# Section 4

# Assessment and Management of Key Environmental Issues

## PREAMBLE

*This section describes the environmental setting within which the Project Site is located and the specific environmental features of the proposed Quarry and its surrounds that may be affected as the result of the Proposal.*

*Emphasis is placed in this section on providing information about the environmental features that would contribute to or influence the assessment of a wide range of other environmental parameters. Information is provided on the local and Site topography, meteorology, land ownership and land use.*

*This is followed by an assessment of any predicted impacts the proposed activities may have after implementation of these measures. Where appropriate, proposed monitoring programs are also described.*

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# 4.1 Environmental Setting

## 4.1.1 Introduction

The descriptions of various environmental aspects of the Site are reliant upon a range of background information common to many of the key environmental issues. In this subsection, the local setting is described and background information is provided on topography, climate, land ownership, residential and other receivers of the surrounding area. The local setting relevant to specific environmental features is described throughout the remainder of Section 4.

## 4.1.2 Topography

### 4.1.2.1 Regional Topography and Drainage

The topography of the region is dominated by steep to moderate rises interspersed with relatively undulating to flat areas (**Figure 4.1**).

Lake George dominates the regional topography and covers an area of approximately 10km east-west and 25km north-south. The Lake is internally draining and is flanked by hills and ridges to the east, south and west. The floor of Lake George is relatively flat with a low point of 673m AHD. The Lake George basin has been the subject of several investigations which have identified correlations between historic climate change and lake levels. Lake George is believed to have reached its highest level of approximately 727m AHD or approximately 54m deep approximately 25 000 years ago.

The escarpment associated with the Lake George Range to the west of the Lake has a maximum elevation of approximately 888m AHD and is a dominant feature of the landscape.

The Great Diving Range is located to the east of Lake George, with the Butmaroo Range (1 137m AHD) to the south, Hammonds Hill (922m AHD) and Governors Hill (902m AHD) on the south-eastern shore of Lake George and Mount Baby (958mAHD) located on the northern shore of Lake George.

The Lake George Catchment encompasses an area of approximately 950km$^2$, with surface water primarily entering Lake George via tributaries from the north, east and south. Lake George is internally draining, with water loss primarily occurring through both infiltration and evaporation.

### 4.1.2.2 Local Topography and Drainage

Topography surrounding the Project Site is dominated by flat to gently undulating land close to Lake George and moderately to steeply sloped land to the east of the Project Site (**Figure 4.2**).

Land immediately surrounding the Project Site is typically flat, with a elevations varying between 680m AHD and 690m AHD and slopes typically less than 1%. Land to the north, east and south of Project Site is typically undulating, with drainage flowing west, towards Lake George. The surrounding landforms are dominated by Governors Hill, Hammonds Hill and Gibraltar Hill, with elevations of 900m AHD, 930m AHD and 890m AHD respectively.

