rare, Mi (W): Migratory Wetlands Species, Mi (T): Migratory Terrestrial Species, Mi (M): Migratory Marine Species.
Presence Type: As identified in the PMST Report
Year of last record: Historical records within 5 km of the Project Area, obtained from BDBSA and Bird Life Australia – Bird Atlas Database (BDBSA Recordset number: *DEWNRBDBSA220902-2)*
Source of Information:
1. **EPBC Act Protected Matters Report (DCCEEW 2022) – 5 km buffer applied to Project Area boundary.**
2. **BDBSA data (DEW 2022a) - 5 km buffer applied to Project Area**

5.1.6 NPW Act listed threatened flora and fauna

The BDBSA database searches indicate that, excluding species also listed under the EPBC Act, 30 flora and 12 fauna species listed as threatened in South Australia under the NPW Act have been recorded previously in the Search Area. This includes 27 Rare, 13 Vulnerable and two Endangered species.

The locations of these historical records are shown on the maps Figure 4 to Figure 6.

Table 12. Species listed as threatened under the NPW Act recorded previously in the Search Area.

Scientific name	Common name	Conservation status		Year of last record	Data Source
		EPBC Act	NPW Act		
FLORA					
Acacia iteaphylla	Flinders Ranges Wattle	-	R	2004	2
Austrostipa gibbosa	Swollen Spear-grass	-	R	2013	2
Brachyscome ciliaris var. subintegrifolia		-	R	1994	2
Crassula peduncularis	Purple Crassula	-	R	1999	2
Crassula sieberiana	Sieber's Crassula	-	E	2009	2
Cryptandra campanulata	Long-flower Cryptandra	-	R	2021	2
Cullen parvum	Small Scurf-pea	-	V	2002	2
Dianella longifolia var. grandis	Pale Flax-lily	-	R	2013	2
Diuris behrii	Behr's Cowslip Orchid	-	V	2016	2
Eremophila subfloccosa ssp. glandulosa	Green-flower Emubush	-	R	1993	2
Eryngium ovinum	Blue Devil	-	V	2019	2
Eryngium vesiculosum	Prostrate Blue Devil	-	R	1993	2
Eucalyptus bicostata	Southern Blue Gum	-	V	2008	2
Eucalyptus percostata	Ribbed White Mallee	-	R	2014	2
Festuca benthamiana	Bentham's Fescue	-	R	1993	2

Scientific name	Common name	Conservation status		Year of last record	Data Source
		EPBC Act	NPW Act		
Frankenia cupularis		-	R	1993	2
Juncus radula	Hoary Rush	-	V	1993	2
Lepidium pseudotasmanicum	Shade Peppercress	-	V	2013	2
Logania saxatilis	Rock Logania	-	R	2008	2
Maireana excavata	Bottle Fissure-plant	-	V	2019	2
Maireana rohrlachii	Rohrlach's Bluebush	-	R	2014	2
Mentha satureioides	Native Pennyroyal	-	R	1988	2
Philotheca angustifolia ssp. angustifolia	Narrow-leaf Wax-flower	-	R	1998	2
Poa drummondiana	Knotted Poa	-	R	2004	2
Ptilotus erubescens	Hairy-tails	-	R	2019	2
Rhodanthe anthemoides	Chamomile Everlasting	-	E	2008	2
Rumex dumosus	Wiry Dock	-	R	2019	2
Rytidosperma tenuius	Short-awn Wallaby-grass	-	R	1999	2
Swainsona behriana	Behr's Swainson-pea	-	V	2013	2
Veronica decorosa	Showy Speedwell	-	R	1993	2
FAUNA					
Ardeotis australis	Australian Bustard	-	V	2009	2
Cladorhynchus leucocephalus	Banded Stilt	-	V	2004	3
Corcorax melanorhamphos	White-winged Chough	-	R	2015	2,3
Coturnix ypsilophora australis	Brown Quail	-	V	2014	3
Falco peregrinus macropus	Peregrine Falcon	-	R	2004	2
Falco subniger	Black Falcon	-	R	2008	3
Hieraaetus morphnoides	Little Eagle	-	V	2016	2
Myiagra inquieta	Restless Flycatcher	-	R	2006	3
Neophema elegans elegans	Elegant Parrot	-	R	1999	2
Plectorhyncha lanceolata	Striped Honeyeater	-	R	2015	2
Stagonopleura guttata	Diamond Firetail	-	V	1998	3
Turnix pyrrhothorax	Red-chested Buttonquail	-	R	2000	3

EPBC Act: National (*Environment Protection and Biodiversity Conservation Act 1999*). NPW Act: South Australia (*National Parks and Wildlife Act 1972*). Conservation status codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable, R: Rare, Mi (W): Migratory Wetlands Species, Mi (T): Migratory Terrestrial Species, Mi (M): Migratory Marine Species.
Presence Type: As identified in the PMST Report
Year of last record: Historical records within 5 km of the Project Area, obtained from BDBSA and Bird Life Australia – Bird Atlas Database (BDBSA Recordset number: *DEWNRBDBSA220902-2)*
Source of Information:
1. **EPBC Act Protected Matters Report (DCCEEW 2022) – 5 km buffer applied to Project Area boundary.**
2. **BDBSA data (DEW 2022a) - 5 km buffer applied to Project Area**
3. **Bird Life Australia (DEW 2022a) – 5 km buffer applied to Project Area**

5.1.7 Maps of threatened species recorded within 5 km of the Project Area

See Figure 4 to Figure 6 on the following pages to see historical records of listed threatened fauna and flora species within 5 km of the Goyder North Project Area boundary.

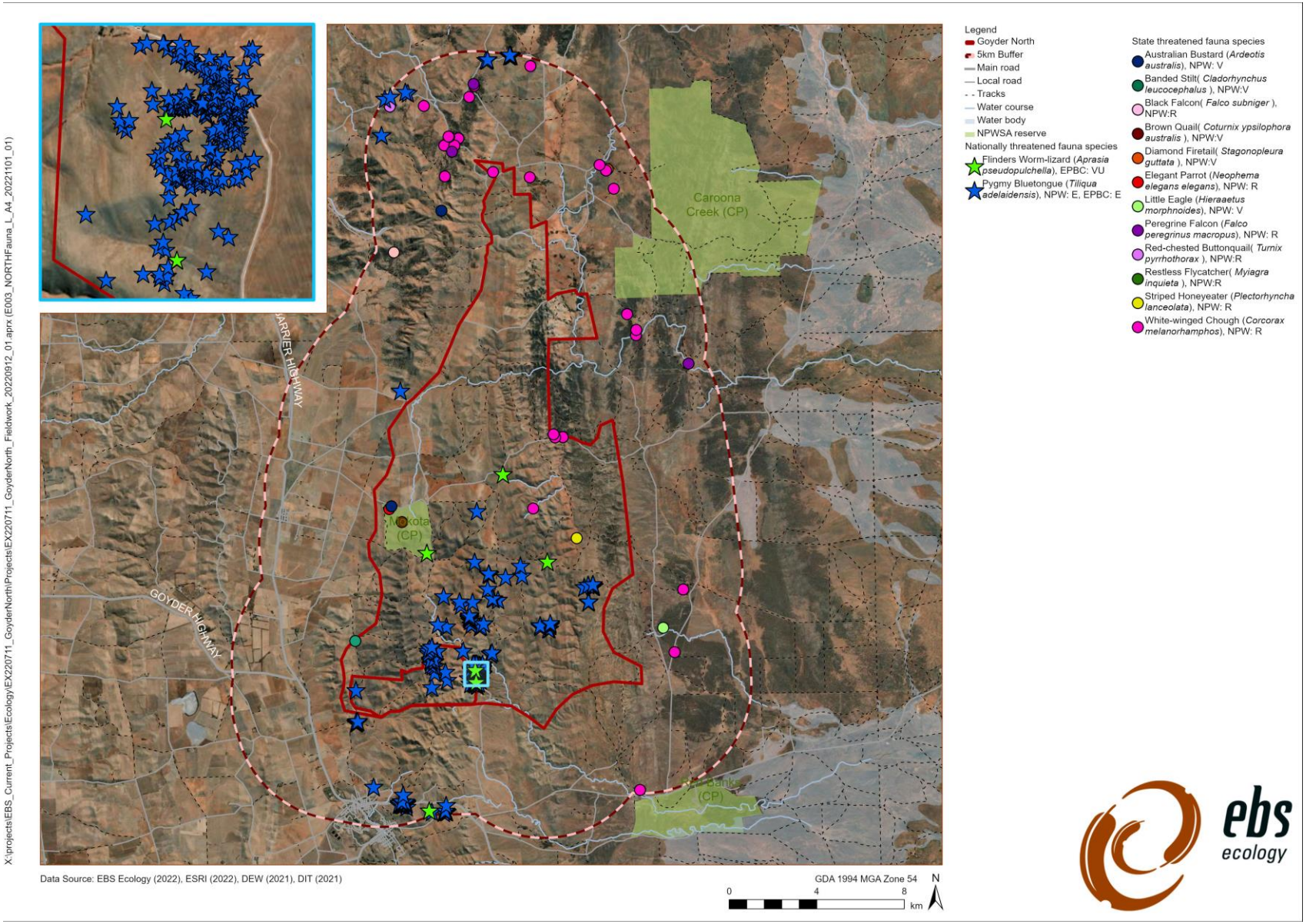


Figure 4. Historical records of EPBC and NPW Act listed threatened fauna species.

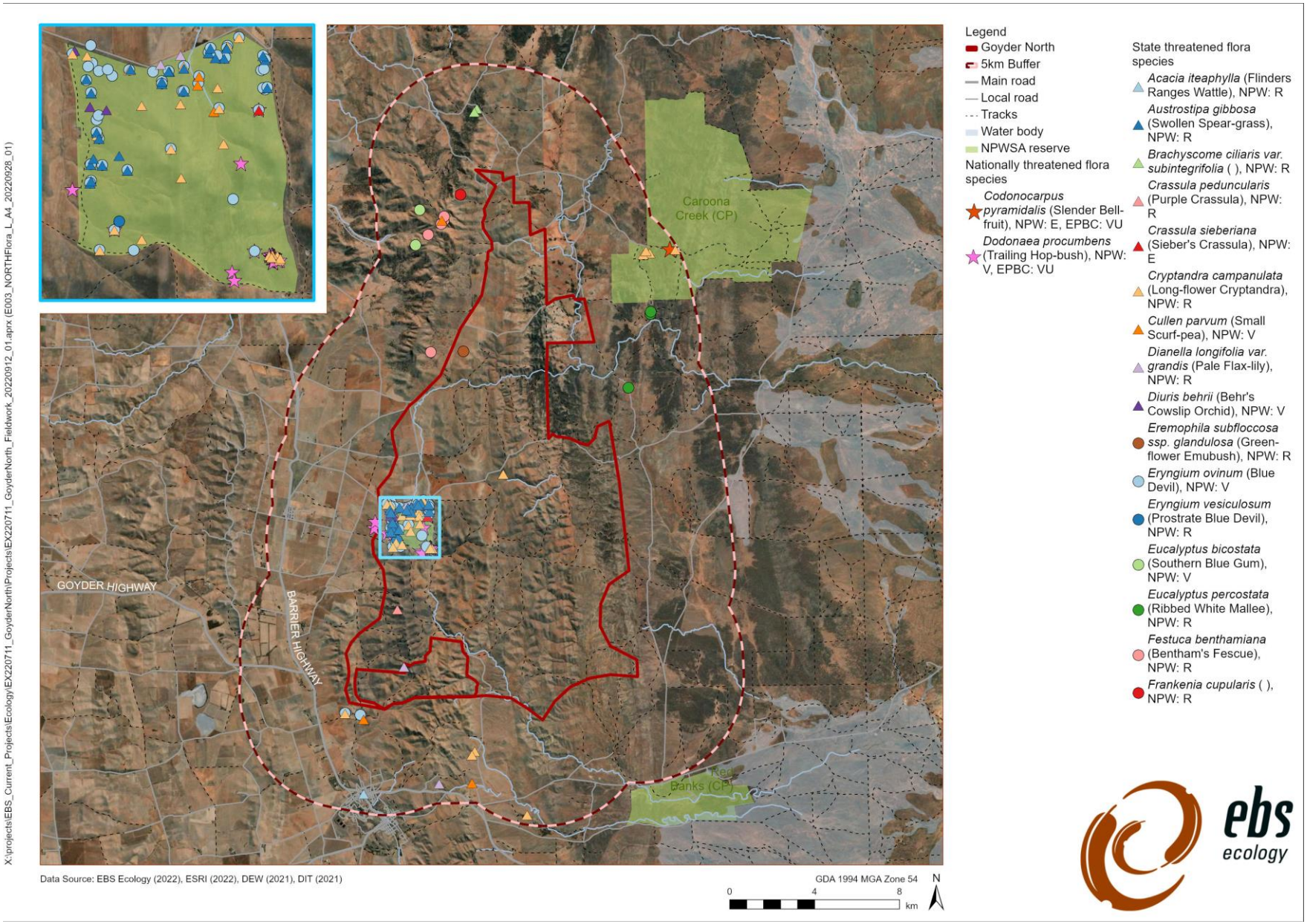


Figure 5. Map 1 of 2 showing EPBC and NPW listed flora species with historical records within 5 km of the Project Area.

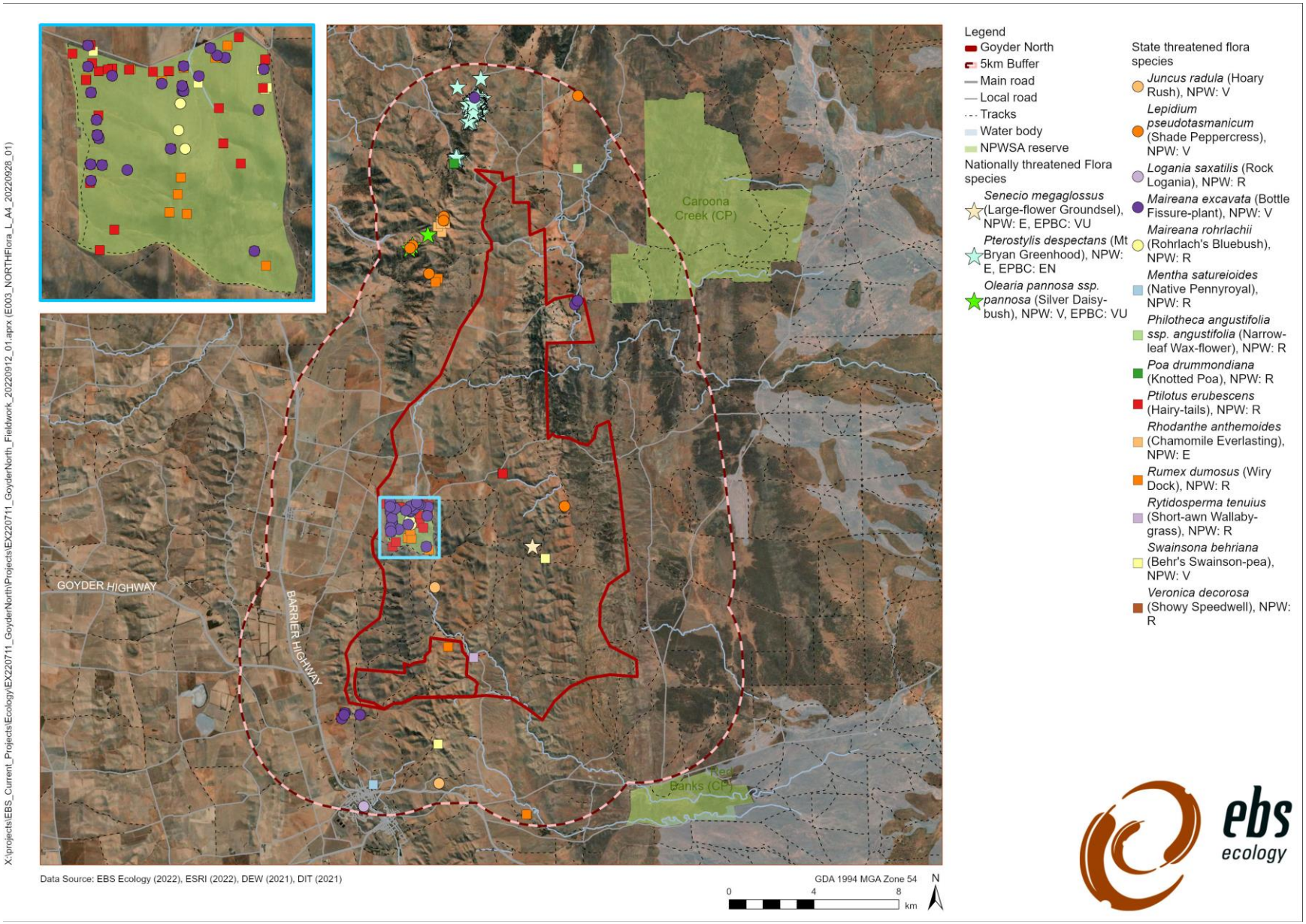


Figure 6. Map 2 of 2 showing EPBC and NPW listed flora species with historical records within 5 km of the Project Area.

6 FIELD SURVEY RESULTS

6.1 Vegetation associations and condition

Vegetation in the Project Area was dominated by mixed native and exotic grasslands in varying condition in the west, with larger tracts of Lomandra grasslands in the middle and eastern slopes and ranges. Smaller pockets of high-quality grasslands and diverse herb lands occurred in isolated locations mainly on the steeper western slopes, intermixed with areas of exotic pastures. Steep, rocky slopes in the south-east of the Project Area contained sparsely scattered *Allocasuarina verticillata* (Sheoak) over *Cymbopogon ambiguus* (Lemon-scented Grass) and herbs.

Mallee vegetation dominated the eastern hills, slopes and plains of the Project Area, with *Eucalyptus porosa* (Mallee Box) the most common species, intergrading with other mallee eucalyptus and underlaid with varying understory components including grassland, sclerophyllous shrubs on the hills and chenopods on the eastern slopes and plains. To the east of the Project Area on the plains, the woodlands graded into Chenopod shrublands, which extended west along Dust Hole Creek becoming shrublands with grassy understorey including mixed Lomandra.

Creeks and drainage lines were predominantly exposed and bare, with extensive weed invasion in most localities, particularly *Cynara cardunculus* (Artichoke thistle). However, some creek lines maintained sparsely scattered *E. porosa* (Mallee Box), *E. odorata* (Peppermint Box)*, E. leucoxylon ssp. pruinosa* (SA Inland Blue gum) and/ or *E. camaldulensis var. camaldulensis* (River Red Gum) with an understorey of sedges such as *Cyperus* sp*., Juncus* sp. and *Phragmites australis* (Common Reed).

Fifteen native vegetation associations, including five dominant and ten minor associations, were identified throughout the Project Area during the field survey, summarised in Table 13, mapped in Figure 7, and detailed in Table 14 to Table 28.

Other non-native vegetation was also mapped, including planted (amenity) vegetation and agricultural cropping / exotic pastureland. Vegetation mapping was not exhaustive and it is likely that additional minor associations occur throughout the Project Area, including on roadsides. Additionally, some small parts of the Project Area were not surveyed or mapped, either due to inaccessibility or landholder permissions.

Table 13. Overall summary of vegetation associations

VA #	Vegetation association	Condition	Area (ha)	Total Area (ha)
Dominant Vegetation Associations				
VA1	*Eucalyptus porosa* +/- *E. gracilis* / *E. brachycalyx* Woodland over Chenopods.	Fair to good	NA	504.71
VA2	'Smooth-barked Mixed Mallee' (*E. gracilis* +/- *E. brachycalyx* +/- *E. dumosa* +/- *E. leptophylla* +/- *E. socialis*) over Chenopods.	Fair to good	NA	1160.23
VA6	*Lomandra* spp. Grassland.	A Class B-Class C-Class	37.57 2267.1 1624.40	3929.07
VA11a / b	a) Mixed *Austrostipa* spp. and *Rytidosperma* spp. Grassland b) +/- emergent Eucalyptus trees.	Good Fair Poor	1562.06 5816.19 1797.74	9187.21 a) 9029.73 b) 157.48
VA12	Mixed Chenopod Shrubland of *Maireana pyramidata* and *Atriplex stipitata* over *Lomandra* spp., native and exotic grasses.	Moderate	NA	714.14
Cropped	Agricultural land currently or historically utilised for cropping.	NA	NA	1838.45
Minor Vegetation Associations				
VA3	*E. porosa* Woodland over *Senna artemisioides sp. coriacea* and Sclerophyllous Shrubs.	Moderate	NA	260.25
VA4	*Acacia pycnantha* Tall Shrubland +/- *Austrostipa* spp. +/- *Cymbopogon ambiguus* in rocky creek.	Moderate	NA	0.072
VA5	*Maireana aphylla* Shrubland over native and exotic grasses.	Fair	NA	232.01
VA7	'Grassland Meadow' +/- *Calocephalus citreus* over native and exotic grasses and herbs.	Fair	NA	481.49
VA8	*E. odorata (Peppermint Box) +/- E. leucoxylon ssp. pruinosa Very Open Woodland over exotic grasses.*	Fair	NA	32.40
VA9	*Maireana rohrlachii* open shrubland over *Austrostipa sp*. and exotics.	Fair	NA	99.79
VA10	*Allocasuarina verticillata* over *Cymbopogon ambiguus* and herbs on steep rocky slopes.	Good	NA	33.11
VA13	*Hakea leucoptera ssp. leucoptera* Shrubland	Good	NA	1.29
VA14	*Eucalyptus camaldulensis* (River Red Gum) Riparian Woodland	Moderate	NA	12.95
VA15	*Juncus* spp. Sedgeland associated with minor drainage lines.	Fair	NA	25.79
Amenity	Vegetation planted for shelter-belts, revegetation or ornamental purposes.	NA	NA	8.32
Exotic	Pastures dominated by exotic grasses (i.e., *Hordeum vulgare,* Barley Grass)	NA	NA	390.91
	Total			**18,910.84**

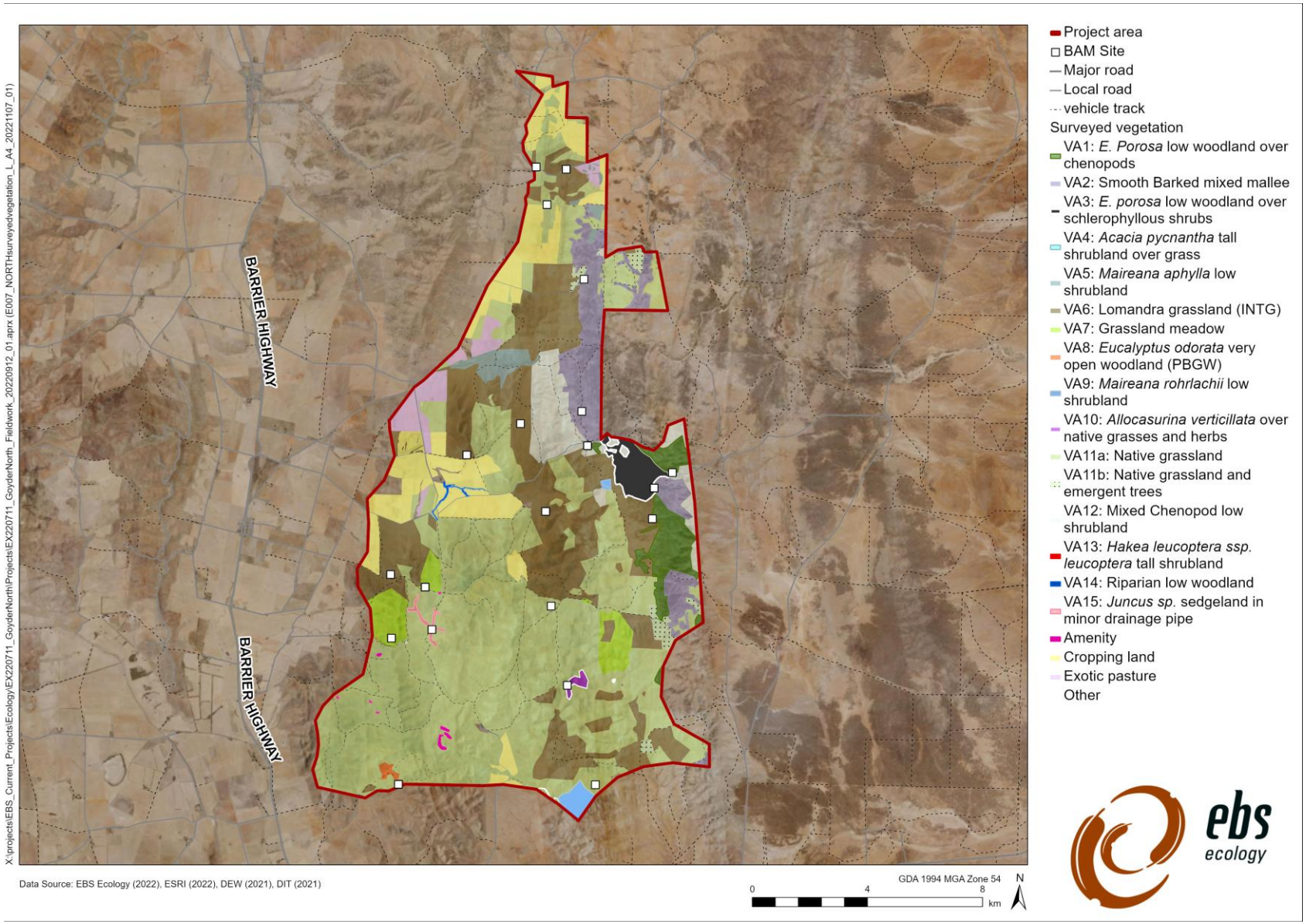
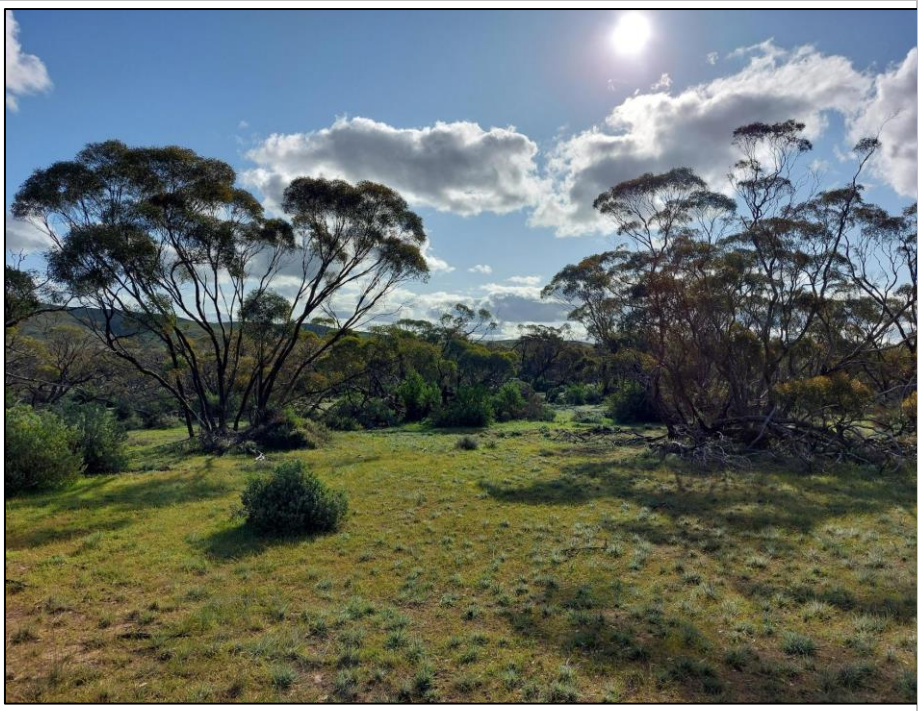


Figure 7. Broad vegetation mapping within Project Area.

6.1.1 Dominant vegetation associations

VA1: Eucalyptus porosa +/- E. gracilis / E. brachycalyx Woodland over mixed understorey of Chenopods, Sclerophyllous shrubs and Grassland.

Table 14. Summary of vegetation association VA1: *Eucalyptus porosa +/- E. gracilis / E. brachycalyx* Woodland over mixed understorey of Chenopods, Sclerophyllous shrubs and Grassland.

Overstorey species	*Eucalyptus porosa* (Mallee Box)
Midstorey species	*Atriplex stipitata* (Bitter Saltbush), *Rhagodia parabolica* (Mealy Saltbush), *Maireana brevifolia* (Small-leaf Bluebush)
Understorey species	*Austrostipa drummondii* (Cottony Spear-grass), *Enchylaena tomentosa* (Ruby Saltbush), *Lomandra multiflora* ssp. *dura* (Hard mat-rush)
Threatened species	*Maireana rohrlachii* (Rohrlach's Bluebush) (NPW Act: Rare) (sparsely scattered)
Weeds (inc. Declared and WoNS)	*Lycium ferocissimum* (African Boxthorn) (WoNS), *Echium plantagineum* (Salvation Jane)
Conservation value	A high diversity of native species (43 species) was recorded within this site including two State Rare species. The area contained important fauna habitat values, including numerous tree hollows of varying sizes and scattered mistletoe and is likely to provide important nesting habitat for avifauna.
Vegetation condition	Mallee woodland was patchily distributed throughout the landscape with a network of low open chenopod shrublands and open grassland areas. Diversity of native plants was highest around the understorey of tree species, where it commonly occurred as dense clumps. Herbaceous species were scattered throughout. Where this VA moved from the lower western slopes to the higher hills, the vegetation condition in the understorey deteriorated, with evidence of heavy grazing and erosion from runoff.
Representative photo	 **Figure 8. VA 1 looking northwest. Lat: 33.55° S; Lon: 139.05° E**

VA2: 'Smooth-barked Mixed Mallee' (E. gracilis +/- E. brachycalyx +/- E. dumosa +/- E. leptophylla +/- E. socialis) over Chenopods

Table 15. Summary of vegetation association VA2: 'Smooth-barked Mixed Mallee' (*E. gracilis* +/- *E. brachycalyx* +/- *E. dumosa* +/- *E. leptophylla* +/- *E. socialis*) over Chenopods

Overstorey species	*Eucalyptus gracilis* +/- *E. brachycalyx* +/- *E. socialis* +/- *E. leptophylla* +/- *E. leucoxylon ssp. pruinosa.*
Midstorey species	*Rhagodia parabolica*, *Atriplex stipitata*, *Maireana pyramidata* (Black Bluebush) +/- *Alectryon oleifolius* (Rosewood)
Understorey species	*Enchylaena tomentosa, Rytidosperma sp*. (Wallaby Grass), *Roepera glauca* (Pale Twinleaf), *Austrostipa nitida*
Threatened species	*Maireana rohrlachii* (NPW Act: Rare)
Weeds (inc. Declared and WoNS)	*Lycium ferocissimum, Carrichtera annua* (Wards Weed), *Mesembryanthemum nodiflorum* (Slender Iceplant), *Echium plantagineum.*
Conservation value	The area contained important fauna habitat values, including numerous tree hollows of varying sizes, and is likely to provide important nesting habitat for avifauna. One State Rare plant species, *Maireana rohrlachii*, was identified in this VA.
Vegetation condition	Vegetation was in fair to moderate condition with widespread evidence of grazing in the understorey, particularly on the more exposed hill slopes.
Representative photo	 **Figure 9. VA2 looking south.**

VA6: Lomandra multiflora spp. dura +/- Lomandra effusa Grassland

Table 16. Summary of vegetation association VA6: *Lomandra* spp. Grassland

Overstorey species	NA
Midstorey species	*Melicytus angustifolius divaricatus* (Gruggly Bush)
Understorey species	*Lomandra multiflora ssp. dura +/- Lomandra effusa*, *Austrostipa* spp. *Rytidosperma* spp.
Threatened species	Parts of this vegetation community are likely to qualify as the nationally listed critically endangered TEC, *Iron-grass Natural Temperate Grassland* (INTG)
Weeds (inc. Declared and WoNS)	*Lycium ferocissimum, Onopordum acaulon, Echium plantagineum, Marrubium vulgare* (Horehound)
Conservation value	Very High – all areas of Lomandra grassland, even those in poor condition (C-class) are considered to be of conservation value, given their ability to improve with careful management.
Vegetation condition	Poor to good condition. Vegetation was mapped to indicate areas of higher quality Lomandra which may qualify for B-Class listing (with higher diversity of species).
Representative photos	 **Figure 10. Lomandra grassland at survey site 'L2', looking south into likely B-Class INTG. Lat: 33.54° S; Lon: 139.00° E.**

VA11: Mixed Austrostipa spp. grassland

Table 17. Summary of VA 11 Mixed *Austrostipa spp*. grassland

Overstorey species	NA
Midstorey species	NA
Understorey species	*Austrostipa spp., Oxalis perennans, Ptilotus spathulatus, Vittadinia gracilis*
Threatened species	Likely to contain scattered occurrences of threatened grassland species including *Austrostipa gibbosa* (Spurred Spear-grass), *Swainsona behriana, Rumex dumosus, Eryngium ovinum* and others. Most native grassland areas are considered likely habitat for Pygmy Blue-tongue Lizards.
Weeds (inc. Declared and WoNS)	*Lycium ferocissimum, Echium plantagineum, Marrubium vulgare*
Conservation value	Moderate – higher quality grassland areas are of higher conservation significance due to the diversity of species and ability to improve over time.
Vegetation condition	Poor to good – mapped as such across the Project Area, detailed in **Figure 12**
Representative photos	 **Figure 11. *Austrostipa* grassland in good condition with high tussock density and variety of species.**

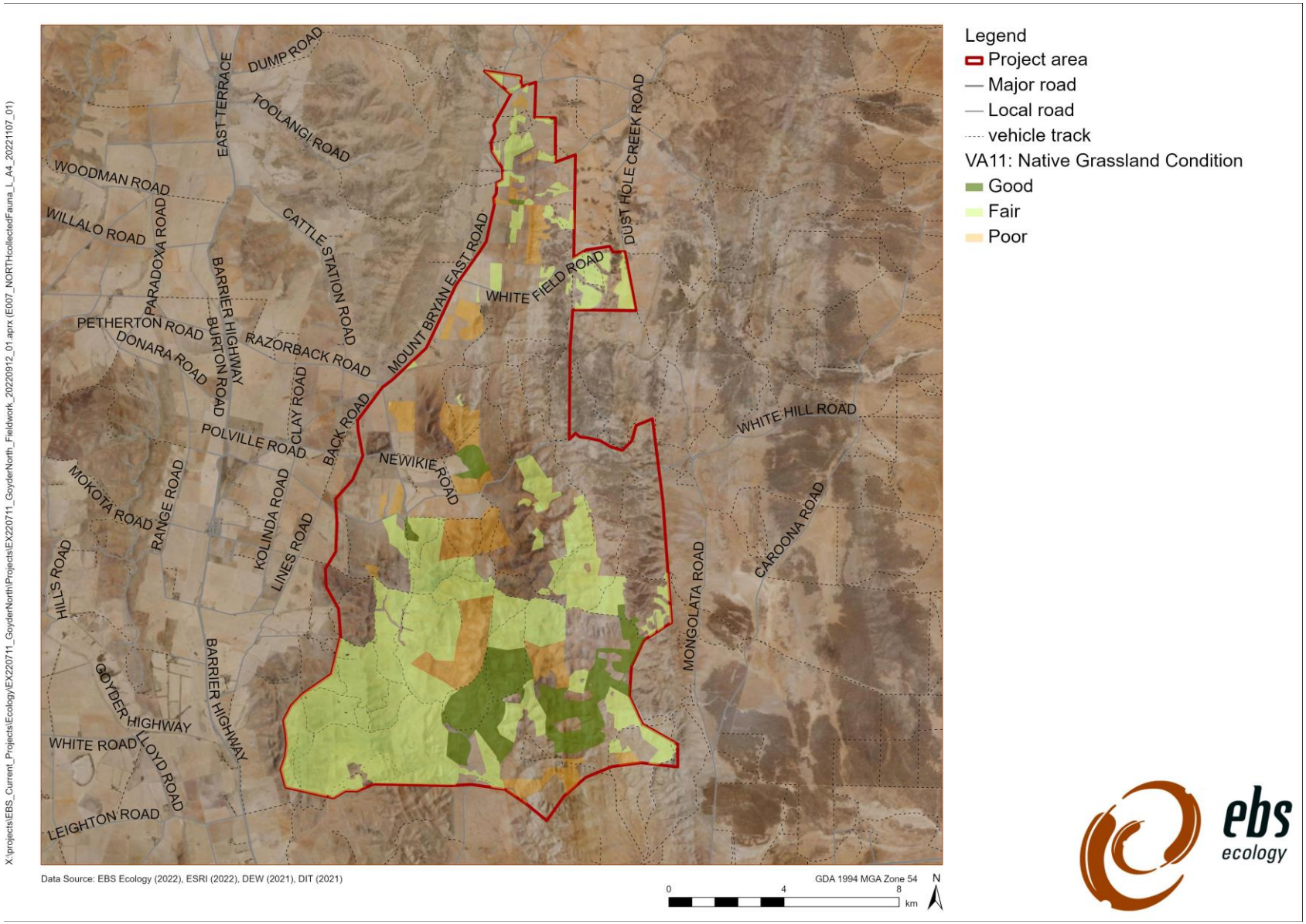


Figure 12. VA11 Grassland condition mapping.

VA12: Mixed Chenopod Shrubland of Maireana pyramidata and Atriplex stipitata over Lomandra spp., native and exotic grasses.

Table 18. Summary of VA12: Mixed Chenopod Shrubland of *Maireana pyramidata* and *Atriplex stipitata* over *Lomandra* spp., native and exotic grasses.

Overstorey species	NA
Midstorey species	*Maireana aphylla, Rhagodia nummularia, Maireana brevifolia, Atriplex stipitata, Maireana pyramidata*
Understorey species	*Rytidosperma sp., Lomandra effusa, Enchylaena tomentosa*
Threatened species	*Maireana rohrlachii*
Weeds (inc. Declared and WoNS)	*Echium plantagineum, Lycium ferocissimum*
Conservation value	Low – moderate. This VA does not contain highly valuable habitat features such as nectar resources or hollows, however it is likely to contain nesting habitat for small birds and feeding resources for seed eating species.
Vegetation condition	Fair to moderate – occurring on lower plains between patches of mallee vegetation on clay soils.
Representative photos	 **Figure 13. Mixed Chenopod Low Shrubland**

6.1.2 Minor vegetation associations

VA3: Eucalyptus porosa Woodland over Senna artemisioides sp. coriacea and Sclerophyllous Shrubs

Table 19. Summary of vegetation association VA3: *E. porosa* Woodland over *Senna artemisioides sp. coriacea* and Sclerophyllous Shrubs

Overstorey species	*Eucalyptus porosa.*
Midstorey species	*Senna artemisioides ssp. coriacea*
Understorey species	*Dodonaea baueri* (Crinkled Hop Bush), *Chrysocephalum semipapposum* (Clustered Everlasting), *Austrostipa drummondii, Maireana pyramidata.*
Threatened species	No threatened species were observed within this VA.
Weeds (inc. Declared and WoNS)	*Lycium ferocissimum*, *Carrichtera annua*, *Sisymbrium* sp. (Mustard).
Conservation value	The area contained important fauna habitat values, including numerous tree hollows of varying sizes, and is likely to provide important nesting habitat for avifauna.
Vegetation condition	Vegetation was in moderate condition, with some dieback occurring in the upper storey.
Representative photos	 **Figure 14. VA3 looking south, with D. baueri and Senna sp. densely present in the understorey.**

VA4: Acacia pycnantha over grasses in steep creek line

Table 20. Summary of vegetation association VA4: *Acacia pycnantha* over grasses in steep creek line.

Overstorey species	NA
Midstorey species	*Acacia pycnantha* (Golden Wattle) +/- *Myoporum platycarpum* (Sugarwood)
Understorey species	*Cymbopogon ambiguus, Themeda triandra* (Kangaroo Grass), *Enchylaena tomentosa, Austrostipa spp.* (Spear-grasses), *Crassula sp.* (Stonecrop)
Threatened species	NA
Weeds (inc. Declared and WoNS)	*Reseda lutea* (Cut-leaf Mignonette), *Lycium ferocissimum, Avena barbata* (Oat grass), *Arctotheca calendula* (Capeweed).
Conservation value	This VA was one of few creek lines which contained vegetated banks and is likely to support a diversity of birds, particularly when the ephemeral creek holds water. The creek is also likely to provide habitat for amphibian species occurring within the Project Area, and may be a foraging flyway for native microbat species.
Vegetation condition	Poor to fair, with a high density of weedy grasses in the understorey. Vegetation condition was better higher up on the slopes under the tree canopy.
Representative photos	 **Figure 15. VA4 looking north along creek bed with steep banks.**

VA5: Maireana aphylla Shrubland over native and exotic grasses

Table 21. Summary of vegetation association VA5: *Maireana aphylla* Shrubland

Overstorey species	NA
Midstorey species	*Maireana aphylla* (Leafless Bluebush)
Understorey species	*Lomandra effusa* (Scented Mat-rush), *Vittadinia gracilis* (Woolly New Holland Daisy), *Austrostipa* spp.
Threatened species	Two Elegant parrots (*Neophema elegans elegans*) (NPW Act Rare) were observed flying over this VA during the field survey.
Weeds (inc. Declared and WoNS)	*Lycium ferocissimum, Cynara cardunculus, Reseda lutea*.
Conservation value	*Maireana aphylla* is likely to provide good nesting habitat for small birds such as Fairywrens (*Malurus* spp.) and Chats (*Epthianura* spp.).
Vegetation condition	This VA occurred along Newikie Creek and along exposed low slopes and hillsides to the south of the creek where it merged into mixed chenopod shrubland of VA12 towards White Hill Road. This VA was generally in poor condition, with *Lycium ferocissimum* the dominant mid-storey shrub in some locations. *Maireana aphylla was* most dense along the banks of Newikie Creek (pictured).
Representative photos	 **Figure 16. *Maireana aphylla* along creek line in north of Project Area.**

VA7: 'Grassland Meadow' +/- Calocephalus citreus over native and exotic grasses and herbs

Table 22. Summary of VA7: 'Grassland Meadow'.

Overstorey species	NA
Midstorey species	*Melicytus angustifolius ssp. divaricatus* (Tree Violet)
Understorey species	*Calocephalus citreus* (Lemon Beauty-heads), *Acaena echinata* (Sheep's Burr), *Eryngium ovinum* (Blue Devil); *Oxalis perennans* (Native Sorrel), *Vittadinia* spp.
Threatened species	*Dodonaea procumbens* (Trailing Hop-bush) (EPBC: Vulnerable), *Eryngium ovinum* (Blue Devil) (NPW Act: Vulnerable), *Rumex dumosus* (Wiry Dock) (NPW Act: Rare); Swainsona behriana (Behr's Swainson-Pea) (NPW Act: Vulnerable) *Neophema elegans elegans* (Elegant Parrot).
Weeds (inc. Declared and WoNS)	*Echium plantagineum* (Salvation Jane), *Marrubium vulgare* (Horehound)
Conservation value	High – this community contains national, and State threatened flora species in local abundance.
Vegetation condition	Fair to good – a high diversity of herbaceous species occurred in understorey. High diversity areas were patchy and interspersed with areas containing common pasture weeds such as *Salvia verbenaca* (Wild Sage), *Avena barbata* (Oat Grass), *Romulea rosea* (Guilford Grass) and Hypochaeris glabra (Smooth Cat's-ear)
Representative photos	 **Figure 17. Grassland Meadow looking north within Mokota Conservation Park. Blue-green patches reveal dense patches of *Calocephalus citreus.***

VA8: Eucalyptus odorata and Eucalyptus leucoxylon ssp. pruinosa Very Open Woodland

Table 23. Summary of vegetation association VA8: *Eucalyptus odorata* and *Eucalyptus leucoxylon* ssp. *pruinosa* Very Open Woodland

Overstorey species	*Eucalyptus odorata* (Peppermint Box) and *Eucalyptus leucoxylon ssp. pruinosa* (SA Inland Bluegum) Very Open Woodland.
Midstorey species	NA
Understorey species	NA
Threatened species / communities	Peppermint Box (*E. odorata*) Grassy Woodland of South Australia is listed as Critically Endangered under the EPBC Act. The patch mapped within the Project Area did not qualify as a TEC due to the low diversity of native species, however any stand of *E. odorata* with a reasonable density may qualify as C Class unless completely degraded, (i.e., more than 5 native species including 1 or more perennial grass species) and is likely to be amenable to rehabilitation.
Weeds (inc. Declared and WoNS)	*Lycium ferocissimum, Echium plantagineum*
Conservation value	High – this area contained a remnant patch of Peppermint Box Grassy Woodland, with intact upper stratum, but degraded understorey. Though it did not qualify as TEC due to the degraded understorey, it contained high habitat value with abundant tree hollows and evidence of an old Wedge-tailed Eagle (*Aquila audax*) nesting site.
Vegetation condition	Fair – trees were in good condition; however, the understorey was largely exotic pasture grasses.
Representative photo	 **Figure 18. VA8 with remnant *Eucalyptus odorata* and *E. leucoxylon* over non-native understorey.**

VA9: Maireana rohrlachii Low Open Shrubland over Austrostipa spp. and exotic grasses

Table 24. Summary of VA9 *Maireana rohrlachii* Low Open Shrubland over *Austrostipa* spp. and exotic grasses.

Overstorey species	NA
Midstorey species	*Maireana rohrlachii* (Rohrlach's Bluebush), *Maireana pyramidata* (Black Blue-bush), *Maireana aphylla* (Leafless Bluebush).
Understorey species	*Vittadinia megacephala* (Big-headed New Holland Daisy*), Salsola australis* (Roly-poly), *Austrostipa nitida* (Balcarra Grass), *Austrostipa scabra* (Rough Spear-grass).
Threatened species	*Maireana rohrlachii* (NPW Act: R)
Weeds (inc. Declared and WoNS)	*Marrubium vulgare, Echium plantagineum, Lycium ferocissimum.*
Conservation value	Moderate to high – contains State threatened species *Maireana rohrlachii* in abundance. The area was noted to contain frequent spider holes and therefore may be considered likely Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*) (EPBC: Endangered) habitat.
Vegetation condition	Moderate – common pasture weeds throughout, such as *Hordeum sp.* (Barley Grass), *Avena barbata, Trifolium sp., Erodium sp.* and *Salvia verbenaca.*
Representative photos	 **Figure 19. VA9 looking southwest into grassland with low *M. rohrlachii* shrubs.**

VA10: Allocasuarina verticillata over Cymbopogon ambiguus on rocky slopes

Table 25. Summary of VA10 *Allocasuarina verticillata* over *Cymbopogon ambiguus* on rocky slopes.

Overstorey species	*Allocasuarina verticillata* (Drooping Sheoak)
Midstorey species	NA
Understorey species	*Cymbopogon ambiguus* (Lemon-scented Grass), *Anthosachne scabra* (Wheatgrass), *Crassula decumbens* (Spreading Stonecrop), *Gonocarpus tetragynus* (Common Raspwort).
Threatened species	*Rumex dumosus* (Wiry Dock) (NPW Act: Rare)
Weeds (inc. Declared and WoNS)	*Echium plantagineum*
Conservation value	Moderate – VA was in good condition and the rocky habitat is likely to provide suitable habitat for a range of reptile species including the Flinders Ranges Worm Lizard (Aprasia inaurita).
Vegetation condition	VA was in good condition with good cover and abundance of native grassland species. Weed species were limited to common grassland pasture weeds including *Carthamus lanatus* (Saffron Thistle).
Representative photos	 **Figure 20. VA10 looking south showing dense covering of surface rock.**

VA13: Hakea leucoptera ssp. leucoptera over Lomandra spp. and Austrostipa drummondii

Table 26. Summary of VA 13 *Hakea leucoptera* ssp. *leucoptera* over *Lomandra* spp. and *Austrostipa drummondii*.

Overstorey species	NA
Midstorey species	*Hakea leucoptera* ssp. *leucoptera* (Needlewood), *Bursaria spinosa* (Sweet Bursaria)
Understorey species	*Lomandra multiflora* ssp. *dura, L. effusa, Oxalis perennans, Themeda triandra, Austrostipa drummondii, Stackhousia monogyna* (Creamy Candles), *Rhodanthe pygmaea* (Pygmy Daisy).
Threatened species	*Cryptandra campanulata* (Long-flowered Cryptandra)
Weeds (inc. Declared and WoNS)	*Echium plantagineum, Arctotheca calendula* (Capeweed)
Conservation value	High – a unique vegetation association only present in a small area. Contains a diversity of species including species not found elsewhere in the Project Area.
Vegetation condition	Moderate to good condition
Representative photos	 **Figure 21. *Hakea leucoptera* Shrubland, looking south.**

VA14: Eucalyptus camaldulensis var. camaldulensis (River Red Gum) Riparian Woodland

Table 27. Summary of VA 14 *Eucalyptus camaldulensis* var. *camaldulensis* (River Red Gum) Riparian Woodland

Overstorey species	*Eucalyptus camaldulensis var. camaldulensis*
Midstorey species	Duma florulenta (Lignum), Bursaria spinosa (Sweet Bursaria)
Understorey species	*Cyperus vaginatus, Cymbopogon ambiguus*
Threatened species	NA
Weeds (inc. Declared and WoNS)	NA
Conservation value	High – a unique vegetation association only present in a small section of the Project Area. Contains important habitat value with large remnant trees as associated habitat features. Some very large River Red Gum trees present. Some areas mapped as this VA may have also had some planted *E. camaldulensis* interspersed with remnant vegetation.
Vegetation condition	The understorey was generally exotic pasture grasses, however sparse native understorey riparian species occurred. Mature trees were in good condition.
Representative photos	 **Figure 22. *Eucalyptus camaldulensis* var. *camaldulensis* along creek line.**

VA15: Juncus spp. Sedgeland associated with minor drainage lines and depressions

Table 28. Summary of VA15: *Juncus* spp. Sedgeland associated with minor drainage lines and depressions

Overstorey species	NA
Midstorey species	NA
Understorey species	*Juncus sp., Austrostipa spp.*
Threatened species	NA
Weeds (inc. Declared and WoNS)	*Rosa canina* (Dog Rose)
Conservation value	Medium-low
Vegetation condition	Scattered patches of *Juncus* spp. in low-lying drainage depressions. Generally low species diversity intermixed with pasture weeds. Scattered remnant and regenerating *Eucalyptus* in some locations.
Representative photos	NA

6.1.3 Non-native vegetation associations

A total of 2237.68 hectares of the Project Area is mapped as non-native vegetation, comprising a mixture of agricultural land uses including dryland cropping, exotic pastures for grazing and mixed native and exotic amenity plantings for livestock or property shelterbelts. These areas were generally of minimal ecological value, though are likely to provide some foraging and sheltering resources for fauna species, particularly given the landscape is largely cleared.

6.2 Flora

A total of 202 flora species were identified within the Project Area during the field survey, including 155 native species (Appendix 2 – Native flora species identified during September 2022 field survey) and 47 exotic species (Appendix 3 – Exotic flora species identified during September 2022 field survey).

Two Weeds of National Significance (WoNS) and three additional weeds listed as Declared under the LSA Act were observed.

6.2.1 Threatened flora

One nationally listed species and five State listed flora species were detected within the Project Area, including:

- *Cryptandra campanulata (*syn. *Cryptandra amara var. longifolia)* (Long-flowered Cryptandra, NPW Act: Rare);
- *Dodonaea procumbens* (Trailing Hop-bush; EPBC Act: Vulnerable, NPW Act: Vulnerable)
- *Eryngium ovinum* (syn. *E. rostratum*) (Blue Devil, NPW Act: Vulnerable);
- *Maireana rohrlachii* (Rohrlach's Bluebush; NPW Act: Rare);

- *Rhodanthe anthemoides* (Chamomile Everlasting; NPW Act: Endangered) (*unconfirmed but probable identification);
- *Rumex dumosus* (Wiry Dock; NPW Act: Rare); and
- *Swainsona behriana* (Behr's Swainson-pea; NPW Act: Vulnerable).

All records of threatened species made during the field survey, including those recorded in BAM vegetation surveys are marked on **Error! Reference source not found.** and discussed in more detail in section 7.

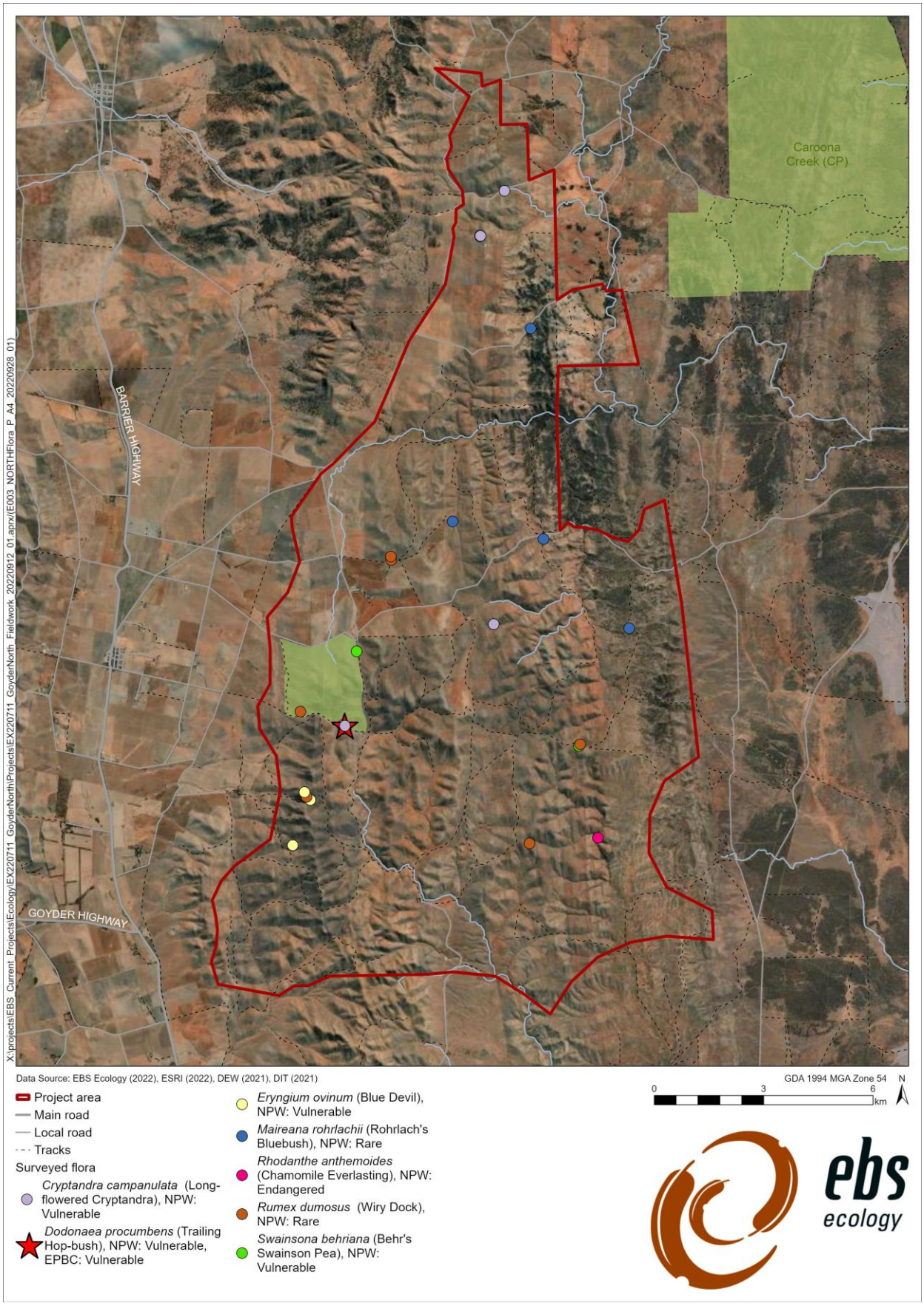


Figure 23. Threatened flora detected in the Project Area during the field survey, including opportunistic observations and observations at BAM sites.

6.2.2 Threatened ecological communities

Four TECs were listed in the PMST as possibly occurring within 5 km of the Project Area. The field survey confirmed that one of these, Iron-grass Natural Temperate Grassland of South Australia occurs within the Project Area, mapped as VA 6: Lomandra Grassland. One other TEC, Peppermint Box Grassy Woodland of South Australia is known to occur in the surrounds, and was found to occur in one isolated locality within the Project Area (mapped as VA 8), however the area was not of sufficient understorey diversity or vegetation quality to qualify for listing as a TEC. Two other TECs were not detected within the Project Area and are unlikely to occur.

Large areas of *Lomandra multiflora* ssp. *dura* / *Lomandra effusa* / *Austrostipa* spp. / *Rytidosperma* spp. Grassland were mapped across the survey area (3929.07 ha). Some areas of this association are likely to qualify under the EPBC Act as the critically endangered TEC, *Iron-grass Natural Temperate Grassland of South Australia* (INTG). Detailed surveys were not within the scope of the assessment; however, this vegetation was broadly mapped according to is quality, based on the density of tussocks and apparent species diversity. Areas which appeared of higher quality (i.e., higher density of *Lomandra* and native perennial grass tussocks, lower weed cover and higher diversity of native species) were mapped as 'possible B-Class' INTG (2267.10 ha), or A-Class where diversity was very high (37.57 ha). Lower quality areas, 'C-Class', are still amenable to rehabilitation, particularly where they adjoin higher quality patches of INTG and should be avoided if possible. Lomandra condition mapping is presented in Figure 24.

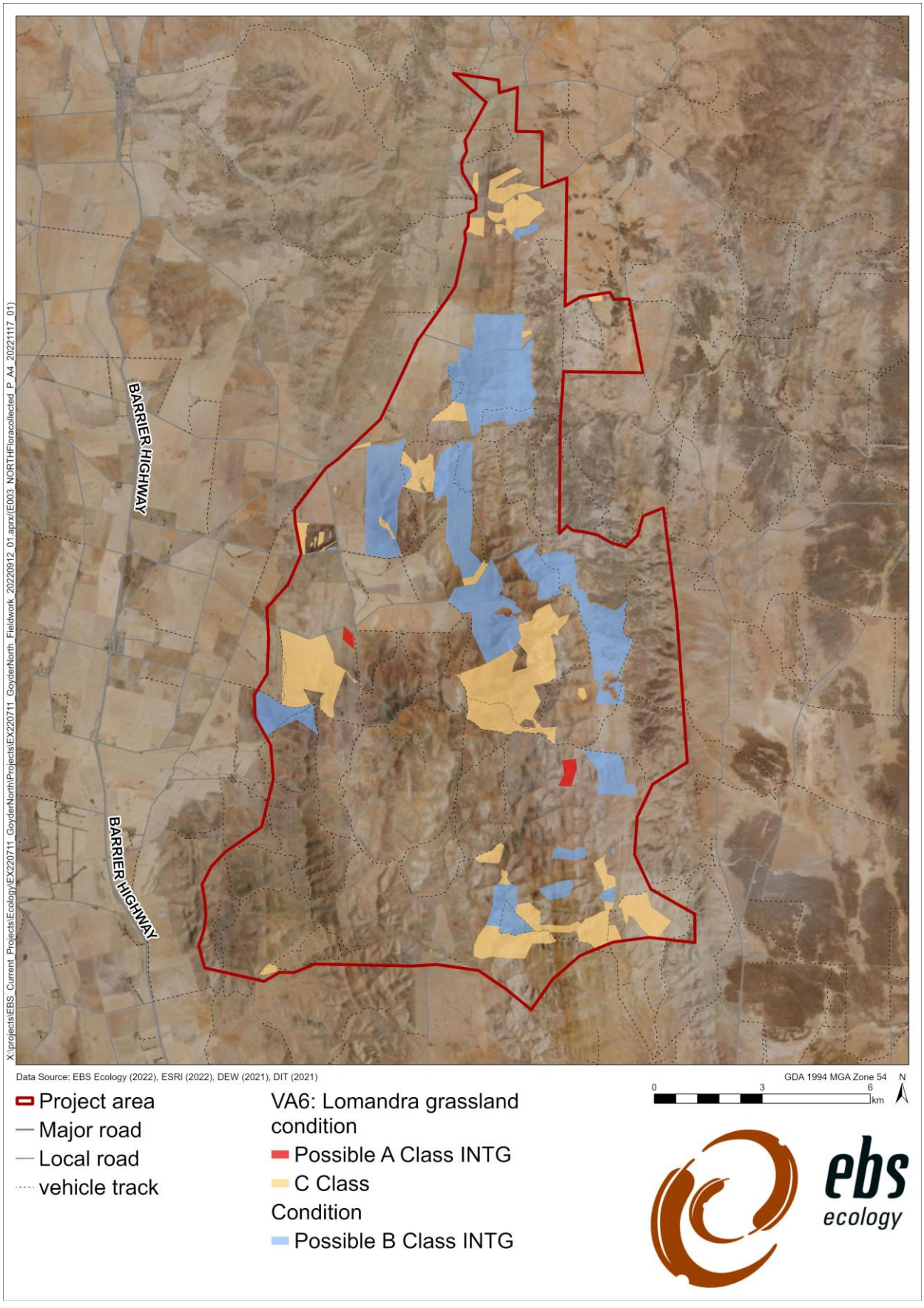


Figure 24. Lomandra condition mapping across the Project Area.

6.3 Fauna

Opportunistic observations of fauna were recorded while traversing the Project Area. Habitat suitability was assessed across the Project Area for threatened fauna species listed in the desktop assessment.

A total of 74 fauna species were observed during the field survey, both opportunistically and through targeted bird surveys, including 66 native and eight non-native (introduced) species. This included three frogs, 60 birds, nine mammals and two reptiles. A full list of species detected during the field survey is presented in Appendix 4 – Fauna species identified during field survey.

6.3.1 Threatened fauna

Three species listed as State threatened under the NPW Act were detected during the field survey:

- Black Falcon (*Falco subniger*) (NPW Act: Rare);
- Elegant Parrot (*Neophema elegans elegans*) (NPW Act: Rare); and
- White-winged Chough (*Corcorax melanorhamphos*) (NPW Act: Rare).

No nationally threatened species were detected during the field survey, though targeted surveys for species known and / or expected to occur, such as Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*) and Flinders Ranges Worm-lizard (*Aprasia pseudopulchella*), were not within the scope of this survey. Habitat suitability mapping for these, and other species, found that there was substantial suitable habitat occurring across the Project Area.

6.3.2 Habitat mapping

Pygmy Blue-tongue Lizard

A total of 13,495.96 hectares of grassland vegetation (including native grassland [VA11a/b] *Lomandra* grassland [VA6] and exotic grassland) was mapped across the Project Area during the field survey. The majority of grassland habitat mapped across the Project Area was identified as potential habitat for Pygmy Blue-tongue Lizards based on the attributes identified in the PBTL Recovery Plan (Duffy, Pound and How, 2012), including:

- Presence of grassland vegetation (+/- emergent trees or shrubs, ranging from native to exotic, but with no history of soil disturbance from cropping); and
- Presence of spider burrows, usually in areas of heavy sandy loam (red-brown earth).

Less desirable habitat characteristics are thought to include steep, exposed rocky terrain, such as ridgelines, overly dense ground cover vegetation which is thought to prevent basking and foraging activities, and areas lacking any cover of perennial tussocks providing inadequate cover. Several areas within the Project Area were noted to have a high number of spider burrows present. Known, likely, possible and unlikely habitat across the Project Area is broadly mapped in Figure 25, however, knowledge surrounding habitat preferences and occupation by this species is constantly evolving and mapping should be taken as indicative only. No targeted PBTL surveys were undertaken as part of this survey and so detailed surveys should be undertaken once impact area is known to ground truth broad mapping.

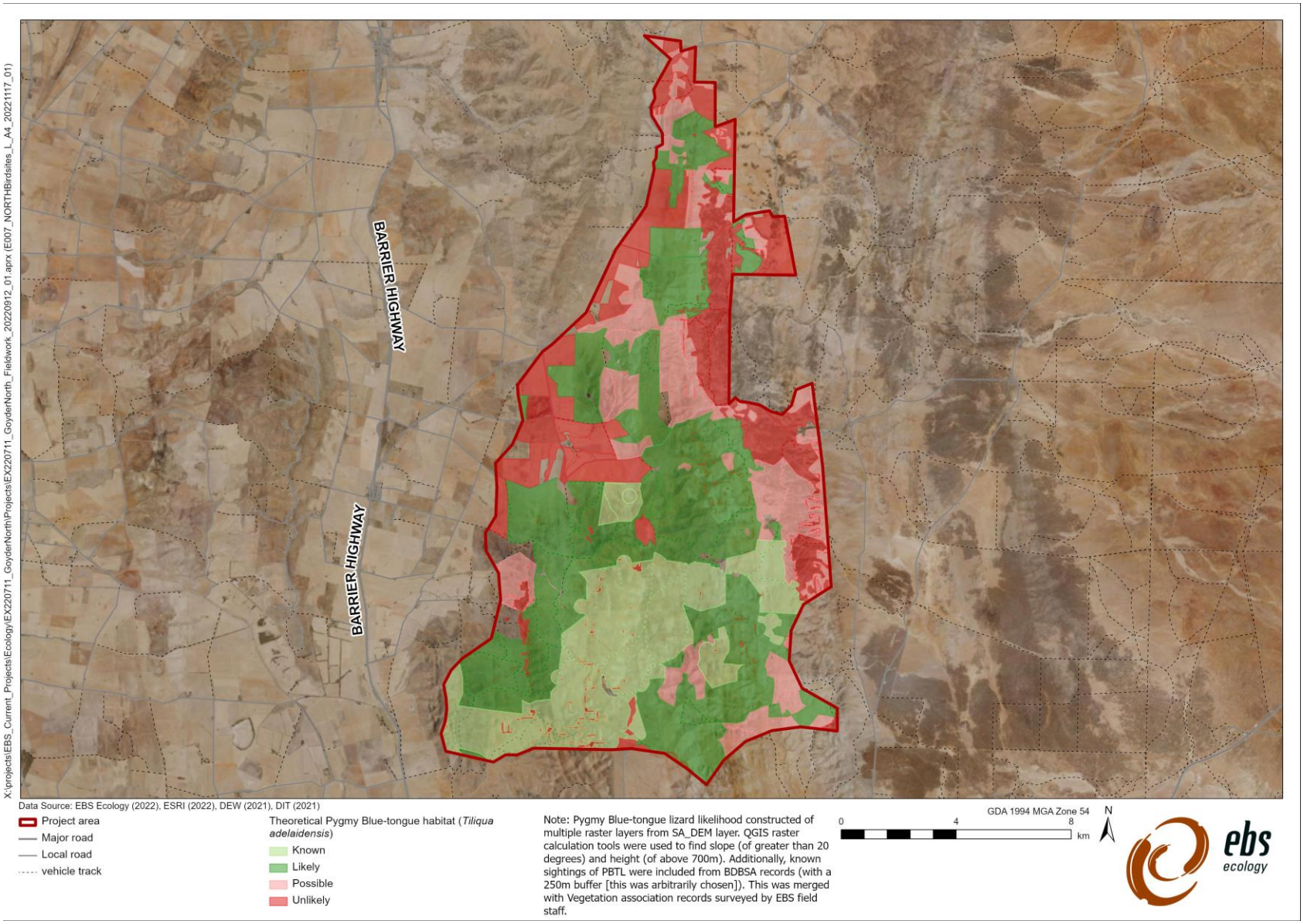


Figure 25. PBTL habitat mapping across the Project Area.