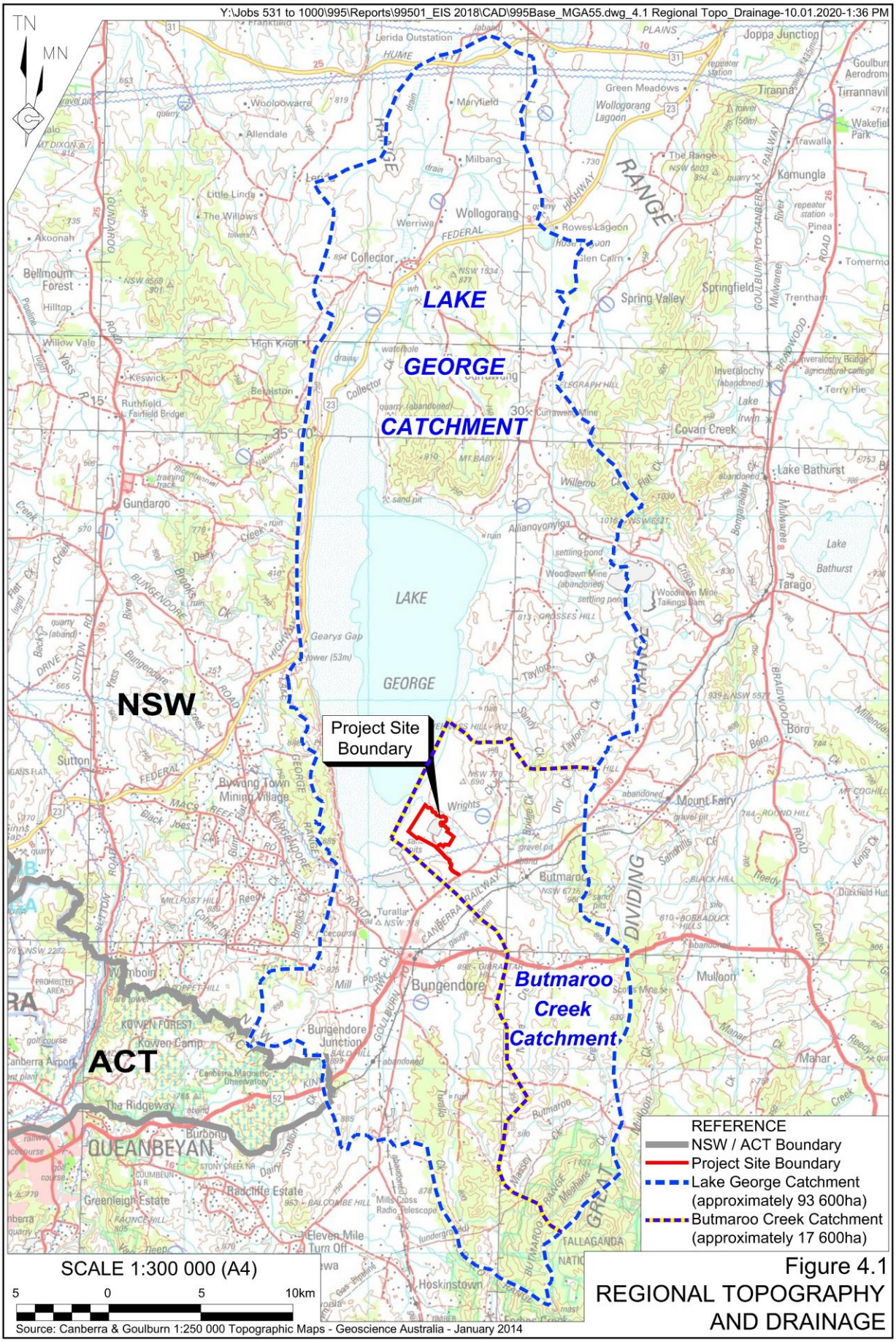



Figure 4.1
REGIONAL TOPOGRAPHY AND DRAINAGE

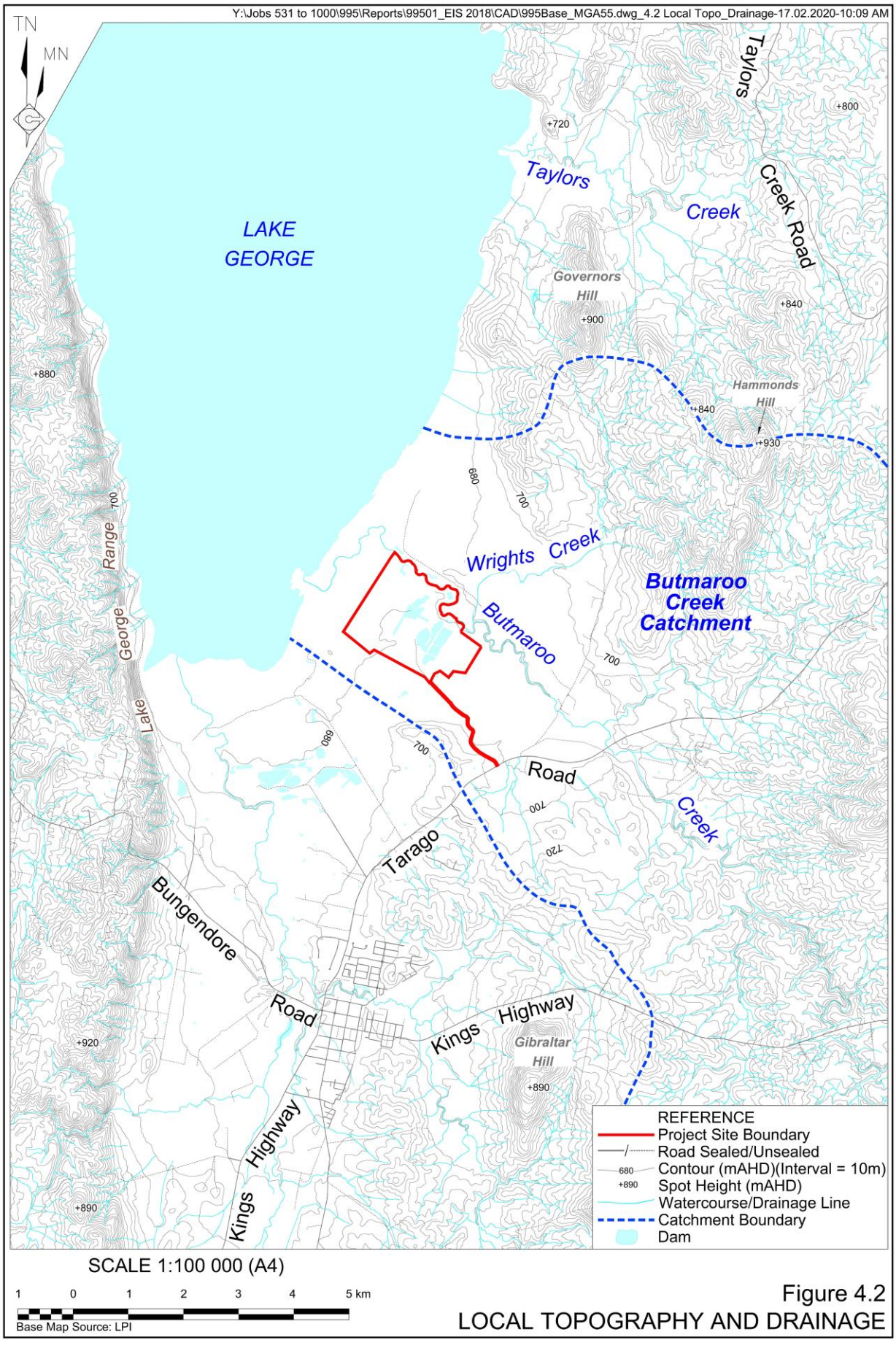



Figure 4.2
LOCAL TOPOGRAPHY AND DRAINAGE

Surface water flows surrounding the Project Site are typically associated with west-flowing watercourses, including Butmaroo Creek and Wrights Creek. These creeks flow towards and discharge into Lake George.

#### 4.1.2.3 Project Site Topography and Drainage

The natural surface of main area of the Project Site is generally flat, with elevations varying between 679m AHD and 682m AHD (**Figure 4.3**). Subtle (approximately 1m to 1.5m high) northeast orientated rises interpreted to be strandlines or former sand dunes associated with the shore of Lake George when it had a higher water level than present occur adjacent to the western boundary of the Project Site. Natural slopes are typically substantially less than 1%.

Sand extraction operations undertaken since 1975 have substantially modified the natural topography of the Project Site. Extraction Areas up to 12m deep have been excavated and some partially backfilled with a combination of overburden and fines. A number of former Extraction Areas have been allowed to fill with water and now form wetlands and ponds. Active sections of the Project Site are bunded and surface water is not permitted to flow from these areas to natural drainage.