Flinders Ranges Worm Lizard

The Flinders Ranges Worm-lizard (*Aprasia pseudopulchella*) is known to occupy open woodland, grassland, riparian habitats and rocky isolates, of which numerous locations occur throughout the Project Area. Much of the Mallee vegetation occurring in the eastern extent and a small patch of *E. odorata* open woodland in the south of the Project Area contained a rocky surface component (Figure 28). Higher ridges, particularly in the southeast of the Project Area, were found to provide suitable rocky habitat, chiefly in the area mapped as VA10, *Allocasuarina verticillata* over *Cymbopogon ambiguus* on rocky slopes. Additionally, many of the larger creeks and drainage lines contained rocky and riparian habitat and in general, given their non-specific requirements, much of the Project Area was considered to provide potential habitat for this species.

Southern Hairy-nosed Wombat

Mallee vegetation interspersed with grassland and chenopod shrubland on the eastern plains and low hills of the Project Area was found to contain scattered warrens of the Southern Hairy-nosed Wombat (*Lasiorhinus latifrons*) (Figure 26). Though the species was not sighted, diggings and fresh scats indicated that they were present and active in the area, with locations of sightings presented in Figure 31.

Wedge-tailed Eagles

One possible Wedge-tailed Eagle nest was observed in the small patch of scattered *E. odorata / E. leucoxylon* Very Open Woodland in the south of the Project Area. The area was inaccessible due to a combination of steep hills and inclement weather and so it was unconfirmed if the nest was recently active, though no wedge-tailed eagles were observed in the vicinity.

Other important habitat features found throughout the Project Area included an abundance of hollows within the Mallee (Figure 29), rock walls and rocky valleys bordering larger creek lines and the steep eastern ranges, and rocky outcrops in the high hills in the south-east of the Project Area (VA10).

Figure 26. Wombat burrow observed in VA01 during the field survey.

Figure 27.Spider burrow in grassland, indicating potential PBTL habitat.

Figure 28. Potentially suitable habitat for Flinders Ranges Worm-Lizard in the south of the Project Area nearby *E. odorata* Grassy Woodland (VA8).

Figure 29. One of numerous hollows observed in mallee vegetation in the Project Area.

6.3.3 Bird surveys

Dedicated 20-minute 2-ha point count surveys were undertaken at seven locations during the field survey, across multiple vegetation associations including:

- two *Austrostipa* spp. Grassland sites (VA11), one near planted amenity vegetation;
- two *Lomandra* spp. Grassland sites (VA06);
- one Mixed Chenopod Shrubland Site (VA12);
- one Smooth-barked Mallee site (VA02); and
- one *Eucalyptus porosa* Mallee site (VA01).

A total of 415 individuals from 43 species, including 40 native and three introduced species, were detected during the targeted bird surveys.

The most numerous native species was Australian Raven (*Corvus coronoides*), followed by Brown Songlark (*Cincloramphus cruralis*), Southern Whiteface (*Aphelocephala leucopsis leucopsis*), Galah (*Eolophus roseicapilla*) and Australian Magpie (*Gymnorhina tibicen*).

The highest diversity of species was detected in VA01 (22 species), followed by VA02 (17 species). Grassland (VA06, VA11) and shrubland (VA12) sites recorded similar species diversity (seven to nine species).

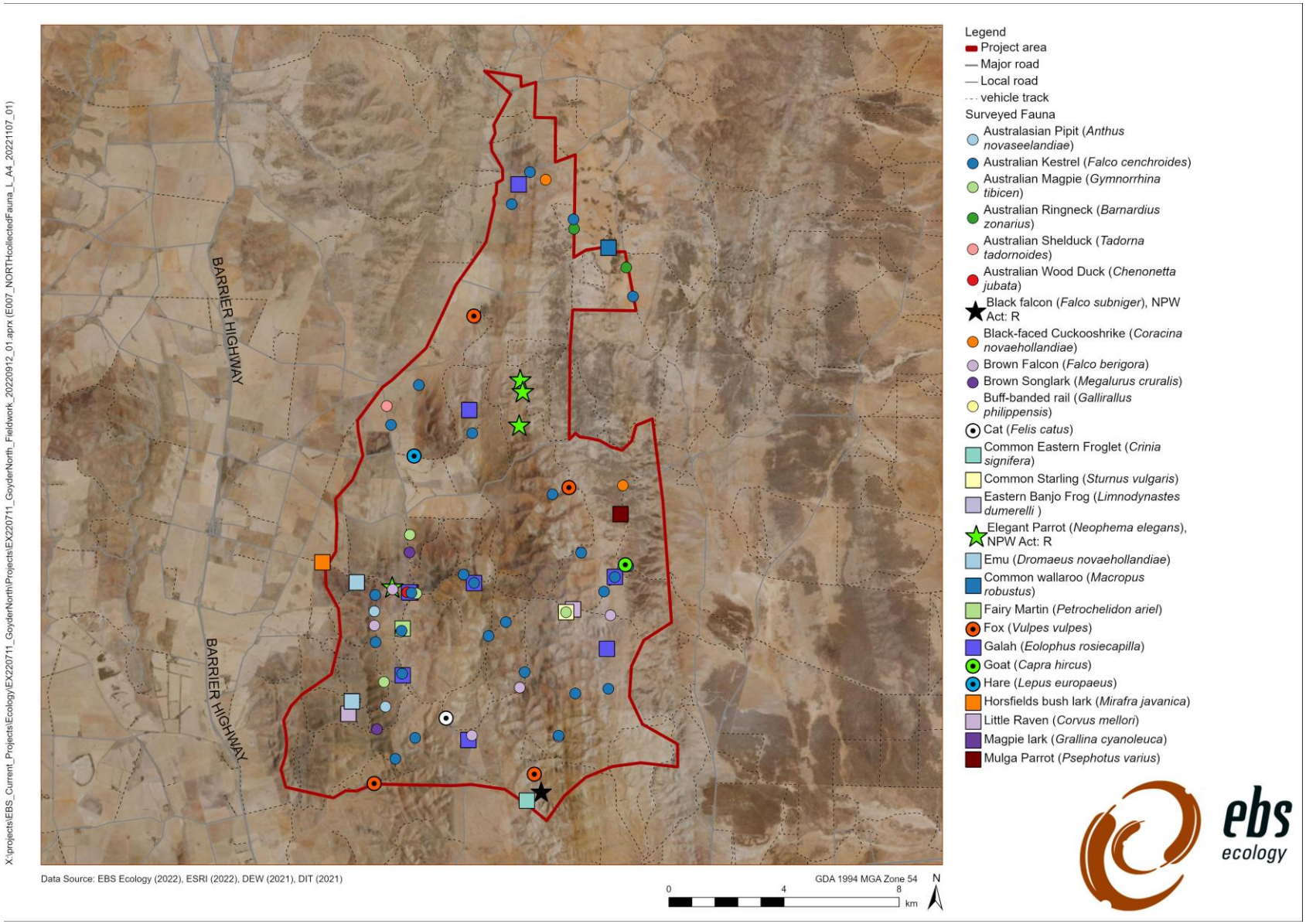


Figure 30. Observations of fauna (opportunistic and dedicated bird surveys) recorded in the Project Area during the field survey (Map 1 of 2).

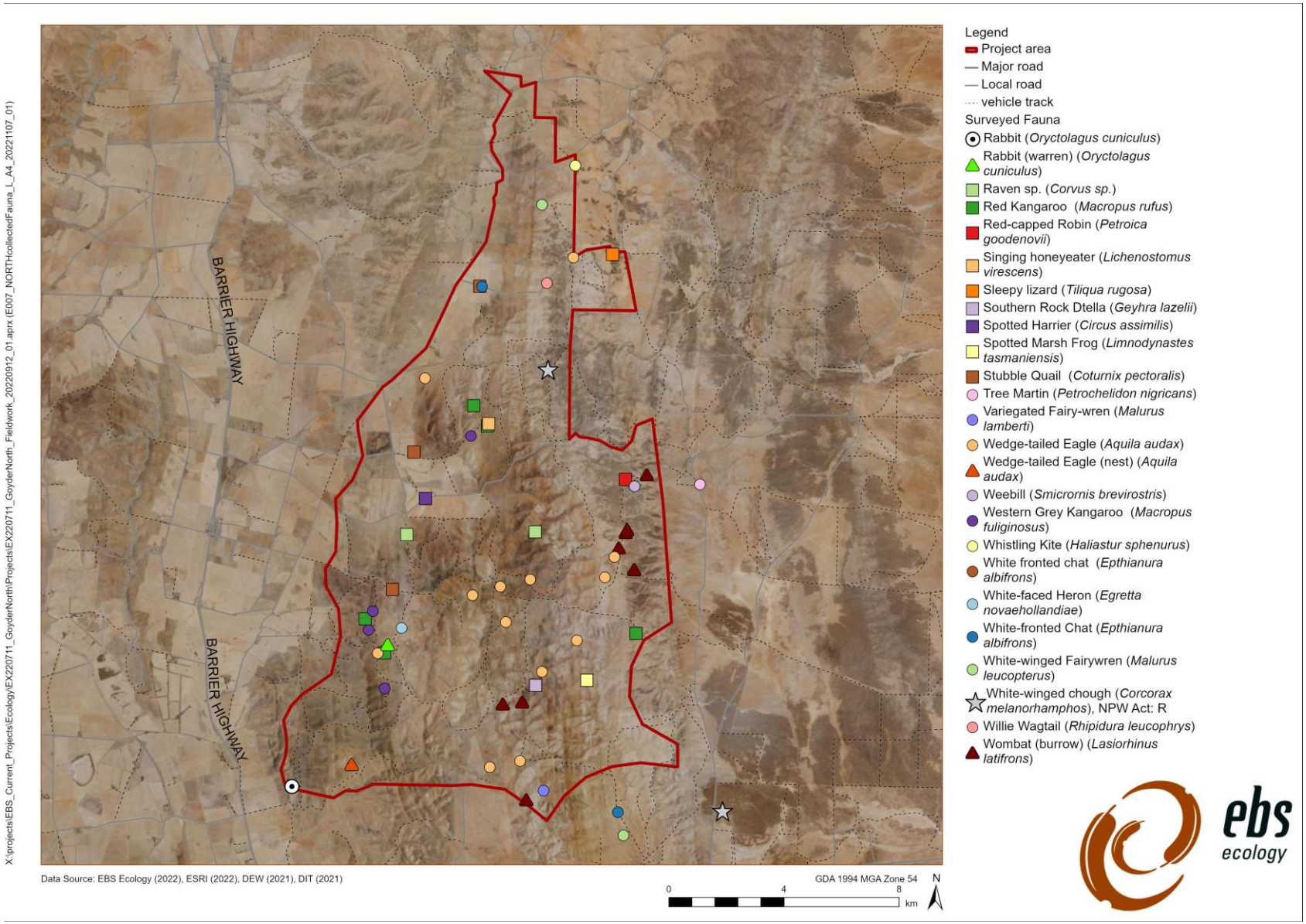


Figure 31. Observations of fauna (opportunistic and dedicated bird surveys) recorded in the Project Area during the field survey (Map 2 of 2).

6.4 Threatened flora and fauna likelihood of occurrence assessment

The likelihood of occurrence assessment indicates that 49 species may occur in the Project Area including 34 plants (seven EPBC Act listed and 27 NPW Act listed) and 15 fauna species (four EPBC listed and 11 NPW Act listed). Twelve flora and five fauna species are considered highly likely or known to occur in the Project Area based on habitat types available, survey effort undertaken and the proximity and recency of historical records, including one plant (*Dodonaea procumbens*, Trailing Hop-bush) and two reptiles (*Tiliqua adelaidensis*, Pygmy Blue-tongue Lizard and *Aprasia pseudopulchella*, Flinders Worm-lizard) which are nationally listed.

All threatened species assessed as possible, likely or highly likely / known to occur in the Project Area are listed in Table 29, with the complete likelihood of occurrence assessment, including habitat information and likelihood discussion, is presented in Appendix 5 – Likelihood assessment of flora and fauna identified in the PMST and from historical records.

Table 29. Likelihood assessment for threatened species within the Project Area.

Scientific Name	Common Name	Conservation Status		Data Source	PMST presence / last record	Likelihood in Project Area
		EPBC	NPW			
FLORA						
Acacia glandulicarpa	Hairy-pod Wattle	VU	E	1	May	Possible
Acacia iteaphylla	Flinders Ranges Wattle		R	2	2004	Possible
Acacia spilleriana	Spiller's Wattle	EN	E	1	Likely	Possible
Austrostipa gibbosa	Swollen Spear-grass		R	2	2013	Known
Codonocarpus pyramidalis	Slender Bell-fruit	VU	E	1, 2	Known, 2003	Possible
Crassula peduncularis	Purple Crassula		R	2	1999	Possible
Crassula sieberiana	Sieber's Crassula		E	2	2009	Highly likely
Cryptandra campanulata	Long-flower Cryptandra		R	2,4	2021	Known
Cullen *parvum*	Small Scurf-pea		V	2	2002	Likely
Dianella longifolia var. *grandis*	Pale Flax-lily		R	2	2013	Known
Diuris behrii	Behr's Cowslip Orchid		V	2	2016	Known
Dodonaea procumbens	Trailing Hop-bush	VU	V	1, 2	Known, 2021	Known
Eremophila subfloccosa ssp. *glandulosa*	Green-flower Emubush		R	2	1993	Possible
Eryngium ovinum	Blue Devil		V	2,4	2019	Known
Eryngium vesiculosum	Prostrate Blue Devil		R	2	1993	Possible
Eucalyptus percostata	Ribbed White Mallee		R	2	2014	Possible
Festuca benthamiana	Bentham's Fescue		R	2	1993	Possible
Juncus radula	Hoary Rush		V	2	1993	Possible
Lepidium pseudotasmanicum	Shade Peppercress		V	2	2013	Likely
Logania saxatilis	Rock Logania		R	2	2008	Possible
Maireana excavata	Bottle Fissure-plant		V	2	2019	Known
Maireana rohrlachii	Rohrlach's Bluebush		R	2,4	2014	Known
Mentha satureioides	Native Pennyroyal		R	2	1988	Possible

Scientific Name	Common Name	Conservation Status		Data Source	PMST presence / last record	Likelihood in Project Area
		EPBC	NPW			
Olearia pannosa ssp. *pannosa*	Silver Daisy-bush	VU	V	1,2	Known, 1993	Possible
Philotheca angustifolia ssp. *angustifolia*	Narrow-leaf Wax-flower		R	2	1998	Possible
Poa drummondiana	Knotted Poa		R	2	2004	Possible
Pterostylis despectans	Mt Bryan Greenhood	EN	E	1, 2	Likely, 2007	Likely
Ptilotus erubescens	Hairy-tails		R	2	2019	Known
Rhodanthe anthemoides	Chamomile Everlasting		E	2,4	2008	Likely
Rumex dumosus	Wiry Dock		R	2,4	2019	Known
Rytidosperma tenuius	Short-awn Wallaby-grass		R	2	1999	Possible
Senecio megaglossus	Superb Groundsel	VU	E	1, 2	Likely, 1993	Likely
Swainsona behriana	Behr's Swainson-pea		V	2,4	2013	Known
Veronica decorosa	Showy Speedwell		R	2	1993	Possible
FAUNA						
Apus pacificus	Fork-tailed Swift	Mi (M)		1	Likely	Possible
Ardeotis australis	Australian Bustard		V	2	2009	Possible
Corcorax melanorhamphos	White-winged Chough		R	2,3,4	2015	Known
Coturnix ypsilophora australis	Brown Quail		V	3	2014	Likely
Falco hypoleucos	Grey Falcon	VU	R	1	Likely	Possible
Falco peregrinus macropus	Peregrine Falcon		R	2	2004	Likely
Falco subniger	Black Falcon		R	3,4	2008	Known
Hieraaetus morphnoides	Little Eagle		V	2	2016	Likely
*Myiagra inquie*ta	Restless Flycatcher		R	3	2006	Likely
Neophema elegans elegans	Elegant Parrot		R	2,4	1999	Known
Numenius madagascariensis	Eastern Curlew	CE, Mi (W)	E	1	May	May
Plectorhyncha lanceolata	Striped Honeyeater		R	2	2015	Possible
Stagonopleura guttata	Diamond Firetail		V	3	1998	Likely
Turnix pyrrhothorax	Red-chested Buttonquail		R	3	2000	Possible
Galaxias rostratus	Flathead Galaxias	CE		1	May	May
Nyctophilus corbeni)	Corben's Long-eared Bat	VU	V	1	May	May
Aprasia pseudopulchella	Flinders Ranges Worm-lizard	VU		1	Known, 2016	Known
Tiliqua adelaidensis	Pygmy Blue-tongue Lizard	EN	E	1, 2	Known, 2019	Known

Scientific Name	Common Name	Conservation Status		Data Source	PMST presence / last record	Likelihood in Project Area
		EPBC	NPW			

EPBC Act: National (*Environment Protection and Biodiversity Conservation Act 1999*). NPW Act: South Australia (*National Parks and Wildlife Act 1972*). Conservation status codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable, R: Rare, Mi (W): Migratory Wetlands Species, Mi (T): Migratory Terrestrial Species, Mi (M): Migratory Marine Species.
Presence Type: As identified in the PMST Report
Year of last record: Historical records within 5 km of the Project Area, obtained from BDBSA and Bird Life Australia – Bird Atlas Database (BDBSA Recordset number: *DEWNRBDBSA220902-2)*
Source of Information:

1. **EPBC Act Protected Matters Report (DCCEEW 2022) – 5 km buffer applied to Project Area boundary.**
2. **BDBSA data (DEW 2022a) - 5 km buffer applied to Project Area**
3. **BirdLife Australia (BDBSA data) (DEW 2022a)**
4. **Observed during field survey.**

7 DISCUSSION

7.1 Threatened Ecological Communities

Four TECs were listed in the PMST as possibly occurring in the Project Area. The field survey confirmed that one of these, Iron-grass Natural Temperate Grassland of South Australia**,** occurs within the Project Area. Three other TECs were not detected within the Project Area, however, Peppermint Box Grassy Woodland of South Australia is known to occur in the surrounds, and was found to occur in the Project Area, but not of sufficient understorey diversity or vegetation quality to qualify for listing as a TEC.

7.1.1 Iron-grass Natural Temperate Grassland of South Australia

Iron-grass Natural Temperate Grassland (INTG) is listed as Critically Endangered under the EPBC Act. The vegetation association is endemic to South Australia, where it is distributed on the slopes and hills of the Mount Lofty Ranges west of the Murray River and throughout the Mid North on loam to clay loam soils. The vegetation association is characterised by *Lomandra multiflora ssp. dura* and / or *Lomandra effusa* as a dominant component of the ground layer, interspersed with perennial native grasses and a variety of herbaceous species. EPBC listed community, patches must be at least 0.1 ha in size and meet native species diversity and density criteria (DEWR 2007).

3929.07 hectares of INTG were assessed during the spring field survey of which 2304.67 ha were determined as likely to comprise B-Class (or higher) INTG. Detailed surveys were not undertaken in all patches, and so this assessment was based on broad comparisons based on the few sites that were surveyed in detail. Using the criteria outlined in the *EPBC Act Policy Statement 3.7, Nationally Threatened Species and Ecological Communities, Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia*, two of the six survey sites within VA6 Lomandra Grassland were assessed to be of minimum B-Class INTG.

The presence of mature iron-grasses indicates areas which have not been subject to disturbance from ploughing, and therefore maintain important refuges for sensitive species such as orchids, burrowing spiders and other invertebrates, as well as EPBC listed species such as the Pygmy Blue-tongue Lizard.

Any impacts to this vegetation community will require an EPBC referral process be undertaken with the Commonwealth Government, to determine the significance of impact, seek approval, and determine any offset requirements.

7.1.2 Peppermint Box (E. odorata) Grassy Woodland of South Australia

Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia was listed as Critically Endangered under the EPBC Act in 2007, due to a severe decline in distribution and an ongoing loss of integrity. The dominant tree species is *E. odorata*, however, other species of Eucalypt commonly co-occur. A grassy understorey is most often present, although some shrubs may exist such as *Bursaria spinosa* (Bursaria) and *Acacia pycnantha* (Golden Wattle). The majority of remnants occur between Victor Harbor and Port Augusta, encompassing the mid-north region, as well as the Adelaide region, Mount Lofty Ranges and part of Yorke Peninsula.

One patch of E. odorata woodland (VA8) was observed within the Project Area, however the understorey was highly modified due to weed invasion and grazing from stock and kangaroos. When assessed against the criteria outlined in the *EPBC Act Policy Statement 3.7, Nationally Threatened Species and Ecological Communities, Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia*, the single *E. odorata* patch observed in the south of the Project Area did not qualify as an ecological community, since it did not contain at least 15 native plant species. Classes A and B are indicative of the listed ecological community, with areas of condition Class A, being considered the highest quality representation of the TEC.

Although there was only a single patch of VA8 in the Project Area it was considered of high value for fauna, as trees provide nesting habitat for the Wedge-tailed Eagle and hollows for bird and bat species to roost and nest. Scattered E. odorata trees were found to occur along some of the creek lines throughout the southern areas of the Project Area, however these areas were highly degraded and did not maintain an intact stratum of mature trees nor sufficient diversity of native understorey species.

7.2 Nationally threatened flora

Six nationally threatened flora species were found to potentially occur within the Project Area. Two of these have known records from within the Project Area and are discussed in detail below. All other EPBC listed species listed as possibly occurring are discussed in Appendix 5 – Likelihood assessment of flora and fauna identified in the PMST and from historical records.

7.2.1 Dodonaea procumbens (Trailing Hop-bush) (EPBC Act: Vulnerable)

Dodonaea procumbens is a small prostrate shrub, growing in woodland, low open forests, heathland and grasslands, where it is widely but patchily distributed in south-eastern Australia (Carter, 2010). Within the Project Area, it was detected within a fenced grazing exclusion area in Mokota Conservation Park (CP) within the Grassland Meadow vegetation association (VA07). Mokota CP is one of 50 known populations of the species. Though not observed outside of Mokota CP, given its small size and inconspicuous nature it is likely that it may occur in similar vegetation across the Project Area. Given the limited distribution of this species, if areas of Grassland Meadow are proposed to be impacted, thorough searches should be undertaken in the proposed footprint area to determine if a significant impact is likely to occur.

7.2.2 Senecio megaglossus (Superb Groundsel) (EPBC Act: Vulnerable)

Senecio megaglossus is a small to medium perennial shrub with bluish waxy leaves and large yellow flowers. It is known from six scattered localities from the Southern Flinders Ranges to the Northern Lofty Ranges, including from Newikie Creek which runs through the centre of the Project Area, south of White Field Road. Preferred habitat includes rocky gorges and valley slopes in vegetation including *Pittosporum angustifolium* (Native Apricot), *Alectryon oleifolius* (Bullock Bush) and *Eremophila longifolia* (Emu Bush); in association with *Triodia irritans* (Spinifex); and in association with *Callitris columellaris* (White Cypress-pine) and *Eucalyptus camaldulensis* (River Red Gum) (Commonwealth Government, 2008a). These associated VAs are restricted within the Project Area, however *Callitris* sp. / *E. camaldulensis* occurs in a small area of riparian zone to the north of White Hill Road. Should these areas be within proposed impact

footprints, historical records (from 1993) and other suitable habitat within the Project Area should be targeted to verify the ongoing presence of this species.

7.3 State threatened flora

A number of State listed threatened flora species were determined as possibly occurring within the Project Area. Species known to occur, such as those observed during the field survey, and those assessed as likely to occur in the Project Area are discussed in more detail below. Potential impacts to these species cannot be quantified without an impact design, however their location within the Project Area can be avoided where possible to minimise potential impacts to these species.

A total of 14 threatened flora species, were found to be known or likely to occur within the Project Area based on a desktop assessment and subsequent field survey. Habitat descriptions and likelihood justification are provided for each species in Appendix 5 – Likelihood assessment of flora and fauna identified in the PMST and from historical records. Six of these species were observed during the field survey, discussed further below.

7.3.1 Cryptandra campanulata (Long-flowered Cryptandra) (NPW Act: Rare)

Cryptandra campanulata is a small woody shrub which grows in rocky habitats of the northern Mount Lofty Ranges and Southern Flinders Ranges (Kellerman, 2020). Within the Project Area it was found in low numbers, in Lomandra Grassland vegetation association (VA6) and within *Hakea leucoptera* Shrubland (VA13). Some small patches of shrubland dominated by *Cryptandra* were observed to the south-west of Old Belcunda Road, however this property was not accessible at the time of the survey. In most instances, the shrub was subjected to heavy grazing impacts (Figure 32) and it is likely that it is more widespread than indicated in mapping.

Figure 32. Heavy grazing of Cryptandra. This condition was observed across the Project Area, likely due to a combination of grazing by livestock and kangaroos.

7.3.2 Eryngium ovinum (Blue Devil) (NPW Act: Vulnerable)

Eryngium ovinum is a small short-lived perennial species which grows in open woodland and grasslands of the Mount Lofty Ranges. At the time of the survey the species was not flowering, and therefore difficult to detect, however it was observed commonly in its vegetative state in Grassland Meadow vegetation association (VA7) within the Project Area. Impacts to NPW listed threatened species cannot be quantified without a defined construction footprint, however, by reducing impacts in areas mapped as VA7 or high-quality diverse grassland sites, impacts to this species will be minimised.

7.3.3 Maireana rohrlachii (Rohrlach's Bluebush) (NPW Act: Rare)

Maireana rohrlachii is a small chenopod shrub typically found in heavy soils (eFlora SA, 2022). Within the Project Area if was found sporadically as an understorey species in mallee dominated vegetation associations (VA1 and VA2) and also formed the dominant shrub in minor association VA09 *Maireana rohrlachii* Very Open Shrubland. Minor occurrences were observed in grasslands (VA06 and VA11) and chenopod shrublands (VA12). If this VA9 is avoided, impacts to this species are likely to be minimal given the low density in other VAs throughout the Project Area.

7.3.4 Rhodanthe anthemoides (Chamomile Everlasting) (NPW Act: Endangered)

Rhodanthe anthemoides is a small perennial sub-shrub with greyish-green leaves which is widespread in eastern Australia and Tasmania, where it grows in montane and / or rocky areas, preferring sandy soils. The species is known only from isolated historical records; however, an unconfirmed specimen, matching its description, was identified during the field survey, on an embankment of a rocky creek in the south of the Project Area (Figure 33). This area should be resurveyed to confirm the presence of this species within the Project Area.

Figure 33. Locality of unconfirmed *Rhodanthe anthemoides* specimen in rocky gully.

7.3.5 Rumex dumosus (Wiry Dock) (NPW Act: Rare)

Rumex dumosus is a small, many-branched dock species which breaks at the base following the withering of leaves, and is blown by wind, similar to a tumbleweed. In the Project Area it was locally common in

patches of grassland vegetation (VA6, VA7 and VA10 and VA11). Given its widespread and scattered occurrence, it is unlikely that the Project would have a significant impact on this species.

7.3.6 Swainsona behriana (Behr's Swainson Pea) (NPW Act: Vulnerable)

Swainsona behriana is a small perennial pea-flowered herb which occurs in grassland habitats. Within the Project Area it was observed in higher quality areas of Lomandra grassland, typically in areas which are likely to quality as the nationally threatened Iron-grass Natural Temperate Grassland of South Australia (Figure 34). Protection of areas mapped as Lomandra grassland is therefore the best way to conserve this species and minimise impacts within the Project Area.

Figure 34. Behr's Swainson-pea within the Project Area.

7.4 Nationally threatened fauna

Two EPBC listed species, were found to be known or likely to occur within the Project Area based on a desktop assessment and subsequent field survey. Habitat descriptions and likelihood justification are provided for each species in Appendix 5 – Likelihood assessment of flora and fauna identified in the PMST and from historical records. Neither species was observed during the field survey, however habitat across the Project Area is considered suitable.

7.4.1 Pygmy Blue-tongue Lizard (Tiliqua adelaidensis) (EPBC Act: Endangered)

Pygmy Blue-tongue Lizards (PBTLs) are known to occur in the Project Area, with numerous records across the southern extent of the Project Area. A private conservation area, Tiliqua Nature Reserve, is situated on one property in the south of the Project Area which protects this species.

Given the large area of potential PBTL habitat, more detailed surveys are required once the proposed infrastructure layout known. Detailed surveys should be undertaken in all intercepted areas mapped as known, likely or possible habitat, and ground-truthing should be done in areas mapped as unlikely habitat,

given the broad scale of the existing mapping. Detailed surveys and mapping will enable more detailed recommendations to be made around avoidance and minimisation of impacts to this nationally important species.

In general, the following potential impacts of the Project on PBTLs must be considered when selecting an appropriate buffer zone from known PBTL locations:

- Direct loss of individuals during construction;
- Noise and vibration disturbance during construction;
- Runoff from construction areas leading to sedimentation build-up in and/or around burrows;
- Division and isolation of populations caused by the construction of vehicular access tracks; and
- Disturbance from turbine blade shadow flicker during operation.

The potential presence of PBTLs should be given consideration with respect to the placement of infrastructure and access tracks and any changes in design layout. Where the refined layout is within potential habitat, a more detailed targeted survey within summer months, will be required when grass cover has declined, and spider's holes are more visible. The survey envelope should extend at least 50 m beyond the footprint of proposed infrastructure. Any new infrastructure (or changes) that are proposed within potential PBTL will need to be surveyed for the presence of PBTLs. Further investigation of spider holes may be required where turbines, roads and other infrastructure are planned within potential habitat to micro-site them in suitable locations. Even if no PBTLs are observed during this type of survey, they cannot be ruled out from occurring.

PBTL habitat should be avoided where possible. Alternatively, more detailed surveys and infrastructure design may be undertaken in consultation with the PBTL Recovery Team to attempt to suitably place infrastructure to avoid impacting PBTL habitat and individuals. If it is not possible to avoid all impacts to PBTL, the EPBC referral process is likely to recommend both a suitable offset to compensate for habitat lost, and likely translocation of any potentially impacted individuals as part of the approval conditions.

7.4.2 Flinders Ranges Worm-lizard (Aprasia pseudopulchella) (EPBC Act: Vulnerable)

The Flinders Ranges Worm-Lizard (FRWL) is a small burrowing legless lizard which is known from the Flinders Ranges of SA, extending south to the western slopes and northern and central Mount Lofty Ranges. The species inhabits open woodland, native tussock grassland, riparian habitats, and rocky isolates, preferring stony or clay soils with a stony / rocky surface, but has also been found sheltering in soil beneath sones and rotting stumps (Commonwealth Government, 2008b).

Multiple historical records of this species occur within the Project Area, most recently from south of Wandillah homestead in 2016. Other records are sparse, but include Mokota CP in 1999, in a small area mapped as diverse Grassland Meadow, and another area south of White Hill Road in an area mapped as possible B-Class INTG.

Considering their non-specific habitat requirements, EBS recognises the whole Project Area to be possible habitat for this species. Areas which contain rocky surface attributes, rocky riparian areas and woodland sites are considered most likely to support populations of this species. Given their propensity to move

around, mitigation measures to reduce impacts on this species should include pre-clearance surveys in which individuals can be relocated out of harms' way prior to construction. If large populations of this species are detected in a particular location, micro siting should be considered to move construction impacts from these more important habitat areas.

Although listed under the EPBC Act as Vulnerable, this species is no longer listed as State threatened under the NPW Act as a review of its conservation status found it to be locally common (though cryptic) in grazing land in the Mid North of SA (DEH, 2008a).

7.5 State threatened fauna

A total of eight threatened fauna species were found to be known or likely to occur within the Project Area based on a desktop assessment and subsequent field survey. Habitat descriptions and likelihood justification are provided for each species in Appendix 5 – Likelihood assessment of flora and fauna identified in the PMST and from historical records. Three of these species were observed during the field survey, discussed further below.

7.5.1 Black Falcon (Falco subniger) (NPW Act: Rare)

Black Falcons are a large raptor, sparsely distributed in the inland and across northern, eastern, southern and central Australia. Typically, they are found along tree-lined watercourses and in isolated woodlands, roosting in trees at night and sometimes using manmade structures such as power poles, to hawk from during the day.

One individual of this species was detected in the south of the Project Area during the field survey and it is likely they utilise the open grasslands for foraging and tree-lined watercourses, especially of taller *E. camaldulensis* within the Project Area. This species is likely to be naturally sparse in the landscape. Bird utilisation surveys are likely to provide a better understanding of how this species utilises the Project Area and inform what sort of impact the Project may have on their populations.

7.5.2 White-winged Chough (Corcorax melanorhamphos) (SA: Rare)

White-winged Choughs were recorded at one location within the 'Smooth-barked Mallee' association (VA2) in the east of the Project Area. White-winged Choughs form large social groups which practice cooperative breeding to raise young. They are ground foraging species which maintain large territories up to 1000 ha in size (Birdlife Australia, 2022). The utilise forest and woodland habitat preferring leaf litter for feeding and nearby water sources from which to seek mud for nest building. The species has declined in South Australia, likely due habitat clearance, resulting in fragmentation of larger patches which are required to support their family groups (DEH, 2008b). Minimising clearance of mallee vegetation within the Project Area is likely to ensure this species is not impacted by the Project.

7.5.3 Elegant Parrot (Neophema elegans elegans) (SA: Rare)

Elegant Parrots are small, ground-foraging species, which occur across western Victoria, south-western NSW, eastern SA, north to the Flinders Ranges and west to the Eyre Peninsula and across to Western

Australia (WA). They are known to utilise a wide variety of open habitats from grassland to mallee woodlands, chenopod shrublands and farmland and use hollow tree branches to nest.

This species was detected on multiple occasions throughout the field survey, flying low over open grassland or chenopod shrublands. It is likely that Elegant Parrots utilise the Project Area for both foraging and breeding, with plentiful resources available, particularly in and around the mallee woodlands and chenopod shrublands in the east of the Project Area. Bird utilisation surveys are likely to provide a better understanding of how this species utilises the Project Area and inform what sort of impact the Project may have on their populations.

7.6 Other constraints

7.6.1 Southern Hairy-nosed Wombat (Lasiorhinus latifrons)

Wombats are the largest burrowing mammals in the world. They spend over 75% of their time in their burrows, which allow them to survive in the harsh, seasonally changing and unpredictable environment of semi-arid and arid Australia (Finlayson *et al.* 2005; Sparrow *et al.* 2016). In suitable environmental conditions (e.g., calcareous soils on calcrete, intermediate surface rockiness), wombats construct large warren complexes that allow long-term occupation (Marshall *et al.* 2018).

The large warrens and digging and foraging behaviour of wombats can cause conflict with agricultural operations, with wombats burrowing in cropping paddocks and under infrastructure such as fences, access tracks and water tanks, creating safety concerns (i.e., farm machinery falling into collapsed burrows) and leading to loss of water for stock, stock escaping or financial loss due to damaged equipment (Sparrow *et al.* 2016). Other impacts caused by wombats include erosion and grazing competition.

These identified conflicts with wombats are likely to impact on the construction and operation of the Project, posing similar constraints on infrastructure and access. Southern Hairy-nosed Wombats are not threatened in South Australia, but are protected as a native species under the NPW Act. As they are sedentary animals with established and long-term warrens, appropriate action must be considered to either avoid or mitigate impacts to this species. Direct and indirect impacts to wombats caused by construction of a wind farm may include:

- Direct loss of individuals during construction;
- Noise and vibration disturbance during construction;
- Runoff from construction areas leading to sedimentation build-up in and/or around burrows;
- Division and isolation of populations caused by the construction of vehicular access tracks; and
- Disturbance from turbine blade shadow flicker during operation.

Risks to the wind farm construction and operation may include:

- Damage to infrastructure from burrows;
- Reduction in structural integrity of infrastructure from burrows; and
- Damage to vehicles and construction plant, as well as safety hazard, from hard-to-see burrows.

Typically, wombats are found in drainage lines and at lower elevations. The wombat warrens encountered during the field survey are not likely to constitute the full extent of warren systems found across the Project

Area. The number of individual burrows found (nine) are not representative of the number of wombats which may occupy the site, as a single wombat may utilise over eight different warrens / burrows (SA MDB, 2011). Implementation of buffer zones from known wombat warren locations to proposed infrastructure should be investigated and implemented, to minimise likelihood of impacts. Newly detected warren systems should continue to be recorded across the Project Area to inform a thorough understanding of their potential impact on the Project.

7.6.2 Wind farm impacts on avifauna and microbats

To date, the primary environmental concern arising from wind farm developments in Australia and overseas has been the mortality of bird and bat species from collision with wind turbine generators (WTGs) (DEWHA, 2009). Potential impacts of wind farms on avifauna include:

- Rotor strikes (bird mortality);
- Barotrauma (i.e., rapid air-pressure reduction near moving turbines causing tissue damage to air-containing structures) (bat mortality);
- Clearance and degradation of habitat;
- Acoustic masking (i.e., adverse impacts on songbird communications caused by noise from WTG's); and
- Behavioural avoidance (i.e., causing displaced territories and reduced breeding success).

Bird and bat utilisation surveys are a requirement of all newly proposed wind farm projects in Australia and aim to provide a risk assessment for the cumulative impact wind farm infrastructure, such as WTGs may pose to susceptible species, particularly EPBC listed threatened and migratory species. Susceptible species / groups include (Smales, 2006 and DCCEEW, 2021):

- All threatened, uncommon and naturally sparse bird species;
- Migratory birds such as waders and seabirds;
- Flocking species including those that travel at night;
- All bats; and
- Larger, less agile birds such as eagles and other raptors, cranes, swans, geese and pelicans.

A total of 101 observations of six species of raptors were identified during the field survey, including State listed Rare Black Falcon (*Falco subniger*). Wedge-tailed Eagles were the most commonly sighted bird, with 48 observations over the course of the survey, however this may not represent the number of individuals in the Project Area, as the same bird(s) may have been observed on multiple occasions. Regardless, the high number of observations indicate that this site contains favourable habitat for a range of raptor species including other species not observed during the field survey. Two other State listed raptor species have nearby records, including Peregrine Falcon (*Falco peregrinus macropus*) and Little Eagle (*Hieraaetus morphnoides*).

No threatened microbat species were found to have records nearby to the Project Area. The nationally Vulnerable Corben's Long-eared Bat (*Nyctophilus corbeni*) has been determined as unlikely to occur in

the Project Area, based the Project Area being on the extremity of its known range and not containing preferred box, ironbark and cypress pine woodland, though the mallee vegetation in the east of the Project Are contains an abundance of suitable roosting hollows.

Several migratory bird species were listed in the PMST search as possibly occurring within the Project Area, however all but one of these species was determined unlikely to occur, due to the lack of suitable wetland habitat. The closest suitable wetland destination for these migratory wetland species is Hiles Lagoon, which lies 23 km to the north of the Project Area. Water sources in the Project Area are unreliable and restricted to ephemeral creeks, many of which are highly eroded with steep banks, and exposed farm dams. The Fork-tailed Swift (*Apus pacificus*) is the only EPBC listed migratory species considered to possibly occur, as it occupies vast areas of airspace throughout Australia.

Bird and bat utilisation surveys over a period of two years would assist in determining the occurrence of the Fork-tailed Swift and other listed species and help to provide a better understanding of how species such as raptors, utilise the airspace over the proposed wind farm site. In turn, this may assist in further micro-siting WTGs to avoid areas of higher activity by susceptible species.

8 MITIGATION MEASURES AND RECOMMENDATIONS

8.1 Addressing the mitigation hierarchy

Any native vegetation proposed to be cleared will require an application under the NV Act. The Native Vegetation Council (NVC) sets out a 'mitigation hierarchy' which proponents must address adequately in their application. This mitigation hierarchy is also relevant to MNES which may be impacted, as it is essential to demonstrate application of avoidance and minimisation measures during the EPBC referral process. The proponent must address, in order of importance, how they propose to:

1) Avoid impacts to native vegetation;
2) Minimise unavoidable impacts to native vegetation;
3) Mitigate potential impacts to native flora and fauna;
4) Offset their unavoidable impacts – either by way of on ground offset or though payment to the NV Fund.

Based on the mitigation hierarchy, EBS recommends the following approach during the planning process for infrastructure related to the Project.

8.1.1 Avoid

Neoen has committed to undertaking a native vegetation clearance application, where further details will be provided on how clearance of native vegetation will be avoided. The following avoidance measures committed to by Neoen, have been summarised below:

- Avoid where possible, placing infrastructure in areas identified as comprising or containing MNES including:
    - Iron-grass Natural Temperate Grassland Threatened Ecological Community (VA6);
    - Peppermint Box Grassy Woodland (VA8) (*unlikely to meet EPBC listing status, however, amenable to rehabilitation and still containing important habitat features).
    - Known populations of Pygmy Blue-tongue Lizards and likely and potential PBTL habitat.
    - EPBC listed threatened plant species.
    - Known or likely Flinders Ranges-worm Lizard habitat.
- Place construction exclusion buffers around all areas known to contain MNES to ensure ecological integrity of these areas are maintained as much as possible.
- Avoid placing infrastructure in areas identified as comprising high quality habitat in terms of diversity or refuge offered for both State threatened and more common species including:
    - Areas which contain high-quality habitat attributes such as hollows and / or rocky outcrops, foraging, breeding or refuge sites (i.e., VA1, VA2, VA10).

- Areas where a high diversity of species occur such as high-quality grassland meadow and native grassland vegetation associations (VA7 and VA11).
- Areas where rare or threatened plant or animal species are known to occur.
- Areas which contain under-represented vegetation communities (VA10, VA13, VA14) which add significantly to the overall plant species diversity in the Project Area and / or provide a unique habitat element (i.e., River Red Gums).

- Avoid placing infrastructure in areas protected for the local environmental significance including:
  - Mokota Conservation Park;
  - Tiliqua Nature Reserve; and
  - Heritage Agreement Area 1264.

8.1.2 Minimise and / or mitigate

Where impacts to MNES, State significant and landscape significant features cannot be entirely avoided, minimisation methods should be utilised to reduce impacts to these matters, including:

- Micro-site infrastructure prior to construction to minimise impacts on PBTL burrows and habitat and / or areas mapped as INTG.
- Undertake an EPBC Referral for all MNES likely to be impacted by the development. The referral process will quantify impacts to MNES, determine whether or not the action is approved, and if approved, the level of on-ground offset that is required for each MNES proposed to be impacted.
- Ensure investigation works in the initial planning stages, including for access, geotechnical assessments and meteorological mast installation utilise minimal impact methods, allowing vegetation to naturally re-establish once the impact has ceased.

8.1.3 Offset

- Investigate opportunities to acquire suitable land for offsetting any impacts the Project may have on native vegetation (i.e., a SEB under the NV Act) or nationally listed fauna (i.e., an EPBC environmental offset under the EPBC Act).
- Offsetting native vegetation clearance can be by way of payment into the NV Fund, or, more favourably, by acquiring suitable offsets which consider:
  - Vegetation that is ‘like for like or better’.
  - Proximity to the area of impact, to ensure that local impacts are adequately offset;
  - The size and dimensions of the site (i.e., greater than 30 m wide for 90 percent of its length and at least three hectares for common vegetation, or one hectare if it contains threatened species or communities).
  - The potential biodiversity gains an area may achieve with protection and management.

- Offsetting impacts to nationally threatened communities and species is additional to the requirements for offsetting native vegetation and requires suitable offsets which deliver an overall conservation outcome that improves or maintains the viability of the MNES being impacted.

8.2 Fauna management recommendations

8.2.1 Pygmy Blue-tongue Lizard

The following recommendations have been made to mitigate the potential impacts of the Project on PBTL populations and PBTL habitat:

- Exclude all areas identified as 'known' PBTL habitat (including an appropriate buffer zone) from any disturbance associated with the Project.
- Ensure a 'STOP WORK' procedure is in place in the event that a previously unknown population of PBTLs is discovered within the Project Area footprint during construction phase.
- Once the preliminary infrastructure layout is known:
    - Undertake detailed PBTL surveys in all likely and possible habitat and surrounding areas to enable micro-siting of infrastructure if PBTLs are found to occur; and
    - Ground truth areas mapped as unlikely habitat within the impact area.
- If the proposed infrastructure layout is modified, survey and ground-truth any new potential PBTL habitat which may be impacted by the new layout.
- If PTBL's are found to occur within any area of the proposed infrastructure layout, and micro siting cannot avoid all impacts:
    - Consult with the PBTL Recovery Team regarding recommended actions around PBTL in the Project Area.
    - Engage an accredited environmental consultant to develop a PBTL Relocation Management Plan for PBTLs impacted by the construction footprint.

8.2.2 Flinders Ranges Worm-lizard

Given the potential for this species to be widespread across the Project Area, and its cryptic but mobile nature, avoidance measures in the planning phase are difficult to achieve. Instead EBS recommends:

- Targeted surveys (i.e., checking under rocks and woody debris) should be undertaken for this species in any suitable habitat occurring within the proposed impact layout, simultaneously with PBTL surveys.
- If numerous individuals are detected in ideal habitat and subsequently defined as a 'hotspot' during these early habitat surveys, Neoen should consider micro-siting construction around these high population density areas.

- Pre-clearance surveys should be undertaken by permitted fauna ecologists in all areas of potential habitat (i.e., areas containing surface rocks and woody debris) to catch and relocate all Flinders Ranges Worm-lizards encountered.

8.2.3 Southern Hairy-nosed Wombat

Implementing an integrated approach to managing the potential impacts caused by Southern Hairy-nosed Wombat is recommended. Therefore, avoidance of the currently identified warren areas would be the first mitigation measure that is recommended.

The issue of wombat management is well known in the region and, as such, the Murray Darling Basin NRM have recommended the following non-lethal management techniques to reduce the impact of wombats on wind and solar farm infrastructure (SA MDB NRMB 2011):

- Electric fencing –may be appropriate to protect infrastructure (e.g., turbines) that are not able to be placed an adequate distance away from a large warren;

- Fence alterations – to allow free movement of wombats and prevent them from digging under the fence (if fences are necessary for certain infrastructure). If security is a priority, 'wombat gates' can be installed to allow wombats to move freely through a fence;

- Burrow/warren marking – Clearly marking existing burrows and warrens (e.g., with a star dropper or flagging tape and GPS point) can reduce the risk of damage to vehicles and machinery, as well as the burrows/warrens themselves;

- Remove access to harbour sites – Access to spaces underneath infrastructure (e.g., site buildings, etc.) can be restricted through the installation of heavy gauge mesh, or a buried wire apron; and

- One-way gates – one-way gates can be installed to restrict access and allow any wombats to exit the burrows prior ripping the burrows if impacts to some areas cannot be otherwise avoided.

8.2.4 Other fauna

- During construction phase, engage qualified fauna spotter catchers, with appropriate relocation permits (issued by the Department for Environment and Water), to undertake pre-construction searches and relocate any fauna occurring within the construction footprint (including Flinders Ranges Worm-lizard).
    - Ensure detailed construction schedule is planned in advance to allow coordination of pre-clearance fauna surveys to take place within a suitable timeframe (i.e., as close as possible to commencement of clearance activities).
- If possible, avoid undertaking construction works during spring, as this coincides with breeding season of many fauna species such as ground and low-shrub nesting birds which are otherwise highly mobile and unlikely to be impacted by construction.

8.3 General recommendations and next steps

8.3.1 Environmental approvals and compliance requirements

As soon as possible:

- Commence 24-month seasonal bird and bat utilisation surveys as soon as possible (i.e., Summer 2023), in line with *CEC Best Practice Guidelines* for Wind Farms. Use the recommended bird survey site layout proposed in Appendix 6 – Proposed bird and bat utilisation survey sites as guide to ensure adequate coverage of the Project Area in terms of habitat type and accessibility. Use bird and bat utilisation data to inform a risk assessment for potential impacts to populations of birds and bats in the Project Area.
- Develop a Construction and Operational Environmental Management Plan (CEOMP) to outline management requirements for MNES known to occur in the Project Area, to ensure their quality / coverage and numbers are not diminished as a result of constructing and operating the wind farm. The COEMP also provides direction in the event that additional MNES are detected during the course of the Project.

Once a preliminary Project impact footprint is known (including all direct and indirect impacts):

- Undertake a detailed vegetation survey in accordance with Native Vegetation Council methodology (Bushland Assessment Method [BAM], Scattered Tree Assessment Method [STAM]), to inform the SEB offset requirements for the Project. Submit a native vegetation clearance application to the Native Vegetation Council to seek approval for proposed impacts.
- Undertake a detailed significant impact assessment for all MNES occurring or potentially occurring within the Project Area.
- Commence EPBC referral process for all MNES for which there may be a significant impact caused by the Project.

8.3.2 Additional surveys recommended

Once a preliminary Project impact footprint is known (including all direct and indirect impacts):

- Undertake detailed assessments within proposed impact footprint during spring to determine if any areas mapped as Lomandra grassland qualify for listing as INTG TEC under the EPBC Act.
- Undertake detailed PBTL survey transects in areas thought to be possible or likely habitat. Utilise results of PBTL surveys to inform micro-siting of infrastructure and / or instigate planning for PBTL relocation works.
- Undertake targeted surveys for Flinders Ranges Worm Lizard (*Aprasia pseudopulchella*) and use results to micro-site infrastructure and / or instigate planning for a fauna spotter catcher to relocate animals during construction.

- Undertake targeted searches in treed locations across the Project Area to detect active and inactive Wedge-tailed Eagle nests. A one-kilometre buffer is required to be placed around WTE nests to avoid potential impacts from WTGs to fledgling birds.
- Undertake targeted searches in proposed impact area (and appropriate buffer to enable micro siting) for nationally threatened species considered known or likely to occur including:
    - *Dodonaea procumbens* (Trailing Hop-bush) (EPBC: Vulnerable) considered likely within VA7 Grassland Meadow and known from populations within similar habitat in Mokota CP.
    - *Senecio megaglossus* (Superb Groundsel) (EPBC: Vulnerable) considered likely within the Project Area and known from a historical population around Newikie Creek.
- If known wombat warren areas are within proposed impact footprint, undertake detailed surveys in these areas to determine the extent of the warren systems and confirm whether the warrens are currently active. Any newly located wombat warrens should also be surveyed (i.e., utilising camera trap surveys) to determine if they are currently active.
- If required (i.e., if impacts are proposed), undertake additional vegetation surveys to cover gaps in vegetation mapping which were not accessible during initial survey.

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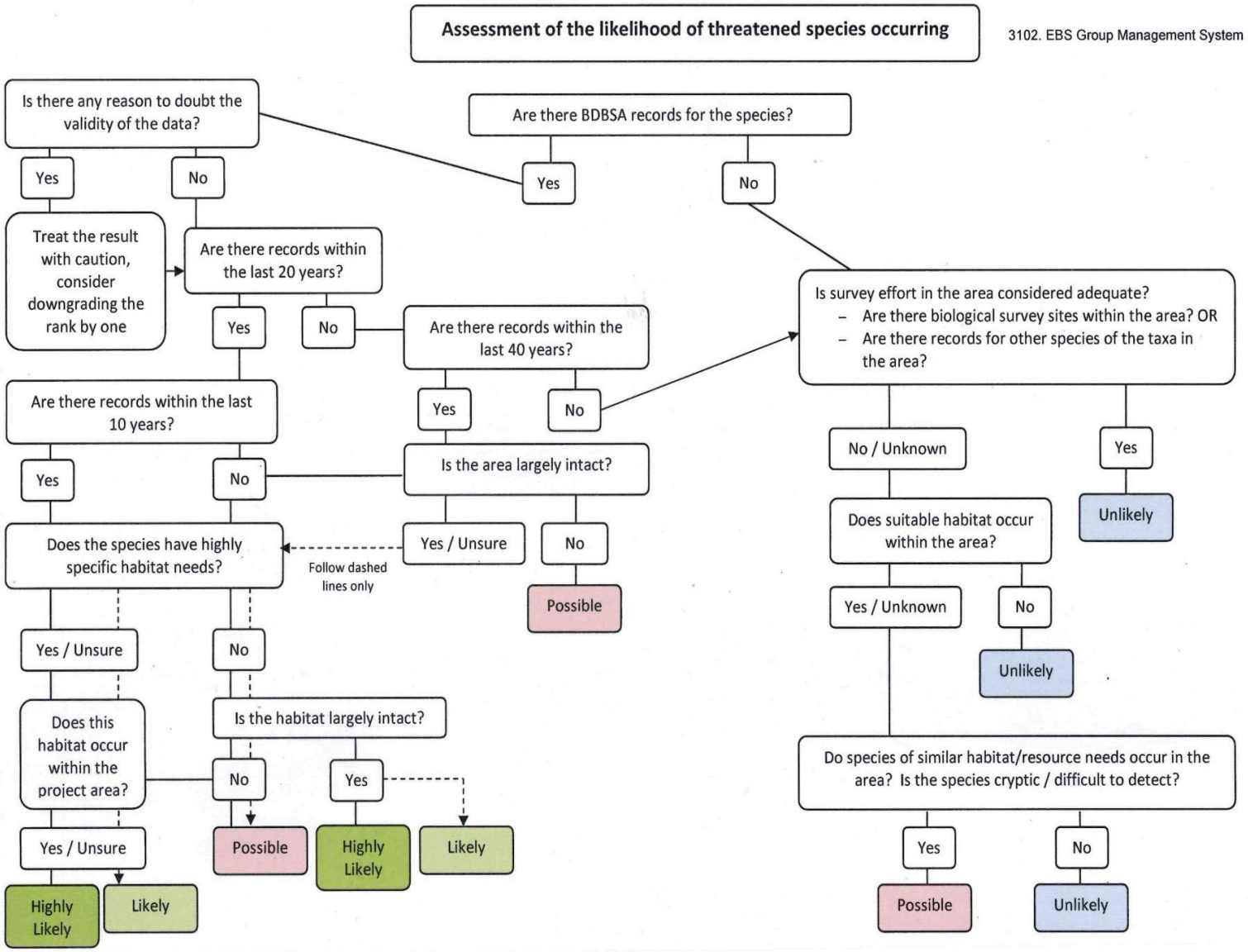
10 APPENDICES

Appendix 1 – Likelihood of occurrence assessment framework



Appendix 2 – Native flora species identified during September 2022 field survey

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Acacia calamifolia																✓			
Acacia hakeoides	Hakea Wattle			✓															
Acacia nyssophylla	Spine Bush				✓														
Acacia oswaldii	Umbrella Wattle					✓													
Acacia provincialis/retinodes						✓													
Acacia pycnantha	Golden Wattle				✓		✓	✓											
Acacia retinodes	Wirilda			✓															
Acacia sp.	Wattle															✓			
Acaena echinata	Sheep's Burr				✓					✓	✓								
Alectryon oleifolius ssp. canescens	Bullock Bush					✓													
Amyema miquelii	Box Mistletoe					✓													
Anthosachne scabra	Native Wheat-grass													✓					
Arthropodium sp.	Vanilla-lily					✓				✓			✓	✓					
Atriplex semibaccata	Berry Saltbush												✓						
Atriplex stipitata	Bitter Saltbush				✓	✓	✓	✓		✓			✓			✓			
Atriplex stipitata	Bitter Saltbush			✓															
Austrostipa blackii	Crested Spear-grass														✓				
Austrostipa drummondii	Cottony Spear-grass				✓	✓	✓	✓	✓	✓					✓	✓	✓		
Austrostipa drummondii	Cottony Spear-grass														✓				
Austrostipa elegantissima	Feather Spear-grass				✓	✓													
Austrostipa eremophila	Rusty Spear-grass			✓															

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Austrostipa mollis	Soft Spear-grass														✓				
Austrostipa nitida	Balcarra Spear-grass						✓			✓			✓		✓				
Austrostipa nodosa	Tall Spear-grass												✓						
Austrostipa scabra ssp.	Rough Spear-grass				✓			✓		✓	✓		✓	✓		✓	✓		
Austrostipa sp.	Spear-grass					✓					✓				✓				
Brachyscome lineariloba	Hard-head Daisy				✓	✓				✓									
Brachyscome sp.	Native Daisy									✓									
Bulbine bulbosa	Bulbine-lily					✓				✓									
Bulbine sp.	Bulbine-lily									✓	✓								
Bursaria spinosa ssp.	Bursaria																✓		
Callitris gracilis	Southern Cypress Pine					✓													
Calocephalus citreus	Lemon Beauty-heads										✓								
Cassytha sp.	Dodder-laurel				✓	✓													
Cheilanthes austrotenuifolia	Annual Rock-fern													✓					
Chenopodiaceae sp.	Goosefoot Family												✓						
Chenopodium desertorum ssp.	Desert Goosefoot									✓									
Chrysocephalum apiculatum	Common Everlasting									✓									
Chrysocephalum apiculatum	(blank)										✓								
Chrysocephalum semipapposum	Clustered Everlasting				✓		✓			✓									
Convolvulus angustissimus	Narrow-leaf Bindweed													✓					
Crassula sp.	Crassula/Stonecrop				✓			✓		✓				✓		✓	✓		
Crassulaceae sp.	Crassula/Stonecrop Family									✓									

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Cryptandra campanulata	Long-flower Cryptandra	R								✓							✓		
Cryptandra campanulata	Silky Cryptandra									✓									
Cryptandra sp.	Cryptandra										✓								
Cymbonotus preissianus	Austral Bear's-ear										✓			✓					
Cymbopogon ambiguus	Lemon-grass													✓			✓		
Cymbopogon sp.	Lemon Grass							✓											
Cyperus vaginatus	Stiff Flat-sedge											✓							
Dianella revoluta var.					✓														
Dissocarpus paradoxus	Ball Bindyi				✓														
Dodonaea baueri	Crinkled Hop-bush				✓	✓	✓				✓					✓			
Dodonaea procumbens	Trailing Hop-bush	V	VU								✓								
Duma florulenta	Lignum											✓							
Einadia nutans ssp.	Climbing Saltbush				✓									✓			✓		
Enchylaena tomentosa var.	Ruby Saltbush				✓	✓		✓	✓	✓						✓	✓		
Enchylaena tomentosa var.	Ruby Saltbush			✓															
Eremophila oppositifolia ssp.	Opposite-leaved Emubush			✓															
Erodium crinitum	Blue Heron's-bill			✓															
Erodium sp.	Heron's-bill/Crowfoot					✓				✓					✓	✓			
Eryngium ovinum	Blue Devil	V									✓								
Eucalyptus camaldulensis ssp. camaldulensis	River Red Gum																	✓	
Eucalyptus gracilis	Yorrell				✓	✓	✓												
Eucalyptus leptophylla	Narrow-leaf Red Mallee					✓													

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Eucalyptus leucoxylon ssp. leucoxylon	South Australian Blue Gum											✓							
Eucalyptus odorata	Peppermint Box											✓							
Eucalyptus oleosa ssp.						✓													
Eucalyptus porosa	Mallee Box				✓	✓	✓												
Eucalyptus socialis ssp.	Beaked Red Mallee				✓	✓													
Eutaxia microphylla	Common Eutaxia				✓														
Exocarpos aphyllus	Leafless Cherry				✓	✓	✓												
Galium sp.	Bedstraw										✓								
Geraniaceae sp.	Geranium Family										✓								
Geranium retrorsum	Grassland Geranium										✓								
Glycine sp.	Glycine	V												✓			✓		
Gonocarpus tetragynus	Small-leaf Raspwort													✓					
Goodenia pinnatifida	Cut-leaf Goodenia					✓				✓							✓		
Goodenia pusilliflora	Small-flower Goodenia					✓													
Gramineae sp.	Grass Family					✓				✓					✓				
Haeckeria punctulata	Sticky Haeckeria				✓														
Hakea leucoptera ssp. leucoptera	Silver Needlewood																✓		
Hyalosperma glutinosum/semisterile	Sunray									✓	✓								
Hypoxis sp.	Yellow Star-lily					✓	✓			✓	✓		✓	✓	✓				
Isoetopsis graminifolia	Grass Cushion												✓						
Lepidium sp.	Peppercress									✓									
Lomandra effusa	Scented Mat-rush									✓			✓			✓	✓		
Lomandra multiflora ssp.	Many-flower Mat-rush									✓	✓						✓		

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Lomandra multiflora ssp. dura	Hard Mat-rush									✓									
Lysiana exocarpi ssp. exocarpi	Harlequin Mistletoe																✓		
Maireana aphylla	Cotton-bush					✓			✓				✓			✓	✓		
Maireana appressa	Pale-fruit Bluebush															✓			
Maireana brevifolia	Short-leaf Bluebush			✓		✓		✓	✓				✓			✓			
Maireana enchylaenoides	Wingless Fissure-plant									✓									
Maireana georgei	Satiny Bluebush															✓			
Maireana planifolia	Flat-leaf Bluebush					✓													
Maireana pyramidata	Black Bluebush					✓	✓						✓			✓			
Maireana rohrlachii	Rohrlach's Bluebush	R			✓	✓							✓			✓			
Maireana sedifolia	Bluebush				✓														
Maireana sp.	Bluebush/Fissure-plant									✓									
Maireana trichoptera	Hairy-fruit Bluebush															✓			
Maireana triptera	Three-wing Bluebush					✓										✓			
Melaleuca brevifolia	Short-leaf Honey-myrtle				✓														
Melaleuca lanceolata	Dryland Tea-tree			✓															
Melaleuca uncinata	Broombush					✓													
Melicytus angustifolius ssp. divaricatus	Tree Violet									✓	✓								
Minuria leptophylla	Minnie Daisy									✓									
Minuria sp.	Minuria						✓												
Muehlenbeckia gunnii	Coastal Climbing Lignum																✓		
Myoporum platycarpum ssp.	False Sandalwood				✓	✓		✓											

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Nitraria billardierei	Nitre-bush					✓										✓			
Olearia minor	Heath Daisy-bush					✓													
Olearia pimeleoides	Pimelea Daisy-bush				✓	✓													
Ophioglossum sp.	Adders-tongue														✓				
Oxalis perennans	Native Sorrel							✓		✓	✓			✓	✓		✓		
Pauridia vaginata var. vaginata	Yellow Star				✓					✓									
Phragmites australis	Common Reed			✓															
Pittosporum angustifolium	Native Apricot				✓	✓	✓												
Plantago sp.	Plantain										✓								
Ptilotus spathulatus	Pussy-tails				✓		✓			✓			✓	✓	✓				
Rhagodia parabolica	Mealy Saltbush					✓	✓	✓								✓	✓		
*Rhodanthe anthemoides**	Chamomile Sunray	E		✓															
Rhodanthe pygmaea	Pigmy Daisy				✓	✓											✓		
Roepera crenata	Notched Twin-leaf															✓			
Roepera glauca	Pale Twinleaf				✓	✓	✓									✓			
Rumex dumosus	Wiry Dock	R								✓	✓			✓					
Rumex sp.	Dock										✓								
Rytidosperma erianthum	Hill Wallaby-grass														✓				
Rytidosperma setaceum	Bristly Wallaby-grass														✓				
Rytidosperma sp.	Wallaby-grass					✓	✓	✓		✓	✓		✓		✓	✓	✓		
Salsola australis	Buckbush												✓			✓	✓		
Scleranthus pungens	Prickly Knawel									✓									
Sclerolaena diacantha	Grey Bindyi				✓	✓	✓						✓			✓			
Sclerolaena obliquicuspis	Oblique-spined Bindyi			✓		✓													

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Sclerolaena uniflora	Small-spine Bindyi					✓													
Senecio glossanthus	Annual Groundsel				✓														
Senecio linearifolius	Fireweed Groundsel																		✓
Senecio quadridentatus	Cotton Groundsel				✓														
Senna artemisiodes ssp. coriaceae	Desert Senna				✓											✓	✓		
Senna artemisioides ssp. artemisioides x ssp. coriacea	Desert Senna						✓												
Senna artemisioides ssp. filifolia	Fine-leaf Desert Senna				✓														
Sida corrugata					✓														
Stackhousia monogyna	Creamy Candles									✓	✓						✓		
Stackhousiaceae sp.										✓									
Swainsona behriana	Behr's Swainson-pea	V								✓									
Swainsona tephrotricha	Ashy-haired Swainson-pea						✓												
Themeda triandra	Kangaroo Grass							✓									✓		
Velleia arguta	Velleia									✓									
Vittadinia blackii	Narrow-leaf New Holland Daisy				✓		✓			✓	✓								
Vittadinia cuneata var.	Fuzzy New Holland Daisy									✓							✓		
Vittadinia gracilis	Woolly New Holland Daisy					✓	✓		✓	✓	✓			✓	✓	✓			
Vittadinia megacephala	Giant New Holland Daisy				✓								✓						
Wahlenbergia sp.	Bluebell																		✓

Scientific Name	Common Name	NPW Act	EPBC Act	Opportune	VA01	VA02	VA03	VA04	VA05	VA06	VA07	VA08	VA09	VA10	VA11	VA12	VA13	VA14	VA15
Wurmbea dioica ssp.	Early Nancy				✓	✓				✓	✓								
Zygophyllum aurantiacum/eremaeum	Shrubby Twinleaf				✓	✓	✓												
Abbreviations: Sp.: species; ssp.: subspecies; EPBC Act: VU = Vulnerable; NPW Act: R = Rare, V = Vulnerable																			

Appendix 3 – Exotic flora species identified during September 2022 field survey

Scientific Name	Common Name	Weed of National Significance (WoNs)	LSA Act Status
Acacia decurrens	Early Black Wattle		
Arctotheca calendula	Cape Weed		
Asphodelus fistulosus	Onion Weed		
Avena barbata	Bearded Oat		
Avena sp.	Oat		
Brassica sp.			
Bromus sp.	Brome		
Buglossoides arvensis	Sheepweed		
Capsella bursa-pastoris	Shepherd's Purse		
Carrichtera annua	Ward's Weed		
Carthamus lanatus	Saffron Thistle		
Casuarinaceae sp.	Sheoak Family		
Cotula coronopifolia	Water Buttons		
Cynara cardunculus ssp. flavescens	Artichoke Thistle		
Echium plantagineum	Salvation Jane		Declared
Erodium botrys	Long Heron's-bill		
Erodium cicutarium	Cut-leaf Heron's-bill		
Galium divaricatum	Slender Bedstraw		
Galium sp.	Bedstraw		
Hordeum vulgare	Barley		
Hypochaeris glabra	Smooth Cat's Ear		
Hypochaeris sp.	Cat's Ear		
Juncus capitatus	Dwarf Rush		
Lycium ferocissimum	African Boxthorn	WoNs	Declared
Malva sp.	Mallow		
Marrubium vulgare	Horehound		Declared
Medicago polymorpha	Burr-medic		
Medicago sp.	Medic		
Mesembryanthemum nodiflorum	Slender Iceplant		
Moraea setifolia	Thread Iris		
Onopordum acaulon	Horse Thistle		
Osteospermum monstrosum	One-eye Monster		
Reseda lutea	Cut-leaf Mignonette		Declared
Romulea rosea var. australis	Common Onion-grass		
Rumex crispus	Curled Dock		
Salix sp.	Willow	WoNs	Declared

Scientific Name	Common Name	Weed of National Significance (WoNs)	LSA Act Status
Salvia verbenaca var.	Wild Sage		
Scabiosa atropurpurea	Pincushion		
Sisymbrium erysimoides	Smooth Mustard		
Sisymbrium irio	London Mustard		
Sisymbrium sp.	Wild Mustard		
Sonchus asper	Rough Sow-thistle		
Sonchus oleraceus	Common Sow-thistle		
Trifolium arvense var. arvense	Hare's-foot Clover		
Trifolium sp.	Clover		