The Quarry Access Road rises from an elevation of approximately 682m AHD to approximately 702m AHD over a distance of approximately 2.1km at an average gradient of approximately 1%

Butmaroo Creek, an ephemeral fourth order creek that drains into Lake George, forms the northeastern boundary of the Project Site.

### 4.1.3 Climate

#### 4.1.3.1 Introduction and Data Sources

This subsection provides a brief overview of the meteorological conditions relevant to the Project Site, focusing particularly on those aspects of the climate with the potential to influence Proposal-related environmental impacts.

The data presented in this section has been sourced from the following Bureau of Meteorology (BoM) weather stations:

- Canberra Airport (Station Number 070351) which has been operational between 2008 and 2019 (ongoing) located approximately 28km southwest of the Site.
- Canberra Airport Comparison (Station Number 070014) was operational between 1939 and 2010 located approximately 28km southwest of the Site.

Climate data derived from the above sources is presented in **Table 4.1**.

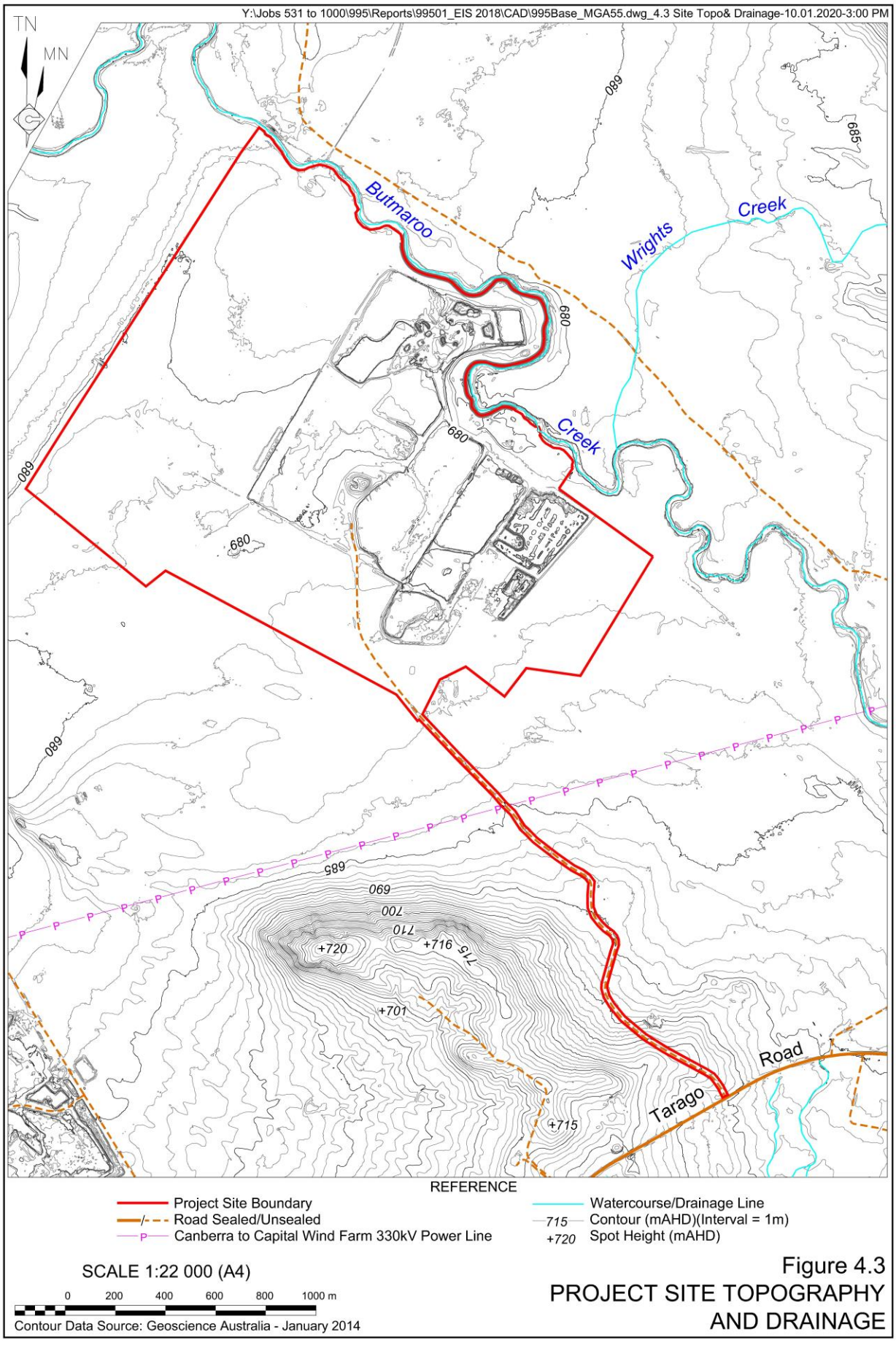



Figure 4.3
PROJECT SITE TOPOGRAPHY AND DRAINAGE

**Table 4.1**
**Climate Statistics**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature (ºC) Canberra Airport (2008-2019)** | | | | | | | | | | | | | |
| Mean maximum | 30.7 | 28.3 | 25.4 | 21.2 | 16.7 | 13.4 | 12.8 | 14.2 | 18.1 | 21.7 | 25.3 | 27.5 | 21.3 |
| Mean minimum | 14.3 | 13.4 | 11.2 | 7.0 | 2.3 | 1.1 | -0.1 | 0.8 | 3.0 | 6.0 | 9.8 | 12.2 | 6.8 |
| **Relative Humidity (%) Canberra Airport (1939-2010)** | | | | | | | | | | | | | |
| Mean 9am | 63 | 68 | 71 | 75 | 82 | 85 | 85 | 78 | 71 | 65 | 63 | 60 | 72 |
| Mean 3pm | 37 | 40 | 42 | 46 | 54 | 60 | 58 | 52 | 49 | 47 | 41 | 37 | 47 |
| **Rainfall (mm) Canberra Airport (2008-2019)** | | | | | | | | | | | | | |
| Mean | 49.1 | 64.8 | 60.0 | 32.4 | 26.3 | 45.6 | 31.9 | 41.0 | 48.2 | 42.1 | 63.8 | 77.8 | 583.2 |
| Lowest | 4.8 | 7.2 | 7.2 | 6.8 | 2.6 | 2.4 | 5.0 | 17.8 | 13.2 | 13.4 | 12.6 | 1.2 | 358.6 |
| Highest | 106.4 | 133.2 | 197.2 | 91.8 | 79.2 | 144.2 | 71.0 | 66.8 | 149.2 | 102.8 | 119.4 | 198.4 | 959.6 |
| Days of Rain (>1mm) | 5.7 | 5.5 | 6.0 | 4.5 | 3.2 | 5.7 | 5.2 | 6.5 | 4.9 | 5.9 | 6.6 | 6.6 | 66.3 |
| **Wind Speed (km/h) Canberra Airport (1939-2010)** | | | | | | | | | | | | | |
| Mean 9am wind speed | 7.5 | 6.4 | 6.1 | 6.5 | 6.9 | 7.8 | 8.5 | 9.9 | 10.4 | 10.9 | 9.8 | 9.1 | 8.3 |
| Mean 3pm wind speed | 16.9 | 15.2 | 14.6 | 14.4 | 14.4 | 15.4 | 17.1 | 19.8 | 20.7 | 20.7 | 19.6 | 19.0 | 17.3 |
| **Evaporation (mm) Canberra Airport (1966-2010)** | | | | | | | | | | | | | |
| Mean Daily | 8.4 | 7.4 | 5.7 | 3.7 | 2.2 | 1.6 | 1.7 | 2.6 | 3.8 | 5.2 | 6.6 | 8.0 | 4.7 |
| Mean Monthly | 260.4 | 207.2 | 176.7 | 111.0 | 68.2 | 48.0 | 52.7 | 80.6 | 114.0 | 161.2 | 198.0 | 248.0 | 143.0 |
| Source: Bureau of Meteorology – Climate Data Online | | | | | | | | | | | | | |