Appendix 4 – Fauna species identified during field survey

Scientific Name	Common Name	Conservation Status	Number of individuals for each observation method.	
			Point Count	Opportune
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		6	0
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		14	0
Acanthiza lineata	Striated Thornbill		10	0
Acanthiza nana	Yellow Thornbill		1	0
Acanthiza uropygialis	Chestnut-rumped Thornbill		2	9
Alauda arvensis arvensis	Eurasian Skylark*		14	0
Anthochaera carunculata	Red Wattlebird			1
Anthus australis	Australian Pipit		19	8
Aphelocephala leucopsis leucopsis	Southern Whiteface		32	1
Aquila audax audax	Wedge-tailed Eagle		2	46
Araneae sp.	Spiders (true spiders)			0
Artamus cyanopterus	Dusky Woodswallow		6	0
Barnardius zonarius	Australian Ringneck			2
Barnardius zonarius barnardi	Mallee Ringneck		2	0
Cacomantis pallidus	Pallid Cuckoo		4	0
Capra hircus	Goat (Feral Goat)*			20
Chalcites basalis	Horsfield's Bronze Cuckoo		1	0
Chenonetta jubata	Maned Duck			2
Cincloramphus cruralis	Brown Songlark		39	6
Circus assimilis	Spotted Harrier			1
Climacteris picumnus picumnus	Brown Treecreeper			1
Colluricincla harmonica	Grey Shrikethrush		6	0
Coracina novaehollandiae	Black-faced Cuckooshrike		4	2
Corcorax melanorhamphos	White-winged Chough	NPW: Rare	1	5
Corvus coronoides	Australian Raven		40	0
Corvus mellori	Little Raven		7	6
Corvus sp.	Crows			12
Coturnix pectoralis	Stubble Quail			4
Crinia signifera	Common Froglet			2
Dromaius novaehollandiae	Emu			4
Egretta novaehollandiae	White-faced Heron			2
Eolophus roseicapilla	Galah		28	102
Epthianura albifrons	White-fronted Chat		6	8
Falco berigora	Brown Falcon		4	7
Falco cenchroides	Nankeen Kestrel		1	38
Falco subniger	Black Falcon	NPW: Rare		1
Felis catus	Domestic Cat (Feral Cat)*			1
Gallirallus philippensis mellori	Buff-banded Rail			1
Gavicalis virescens	Singing Honeyeater		5	7

Scientific Name	Common Name	Conservation Status	Number of individuals for each observation method.	
			Point Count	Opportune
Gehyra lazelii	Southern Rock Dtella			1
Grallina cyanoleuca	Magpielark		1	1
Gymnorhina tibicen	Australian Magpie		26	11
Haliastur sphenurus	Whistling Kite			1
Lasiorhinus latifrons	Southern Hairy-nosed Wombat			9
Lepus europaeus	European Brown Hare*			1
Limnodynastes dumerilii	Banjo Frog			2
Limnodynastes tasmaniensis	Spotted Marsh Frog			1
Macropus (Osphranter) robustus	Euro			1
Macropus (Osphranter) rufus	Red Kangaroo			31
Macropus fuliginosus	Western Grey Kangaroo		3	87
Malurus assimilis assimilis	Purple-backed Fairywren		17	1
Malurus leucopterus leuconotus	White-winged Fairywren		18	6
Malurus sp.	fairywrens			1
Manorina flavigula	Yellow-throated Miner		3	0
Mirafra javanica	Horsfield's Bush Lark		8	1
Neophema elegans elegans	Elegant Parrot	NPW: Rare		12
Nesoptilotis leucotis	White-eared Honeyeater		1	0
Ocyphaps lophotes	Crested Pigeon		11	0
Oryctolagus cuniculus	Rabbit (European Rabbit)*			42
Pardalotus striatus	Striated Pardalote		2	0
Passer domesticus domesticus	House Sparrow*		27	1
Petrochelidon ariel	Fairy Martin			3
Petrochelidon nigricans	Tree Martin			6
Petroica goodenovii	Red-capped Robin		5	4
Pomatostomus superciliosus	White-browed Babbler		11	1
Psephotellus varius	Mulga Parrot		1	3
Ptilotula ornata	Yellow-plumed Honeyeater		1	0
Pyrrholaemus brunneus	Redthroat		12	0
Rhipidura leucophrys leucophrys	Willie Wagtail		4	2
Smicrornis brevirostris	Weebill		10	2
Strepera versicolor	Grey Currawong		1	0
Sturnus vulgaris vulgaris	Common Starling*		2	20
Tadorna tadornoides	Australian Shelduck			2
Tiliqua rugosa	Sleepy Lizard		1	2
Vulpes Vulpes	Fox (Red Fox)*			4

Appendix 5 – Likelihood assessment of flora and fauna identified in the PMST and from historical records

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
FLORA						
Acacia glandulicarpa (Hairy-pod Wattle)	VU	E	1	May	Semi-arid environments with a mean annual rainfall of 400–500 mm, with many records at sites coinciding with gentle slopes at the transition zone between heavy clay/gravel soils on the flats and sandy soils on the rises. In SA it is known from Burra Creek Gorge and Hanson in mixed vegetation including *E. socialis* and *C. gracilis* Woodland, *Dodonaea viscosa* Shrubland, *Acacia carneorum* and *Hakea leucoptera* Shrubland and *Acacia pycnantha* Tall Shrubland (DCCEEW, 2022).	Possible - no records within 5 km of the Project Area, however known populations occur nearby to the south of Burra, and some similar vegetation associations occur within the Project Area, including *Hakea leucoptera* shrubland.
Acacia iteaphylla (Flinders Ranges Wattle)		R	2	2004	Endemic to SA, found naturally from the FR and northern MLR westward across to the Gawler Ranges (EP). Widely planted and naturalised beyond its native range in some parts of south-eastern and southern SA. Grows mainly among rocky outcrops on hillsides or along rocky creeks in valleys (DEW, 2022b).	Possible - not observed during field survey, but recent nearby records occur, and it is likely to occur as a planted specimen.
Acacia menzelii (Menzel's Wattle)	VU	V	1	Known	Endemic to SA. Localised in a small area in the Murray region near Monarto and in the FR around Brachina Gorge, where it occurs in open scrub, often associated with *E. socialis and E. incrassata* on grey-brown loamy soils (DEW, 2022c).	Unlikely - not observed during the field survey, no records in the search area and associated vegetation types are absent.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Acacia spilleriana (Spiller's Wattle)	EN	E	1	Likely	Endemic to SA, this species has severely fragmented populations occurring in the northern Mount Lofty Ranges and in the ranges around Burra and Auburn. Its range extends from Burra, south to Tarlee and east to Robertstown. Most populations are on road verges, except for larger populations that occur in the Burra Gorge/Hallelujah Hills area. Grows on rocky hills, commonly along watercourses and roadsides. Associated with species such as *Acacia calamifolia* (Wallowa) and communities dominated by *Eucalyptus gracilis* (Yorrell), *E. socialis* (Beaked Red Mallee) and *E. brachycalyx* (Gilja) open scrub with a shrubby understorey and *E. camaldulensis* (River Red Gum) woodland (DCCEEW, 2022).	Possible - no records within 5 km of the Project Area, and the Project Area is north of its current known range, however potentially suitable habitat occurs, though it was not observed during the field survey.
Austrostipa gibbosa (Swollen Spear-grass)		R	2	2013	In SA grows in FR, NL, MU, SL and SE regions. Grows in rich loamy soils along creeks and in other seasonally wet places. Also prefers open forests and woodlands or grasslands with *Eucalyptus odorata, Acacia pycnantha, Allocasuarina verticillata* and *Rytidosperma setaceum* (DEW, 2022d).	Known - recent records within Mokota CP, and likely to occur elsewhere in Project Area, though not recorded on survey.
Brachyscome ciliaris var. *subintegrifolia*		R	2	1994	*Brachyscome ciliaris* is a polymorphic species with several described varieties (var.), most of which do not have distinct geographical or ecological ranges. The var. *subintegrifolia* is distinguished by its entire leaf (eFlora	Unlikely - not observed during the field survey, records in the search area over 30 years old. Associated vegetation types not known.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
					SA, 2022). Old records occur to the north of the Project Area.	
Caladenia tensa (Greencomb Spider-orchid, Rigid Spider-orchid)	EN		1	Known	Found in the east and upper South-east of SA, including Telowie Gorge, Murray Bridge and Mt Boothby CP. Grows in dry woodland and mallee on red-brown sandy loams in Yellow Gum (*Eucalyptus leucoxylon*) and Cypress (*Callitris preissii*) Woodland (DCCEEW, 2022).	Unlikely - no nearby records, no preferred habitat observed in the Project Area and not detected during field survey.
Codonocarpus pyramidalis (Slender Bell-fruit, Camel Poison)	VU	E	1, 2	Known, 2003	Scattered throughout the FR, northern MLR, and eastern regions of SA. Grows on crests of hills and ridges, slopes and along creeks in loamy sand or sandy clay loam.	Possible - records from Caroona Creek CP to the northeast of the Project Area. Potentially suitable habitat occurs on eastern slopes in Mallee vegetation. Not detected on field survey.
Crassula peduncularis (Purple Crassula)		R	2	1999	Grows in marshy areas which are rarely flooded, mainly from SE Australia (eFlora SA). One record, over 20 years old from nearby Project Area.	Possible - old records exist within the search area, inconspicuous species easily overlooked. Some potentially suitable habitats in low-lying areas, though not detected on field survey.
Crassula sieberiana (Sieber's Crassula)		E	2	2009	Found in southern MLR on rock ledges and in crevices and on seasonally inundated ground (DEW, 2022e).	Highly likely - recent records exist within Mokota CP. An inconspicuous species easily overlooked, with some potentially suitable habitat in low-lying areas of Project Area, though not detected on field survey.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Cryptandra campanulata (Long-flower Cryptandra)		R	2	2021	Grows in rocky habitats of the northern MLR and Southern FR (Kellerman, 2020).	Known - detected in low numbers, in Lomandra Grassland vegetation association (VA06) and within Hakea leucoptera Shrubland (VA13).
Cullen parvum (Small Scurf-pea)		V	2	2002	Found in southern FR to MLR in grassland, grassy woodland and open forest vegetation on alluvial plains, creeks, ephemeral pools and river channels (DEW, 2022f).	Likely - records over 20 years old from within Mokota CP. Inconspicuous species likely to occur in suitable habitat within Project Area.
Dianella longifolia var. *grandis* (Pale Flax-lily)		R	2	2013	Recorded from southern FR, MLR and SE in SA in grassy woodland (DEW 2022g)	Known - not observed during field survey, but recent scattered records occur in the west of the Project Area.
Diuris behrii (Behr's Cowslip Orchid)		V	2	2016	Found in the southern FR, MLR and EP in native grassland, open woodland and grassy forest on fertile soils, especially among Kangaroo Grass and *Triodia* on gentle slopes and flats (DEW, 2022h).	Known - recent records from within Mokota CP, though not within listed preferred habitat.
Dodonaea procumbens (Trailing Hop-bush)	VU	V	1, 2	Known, 2021	Widely but patchily distributed across south-eastern Australia in NSW, Vic and SA. In SA it occurs near Port Lincoln, Clare, Burra, in the MLR and on KI. Associated with a wide range of vegetation, including in grassland meadows of Mokota Conservation Park (DCCEEW, 2022).	Known - observed during field survey in Mokota CP. Inconspicuous species which may occur in other suitable habitat throughout the Project Area.
Dodonaea subglandulifera (Peep Hill Hop-bush)	EN	E	1	Likely	Endemic to SA with a restricted and disjunct distribution. Recorded from semi-arid mallee areas of SAMDB, NY, FL, SAAL. Known populations occur around Robertstown (Moritz and Bickerton, 2010).	Unlikely - no records from within 5km of the Project Area. Known populations occur to the south.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Eremophila subfloccosa ssp. *glandulosa* (Green-flower Emubush)		R	2	1993	Occurs in two disjunct populations, one in WA and the other in SA in the YP, NMLR, MU and SMLR botanical regions. Limited habitat information available, however thought to occur in alkaline soils including gravel, sandy, clay, loam and laterite on undulating plains, margins of salt lakes and disturbed roadsides (Australian National Herbarium, 2022).	Possible - no preferred habitat in Project Area. Historical record within largely cleared area. Not confirmed on field survey.
Eryngium ovinum (Blue Devil)		V	2	2019	Found in the wetter parts of the MLR and in the SE of SA in open woodland on damp clay and sandy soils (DEW, 2022i).	Known - observed in grassland and meadow vegetation associations predominantly on the western slopes of the Project Area during the field survey. Multiple historical records of the species within the Project Area.
Eryngium vesiculosum (Prostrate Blue Devil)		R	2	1993	Mainly occurs in sandy flats, often near the sea (eFlora SA, 2022).	Possible - not within preferred habitat of species, though one old (30 years), isolated record from Mokota CP. Possible misidentification.
Eucalyptus bicostata (Southern Blue Gum)		V	2	2008	Occurs as E. globulus ssp. bicostata, occurring in Victoria and NSW. Not within typical range for this species, unclear if specimen is planted.	Unlikely - not within current known range of species, not observed on field survey.
Eucalyptus percostata (Ribbed White Mallee)		R	2	2014	Mallee species endemic to SA and known on from a few localities in the southern FR including Telowie Gorge, Alligator Gorge and east of Devils Peak. Occurs on hills and slopes on loam soils (Slee *et. al*., 2019).	Possible - recent records from east of the Project Area. Potentially suitable habitat in Project Area, though not observed during field survey.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Festuca benthamiana (Bentham's Fescue)		R	2	1993	Endemic species restricted to the FR, NMLR and SMLR.	Possible - historical records in Project Area, inconspicuous species easily overlooked.
Frankenia cupularis		R	2	1993	Northern and north-eastern SA on sand flats and salt pans (DEW, 2022j). Historical record just outside of the Project Area to the northwest.	Unlikely - no suitable habitat in Project Area, historical records over 30 years old.
Juncus radula (Hoary Rush)		V	2	1993	Grows in seasonally wet places in climatically dry regions (eFlora SA, 2022).	Possible - potentially suitable habitat in low-lying depressions and ephemeral creeks. Not observed in Project Area during field survey, and historical records 30 years old.
Lepidium pseudotasmanicum (Shade Peppercress)		V	2	2013	Data deficient species.	Likely - recent records scattered to the northwest of the Project Area. Similar species *Lepidium africanum* (introduced) was observed in the Project Area which may indicate suitable habitat.
Logania saxatilis (Rock Logania)		R	2	2008	Endemic to SA, found in the FR and MLR on steep-sided sandstone gorges in open woodland, and in crevices of rocky outcrops in shallow sandy or clay rich soils.	Possible - no preferred gorge habitat in Project Area, nearby records to the south of the Project Area.
Maireana excavata (Bottle Fissure-plant)		V	2	2019	SA: FR, EP, NL, MU. In NSW common in grasslands (PlantNET, 2022).	Known - recent nearby records within the Project Area, especially Mokota CP.
Maireana rohrlachii (Rohrlach's Bluebush)		R	2	2014	Found in heavy soil. SA: FR, EP, NL, MU, YP, SL. Vic. (eFlora SA, 2022).	Known - observed throughout Project Area, scattered in Mallee associations and as dominant shrub in some

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
						grassland areas, forming its own vegetation association.
Mentha satureioides (Native Pennyroyal)		R	2	1988	SA: FR, EP, NL, YP, SL, SE. Typically, on heavy, seasonally wet soils.	Possible - historical records over 30 years old, isolated from south of the Project Area. Minimal preferred habitat in Project Area. Not detected on field survey, though inconspicuous species.
Olearia pannosa ssp. *pannosa* (Silver Daisy-bush)	VU	V	1,2	Known, 1993	Endemic to SA where it is scattered throughout agricultural areas in the EP, YP, FR, S-and NMLR, MU, SE and KI. It occurs in sandy, flat areas and in hilly rocky areas in woodland or mallee (Commonwealth Government, 2013).	Possible - potentially suitable habitat occurs, however nearby historical records are 30 years old and it was not observed in the Project Area during the field survey.
Philotheca angustifolia ssp. *angustifolia* (Narrow-leaf Wax-flower)		R	2	1998	Grows in open woodland and mallee. Data deficient species. Records from Caroona Creek CP and north of the Project Area.	Possible - no records within Project Area, nearby records over 20 years old. Possibly suitable habitat in Project Area, not observed on field survey.
Poa drummondiana (Knotted Poa)		R	2	2004	SA.: EP, NL, MU, YP. Vic. Rocky areas.	Possible - isolated record nearby, over 15 years old. Not observed in Project Area, however, inconspicuous species.
Pterostylis despectans (Lowly Greenhood (Mt Bryan Greenhood))	EN	E	1, 2	Likely, 2007	Disjunct distribution in Vic, SA, and NSW, each from very small populations. In SA, recorded from Hallet, Yacka and near Mount Bryan in gently sloping E. odorata (Peppermint Box) woodland on hard, stony loam (DCCEEW, 2022).	Unlikely - no preferred habitat in Project Area and only known from very isolated populations.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Pterostylis xerophila (Desert Greenhood)	VU	V	1	May	Precise habitat requirements are unknown, but in SA it occurs in dry woodland on fertile red loamy soils, on or around granite or quartzite rock outcrops as well as mallee woodlands with *M. uncinata* understorey. Only known from EP (Duncan, 2010).	Unlikely - not within current known distribution of the species and no nearby or historical records.
Ptilotus erubescens (Hairy-tails)		R	2	2019	Mainly in southern FR and MLR growing in fertile soil in grassy woodlands.	Known - multiple records from within Mokota CP, likely to occur in suitable habitat throughout Project Area.
Rhodanthe anthemoides (Chamomile Everlasting)		E	2	2008	Grows primarily in rocky areas, preferring sandy soils (Australian National Botanic Gardens, 2022). Unconfirmed record from within rocky creek line in Project Area during field survey.	Likely - areas of suitable habitat may occur in Project Area. Unconfirmed record in rock wall of steep creek in south of Project Area.
Rumex dumosus (Wiry Dock)		R	2	2019	Widespread from Roma in southern QLD through inland NSW and Victoria to Tasmania and west to the EP of SA and SW WA. In grasslands and disturbed grassy areas predominantly on clayey soils (PlantNET, 2022).	Known - observed throughout Project Area, scattered in various grassland and meadow vegetation.
Rytidosperma tenuius (Short-awn Wallaby-grass)		R	2	1999	Found in south-eastern Australia on clay or sandy soils in drier eucalyptus woodland (AoLA, 2022).	Possible - potentially suitable habitat in mallee woodland areas, however, most recent record is over 20 years old and it was not detected on field survey.
Senecio macrocarpus (Large-fruit Fireweed, Large-fruit Groundsel)	VU	V	1	May	Endemic to South Australia, recorded from the YP, FLMR and SE, EP and FLB, with the largest known population in Messent CP in the South-east. Utilises a diverse variety of habitats including grasslands, sedgelands, shrubland	Unlikely - not within current known range of species, no nearby records and not observed during field survey.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
					and woodland on sparsely vegetated sites on sandy loam to heavy clay (Sinclair, 2010).	
Senecio megaglossus (Superb Groundsel)	VU	E	1, 2	Likely, 1993	Confined to the northern MLR and southern FR of SA. Known populations include Orroroo, Black Rock and large population of 1000 plus plants at Newikie Creek (in the Project Area). Mostly confined to rocky creek banks and rocky gorge slopes as well as in creek beds, drainage lines and erosion gullies (Commonwealth Government, 2008a).	Likely - historical records not verified during field survey, however small areas of suitable habitat are known to occur in the Project Area.
Swainsona behriana (Behr's Swainson-pea)		V	2	2013	Grows on light or occasionally heavy soils in moist grassland and woodland. Previously widespread in the MLR and SE, but now restricted to northern and eastern side of MLR as well as NSW and Vic (DEW, 2022k).	Known - observed in grassland and meadow vegetation associations in Project Area during the field survey. Multiple historical records of the species within the Project Area.
Swainsona pyrophila (Yellow Swainson-pea)	VU	R	1	May	Occurs in mallee vegetation in inland south-eastern Australia where it is widely distributed. In SA it is recorded to occur in mallee woodland with *E. brachycalyx, E. calycogona, E. dumosa, E. gracilis* and other species including *Melaleuca uncinata* (Tonkinson and Robertson 2010).	Unlikely - no nearby records and not within current known range of the species. Highly cryptic, appearing only after fire or other disturbance.
Veronica decorosa (Showy Speedwell)		R	2	1993	Endemic to SA. Found mostly in rocky gullies and ridges primarily in the Flinders Ranges.	Possible - isolated record to the north of the Project Area, however, record is 30 years old and its preferred habitat is limited in the Project Area.
FAUNA - BIRDS						

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Actitis hypoleucos (Common Sandpiper)	Mi (W)	R	1	May	Varied habitat of coastal and interior wetlands on narrow muddy edges of billabongs, river pools, mangroves, rocks, snags , reefs or rocky beaches (Morcombe, 2011).	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded, steep sided ephemeral creeks and exposed / raised edge farm dams.
Apus pacificus (Fork-tailed Swift)	Mi (M)		1	Likely	Occupies low to very high airspace over varied habitat from rainforest to semi-desert, where it hawks for insects (Morcombe, 2011).	Possible - no nearby recent records, but may occur as a flyover
Ardeotis australis (Australian Bustard)		V	2	2009	Once widespread in open habitats across much of Australia's inland plains. Typically associated with grassland, spinifex, arid saltbush and bluebush scrub and dry woodland of mulga, mallee, and heath. Nomadic species, known to turn up in unexpected locations following rainfall events.	Possible - Project Area is on the extremity of typical known range, however this species may occasionally occur, particularly following significant rainfall events, however it is not known to be a regular resident of this area.
Calidris acuminata (Sharp-tailed Sandpiper)	Mi (W)		1	May	Fresh or saltwater wetlands on the muddy edges of lagoons, swamps, lakes, dams, and temporary floodwaters.	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded, steep sided ephemeral creeks and exposed / raised edge farm dams.
Calidris ferruginea (Curlew Sandpiper)	CE, Mi (W)	E	1	May	Intertidal mudflats of estuaries, lagoons, mangrove channels, lakes, damns, floodwaters, and flooded saltbush of inland lakes.	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded, steep sided ephemeral creeks and exposed / raised edge farm dams.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Calidris melanotos (Pectoral Sandpiper)	Mi (W)	R	1	May	Forages in shallows and soft mud in fresh and saline coastal wetlands and inland on permanent and temporary wetlands.	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded, steep sided ephemeral creeks and exposed / raised edge farm dams.
Cladorhynchus leucocephalus (Banded Stilt)		V	3	2004	Most commonly on ocean beaches, salt lakes of coast and inland and on temporary flooded saltpan lakes.	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded, steep sided ephemeral creeks and exposed / raised edge farm dams.
Corcorax melanorhamphos (White-winged Chough)		R	2,3	2015	Varied habitats of woodland, open forest, mallee, mulga, timbered watercourse margins. Typically, the prefer wetter areas, with abundant leaf litter for foraging and available mud for nest building (Morcombe, 2011). .	Highly likely - recent records exist and suitable habitat occurs across the Project Area, particularly in the eastern slopes among Mallee Woodland vegetation.
Coturnix ypsilophora australis (Brown Quail)		V	3	2014	Inhabits rank, overgrown grasslands often in damp, low-lying areas around wetlands, on the edges of open forest, roadsides and in bracken.	Likely - recent nearby record of the species, patchy areas of potentially suitable habitat near watercourses in Project Area.
Falco hypoleucos (Grey Falcon)	VU	R	1	Likely	Occurs in arid and semi-arid Australia, including the MDB, Eyre Basin, central Australia and WA. Typically found where annual rainfall is <500mm. Frequents timbered lowland plains such as *Acacia* shrublands crossed with tree-lined watercourses but may also use tussock grassland and woodland for hunting (TSSC, 2020).	Possible - no nearby recent records, however suitable habitat occurs within the Project Area and it is within the indicative 'likely' distribution map.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Falco peregrinus macropus (Peregrine Falcon)		R	2	2004	Widespread across Australia, but uncommon. Found in a variety of habitats, preferring high nest sites such as coastal and inland cliffs, woodlands near water and even high city buildings.	Likely - suitable habitat occurs in Project Area, including some potentially suitable nesting habitat.
Falco subniger (Black Falcon)		R	3	2008	Typically found along tree-lined watercourses and in isolated woodlands in arid and semi-arid regions.	Known - observed in Project Area during field survey, and historical records of the species occur. Suitable habitat occurs within the Project Area.
Gallinago hardwickii (Latham's Snipe, Japanese Snipe)	Mi (W)	R	1	May	Non-breeding migrant to the south-east of Australia where it forages in freshwater wetlands or near the coast, generally among dense cover. They use vegetation around wetlands including saltmarsh, creek edges and crops / pastures during migration.	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded, steep sided ephemeral creeks and exposed / raised edge farm dams.
Grantiella picta (Painted Honeyeater)	VU	R	1	May	Sparsely distributed from south-eastern Australia to north-western Queensland and eastern NT, migrating seasonally with fruiting of mistletoe. SA is not known to host breeding populations, with birds migrating after breeding to semi-arid regions of north-eastern SA. Inhabits mistletoes in mature trees of eucalyptus woodlands, riparian woodlands, and acacia woodlands, including utilising isolated trees on farmland or in gardens (Australian Government, 2015a).	Unlikely - no nearby records, and Project Area is on edge of known range of the species. Mistletoe present, but not abundant in Project Area.
Hieraaetus morphnoides (Little Eagle)		V	2	2016	Widespread in mainland Australia in woodland, open country and into the arid zone. Nesting in mature trees in open woodland or tree-lined watercourses.	Likely - previous records of the species within the Project Area, and suitable habitat occurs.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Motacilla cinerea (Grey Wagtail)	Mi (T)		1	May	European / Asian species which migrates in winter to Indonesia and New Guinea, occasionally reaching Australia where it may be found near fresh streams and pastures near water (Morcombe, 2011).	Unlikely - very uncommon migrant, no preferred habitat in Project Area.
Motacilla flava (Yellow Wagtail)	Mi (T)		1	May	European / Asian species which migrates in winter to sub-Saharan Africa, and South Asia, occasionally reaching Australia where it may be found near wet habitats including damp meadows and freshwater streams (Morcombe, 2011).	Unlikely - very uncommon migrant, no preferred habitat in Project Area.
Myiagra cyanoleuca (Satin Flycatcher)	Mi (T)	E	1	May	Found along the east coast of Australia from far northern QLD to Tas and south-eastern SA where it is a summer breeding migrant. Typically found in tall forests, preferring wetter habitats such as heavily forested gullies.	Unlikely - on western edge of range and no preferred habitat occurs in Project Area.
Myiagra inquieta (Restless Flycatcher)		R	3	2006	Found throughout northern, eastern and south-western Australia. Inhabits open forests and woodlands and is frequently seen on farmland.	Likely - historical records of the species over 15 years old, however potentially suitable habitat occurs in the Project Area.
Neophema elegans elegans (Elegant Parrot)		R	2	1999	Occurs in the eastern parts of SA, north to the FR and west to the EP. Inhabits a wide variety of habitats including grasslands, shrublands, mallee, woodlands, chenopod shrublands, saltmarsh and farmland.	Known - this species was observed in low numbers flying through the Project Area (western side) during the field survey. Various suitable habitats for foraging and breeding occur.
Numenius madagascariensis	CE, Mi (W)	E	1	May	Occasional migrant to SW WA and SA. Uses tidal mudflats, sand spits of estuaries, mangroves, lake shores and ocean beaches (Morcombe, 2011).	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded,

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
(Eastern Curlew, Far Eastern Curlew)						steep sided ephemeral creeks and exposed / raised edge farm dams.
Pedionomus torquatus (Plains-wanderer)	CE	E	1	Known	Distributed across north-central Vic, southern NSW Riverina region, eastern SA and west-central QLD. Sedentary species which inhabit sparse grasslands with approximately 50% bare ground, with most vegetation less than 5 cm in height. Cannot persist in agricultural landscapes though may occasionally use cereal crop stubble for shelter (Australian Government, 2015b).	Unlikely - no nearby records and most grassland habitats in Project Area have a denser cover than preferred habitat of this species.
Pezoporus occidentalis (Night Parrot)	EN	E	1	May	Most habitat records for the species are in Triodia (Spinifex) grasslands and / or chenopod shrublands in the arid and semi-arid zones, including shrubby samphire, chenopods, scattered trees and shrubs, Acacia aneura (Mulga) woodland and gibber plains (TSSC, 2016).	Unlikely - this species is presumed extinct in South Australia.
Plectorhyncha lanceolata (Striped Honeyeater)		R	2	2015	Found in eastern Australia, mainly inland from the YP in SA to the coast of NSW and north to Charters Towers in QLD. Inhabits drier forests and woodlands as well as along rivers and mangroves (Morcombe, 2011).	Possible - recent nearby record of the species and within known distribution. Suitable habitat occurs within the woodland / mallee vegetation in the east of the Project Area.
Rostratula australis (Australian Painted Snipe)	EN	E	1	May	Prefers the surrounds and shallows of well vegetated wetlands with dense low cover (Morcombe, 2011).	Unlikely - no preferred habitat in Project Area and no nearby recent records. Wetland habitat limited to highly eroded, steep sided ephemeral creeks and exposed / raised edge farm dams.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
Stagonopleura guttata (Diamond Firetail)		V	3	1998	Inhabits grassy groundcover underneath open forests, woodland, mallee, acacia scrub and timber belts along watercourses and roadsides including in farmland. Nests in dense foliage of trees or shrubs (Morcombe, 2011).	Likely - most recent nearby record is over 25 years old, however much of the habitat in the Project Area is considered suitable for this species.
Turnix pyrrhothorax (Red-chested Buttonquail)		R	3	2000	Occupies grassland on black-soil plains and other flat, heavy soil country as well as grassy woodland, rainforest margins, spinifex and crops. Breeds in grassland and sedgeland near water (Morcombe, 2011).	Possible - preferred black soil plains occur to the east but are limited within Project Area itself. Some other habitats in the Project Area may be suitable.
FAUNA - FISH						
Galaxias rostratus (Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow)	CE		1	May	Known from southern half of the MDB system. Inhabits billabongs, lakes, swamps, and rivers with a preference for still or slow flowing waters (DCCEEW, 2022).	Unlikely - no natural permanent watercourses in Project Area, and the area is far removed from its known MDB distribution.
Maccullochella peelii (Murray Cod)	VU		1	May	Naturally distributed throughout the MDB in the main channels of rivers and larger tributaries (DCCEEW, 2022).	Unlikely - no natural permanent watercourses or large river tributaries in Project Area, and the area is far removed from its known MDB distribution.
FAUNA - MAMMALS						
Nyctophilus corbeni (Corben's Long-eared Bat, South-eastern Long-eared Bat)	VU	V	1	May	Scattered within the MDB in box, ironbark and cypress pine woodland on the western slopes and plains, and roosts in tree hollows (DCCEEW, 2022).	Unlikely - no records nearby, and the Project Area is on its far western possible distribution with minimal preferred habitat.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area
FAUNA - REPTILES						
Aprasia pseudopulchella (Flinders Ranges Worm-lizard)	VU		1	Known, 2016	Known from the FR of SA, extending south to the western slopes and northern and central MLR. The species inhabits open woodland, native tussock grassland, riparian habitats, and rocky isolates, preferring stony or clay soils with a stony / rocky surface, but has also been found sheltering in soil beneath sones and rotting stumps (Commonwealth Government, 2008b).	Known - historical records occur within the Project Area and areas of suitable rocky habitat occur.
Tiliqua adelaidensis (Pygmy Blue-tongue Lizard, Adelaide Blue-tongue Lizard)	EN	E	1, 2	Known, 2019	Fragmented populations known from across the mid-north of SA, with unknown population size. Occurs in a variety of habitats, ranging from highly degraded grasslands to grasslands of high biodiversity, sparse to moderate coverage, preferably on lower slopes. The species uses empty spider burrows (trapdoor, wolf spider) as refuges and basking sites and requires these to occur in moderate abundance in the landscape. Historically (pre-1992), the species was found in chenopod and mallee scrublands with compacting or crusty sand soils associated with hollow mallee lignotubers and near surface limestone sheets (DCCEEW, 2022).	Known - species records occur in abundance particularly in the southern parts of the Project Area. Suitable habitat occurs throughout, and the species is likely to be in other areas as the Project progresses. Targeted surveys are required to confirm presence.

Scientific Name (Common Name)	EPBC Act	NPW Act	Data Source	Simple Presence / Year of Last Record	Habitat	Likelihood of Occurrence in Project Area

EPBC Act: National (*Environment Protection and Biodiversity Conservation Act 1999*). NPW Act: South Australia (*National Parks and Wildlife Act 1972*). Conservation status codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable, R: Rare, Mi (W): Migratory Wetlands Species, Mi (T): Migratory Terrestrial Species, Mi (M): Migratory Marine Species.

Presence Type: As identified in the PMST Report

Year of last record: Historical records within 5 km of the Project Area, obtained from BDBSA and Bird Life Australia – Bird Atlas Database (BDBSA Recordset number: *DEWNRBDBSA220902-2)*

Source of Information:

5. **EPBC Act Protected Matters Report (DCCEEW 2022) – 5 km buffer applied to Project Area boundary.**
6. **BDBSA data (DEW 2022a) - 5 km buffer applied to Project Area**
7. **BirdLife Australia (BDBSA data) (DEW 2022a)**
8. **Observed during field survey.**

Common abbreviations: SA: South Australia, Vic: Victoria, NSW: New South Wales, NT: Northern Territory; QLD: Queensland, Tas.: Tasmania, FR: Flinders Ranges, MLR: Mount Lofty Ranges, EP: Eyre Peninsula, MU: Murray, MDB: Murray Darling Basin; YP: Yorke Peninsula, SE: South-east.

Appendix 6 – Proposed bird and bat utilisation survey sites

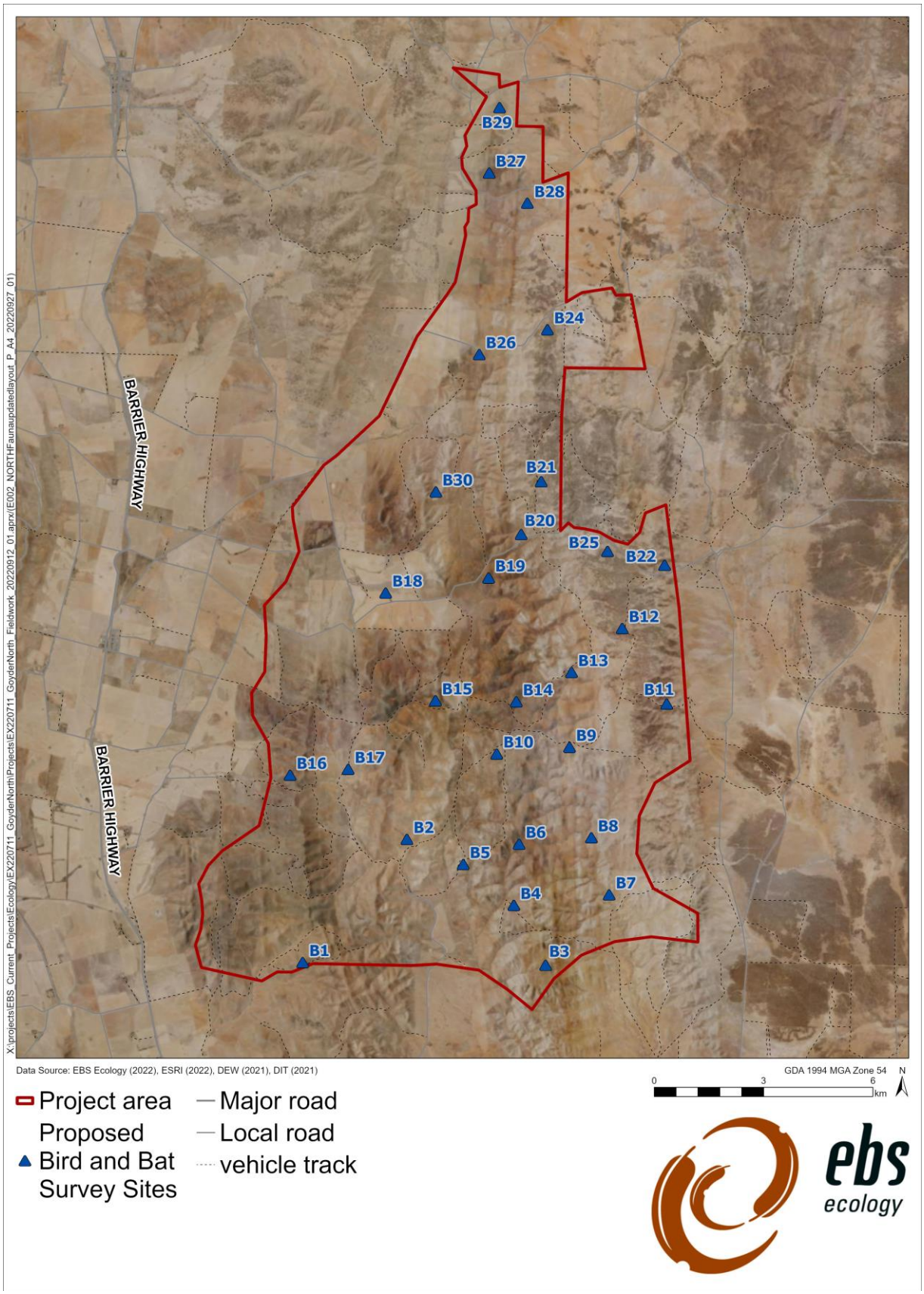


Figure 35. Proposed bird and bat utilisation survey sites across the Project Area, mapped according to vegetation type, spatial coverage and accessibility.

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Goyder North Wind Farm

Electromagnetic Interference Assessment

Neoen

12 January 2024

→ **The Power of Commitment**

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Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.

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1. Introduction

1.1 Purpose of this report

The purpose of this report is to assess the potential electromagnetic interference and subsequent impacts caused by the wind turbine layout for the proposed Goyder North Wind Farm. This report is intended to support the application approval process and to present mitigation measures to eliminate or minimise impact to existing electromagnetic (radio) systems.

1.2 Project Description

Neoen is developing the Goyder North Wind Farm (GNWF) as a part of its wider Goyder Renewables Zone (GRZ) concept. As a part of this concept, the Goyder South Hybrid Renewables Energy Project was granted Development Approval in 2021 with construction of stage 1 beginning in 2022, consisting of 412 MW of wind generation. The GRZ represents one of the most ambitious renewable energy developments proposed in South Australia and is ideally located to complement Project EnergyConnect, a large interconnector to New South Wales currently under construction by ElectraNet and TransGrid.

The proposed wind farm development will be in South Australia, approximately 150km north of Adelaide. The development involves the installation of up to 138 wind turbines across an area of approximately 19,500ha in the regional council of Goyder. The predicted power generation is 1,050,000 MWh annually.

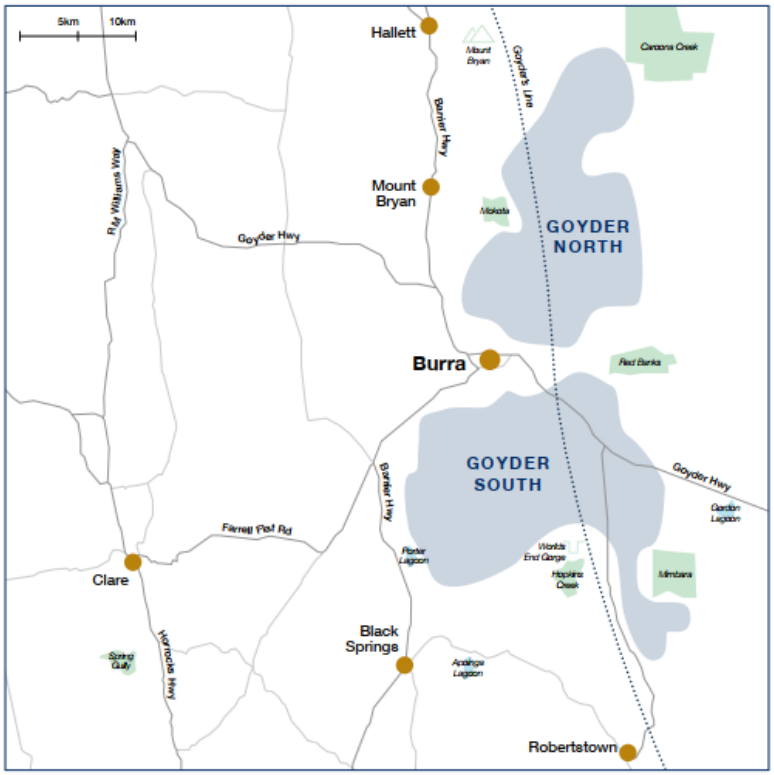


Figure 1 Goyder Renewables Zone concept

Neoen aims to build on the success of the Goyder South project and continue the progress of the GRZ concept with the GNWF development. The proposed project site is located north-east of Burra and east of the Mount Bryan township in the Goyder Regional Council area. The project will comprise of up to 1000MW of wind generation including wind turbines, meteorological masts, buried collector cables, electrical substations, operations and maintenance buildings and an overhead transmission line to connect the wind farm to the existing ElectraNet Transmission network. The overhead transmission line is proposed to connect into the Bundey substation which is being built for the SA-NSW interconnector (Project EnergyConnect). Given the scale of wind energy generation

that would be achieved by the development of the GNWF, it will likely be developed in stages, though it is not yet possible to determine the size of each stage as it is dependent on demand from electricity customers. The Goyder North site is characterised by world-class wind resources and complimentary land uses (comprising primarily of marginal grazing land located on the edge of Goyder's Line).

Figure 2 Project Area Location

The southern boundary of the proposed development is approximately 5.5km north-east of the centre of Burra. It extends approximately 22km to the north, with the northern tip being a distance of approximately 10.2km north-west of the centre of Hallett. Its western-most boundary is also positioned approximately 4.4km west of the centre of the Mount Bryan township. It is approximately 14.5km east to west at its greatest width at the south of the site, tapering to its narrowest width of 3km in the northern portion. The land within the development site is generally privately owned and comprises predominantly dryland cropping and grazing.

The area is located in the eastern portion of the Mount Lofty Ranges and wholly located within the Regional Council of Goyder. From a transport and access perspective, the region is serviced by the Barrier highway and the Burra-Morgan Highway (Goyder Highway). The project is located within the Mid North Region and the SA Murray-Darling Basin Natural Resource Management (NRM) Area. This area is generally described as a transitional zone between cropping and pastoral country. It is noted that the project is not located within a prescribed water resources area.

The Goyder North Wind Farm development comprises of:

– A multi-stage wind farm of up to 138 turbines with a capacity of approximately 1000MW, a maximum hub height of 160m, a maximum blade length of 90m, and an overall maximum height (tip height) of 240m;

– Associated infrastructure for connection to the electricity grid including substations, access tracks, underground connection cabling and transmission lines;
– Temporary construction compounds for wind components, including concrete batching plants; and
– A number of meteorological masts (in addition to those already on site) to record wind speed and other meteorological data, both pre- and post- construction.

It is envisaged that the project would be built in stages in response to the market demand and Power Purchase Agreement availability. While the size of each stage is not yet certain, the current intention is to construct two stages of up to approximately 500MW of wind generation each.

The final sizing will depend on the specific wind resource characteristics of each portion of the site and the requirements of individual power purchasers and may be less than these maximums.

1.3 Scope and limitations

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

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

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 4.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

GHD has prepared this report on the basis of information provided by Neoen and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.4 Abbreviations

The following abbreviations have been used in this report:

Table 1 Definitions

Abbreviation	Definition
ACMA	Australian Communications and Media Authority
AM	Amplitude Modulation
AMTA	Australian Mobile Telecommunications Association
BoM	Bureau of Meteorology
FM	Frequency Modulation
GHz	Gigahertz (10^9)
GNSS	Global Navigation Satellite System
kHz	Kilohertz (10^3)
LMR	Land Mobile Radio
MHz	Megahertz (10^6)
MW	Megawatt (10^6)

Abbreviation	Definition
PTMP	Point to Multi-Point
PTP	Point to Point
RFNSA	Radio Frequency National Site Archive
UHF	Ultra-High Frequency
VAST	Viewer Access Satellite Television
VHF	Very-High Frequency
WTG	Wind Turbine Generator

1.5 References

Table 2 References

Ref No	Reference
1	Visiwave™, http://www.vias.org/wirelessnetw/wndw_04_08b.html
2	Javad Ahmadi, The effects of Fresnel Zone in communication theory based on radio waves, Bulletin de la Société Royale des Sciences de Liège, Vol. 85, 2016, p. 729 - 734
3	D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002
4	Draft National Wind Farm Development Guidelines, Environment Protection and Heritage Council of Australia and New Zealand, EPHC July 2010

2. Electromagnetic Interference Theory

Electromagnetic fields are a combination of electric fields associated with a voltage source and magnetic fields associated with current flowing through a conductor. These fields increase in strength with voltage and current.

Radio system interference may occur when a wind turbine is located in such a way as to induce an unwanted disturbance to radio waves propagated between a signal source and signal receiver. The interference may occur by way of radiation of electromagnetic energy by the turbine within the operating band of the radio system, diffraction, or partial reflection of the radio system signal by the turbine tower and rotor.

The following sections briefly describe the various types of interference that may impact existing operational telecommunications services in the vicinity of the wind farm development area to provide context to the specific findings identified in Section 4 of this report.

2.1 Radiation of Electromagnetic Energy

Electromagnetic interference potentially occurs when the wind turbine electrical infrastructure radiates energy with a frequency within the operating frequency of a radio communications system.

Turbines supplied within Australia are required to be compliant with electromagnetic compatibility as defined in relevant Australian Standards. As a result of complying with these standards, the electromagnetic interference due to radiation is negligible.

Battery storage inverters, synchronous condensers, and transformers may cause interference to radio signals due to the emission of electromagnetic fields. These electric fields typically propagate over very short distances (tens of metres) and are limited to “near-field” effects.

2.2 Diffraction

Diffraction occurs when the wind turbine infrastructure is positioned such that the signal of a radio communications system is partially or temporarily blocked causing a reduction in the signal power at the radio signal receiver.

For point-to-point radio systems it is understood that the radio signal travels on a path between the signal source and signal receiver defined by an ellipsoid area known as the Fresnel zone.

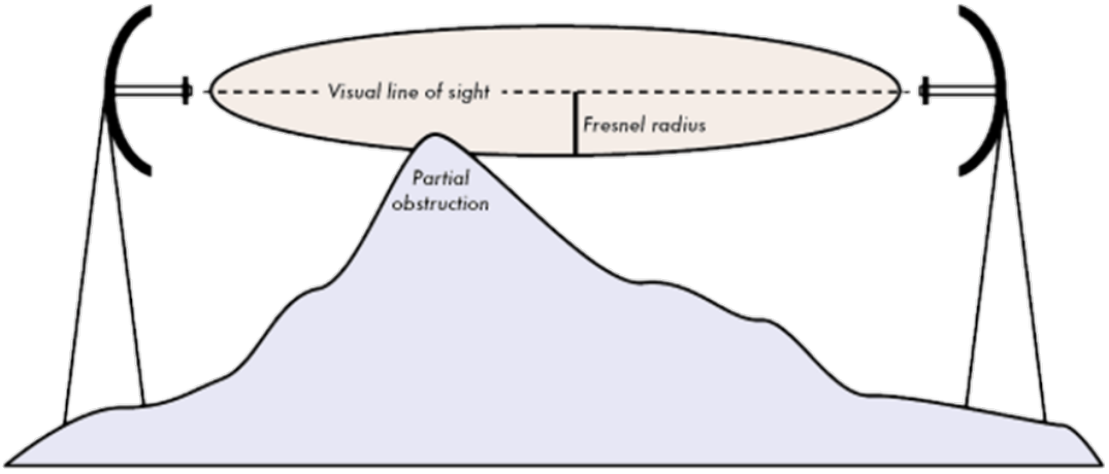


Figure 3 Fresnel Zone over the Radio Path[1]

The Fresnel zone is defined as the locus between two points, such as a radio transmitter and receiver, where the indirect ray path length from the point T to point R is multiple of the half-wavelength distance of the radio signal. Refer to Figure 2 and Figure 3 for further details.

[1] Source: Visiwave™, http://www.vias.org/wirelessnetw/wndw_04_08b.html

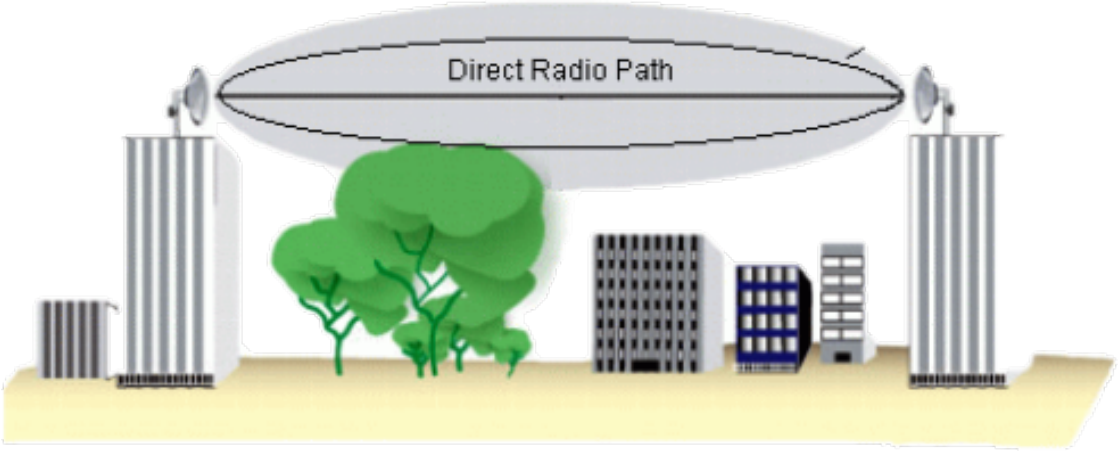


Figure 4 Fresnel Zone Clearance Criteria[2]

In the presence of an obstruction between the signal source and the signal receiver, it is generally accepted that an obstructed path provided with 60% clearance of the first Fresnel zone will operate without degradations to the communications system.

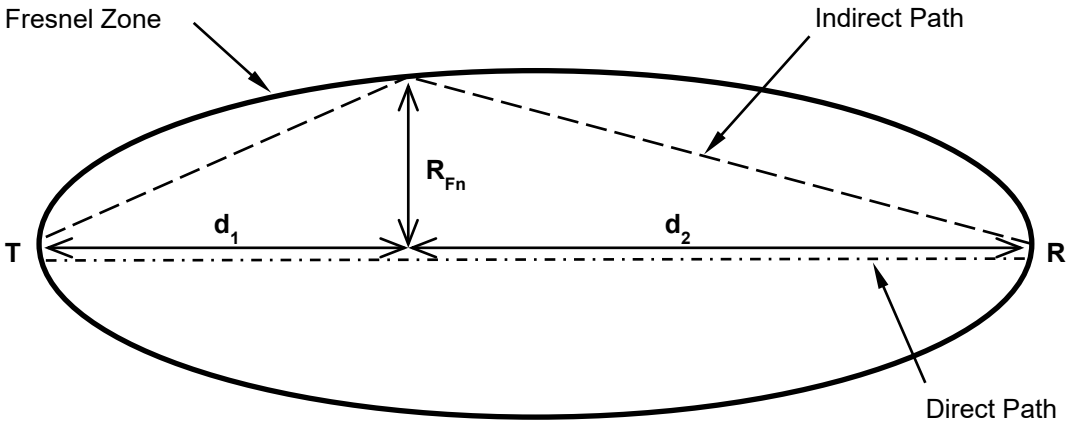


Figure 5 Fresnel Zone Calculation[3]

The Fresnel zone is defined by the formula:

$$R_{Fn} = \sqrt{\frac{n\lambda d_1 d_2}{d_1 + d_2}}$$

R_{Fn} = the nth Fresnel Zone Radius in metres

n = the nth Fresnel zone

λ = the wavelength of the transmitted signal in metres

d1 = the distance from T in metres

d2 = the distance from R in metres

[2] Javad Ahmadi, The effects of Fresnel Zone in communication theory based on radio waves, Bulletin de la Société Royale des Sciences de Liège, Vol. 85, 2016, p. 729 - 734

[3] D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002

F1 may be used to describe the first Fresnel zone between two points. F1 may also be described as the 100% Fresnel zone. In this case, F2 is the second Fresnel zone or the 200% Fresnel zone.

According to D F Bacon [Ref 3] it is recommended to design the geographic wind turbine layout such that all infrastructure including turbine blades are located outside the second Fresnel zone of all point-to-point radio systems.

The second Fresnel zone defines the region where an object such as a wind turbine may cause a reflected signal to be transmitted to the receiver at a half wavelength (180°) out of phase with the direct ray causing maximum interference potential.

The drawings included in Appendix C – Figure 1 shows the plot of ray-lines (direct line of sight) for point-to-point radio links and Appendix C – Figure 2 plots the second Fresnel zone (WTG exclusion zones) for point-to-point radio links.

2.3 Reflection

Reflection occurs when the wind turbine infrastructure is positioned such that the incident ray of a radio communication system is partially or temporarily reflected from its normal path of propagation. The complex geometrical design of the wind turbine causes the reflected signals to be dispersed or 'scattered' over a wide angle. These reflections have the potential to generate destructive interference to the radio signal resulting in signal power reduction or unwanted duplication of the radio signal as seen in Figure 4.

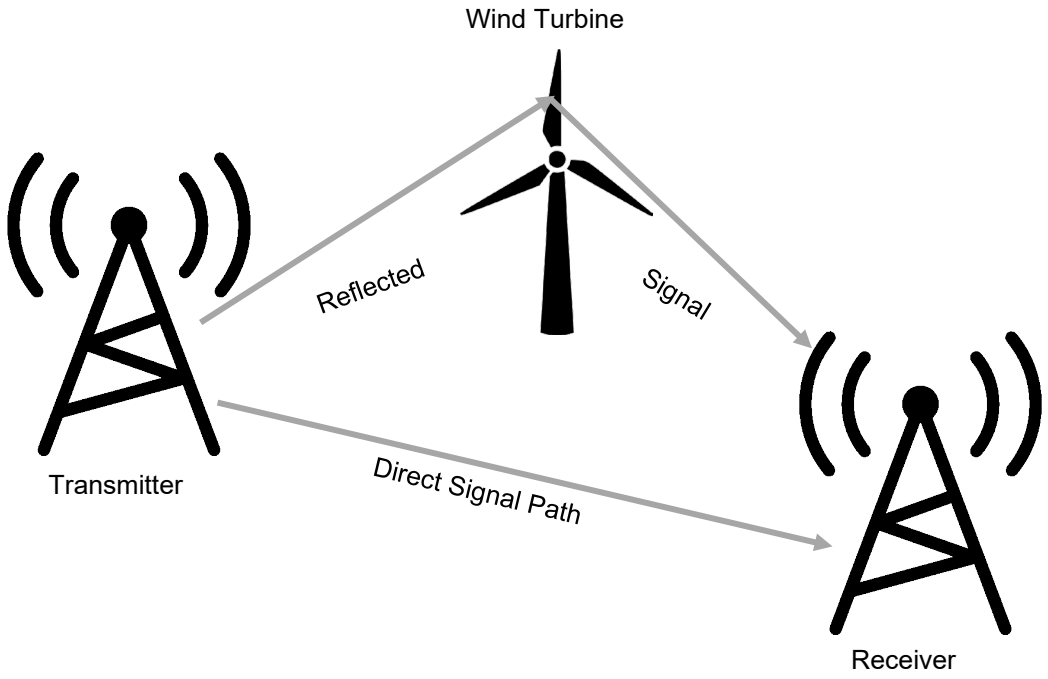


Figure 6 Reflection of Radio Signals by Wind Turbine Infrastructure

At the boundary of the second Fresnel zone, any reflected wave will be 180° out of phase with the direct signal, which can lead to cancellation effects at the receiver. As such, any turbine located along (and near) the F2 boundary has the potential to significantly degrade a radio link.

2.4 Scattering

Wind turbines have been observed to cause interference by scattering the incident signal. Scattering is described as either ‘forward’ or ‘back’ and is depicted in Figure 5 below.

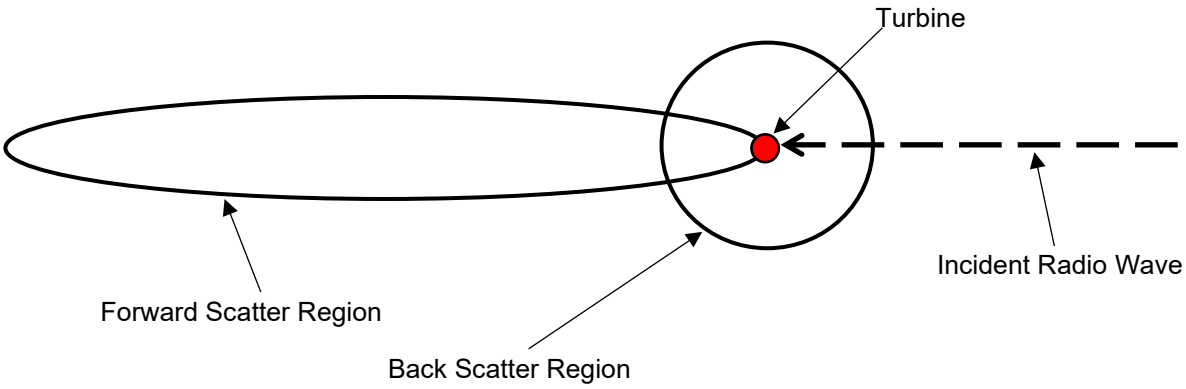


Figure 7 Scattering of Radio Signals by Wind Turbine Infrastructure

The forward scatter region is significant and can extend as far as 5 km forward from the wind turbine. Where the receiver is in direct line of sight of a turbine, but shielded from a direct signal from the transmission tower, the forward scatter region may extend beyond 5 km. The back scattering region created by the incident signal is generally less than 1 km from the turbine.

2.5 Near Field Effects

Wind turbine infrastructure located close to a radio communication system, such as within the near field of the radiating antenna, can detrimentally affect the normal radiation pattern of the antenna, causing unwanted signal power reductions to the radio system service area. The result is an alteration of the antenna's impedance.

Typical near-field exclusion zone radii are:

– 2 metres for low band VHF paging systems (i.e., under 50 MHz)
– 20 metres for UHF, LMR and cellular sites (i.e., up to 2.5 GHz)
– 720 metres for point-to-point microwave radio links (in the direction of the link)

Existing transmitters and microwave point to point links in the vicinity of the proposed wind farm have been analysed to aid in turbine micro-siting activities to mitigate the near field effects so that turbines should not be placed in paths of known microwave links. Future transmitter installations should be built outside the exclusion zones noted above. In the case of future PTP microwave links, antennas can be installed within 720 meters of a turbine, but the alignment of the link must be engineered to not point at a turbine.

3. Guidelines and Codes

In South Australia, the Planning, Development, and Infrastructure Act of 2016 establish the framework for land use regulation, but it lacks specific guidelines for evaluating the electromagnetic effects of wind farm projects.

During this assessment the *Draft National Wind Farm Development Guidelines*[4] were considered. This document provides methodologies for assessing the impacts of proposed wind farm developments. Section F "Electromagnetic Interference," outlines the issues addressed in this assessment of electromagnetic interference (EMI) and references relevant Australian Standards and publications related to EMI resulting from wind farm developments in Australia.

[4] Draft National Wind Farm Development Guidelines, Environment Protection and Heritage Council of Australia and New Zealand, EPHC July 2010

4. Analysis of Development Impact

4.1 Methodology

GHD has undertaken this electromagnetic interference assessment to determine which areas of the project site are unsuitable for the installation of turbines as well as to consider the impacts on wide-area services in the region. Information on radio sites and services in the proximity of the proposed Goyder North Wind Farm have been obtained from the ACMA Radio Communications Licence Database, covering an area of approximately 50 km radius from the centre of the provided project boundary. This distance is sufficient to capture any potential point-to-point links traversing the development area.

4.2 Radio System Search

In August 2023, a search was conducted on the Australian Communications and Media Authority (ACMA) radio communications database to identify all licensed radio systems, operating on the frequency above 30 MHz, within 50 km radius from the centre of the proposed wind farm development. Additional radio frequency information was accessed from The Australian Mobile Telecommunications Association's (AMTA) and the Radio Frequency National Site Archive (RFNSA). This search was conducted in accordance with the methodology stated in Section F of the Draft National Wind Farm Development Guidelines.

The results of the ACMA radio communications data extraction were reviewed and presented in graphical format depicting the radio site locations and ray-lines of the radio systems within the vicinity of the wind farm. The map was refined to only show those radio sites and services with the potential impact for radio-interference caused by the proposed wind farm development.

This method does not determine the impact on users of class licence services, as these services are operated on shared frequencies, can be used by member of public, and are not listed within the ACMA database.

4.3 Assumptions

The initial layout was provided to GHD in May 2023 from which GHD provided a preliminary analysis that indicated impacts to telecommunication systems. Neoen updated the wind farm layout based on the preliminary analysis and therefore, the working layout was provided to GHD in August 2023 that shows the indicative layout of 138 WTG. A final layout was provided in October 2023, where changes were made to only the transmission line locations (Appendix A).

The WTG dimensions consist of rotor diameter of up to 180m, hub height of up to 160m and overall tip height of up to 240m. These dimensions were selected based on a ‘worst case scenario’, with currently available turbines selected and a margin of safety added. This is to ensure that the assessment is applicable to any turbine selected for construction is applicable, so long as its dimensions are less than or equal to those previously stated the dimensions assessed.

4.4 Radio Technology Review

The following radio systems are considered in this assessment:

– Fixed point-to-point radio systems (Appendix C - Figure 1 & 3),
– Fixed point-to-multipoint radio systems (Appendix C - Figure 2),
– Land Mobile Radio Systems (Appendix C - Figure 4),
– AM/FM Radio Narrowcast and Broadcast (Appendix C - Figure 5),
– Digital Television Broadcast (Appendix C - Figure 6 – 8),
– Mobile Telephone and Broadband Internet Broadcast (Appendix C – Figure 10, 18, 19 – 25),
– Meteorological Radar (Appendix C - Figure 12),
– Aircraft Communications Systems (Appendix C - Figure 11),

– Defence Radio Systems,
– Trigonometrical Systems,
– Amateur Radio Systems (Appendix C - Figure 13),
– Maritime Radio Systems (Appendix C - Figure 14),
– Earth Stations (Appendix C - Figure 15),
– Scientific Radio Systems (Appendix C - Figure 16),
– Radiodetermination Station (Appendix C - Figure 17).

Radio services below 30 MHz, including AM Radio Broadcast services, were excluded from this assessment as the propagation characteristics of the radio wave does not rely on direct-ray transmission characteristic between the transmitting and receiving antennas e.g., AM radio broadcast services, operating within the Medium Frequency band of 300 Hz – 3 kHz, relies on ground wave (surface wave) propagation.

5. Radio Technology Assessment

5.1 Fixed Radio Systems

Wind turbines can heavily impact point-to-point radio systems, but the mitigation method is uncomplicated. To avoid the wind turbines downgrading or impacting the service, when determining final wind turbine locations, the turbines should not block the 200% Fresnel zone (second Fresnel Zone) exclusion zones of the radio links.

During the construction of the project, these zones should not be entered when lifting turbines into place. In the event that entering these zones is unavoidable, the link operator should be consulted prior to construction, allowing the link operator to anticipate the potential temporary service degradation and take steps to minimise or negate the impact on the communications link.

As discussed in section 4.3, the WTG layout of the Goyder North Wind Farm has developed over time due to stakeholder and GHD feedback / analysis. In particular, analysis of the initial layout resulted in multiple WTG being microsited due to being located within the second Fresnel exclusion zone to minimise service impact.

The point-to-point radio systems within 50 km radius of the centre of the proposed wind farm are shown in Figure 8.

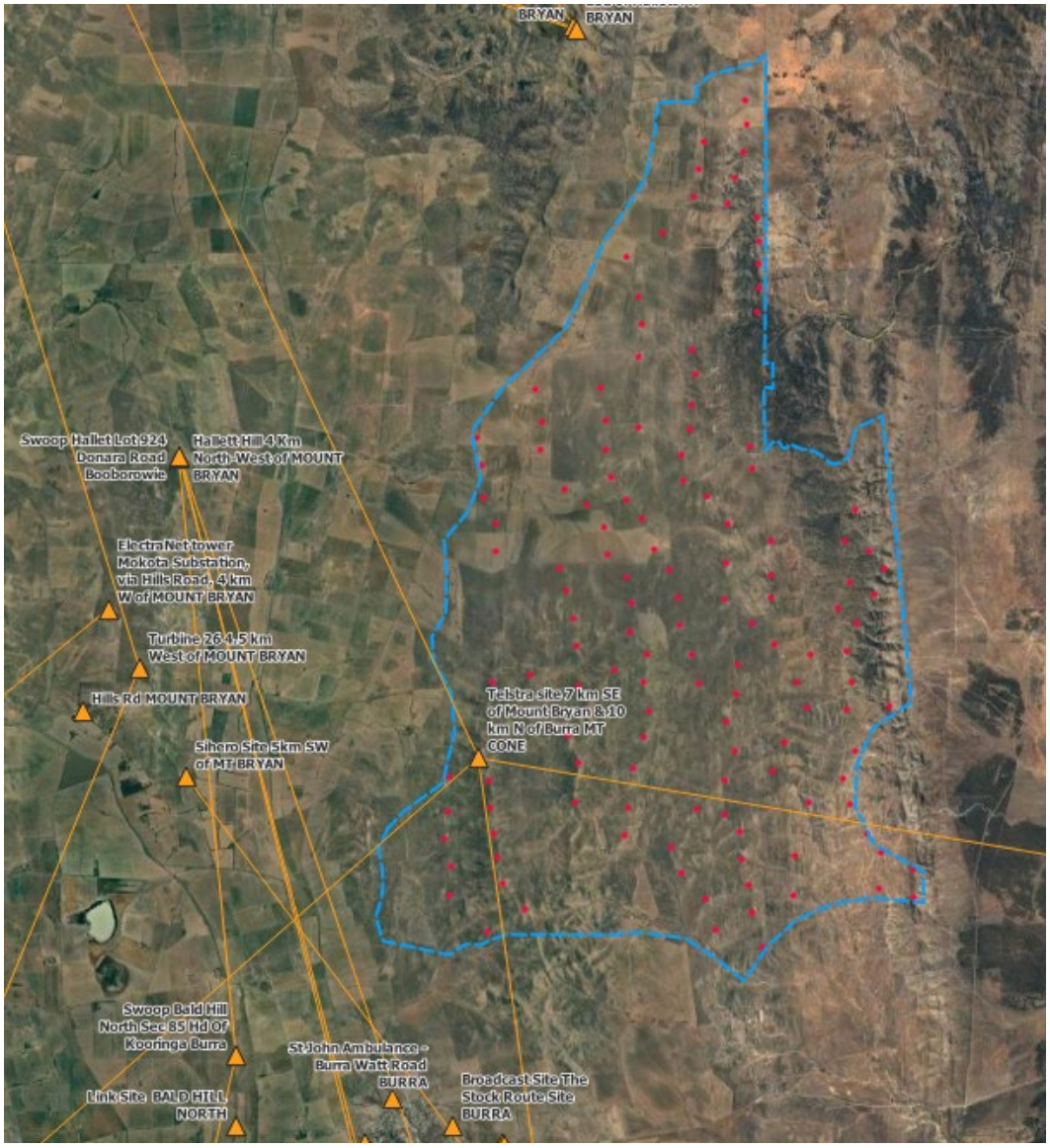


Figure 8 Fixed Point-to-Point Radio Links in Wind Farm Vicinity

Figure 9 shows the second Fresnel exclusion zone. It is evident that none of the WTG sit within an exclusion zone, however some WTG blade extents are close. Specifically, WTG1 and WTG16 sit within 25m of the point-to-point radio link second Fresnel exclusion zone.