### 4.1.3.2 Temperature and Humidity

January is typically the warmest month of the year with a mean daily maximum temperature of 30.7°C and mean daily minimum temperature of 14.3°C. The coolest month of the year is typically July with the lowest mean daily maximum temperature of 12.8°C and coldest mean minimum temperature of -0.1°C.

Relative humidity is generally higher in the cooler months of the year with the highest mean 9:00am relatively humidity of 85% being recorded in June and July and the highest mean 3:00pm relative humidity of 60% being recorded in June. Conversely, the least humid month is December with a 9:00am and 3:00pm relative humidity of 60% and 37% respectively.

### 4.1.3.3 Rainfall

On average, the annual rainfall is 583.2mm, with mean rainfall ranging from 26.3mm in May to 77.8mm in December. Rainfall can, however, be highly variable from year to year with annual levels ranging from 358.6 to 959.6mm and monthly rainfall in December ranging between 1.2mm and 198.4mm.

#### 4.1.3.4 Evaporation

Mean pan evaporation throughout the year is 4.7mm per day or 1 715.5mm per year. Applying a conversion factor of 0.75 to convert pan evaporation to pond evaporation, the mean annual evaporation from the pond surfaces within the Project Site would be approximately 1 286.6mm per year.

Monthly mean evaporation rates fluctuate throughout the year; from a minimum pond evaporation rate of 36mm in June to a maximum of 195mm in January. Mean monthly pond evaporation is greater than mean monthly rainfall in all months with the exception of June.

#### 4.1.3.5 Wind Speed & Direction

**Figure 4.4** presents wind roses for Canberra Airport for 2017 used for the air quality assessment (see Section 4.8). In summary, winds from the northwest are common, particularly in winter and spring. In summer and autumn, winds from the southeast are also common. Winds are also typically strong, with winds in excess of 7.5m/s or 27km/h common.

### 4.1.4 Land Ownership and Land Use

#### 4.1.4.1 Land Ownership

**Figure 4.5** displays landownership within and surrounding the Project Site, as well as the locations of residential receivers in the vicinity of the Project Site.

#### 4.1.4.2 Surrounding Land Use

**Figure 4.6** presents land uses within and surrounding the Project Site. These include the following.

- Extractive Industry – In addition to the existing Bungendore Sands Quarry within the Project Site, two other quarry operations are located to the south of the Project Site. The Corkhill Quarry is located approximately 1km to the southwest, while Holcim's Leonie and Monier Quarries are located approximately 1.5 km to the southwest.
- Agriculture –Grazing and cropping dominates land uses surrounding the Project Site, with some properties including rural residential dwellings. Lake George is also subject to periodic agricultural activities.
- Power Generation – Wind turbines associated with the Capital Wind Farm are located approximately 2.5km to the northeast of the Project Site.
- Currandooley Road Composting Facility – An application for the development of a composting facility within Lot 1 DP 1154765, involving the processing of compost at a maximum rate of 5 000tpa, has been proposed and is currently being considered by Council.

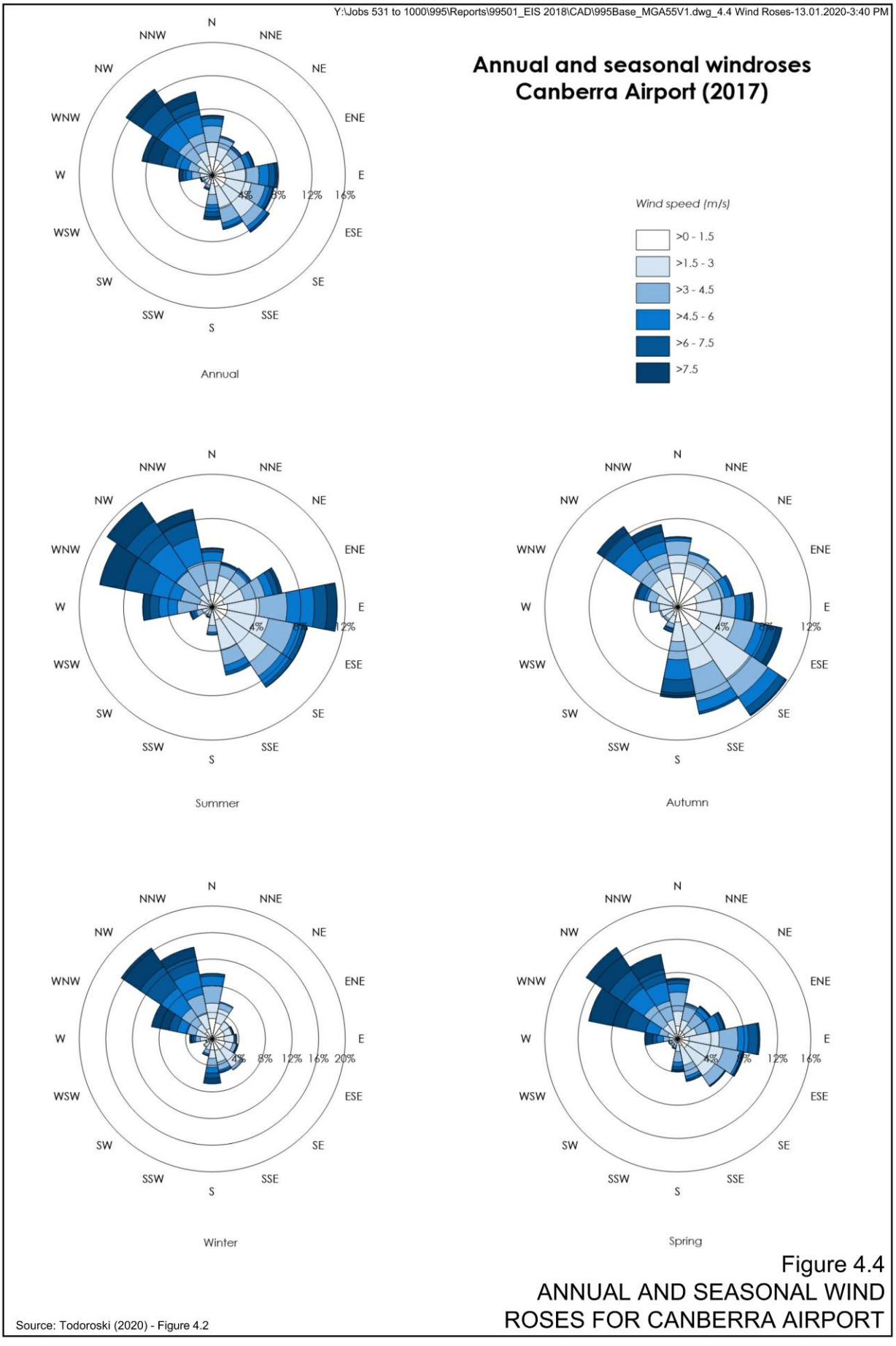



Figure 4.4
ANNUAL AND SEASONAL WIND ROSES FOR CANBERRA AIRPORT