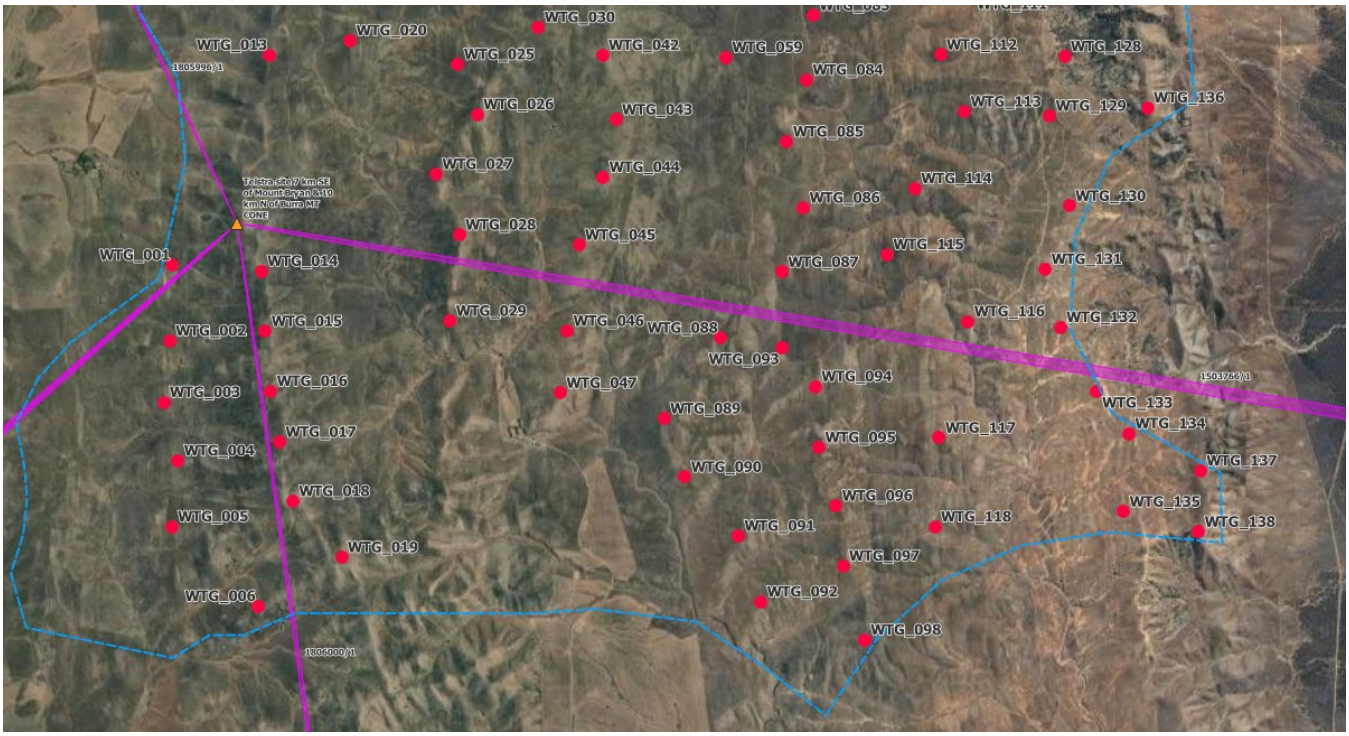


Figure 9 Fresnel Exclusion Zones of Fixed Point-to-Point Radio Links in Wind Farm Vicinity

GHD anticipates the proposed wind farm development will have nil to negligible effect on radio link performance.

Based on previous consultation with SAGRN it is desirable for 100m of separation to be maintained between any SAGRN path and the outer diameter of any turbine blade. Therefore, it would be desirable for:

– WTG1 to be microsited as far as practicable to the north-west,
– WTG15 to be microsited as far as practicable to the east,
– WTG16 to be microsited as far as practicable to the east,
– WTG17 to be microsited as far as practicable to the east.

Telstra, also operating at the Mt Cone site that sits within the wind farm boundary, have requested larger than typical set-back distances for both the site itself and proximity to the boresight (centre line) of its radio links operating from this site. The current WTG layout has been designed to typical Telstra standards as agreed and used on prior projects; however, Neoen are still in discussions with Telstra. Consultation will continue between the parties during the DA assessment process.

Refer to Appendix D for more information regarding consultation with Telstra and SAGRN.

5.2 Fixed Point-to-Multipoint Radio Links

The point-to-multipoint radio sites within 50 km radius of the centre of the proposed wind farm are shown in Appendix C- Figure 2. The closest point-to-multipoint transmitter site is located approximately 3.5km from the closest proposed turbine.

None of the point-to-multipoint radio sites have any current licenses / assignments, indicating no transmitters are currently operating. The point-to-multipoint sites are shown for information only, as future provisioned transmitters may be installed at these existing sites.

As there are no active point-to-multipoint transmitters in the area, GHD does not foresee any electromagnetic interference impact that would degrade point-to-multipoint radio systems as a result of the proposed wind farm development.

5.3 Land Mobile Radio Systems

A land mobile radio system (LMRS) is a person-to-person voice communication system with the transmitter and receiver in one unit. It can be stationary (base station units), mobile (installed in vehicles), or portable (handheld two-way radios). In Australia, most land mobile radio systems operate in the VHF Mid Band (70-87.5 MHz), VHF High Band (148-174 MHz), and the UHF 400 MHz band[5]. As the wavelengths at these frequencies are large, the radio signals are generally unaffected by wind turbines.

Most land mobile radio systems are used exclusively for public safety organisations such as police, firefighters, and other emergency response organisations. The systems are quite resilient as they usually operate on specific reserved frequencies.

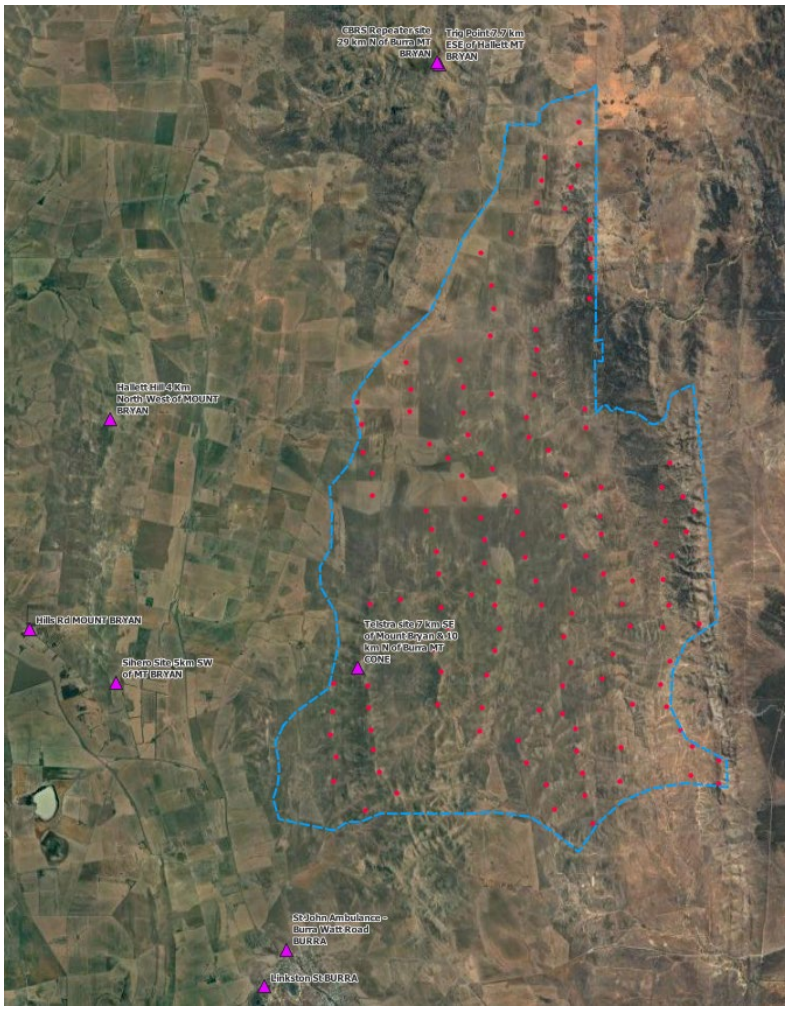


Figure 10 Land Mobile Radio Transmitters in Wind Farm Vicinity

The land mobile radio systems within 50 km radius of the proposed wind farm are shown on Appendix C – Figure 4 and are listed on Appendix B – Table 2. There are no LMR transmitters located within 20 m of the current turbine layout.

GHD does not foresee any electromagnetic interference impact that would degrade LMR signals as a result of the proposed wind farm development. There is one transmitter that sits ~600m from the nearest turbine, it is owned by

5 https://www.acma.gov.au/technical-details-land-mobile-licences Technical details for land mobile licences | Accredited persons | ACMA

South Australian Government Radio Network. This transmitter is located much further than the frequency derived 20 m nearfield exclusion zone typical for this type of VHF transmitter. Consultation with SAGRN also indicates nil to negligible impact to LMR signal, with a request of 100m clearance between the turbine blade tip and the second fresnel exclusion zone of any SAGRN radio path. Refer to Appendix D for more information.

5.4 AM / FM Narrowcast and Broadcast

Overseas and local experience indicates that radio reception is unlikely to be affected by operating wind farms. AM signals are not affected due to their low frequency resulting in a wavelength large enough relative to the turbine to not be affected by it. The majority of FM services transmitting in the vicinity of the wind farm are narrowcast services not focused on servicing the wind turbine area.

Broadcast FM services have smaller wavelengths than AM services and can be affected by turbines directly in the path of the receptor. There may be a minor impact / signal degradation for FM broadcast services for receivers in the immediate vicinity of the wind farm.

AM / FM narrowcast and broadcast sites within 50 km radius of the proposed wind farm are shown on Figure 11 and are listed on Appendix B – Table 3.

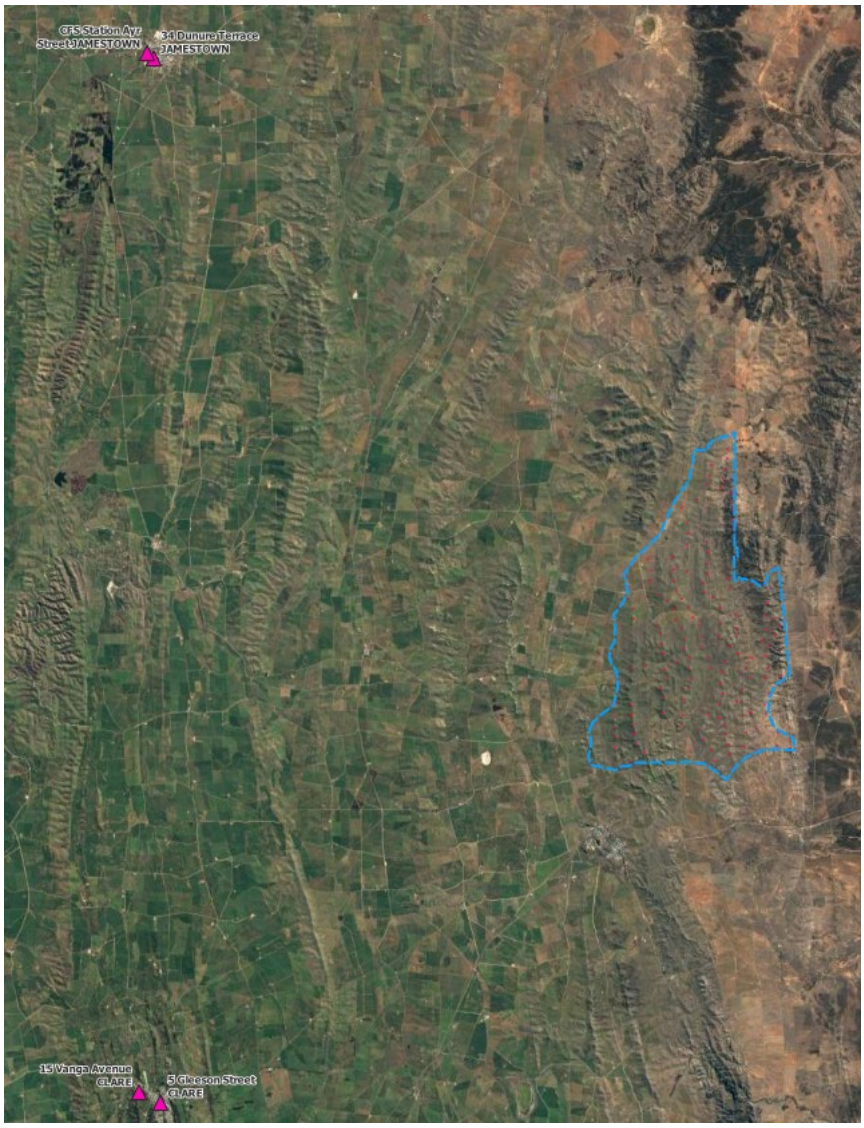


Figure 11 AM/FM Narrowcast and Broadcast Transmitters in Wind Farm Vicinity

GHD does not foresee any electromagnetic interference impact that would degrade AM/FM narrowcast or broadcast signals as a result of the proposed wind farm development.

5.5 Digital Television Broadcast

Wind farms have the potential to cause signal degradation to TV reception due to signal scattering, diffraction and near-field effects.

Digital television is not susceptible to visible “ghosting” degradation as was experienced from analogue broadcasts; any impact of reflections from the turbines would be a minor reduction of coverage at the limit of the service area. However, the signal can be degraded when the receivers are already at the border of the television reception zone or when the receiver is located within approximately 2 km of the wind farm, in the range affected by scattering of signals off the turbines. The most significant effect occurs when the receivers are near the wind farm and in the line of sight of the turbines but not in the line of sight of the television transmitter.

The zone of potential interference for a wind farm on digital television broadcast is the resultant total of the individual turbines’ effects. The International Telecommunications Union Recommendation ITU-R BT.1893[6] states that impacts beyond 10 km from a wind farm are unlikely.

Television signal coverage is provided by transmitters at Burra, Spencer Gulf and Adelaide (Crafers). These transmitters are approximately 14km, 90km and 160km from the centre of the project boundary respectively. Signal strength is indicated by the black to white gradient overlay, refer to Appendix C – Figure 6 – 8 for more information.

The signal scattering effect limits from the wind turbines to radio signals from the Burra TV, Spencer Gulf North TV and Adelaide (Crafers) TV transmitters are shown in, Figure 12, Figure 13, and Figure 14.

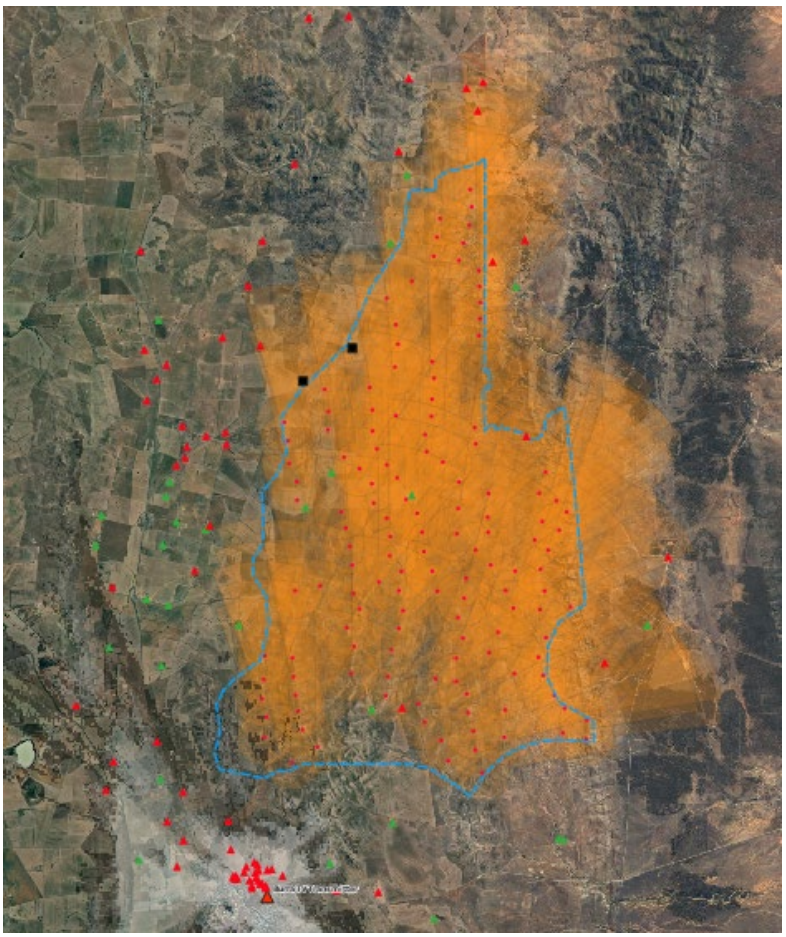


Figure 12 Burra Television Transmitter Signal Scatter Zones

6 International Telecommunications Union Recommendation ITU-R BT.1893, Assessment of impairment caused to digital television reception by a wind turbine

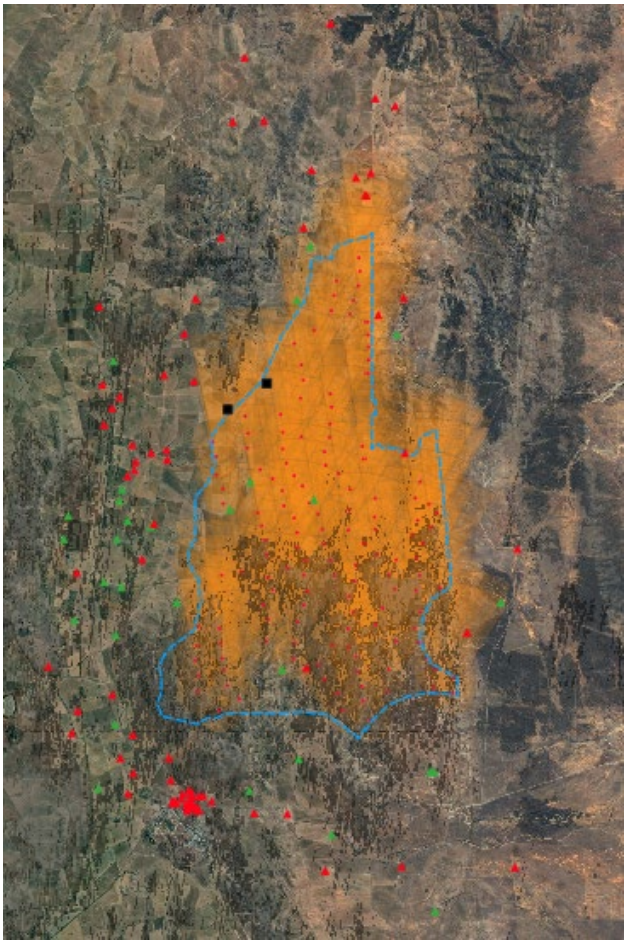


Figure 13 *Adelaide (Crafers) Television Transmitter Signal Scatter Zones*

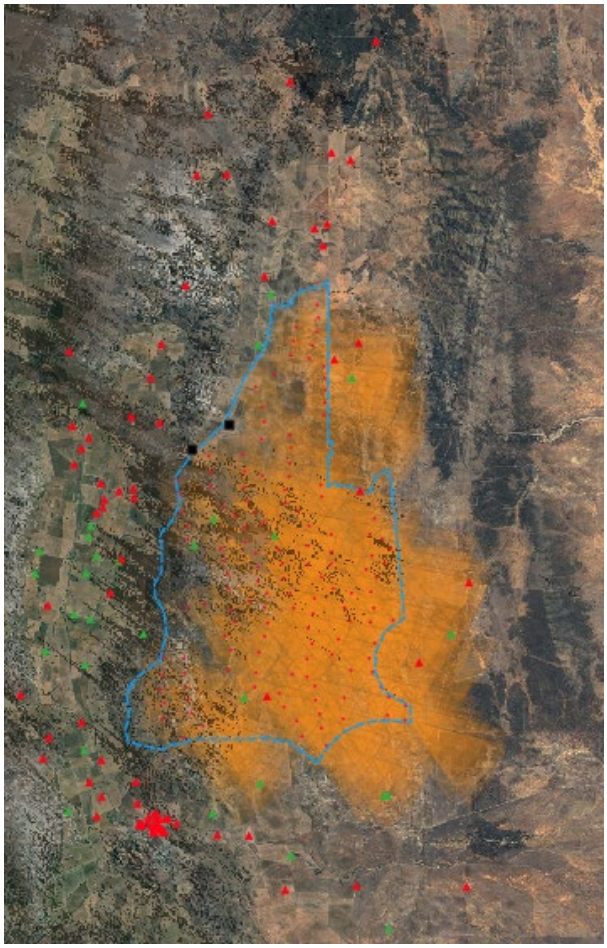


Figure 14 *Spencer Gulf North Television Transmitter Signal Scatter Zones*

Television reception at dwellings located in the scattering zones may be adversely affected by the proposed wind farm development. Figure 12 Burra Television Transmitter Signal Scatter ZonesFigure 12, Figure 13 and Figure 14 give some indication on the possibility of the degraded signal to the dwellings, either directly in the wind farm turbine area, or north-east and south-east of the wind farm. For dwellings (shown as triangle symbols) to have a potential impact, they must be located within the scatter zone area and within the respective transmitters signal area (shown as grey gradient). The dwellings which have coverage and are within the scatter zone area should be considered ‘at-risk’. As seen in the above figures, there is a relatively low density of dwellings within the scatter zone area.

A pre-construction TV signal survey should be conducted at locations at or near identified dwellings in the impact area to determine the existing TV signal level as a baseline measurement. For dwellings receiving digital television signals from the Digital Terrestrial Television system, the baseline measurement can be compared to a post-construction survey to determine any service impact. For dwellings receiving digital television signals from Viewer Access Satellite Television System (VAST), which is common in areas with limited terrestrial transmitter signal coverage, there will be no to negligible impact to these dwellings.

5.6 Mobile Telephone and Broadband Internet Broadcast

Cellular mobile phone technologies provide robust communications in areas of significant obstruction via multipath communications between customer equipment and the network base station sites. The four carrier networks (Telstra, Optus, Vodafone and NBN fixed wireless) have transmitter sites covering the main population areas around the greater wind farm area.

Appendix C – Figure 10 shows Public Telecommunications Service (PTS) transmitters in the project vicinity.

Appendix C – Figure 18 shows Spectrum Transmitters in the project vicinity.

Appendix C – Figure 19 shows the NBN fixed wireless coverage in the project vicinity.

Appendix C – Figure 20 shows the Optus 3G coverage in the project vicinity.

Appendix C – Figure 21 shows the Optus 4G coverage in the project vicinity.

Appendix C – Figure 22 shows the Telstra 3G coverage in the project vicinity.

Appendix C – Figure 23 shows the Telstra 4G coverage in the project vicinity.

Appendix C – Figure 24 shows the Telstra 5G coverage in the project vicinity.

Appendix C – Figure 25 shows the Vodaphone 3G and 4G coverage in the project vicinity.

Interference to cellular phone coverage and NBN fixed wireless coverage is anticipated to be minimal, except for those operating close to the proposed wind farm infrastructure (such as maintenance staff), or where existing coverage is already inadequate according to the carrier's publicly available coverage maps as shown in the figure references above.

Interference to NBN fixed wireless coverage is anticipated to be none based on consultation with NBNCo. There is no NBN Fixed Wireless coverage within the project boundary, as shown in Figure 15, NBN Co has confirmed that none of the proposed wind tower locations pose any risk of introducing a physical obstruction to the existing RF Path Profiles or boresight paths of existing NBN microwave links. Refer to Figure 15 for further details.

GHD is currently awaiting feedback from Optus, Telstra and Vodafone to confirm potential impact.

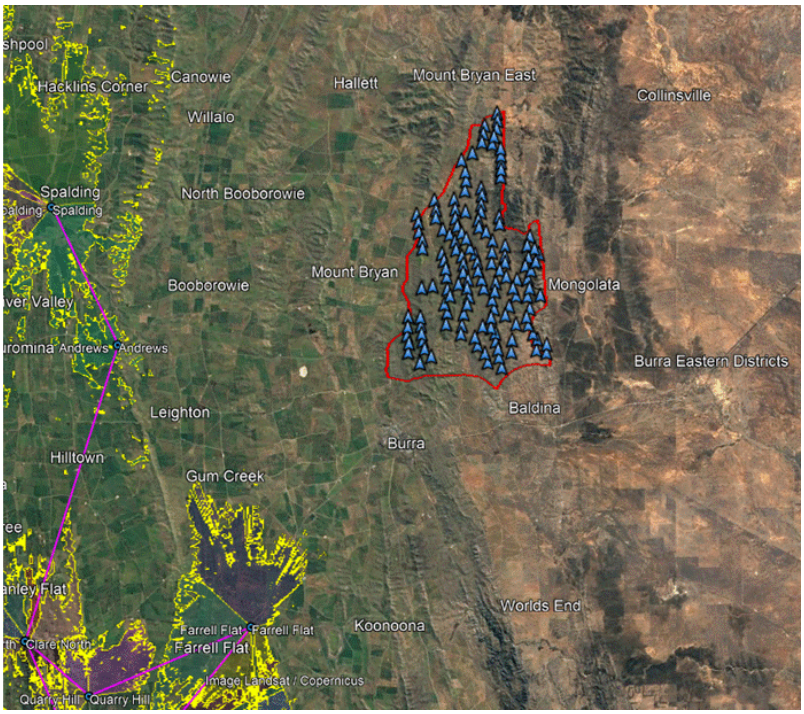


Figure 15 NBN Co fixed wireless coverage and client locations

5.7 Meteorological Radar

The meteorological radar is a critical radio infrastructure operated by the Bureau of Meteorology. It provides data to be computationally analysed and give a precise prediction on the wind speeds and weather conditions in sight of the radar. The radar typically has capability to indicate the weather at 250 km or more. The meteorological radar is also called the weather watch radar.

There are no meteorological radars within 50 km radius of the proposed wind farm, however, the closest radar, Adelaide (Buckland Park) (~120km away) is shown on Figure 16.

Figure 16 Bureau of Meteorology Weather Watch Radar

GHD foresees that the proposed wind farm development effect on the Adelaide (Buckland) radar may have minor impact, however, predict that this will be manageable through technical or operational means through agreements with the Bureau of Meteorology. There is a large distance between the transmitting radar and the proposed windfarm development, as well as the relatively small radar cross-sectional impact. Consultations with the Bureau of Meteorology have indicated manageable impact to assets under normal propagation conditions. The Bureau of Meteorology have requested Neoen to the inform them of any changes in the wind farm (layout change and turbine dimensions), any planned shut-down of the wind farm within 2 weeks and collaborate with the Bureau in the event of a severe weather event. Refer to Appendix D for more detail.

5.8 Wireless Internet Service Providers (Goyder Connect)

Goyder Connect operates a high-speed 5.8GHz microwave radio broadband service to local residents and businesses, similar to NBN Fixed Wireless to cover a number of areas in which only NBN satellite services are available.

The proposed wind turbines will be constructed North to Goyder Connect's STN transmitter, approximately 2.5km from the closest turbine. This is shown in Appendix C – Figure 9.

GHD foresees that the proposed wind farm development's effect on Goyder Connect will be nil to negligible. Consultation with Goyder Connect has indicated that there will be no impact to services as there are no customers nor links in the proposed windfarm area. Refer to Appendix D for more information.

5.9 Aircraft Communications Systems

Wind farms have the potential to disturb navigational signals, which can distort the accuracy of the aircraft positioning systems and introduce 'false targets'.

There is one aircraft communications system within 50 km radius of the proposed wind farm, the Clare Valley Aerodrome, which is approximately 43km from the centre of wind farm. This is shown in Appendix C – Figure 11 and are listed on Appendix B – Table 5.

GHD foresees that the proposed wind farm development's effect on navigation signals will be nil to negligible.

5.10 Defence Radio Systems

Defence radio systems are not required to be recorded in the ACMA radio communications database and therefore direct consultation with the Department of Defence is required to determine the impact of the wind farm on the Defence's operations around the wind farm area.

Typically, the Defence Spectrum Office (DSO), raises the following concerns to Defence HF transmissions and wind farm development projects:

Defence use HF in both a fixed and itinerant nature on their ranges and bases. They can use this equipment anywhere in country, but typical high tempo use of the itinerant variation could be at Defence range boundaries.

As the wind farm conforms to AS/NZS 61000.6.4:2012[7], the wind farm will reduce, as much as is practicable, the emission of HF noise from the turbines, substation(s) and electronic control equipment.

GHD is currently awaiting feedback from the Defence Security and Estate Group to confirm impact to Defence transmitters.

5.11 Trigonometric Systems

Trigonometrical systems operate across Australia are operated and maintained by Geoscience Australia. The GNSS networks of approximately 100 Continuously Operating Reference Stations (CORS) across the Australian region and the South Pacific, including: Australian Regional GNSS Network (ARGN), South Pacific Regional GNSS Network (SPRGN), and AuScope Network.

GHD foresees that the proposed wind farm development's effect on trigonometric systems will be nil as there are no assets in the vicinity. Consultations with Geosciences Australia have not identified any impact to trigonometric systems by the proposed wind farm development (Appendix D).

[7] AS/NZS 61000.6.4:2012, Electromagnetic compatibility (EMC) Generic standards - Emission standard for industrial environments, Standards Australia, 2012

5.12 Amateur Radio Systems

Amateur radio can consist of transmitters ranging from HF to UHF spectrum in specific bands reserved for citizen use by licenced individuals. Fixed amateur stations are registered on the ACMA database however the specific frequencies of the transmissions can vary depending on the type of communications being used at the time.

The amateur radio systems within 50 km radius of the proposed wind farm are shown in on Appendix C – Figure 13 and are listed on Appendix B – Table 8.

GHD foresees that the proposed wind farm development's effect on amateur radio systems will be nil to negligible.

5.13 Maritime Radio Systems

The proposed wind farm development location is sited inland to the VHF and HF maritime transmitter locations.

The maritime radio systems within 50 km radius of the proposed wind farm are shown in on Appendix C – Figure 14 and are listed on Appendix B – Table 7.

GHD does not foresee any electromagnetic interference impact that would degrade maritime radio systems.

5.14 Earth Stations

Earth stations are radio transmission systems which transmit and receive signals between the ground (Earth) and communication satellites in orbit. Earth station antennas face north in the southern hemisphere for communication with geostationary satellites and can face any direction for communication to low/medium earth orbit satellites.

The Earth stations within 50 km radius of the proposed wind farm are shown in Appendix C – Figure 15 and are listed on Appendix B – Table 9.

Figure 17 Satellite Earth Stations in Wind Farm Vicinity

GHD foresees that the proposed wind farm development's effect on earth stations will be nil to negligible.

5.15 Scientific Radio Systems

Scientific Radio Systems are reserved for research, teaching, demonstration, trialling new technologies or for repair and maintenance purposes. Scientific Radio Systems are registered on the ACMA database, however the specific frequencies can vary depending on the use case and/or license.

The scientific radio systems within 50 km radius of the proposed wind farm are shown in on Appendix C – Figure 16 and are listed on Appendix B – Table 10.

GHD foresees that the proposed wind farm development's effect on scientific radio systems will be nil to negligible.

5.16 Radiodetermination Station

Radiodetermination stations are radio transmission systems which are used determine location, velocity, or other characteristics of an object. These systems are commonly used in various fields such as aviation, maritime navigation, military applications etc.

The Radiodetermination stations within 50 km radius of the proposed wind farm are shown in Appendix C – Figure 17 and are listed on Appendix B – Table 11.

GHD foresees that the proposed wind farm development's effect on Radiodetermination stations will be nil to negligible.

5.17 50Hz Transmission Lines

The main sources of electromagnetic fields associated with wind farms are the substations and transmission lines. The transmission line and substation will be equivalent to others in the electricity transmission network, with comparable electromagnetic field levels.

Designing to the relevant Australian and industry standards will ensure safe levels of electromagnetic radiation are achieved.

6. Summary and Mitigation Strategies

All types of radio communications can benefit from general mitigation through the design of the turbine and the choice of materials used in its construction.

The turbines have been spaced to mitigate the effect of creating a "virtual wall" of turbines. A virtual wall is an electromagnetic barrier between a TV transmitter and households serviced by that transmitter.

In addition, wind farm developers should utilise (wherever practicable) equipment complying with the Electromagnetic Emission Standard, AS/NZS 61000.6.4:2012 to avoid the creation of excessive RF noise at frequencies that interfere with radio communication signals. Electrical insulation and shielding should be considered in the turbine design to reduce the RF noise emitted from the electronic control systems located in the nacelle.

6.1 Mitigation Strategies

Table 3 provides a summary of the findings from section 5 inclusive of Mitigation Strategies and other recommendations.

Table 3 Summary of Mitigation Strategies and Recommendations

Impact	Service Mitigation Strategy	Recommendation
Fixed Point-to-Point Radio Links		
Nil to negligible anticipated impact to services.	SAGRN has requested it would be desirable for 100m of separation to be maintained between any SAGRN path and the outer diameter of any turbine blade. Telstra has requested an additional set-back for this project above typical provisions which is currently under negotiation as of January 2024. The current WTG layout is designed to typical Telstra set-back standards used on prior projects.	Microsite WTG1 a minimum of 42m north-west, WTG15 a minimum of 40m east, WTG16 a minimum of 60m east and WTG17 a minimum of 45m east. Agree set-back distance with Telstra and implement and changes necessary via micrositing.
Fixed Point-to-Multipoint Radio Links		
Nil to negligible anticipated impact to services.	Nil	Not required
Land Mobile Radio Systems		
Nil to negligible anticipated impact to services.	Nil	Not required
Digital Television Broadcast		
Minor to no impact anticipated to services.	The wind farm's impact on digital TV services can be quantified by recording and comparing pre-construction baseline signal measurements and post-construction signal level measurements in and around the wind farm areas by an independent radio monitoring specialist; however, the mitigation measures remain the same. The first mitigation strategy can be performed from the user side by realigning the receptor antenna more directly towards the existing transmitter, repositioning or replacing existing antennas to higher gain alternatives can	Neoen should undertake a pre- and post-construction assessment of the television reception strength at the location of any 'at-risk' existing or approved dwellings as at the date of development approval that are within 5 kilometres of any turbine. The assessments should be undertaken by an independent television and radio monitoring specialist and include testing at locations to be determined by the television and radio monitoring specialist to enable the average television and radio reception strength to be determined. If the post-construction assessment establishes an unacceptable increase in interference to reception as a result of the

Impact	Service Mitigation Strategy	Recommendation
	also remedy the majority of forward scatter signal degradation effects.	wind farm, as determined by the independent television and radio monitoring specialist, measures to restore the affected reception to preconstruction quality should be undertaken.
AM / FM Narrowcast and Broadcast		
Minor to no impact anticipated to services.	Mitigation options may include installing high-quality antennas or amplifiers at affected dwellings, increasing broadcast signal strength from the transmission tower, moving the tower to a new location further away from the turbines, or installing a signal repeater or additional tower on the opposite side of the wind farm.	Neoen should undertake a pre- and post-construction assessment of the radio reception strength of a sample of dwellings as based on 'at-risk' geographic locations that may be up to 5 kilometres from any turbine. The assessments should be undertaken by an independent television and radio monitoring specialist and include testing at locations to be determined by the television and radio monitoring specialist to enable the average television and radio reception strength to be determined. If the post-construction assessment establishes an unacceptable increase in interference to reception as a result of the wind farm, as determined by the independent television and radio monitoring specialist, measures to restore the affected reception to pre-construction quality should be undertaken.
Mobile Telephone and Broadband Internet Broadcast		
Nil to negligible anticipated impact to NBN, Telstra, Optus and Vodafone services. (Pending Telstra, Optus and Vodafone feedback)	Nil.	Not required (Pending Telstra, Optus and Vodafone feedback)
Meteorological Radar		
Manageable impact to services.	Neoen is to regularly communicate with the Bureau of Meteorology, informing them of changes to the wind farm, any planned shut-downs and to collaborate with the Bureau in the event of a severe weather event. Refer to Appendix D for more information.	Neoen to consult with the Bureau to allow calibration of the radar system, and enter an agreement with the Bureau if operational mitigation is required.
Goyder Connect		
Nil to negligible anticipated impact to services.	Nil.	Not required
Aircraft Communications Systems		
Nil to negligible anticipated impact to services.	Nil.	Not required
Defence Radio Systems		
Nil to negligible anticipated impact to services. (Pending Defence review)	Nil. (Pending Defence review)	Obtain Defence review feedback.
Trigonometric Systems		
Nil to negligible anticipated impact to services.	Nil.	Not required
Amateur Radio Systems		

Impact	Service Mitigation Strategy	Recommendation
Nil to negligible anticipated impact to services.	Nil.	Not required
Maritime Radio Systems		
Nil to negligible anticipated impact to services.	Nil.	Not required
Earth Stations		
Nil to negligible anticipated impact to services.	Nil.	Not required
Scientific Radio Systems		
Nil to negligible anticipated impact to services.	Nil.	Not required
Radiodetermination Stations		
Nil to negligible anticipated impact to services.	Nil.	Not required
50Hz Transmission Lines		
Nil to negligible anticipated impact to services.	Design as per relevant Australian Standards.	Not required

6.2 Construction Approach

The WTG layout may be adjusted to incorporate the mitigation strategies from this study, other impact studies and/or to optimise energy yields. If the WTG layout is changed, it is recommended to undertake a review of the changes and update this report with the updated findings.

Appendices

Appendix A

Turbine Locations

Turbine Locations

Turbine ID	Latitude	Longitude
WTG_001	-33.5947	138.9399
WTG_002	-33.6024	138.9395
WTG_003	-33.6086	138.9388
WTG_004	-33.6146	138.9405
WTG_005	-33.6213	138.9398
WTG_006	-33.6294	138.9503
WTG_007	-33.5181	138.9475
WTG_008	-33.5242	138.949
WTG_009	-33.5316	138.9494
WTG_010	-33.5376	138.9525
WTG_011	-33.5437	138.9526
WTG_012	-33.4418	139.0199
WTG_013	-33.5732	138.9518
WTG_014	-33.5953	138.9507
WTG_015	-33.6014	138.9512
WTG_016	-33.6075	138.9519
WTG_017	-33.6127	138.953
WTG_018	-33.6187	138.9546
WTG_019	-33.6245	138.9606
WTG_020	-33.5717	138.9616
WTG_021	-33.5475	138.97
WTG_022	-33.5527	138.9717
WTG_023	-33.5588	138.9733
WTG_024	-33.5649	138.9742
WTG_025	-33.5742	138.9748
WTG_026	-33.5793	138.9772
WTG_027	-33.5854	138.9722
WTG_028	-33.5916	138.975
WTG_029	-33.6004	138.9739
WTG_030	-33.5704	138.9847
WTG_031	-33.5073	138.9634
WTG_032	-33.5146	138.9649
WTG_033	-33.5206	138.9647
WTG_034	-33.5296	138.971
WTG_035	-33.5333	138.9772
WTG_036	-33.5382	138.9819
WTG_037	-33.5446	138.9827
WTG_038	-33.5495	138.9879
WTG_039	-33.5555	138.9892

Turbine ID	Latitude	Longitude
WTG_040	-33.5618	138.989
WTG_041	-33.5671	138.9935
WTG_042	-33.5732	138.9926
WTG_043	-33.5798	138.9942
WTG_044	-33.5857	138.9927
WTG_045	-33.5926	138.9897
WTG_046	-33.6014	138.9883
WTG_047	-33.6077	138.9874
WTG_048	-33.5067	138.9811
WTG_049	-33.5141	138.9822
WTG_050	-33.521	138.9822
WTG_051	-33.5269	138.9839
WTG_052	-33.532	138.9879
WTG_053	-33.5363	138.9919
WTG_054	-33.5434	138.9954
WTG_055	-33.5479	138.9998
WTG_056	-33.5541	139.0018
WTG_057	-33.5605	139.0025
WTG_058	-33.5669	139.0057
WTG_059	-33.5734	139.0077
WTG_060	-33.4774	138.9878
WTG_061	-33.4861	138.9914
WTG_062	-33.4925	138.9922
WTG_063	-33.5	138.991
WTG_064	-33.5159	138.9915
WTG_065	-33.4719	138.9977
WTG_066	-33.4535	139.0197
WTG_067	-33.4513	139.0087
WTG_068	-33.4575	139.0076
WTG_069	-33.4637	139.0063
WTG_070	-33.4651	139.0156
WTG_071	-33.4737	139.0237
WTG_072	-33.4474	139.0205
WTG_073	-33.5106	139.0056
WTG_074	-33.4982	139.0057
WTG_075	-33.5037	139.0064
WTG_076	-33.5162	139.0054
WTG_077	-33.5222	139.0029
WTG_078	-33.5277	139.0036
WTG_079	-33.5312	139.0099
WTG_080	-33.5377	139.0156

Turbine ID	Latitude	Longitude
WTG_081	-33.5464	139.0152
WTG_082	-33.5546	139.0148
WTG_083	-33.5692	139.0184
WTG_084	-33.5758	139.0176
WTG_085	-33.5821	139.0152
WTG_086	-33.5888	139.0172
WTG_087	-33.5954	139.0146
WTG_088	-33.6021	139.007
WTG_089	-33.6103	139.0001
WTG_090	-33.6163	139.0027
WTG_091	-33.6223	139.0092
WTG_092	-33.629	139.012
WTG_093	-33.6031	139.0145
WTG_094	-33.607	139.0187
WTG_095	-33.6133	139.0191
WTG_096	-33.6192	139.0212
WTG_097	-33.6253	139.022
WTG_098	-33.6329	139.0247
WTG_099	-33.4594	139.0173
WTG_100	-33.4685	139.0234
WTG_101	-33.4788	139.024
WTG_102	-33.4842	139.0239
WTG_103	-33.4897	139.0235
WTG_104	-33.5198	139.0217
WTG_105	-33.5251	139.0222
WTG_106	-33.5414	139.0272
WTG_107	-33.5492	139.0269
WTG_108	-33.5541	139.0271
WTG_109	-33.56	139.0222
WTG_110	-33.5648	139.028
WTG_111	-33.5668	139.0377
WTG_112	-33.5732	139.034
WTG_113	-33.579	139.0369
WTG_114	-33.5868	139.0309
WTG_115	-33.5936	139.0275
WTG_116	-33.6004	139.0374
WTG_117	-33.6123	139.0338
WTG_118	-33.6213	139.0333
WTG_119	-33.5414	139.0472
WTG_120	-33.5505	139.0483
WTG_121	-33.5566	139.0453

Turbine ID	Latitude	Longitude
WTG_122	-33.5345	139.0497
WTG_123	-33.5438	139.0539
WTG_124	-33.5475	139.0579
WTG_125	-33.5535	139.055
WTG_126	-33.56	139.0506
WTG_127	-33.5662	139.0476
WTG_128	-33.5734	139.0492
WTG_129	-33.5794	139.0474
WTG_130	-33.5886	139.0498
WTG_131	-33.5951	139.0468
WTG_132	-33.601	139.0487
WTG_133	-33.6075	139.0531
WTG_134	-33.6118	139.0571
WTG_135	-33.6198	139.0564
WTG_136	-33.5786	139.0594
WTG_137	-33.6156	139.0659
WTG_138	-33.6219	139.0656

Appendix B

Radio sites in vicinity of wind farm ACMA details

Fixed Point-to-Point Transmitters with exclusion zones of concern

Radio Site	Site ID	Licence No.	Licensee	Site Location	Operating Frequency
Telstra site 7 km SE of Mount Bryan & 10 km N of Burra MT CONE	24314	1806000/1 1805996/1 1805878/1 1503765/1 1503766/1	South Australian Government Radio Network Telstra Limited	-33.590384, 138.947803	8.25 GHz 8.19 GHz 7.62 GHz 1.43 GHz 1.44 GHz

Land Mobile Transmitters

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
CBRS Repeater site 29 km N of Burra MT BRYAN	24320	1326600/1	Mt. Bryan Repeater Association Inc.	-33.425257, 138.973634	476.6 MHz
Hallett Hill 4 Km North-West of MOUNT BRYAN	24310	1505453/1 11838791/1 319030/1	Regional Council Of Goyder Epic Energy South Australia Pty Ltd	-33.52264, 138.86694	470.3 MHz 150.9 MHz 162.5 MHz
Sihero Site 5km SW of MT BRYAN	9010043	1914229/1	Sihero Pty Ltd	-33.594494, 138.868748	474.7 MHz
St John Ambulance - Burra Watt Road BURRA	137207	1567691/1 1567694/1 1567692/1 1567693/1	St. John Ambulance Australia Incorporated	-33.667129, 138.924521	411.4 MHz 472.2 MHz 412.1 MHz 472.15 MHz
Telstra site 7 km SE of Mount Bryan & 10 km N of Burra MT CONE	24314	10139614/1 10139616/1 10139611/1 10139612/1 10139615/1 1514548/1 1514549/1 1514550/1 1514551/1 1514552/1 1515398/1	South Australian Government Radio Network	-33.590384, 138.947803	415.23 MHz 421.98 MHz 414.73 MHz 414.98 MHz 418.73 MHz 412.73 MHz 413.23 MHz 416.23 MHz 416.73 MHz 417.23 MHz 148.81 MHz
Trig Point 7.7 km ESE of Hallett MT BRYAN	24322	10490596/1	South Australian Country Fire Service	-33.42602, 138.974462	423.9 MHz

Digital Television Broadcast and AM/FM Narrowcast and Broadcast

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
15 Vanga Avenue CLARE	139338	1902475/1	United Christian Broadcasters Australia Limited	-33.827675, 138.595999	88 MHz

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
34 Dunure Terrace JAMESTOWN	10025159	10564663/2	United Christian Broadcasters Australia Limited	-33.206495, 138.606641	88 MHz
5 Gleeson Street CLARE	138372	523288/1	BUNDABERG NARROWCASTERS PTY. LTD.	-33.834292, 138.611727	87.6 MHz
CFS Station Ayr Street JAMESTOWN	24527	1150213/1	Suzette Munro	-33.203335, 138.601937	87.6 MHz

Mobile Telephone and Internet Broadcast Sites

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Optus Site Burra Off Ludgvan Road BURRA	135325	1136358/1 10094267/116	Optus Mobile Pty Limited	-33.677472, 138.95488	947.6MHz 2.1425 GHz 2.1475 GHz
Lot 581 Section 582 Farrell Flat Road FARRELL FLAT	9001664			-33.862917, 138.825811	
Optus/Vodafone Site Lot 2 Quarry Rd CLARE	500947			-33.871023, 138.651993	
Optus Monopole Lot 235 Government Road CLARE	9010635			-33.835014, 138.620588	
Clare NW optus monopole Cnr McDonalds and Dunstan rds, Clare Clare	10003155			-33.798754, 138.582893	
NBN Co Site Benbournie Rd BLYTH	9020476			-33.831332, 138.485638	
NBN Co Site 35 Tatkana Road SEVENHILL	9027257			-33.907042, 138.634072	
Optus Mast Section 86, Belalie East Rd SPALDING	9000375			-33.447934, 138.61555	
Jamestown Ausbulk Terminal Irvine St JAMESTOWN	135715			-33.201554, 138.606394	
Jamestown East 879 James Town Whyte Yarcowie Road Belalie North	10006865			-33.217074, 138.723461	
Yongala Frost Road James Town	10009276			-33.121495, 138.639009	
Telstra Site Watts Range Rd GULNARE	9018541	1136358/1		-33.490344, 138.479927	947.6MHz
Telstra/Optus Site Lot 93 Hundred of Kooringa BURRA	131771			-33.677225, 138.954638	

Meteorological Radar

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Met Bureau Site cnr Shellgrit & Applebee Rds BUCKLAND PARK	306141	1329003/2 10357238/1	Bureau of Meteorology	-34.616962,138.468366	2.86 GHz

Aircraft Communication Systems

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
PAL Site, Clare Valley Aerodrome RM Williams Way CLARE 5453	10018995	10922371/1	The Clare Valley Flying Group Incorporated	-33.710616, 138.583929	120.05 MHz
75 Booborowie Rd PETERBOROUGH	138485	1915424/1	District Council Of Peterborough	-32.997857,138.847446	120.6 MHz
Broadcast Australia Site TV Track THE BLUFF	24650	421835/1	Airservices Australia	-33.103845,138.16414	123.9 MHz
Waikerie Airport WAIKERIE	24019	1328491/1	District Council of Loxton Waikerie	-34.182564,140.032259	126.7 MHz

Amateur Radio System

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Comms Tower Electranet Site TV Track THE BLUFF	24631	1503166/2	The Wireless Institute of Australia	-33.086404,138.162772	147.58 MHz
Major Radio Site 5 km NW of Lochiel Trig Point BUMBUNGA HILL	24567	1503165/1	The Wireless Institute of Australia	-33.903603,138.130403	144.73 MHz
102 Hill Rd SUNLANDS	10026889	11329761/1	Raymond Spargo	-34.141184,139.862169	145.18 MHz
Broadcast/Comms Mast Pirie Cmty Radio Bcers Site TV Track THE BLUFF	554119	10609355/1	Pirie Community Radio Broadcasters Inc	-33.105937,138.164544	445.5 MHz

Maritime Radio Systems

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Remote Radar Tower 16km SE Proof Range via PORT WAKEFIELD	9019770	1971602/1	Australian Maritime Safety Authority	-34.387939, 138.242202	161.98 MHz
Light Pole Berth 4 PORT PIRIE HARBOUR	306300	1941618/1 1941617/1 323487/1 323486/1	AUSTRALIAN MARITIME SAFETY AUTHORITY	-33.177155, 138.011357	162.025 MHz 161.975 MHz 156.3 MHz 156.4 MHz

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
		1975437/1 1975438/1 1975440/1 1975441/1 1975439/1 1508217/1	Flinders Ports Pty Ltd		153.225 MHz 152.5375 MHz 153.38 MHz 153.662 MHz 152.987 MHz 461.543 MHz
Broadcast Australia Site TV Track THE BLUFF	24650	1929653/1	Department of Planning Transport and Infrastructure	-33.103845, 138.16414	156.8 MHz
Comms Tower ElectraNet Site TV Track THE BLUFF	24631	217499/1	The Australian Volunteer Coast Guard Association Inc	-33.086404, 138.162772	157.13 MHz

Earth Stations

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
3.7 m Earth Station Antenna, 112 Cotton Road	10029898	11903100/1 11689909/6 11689912/1 11903103/2 12139215/1 12111898/1 11872412/1 11903090/1 11903099/1	Nova Systems Consulting PTY LTD	-32.96198, 138.849493	2.0875 GHz 2.094 GHz 2.0453 GHz 2.092 GHz 2.0425 GHz 2.067 GHz 2.0675 GHz 2.0785 GHz 2.0375 GHz
112 Cotton Road	10016525	10533232/2 10533267/2		-32.961899, 138.849131	2.056 GHz 449.875 MHz
cnr Coleman and Farrelly Roads PINKERTON PLAINS SA	10010120	No assignments	No assignments	-34.4375,138.586331	No assignments

Scientific Radio Systems

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Baldon Station Baldon Road TRURO SA	10032818	11900723/1	Fleet Space Technologies Pty Ltd	-34.436, 139.2167	1.995 GHz
Silentium temp field trial facility 1Km south East of Hecke Rd and Bower Boundary Rdnd Bowe Brownlow	10029485	11902840/1	SILENTIUM DEFENCE TRADING PTY LTD	-34.216417,139.361573	10.5 GHz

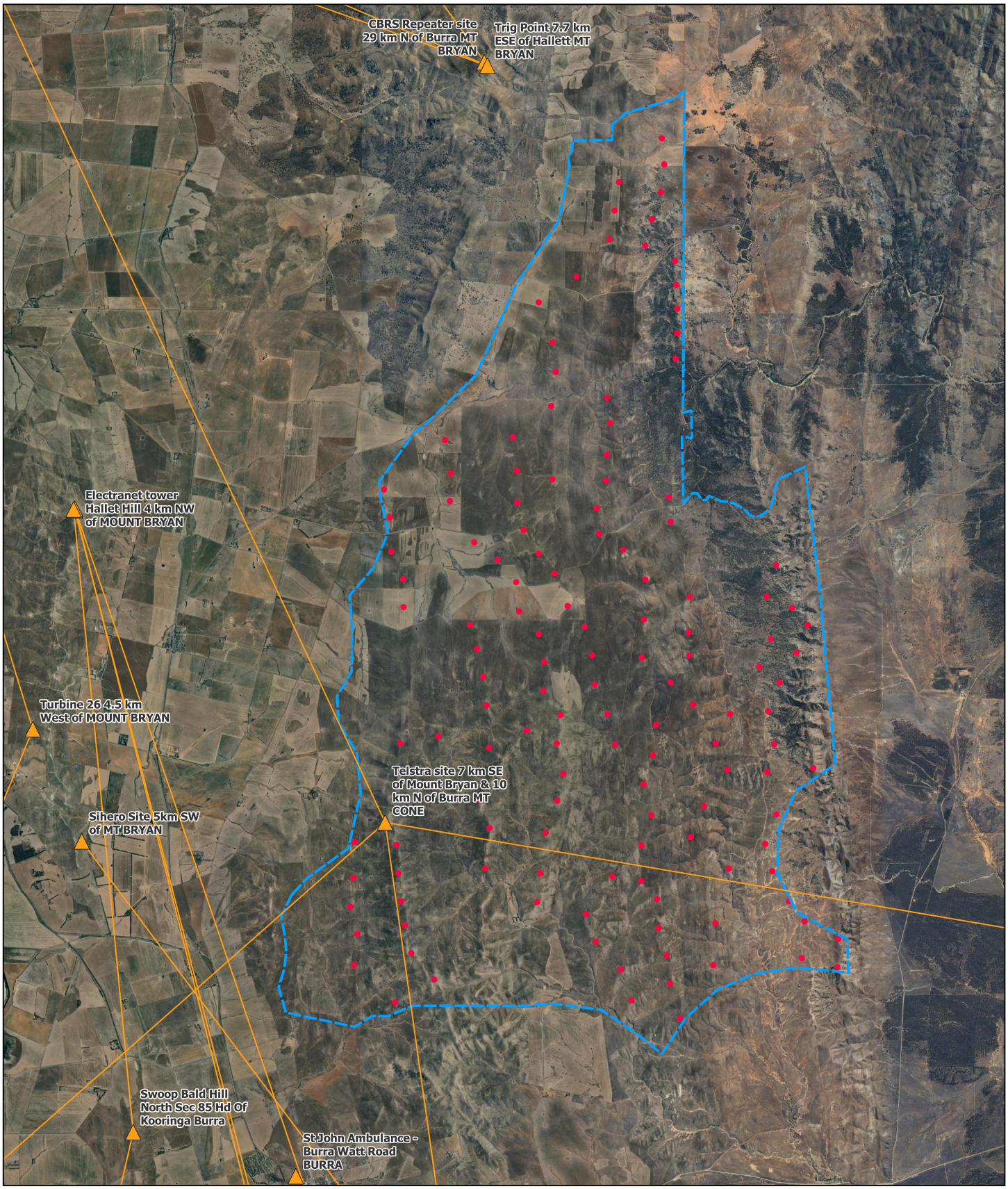
Radiodetermination Stations

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Department of Defence PORT WAKEFIELD	24660	1961703/1	Department of Defence	-34.181869,138.151353	10.53 GHz

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Proof Range Control Tower Proof Range Rd PORT WAKEFIELD	9019771	1972063/1		-34.254774,138.178805	9.41 GHz
Remote Radar Tower 16km SE Proof Range via PORT WAKEFIELD	9019770	1972064/1		-34.387939,138.242202	9.41 GHz

Appendix C

Reference Figures



LEGEND

- Project Site Boundary
- Turbine
- Fixed Point-to-Point Transmitter
- Radio Communications Link

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

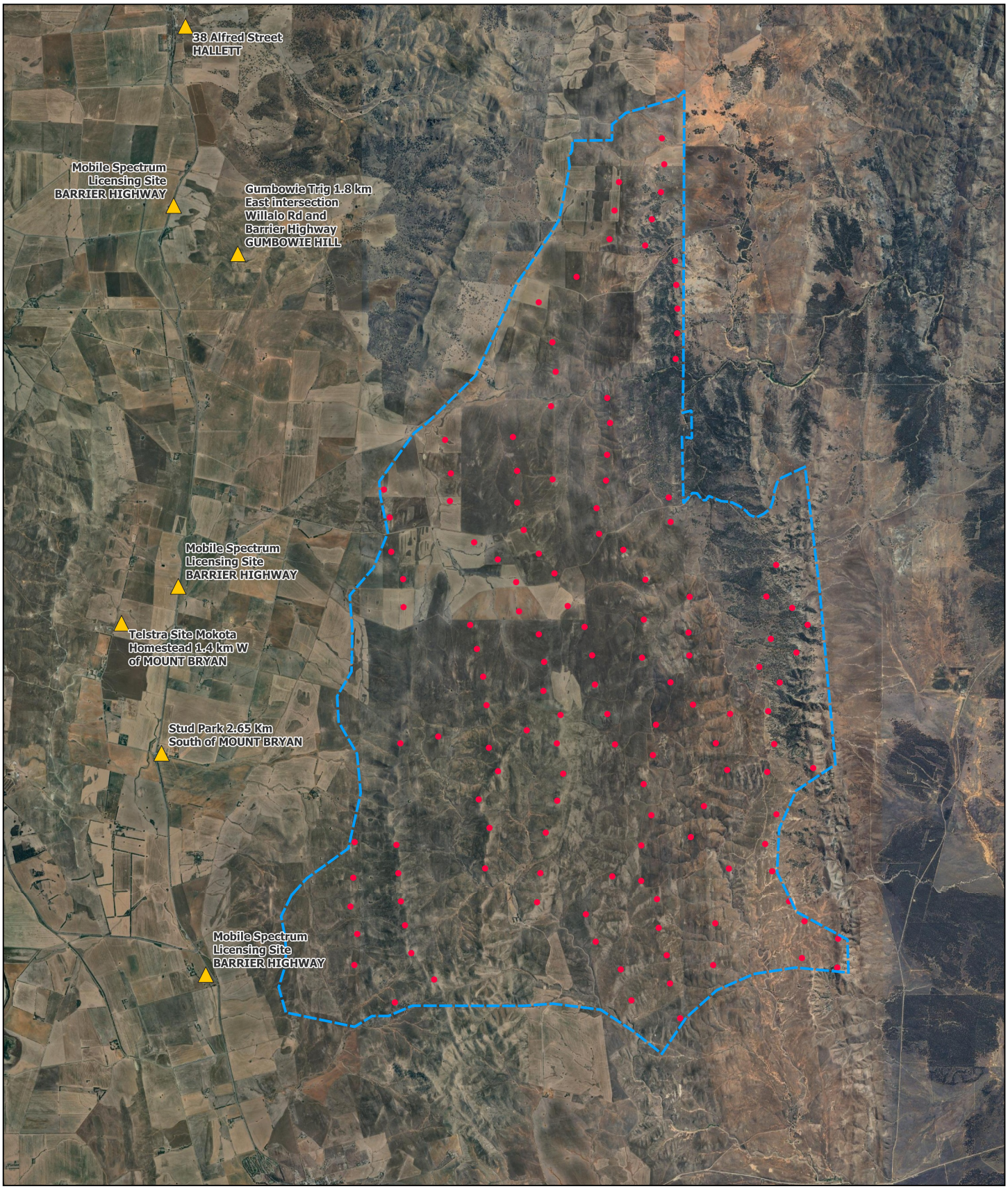
Fixed Point-to-Point Radio Systems

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 1

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Fixed Point-to-Multipoint Transmitter

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

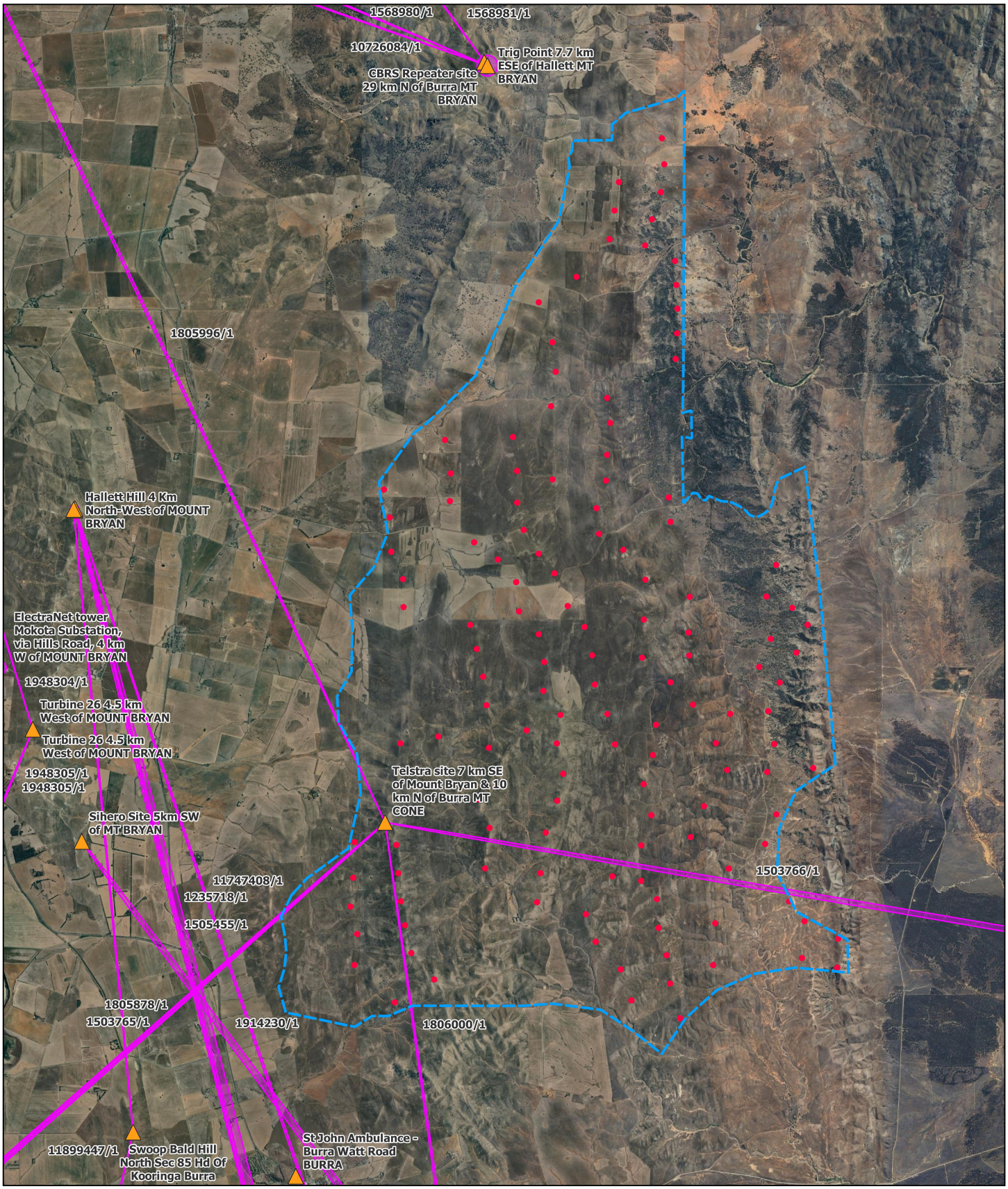
Fixed Point-to-Multipoint Radio Systems

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 2

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Fixed Point-to-Point Transmitter
- Exclusion Zones

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

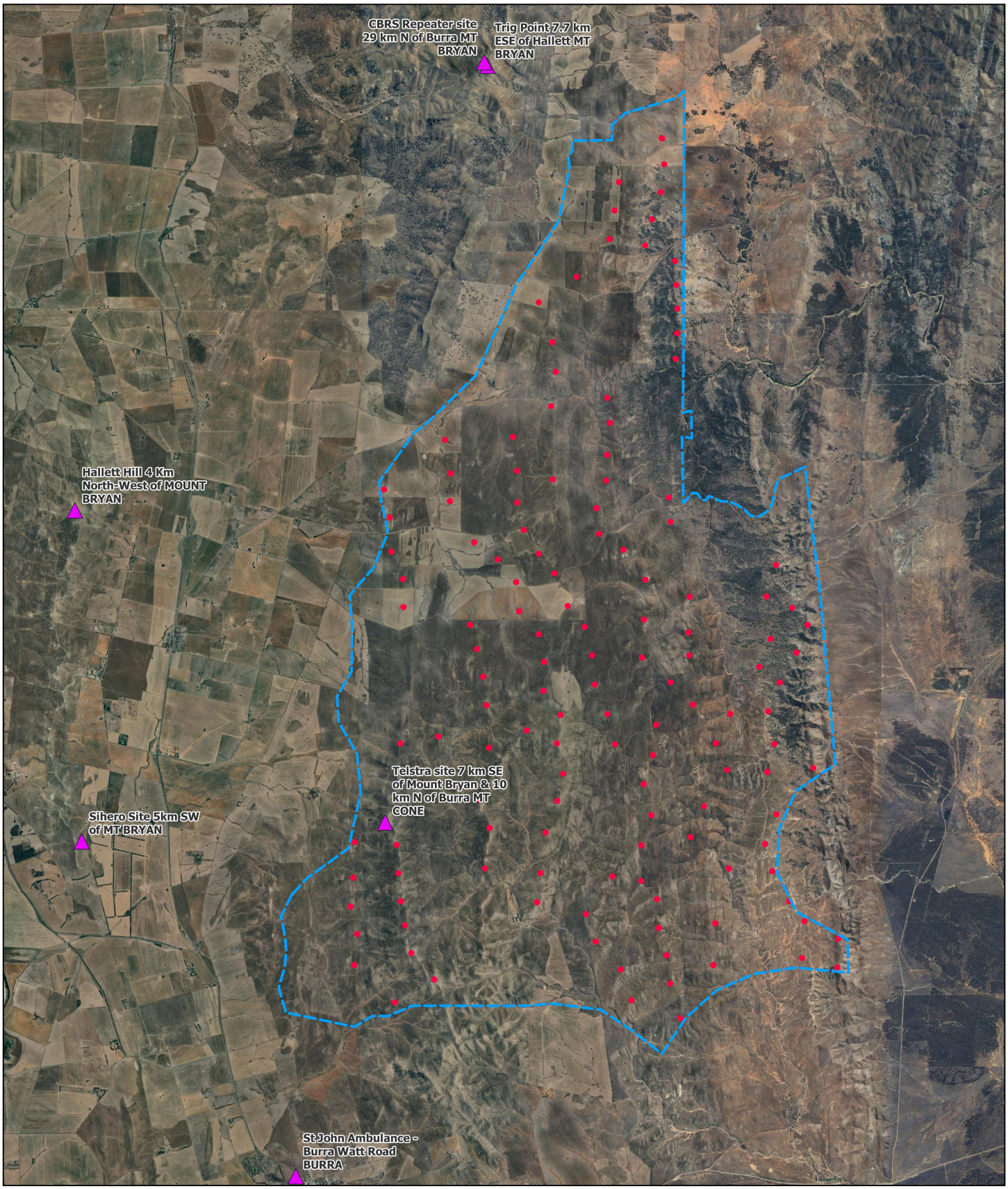
Point-to-Point Exclusion Zones

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 3

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Land Mobile Transmitter

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

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Goyder North Wind Farm

Electromagnetic Interference Assessment

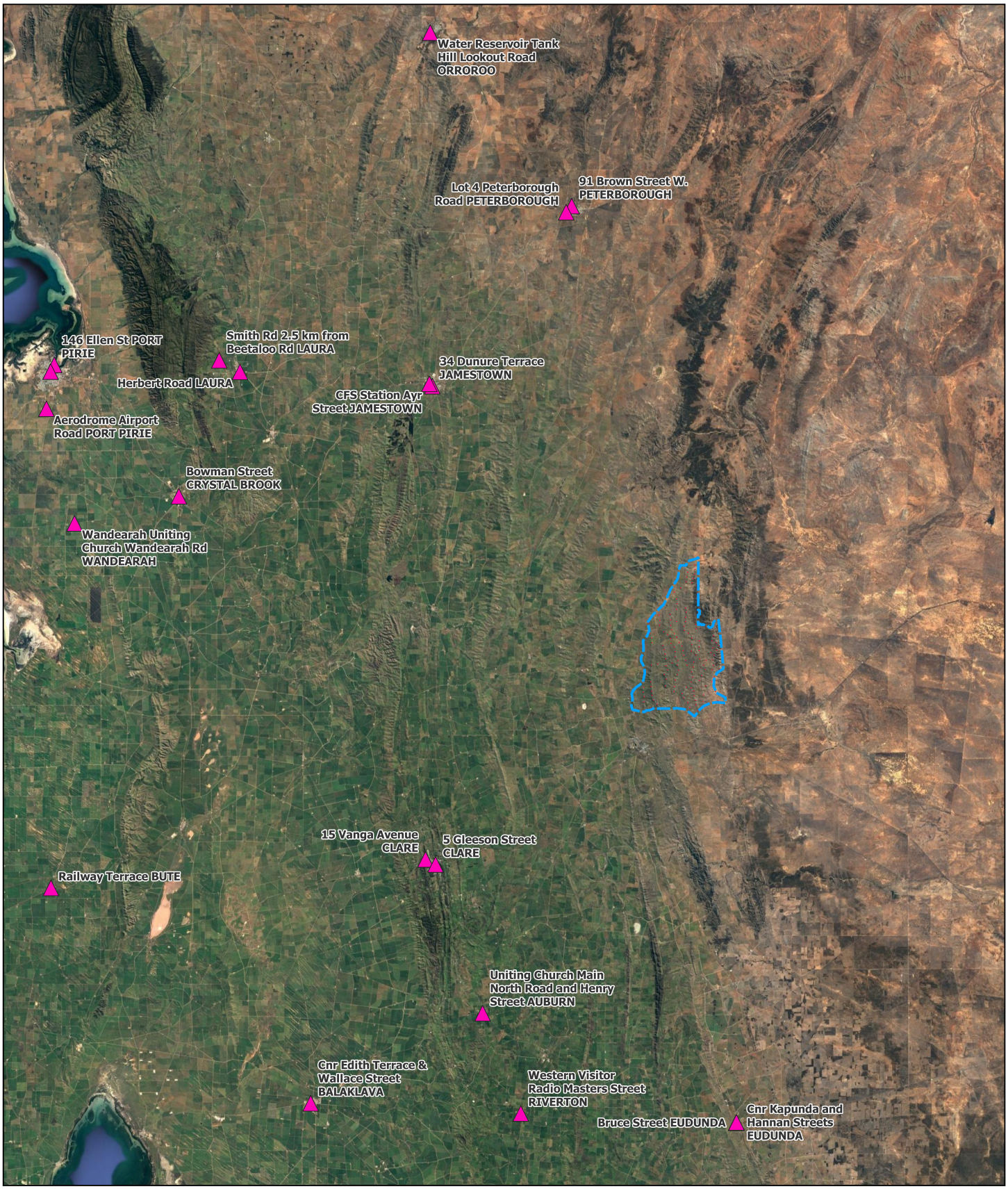
Land Mobile Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 4

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Broadcasting Transmitter

Paper Size A4

0 10 20 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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Goyder North Wind Farm

Electromagnetic Interference Assessment

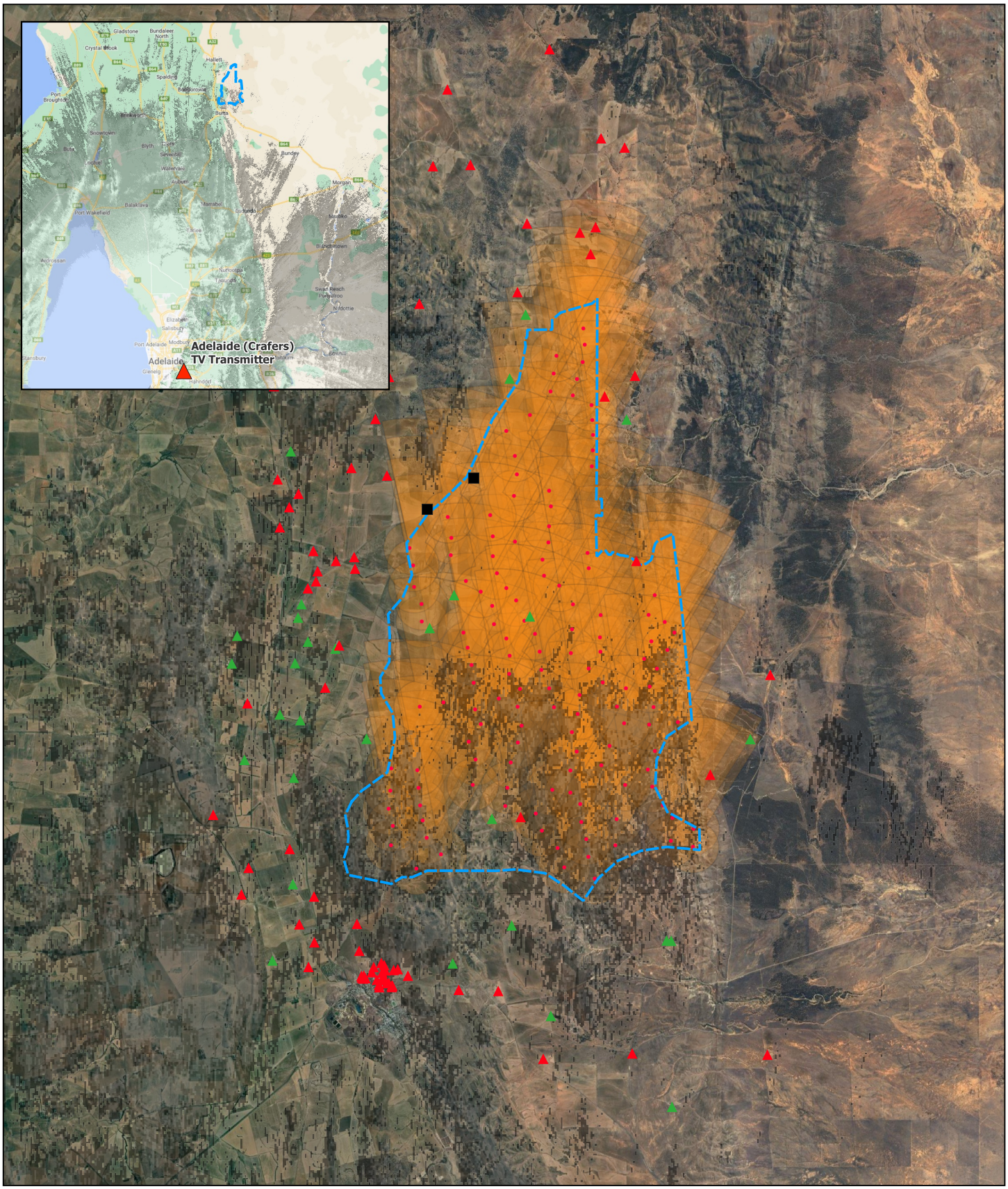
Broadcasting Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 5

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Adelaide (Crafers) TV Transmitter
- Scatter Zone
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

TV Transmitter Signal Coverage

- Strong
- Variable moderate
- Unlikely to none

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

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Goyder North Wind Farm

Electromagnetic Interference Assessment

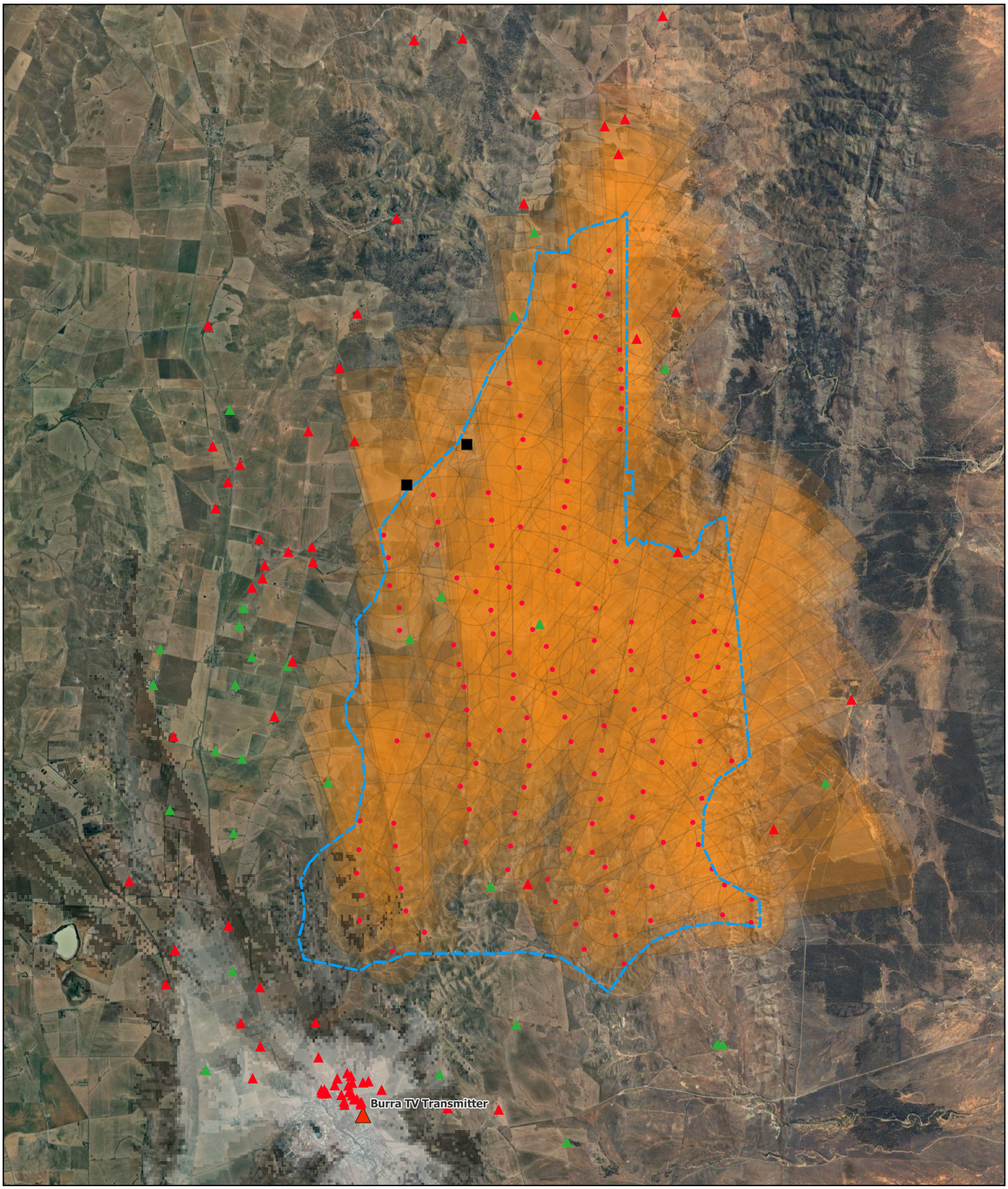
Adelaide (Crafers) TV Transmitter Scatter Zone

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 6

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Burra TV Transmitter
- Scatter Zone
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

TV Transmitter Signal Coverage

- Strong
- Variable moderate
- Unlikely to none

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

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Goyder North - Hybrid Renewable Energy Project
Electromagnetic Interference Assessment

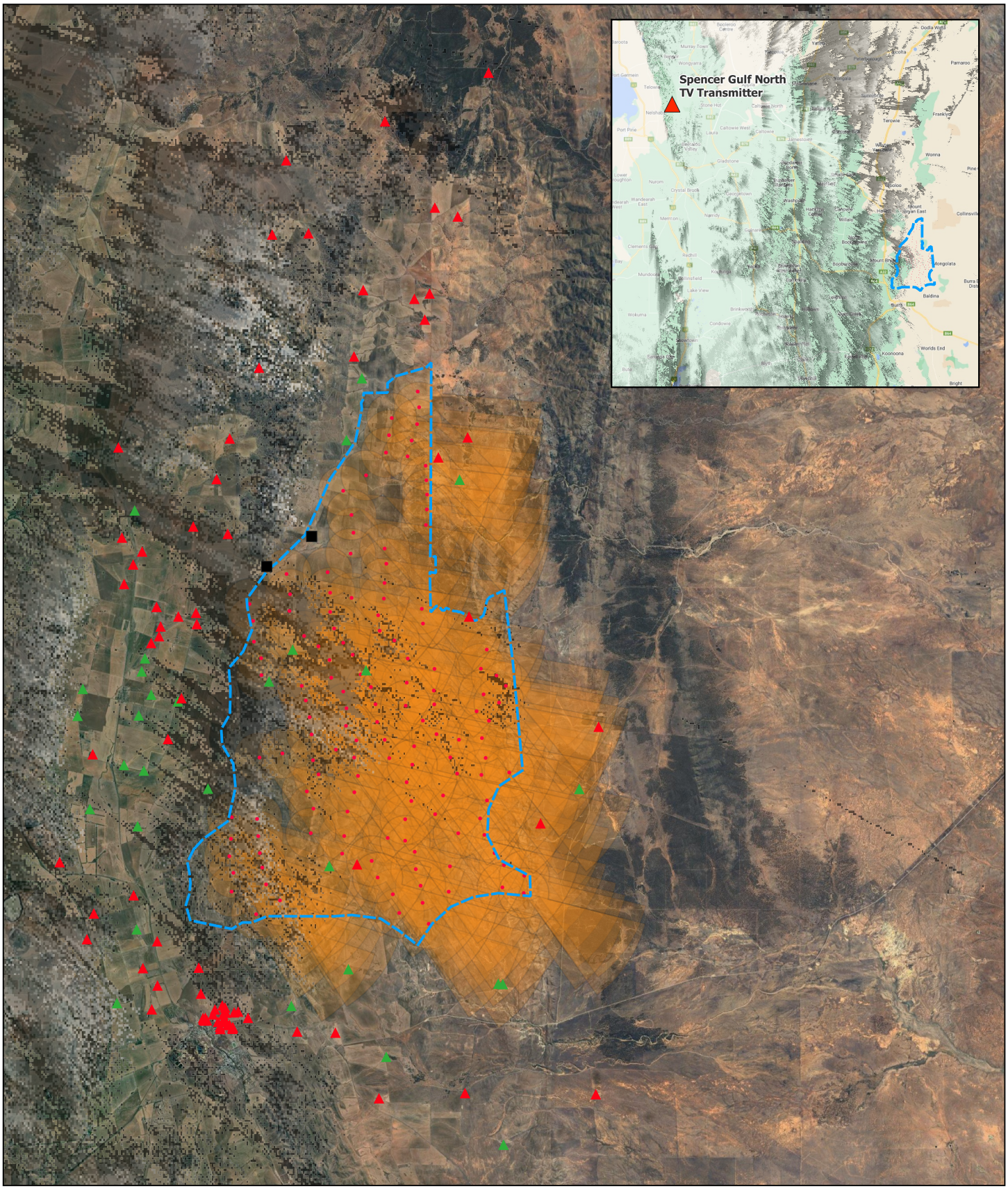
Burra TV Transmitter Scatter Zone

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 7

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Spencer Gulf North TV Transmitter
- Scatter Zone
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

TV Transmitter Signal Coverage

- Strong
- Variable moderate
- Unlikely to none

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

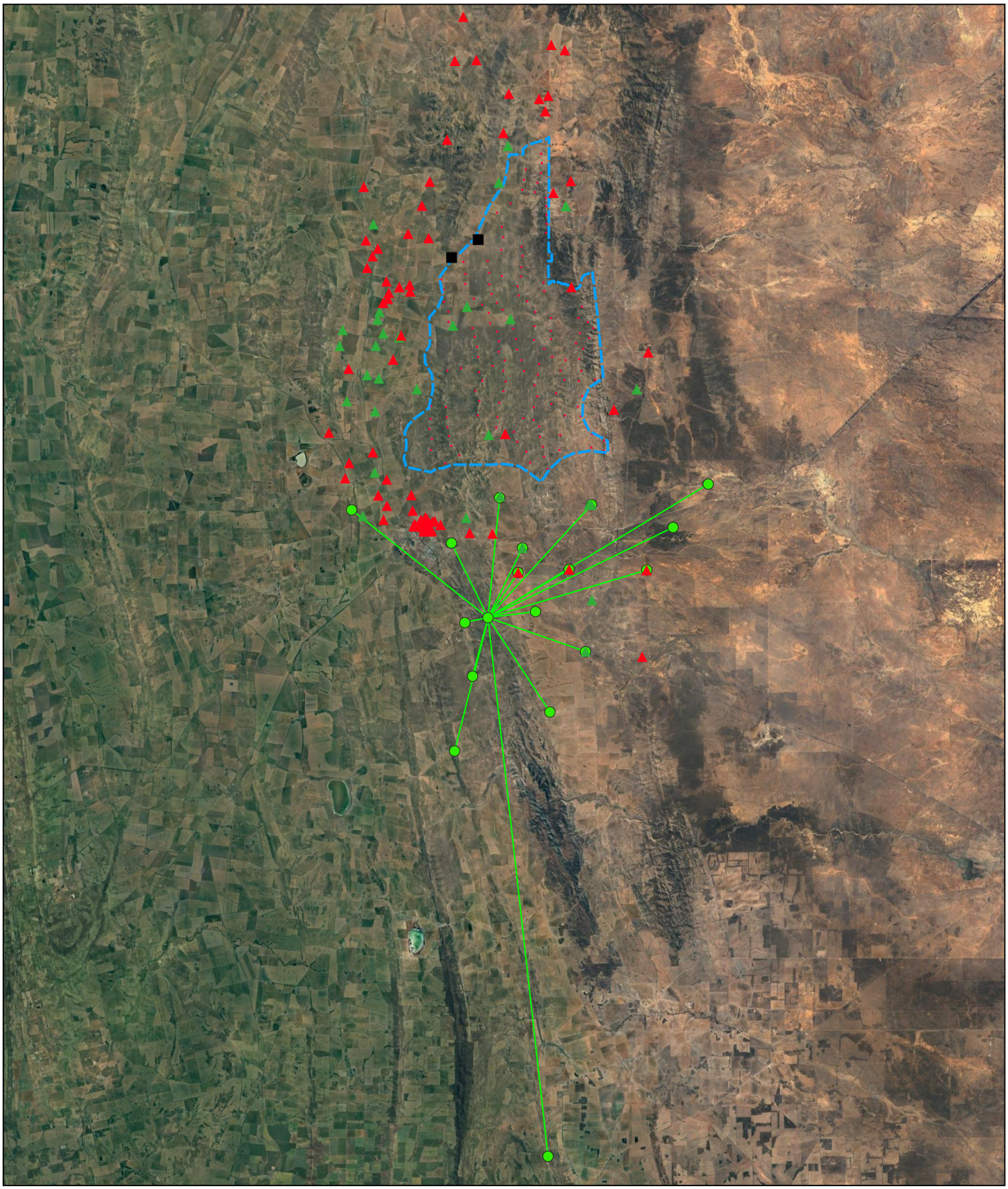
Spencer Gulf North TV Transmitter Scatter Zone

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 8

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Goyder Connect Transmitters
- STN Sites
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

Paper Size A4

0 5 10 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

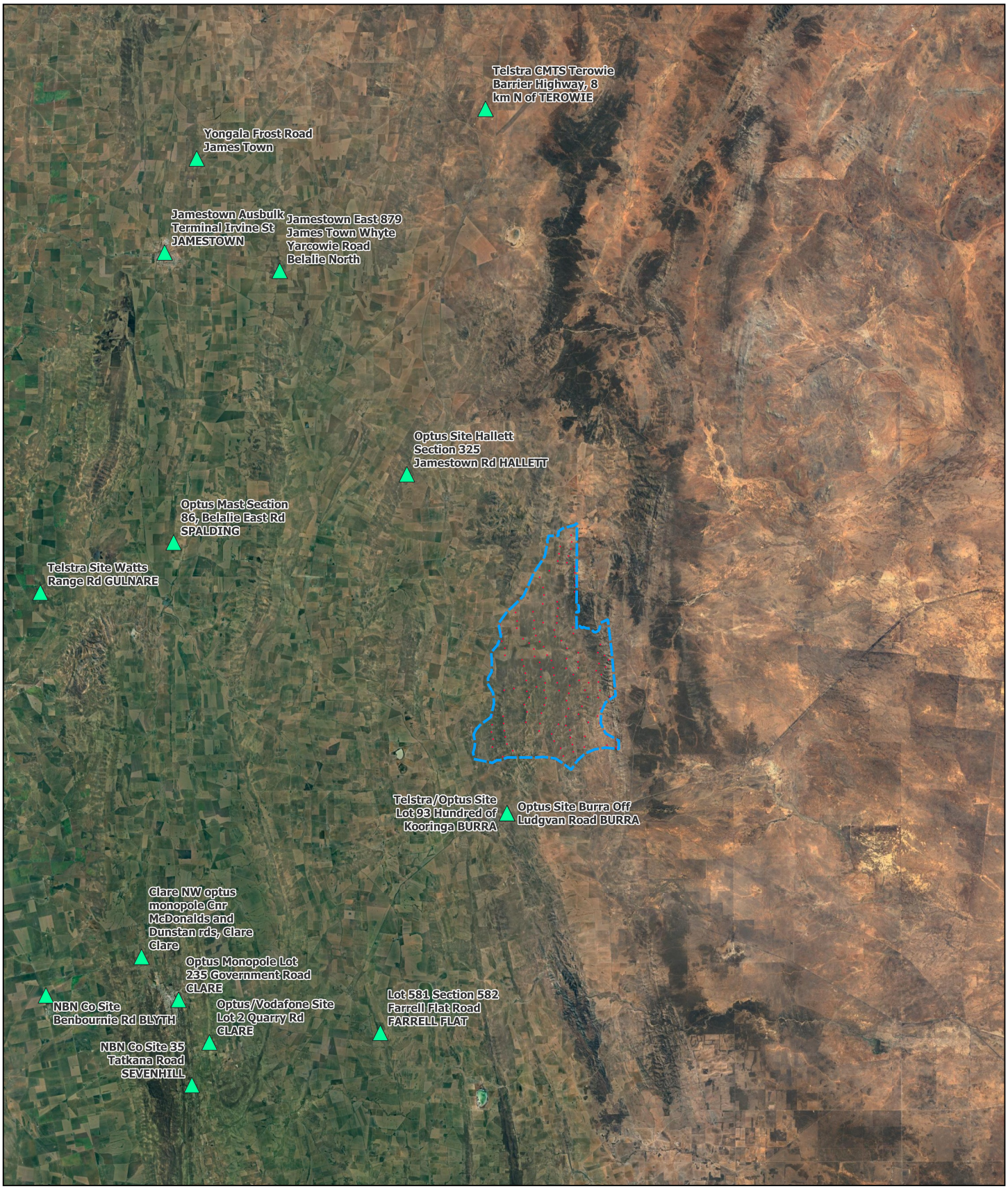
Goyder Connect

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 9

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- PTS Transmitter

Paper Size A4

0 7.5 15 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

PTS Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 10

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME

LEGEND

- Project Site Boundary
- Turbine
- Aeronautical Transmitter

Paper Size A4

0 10 20 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

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Goyder North Wind Farm

Electromagnetic Interference Assessment

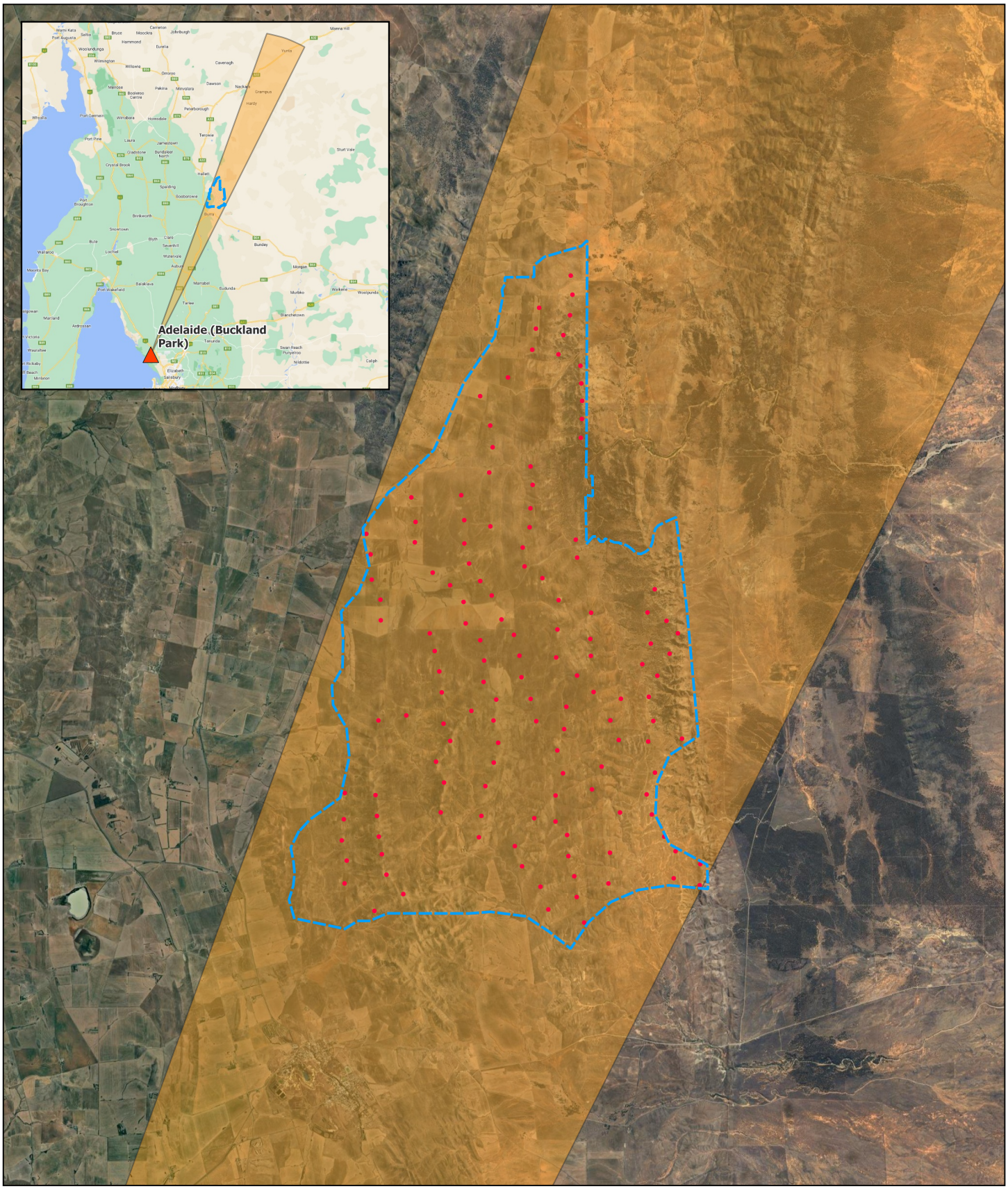
Aeronautical Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 11

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Adelaide (Buckland Park) Radar
- Adelaide Radar Cone

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

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Goyder North Wind Farm

Electromagnetic Interference Assessment

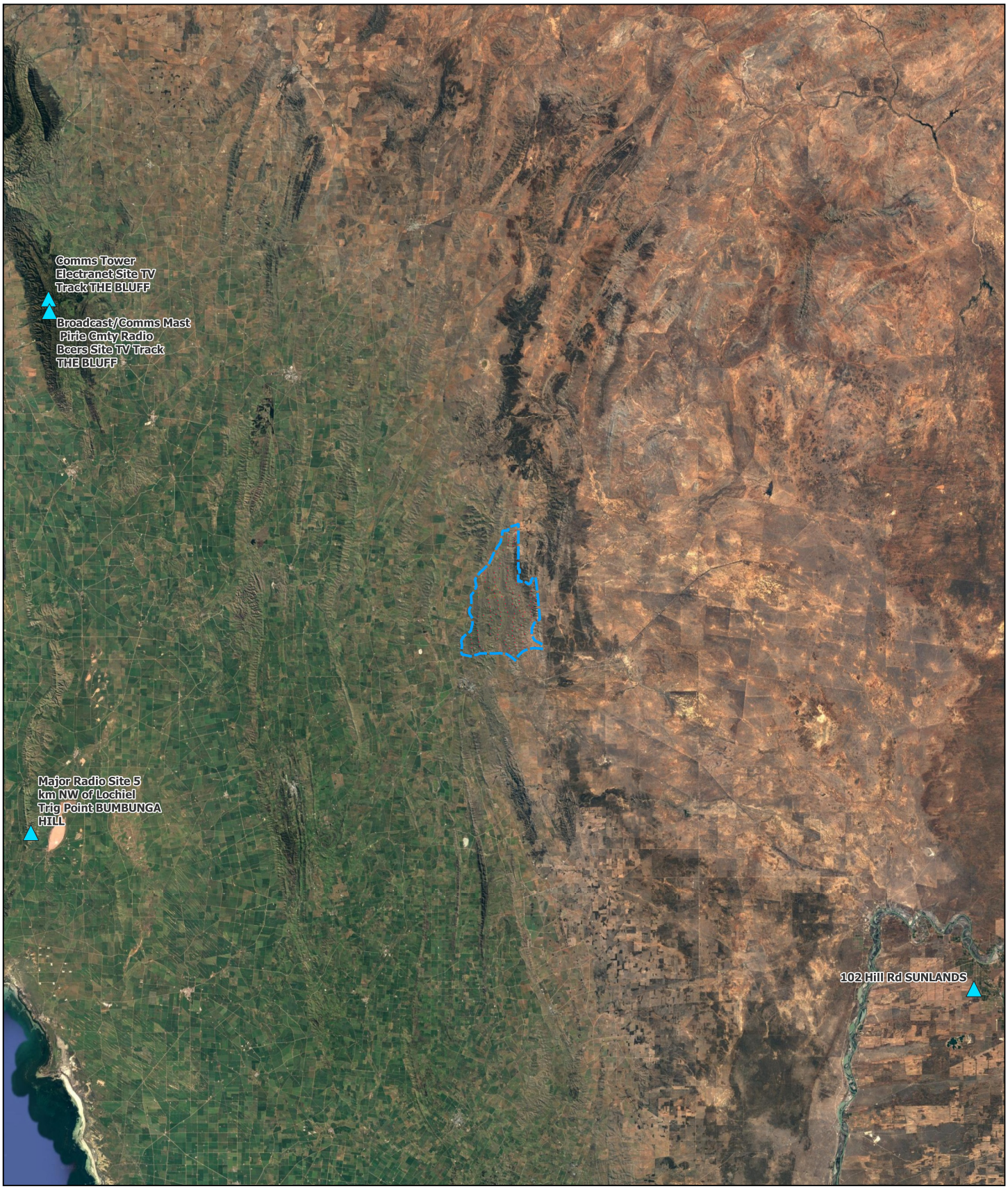
Meteorological Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 12

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Amateur Transmitter

Paper Size A4

0 10 20 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

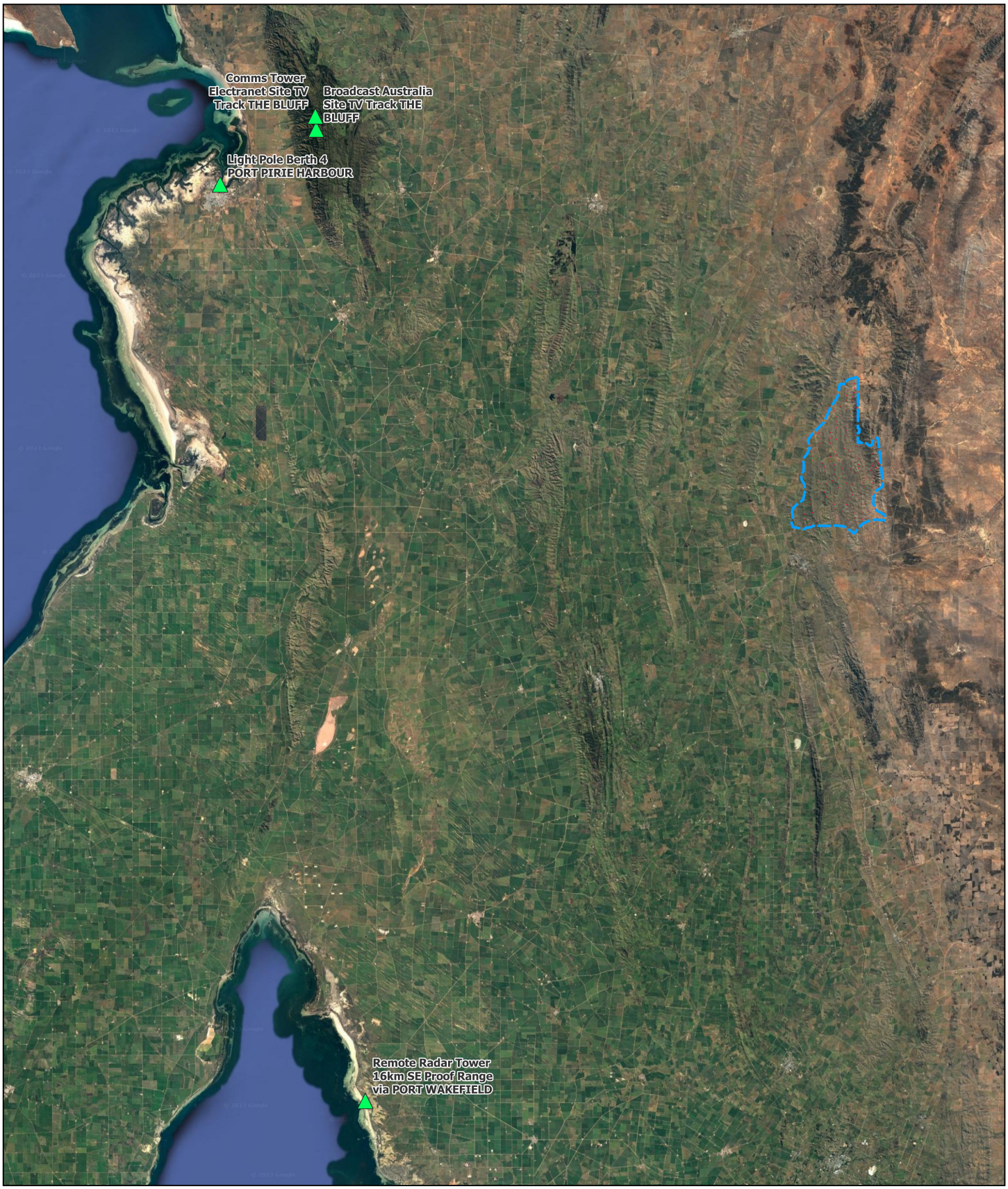
Amateur Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 13

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Maritime Coast Transmitter

Paper Size A4

0 10 20 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

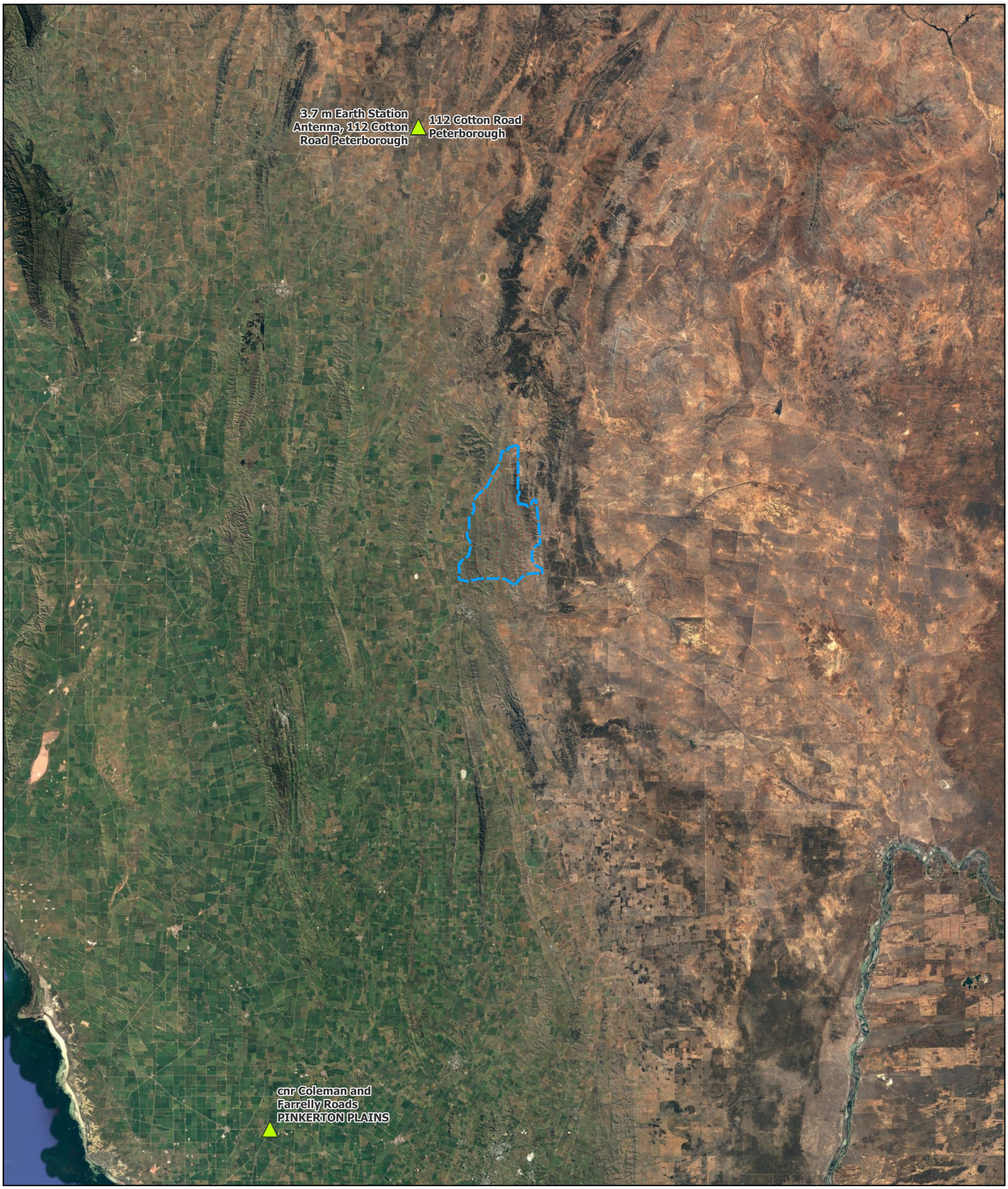
Maritime Coast Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 13

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Earth Transmitter

Paper Size A4

0 10 20 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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Goyder North Wind Farm

Electromagnetic Interference Assessment

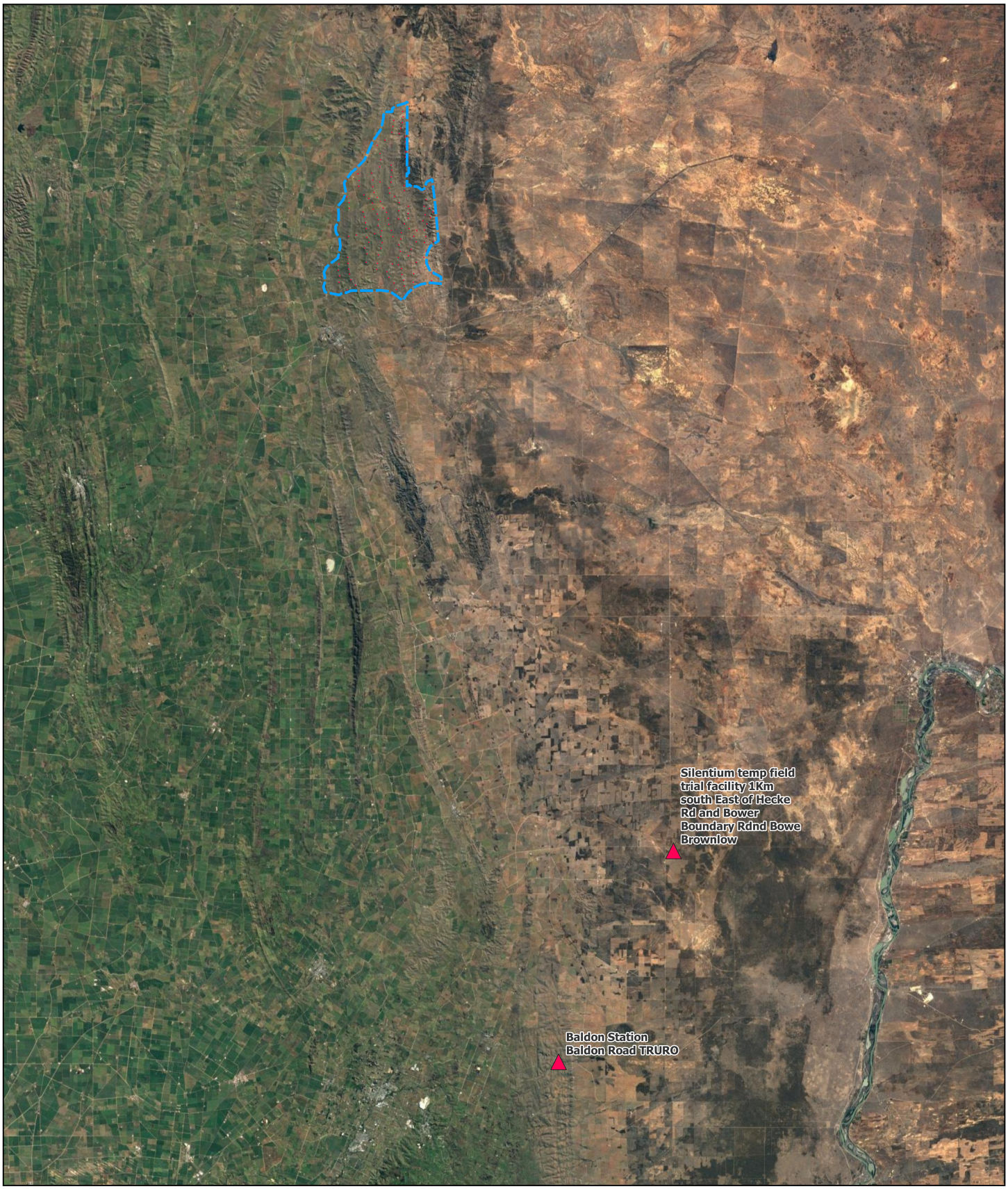
Earth Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 15

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Scientific Transmitter

Paper Size A4

0 10 20 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

Scientific Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 16

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME

LEGEND

- Project Site Boundary
- Turbine
- Radiodetermination Transmitter

Paper Size A4

0 10 20 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

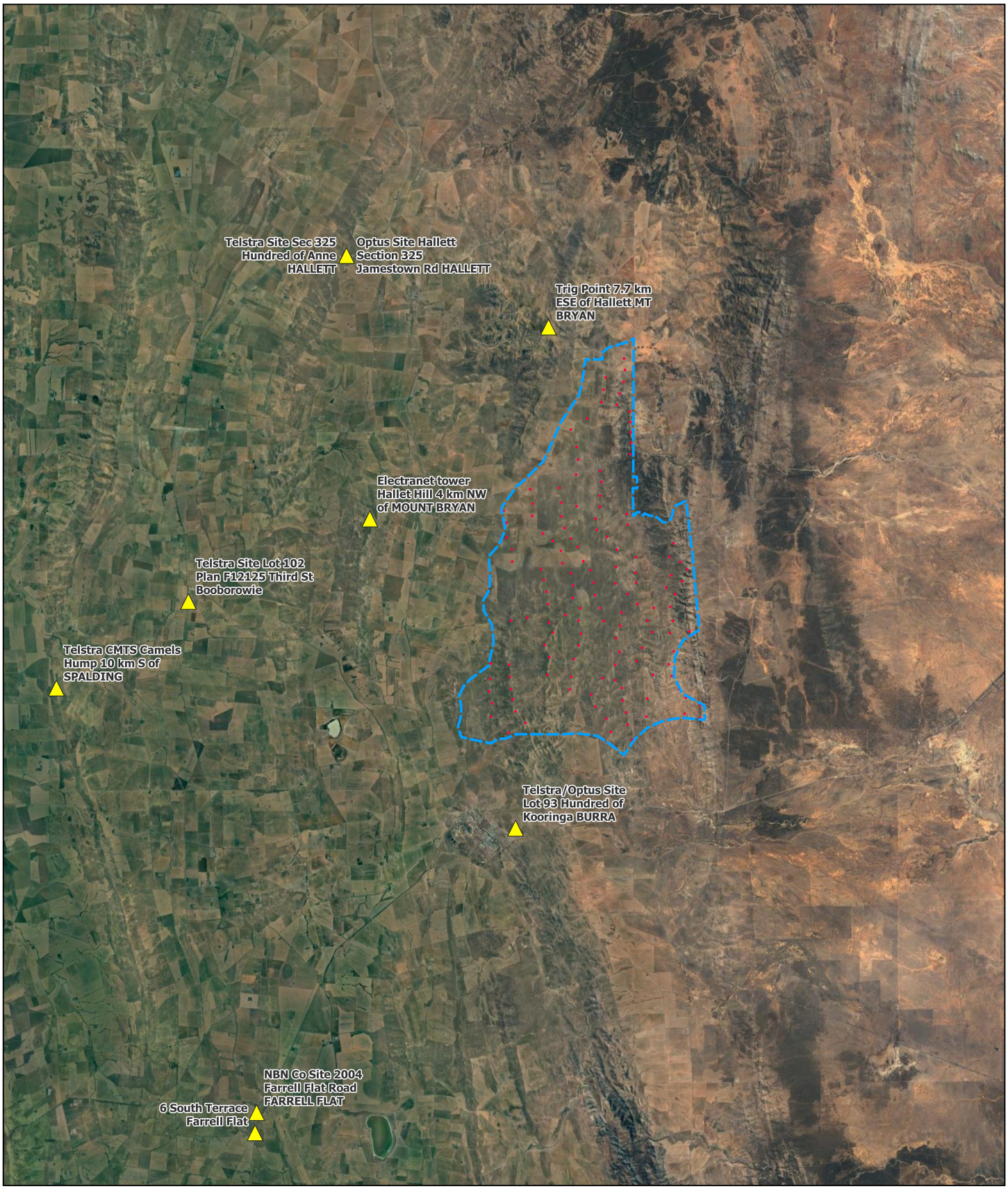
Radiodetermination Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 17

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Spectrum Transmitter

Paper Size A4

0 5 10 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

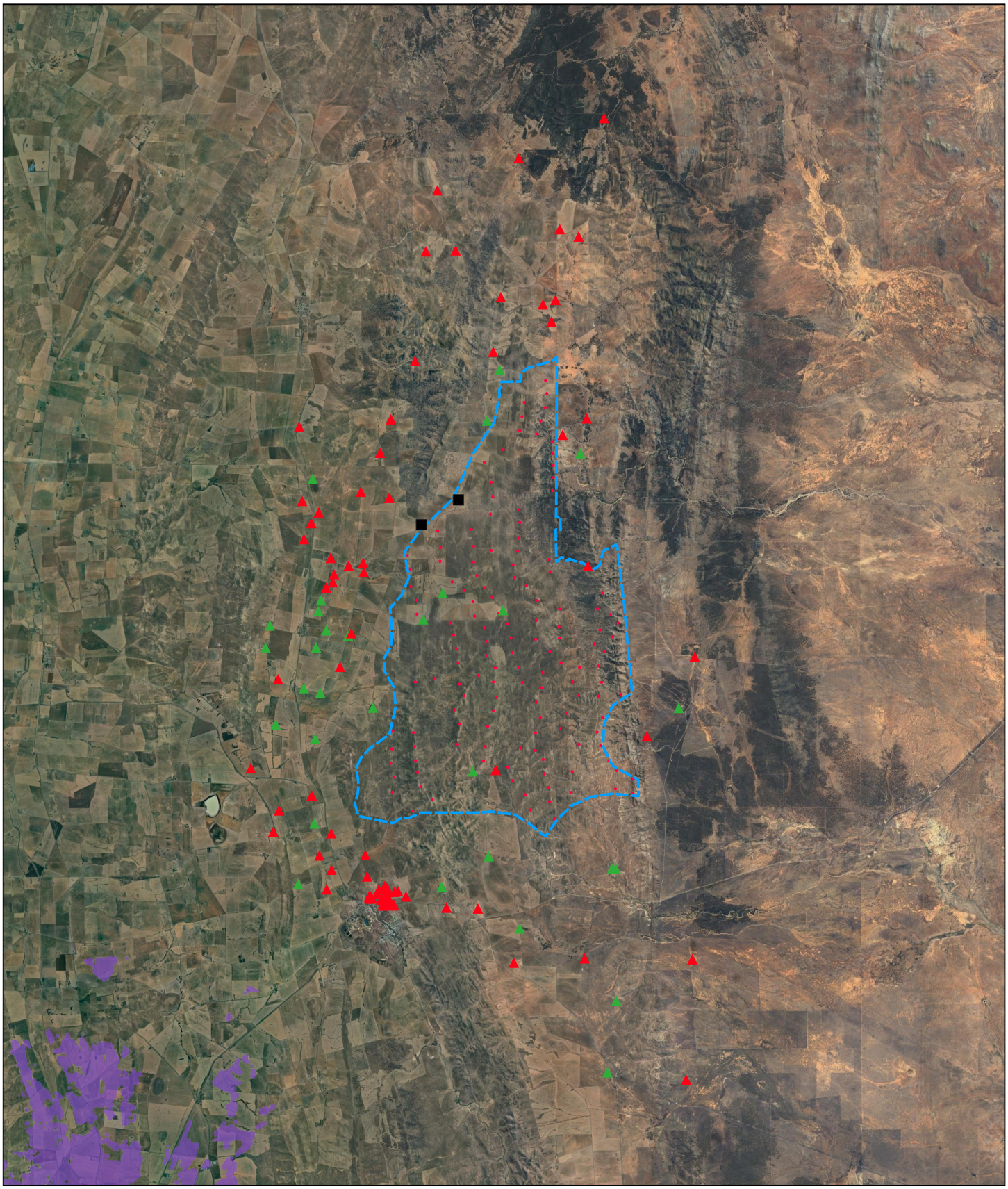
Spectrum Transmitters

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 18

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- NBN Fixed Wireless
- Dwellings - Uninvolved
- Dwellings - Close Neighbour
- Dwellings - Involved

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

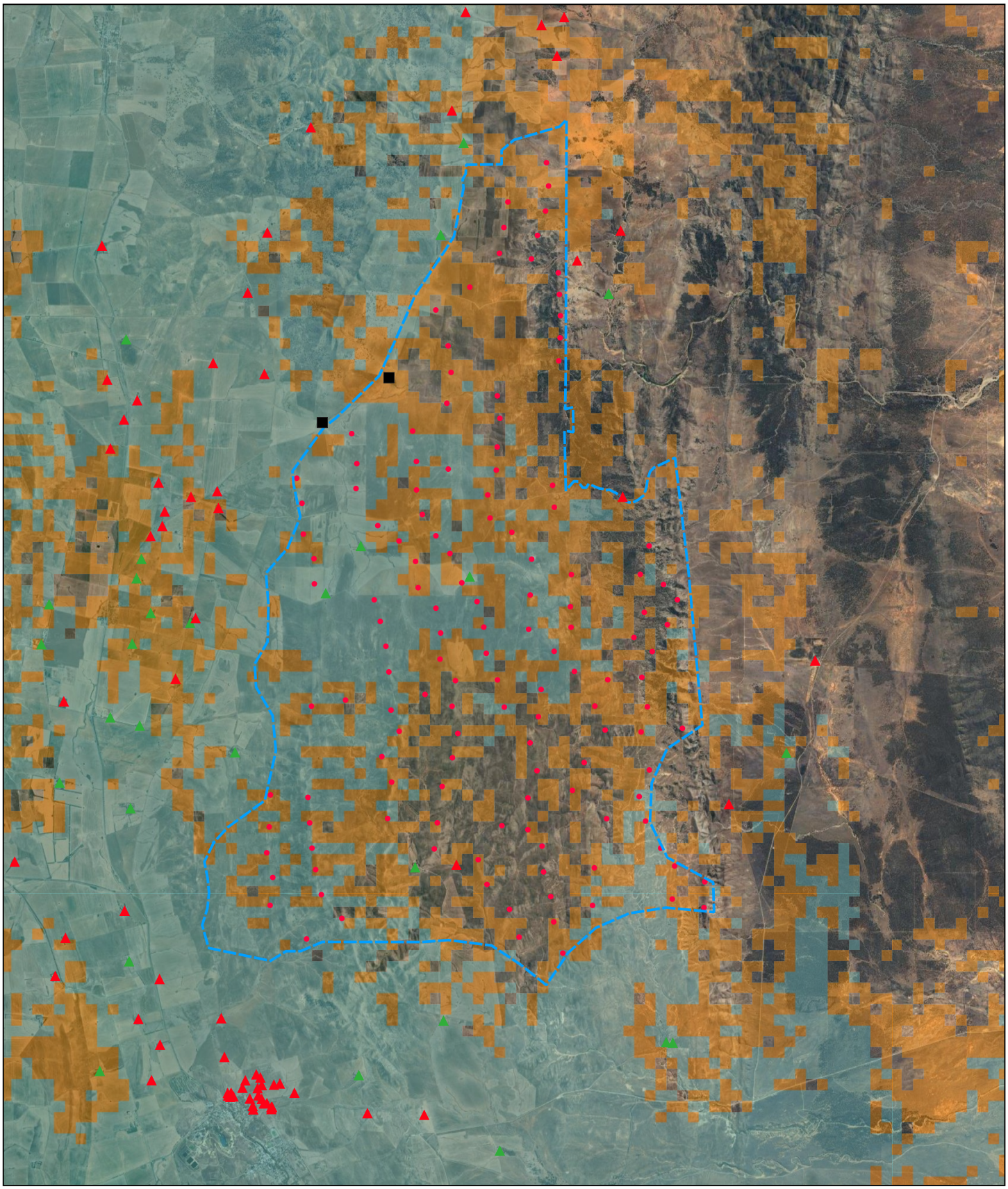
NBN Spectrum Coverage

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 19

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Optus 3G Outdoors (without antenna)
- Optus 3G Outdoors (with external antenna)
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

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NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

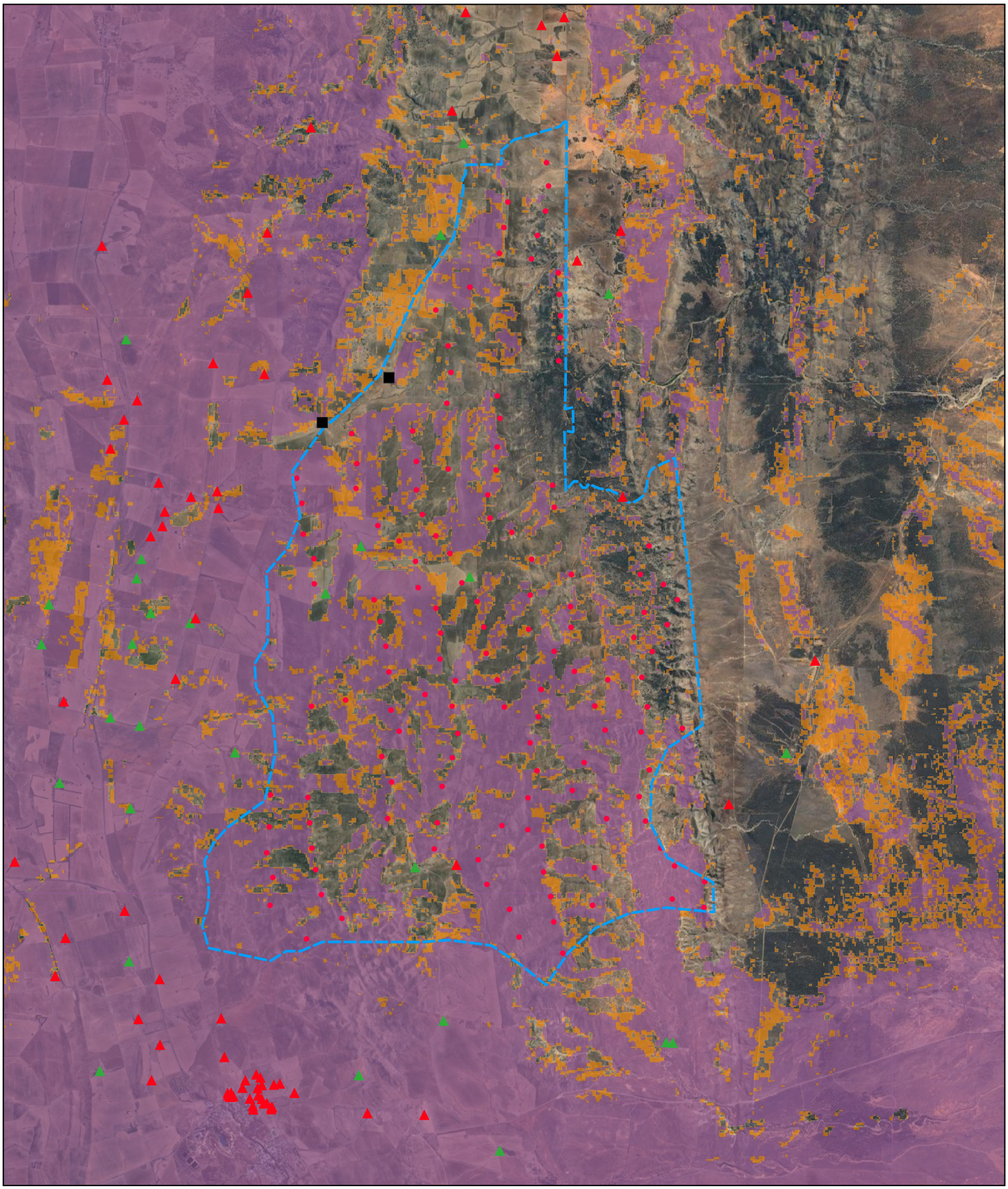
Optus 3G Spectrum Coverage

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 20

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Optus 4G (without external antenna)
- Optus 4G (with external antenna)
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

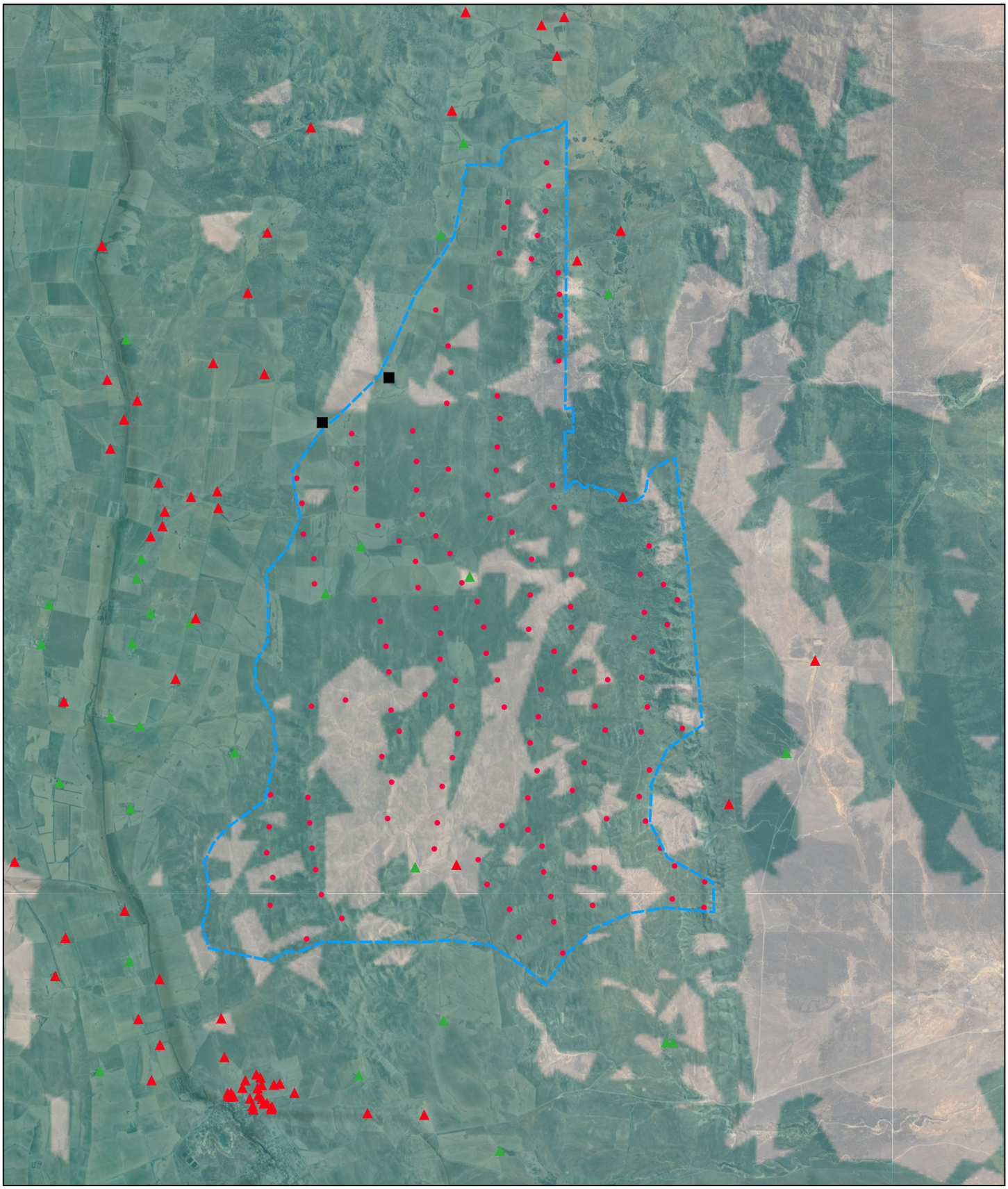
Optus 4G Spectrum Coverage

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 21

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Telstra 3G
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

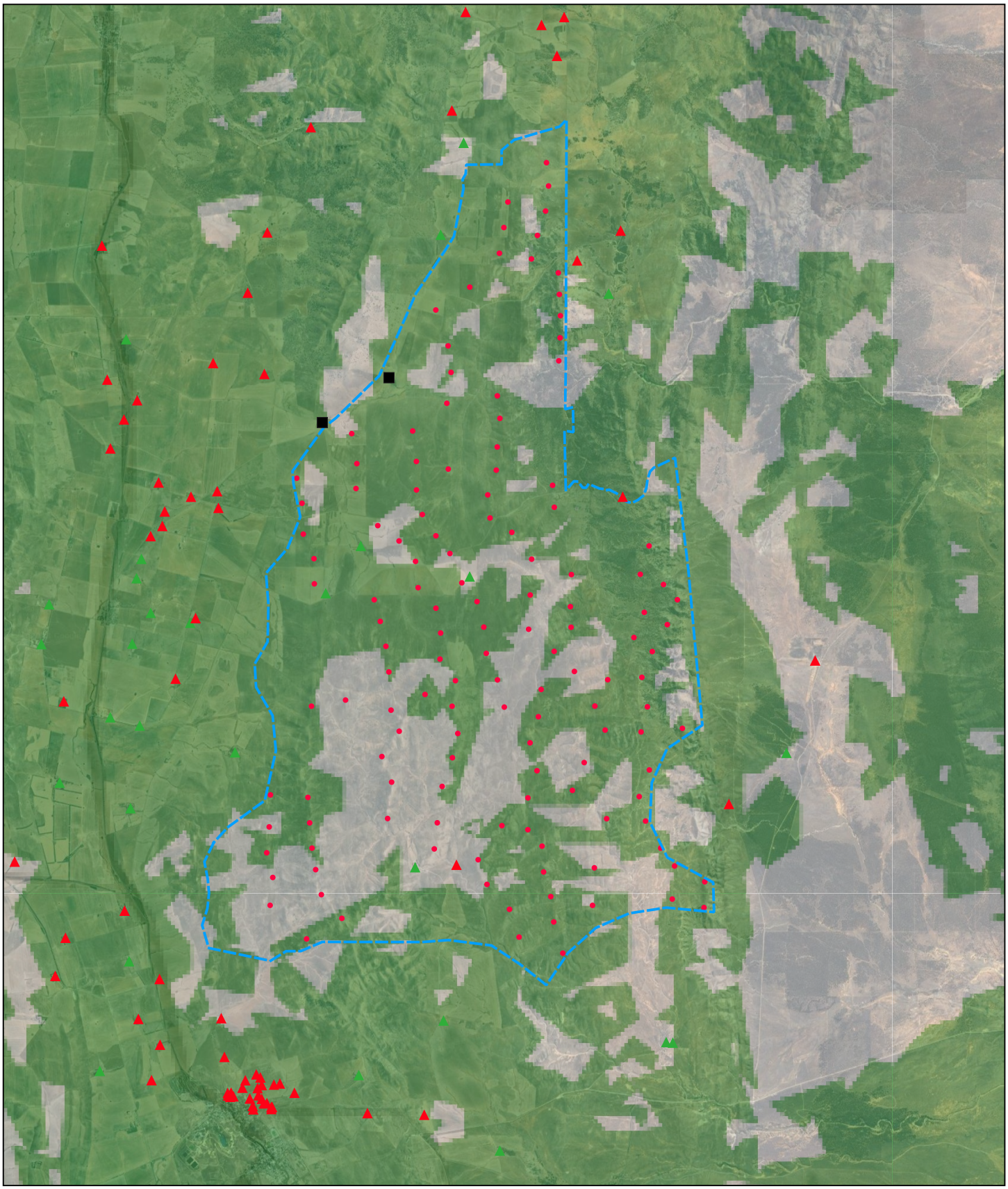
Telstra 3G Spectrum Coverage

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 22

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Telstra 4G
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

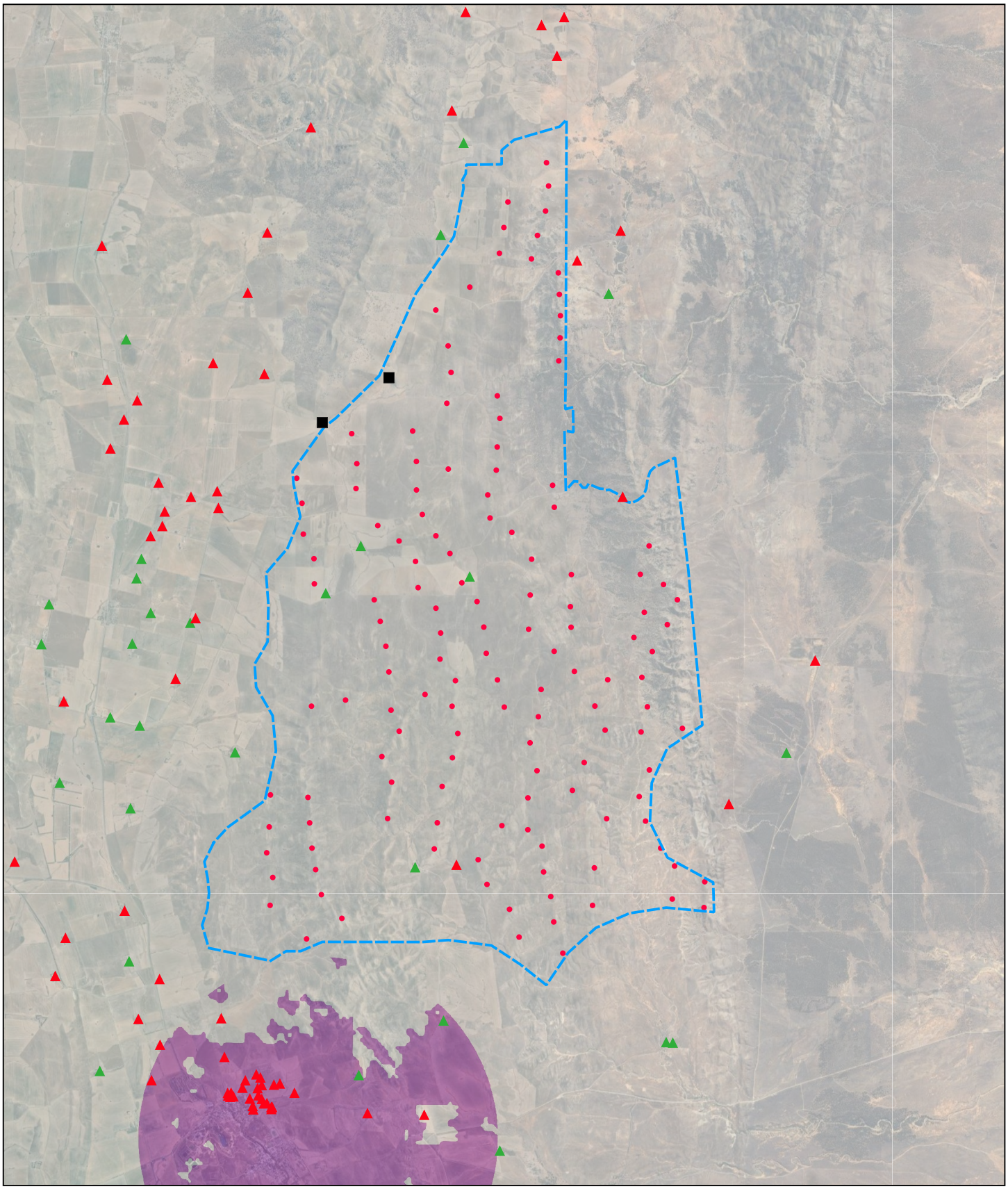
Telstra 4G Spectrum Coverage

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 23

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Telstra 5G
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

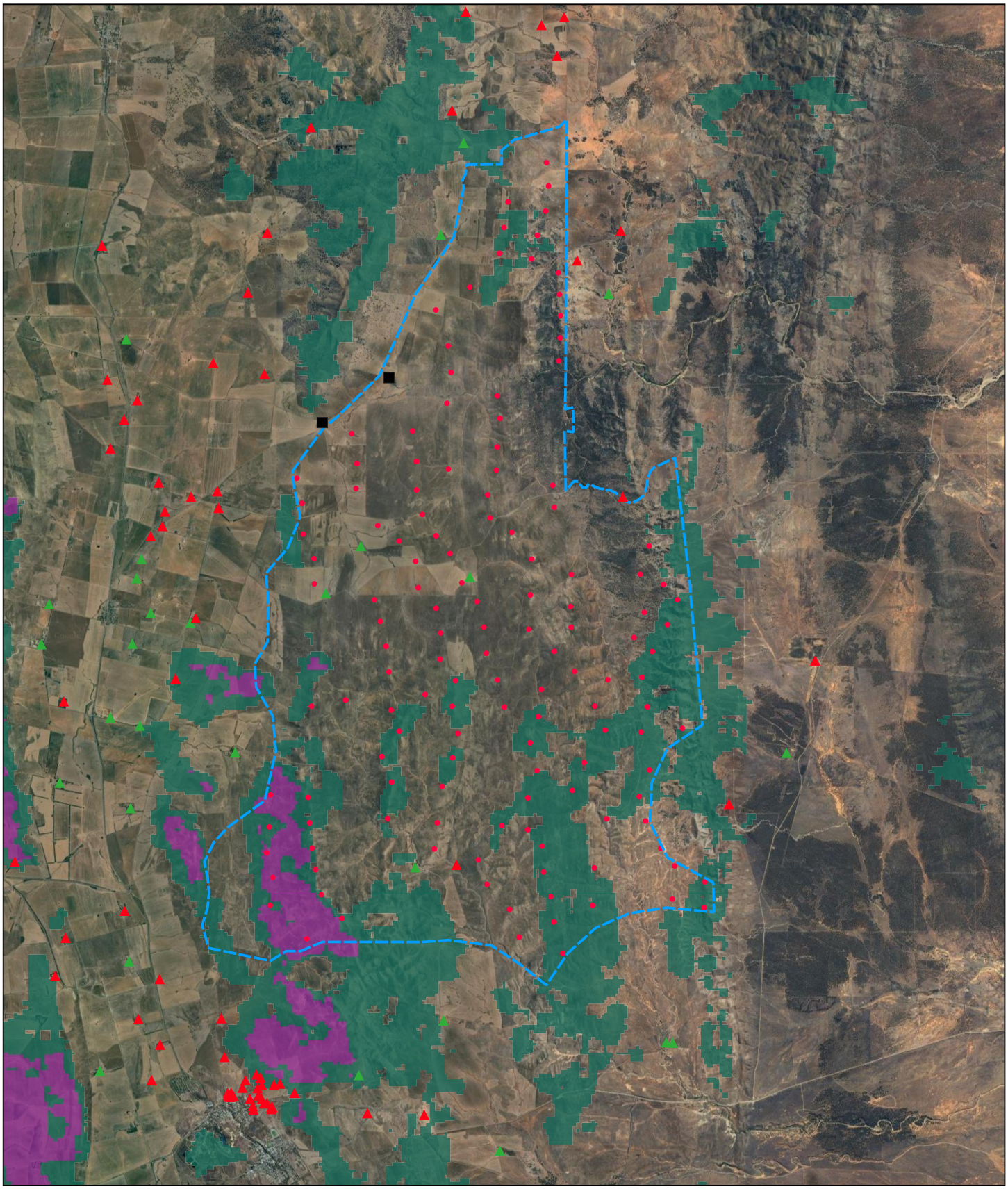
Telstra 5G Spectrum Coverage

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 24

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME



LEGEND

- Project Site Boundary
- Turbine
- Vodafone 3G Outdoor
- Vodafone 4G Outdoor
- Dwellings - Close Neighbour
- Dwellings - Involved
- Dwellings - Uninvolved

Paper Size A4

0 2.5 5 km

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid Of Australia, Zone 54

N

GHD

NEOEN

Goyder North Wind Farm

Electromagnetic Interference Assessment

Vodafone Spectrum Coverage

Project No. **12589003**
Revision No. **0**
Date. **29/11/2023**

FIGURE 25

\\ghdnet\ghd\AU\Adelaide\Projects\33\12589003\GIS\Maps\Working\12589003-SiteMap_20230831.qgz

Data source: Google Earth Imagery 2023. Created by: ME

Appendix D

Consultation Letters

From: Mohammad Zomorrodi <Mohammad.Zomorrodi@bom.gov.au>
Sent: Tuesday, 17 October 2023 10:48 AM
To: Brendan Siebert; Marcus Eymael
Cc: windfarmenquiries; Energy; Adrian Cresswell
Subject: RE: Goyder North Electromagnetic Interference Assessment [SEC=OFFICIAL]

Hi Brendan and Marcus,

The Bureau of Meteorology's assessment of the proposed Goyder North Wind Farm is now complete, which indicates manageable impact to our neighboring assets, under normal propagation conditions.

The Bureau requests that the owner/operator of the Goyder North Wind Farm to provide a letter confirming the acceptance of:

- informs the Bureau of any changes in the wind farm, including varying the layout of the farm, changing the location of a turbine more than 100 meters, or altering turbine height
- informs the Bureau at least 2 weeks before any planned shut-down of the wind farm (for maintenance or any other reason) so that the Bureau may calibrate its weather radar system
- collaborates with the Bureau in the event of severe weather conditions to assist in matters of community safety

Please direct any further correspondence to energy@bom.gov.au & windfarmenquiries@bom.gov.au, including Goyder North Wind Farm in the subject line, and let us know if you have any queries.

Kind regards,

Mohammad

Dr. Mohammad Zomorrodi
Radio Frequency Spectrum Manager
Data & Digital, Operational Technology & Engineering
M: 0415 524 457 | T: 03 9669 4413
Level 7, 700 Collins St, Docklands, VIC 3008
Mohammad.Zomorrodi@bom.gov.au | www.bom.gov.au

The Bureau of Meteorology

From: Brendan Siebert <Brendan.Siebert@ghd.com>
Sent: Wednesday, October 11, 2023 1:05 PM
To: Mohammad Zomorrodi <Mohammad.Zomorrodi@bom.gov.au>; Marcus Eymael <Marcus.Eymael@ghd.com>
Cc: windfarmenquiries <windfarmenquiries@bom.gov.au>
Subject: RE: Goyder South Electromagnetic Interference Assessment [SEC=OFFICIAL]

Hi Mohmmad,

Please see attached spreadsheet, column I (Ground_AHD), which shows ground elevation at each turbine location.

MIN ELEVATION:	464.6661
MAX ELEVATION:	736.9201

Best regards,
Brendan Siebert
BE(IT&Telecommunications)(Hons.) MIEAust MTCNA
Senior Engineer - Telecommunications
GHD
Proudly employee-owned | ghd.com
Level 4 211 Victoria Square Adelaide SA 5000 Australia
D +61 8 8111 6743 **O** +61 8 8111 6600 **E** brendan.siebert@ghd.com
The Power of Commitment

Connect

From: Mohammad Zomorrodi <Mohammad.Zomorrodi@bom.gov.au>
Sent: Tuesday, October 10, 2023 5:16 PM
To: Marcus Eymael <Marcus.Eymael@ghd.com>
Cc: Brendan Siebert <Brendan.Siebert@ghd.com>; windfarmenquiries <windfarmenquiries@bom.gov.au>
Subject: RE: Goyder South Electromagnetic Interference Assessment [SEC=OFFICIAL]

Hi Marcus,

Thanks for your reply. Would you please provide response for question 5? We need the min and max elevation of the site that turbines are placed per meter .

Regards
Mohammad

From: Marcus Eymael <Marcus.Eymael@ghd.com>
Sent: Tuesday, October 10, 2023 5:37 PM
To: Mohammad Zomorrodi <Mohammad.Zomorrodi@bom.gov.au>
Cc: Brendan Siebert <Brendan.Siebert@ghd.com>; windfarmenquiries <windfarmenquiries@bom.gov.au>
Subject: RE: Goyder South Electromagnetic Interference Assessment [SEC=OFFICIAL]

Hi Mohammad,
I can confirm the project is Goyder North WF, apologies for the confusion. Please see attached filled details form.

Marcus Eymael
Security & Communications Consultant
Building Engineering

GHD
Proudly employee-owned | ghd.com
Level 15 133 Castlereagh Street Sydney NSW 2000 Australia
D +61 2 9239 7980 **E** marcus.eymael@ghd.com

The Power of Commitment

Connect

Please consider the environment before printing this email

From: Mohammad Zomorrodi <Mohammad.Zomorrodi@bom.gov.au>
Sent: Friday, October 6, 2023 9:16 PM
To: Rhys Lade <Rhys.Lade@bom.gov.au>; Marcus Eymael <Marcus.Eymael@ghd.com>; windfarmenquiries <windfarmenquiries@bom.gov.au>
Cc: Andrew Collins <andrew.collins@bom.gov.au>; Brendan Siebert <Brendan.Siebert@ghd.com>; Marc Keppler <Marc.Keppler@bom.gov.au>
Subject: RE: Goyder South Electromagnetic Interference Assessment [SEC=OFFICIAL]

Dear Marcus,

Thanks for contacting the Bureau on the Goyder south wind farm impact analysis.

I noticed that the subject line of the Email is referring to the **Goyder South WF** while in the body of your message, the reference is to **Goyder north WF**. Would you please clarify this?

Moreover, to officially start the process of analysis, may I kindly request filling the attached form and send it to us? I can see that the kml file of the proposed WF as well as the spreadsheet showing the coordinates of the Turbines are already submitted.

Regards

Mohammad

Dr. Mohammad Zomorrodi
Radio Frequency Spectrum Manager
Data & Digital, Operational Technology & Engineering
M: 0415 524 457 | T: 03 9669 4413
Level 7, 700 Collins St, Docklands, VIC 3008
Mohammad.Zomorrodi@bom.gov.au | www.bom.gov.au

The Bureau of Meteorology

From: Rhys Lade <Rhys.Lade@bom.gov.au>
Sent: Friday, October 6, 2023 3:19 PM
To: Marcus Eymael <Marcus.Eymael@ghd.com>; windfarmenquiries <windfarmenquiries@bom.gov.au>
Cc: Andrew Collins <andrew.collins@bom.gov.au>; Brendan Siebert <Brendan.Siebert@ghd.com>; Marc Keppler <Marc.Keppler@bom.gov.au>
Subject: RE: Goyder South Electromagnetic Interference Assessment [SEC=OFFICIAL]

Afternoon Marcus,

Paul has retired from the BOM (well earned). Windfarmenquiries above is the new e-mail to use so we don't loose communication to dormant e-mail accounts.

Mohammad will most likely be the person who gets in touch. He may need some background if information was lost in the staff transition.

Thanks for keeping us updated. This is getting to be quite a substantial amount of work for the BOM.

Regards

Rhys

From: Marcus Eymael <Marcus.Eymael@ghd.com>
Sent: Friday, October 6, 2023 2:15 PM
To: paul.hettrick@bom.gov.au
Cc: Andrew Collins <andrew.collins@bom.gov.au>; Rhys Lade <Rhys.Lade@bom.gov.au>; Brendan Siebert <Brendan.Siebert@ghd.com>
Subject: FW: Goyder South Electromagnetic Interference Assessment [SEC=UNCLASSIFIED]

Hi Paul,
The layout for the Goyder North wind farm has changed since your last consultation with GHD. Based on your previous advice and the change in layout, can you please confirm whether there will be an impact on BOM services. I have attached the site boundary and turbine layout in the .kml file and coordinates in the attached excel spreadsheet.
The turbine specifications will not exceed the dimensions shown below:

- Maximum tip height: Up to 240m
- Rotor diameter: Up to 180m

Please do not hesitate to contact me if you have any questions.

Marcus Eymael
Security & Communications Consultant
Building Engineering

GHD
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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia
D +61 2 9239 7980 **E** marcus.eymael@ghd.com

From: Paul Hettrick <paul.hettrick@bom.gov.au>
Sent: Tuesday, September 17, 2019 4:28 PM
To: Brendan Siebert <Brendan.Siebert@ghd.com>
Cc: Andrew Collins <andrew.collins@bom.gov.au>; Rhys Lade <Rhys.Lade@bom.gov.au>
Subject: RE: Goyder South Electromagnetic Interference Assessment [SEC=UNCLASSIFIED]

Hi Brendan

The attached plot for the lowest (0.5 deg) elevation scan shows that turbines in the proposed Goyder North wind farm shouldn't pose an interference risk to the Buckland Park radar due to beam blocking by intervening terrain. Turbines in the areas associated with the Stony Gap (Goyder South?) wind farm further south of this are closer to the radar coverage area but shouldn't be visible under normal radio propagation conditions. However any expansion of the wind farm on the ridges further south would risk putting turbines within the interference zones.

You will notice that the Snowtown Stage 2 wind farm turbines are within the theoretical path of the radar beam, and indeed we do see interference from them as well as the Stage 1 turbines further north under certain propagation conditions (second attachment). The fact that these turbines are situated along N-S ridges results in a larger total radar cross-section relative to the radar location.

Regards
Paul

Paul Hettrick | RF Spectrum Manager

Australian Government
Bureau of Meteorology

Bureau of Meteorology
GPO Box 1289 Melbourne VIC 3001
Level 7, 700 Collins Street, Docklands VIC 3008
Tel: +61 3 9669 4240 | P.Hettrick@bom.gov.au
www.bom.gov.au

From: Brendan.Siebert@ghd.com [mailto:Brendan.Siebert@ghd.com]
Sent: Tuesday, 17 September 2019 11:43 AM
To: Paul Hettrick
Cc: Andrew Collins
Subject: Goyder South Electromagnetic Interference Assessment

Hi Paul,

Did you have any information regarding this development that we can include this week?

Best Regards,

Brendan Siebert
Senior Engineer - Telecommunications
BE Hons. (IT & Telecommunications), MIEAust, MTCNA

GHD
Proudly employee owned
T: +61 8 8111 6743 | VoIP: 336743 | E: brendan.siebert@ghd.com
GHD Level 4 211 Victoria Square Adelaide SA 5000 Australia | www.ghd.com
Connect

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

From: Ryan Ruddick <Ryan.Ruddick@ga.gov.au>
Sent: Friday, 6 October 2023 4:45 PM
To: Marcus Eymael
Cc: Brendan Siebert; Client Services
Subject: RE: CLIENT ENQUIRY: Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points [SEC=OFFICIAL]

Hi Marcus,

The same advice applies – we do not foresee any impact.

Cheers

Ryan

From: Marcus Eymael <Marcus.Eymael@ghd.com>
Sent: Friday, October 6, 2023 11:43 AM
To: Ryan Ruddick <Ryan.Ruddick@ga.gov.au>
Cc: Brendan Siebert <Brendan.Siebert@ghd.com>; Client Services <ClientServices@ga.gov.au>
Subject: RE: CLIENT ENQUIRY: Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points [SEC=UNCLASSIFIED]

Hi Ryan,
The layout for the Goyder North wind farm has changed since your last consultation with GHD. Based on your previous advice and the change in layout, can you please confirm whether there will be an impact on Geoscience services. I have attached the site boundary and turbine layout in the .kml file and coordinates in the attached excel spreadsheet.
The turbine specifications will not exceed the dimensions shown below:

- Maximum tip height: Up to 240m
- Rotor diameter: Up to 180m

Please do not hesitate to contact me if you have any questions.

Marcus Eymael
Security & Communications Consultant
Building Engineering

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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia
D +61 2 9239 7980 **E** marcus.eymael@ghd.com

From: Ruddick Ryan <Ryan.Ruddick@ga.gov.au>
Sent: Friday, August 23, 2019 10:16 AM
To: Brendan Siebert <Brendan.Siebert@ghd.com>
Cc: Geodesy <geodesy@ga.gov.au>; Client Services <ClientServices@ga.gov.au>
Subject: RE: CLIENT ENQUIRY: Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points [SEC=UNCLASSIFIED]

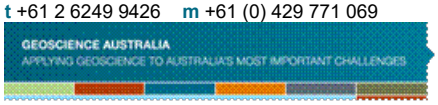
Hi Brendan.

Please see attached advice on the impact of three wind farm projects on our equipment.

Kind regards,

Ryan Ruddick
Section Leader | GNSS Infrastructure and Informatics
National Positioning Infrastructure | Positioning and Community Safety Division

t +61 2 6249 9426 m +61 (0) 429 771 069



Make flexibility work. If you receive an email from me at a time that is outside of normal business hours, I am sending it at a time that suits me. I am not expecting you to read or reply until normal business hours.

From: Brendan.Siebert@ghd.com <Brendan.Siebert@ghd.com>
Sent: Thursday, 22 August 2019 9:15 AM
To: Ruddick Ryan <Ryan.Ruddick@ga.gov.au>
Cc: Geodesy <geodesy@ga.gov.au>; Client Services <ClientServices@ga.gov.au>
Subject: RE: CLIENT ENQUIRY: Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points [SEC=UNCLASSIFIED]

Hello Ryan,

Please find attached the coordinates of the wind turbine layout for the southern phase of the project named Stony Gap Layout Rev C kmz. This is the development which will be progressing very shortly and needs priority attention.

Goyder North Layout is the following phase of the project that will likely be built after the southern phase, but will still need analysis, although the locations are subject to changes.

GHD is also working on another EMI Assessment for another wind farm called Forest Wind in the Wide Bay area of SE Qld.. Are you the correct contact to review that layout as well? I have sent another email directly to the clientservices@ga.gov.au email but have not had a response yet.

If you need any further information please contact me on the phone or email details below at any time.

Best Regards,

Brendan Siebert
Senior Engineer - Telecommunications
BE Hons. (IT & Telecommunications), MTCNA

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Proudly employee owned
T: +61 8 8111 6743 | VoIP: 336743 | E: brendan.siebert@ghd.com
GHD Level 4 211 Victoria Square Adelaide SA 5000 Australia | www.ghd.com
Connect

From: Ruddick Ryan <Ryan.Ruddick@ga.gov.au>
Sent: Thursday, 22 August 2019 08:31
To: Brendan Siebert <Brendan.Siebert@ghd.com>
Cc: Geodesy <geodesy@ga.gov.au>; Client Services <ClientServices@ga.gov.au>
Subject: Re: CLIENT ENQUIRY: Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points [SEC=UNCLASSIFIED]

Hi Brendan.

To help with our response could you please provide the coordinates of the proposed turbines.

Regards,

Ryan Ruddick
Section Leader GII
National Positioning Infrastructure Branch
Geoscience Australia
Phone: +61 429 771 069

From: Client Services <ClientServices@ga.gov.au>
Sent: Friday, August 16, 2019 10:38 am
To: Geodesy
Subject: CLIENT ENQUIRY: Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points [SEC=UNCLASSIFIED]

Hi Geodesy,

Client Services has received the request below requesting assistance from GA regarding potential impact to Trig Points from a wind farm. Is this something you can assist with?

If so, could you please keep Client Services in the loop with your response so we can track the enquiry's progress.

Thanks

Sam

Samantha Murphy | Client Services
Discovery & Engagement | Digital Science and Information Branch

t +61 2 6249 9012 www.ga.gov.au

-----Original Message-----
From: contact-form@ga.gov.au <contact-form@ga.gov.au>
Sent: Wednesday, 14 August 2019 5:58 PM
To: Client Services <ClientServices@ga.gov.au>
Subject: Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points [SEC=UNCLASSIFIED]

Name : Brendan Siebert
Email : brendan.siebert@ghd.com
Confirm email : brendan.siebert@ghd.com
Type of enquiry : Scientific enquiry

Topic of interest (optional) : Positioning and Navigation
Subject : Goyder Wind Farm - Electromagnetic Interference Assessment - Impact on Trig Points

Message : Hello Geoscience Australia,

GHD is also conducting an EMI assessment of a wind farm for a project here in SA, Goyder North and Goyder South - Hybrid Renewable Energy Project.

Is it possible that you could provide input regarding potential impact to Trig Points in the area?

I can send you the proposed turbine locations on request.

Best Regards,

Brendan Siebert
Senior Engineer - Telecommunications
GHD

From: Whitney Tucker <whitneytucker@nbnco.com.au>
Sent: Thursday, 19 October 2023 10:44 AM
To: Marcus Eymael
Cc: Brendan Siebert
Subject: [WARNING: ATTACHMENT UNSCANNED]Wind Farm EMI Assessment - Goyder North Wind Farm [Commercial - Anyone]
Attachments: Boundary_Overview D.kmz; Turbine.kmz; Turbine Locations_Goyder.csv

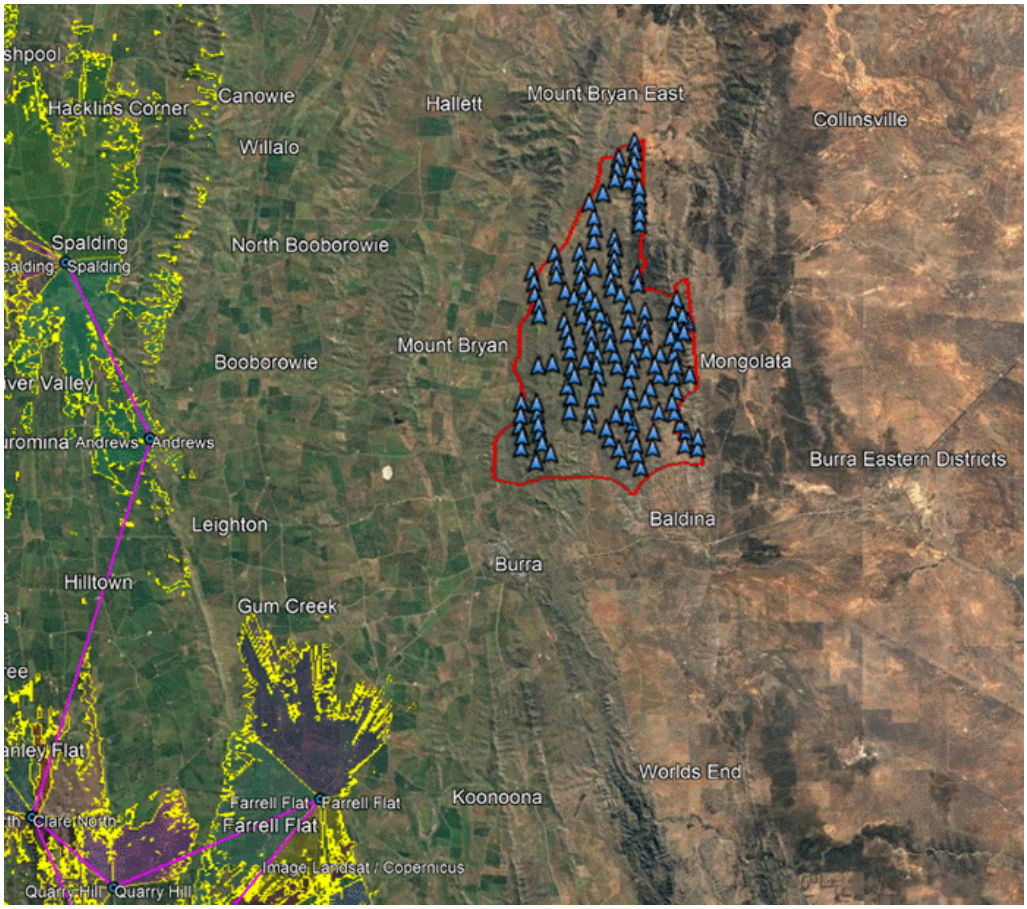
Follow Up Flag: Follow up
Flag Status: Flagged

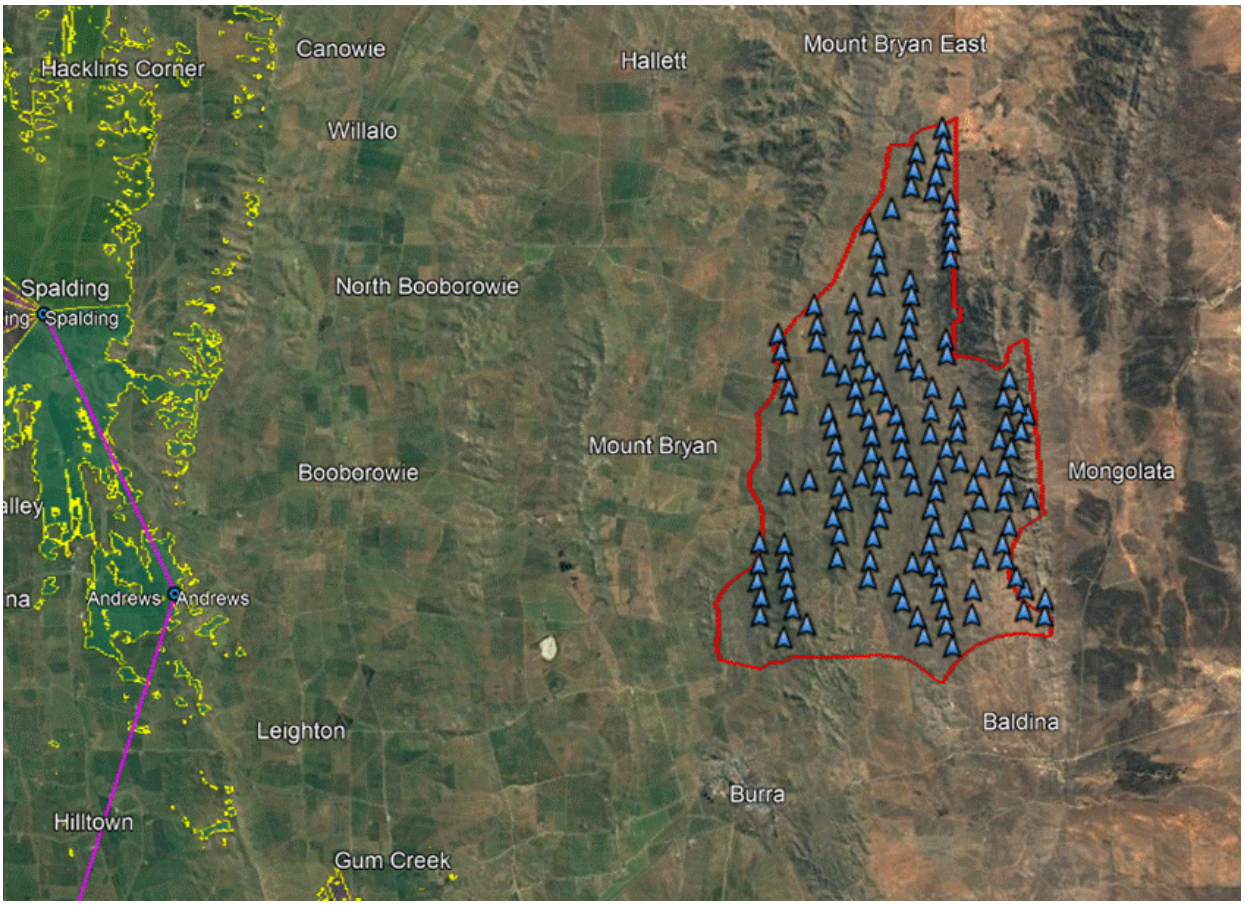
Good Morning Marcus,

Frank is back from leave and provided his comments below:

Desktop Analysis

I have reviewed the data provided based on the proposed wind farm location ; The wind farm boundaries are not inside any existing nbn wireless coverage boundaries. None of the proposed wind tower locations pose any risk of introducing a physical obstruction to the existing RF Path Profiles or boresight paths of existing nbn microwave links. Nor are there any nbn connected customer premises within the wind farm boundary hence there are no intrusions into any RF path between the customer sites and a nbn eNB causing degraded service.


Hacklins Corner
Canowie
Hallett
Mount Bryan East
Collinsville
Willalo
Spalding
North Booborowie
Mount Bryan
Booborowie
Mongolata
Andrews
Burra Eastern Districts
Leighton
Baldina
Burra
Hilltown
Gum Creek
Worlds End
Koonoona
Farrell Flat
Image Landsat / Copernicus
Quarry Hill



Images show current operational nbn wireless coverage areas relative to wind farm location and turbines. Numerous parts of the wind farm are inside current nbn Wireless Coverage Boundaries.

Legend: blue triangle = wind turbine, yellow line = nbn Wireless Coverage Boundary , purple line = nbn microwave link

Of potential greater concern is any impact from wind farm operated RF transmission equipment impacting nbn licensed spectrum.

Therefore, please provide information on any planned RF transmission equipment planned to be installed so a potential interference impact can be assessed. This information should include as a minimum, the operating transmission frequencies and transmit power, channel bandwidths, antenna types and their radiation patterns as well as their exact location with antenna height, boresight azimuth and tilt [either mechanical or electrical tilt].

A standard nbn response for wind farm applications regarding potential interference impact on the nbn Fixed Wireless network is as follows;

Potential Impacts of the Proposed Goyder North Wind Farm on NBN Co Spectrum Communication Assets

Referring to the email dated 6th October 2023 regarding the application for the Goyder North Wind Farm .

We confirm that NBN Co Spectrum Pty Ltd (**nbn Spectrum**) has a number of spectrum licenses within 75 km of the proposed Goyder North Wind Farm.

nbn has strict obligations to provide internet services to the community, and this area has been determined as a FW service area where the footprint of this service is now in place.

nbn will be forced to consider its position as part of the planning should there an interference issue.

If the Application is amended before it is lodged, we request that we are sent any amended Application so we can determine whether we have any objections to the amended Application.

We note that, as you would be aware, under section 197 of the *Radiocommunications Act 1992* (Cth) it is an offence to knowingly or recklessly do anything likely to interfere substantially with radiocommunications or otherwise substantially disrupt or disturb radiocommunications.

Any questions or concerns please reach out.

Thank you and have a great day.

Whitney

From: Marcus Eymael <Marcus.Eymael@ghd.com>
Sent: Friday, October 6, 2023 1:32 PM
To: Whitney Tucker <whitneytucker@nbnco.com.au>
Cc: Brendan Siebert <Brendan.Siebert@ghd.com>
Subject: [External] Wind Farm EMI Assessment - Goyder North Wind Farm

EXTERNAL SENDER – Be cautious opening Links and Attachments

Hi Whitney,

GHD is conducting the Electromagnetic Interference Assessment report on behalf of NEOEN for a wind farm feasibility study on land in Goyder, SA. If the study progresses through feasibility, this assessment will be used to support approvals of the project.

Based on the publicly available information on the ACMA database, there are no NBN Co p2p links crossing. Can you or someone else confirm whether there will be an effect on NBN Co services?

I have attached the site boundary and turbine layout in the .kml file and coordinates in the attached excel spreadsheet.
The turbine specifications will not exceed the dimensions shown below:

- Maximum tip height: Up to 240m
- Rotor diameter: Up to 180m

Thank you for your responses to data, especially noting the volume of them! Your prompt responses are greatly appreciated, as always please do not hesitate to contact me if you have any questions.

Marcus Eymael
Security & Communications Consultant
Building Engineering

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D +61 2 9239 7980 **E** marcus.eymael@ghd.com

The Power of Commitment

Connect

Government of South Australia
Attorney-General's Department

If calling please ask for
David Loy

Telephone
0416 268 284

Reference
qA11331

Public Safety

Level 16
45 Pirie Street
Adelaide SA 5000

GPO Box 464
Adelaide SA 5001
DX 336

Tel 08 8207 1873
Fax 08 8204 1053

17 October 2019

Brendan Siebert
Senior Engineer – Telecommunications
GHD Level 4, 211 Victoria Square
Adelaide, SA 5000

Dear Brendan,

Re: Goyder North and Goyder South Hybrid Renewable Energy Project.

I refer to your request for advice relating to the potential effects of this project on SAGRN point-to-point inter-site links.

The network operator (Motorola) has performed an analysis of the project information supplied and concluded that, in relation to Phase 1 of the project, there is one turbine (B017) that obstructs the link path between SAGRN sites at Mt Cone and Windy Hill. There are another three turbines that are close to obstructing the same link path (B005, B008 and B022). The nearest of these turbines is approximately eighty-five metres from the link path.

Regarding Phase 2 of the project, there appears to be several turbines obstructing the link paths between SAGRN sites at Mt Cone to Windy Hill (six in total) and Mt Cone to Clare West (three in total). There are two turbines that are close to the link path between Mt Cone to Jamestown but appear to be more than 100m from the F2 zone.

It is desirable that a minimum of one hundred metres separation is maintained between any SAGRN link path and the outer diameter of any turbine blade that is operating parallel to any link path. We are confident that if this separation is maintained there will be no effect on SAGRN inter-site link performance.

Yours sincerely

P.D. Sinclair

Peter Sinclair
A/Director, Public Safety Solutions
Peter.Sinclair@sa.gov.au

ghd.com

→ The Power of Commitment

Heritage Assessment Summary

Project Title: Goyder North Renewable Energy Project

Locations: Wind Farm and OHL Transmission Route

Client: Neoen

Date: January 2024

Associated Report: IHC 2023. Goyder North Renewable Energy Project – Desktop Heritage Assessment. Report prepared for Neoen Australia Pty Ltd.

Goyder North Renewable Energy Project OHL Transmission Note – Heritage Technical Note. Report prepared for Neoen Australia Pty Ltd.

Independent Heritage Consultants (IHC) has been engaged by Neoen Pty Ltd to undertake Aboriginal and historic heritage desktop assessments as part of the planning process Neoen's Goyder North Renewable Energy Project in the mid north of South Australia. IHC has prepared assessments for the wind farm and OHL Transmission Route (100m) corridor (Map 1).

IHC understands that additional infrastructure may be added to the development application at a later stage and Neoen are in the process of updating their research to encompass these areas. On-site surveys and micro-siting processed will be carried out through future more detailed design stages of the renewable energy facility to ensure that heritage is considered and protected. The following document presents a summary of the findings of these assessments and recommended management measures carried out by IHC to date (January 2024).

Historic Heritage

The historic heritage assessment has identified that the Goyder North wind farm project area and OHL transmission route will not intersect any listed heritage places.

Considering the heritage context for the area, the level of previous development and recorded finds elsewhere in the region, it was assessed there is a ***high risk*** of works encountering the remains of undocumented built heritage and archaeological features of heritage significance.

Recommendations

All historic heritage and archaeological features, whether listed or not, are protected and must be managed in line with the requirements of the *Heritage Places Act 1994 (HPA)* and the Planning, Development and Infrastructure Act 2016, (*PDIA)*.

Any works within the curtilage of a state heritage place with the potential to materially affect the heritage value of the site, must be carried out in consultation with Heritage SA and in line with the Heritage Places Act and Planning, Development and Infrastructure Act.

In the event that works encounter the remains of undocumented built heritage and archaeological features of heritage significance, these should be managed under the requirements of s.27 of the Heritage Places Act.

Although not mandated by the HPA, a number of management options have been recommended to mitigate the assessed heritage risk for both wind farm and OHL transmission line corridor. These include; archaeological assessment/s.27 permit authorisation, implementation of a site discovery procedure, site inductions and archaeologists on call to identify potential discoveries.

Aboriginal Heritage

The heritage assessment determined that there are two known Aboriginal heritage sites within the wind farm project area. These are associated with Baldina Creek in Red Banks Conservation Park (Reference 4934). The OHL Transmission route will not intersect any known Aboriginal heritage sites (Reference 5985).

Considering the Aboriginal heritage context for the area, the environmental landforms, and the level of previous development, it was assessed that there is a ***low risk*** of works encountering unknown Aboriginal sites and objects in previously developed soils and a ***moderate risk*** in undeveloped soils.

Recommendations

There are two known Aboriginal heritage sites within the wind farm project area. If works are not able to avoid these sites, Ministerial authorisation to impact heritage section 23 of the *Aboriginal Heritage Act 1*988 (AHA) is required. All Aboriginal heritage sites are protected under the AHA, whether reported/registered or undocumented. Therefore, if a previously unknown Aboriginal heritage site is discovered during works and cannot be avoided, Ministerial authorisation under section 23 of the AHA will be required.

Although not mandated by the AHA, a number of management options have been recommended to mitigate the assessed heritage risk for both wind farm and OHL transmission line corridor. These include; Implementation of a site discovery procedure, site inductions, consultation with the relevant Aboriginal groups and archaeologists on call to identify potential discoveries.

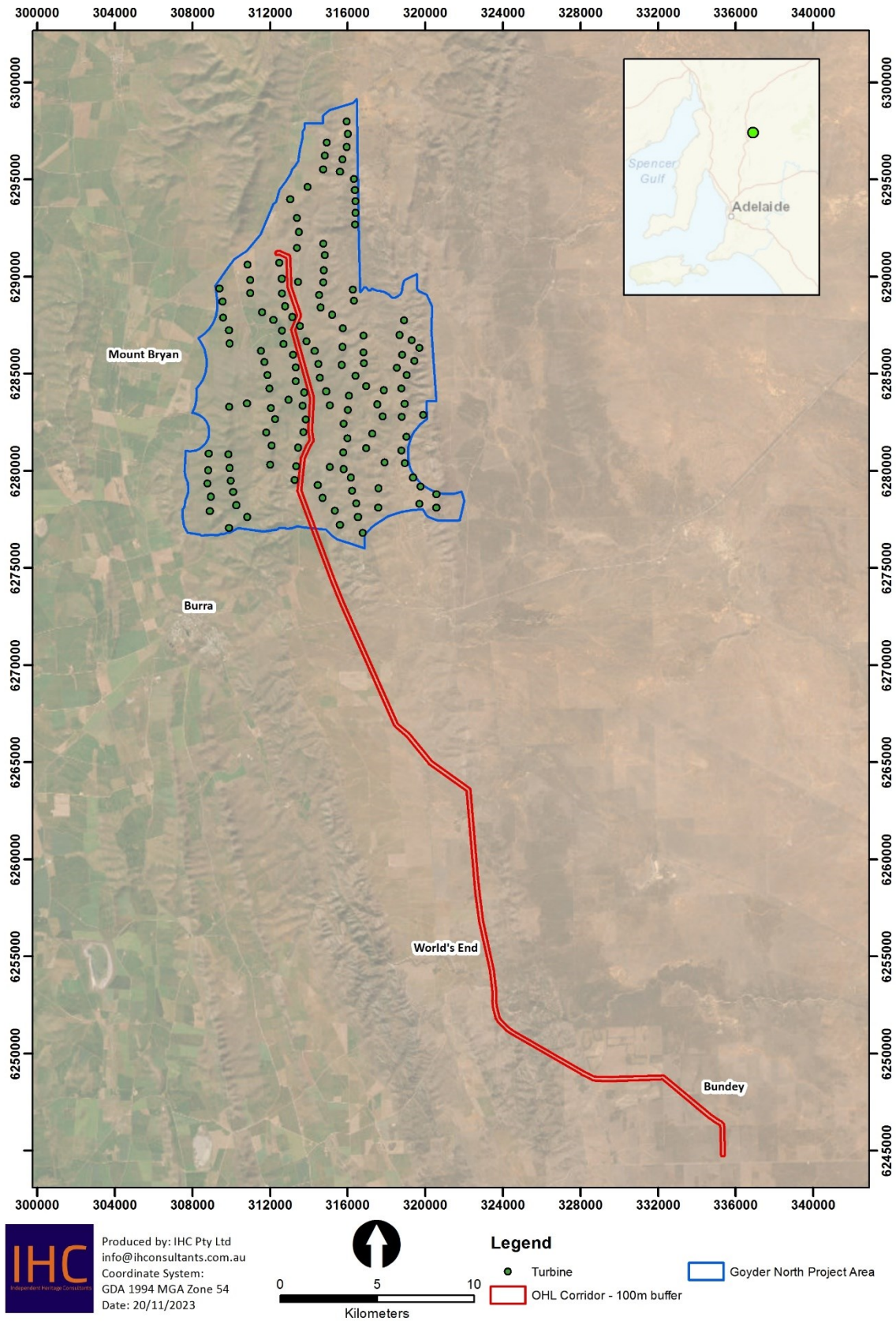
Native Title

The wind farm project area is located within the Ngadjuri Nation #2 claim area. The Federal Court has determined that native title does exist (non-exclusive) in several pockets within the wind farm project boundary, but has been determined to not exist elsewhere across the project area. Neoen is committed to minimising impacts on areas where native title exists.

The OHL transmission corridor crosses through two native title claim areas; the Ngadjuri Nation #2 claim in the north and the First Peoples of the River Murray and Mallee #2 claim area in the south. There is also a small section of OHL corridor which is not the subject of any current native title claims.

In the Ngadjuri claim area; the OHL corridor does intersect a number locations where the Federal Court has determined that native title exists (Non-exclusive). In the First Peoples of the River Murray and Mallee Region #2 claim area, the Federal Court has not yet made a determination in relation to native title, although the claim has been accepted for registration.

There are no current Indigenous Land Use Agreements in place for the OHL corridor.



Map 1: Project areas

Goyder North Renewable Energy Facility:

Heritage Impact Assessment

FINAL REPORT

Prepared for Neoen Australia Pty Ltd

1 February 2024

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Document control

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Final version 01	Claire Nunez	31/01/2024

Acknowledgements

Biosis gratefully acknowledges the contributions of the following people and organisations in preparing this report:

- Neoen Australia Pty Ltd: Thomas Daly, Tom Jenkins and Mikaela Georgiadis.
- SFC Group Limited: Simone Fogerty.

Biosis staff involved in this project were:

- Astrid Mackegard and Jen Townsend (mapping).

Contents

Tables

Figures

Photos

Glossary

BESS	Battery Energy Storage System
Biosis	Biosis Pty Ltd
Burra Charter	*Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*
CHL	Commonwealth Heritage List
CMP	Conservation Management Plan
DCCEEW	Australian Government Department of Climate Change, Energy, the Environment and Water
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GNREF	Goyder North Renewable Energy Facility
GML	GML Heritage Pty Ltd
GRZ	Goyder Renewables Zone
Heritage Act	*Heritage Place Act 1993*
HIA	Heritage Impact Assessment
kV	Kilovolt
MW	Megawatts
MWh	Megawatt hours
NHL	National Heritage List
NRM	Natural Resource Management
Neoen	Neoen Australia Pty Ltd
NSW	New South Wales
SA	South Australia
WTG	Wind turbine generators

1. Introduction

1.1. Project background

Biosis Pty Ltd (Biosis) has been commissioned by Neoen Australia Pty Ltd (Neoen) to provide heritage advice and a Heritage Impact Assessment (HIA) for the Goyder North Renewable Energy Facility (GNREF) (the project) as part of the wider Goyder Renewables Zone (GRZ) project in Burra, South Australia (SA) (Figure 1 and Figure 2). The proposed project site is located north-east of Burra and east of the Mount Bryan township in the Goyder Regional Council area.

A HIA was prepared for the Goyder South Wind Farm in 2020 by GML Heritage Pty Ltd (GML) and this HIA utilises some information in the previous report to inform this assessment of the GNREF.

1.2. Statutory context

1.2.1. Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The proposed GNREF project is subject to the provisions of the EPBC Act as it is located near to the National Heritage listed Australian Cornish Mining Sites (Burra).

The EPBC Act and associated *Environment Protection and Biodiversity Regulations 2000* provides protection for the environment (including heritage) on Commonwealth land and the protection of Matters of National Environmental Significance which include items on the Commonwealth Heritage List.

Pursuant to s. 26 of the EPBC Act; *'The Commonwealth or a Commonwealth agency must not take inside or outside the Australian jurisdiction an action that has, will have or is likely to* ***have a significant impact on the environment*** *inside or outside the Australian jurisdiction'.*

For proposed actions situated on Commonwealth land or which may impact on Commonwealth land, the guidelines actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies *Significant Impact Guidelines 1.2* apply. The guidelines require the proponent to undertake a self-assessment process to decide whether or not the action is likely to have a significant impact on the environment, including the heritage value of places. If an action is likely to have a significant impact an Environmental Clearance Certificate and/or an EPBC Act referral must be prepared and submitted to the Minister for approval.

What is significant impact?

A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

In assessing impacts on heritage values on Commonwealth land under the *Significant Impact Guidelines 1.2* National Heritage place, the *Significant Impact Guidelines 1.2* present a number of questions to be answered.

Is there a real chance or possibility that the action will:

- Permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures, contents, and objects) of a heritage place.

- Involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place.
- Involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place.
- Substantially diminish the heritage value of a heritage place for a community or group for which it is significant.
- Substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place.
- Substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site.

1.2.2. Heritage Places Act 1993

Heritage in SA is principally protected by the *Heritage Place Act 1993* (Heritage Act) which was passed for:

> *the purpose of the identification, recording and conservation of places and objects of non-Aboriginal heritage significance; to establish the South Australian Heritage Council.*

The Act is administered by the South Australian Heritage Council, and provides strategic advice to the Minister for Climate, Environment and Water and to the Minister for Planning on heritage-related matters.

Part 4, division 1, section 16 of the Heritage Act outlines that a place is of heritage value if it satisfies one or more of the following criteria:

- Demonstrates important aspects of evolution of State history.
- Has rare, uncommon or endangered qualities that are of cultural significance.
- May yield information relevant to States history including its natural history.
- Is an outstanding representative of a particular class of places of cultural significance.
- Demonstrates a high degree of creative, aesthetic or technical accomplishment or is an outstanding representative of particular construction techniques or design characteristics.
- Has strong cultural or spiritual associations for the community or group within it.
- Has a special association with the life or work of a person or organisation or an event of historical importance.

Impacts to State Heritage Places are assessed by the Department of Environment and Water and require a Heritage Impact Statement. Works to a State Heritage Place also require development approval under the Heritage Act. The *Development Act 1993* and its successor, the *Planning, Development and Infrastructure Act 2016* requires a planning authority to refer a development application affecting a State Heritage Place or State Heritage Area to the Minister responsible for the Heritage Act for response. Impacts to the state heritage significance of the Burra State Heritage Area have been assessed within this HIA.

1.3. Report methodology

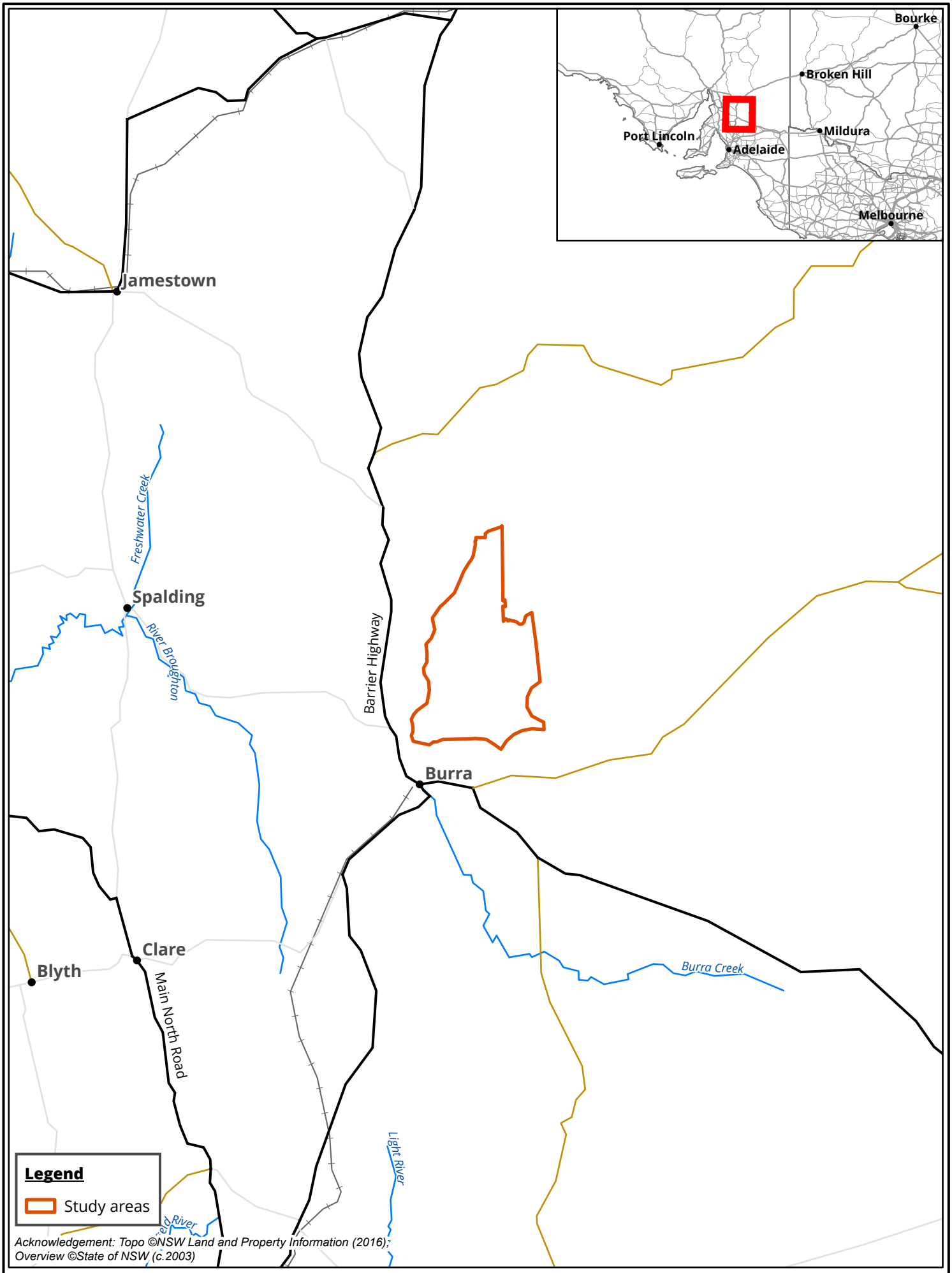
This report was prepared in accordance with the principles outlined in the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (Commonwealth of Australia 2013), *Heritage Impact Statement Guidelines for State Heritage Places* (DEWNR 2013), and the *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Burra Charter) (Australia ICOMOS 2013).

1.4. Investigators and contributors

This report was prepared by Anthea Vella, Senior Heritage Consultant, Biosis. This report has been reviewed by Claire Nunez, General Manager (New South Wales (NSW)).

1.5. Limitations of the report

This HIA has included an assessment of impacts to the National Heritage values of the Australian Cornish Mining Sites (Burra) and on the state heritage significance of the Burra State Heritage Area. This HIA does not address any other local heritage listings or local planning schemes. This HIA has been prepared to undertake an overall assessment of the visual impacts on Burra as this will also capture the individual listings.



Acknowledgement: Topo ©NSW Land and Property Information (2016); Overview ©State of NSW (c.2003)

biosis

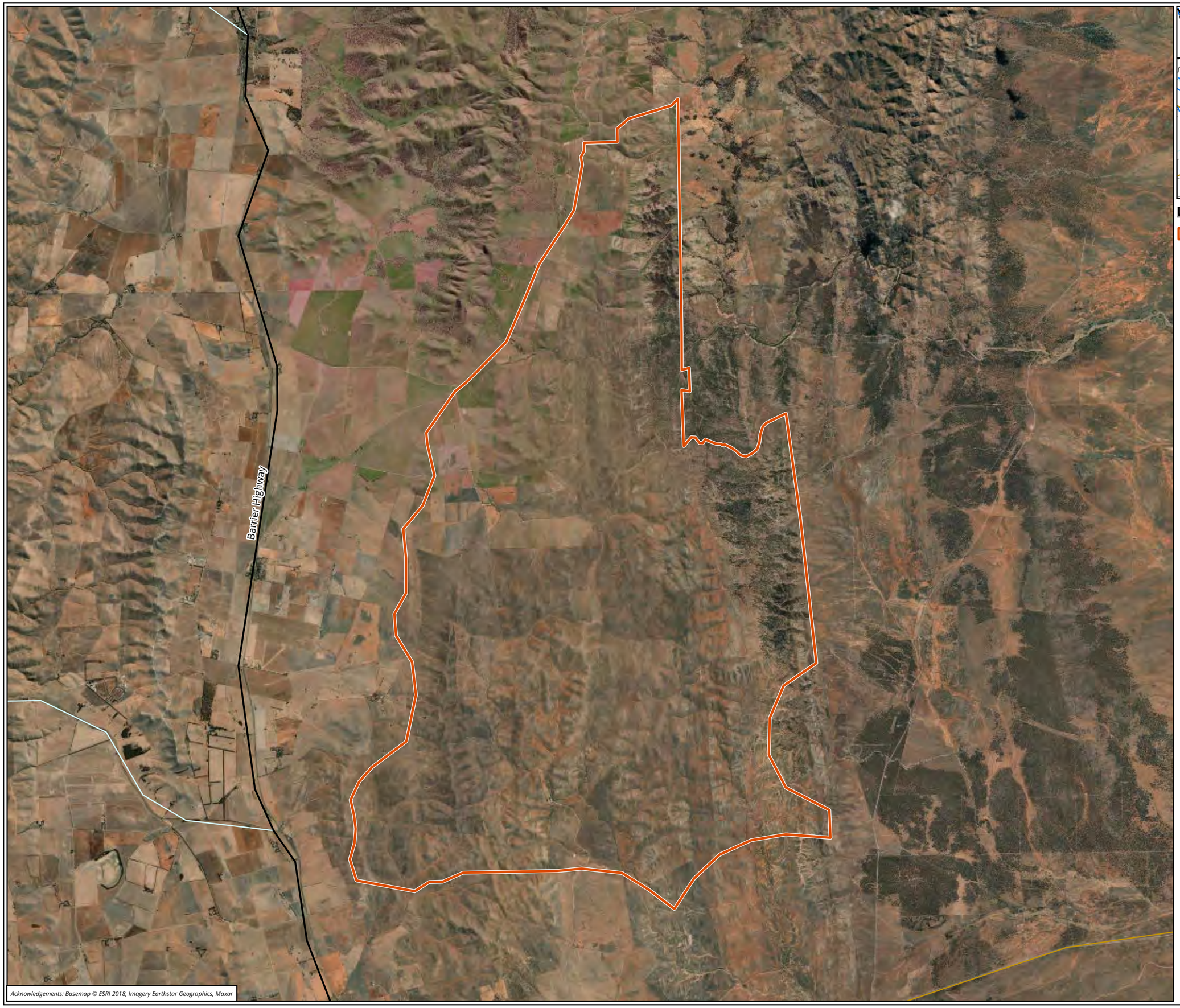
Figure 1 Location of the study area

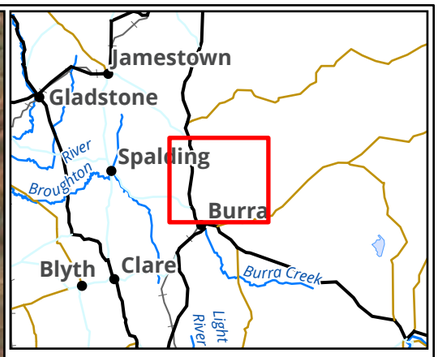
Matter: 37855
Date: 07 November 2023,
Prepared for: AV, Prepared by: AM, Last edited by: amackegard
Location:P:\37800s\37855\Mapping\

0 3 6 9 12 15
Kilometers

N

Scale 1:500,000 @ A4, GDA 1994 MGA Zone 54





Legend

Study area

Figure 2 Study area detail

0 1 2 3 4 5

Kilometers

Scale: 1:100,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

N

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Matter: 37855,
Date: 07 November 2023 ,
Prepared for: AV, Prepared by: AM, Last edited by: amackegard
Layout: 37855_F2_StudyArea
Project: P:\37800s\37855\Mapping\
37855_GoyderNorth.aprx

2. Site character and setting

2.1. Site

The project site is located approximately 5.5 kilometres north-east of the centre of Burra in the Goyder Local Government Area (Figure 1 and Figure 2). The area is located in the eastern portion of the Mount Lofty Ranges and wholly located within the Regional Council of Goyder. The surrounding landscape is characterized by pastoral and grazing land on rolling hills.

In the vicinity of the project there is the National Heritage listed Australian Cornish Mining Sites (Burra), and the Burra State Heritage Area (Figure 3, Appendix 1 and Appendix 2). The Burra State Heritage Area incorporates 70 places and one object on the South Australian Heritage Register.

The history of Burra has been previously detailed in the National Heritage Listing (NHL) for the Australian Cornish Mining Sites (Burra) (Appendix 1) and the state listing (Appendix 2).

2.2. Views to Goyder North from Burra

Views towards the proposed Goyder North site from Burra are included in Photo 1 to Photo 18, also noted on Table 1, and the locations of these photos are also shown on Figure 4. For consistency with the Goyder South HIA, the same locations for the photo viewpoints were used, with photos taken in the direction of the proposed Goyder North site (GML 2020). These locations were also used for the photomontage (see Section 4.1).

Photo 1 View from Burra Cemetery facing north

Photo 2 View from chimney facing north-east

Photo 3 View from Church, facing east

Photo 4 View from Morphett's Enginehouse facing north (red arrow showing approximate location of the proposed turbines – obstructed view)

Photo 5 View from gate facing north-east

Photo 6 View from Hampton Township facing north

Photo 7 View from Hampton Township facing north

Photo 8 View from Mine Lookout facing north

Photo 9 View from Mine Lookout facing north-east

Photo 10 View from Ore Dressing Tower facing north

Photo 11 View to the ranges along the Goyder Highway facing east

Photo 12 View from Redruth Gaol facing north

Photo 13 View from Burra Smelting Works facing north-east

Photo 14 View from Burra along the Barrier Highway facing north

Photo 15 View from Burra along Commercial Street facing east

Photo 16 View from Burra Town Lookout facing east

Photo 17 View from Burra Town Lookout facing north-east

Photo 18 View from Burra Town Hall facing north

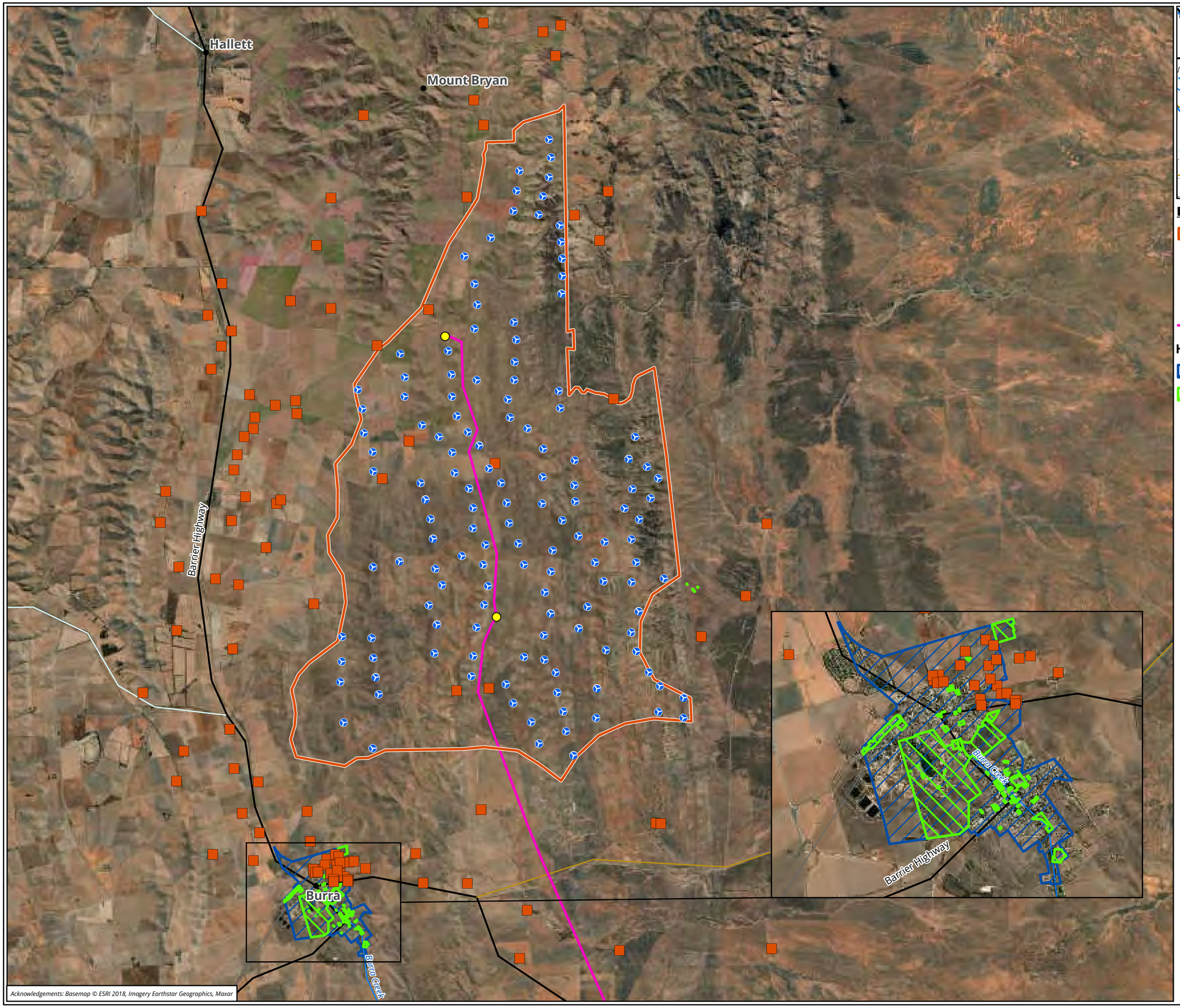
Photo 19 View from Morphett's Enginehouse facing north-east (Source: Neoen)

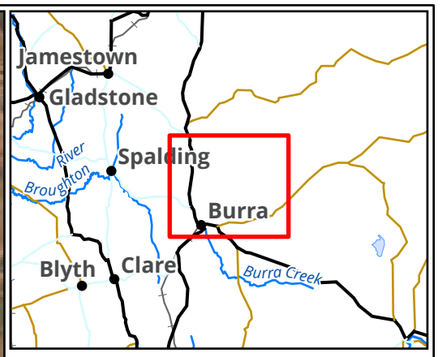
Photo 20 View from Mine Lookout facing south (Source: Neoen)

Table 1 Photo point directions

Photo no.	Date	Description	Orientation
1	12/10/2022	View from Burra Cemetery	N
2	12/10/2022	View from chimney	NE
3	12/10/2022	View from Church	E
4	12/10/2022	View from Morphett's Enginehouse	N
5	12/10/2022	View from gate	NE
6	12/10/2022	View from Hampton Township	N
7	12/10/2022	View from Hampton Township	N
8	12/10/2022	View from Mine Lookout	N

Photo no.	Date	Description	Orientation
9	12/10/2022	View from Mine Lookout	NE
10	12/10/2022	View from Ore Dressing Tower	N
11	12/10/2022	View to the ranges along the Goyder Highway	E
12	12/10/2022	View from Redruth Gaol	N
13	12/10/2022	View from Burra Smelting Works	NE
14	12/10/2022	View from Burra along the Barrier Highway	N
15	12/10/2022	View from Burra along Commercial Street	E
16	12/10/2022	View from Burra Town Lookout	E
17	12/10/2022	View from Burra Town Lookout	NE
18	12/10/2022	View from Burra Town Hall	N
19	30/01/2024	View from Morphett's Enginehouse	NE
20	30/01/2024	View from Mine Lookout	S





Legend

- Study area
- Wind turbine
- Dwellings
- GN substations
- Overhead transmission line

Historical heritage

- National heritage item
- State heritage item

Acknowledgements: Basemap © ESRI 2018, Imagery Earthstar Geographics, Maxar

Figure 3 Heritage items in the vicinity of the study area

0 1 2 3 4 5

Kilometers

Scale: 1:120,000 @ A3

Coordinate System: GDA2020 MGA Zone 54

N

biosis

Matter: 37855,
Date: 22 January 2024 ,
Prepared for: AV, Prepared by: AM, Last edited by: jtownsend
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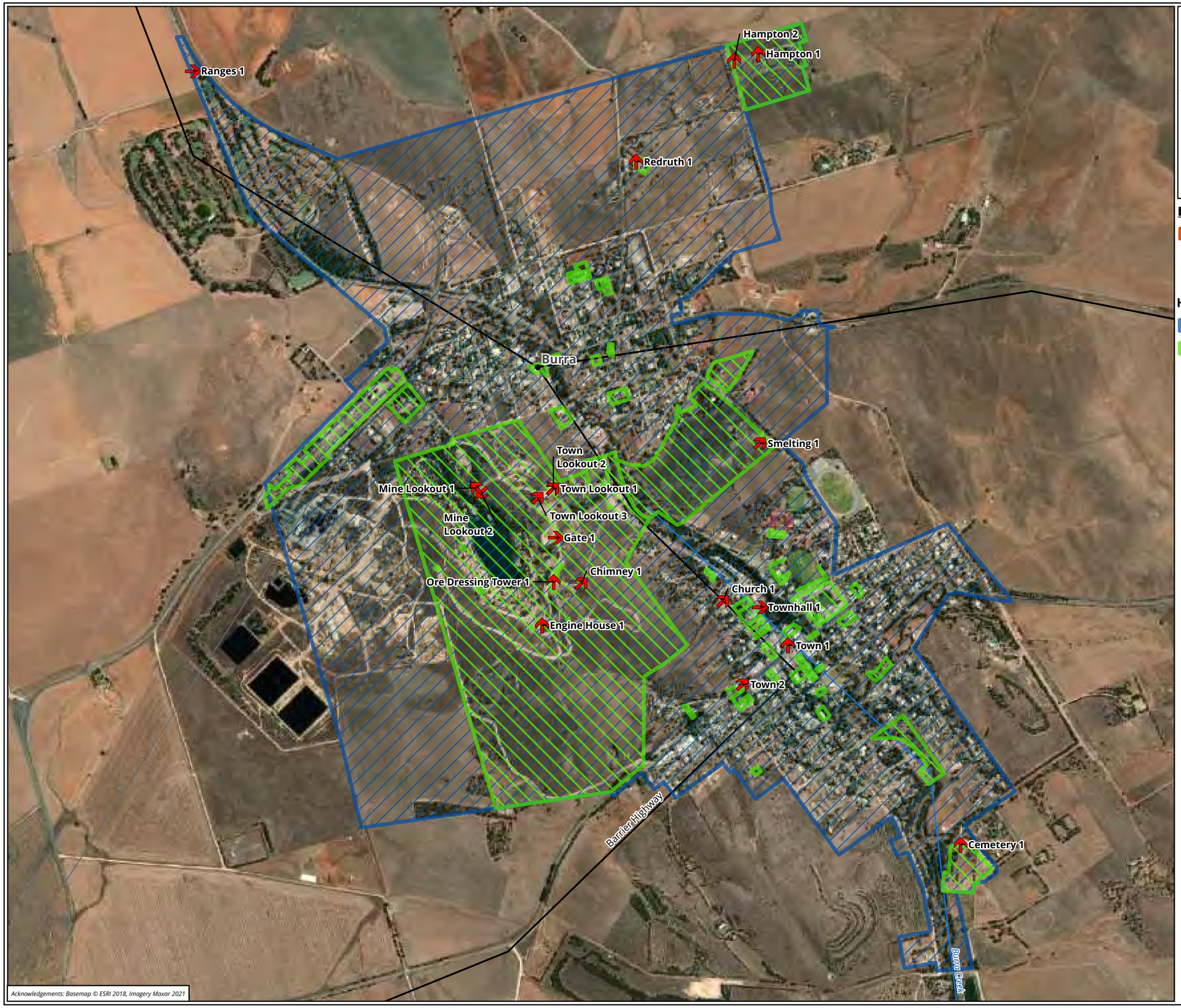

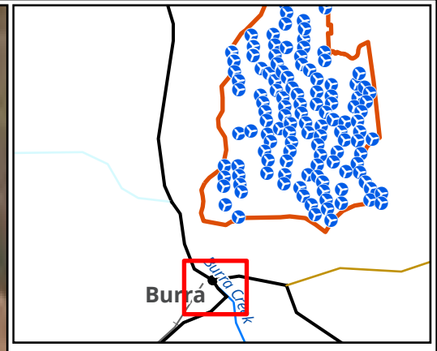

Legend

- Study area
- Wind turbine
- Photo point

Historical heritage

- National heritage item
- State heritage item

Figure 4 Photo points

0 100 200 300 400 500

Meters

Scale: 1:14,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

N

biosis

Matter: 37855,
Date: 08 January 2024 ,
Prepared for: AV, Prepared by: AM, Last edited by: jtownsend
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37855_GoyderNorth.aprx

3. Proposed project

The information in the following sections (3.1, 3.2, 3.4, 3.4 and part of 3.5) has been provided by Neoen.

3.1. Description

Neoen is developing the GNREF as a part of its wider GRZ concept. As a part of this concept, the Goyder South Hybrid Renewables Energy Project was granted Development Approval in 2021 with construction of stage 1 beginning in 2022, consisting of 412 megawatts (MW) of wind generation. The GRZ represents one of the most ambitious renewable energy developments proposed in South Australia and is ideally located to complement Project EnergyConnect, a large interconnector to New South Wales currently under construction by ElectraNet and TransGrid.

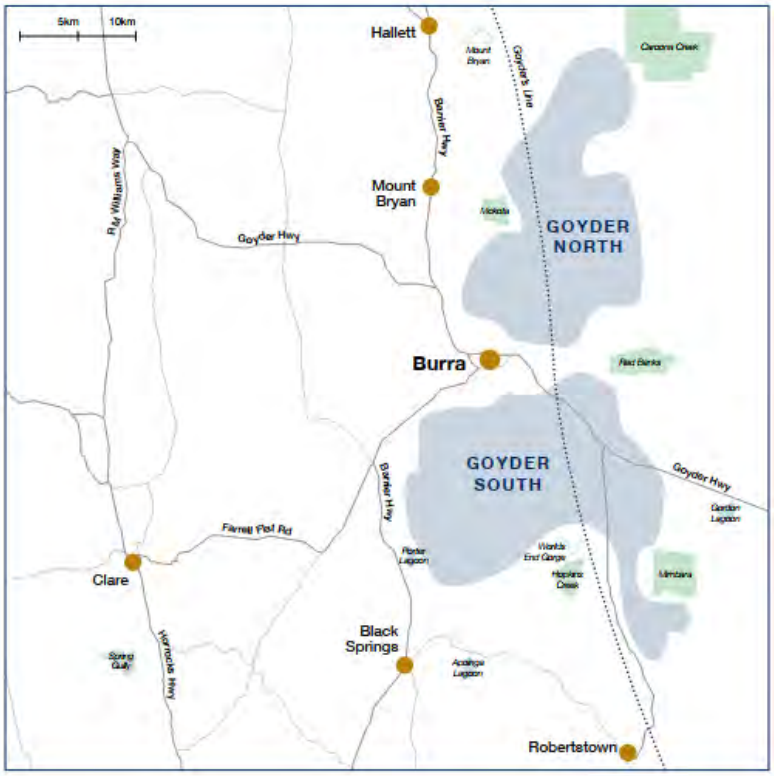


Photo 21 Goyder Renewables Zone concept (Source: Neoen)

Neoen aims to build on the success of the Goyder South project and continue the progress of the GRZ concept with the GNREF development. The proposed project site is located north-east of Burra and east of the Mount Bryan township in the Goyder Regional Council area. The project will comprise of up to 1000MW of wind generation and 900 MW/3,600 megawatt hour (MWh) of Battery Energy Storage Systems (BESSs); including wind turbine generators (WTGs), BESS technology, meteorological masts, buried collector cables, electrical substations, operations and maintenance buildings and an overhead transmission line to connect the wind farm to the existing ElectraNet Transmission network. The overhead transmission line is proposed to connect into the Bundey substation which is being built for the SA-NSW interconnector (Project EnergyConnect). Given the scale of wind energy generation that would be achieved by the development of the GNREF, it will likely be developed in stages, though it is not yet possible to determine the size of each stage as it is dependent on demand from electricity customers. The Goyder North site is characterised by

world-class wind resources and complimentary land uses (comprising primarily of marginal grazing land located on the edge of Goyder's Line).

3.2. Project location

The southern boundary of the proposed development is approximately 5.5 kilometres north-east of the centre of Burra. It extends approximately 22 kilometres to the north, with the northern tip being a distance of approximately 10.2 kilometres north-west of the centre of Hallett. Its western-most boundary is also positioned approximately 4.4 kilometres west of the centre of the Mount Bryan township. It is approximately 14.5 kilometres east to west at its greatest width at the south of the site, tapering to its narrowest width of 3 kilometres in the northern portion. The land within the development site is generally privately owned and comprises predominantly dryland cropping and grazing.

The area is located in the eastern portion of the Mount Lofty Ranges and wholly located within the Regional Council of Goyder. From a transport and access perspective, the region is serviced by the Barrier Highway and the Burra-Morgan Highway (Goyder Highway). The project is located within the Mid North Region and the SA Murray-Darling Basin Natural Resource Management (NRM) Area. This area is generally described as a transitional zone between cropping and pastoral country. It is noted that the project is not located within a prescribed water resources area.

3.3. Timing

Each construction stage is expected to take approximately 24-36 months. Depending on the assessment process, it is proposed that construction of Stage 1 of the GNREF will commence during mid- to late 2025. Stage 2 is proposed to start after completion of Stage 1 construction and commissioning. These timelines are subject to the timing of each stage to reach financial close, which is dependent on several factors such as the availability of Power Purchase Agreements.

3.4. Project components

The GNREF development comprises:

- A multi-stage wind farm of up to 135 turbines (previously 138) with a capacity of approximately 1000 MW, a maximum hub height of 160 metres, a maximum blade length of 90 metres, and an overall maximum height (tip height) of 240 metres.
- BESS facilities comprising a total of 900 MW / 3,600 MWh within four fenced compounds of approximately 9.769 hectares each.
- Associated infrastructure for connection to the electricity grid including substations, access tracks, underground connection cabling and transmission lines.
- Temporary construction compounds for wind components, including concrete batching plants.
- A number of meteorological masts (in addition to those already on site) to record wind speed and other meteorological data, both pre- and post- construction.

It is envisaged that the project would be built in stages in response to the market demand and Power Purchase Agreement availability. While the size of each stage is not yet certain, the current intention is to construct two stages of up to approximately 500 MW of wind generation and 450 MW / 1,800 MWh storage per stage.

More specifically, the project will comprise:

1. **Wind turbine generators:** Up to 135 turbines with a maximum tip height of 240 metres. The final sizing will depend on the specific wind resource characteristics of each portion of the site and the requirements of individual power purchasers and may be less than these maximums.

2. **Collector substations**: The project will include at least two 'collector' substations located centrally to each stage of wind farm development. This likely includes a substation in the southern portion of the project area and one in the northern portion. These substations will be connected by an overhead transmission line as described below. The footprint of the substations has been developed to encompass the substation, switchyard, control room(s), switchroom(s), and maintenance shed. Additional land near these substations has been included to accommodate operations and maintenance facilities and temporary construction-phase facilities.

3. **BESSs**: Up to four BESS locations, each comprising of a fenced compound of approximately 9.769 hectares.

4. **Overhead transmission line:** There will be a multi-circuit 275 or 330 kilovolts (kV) overhead transmission line connecting the two substations and then extending from the southern substation to ElectraNet's Bundey Substation. Each BESS will also be connected to a substation via an overhead transmission line.

Temporary construction facilities will also be required and include the following:

- Up to three wind construction compounds (200 metres x 200 metres).
- Up to four battery construction compounds (150 metres x 150 metres).
- The construction compounds will include office, staff amenities, and carparking facilities.
- Temporary batching plant facilities (150 metres x 150 metres).
- Temporary Overhead Transmission Line construction compounds (150 metres x 150 metres).
- Temporary civil contractor compounds.
- Other temporary construction areas including storage and laydown areas (150 metres x 150 metres).
- Laydown areas will also be required at the base of each turbine.

All construction facilities and construction impact areas will be decommissioned at the conclusion of the construction phase.

Neoen are seeking a 200 metre micro-siting allowance for all of the permanent project elements in order to ensure that the project maximises shared land use opportunities and generation efficiencies, whilst minimising impacts on landform, flora, fauna, and residents.

Details of the site and component dimensions are provided in Table 2 and Photo 22.

Table 2 GNREF site details and maximum component dimensions

Project name	Goyder North Renewable Energy Facility
Capacity	Up to approximately 1000 MW wind generation and 900MW / 3,600 MWh energy storage.
Staging	Estimated 2 stages of up to approximately 500 MW wind generation and 450MW / 1,800 MWh energy storage each.

Project name	Goyder North Renewable Energy Facility
Wind Turbine Generators	• Max number –135 • Max height – 240 metres • Max blade length – 90 metres • Max rotor diameter – 180 metres Footings may be either a mass concrete footing (raft style), piled type rock anchors, or a combination of both at approximately 30 metres in diameter.
Battery Energy Storage Systems	• Max total capacity – 900 MW / 3,600 MWh • Four fenced compounds of approximately 9.769 hectares
Transmission lines	275 or 330 kV multi-circuit overhead line connecting the wind farm substations and then to the grid (Bundey substation). Transmission towers of up to 65 metres height with a footprint of approximately 26 metres x 26 metres. Spaced approximately 200-400 metres apart.
Met masts	3 existing approved met masts (all installed for prior Mount Cone project) Likely to include an additional 10 met masts with a height similar to the hub height of the proposed turbines and including appropriate aviation safety markers. The specific locations have yet to be identified as this depends on the final micro-siting of the turbines.
Collector substations	A fenced compound of approximately 200 x 200 metres. Including substation and ancillary equipment.
Operations & Maintenance	A fenced compound adjacent to both substations of approximately 75 x 50 metres. Comprising buildings (office, staff amenities), car park area, workshop, and laydown area.
Access tracks	Access tracks will be up to 10 metres wide to accommodate construction activities and cranes and designed to be of acceptable gradient. Following construction these tracks will be rehabilitated under the advice of the Country Fire Service.
Underground cabling	Underground cabling for transmission (33-66 kV) and communications (fibre). Generally located adjacent to access tracks. Trench width approx. 500 millimetres per circuit and depth approx. 1.2 metres (900 millimetre coverage on top). Impact areas of 5 metre width for single cable plus 2 metre for additional cable.

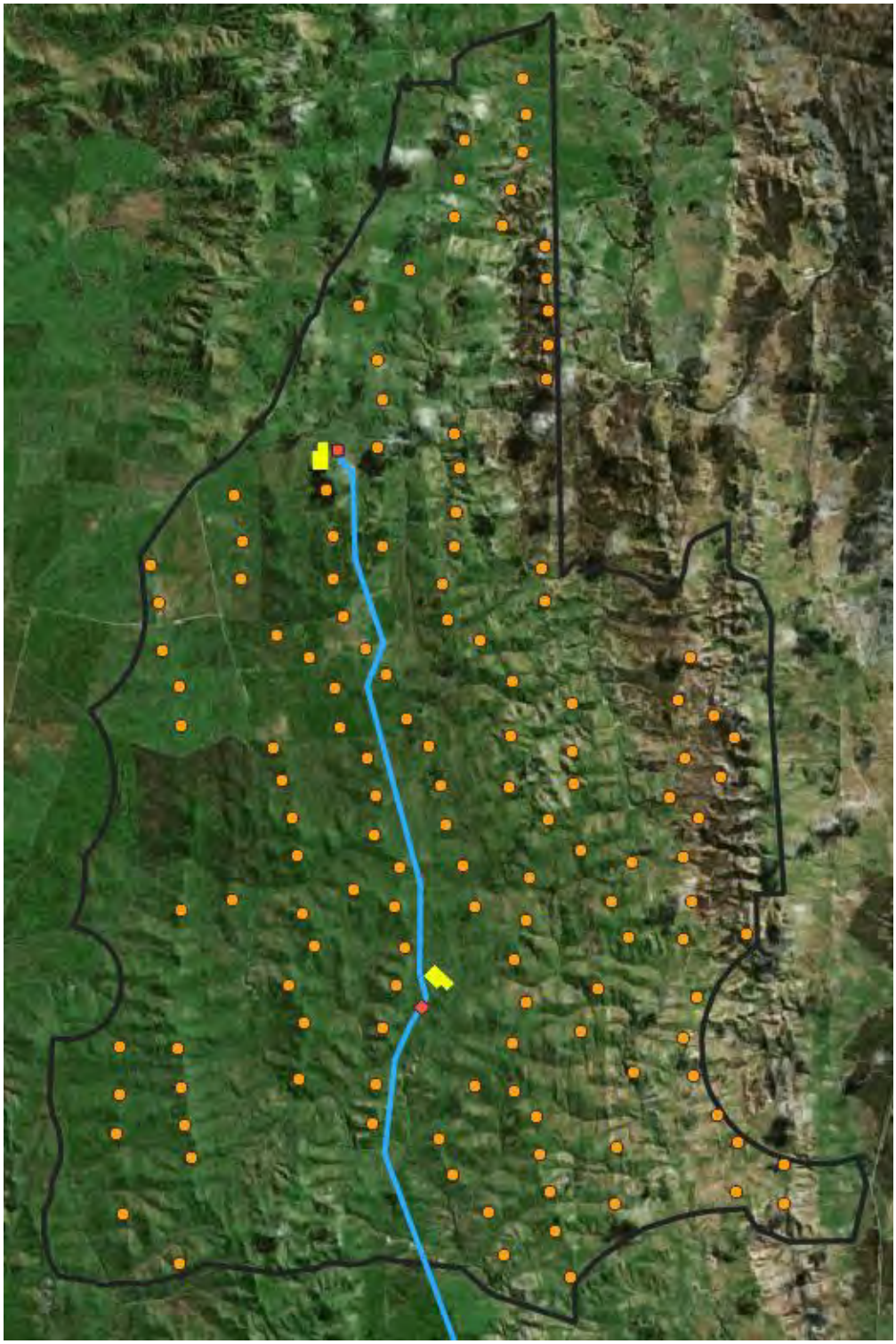


Photo 22 GNREF proposed site boundary and layout (Source: Neoen 2024)

3.5. Heritage input to project

Biosis has provided heritage advice for this project regarding views from the National Heritage listed Australian Cornish Mining Sites (Burra), and the Burra State Heritage Area. This has been summarised in Table 3. Although the project includes BESSs and overhead transmission lines the only impacts are from the wind turbines which have been assessed in this HIA. The heritage input to the project has aimed to minimise

the visual impacts as much as possible on Burra. Advice provided to Neoen has resulted in the removal of several turbines, which has reduced the potential for visual impacts on the town. As noted in the previous section this is comparable to those present for the Goyder South Wind Farm, currently in construction.

Table 3 Summary of heritage advice for the project

Image of layout	Heritage advice and input
 **Photo 23 Turbine layout A (September 2022)**	The four turbines located in the south-western corner of Goyder North were clearly visible from Burra (T02, T06, T12, T19 – also outlined in red on Photo 23). Removal of these four turbines were recommended and Neoen removed these from the layout (see Photo 24).

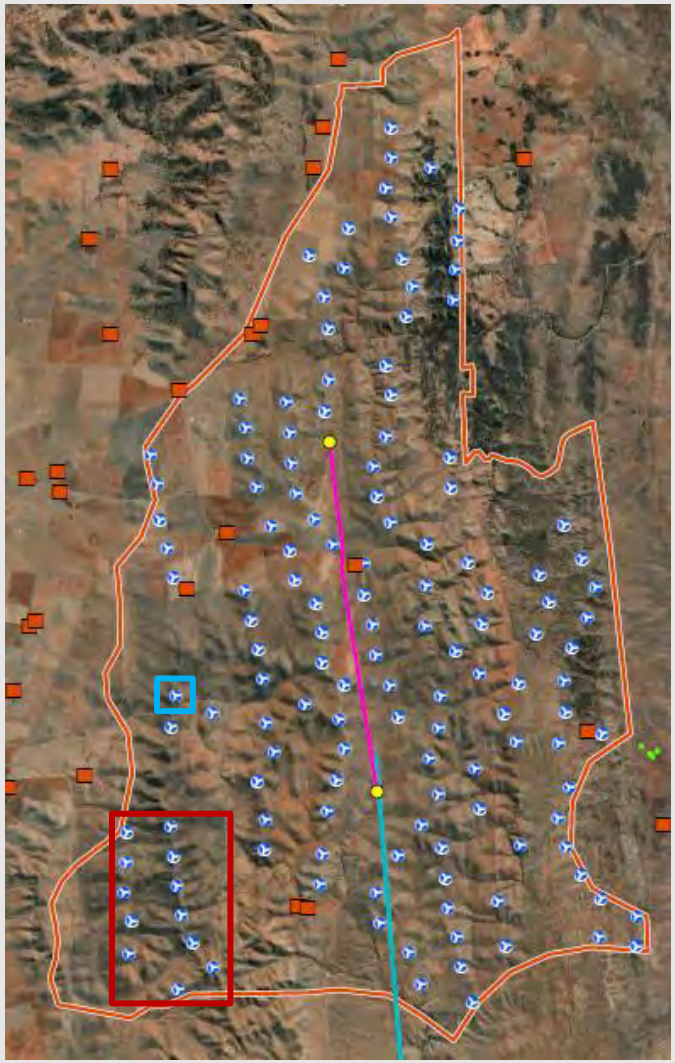
Image of layout	Heritage advice and input
 **Photo 24** **Turbine layout B (October 2023)**	The 12 turbines located in the south-western corner of Goyder North were also considered to be intrusive on views from Burra (GN001 to 006 and GN014 to 019) given their location and proximity to Burra. These are outlined in red on Photo 24. An additional turbine (GN_012) was also recommended for removal (individual turbine outlined in red on Photo 24 and also see Photo 25). Removal of the 13 turbines was recommended. Neoen indicated that the 12 turbines in the south-western corner may not be able to be moved from the proposed layout due to cost/overall performance however this would be considered. The individual turbine outlined in blue on Photo 24 was removed by Neoen.

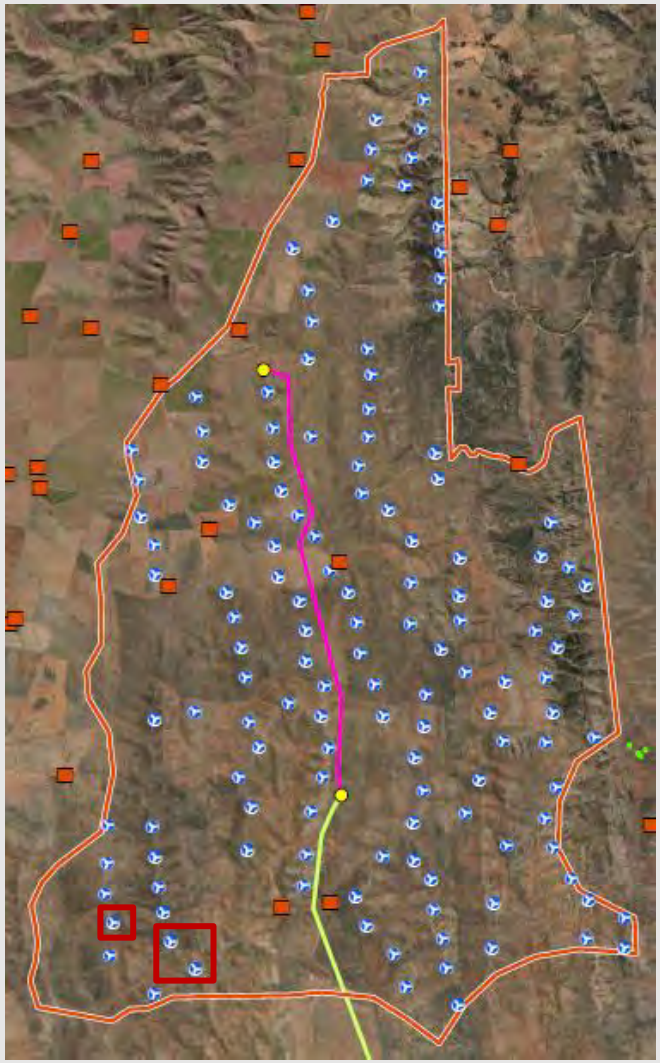
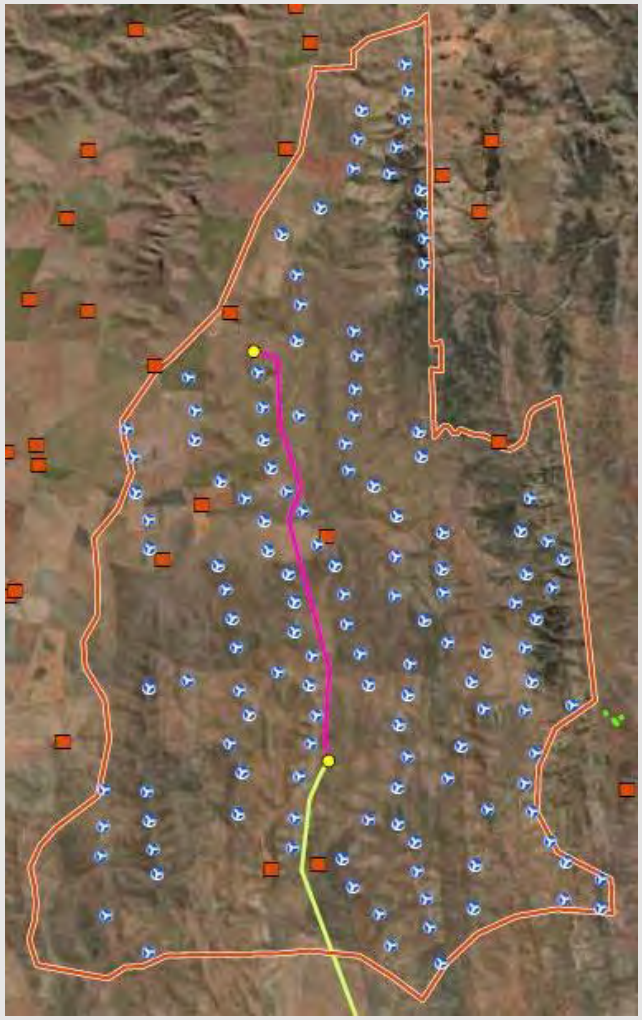
Image of layout	Heritage advice and input
 **Photo 25** **Turbine layout C (October 2023)**	Following initial changes to the layout, further review and analysis showed that the number of turbines grouped together in the south-western corner of Goyder North had an increased impact on the view from Burra (WTG_004, WTG_018, and WTG_019). These are outlined in red on Photo 25. Removal of these three turbines was recommended as they were determined to heavily impact the view from Burra (there were crowding of turbines which made the turbines the focus of the view as compared to the landscape). Neoen agreed to have those three turbines removed from the project (see Photo 26).

Image of layout	Heritage advice and input
 **Photo 26** **Turbine layout D – final layout (December 2023)**	The final layout for Goyder North is shown on Photo 26, with a total of eight turbines removed from the initial layout shown on Photo 23. Overall, impacts have been reduced with moderate impacts still present in the south-western corner.

Five WTGs identified as some of the highest performing locations on the site were removed from the initial layouts even though they were compliant with the proposed setbacks. Set upon the ridge closest to the Barrier Highway and Burra Township it was deemed that, despite their expected performance, they provided an unacceptable visual impact to the area and were removed.

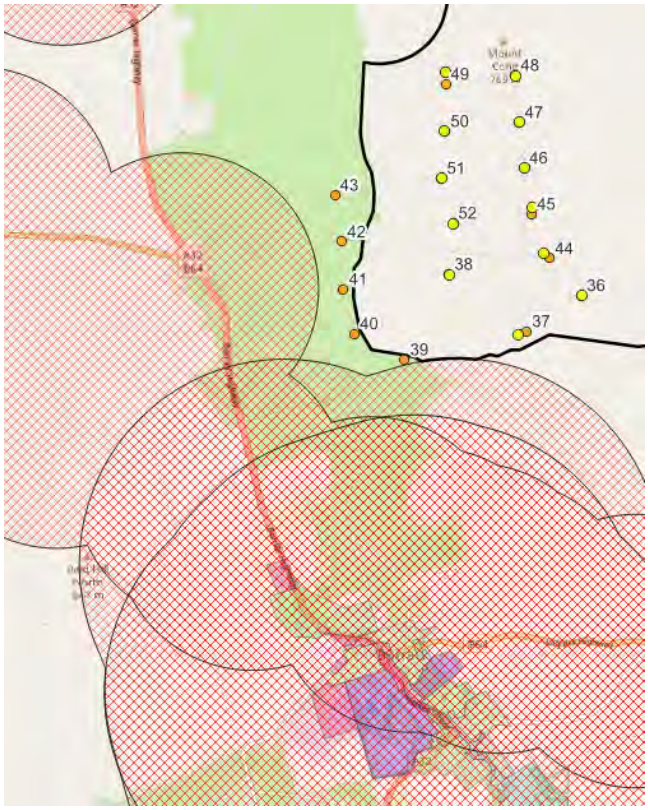
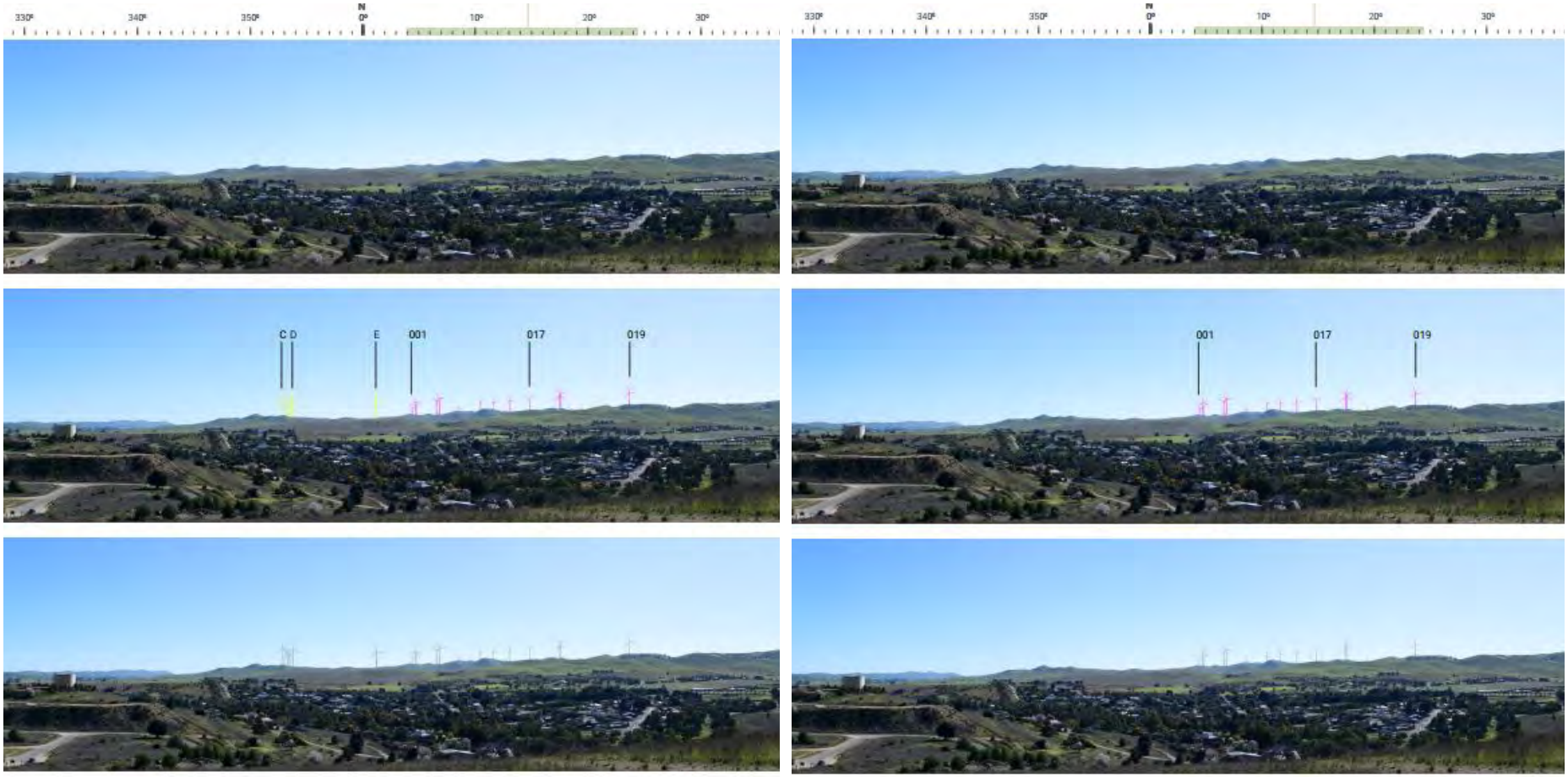
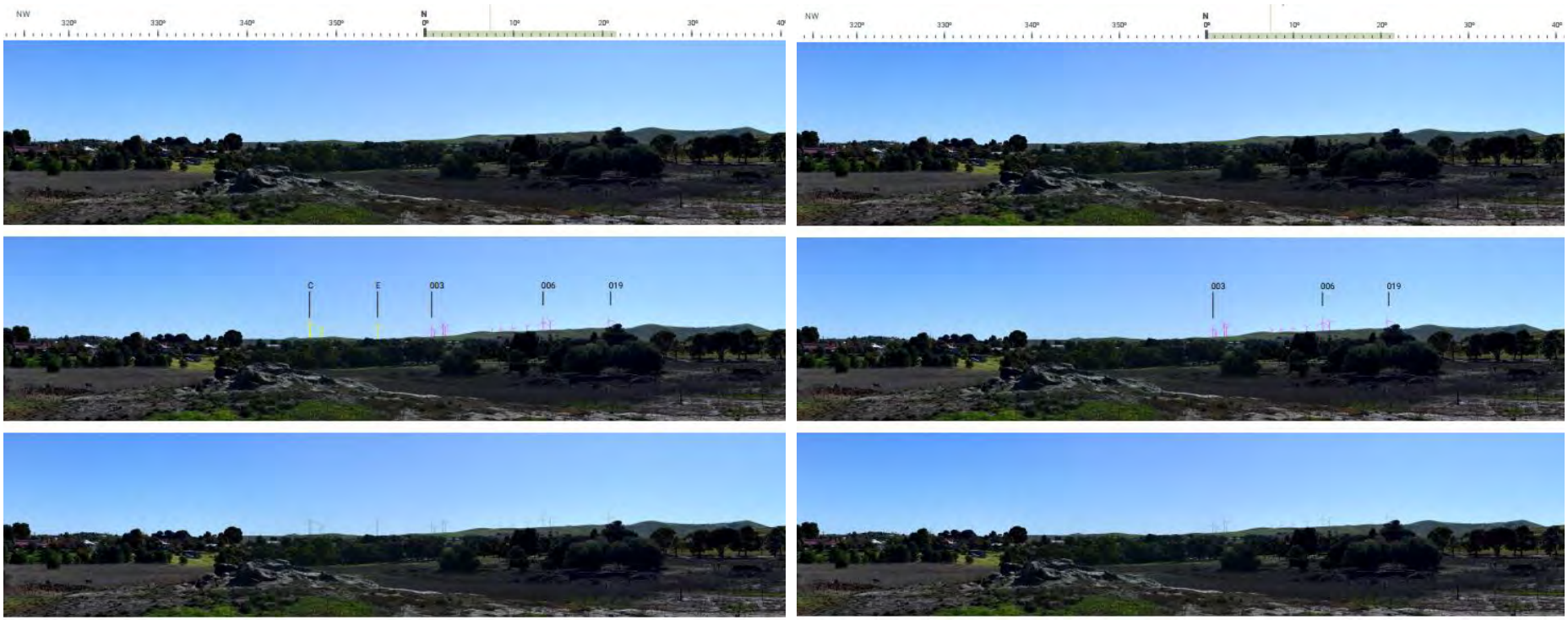


Photo 27 **WTG 39 – WTG 43 were removed from the initial layout to reduce the visual impact of the project (Source: Neoen 2023)**



(a) (b)

Photo 28 **Image (a) shows the view from the Haulage Enginehouse Chimney based on the initial layout (including highest performing turbines). Image (b) shows the view with these turbines removed and the reduced visual impact (Source: Neoen 2023)**



(a) (b)

Photo 29 **Image (a) shows the view from the Smelting Works site based on the initial layout (including highest performing turbines). Image (b) shows the view with these turbines removed and the reduced visual impact (Source: Neoen 2023)**

Throughout this process, Neoen has sought advice from various consultants, including both visual impact and heritage specialists. The production of wire frame images and photomontages have been instrumental in assisting our advisory teams to provide sound and evidence-based advice. The proposed layout now has a reduced visual impact and has setbacks that exceed those proposed and is comparable to those present for the Goyder South Wind Farm, currently in construction. This has also been detailed further in Section 3.5.

The following images demonstrate the achieved setbacks from both the National Heritage area, State Heritage areas and the Residential Zones of the township of Burra. Please note that Photo 30 and Photo 31 include an earlier layout for the turbines, however the setback is still applicable to the current project boundary and layout.

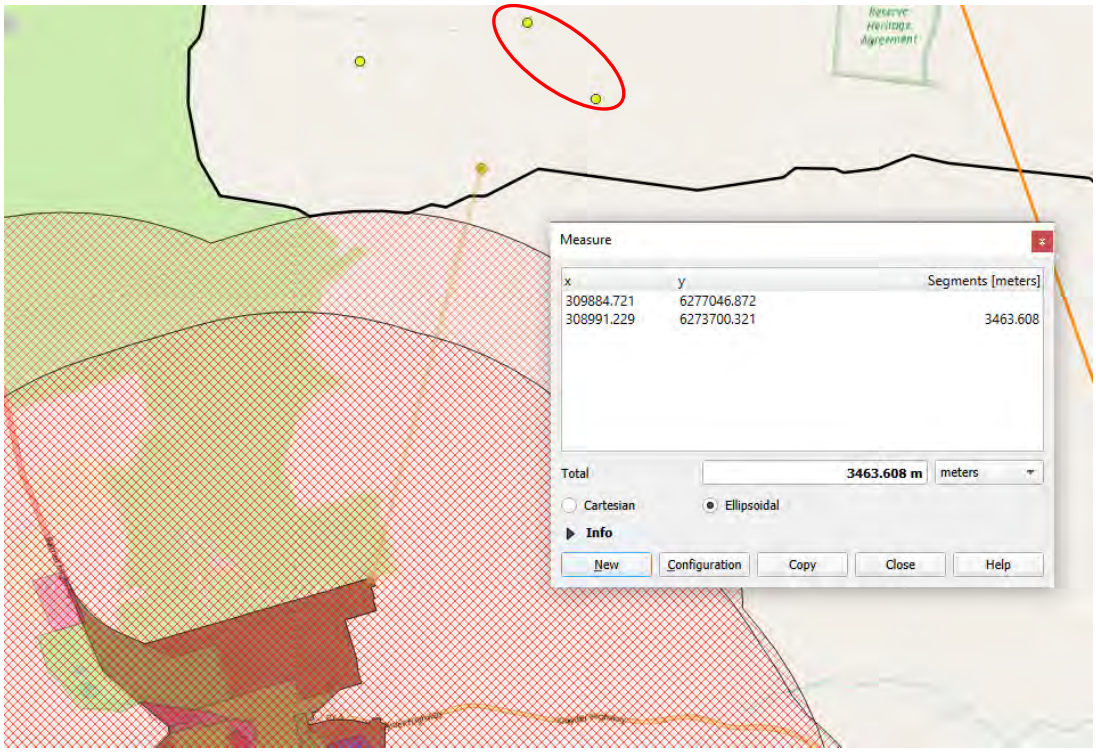


Photo 30 **This shows a setback of greater than the proposed 3000 metres from both National and State Heritage Areas near Burra. Turbines circled in red have been removed from the current layout (Source: Neoen 2023)**

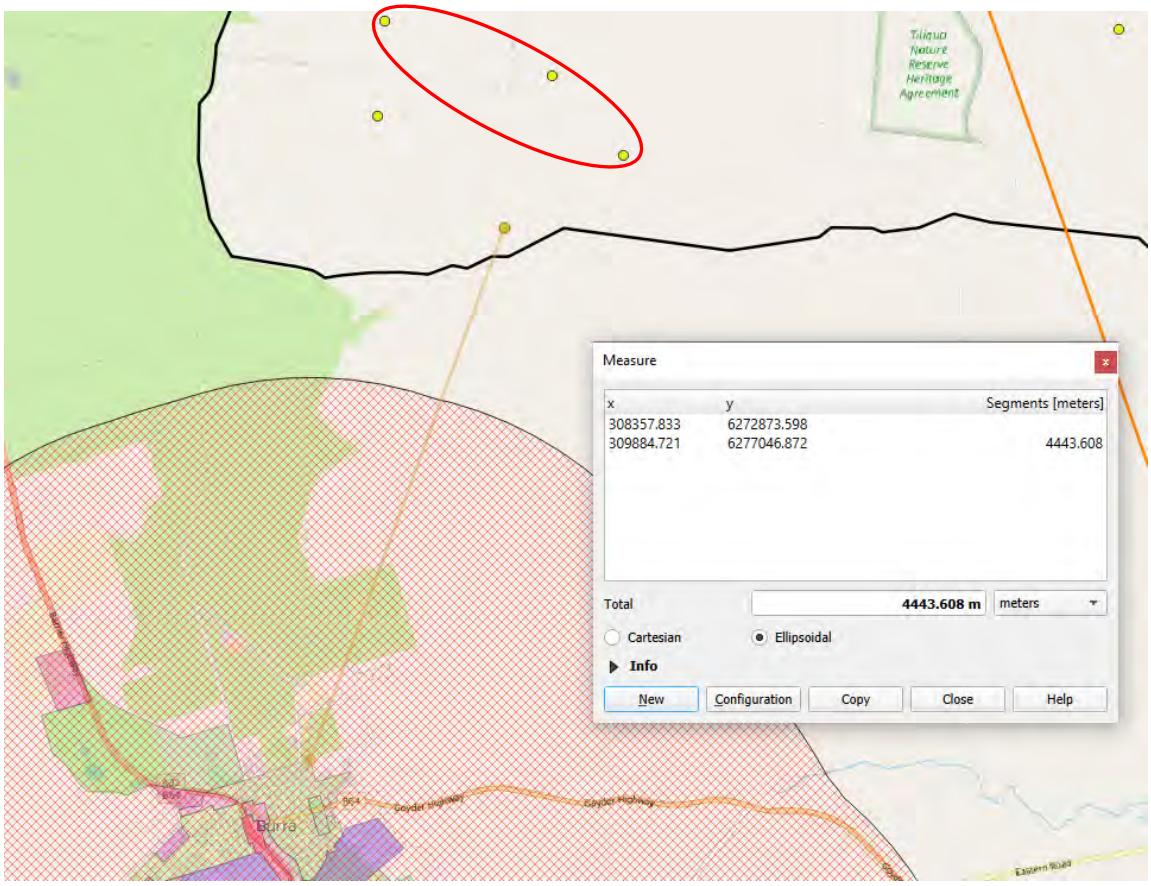


Photo 31 **This shows a setback of greater than the proposed 3000 metres from Residential Zone of Burra. Turbines circled in red have been removed from the current layout (Source: Neoen 2023)**

4. Assessment of heritage impacts

4.1. Setting of Burra

The proposed project is not located within the curtilage of the state heritage listed Burra or the National Heritage listing of the Australian Cornish Mining Sites (Burra), and therefore there are no direct impacts to the physical fabric of the listed sites. The potential impacts on the National Heritage and State Heritage values are therefore visual and have been assessed in this HIA. The National Heritage listing citation can be found in Appendix 1, and State Heritage listing citation in Appendix 2.

Photomontages showing the landscape and visual impact assessment have been prepared by Green Bean Design Pty Ltd and are included in Appendix 3. These photomontages show how the wind turbines will be viewed from Burra, and an assessment of the view for each photomontage location are included in Table 4.

Table 4 Assessment of views for each photomontage/photo location

Photomontage location	Assessment of views	Impact
PM1 – Kangaroo Street, Burra	Existing object located in line with the proposed turbines. Turbines are located in the distance. View is not crowded by the turbines. This photo location is also located inside of the NHL curtilage and state heritage area.	Moderate
PM2 – Kangaroo and Church Street	Turbines are visible, and predominantly spaced out. Landscape is the main focus of the view. This photo location is also located inside of the NHL curtilage and state heritage area.	Moderate
PM3 – Town Hall steps, Burra	Partially obstructed view with some turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Low
PM4 – Mount Pleasant Street, Burra	Obstructed view no turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Nil
PM5 – Burra Mine (toward Morphett's Enginehouse and Windinghouse)	Turbines are visible and are spaced out. Photo location is a high point in the landscape. This photo location is also located inside of the NHL curtilage and state heritage area.	Major
PM6 – Dressing tower	Turbines are visible in the distance and are spaced out. This photo location is also located inside of the NHL curtilage and state heritage area.	Moderate
PM7 – Haulage Enginehouse Chimney	Turbines are visible in the distance and are spaced out. This photo location is also located inside of the NHL curtilage and state heritage area.	Moderate
PM8 - Town Lookout	Turbines are visible in the distance and are spaced out. Photo location is a high point in the landscape. This photo location is also located inside of the NHL curtilage and state heritage area.	Moderate
PM9 – Smelting Works Site	Turbines are visible in the distance and are spaced out. This photo location is also located inside of the NHL curtilage and state heritage area.	Moderate

Photomontage location	Assessment of views	Impact
PM10 – Butterworth Street, Burra	Turbines are visible in the distance and are spaced out. This photo location is also located inside of the NHL curtilage and state heritage area.	Moderate
PM11 – Redruth Gaol	Obstructed view no turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Nil
PM14 – East Terrace, Mount Bryan	Turbines are visible in the distance and are spaced out. This photo location is also located outside of the NHL curtilage and state heritage area.	Low
PM18 – Burra Cemetery	Obstructed view no turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Nil
PM19 - Josephs Church	Obstructed view no turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Nil
PM20 - Burra Square	Obstructed view no turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Nil
PM21 - Burra Mine Lookout	Obstructed view no turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Nil
PM22 - Hamptons Village	Obstructed view no turbines present. This photo location is also located inside of the NHL curtilage and state heritage area.	Nil

4.2. National Heritage Vales

Table 5 is an assessment of the potential for impacts from the proposed action on the National Heritage values of the Australian Cornish Mining Sites (Burra). The criterion has been taken from the NHL citation (DCCEEW 2017).

Table 5 National Heritage values for the Australian Cornish Mining Sites (Burra)

Criterion	Assessment of Potential Impact
Criterion A – Events, Processes	
The 'Burra' copper mine operated profitably for thirty two years from 1845 to 1877. This mine was one of the early and first copper mines in Australia, established following finds of copper in South Australia. The copper mines at Burra and Kapunda (a much smaller mine) mark the beginning of Australia's base metal mining industry. This new form of deep, hard rock mining required new skills and technology not then present in Australia. Mining for copper required the skills of miners who knew how to establish mines and systematically mine them in a way which created the best return for the effort and cost required to access the ore body. Cornish technology, embodied in the steam engines, work practices and ore processing methods applied in the early copper mines of South Australia, was critical to the establishment and ongoing economic viability of these mines. The application of steam power in particular was essential. Without steam power copper mining was impossible. Over the course of the nineteenth century Australia began to move from a pre-industrial agrarian based society and economy to one which was rapidly industrialising. At Burra, Cornish miners established a system of mining on a 'greenfield' site, transplanting from one of the world's most advanced centres of machine innovation (Cornwall) an emergent form of industry which was being shaped by a new revolutionary machine, the steam engine. South Australia's colonial relationship with Britain enabled access to Britain's steam engine technology which at the time was protected to prevent transfer to competitor nations. Steam power was not just an 'improving' technology - it was revolutionary. The power of one boiler for example replaced the power of one thousand men. Burra is of outstanding importance because Burra remains, with Moonta, one of only two areas in Australia where Cornish mining technology, skills and culture is demonstrated to a high degree. Burra represents the Cornish mining system's successful transplantation in Australia. Features which express these values include an outstanding collection of nineteenth century civic, residential, church and Cornish mining built structures, all located	The proposed Goyder North project will be undertaken approximately 5.5 kilometres north-east from the centre of Burra and approximately 2.7 kilometres from the most northern point of the NHL for the Australian Cornish Mining Sites (Burra). The proposed Goyder North project is not located within the NHL town of Burra. Therefore, there is no physical impact to the NHL for the Australian Cornish Mining Sites (Burra). The views from Burra are not explicitly cited in the National Heritage Criterion A. The location of the proposed project will not disturb, alter or change the events or processes under Criterion A, and will not alter the significant remanent mining technology that is included in Criterion A. There are seven photomontage views from around the township of Burra that have been assessed to have nil impacts as the view to the turbines is obstructed (PM4, PM11, PM18-22). There are some photomontage views from specific locations around Burra and within the Burra mine site, including PM1-3, and PM5-11, that will be moderately impacted. The turbines are clearly visible in the distance and do change the distant setting of the town towards the north-east of the town. The turbines are contained in a group and there are still wider landscape views from Burra to the north and west that are not altered. The distant view from these locations is altered and the turbines are clearly a new element on the horizon, but the immediate setting of the heritage site and immediate vicinity of the significant remanent mining technology is not dominated by the turbines. The mine site can still be understood in a broader rural context while moving through the remnant mining infrastructure. The turbines would be the most obvious when standing at the highest points of the mine site, at look outs and up on hill rises; however, the view to the turbines is mostly obstructed by the topography when exploring the mine site and reading interpretive signage at lower ground level (Photo 4, Photo 19, Photo 20).

Criterion	Assessment of Potential Impact
within the former villages (Kooringa, New Aberdeen, Aberdeen, Llwchwr, Hampton) and mine at Burra. In relation to the demonstration of Cornish mining technology, skills and practice the following items in or near to the Burra Mine Area are significant including but not limited to the former Winding House, the former Ore Sorting Floor, the former Crusher Chimney (Cornish), the former Morphett's Pump House, the former Engine/Crusher House, the former Mine Manager's Dwelling and Office, the former Graves Pump House, the former Haulage Engine Chimney (Welsh), the former Powder Magazine, Peacock's Chimney (Cornish), the former SA Mining Association Store Room, Yard and Walls (Market Street) and the former SA Mining Association Storeman's Dwelling (Market Street). The Burra Mines Historic Site as a whole is also significant as a place which on the surface and underground demonstrates the layout of surface and underground mining operations. The remnant underground shafts including but not limited to Morphetts shaft, Hector shaft and Waterhouse Shaft with their connecting horizontal levels are significant for their ability to demonstrate underground mining practice in association with the arrangement of surface mining structures. In relation to the demonstration of smelting technology used to improve the economic viability of the mine, the following items in the Smelter area to the east of the Burra Mine Area are significant including but not limited to the Former Burra Smeltsyard and Storehouse, the former Burra Smelts Historic Site (including Smelter Ruins, Smelter Furnace Ruins, Smelts Manager's Residence and Office) and the former Smelts Superintendent's Dwelling and Wall. In relation to the demonstration of the Cornish miner's living conditions and ways of life which enabled them to mine, the following items are significant including but not limited to the former Miner's Dugouts (tributary of Burra Creek), the former Dugout Sites (Burra Creek), the small, attached dwellings on Truro Street in Redruth (street numbers 8, 9, 10, 11, 12, 13, 14, 16 and 18), the stone cottages and dwellings on Upper Thames Street in old Kooringa (street numbers 2, 4, 6, 8, 10, 12, 16), the former Burra Primitive Church (9 Upper Thames Street), the Paxton Square cottages (33), the former Burra Bible Christian Chapel (Kingston Street), the former Smelter's Home Hotel (SAHR 10419 ' Market Street), the Burra Hotel (SAHR 10404 ' Market Street), the former Burra Salvation Army Citadel (11 Kingston Street) and a 1840s timber dwelling (39 Commercial Street ' SAHR 10434) and Burra Town Hall (original	The distant rural setting of Burra would be altered to the north-east and therefore the potential impacts have been assessed as moderate adverse.

Criterion	Assessment of Potential Impact
Miners' and Mechanics' Institute). While the Cornish miners were mostly Methodist in faith the following early Anglican Churches are significant for their representative demonstration of the importance of religion in these miner communities including St Mary's Anglican Church and St Mary's Anglican Church Hall. In relation to the demonstration of the speculative nature of mining operations, the former Bon Accord Mine Buildings (SAHR10023) are significant including but not limited to the 1859 mine offices, blacksmith's forge, carpenter's shop and a manager's residence. The following additional features also reflect the Cornish influence within the town of Burra including but not limited to the stone wall located on the east side of Commercial Street and Ware Street, Burra (SAHR 10435) and the stone wall located on the west side of Commercial Street (SAHR 10436) in Burra. Burra is distinctive in its development from a group of smaller townships including Kooringa (Company town), Redruth (Government surveyed town), Aberdeen (Scottish speculators), New Aberdeen (Scottish association), Llwwchwr (Welsh Smelter workers) and Hampton (new mining settlement named after the assayer at the smelting works). The names of these townships reflect the mining history of Burra and the haphazard nature of its development as a mining settlement. The Hampton Township Precinct (SAHR 10359) represents the impact of the decline of the mine and the consequent loss of population when the Burra Mine closed in 1877. The features of significance include but are not limited to Jacka House, the remnant street and allotment layout, fences, walls and remnant stone domestic buildings and introduced trees such as almond, pine, olive and pepper trees and the remains of the quarries that provided stone for the dwellings. Burra Cemetery (SAHR 10432 Spring Street, Burra) is also significant as a place which, through the headstones within the cemetery, chronicles the lives and misfortunes of the mining community up to 1877. These stories are valued as an important complementary record of the life of Cornish miners in Burra.	
Criterion F – Creative or Technical achievement	
At Burra, Cornish miners established a system of mining on a 'greenfield' site, transplanting from Cornwall – one of the world's most advanced centres of machine innovation – an emergent form of industry which was being shaped by a new revolutionary machine, the steam engine. Welsh smelting technology was also successfully established at the mine soon after its establishment.	The proposed Goyder North project will be undertaken approximately 5.5 kilometres north-east from the centre of Burra and approximately 2.7 kilometres from the most northern point of the NHL for the Australian Cornish Mining Sites (Burra). The proposed Goyder North project is not located within the NHL town of Burra.

Criterion	Assessment of Potential Impact
This achievement created a 'prototype' system which could then be repeated and applied in other later significant mining ventures such as Broken Hill in NSW, Bendigo in Victoria, Kalgoorlie in WA and Charters Towers in Queensland. Cornish mining traditions continued to be used and improved as Cornish miners moved from one mine to another across the country. This achievement also demonstrates the important role technology played in the evolution of Australia's industrialised modern economy. Features which express these values include the remnant mining structures within the Burra Mines Historic Site (SAHR 10970) and all of the significant features listed under criterion (a).	Therefore, there is no physical impact to the NHL for the Australian Cornish Mining Sites (Burra). The views from Burra are not explicitly cited in the National Heritage Criterion F. The location of the proposed project will not disturb, alter or change the mining technology or the creative or technical achievement under Criterion F. There are seven photomontage views from around Burra that have been assessed to have nil impacts as the view to the turbines is obstructed (PM4, PM11, PM18-22). There are some photomontage views from specific locations around Burra and within the Burra mine site, including PM1-3, and PM5-11, that will be moderately impacted. The turbines are clearly visible in the distance and do change the distant setting of the town towards the north-east of the town. The turbines are contained in a group and there are still wider landscape views from Burra. The distant view from these locations is altered and the turbines are clearly a new element on the horizon, but the immediate setting of the mine site is not dominated by the turbines. The mine site can still be understood in a broader rural (greenfield) context while moving through the remnant mining infrastructure. The turbines would be the most obvious when standing at the highest points of the mine site, at look outs and up on hill rises; however, the view to the turbines is mostly obstructed by the topography when exploring the mine site and reading interpretive signage at lower ground level (Photo 4, Photo 19, Photo 20. The proposed turbines would also be completely out of view when observing the mine from the Mine Lookout, as the view faces south (Photo 20). The altering of the distant views to the north-east from the mine site would not impact on the understanding of the revolutionary mining technology. The distant rural setting of Burra would be altered to the north-east and therefore the potential impacts have been assessed as moderate adverse.

4.3. State Heritage Values

Table 6 is an assessment of the potential for impacts from the proposed action on the State heritage significance of Burra. The statement of significance has been taken from the State Heritage listing (Government of South Australia 1993).

Table 6 State Heritage values for the State Heritage significance of Burra

Statement of Significance	Assessment of Potential Impact
The Burra State Heritage Area is of significance to the economic and social history of South Australia, and is a testament to the success of copper mining in the area. In the late 1840s, the Burra Mine made South Australia the most prosperous colony in Australia. At one stage the mine was the second largest producer of copper in the world. Comprising the mining area and a complex of what were originally separate townships which are now merged into one, the area provides evidence of early mining, industrial and urban functions with Welsh and Cornish influences.	The proposed Goyder North project will be undertaken approximately 5.5 kilometres north-east from the centre of Burra and approximately 2.7 kilometres from the most northern point of the Hampton Township Precinct (SAHR 17652). The proposed Goyder North project is not located within the town of Burra. Therefore, there is no physical impact to the State Heritage significance of Burra. The proposed project will not physically disturb, alter or change the listed items in the Burra State Heritage Area. There are seven photomontage views from around Burra that have been assessed to have nil impacts as the view to the turbines is obstructed (PM4, PM11, PM18-22). This includes Hamptons Village where the topography would obscure views of the turbines. There are some photomontage views from specific locations around Burra and within the Burra mine site, including PM1-3, and PM5-11, that will be moderately impacted. The turbines are clearly visible in the distance and do change the distant setting of the town towards the north-east of the town. The turbines would be the most obvious when standing at the highest points of the mine site, at look outs and up on hill rises; however, the view to the turbines is mostly obstructed by the topography when exploring the mine site and reading interpretive signage at lower ground level (Photo 4, Photo 19, Photo 20). The proposed turbines would also be completely out of view when observing the mine from the Mine Lookout, as the view faces south (Photo 20). The altering of the distant views to the north-east from the mine site would not impact on the understanding of the revolutionary mining technology. The distant rural setting would be altered to the north-east by the proposed works and therefore the potential impacts have been assessed as moderate adverse.

4.4. Conservation Management Plan

The draft *Burra Township and Historic Mine Site Conservation Management Plan* (CMP) was prepared by Swanbury Penglase (2019). The CMP details how the National Heritage values of the Australian Cornish Minig Sites can be conserved. There is one CMP Policy that relates to the setting of the Burra and this has been discussed below in Table 7.

Table 7 CMP policy for Burra

CMP Policy	Assessment of Potential Impact
Policy 5.9 - Burra's Sense of Place and the visual setting of the Burra Cornish mining sites. Future development should carefully consider the influence on Burra's visual landscape and the historic and spatial relationships of individual places of National value. Views to and from the Burra Mine site and Smelts site are of highest significance to the National Values.	The proposed Goyder North project will be undertaken approximately 5.5 kilometres north-east from the centre of Burra and approximately 2.7 kilometres from the most northern point of the NHL for the Australian Cornish Mining Sites (Burra). The proposed Goyder North project is not located within the NHL town of Burra. Therefore, there is no physical impact to the NHL for the Australian Cornish Mining Sites (Burra). There are seven photomontage views that are located inside the NHL curtilage that have been assessed to have nil impacts as the view to the turbines is obstructed (PM4, PM11, PM18-22). There are some photomontage views from specific locations around Burra and within the Burra mine site, including PM1-3, and PM5-11, that will be moderately impacted. The turbines are clearly visible in the distance and do change the distant setting of the town towards the north-east of the town. The turbines would be the most obvious when standing at the highest points of the mine site, at look outs and up on hill rises; however, the view to the turbines is mostly obstructed by the topography when exploring the mine site and reading interpretive signage at lower ground level (Photo 4, Photo 19, Photo 20. The proposed turbines would also be completely out of view when observing the mine from the Mine Lookout, as the view faces south (Photo 20). The mine site can still be understood in a broader rural (greenfield) context while moving through the remnant mining infrastructure. The altering of the distant views to the north-east from the mine site would not impact on the understanding of the revolutionary mining technology. The distant rural setting would be altered to the north-east by the proposed works and therefore the potential impacts are not generally in accordance with this policy

CMP Policy	Assessment of Potential Impact
	of the CMP. Therefore, the proposed works have been assessed as moderate adverse.

5. Conclusion

The proposed GNREF is located approximately 5.5 kilometres north-east from the centre of Burra and approximately 2.7 kilometres from the most northern point of the NHL for the Australian Cornish Mining Sites (Burra) and the most northern point of the Hampton Township Precinct (SAHR 17652). The proposed project is not located within the NHL town of Burra. Therefore, there is no direct physical impact to the NHL values for the Australian Cornish Mining Sites (Burra). Likewise, there is no direct physical impact to the values of the Burra State Heritage Area.

This HIA has focused on potential impacts to the views from Burra and the setting of the place. As noted in above, the views from Burra are not explicitly cited in the National Heritage criteria or the State Heritage statement of significance.

This HIA has assessed the proposed GNREF project to have a moderate indirect visual impact. The distant rural setting would be altered to the north-east by the proposed works as they are a new element in the currently empty horizon. However, the altering of the distant views to the north-east from the mine site would not impact on the understanding of the revolutionary mining technology.

There is one CMP Policy that relates to the setting of Burra (policy 5.9), and this HIA has noted that the proposed works are not generally in accordance with this policy. However, the view to the turbines is mostly obstructed by the topography when exploring the mine site and reading interpretive signage at lower ground level. The proposed turbines would also be completely out of view when observing the mine site from the Mine Lookout, as the view faces south.

A reduction of the number of turbines has already aided in decreasing the potential for adverse impacts on the heritage values of Burra. Further reduction in the number of turbines that are visible from the mine site in particular would further reduce the adverse visual impacts and should be considered where changes are possible to the turbine layout.

As the views from Burra are not specifically cited in the NHL criteria, the proposed Goyder North project would not have a significant impact as defined by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The proposed project will not have a substantive impact on the National Heritage values of the Australian Cornish Mining Sites (Burra).

The proposed Goyder North project would also likely not have a major adverse heritage impact on the state heritage significance of the Burra State Heritage Area.

Table 8 Significant Impact Guidelines 1.2 - Reponses

Significant Impact Guidelines 1.2	Response
Permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures, contents, and objects) of a heritage place.	N/A – the proposed GNREF is not located within the curtilage of the NHL listed town of Burra. There is no physical impact to the NHL for the Australian Cornish Mining Sites (Burra). Therefore, no fabric of a heritage place will be destroyed, removed, or substantially altered.
Involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place.	N/A - the proposed GNREF is not located within the curtilage of the NHL listed town of Burra. There is no physical impact to the NHL for the Australian Cornish Mining Sites (Burra). Therefore, no extension, renovation, or substantial alteration of a heritage place which is inconsistent with the heritage values of the place will occur.
Involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place.	This HIA has assessed the proposed GNREF project to have visual impacts. These have been classed as moderate adverse in nature as the turbines will be grouped together which will not crowd the view of the landscape from Burra. This is a result of the heritage advice provided for the project. The views from Burra are not included in the National Heritage criteria, and therefore unlikely to significantly alter the listed heritage values. The proposed GNREF will therefore not have a significant impact on the heritage values of the place.
Substantially diminish the heritage value of a heritage place for a community or group for which it is significant.	N/A – the proposed GNREF is not located within the curtilage of the NHL listed town of Burra and does not diminish the heritage value of a heritage place for a community or group for which it is significant.
Substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place.	This HIA has assessed the proposed GNREF project to have indirect visual impacts. These have been classed as moderate adverse in nature as the turbines will be grouped together which will not crowd the view of the landscape from Burra. This is a result of the heritage advice provided for the project, and therefore the wider landscape will remain the focus of the view. The views from Burra are not included in the National Heritage criteria. The distant wider rural setting and landscape will be altered with the proposed turbines, however the proposed GNREF will not impact the heritage values that Burra is listed for. The proposed GNREF will therefore not have a significant impact on the heritage values of the place.
Substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site.	N/A - the proposed GNREF is not located within the curtilage of the NHL listed town of Burra and does not restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site.

References

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Government of South Australia 1993, *The South Australia Heritage Places database. Burra State Heritage Area.*, viewed 15 November 2023, <https://maps.sa.gov.au/heritagesearch/HeritageItem.aspx?p_heritageno=27549>.

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Appendices

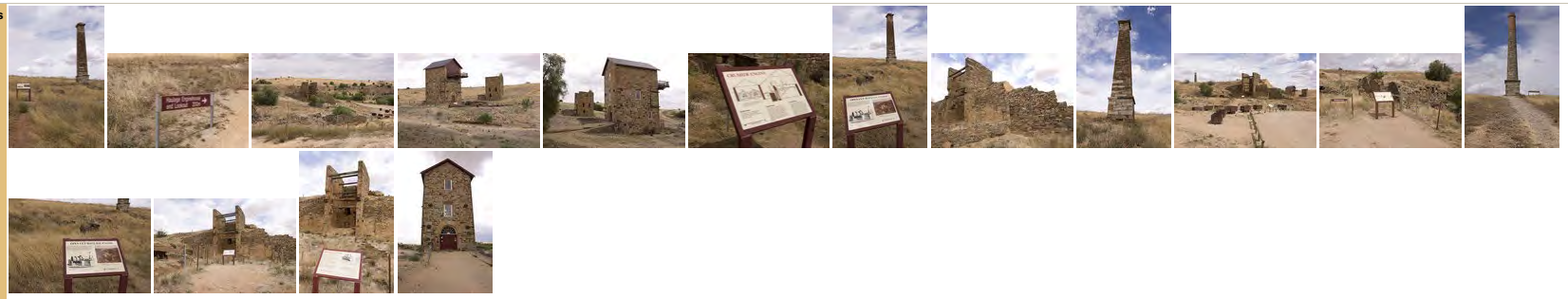
Appendix 1 Australian Cornish Mining Site – Burra NHL Citation

Place Details

new search

Send Feedback

Australian Cornish Mining Sites: Burra, Barrier Hwy, Burra, SA, Australia

Photographs	
List	National Heritage List
Class	Historic
Legal Status	Listed place (09/05/2017)
Place ID	106304
Place File No	3/08/042/0012

Summary Statement of Significance

The former copper mine at Burra represents a milestone in Australia's history of mining. During the nineteenth century the scale and richness of the copper mine at Burra marked the beginning of Australia's metal mining industry.

Using technology and skills transferred from Cornwall to Australia, the 'monster mine', for the first ten years of its life was the largest mine in Australia. Copper wealth at this time was a critical revenue source needed for the survival of the then new colony of South Australia. From 1850 to 1860 the Burra mine produced five percent of the world's copper. South Australia soon became known as the Copper Kingdom in recognition of its substantial industrial development focused on copper mining and the export of copper overseas.

The surface and underground mining operations at the Burra mine were mainly Cornish in nature. Smelting skills, technology and equipment were also imported from Wales and operated by Welsh smelter experts. Cornish technology and skills transferred to Australia and demonstrated at Burra were essential aspects in the establishment of Australia's first copper mines. The Cornish steam engine, as in Cornwall, was revolutionary, enabling for the first time the mining of metals at depths not previously possible. The deep rock mining skills bought to Australia by Cornish miners also facilitated the further expansion and development of Australia's mining industry.

The Cornish Steam engine and its use in the copper mines of South Australia also demonstrates the early course and pattern of Australia's industrialisation. Burra and Moonta former mine areas include the best remaining evidence of these Cornish machines and their application in Australia in the mid to late nineteenth century.

Burra is of outstanding heritage significance to Australia because of its very high capacity to demonstrate this major national industrial milestone. At Burra copper mining was of a substantial scale compared to other previous smaller copper mines. The transfer of Cornish mining skills and technology is best demonstrated here more than any other place in Australia.

Official Values

Criterion A Events, Processes

The 'Burra' copper mine operated profitably for thirty two years from 1845 to 1877. This mine was one of the early and first copper mines in Australia, established following finds of copper in South Australia. The copper mines at Burra and Kapunda (a much smaller mine) mark the beginning of Australia's base metal mining industry.

This new form of deep, hard rock mining required new skills and technology not then present in Australia. Mining for copper required the skills of miners who knew how to establish mines and systematically mine them in a way which created the best return for the effort and cost required to access the ore body.

Cornish technology, embodied in the steam engines, work practices and ore processing methods applied in the early copper mines of South Australia, was critical to the establishment and ongoing economic viability of these mines. The application of steam power in particular was essential. Without steam power copper mining was impossible. Over the course of the nineteenth century Australia began to move from a pre-industrial agrarian based society and economy to one which was rapidly industrialising. At Burra, Cornish miners established a system of mining on a 'greenfield' site, transplanting from one of the world's most advanced centres of machine innovation (Cornwall) an emergent form of industry which was being shaped by a new revolutionary machine, the steam engine.

South Australia's colonial relationship with Britain enabled access to Britain's steam engine technology which at the time was protected to prevent transfer to competitor nations. Steam power was not just an 'improving' technology - it was revolutionary. The power of one boiler for example replaced the power of one thousand men.

Burra is of outstanding importance because Burra remains, with Moonta, one of only two areas in Australia where Cornish mining technology, skills and culture is demonstrated to a high degree. Burra represents the Cornish mining system's successful transplantation in Australia.

Features which express these values include an outstanding collection of nineteenth century civic, residential, church and Cornish mining built structures, all located within the former villages (Kooringa, New Aberdeen, Aberdeen, Llwchwr, Hampton) and mine at Burra.

In relation to the demonstration of Cornish mining technology, skills and practice the following items in or near to the Burra Mine Area are significant including but not limited to the former Winding House, the former Ore Sorting Floor, the former Crusher Chimney (Cornish), the former Morphett's Pump House, the former Engine/Crusher House, the former Mine Manager's Dwelling and Office, the former Graves Pump House, the former Haulage Engine Chimney (Welsh), the former Powder Magazine, Peacock's Chimney (Cornish), the former SA Mining Association Store Room, Yard and Walls (Market Street) and the former SA Mining Association Storeman's Dwelling (Market Street).

The Burra Mines Historic Site as a whole is also significant as a place which on the surface and underground demonstrates the layout of surface and underground mining operations. The remnant underground shafts including but not limited to Morphetts shaft, Hector shaft and Waterhouse Shaft with their connecting horizontal levels are significant for their ability to demonstrate underground mining practice in association with the arrangement of surface mining structures.

In relation to the demonstration of smelting technology used to improve the economic viability of the mine, the following items in the Smelter area to the east of the Burra Mine Area are significant including but not limited to the Former Burra Smeltsyard and Storehouse, the former Burra Smelts Historic Site (including Smelter Ruins, Smelter Furnace Ruins, Smelts Manager's Residence and Office) and the former Smelts Superintendent's Dwelling and Wall.

In relation to the demonstration of the Cornish miner's living conditions and ways of life which enabled them to mine, the following items are significant including but not limited to the former Miner's Dugouts (tributary of Burra Creek), the former Dugout Sites (Burra Creek), the small, attached dwellings on Truro Street in Redruth (street numbers 8, 9, 10, 11, 12, 13, 14, 16 and 18), the stone cottages and dwellings on Upper Thames Street in old Kooringa (street numbers 2, 4, 6, 8, 10, 12, 16), the former Burra Primitive Church (9 Upper Thames Street), the Paxton Square cottages (33), the former Burra Bible Christian Chapel (Kingston Street), the former Smelter's Home Hotel (SAHR 10419 ' Market Street), the Burra Hotel (SAHR 10404 ' Market Street), the former Burra Salvation Army Citadel (11 Kingston Street) and a 1840s timber dwelling (39 Commercial Street ' SAHR 10434) and Burra Town Hall (original Miners' and Mechanics' Institute). While the Cornish miners were mostly Methodist in faith the following early Anglican Churches are significant for their representative demonstration of the importance of religion in these miner communities including St Mary's Anglican Church and St Mary's Anglican Church Hall.

In relation to the demonstration of the speculative nature of mining operations, the former Bon Accord Mine Buildings (SAHR10023) are significant including but not limited to the 1859 mine offices, blacksmith's forge, carpenter's shop and a manager's residence. The following additional features also reflect the Cornish influence within the town of Burra including but not limited to the stone wall located on the east side of Commercial Street and Ware Street, Burra (SAHR 10435) and the stone wall located on the west side of Commercial Street (SAHR 10436) in Burra.

Burra is distinctive in its development from a group of smaller townships including Kooringa (Company town), Redruth (Government surveyed town), Aberdeen (Scottish speculators), New Aberdeen (Scottish association), Llwwchwr (Welsh Smelter workers) and Hampton (new mining settlement named after the assayer at the smelting works). The names of these townships reflect the mining history of Burra and the haphazard nature of its development as a mining settlement. The Hampton Township Precinct (SAHR 10359) represents the impact of the decline of the mine and the consequent loss of population when the Burra Mine closed in 1877. The features of significance include but are not limited to Jacka House, the remnant street and allotment layout, fences, walls and remnant stone domestic buildings and introduced trees such as almond, pine, olive and pepper trees and the remains of the quarries that provided stone for the dwellings.
Burra Cemetery (SAHR 10432 Spring Street, Burra) is also significant as a place which, through the headstones within the cemetery, chronicles the lives and misfortunes of the mining community up to 1877. These stories are valued as an important complementary record of the life of Cornish miners in Burra.

Criterion F Creative or technical achievement

At Burra, Cornish miners established a system of mining on a 'greenfield' site, transplanting from Cornwall - one of the world's most advanced centres of machine innovation - an emergent form of industry which was being shaped by a new revolutionary machine, the steam engine. Welsh smelting technology was also successfully established at the mine soon after its establishment.

This achievement created a 'prototype' system which could then be repeated and applied in other later significant mining ventures such as Broken Hill in NSW, Bendigo in Victoria, Kalgoorlie in WA and Charters Towers in Queensland. Cornish mining traditions continued to be used and improved as Cornish miners moved from one mine to another across the country. This achievement also demonstrates the important role technology played in the evolution of Australia's industrialised modern economy.

Features which express these values include the remnant mining structures within the Burra Mines Historic Site (SAHR 10970) and all of the significant features listed under criterion (a).

Description

The place comprises the Burra Mines State Heritage Area including the Burra mine area and the surrounding collection of small historic town settlements associated with the Burra mine. The Burra Smelts works contains one of the earliest major smelting works established in Australia.

Burra is made up of a number of former past townships. Kooringa was the company town settled just to the south of the mine. Redruth was one of the government townships laid out in the 1850s; whereas Hampton was one of the privately surveyed villages built to accommodate miners returning from the gold fields in the 1860s. Aberdeen and New Aberdeen were established by Scottish speculators hoping that the mine would extend north. This extension failed to materialise. All these areas contain surviving architecture and archaeological remains dating from a period of Australia's early copper mining (1845-1877).

The Burra Mines Historic Site is within the Burra State Heritage Area. It is west of Burra Creek, between Burra and North Burra (the old townships of Kooringa and Redruth and Aberdeen), and encompasses the remaining structures of the former Burra "Monster Mine". This area retains much of Burra's significant mining heritage and includes both the early underground workings and the open-cut mine that dominates the site. The open cut mine feature is a product of a later period of mining undertaken in the 1970s. The barren landscape also contains the 'artificial hills' of mine tailings, as well as abandoned buildings and archaeological sites.

History

Indigenous history
The Ngadjuri people are the Traditional Owners of the mid north region of South Australia, including the area now known as Burra. Aboriginal people have used the terrain from Burra to Broken Hill extensively over thousands of years. Archaeological evidence of the Ngadjuri's engagement with their land includes campsites, economic sites, such as where tools were made, quarries, stone arrangements, sacred trees, burials, rock engravings (petroglyphs) and painting sites. Several sites in the area represent major gathering places that demonstrate multiple activities, including, domestic, economic and ceremonial evidence. (Warrior et al, 2005:67;67).

In 1834 the South Australia Act, also known as the Foundation Act, was passed in the British Parliament. This Act made provision for 300,000 square miles to become the territory in which British settlers could begin the colony of South Australia. The territory was described as 'waste and unoccupied'. However, the Letters Patent related to the Act that was issued in 1836, said that nothing could be done which would:
"affect the rights of any Aboriginal natives of the said Province to the actual occupation or enjoyment in their own persons or in the persons of their descendants of any lands therein now actually occupied or enjoyed by such natives." (Cunneen and Libesman 1995 in Warrior et al, 2005:73).

The South Australia Act had precedence over the Letters Patent, which appears to have been largely ignored as squatters took land and later sought title for it. Early attempts were made to establish friendly relationships with the Ngadjuri people which included the appointment of a Protector of Aborigines in 1836. Missionaries were sent to teach Christianity and ration stations were set up to issue biscuits, clothing and blankets (Raynes 2002: 7-10).

The Mid North region was one of the first areas in South Australia settled by Europeans after colonisation, due to its suitability for farming. Dispossession of Aboriginal people from their land eventually led to resistance. Resistance in the area included taking animals, pulling down fences and lighting bushfires (Warrior et al 2005:77). Auhl (1986:233) states that during the exodus of miners from Burra to the Victorian gold rush in the 1850s, the Ngadjuri took the opportunity to hasten the departure of Europeans and became "more insolent and aggressive". However, the Ngadjuri also filled the labour shortage, and in 1852 the Protector of Aborigines reported that there were over 20,000 sheep in the charge of Aboriginal shepherds.

Mining
The discovery of silver lead ore, was made in the Adelaide suburbs in 1841 (Both & Drew 2008). With the discovery of minerals, it became South Australian practice to recruit experienced teams of miners direct from Cornwall to open new mines; this also happened at Kapunda in 1844, and at Reedy Creek (Tungkillo) and Glen Osmond in 1847.

There is a strong historical connection between the Cornish in Australia and the mining industry, but South Australia's Cornish community was established before any metalliferous mining industry existed on the Australian continent. The utopian free-enterprise ethos of early South Australia attracted a high proportion of immigrants from Cornwall and the West Country generally, where the Methodist faith, political liberalism and anti-establishment beliefs had a strong following. One in ten applications for passage to South Australia in the first five years of the introduction of the free Migration Scheme – representing 941 families – came from Cornwall (Migration Museum 1995: 97); 3-4% of today's Australians claim Cornish descent (Cornish Association of Western Australia 2014). Even before a single mine had been opened, the population of South Australia was about 8-10% Cornish-born, the largest enclave of Cornish immigrants in Australia (Payton 1984: 12). Precisely because these immigrants included a large number of people with experience in mining, they were able to play a major role in establishing enterprises very early in South Australia's history (Blainey 1969: 106).

In 1842, regulations were introduced stipulating that the minimum amount of land that could be purchased in unsurveyed districts was 20,000 acres at one pound per acre. This became, therefore, the only way to acquire mineral rights on unsurveyed Crown land. Four such special mineral or "Monster Surveys" were made and purchased before the system was abolished in 1851. Those were Burra Creek and Mt. Barker in 1845, and Mt. Remarkable and Reedy Creek in 1846. The first discoveries of minerals outside the surveyed districts were near Burra Burra Creek in 1845, by two shepherds at two separate localities (Auhl 1986: 85). To acquire the mineral rights, the Burra Creek Special Survey was jointly purchased in late 1845 by two parties that were formed to raise the purchase sum of £20,000. These parties were the South Australian Mining Association (SAMA) and the Princess Royal Mining Company (PRMC). After purchase, the survey, measuring eight miles by four miles, was laid out to incorporate the two discoveries, one in each half; and lots were drawn to determine ownership of the two halves. SAMA gained the northern half and what was to become the Burra Burra Mine (Fuss & Satchell 2011: 4).

The nature of the mine's foundation significantly influenced the development of the settlements on and around it. The settlement patterns of the Burra Burra became strikingly different from those established later in the Copper Triangle districts on the Yorke Peninsula. Rather than being a planned town, the Burra Burra comprised a cluster of towns during the mining era (and, indeed, for much of the following century) around the mine property of the SAMA (Auhl 1986: 4). Kooringa was the first and largest settlement, located south of the mine site entirely on the mining company's land. Allotments could only be obtained on a maximum 21-year lease. This had profound implications for the physical and social development of the township, and its residential and commercial properties, as individuals were not prepared to invest their capital in substantial houses or business premises until they could obtain freehold. As a result, none of the better quality houses in the town were erected before 1870. There were also doubts over the permanency of the mine as there seemed to be no regular stratification in the copper seams (Fisher 1851: 11).

Other townships developed adjacent to the northern boundary of the SAMA company property. This included the government township of Redruth, laid out on a grid pattern centred on a Police Reserve which contained a police station built in 1847. Several other speculative private townships were also laid out, including Aberdeen, Llwchwr and Hampton (Auhl 1986: 101). In 1876, the three main townships, Kooringa, Redruth and Aberdeen, were formed into the Corporation of the Town of Burra but retained their separate identities until 1940, when the name Burra was officially adopted. This settlement pattern is clearly evident in present-day cadastral plans and aerial photographs.

Even at Redruth and the township of Hampton, where freehold was available, there were few substantial homes before 1870 and certainly none at Hampton. Miners were wary of investing in a town where the mine might have only a brief life (Fisher 1851: 11). Freehold only became available in Kooringa from 1869, when mine income was failing and the company saw that selling the land (while retaining the mineral rights) would best serve its interests.

For most of the life of the mine, the town had no local government at all and, hence, virtually no capital investment in normal town amenities. Only when the mine faced closure did the SAMA decide that improvements to the town would increase its value as an asset. Neither did the townsfolk generally want local government if it meant merely paying rates to improve the value of the mining company's property, rather than their own. When the government did lay out the grid pattern township, it was at Redruth immediately north of the mine property, a convenient location for such government institutions as the police station, lock-up, stables, court and gaol.

Hampton was subdivided in 1857, next to the local quarry. It consisted of about 30 dwellings and a Bible Christian Chapel (Government of South Australia 2014n: 4-5), and was largely occupied by miners who had returned from the gold fields in Victoria in the 1860s (Auhl 1986: 101). Hampton lay beyond the reach of the 1880s water supply and also of the 1920s electrification. It contributed little to the Town Council's revenue and so received virtually no capital investment in roads, drainage, kerbing or footpaths. Over a century, it gradually withered away to become a ghost town (Auhl 1986: 101). Its relative remoteness contributed to its decline; but this, in turn, meant it was virtually untouched by any modernisation or modification and was not redeveloped for other use.

The biggest mines naturally attracted the largest concentrations of Cornish miners (Auhl 1986: 1). The discovery of the Burra Burra copper deposit in 1845 set in train what was becoming the usual response. Captain Roberts, the Cornish manager of a small mine in the Adelaide Hills, was recruited along with a team of nine experienced Cornish miners to open the mine. "The Monster Mine" proved to be vastly richer than any earlier discovery, bringing fabulous wealth to the shareholders and the colony in general. "Copper Roads" were constructed between 1845 and 1870 to export the copper (Fuss & Satchell 2011: 43) not only to England but to Singapore, Calcutta, Bombay, Madras, Batavia and Mauritius (Auhl 1986: 11).

The operations attracted an influx of Cornish miners already in the colony and prompted a recruiting drive to bring more from Cornwall (Birt 2001: 11). Cornish miners knew how to excavate with hand tools and explosives, to design safe and efficient underground workings, to recognise valuable ore, to extract it and raise it to the surface for crushing and processing. Their boots and tools, helmets and candles, along with their systems including "Tutwork' (payment was dependent upon the volume of ground dug) and 'Tribute" (whereby a miner or group of miners was remunerated according to the value of the ore won), management structure, industrial relations, company finances, book-keeping, language and folklore, all arrived with them from Cornwall (Fisher 1851: 8; Auhl 1986: 83). As the mines went deeper they ordered machinery from Cornwall to pump out water and raise ore. For fifty years the Cornish mines in Cornwall had been the world leaders in steam-powered industrial technology, and steam engines and pumps from Cornish foundries were exported all over the world.

The Burra workforce had grown to over 2,000 people by 1850 and it became the largest inland town in Australia (Auhl 1986: 1). Henry Roach from Redruth in Cornwall was appointed mine captain (Fisher 1851: 7) and surrounded with staff whose surnames identify their Cornish origins: Osbourne, Trevorrow, Andrewartha, Tremewan, Santo, Boswarva, Spargo, Tregear (Payton 2007: 43-4). The Burra Burra soon had an industrial landscape that arriving Cornish immigrants recognised instantly: tall stone engine houses with their enormous slow-moving iron bobs working the pump rods in the shafts and boiler houses

with their tall characteristically Cornish, round stone and brick smokestacks. There are ten Cornish engine houses still standing in Australia out of 33 built during the nineteenth century (Drew & Connell 1993). Three engine houses are still standing within the Burra Mines, and the archaeological remains of more also survive. All the boilers, engines and pumps came from foundries in towns like Hayle, Cranbourne and Redruth, Cornwall (Birt 2001: 11). Immigrants also recognised the landscape of the town alongside the mines. The housing, mostly small attached and row cottage and the simple Methodist chapels were modelled on the buildings of the mining towns of Cornwall (Fisher 1851: 4-6). The entire culture of a Cornish town was present: the social structure, religion, politics, educational practices, cuisine, sport and recreation, festivals, music and burial practices.

The railway arrived in 1870; and it was hoped, in vain, that the reduced transport costs would enable the mine to remain viable despite falling copper prices and rising costs of raising ore (Auhl 1986: 389). The goods platforms originally included an ore platform (Auhl 1986: 403), and the size of the station reflected the town's importance as it made the transition from mining town to rural agricultural service centre (Fuss & Satchell 2011: 88). The stripping of the bush to service the mine had created a cleared landscape ripe for agriculture and the construction of the copper transport network had opened up South Australia's mid-north. Burra was on the main line to Broken Hill and, from 1917 to 1937, the line from Adelaide to Port Wakefield and Perth. From thereon, Burra's production was connected to the rest of the world.

Burra Charter
In 1979, the Australia ICOMOS Charter for the Conservation of Places of Cultural Significance was adopted at a meeting of Australia ICOMOS in Burra (Government of South Australia 2014c). It was given the short title of the 'Burra Charter'. The Charter defines the basic principles and procedures to be followed in the conservation of Australian heritage places. The Charter accepted the philosophy and concepts of the ICOMOS Venice Charter but developed and documented them in a form which would be practical and useful in Australia. The Burra Charter has been called Australia's most significant document on the basic principles and procedures for the conservation of heritage places (Heritage Perth 2011).

The Cornish steam engine
Steam power was transformative. The introduction of the steam engine into Australia marks a significant milestone in the industrialization of Australia. Through its colonial relationship with Britain technology transfers like the importation of the Cornish engine, were significant in enabling Australia to keep pace with the broader industrial transformation of Europe.

The Cornish engine was based on Watt's pumping engine with improvements made by Cornish engineers working in Cornwall. The effects of the Cornish Beam Engine on mining and ore processing technology were revolutionary and this revolution was transferred to Burra in the 1840s and Moonta in 1860s, Cadia Copper Mine in New South Wales in 1870s, and gold mines in Victoria in 1860s. It was during a period of rapid development in steam technology that Australia moved into the industrial era as its early mining ventures became mechanised. Before this transfer of Cornish steam technology, Australia was still largely an agricultural economy. This was the Industrial Revolution moving to Australia. As mining in Cornwall fell into terminal decline, South Australia became the largest producer of copper in the world (Drew 2011:11-12).

Cornish Mining Technology
In the early eighteenth century, Cornwall became the world's biggest producer of copper with the arrival of steam power. As Cornish mining boomed, Cornish engineers influenced the development of steam power. Most notable was Richard Trevithick, a Cornish engineer who pioneered the use of high-pressure steam and made great contributions to the efficiency of steam engines. Because of their high efficiency many of these machines were installed for pumping in Cornish mines and exported worldwide. Cornwall became the major centre for the manufacture of engines and large horizontal boilers for the remainder of the nineteenth century. The period of greatest development was between 1825 and 1850, when a more or less standardised Cornish beam engine came into general use. At the peak of the Cornish mining industry between 1850 and 1860, hundreds of beam engines were working in Cornwall. Several large foundries in Cornwall manufactured these Cornish engines at that time (Drew 2011:19).

In the mid eighteenth century, the Cornish system of working mines was established along with the new techniques which allowed mining to progress underground. The form and arrangement of a mine depends on the nature of the mineral deposit to be excavated. Cornish mines worked tabular or rectangular mineral deposits known as veins or loads. Depending on the dip of the lode, a shaft was sunk vertically to intersect the lode at a given depth or inclined following the lode. These shafts were rectangular and of two types; small winding or whim shafts which were often inclined or larger vertical engine shafts used for pumping (Drew 2011:2).

Opening up the mine by sinking shafts and driving levels was called 'tut work', which prepared the lode for extraction of ore or tribute. Hence two kinds of mining activity were undertaken: development of the mine and ore extraction, which were generally carried out simultaneously. The Cornish system of mining was the first to develop the concept of ore reserve, which they called the 'eyes' and their removal was referred to as 'picking out the eyes of the mine' (Drew 2011:3).

Governance and Management
The Cornish innovation is also evident in their associated traditional methods of mine management and employment systems. Cornish employment systems were known as 'Tribute and Tut work Contracts'. This method of working constituted and advanced the Cornish technical mining achievement. Tut workers were contracted by the fathom and the rate depended on the nature of the rock to be excavated. Tribute on the other hand involved the excavation of ore and removal to the surface and was paid as a proportion of the value of ore mined. Individual Cornish miners organised themselves into self-selected teams called 'pares' which were usually four to eight men and/or boys. The underground workings were surveyed into blocks or pitches. Each pitch and tut work contract or take was numbered and let by public auction on Survey or Setting Day for a period of two months.

Evidence of the application of the Cornish employment systems in South Australian mines is abundant in newspaper reports throughout the second half of the nineteenth century. There are advertisements for the letting of tut work bargains and tribute pitches at the Burra and Moonta mines in the late 1840s and 1860s. Detailed descriptions are provided of Survey Day at the Burra and Moonta mines which are strikingly similar to accounts from Cornwall (Drew 2011: 8).

Ore Dressing
The ore dressing process was first developed by Cornish miners in the eighteenth Century which initially involved breaking by hand (spalling) followed by hand picking. This was undertaken at the surface on extensive dressing floors which were a characteristics feature of Cornish mines throughout the nineteenth century. In the early 1800s, mechanical improvements to rock breaking and concentration were introduced in Cornwall and soon this innovation became the standard technology at mines throughout the world during the next 100 years. Cornish beam engine technology was quickly adopted to power this new technology. Cornish crushing rolls replaced hand picking and consisted of two cast iron rolls about 60cm in diameter running against each other. Ore was fed between the rolls, crushed and passed through a sieve below but any undersized ore was lifted by a raft wheel and tipped back for re-crushing. Two storey Cornish crush houses were distinctive features of nineteenth century copper mining landscape along with beam engine houses. More than 20 were erected at mines throughout South Australia including five at Moonta and Burra (Drew 2011:8).

Condition and Integrity

Burra is a town recognised for its mining heritage. The town and mine features vary in their condition. The town buildings are mostly in good condition and the remnant mining structures are mainly in situ in the Burra Mines Historic Site. Many of these mining structures are remnant features in now a relict mining landscape.

All of the mining and town features noted are listed on the South Australian Heritage Register and are afforded heritage protection under South Australian law. All of the remnant surface mining features remain outdoors with variable maintenance.

Location

Approximately 640ha at Burra comprising the Burra State Heritage Area (Heritage Number 27549 and State Heritage ID 16183) designated as a state heritage area in 1993.

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Appendix 2 Burra State Heritage Area Citation

SA Heritage Places Database Search

Heritage Places

Heritage Place Details

LOCATION

Map	Show Map
Address	BURRA
Locality	
Accuracy	H - high level confidence
Development Plan	Goyder Council
Polygon Type	D - item has been digitised (generally because it doesn't exist in a DCDB parcel, eg. bridge

DESCRIPTION

Details (Known As)	Burra State Heritage Area [see also National Heritage Place ID: 106304]
Registered Name	
Significance	The Burra State Heritage Area is of significance to the economic and social history of South Australia, and is a testament to the success of copper mining in the area. In the late 1840s, the Burra Mine made South Australia the most prosperous colony in Australia. At one stage the mine was the second largest producer of copper in the world. Comprising the mining area and a complex of what were originally separate townships which are now merged into one, the area provides evidence of early mining, industrial and urban functions with Welsh and Cornish influences.
Subject Index	Urban area - State Heritage Area [Urban]; Mining and mineral processing - Mine
Class	State Her Area

STATUS

Status Code	SHA - State Heritage Area (SA Heritage Act 1978)
Status Date	28-JAN-1993

REFERENCE

LGA	
State Heritage ID	16183
Heritage Number	27549

SECTION 16 INFORMATION

Section 16

PLAN PARCEL & TITLE

As listed in the SA Heritage Register

Plan Parcel & Title Information

Disclaimer

GIS FILES

To access downloadable GIS files, go to **Data.SA**.

Burra State Heritage Area

Burra was declared a State Heritage Area on 28 January 1993.

HISTORY

Copper ore was discovered near Burra Burra creek in June 1845 and, before the end of the year, the South Australian Mining Association had established its 'Monster Mine' in the region. During its first six years nearly 80,000 tonnes of rich ore were shipped to England to be smelted, boosting South Australia's flagging economy and making the colony the most prosperous in Australia.

The mine employed more than 1 000 men and boys, most of them Cornish. From 1849 smelting was done on-site by the Patent Copper Company, who brought the smelters from Wales. The ore was initially carted to Port Wakefield by bullocks, and later by teams of mules. By 1860 Burra was recognised as the second largest producer of copper in the world.

Production declined after 1860 and eventually, in 1867, underground mining ceased. From 1870, until the mine's closure in 1877, it was worked by an open-cut system, but this proved unprofitable. Between 1845 and 1877 the Burra 'Monster Mine' had produced about 50,000 tonnes of copper metal, valued at approximately £5,000,000.

The town of Burra began in 1846 as the company settlement of Kooringa. As the population and the demand for freehold land increased, other villages were surveyed further north. These settlements - Redruth, Llwchwr, Aberdeen and Hampton - reflected the cultures of the various immigrants who flocked to the Burra Mine. In 1876 the individual townships were formed into the Corporation of the Town of Burra, but retained their identity until 1940, when the name Burra was adopted.

From the 1870s, when copper production ceased and the town's population declined, Burra developed as a service town for the district's rapidly expanding agricultural and pastoral industries. New public buildings appeared, but much of Burra's mining era was retained. Today Burra attracts attention as a cultural tourist destination, displaying a unique mix of mining heritage and well-preserved 19th century architecture.

CHARACTER

Burra today is a vibrant community offering one of Australia's finest historic precincts. The town retains many mid-nineteenth century buildings and structures from the years when the Burra mine was one of the world's great copper producers. It also displays many later Victorian buildings reflecting the town's secondary role as a regional centre for agriculture, pastoralism and local government.

Experienced miners, smelters, labourers, tradesmen and businessmen flocked to Burra from Cornwall, Wales, England, Scotland, Ireland and Germany. There were also Chinese market gardeners and Chilean muleteers. Many brought their families and attempted to preserve a familiar lifestyle. The cultural diversity of Burra's early days is evident in the street names and the distinctive architectural styles that developed in the original villages.

Burra's built environment is clearly derived from the two historical phases of its development. The mining phase from 1845-1877 gave rise to the mining and industrial architecture at the Burra and Bon Accord mine sites, and provided the impetus for both company and private housing, much of which was timber and has not survived. Many of the stone cottages that remain (such as Paxton Square and Tiver's Row) are based on company housing in Cornish towns, and are some of the oldest buildings remaining in Burra. The architecture of this era mostly followed the 'Old World' models, with designs coming unaltered from Europe. For example, many of the early structures do not have verandahs.

The later agricultural and pastoral phase brought a new prosperity, which stimulated the use of Australian colonial architecture. This style is particularly evident in the buildings of the commercial core of Kooringa, at Commercial Street and Market Square, in public buildings such as the Town Hall and the school, and in the gracious hillside houses with spreading verandahs.

One important element in Burra's architecture is the distinctive use of rich, local bluestone that gives a unifying effect to many buildings, regardless of their form or age.

Burra's built heritage remains largely intact, thanks to a caring community and the efforts of the National Trust. This historic town is now one of South Australia's best-conserved reminders of industry and every day life in the nineteenth century. While the town's economy is now linked to the surrounding agricultural and pastoral communities, its copper heritage is evident everywhere. The town's character has become a key in the success of a developing local industry - tourism. Today many people in Burra volunteer to interpret heritage sites for visitors or provide services and facilities specifically targeting the cultural heritage tourism market.

FEATURES

The town of Burra consists of two precincts, linked by the Burra Creek, the main road (Market Street) and the topography of the valley: the old Kooringa township and Burra north.

The old Kooringa township to the south includes early company housing, Market Square, a section of the Burra Creek dugouts, and both residential and commercial buildings of the post-mining era.

Burra North encompasses the former government and private settlements of Redruth and Aberdeen. It includes terrace houses and cottages built by miners and smelts workers, along with the original courthouse, police station, gaol and later Victorian dwellings. The railway station is located in this section, and the ruins of the Hampton township are located on the state heritage area's north-eastern boundary.

The two precincts are separated by the Burra mines site to the west and the Burra smelts site across the creek to the east, ensuring that development has not linked the townships over the years.

THE BURRA JINKER

Discussion of Burra's attractions is not complete without mention of the Burra Jinker, displayed near Market Square. This massive 'cart' was purpose-built to transport the mine's huge beam-engines (imported from Cornwall) from Port Adelaide to Burra.

The epic journey, using 36 oxen, took two months and is a part of South Australian folklore. The Burra Jinker was one of eight South Australian items listed on the 2001 BankSA Heritage Icons List and was entered in the South Australian Heritage Register on 16 March 2016.

Further Information

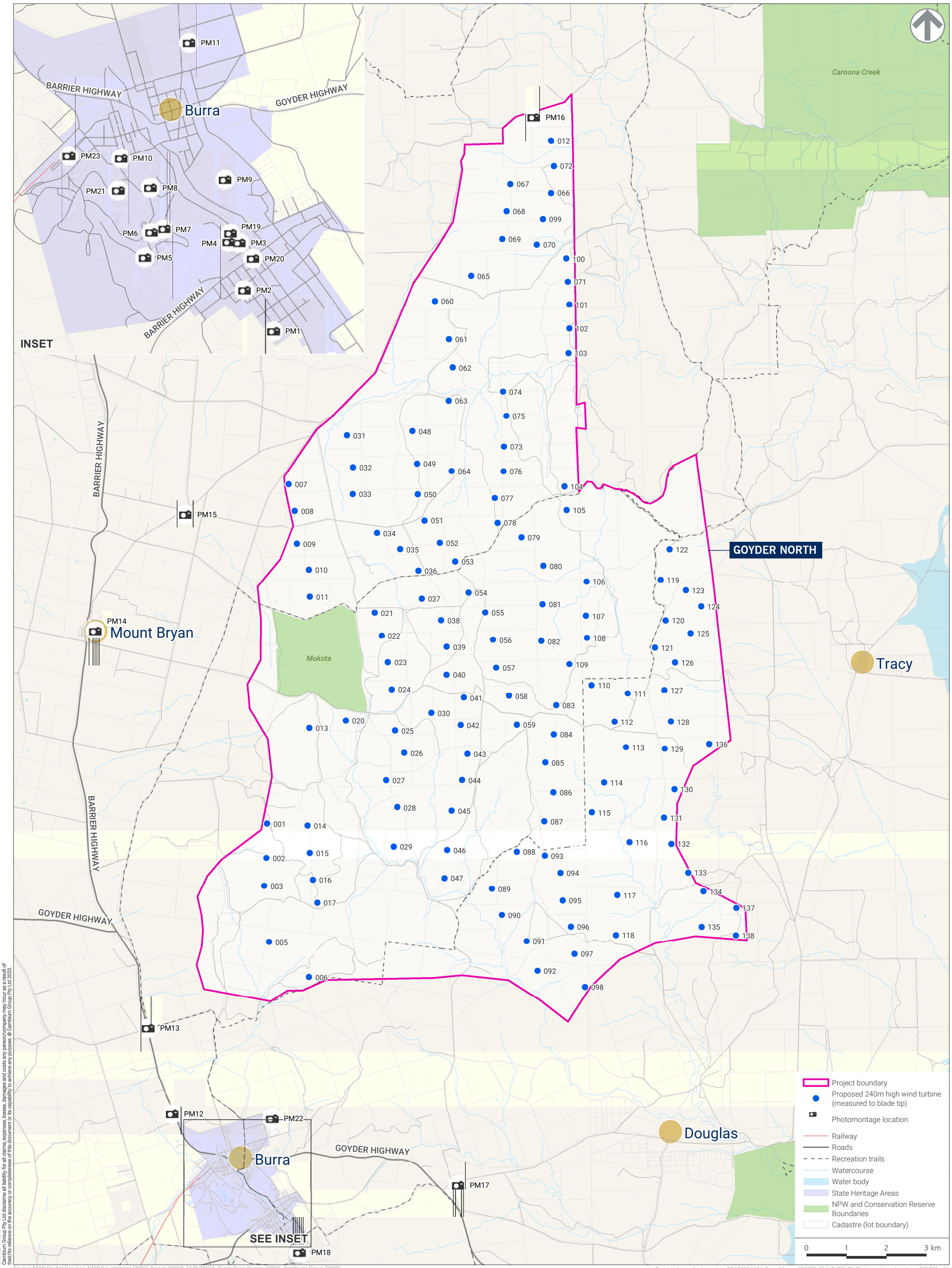
For further information please contact the State Heritage Unit

Department for Environment, Water and Natural Resources
Telephone (08) 8124 4960

Email DEWNRHeritage@sa.gov.au

Appendix 3 Photomontage of the landscape and visual impact assessment (Green Bean Design Pty Ltd 2023)

Figure 1
Photomontage locations



Source: NSW Spatial Services, NSW Government (2023), Neoen (2023), GHD (2023), Green Bean Design (2023), Cambium Group (2023).

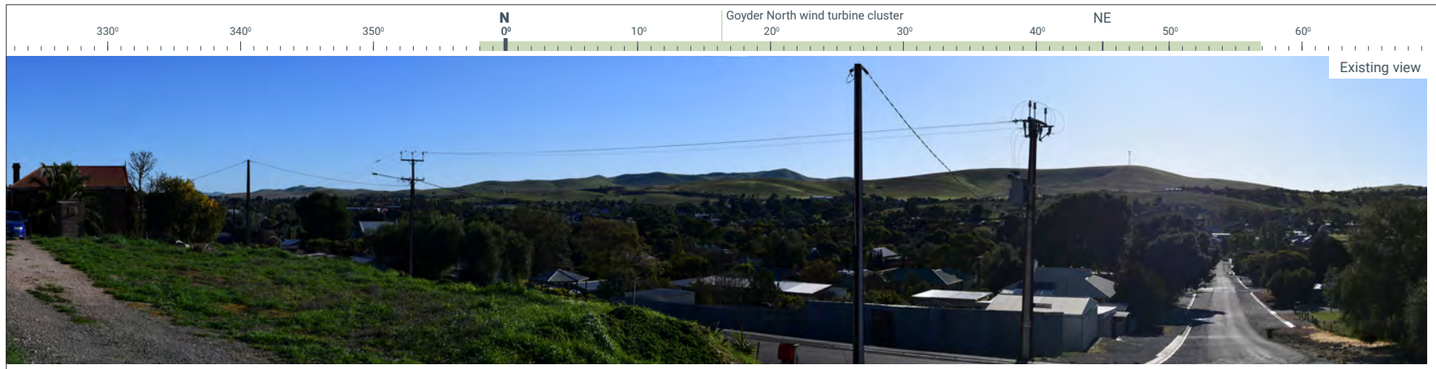
Projected coordinate system GDA2020 MGA Zone 54

Figure 2

PM1 | Kangaroo Street, Burra

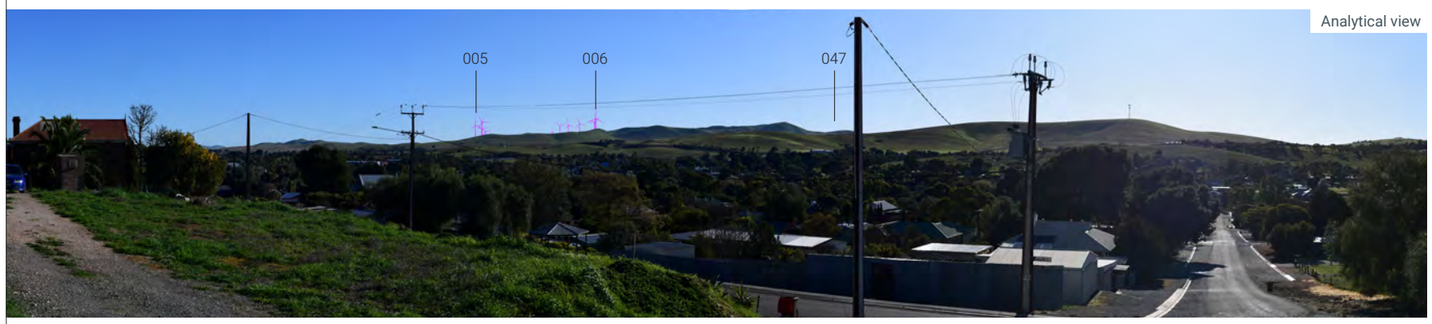
GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

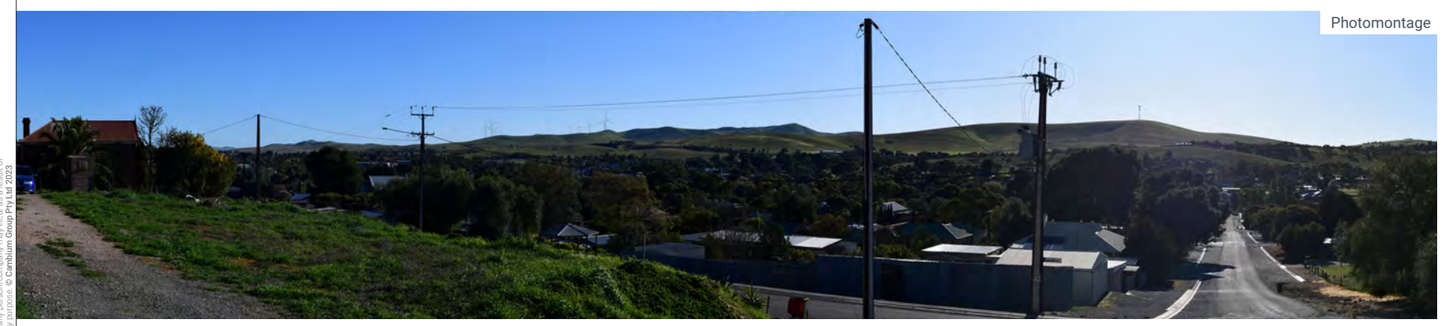


Existing view

Analytical view



Photomontage



Date	15/08/2023
Time	10:37
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	309115m E, 6270537m S
Camera level	487.8 mAHD
Camera bearing	27°
Vertical field of view	27°
Project horizontal field of view	59°
Distance to nearest turbine	6.57 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 3

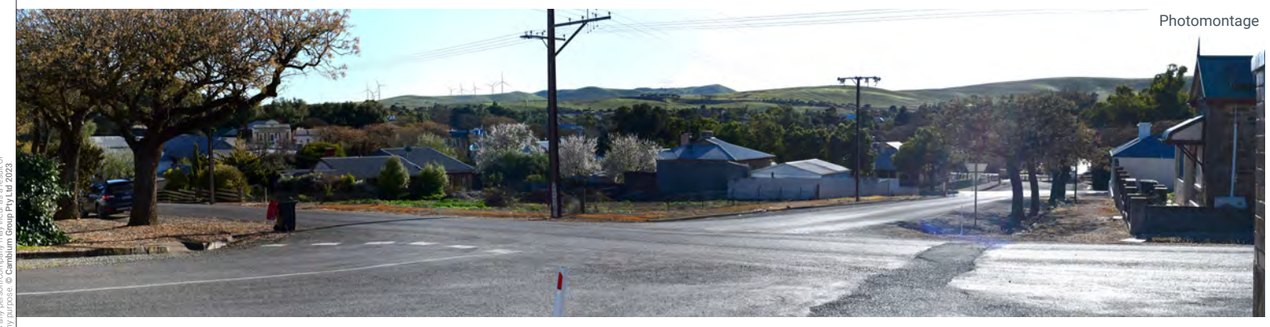
PM2 | Kangaroo and Church Street

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

Existing view

Analytical view



Photomontage

Date	15/08/2023
Time	10:21
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308850m E, 6270908m S
Camera level	478.1 mAHD
Camera bearing	29°
Vertical field of view	27°
Project horizontal field of view	59°
Distance to nearest turbine	6.22 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

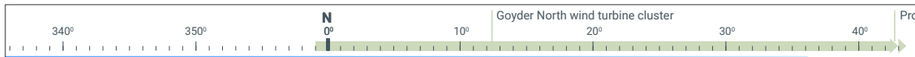
CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

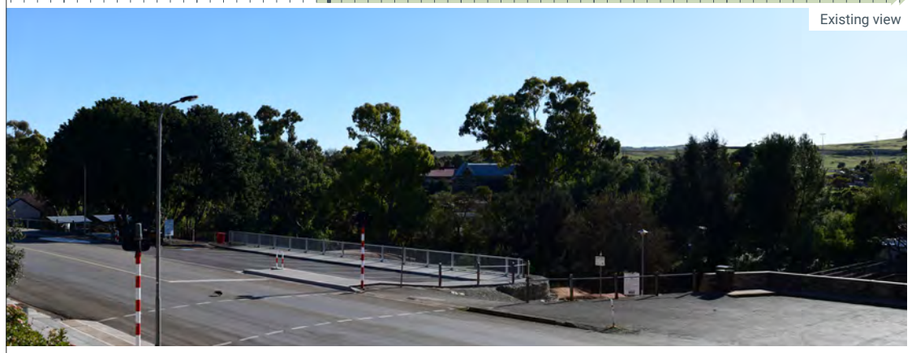
Figure 4
PM3 | Town Hall steps, Burra

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**



Existing view



Analytical view

Photomontage

Date	15/08/2023
Time	10:33
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308804m E, 6271337m S
Camera level	472.17 mAHD
Camera bearing	30°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	5.83 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 5
PM4 | Mount Pleasant Street, Burra

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

Existing view

Analytical view

Photomontage

Date	15/08/2023
Time	10:40
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308709m E, 6271345m S
Camera level	483.88 mAHD
Camera bearing	30°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	5.84 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

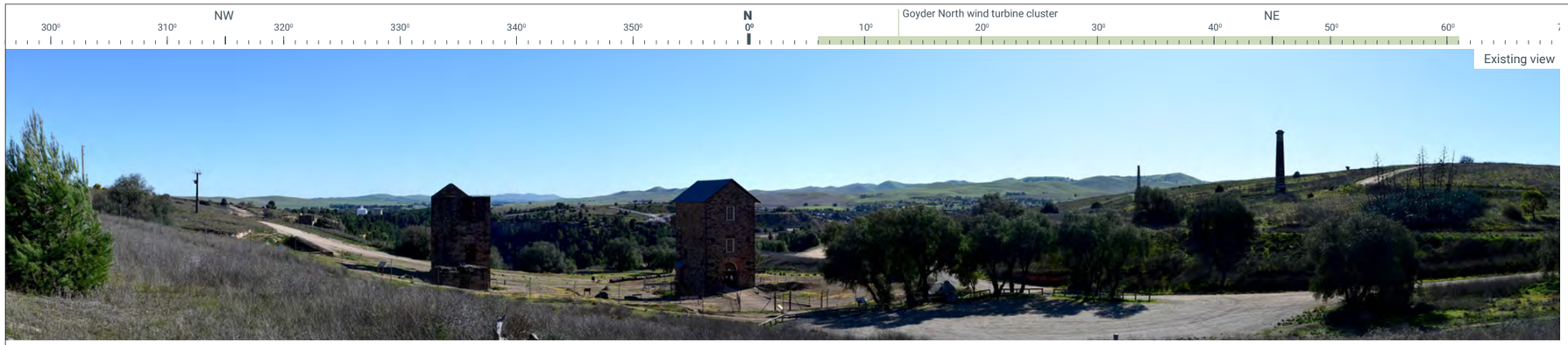
CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 6

PM5 | Burra Mine (toward Morphett's Enginehouse and Windinghouse)

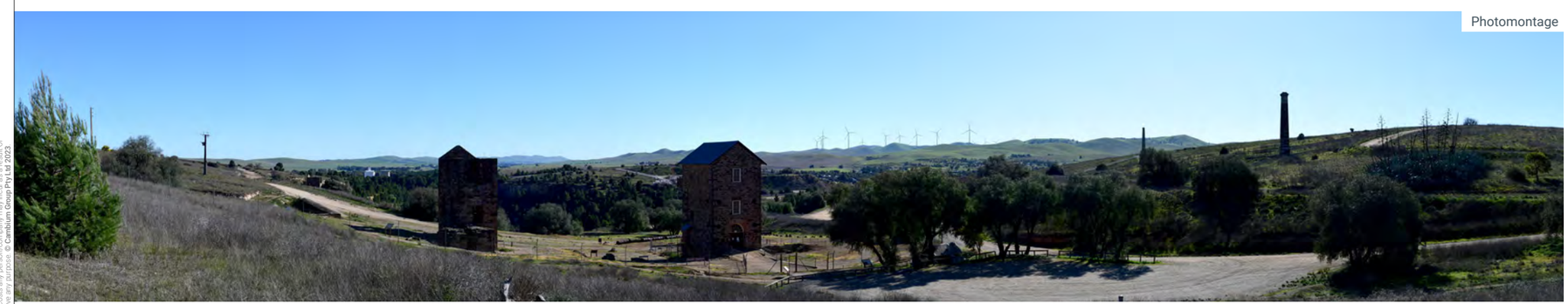
GBD Landscape architecture



Existing view

Analytical view

Photomontage



Date	15/08/2023
Time	11:19
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307945m E, 6271203m S
Camera level	518.41 mAHD
Camera bearing	34º
Vertical field of view	27º
Project horizontal field of view	56º
Distance to nearest turbine	6.17 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 7
PM6 | Dressing Tower

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

Date	15/08/2023
Time	11:39
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308003m E, 6271432m S
Camera level	507.33 mAHD
Camera bearing	33°
Vertical field of view	27°
Project horizontal field of view	58°
Distance to nearest turbine	5.94 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

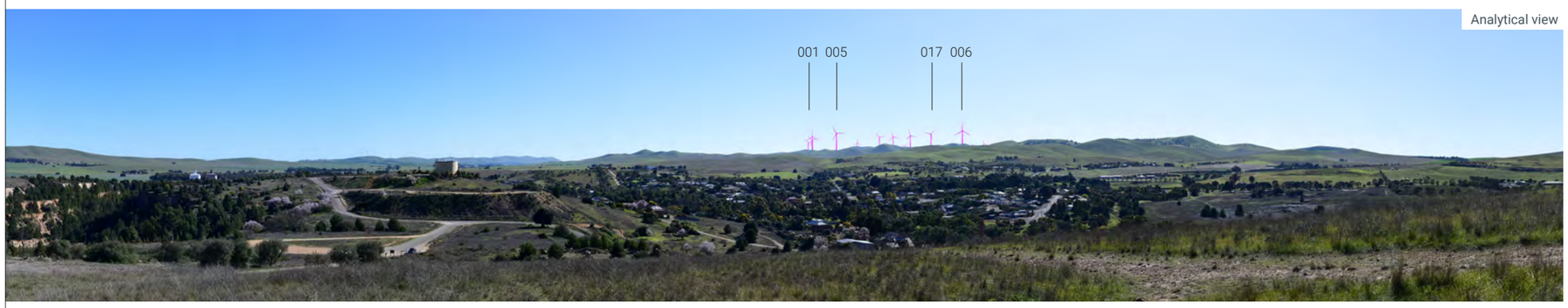
Figure 8

PM7 | Haulage Enginehouse Chimney

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

Existing view



Analytical view

Photomontage

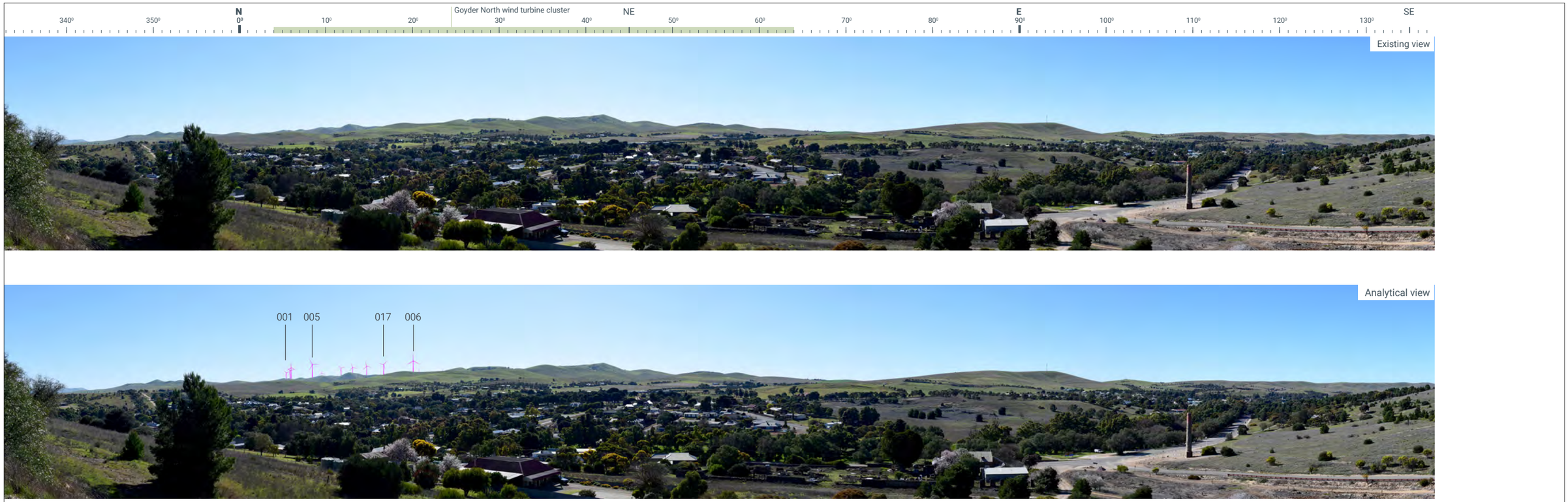
Date	15/08/2023
Time	11:31
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308121m E, 6271464m S
Camera level	522.57 mAHD
Camera bearing	33º
Vertical field of view	27º
Project horizontal field of view	58º
Distance to nearest turbine	5.87 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 9
PM8 | Town Lookout

GBD Landscape architecture



Date	15/08/2023
Time	11:48
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307996m E, 6271840m S
Camera level	503.9 mAHD
Camera bearing	34°
Vertical field of view	27°
Project horizontal field of view	59°
Distance to nearest turbine	5.56 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

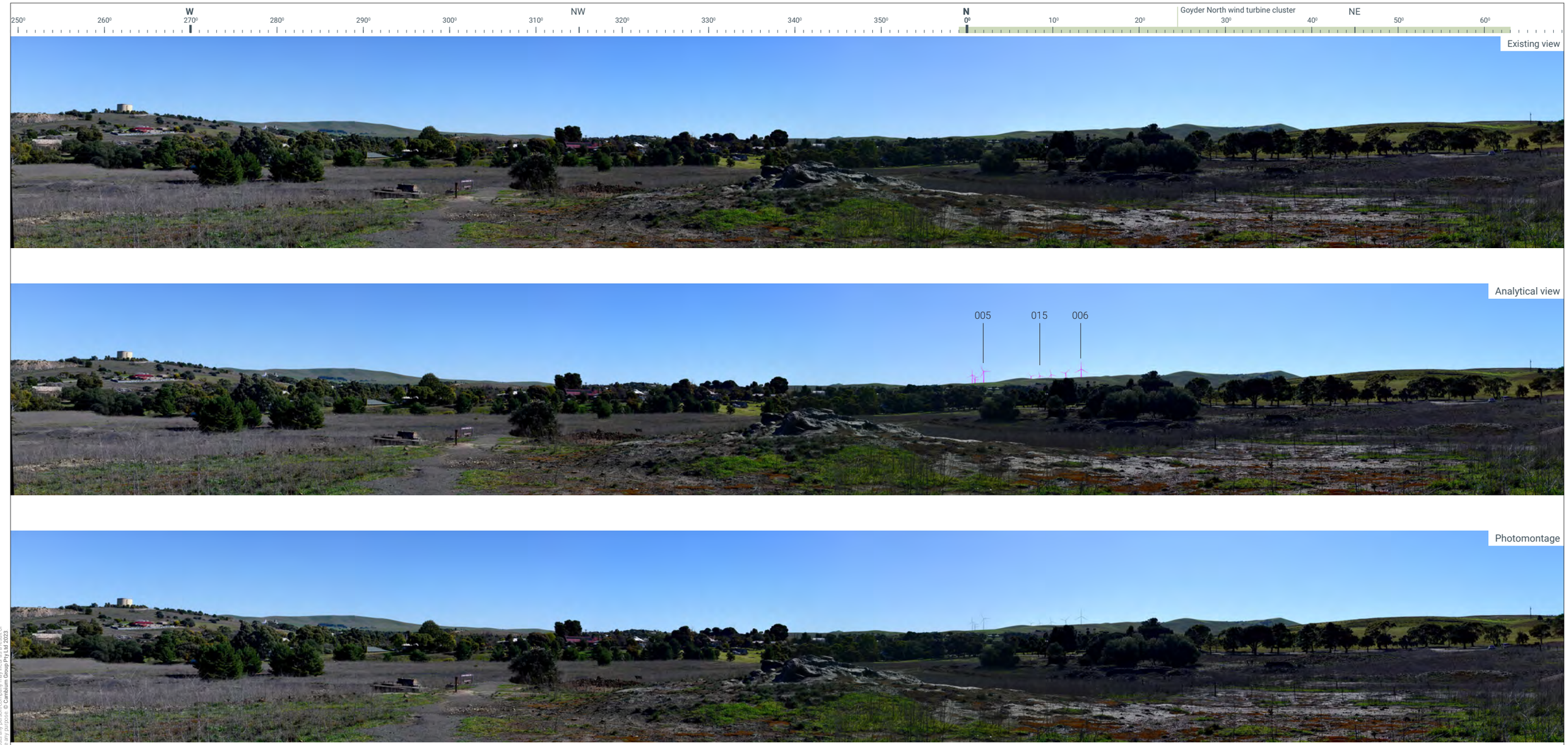
Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 10

PM9 | Smelting Works Site

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**



Date	15/08/2023
Time	12:20
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308675m E, 6271914m S
Camera level	487.23 mAHD
Camera bearing	32°
Vertical field of view	27°
Project horizontal field of view	62°
Distance to nearest turbine	5.29 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 11

PM10 | Butterworth Street, Burra

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

Date	15/08/2023
Time	16:16
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307728m E, 6272109m S
Camera level	496.48 mAHD
Camera bearing	35°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	5.41 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 12
PM11 | Redruth Gaol

GBD Landscape architecture

Date	15/08/2023
Time	12:34
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308346m E, 6273158m S
Camera level	495.5 mAHD
Camera bearing	36°
Vertical field of view	27°
Project horizontal field of view	64°
Distance to nearest turbine	4.21 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

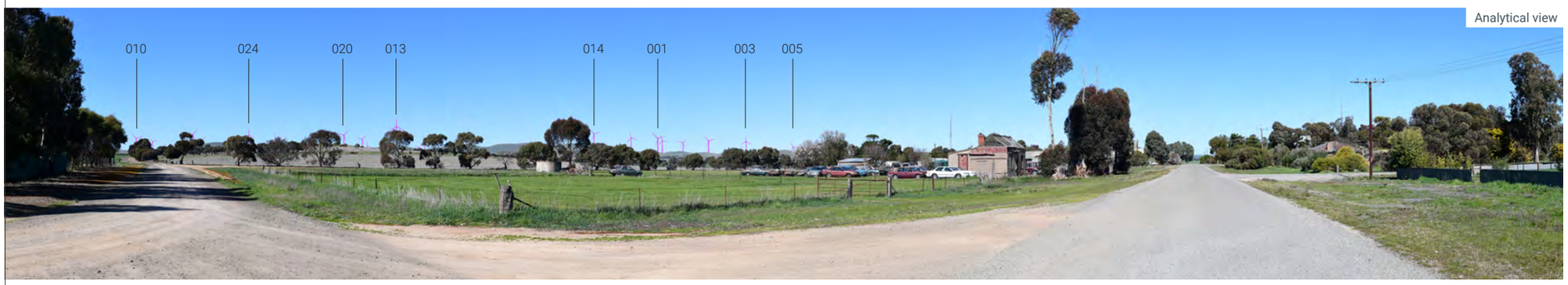
Figure 15

PM14 | East Terrace, Mount Bryan

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

Existing view



Analytical view

Photomontage

Date	15/08/2023
Time	13:33
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	304534m E, 6285818m S
Camera level	523.92 mAHD
Camera bearing	97°
Vertical field of view	27°
Project horizontal field of view	108°
Distance to nearest turbine	5.44 km (011)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 19

PM18 | Burra Cemetery

GBD Landscape architecture

Existing view

Analytical view

Date	15/08/2023
Time	10:05
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	309646m E, 6270259m S
Camera level	465.8 mAHD
Camera bearing	24°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	6.79 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 20

PM19 | Josephs Church

GBD Landscape architecture

Existing view

Analytical view

Date	15/08/2023
Time	10:37
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308724m E, 6271424m S
Camera level	477.8 mAHD
Camera bearing	31º
Vertical field of view	27º
Project horizontal field of view	61º
Distance to nearest turbine	5.74 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

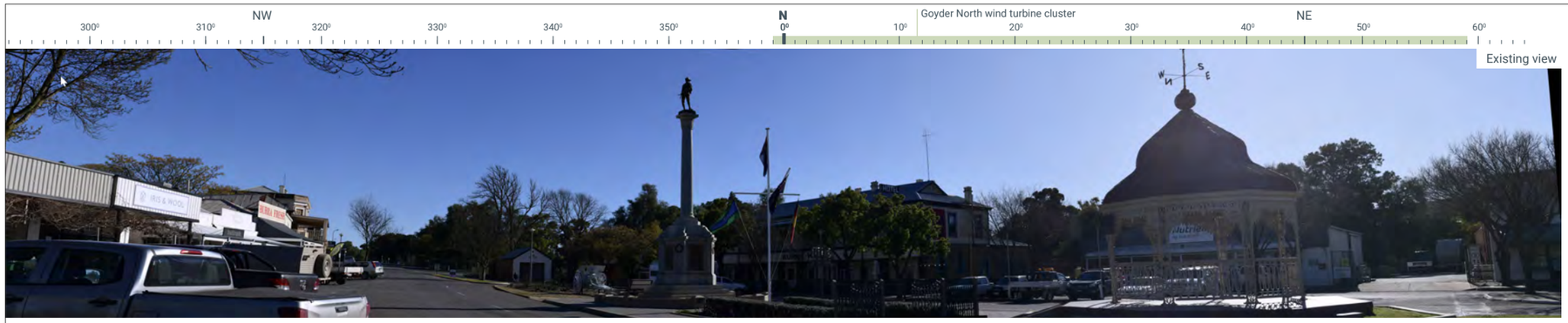
CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 21

PM20 | Burra Square

GBD Landscape architecture



Existing view

Analytical view

Date	15/08/2023
Time	10:48
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308927m E, 6271195m S
Camera level	469.6 mAHD
Camera bearing	30°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	5.9 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 22

PM21 | Burra Mine Lookout

GBD Landscape architecture

GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**

Existing view

Analytical view

Date	15/08/2023
Time	11:59
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307957m E, 6271799m S
Camera level	498.9 mAHD
Camera bearing	36°
Vertical field of view	27°
Project horizontal field of view	57°
Distance to nearest turbine	5.66 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

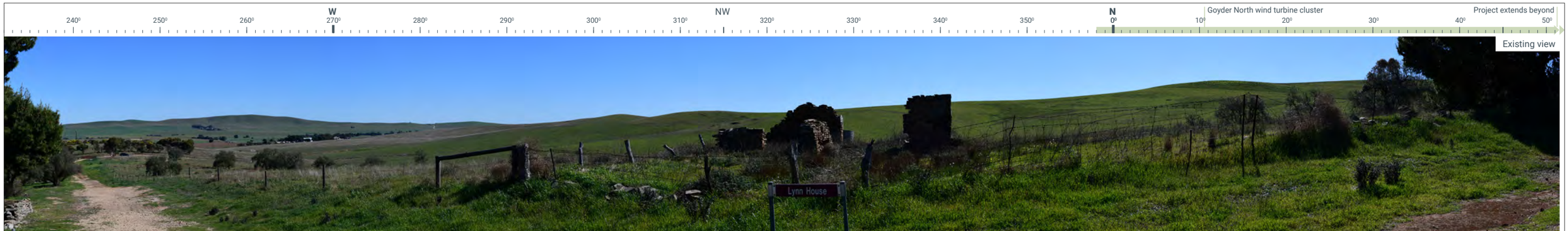
CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 23

PM22 | Hamptons Village

GBD Landscape architecture



Date	15/08/2023
Time	12:49
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308956m E, 6273615m S
Camera level	538 mAHD
Camera bearing	34°
Vertical field of view	27°
Project horizontal field of view	71°
Distance to nearest turbine	3.55 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

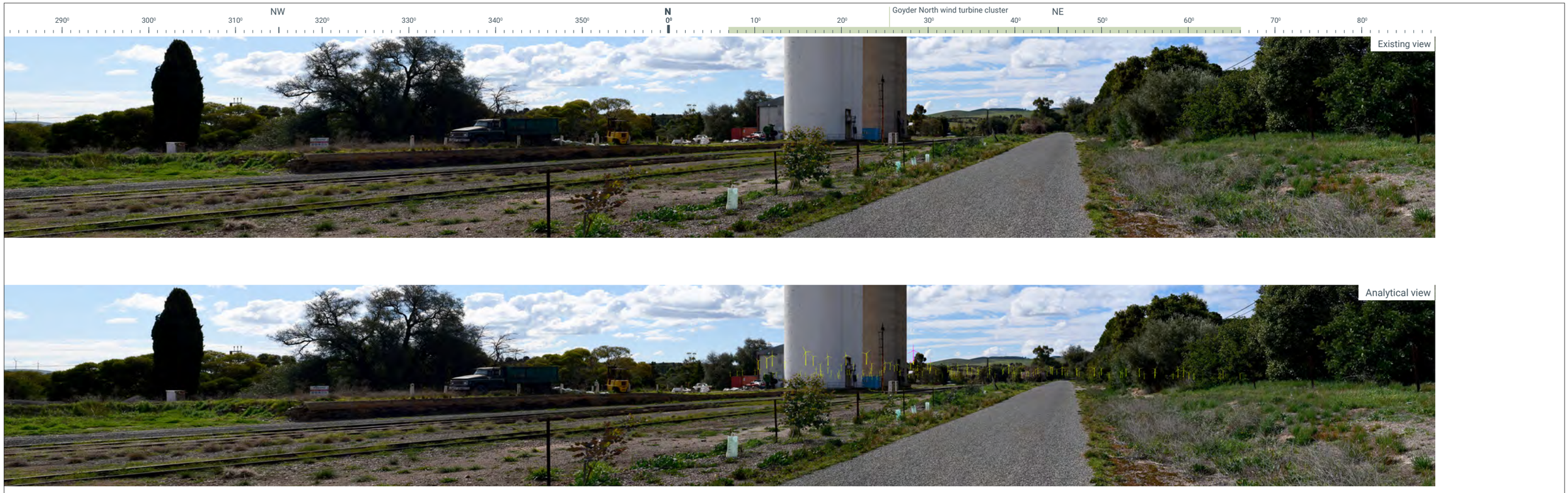
Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 24

PM23 | Railway Terrace, Burra

GBD Landscape architecture

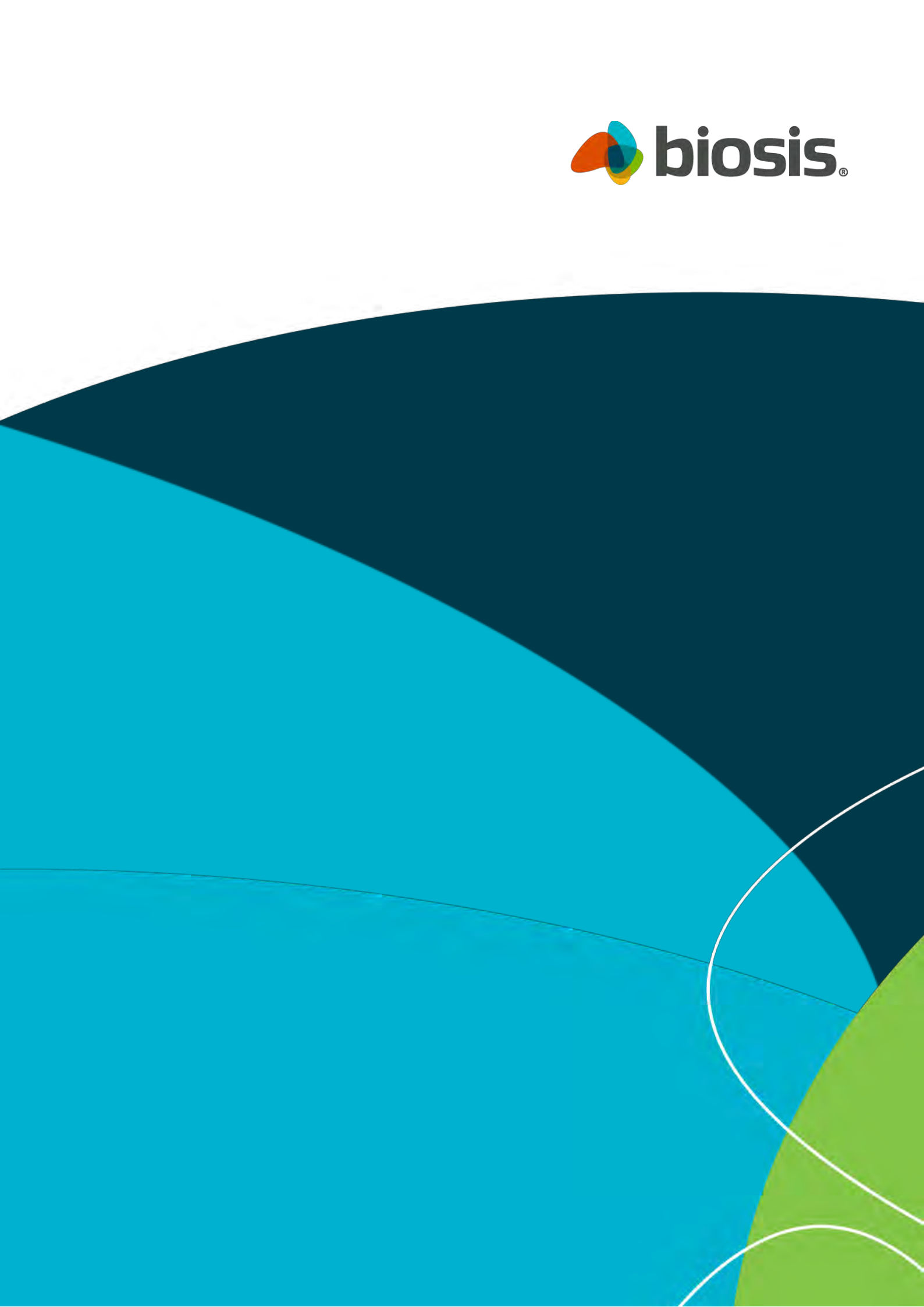
GOYDER NORTH | **LANDSCAPE AND VISUAL IMPACT ASSESSMENT**



Date	16/08/2023
Time	14:53
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307254m E, 6272130m S
Camera level	480.2 mAHD
Camera bearing	36°
Vertical field of view	27°
Project horizontal field of view	59°
Distance to nearest turbine	5.57 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).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