Source: Todoroski (2020) - Figure 4.2

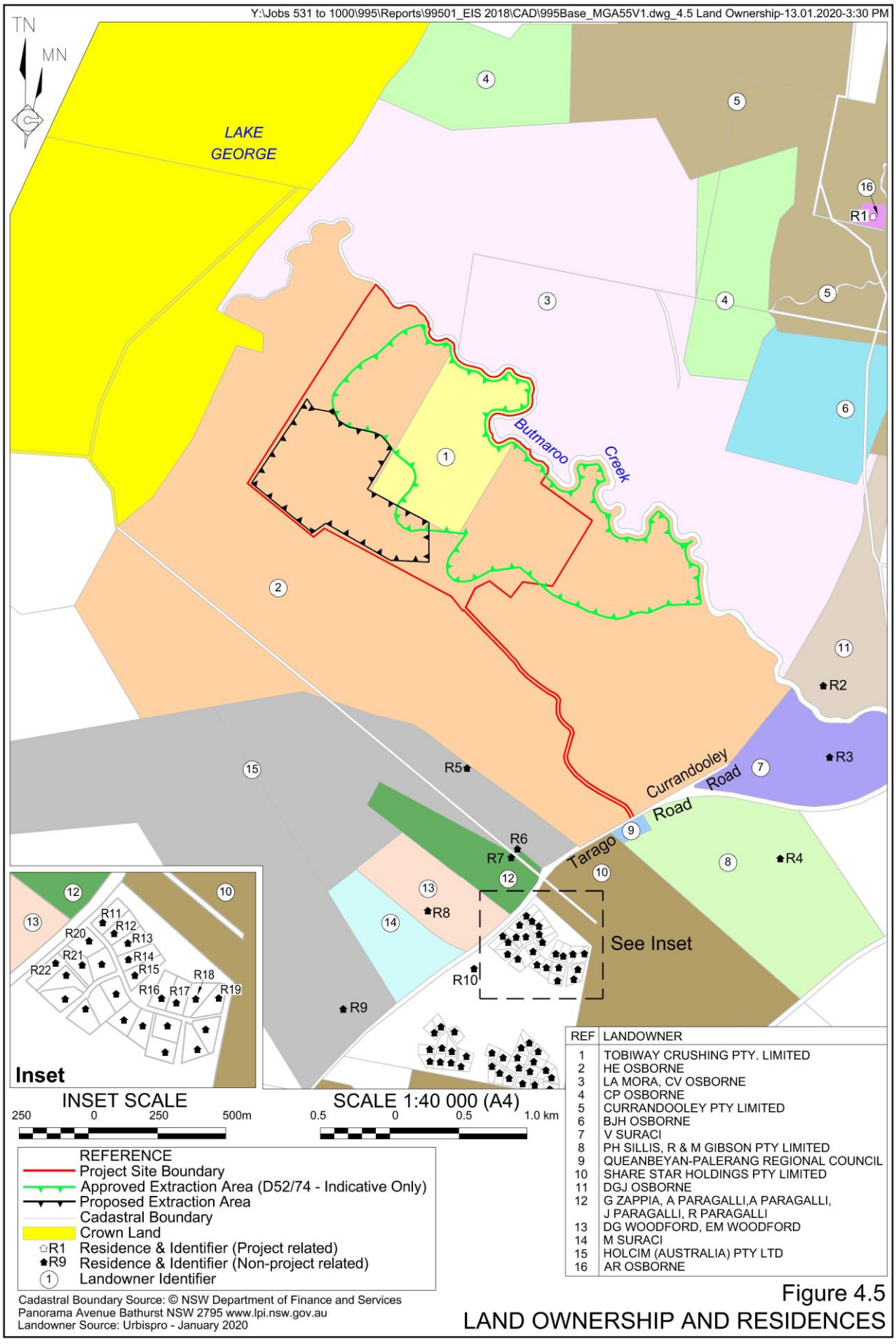



Figure 4.5
LAND OWNERSHIP AND RESIDENCES

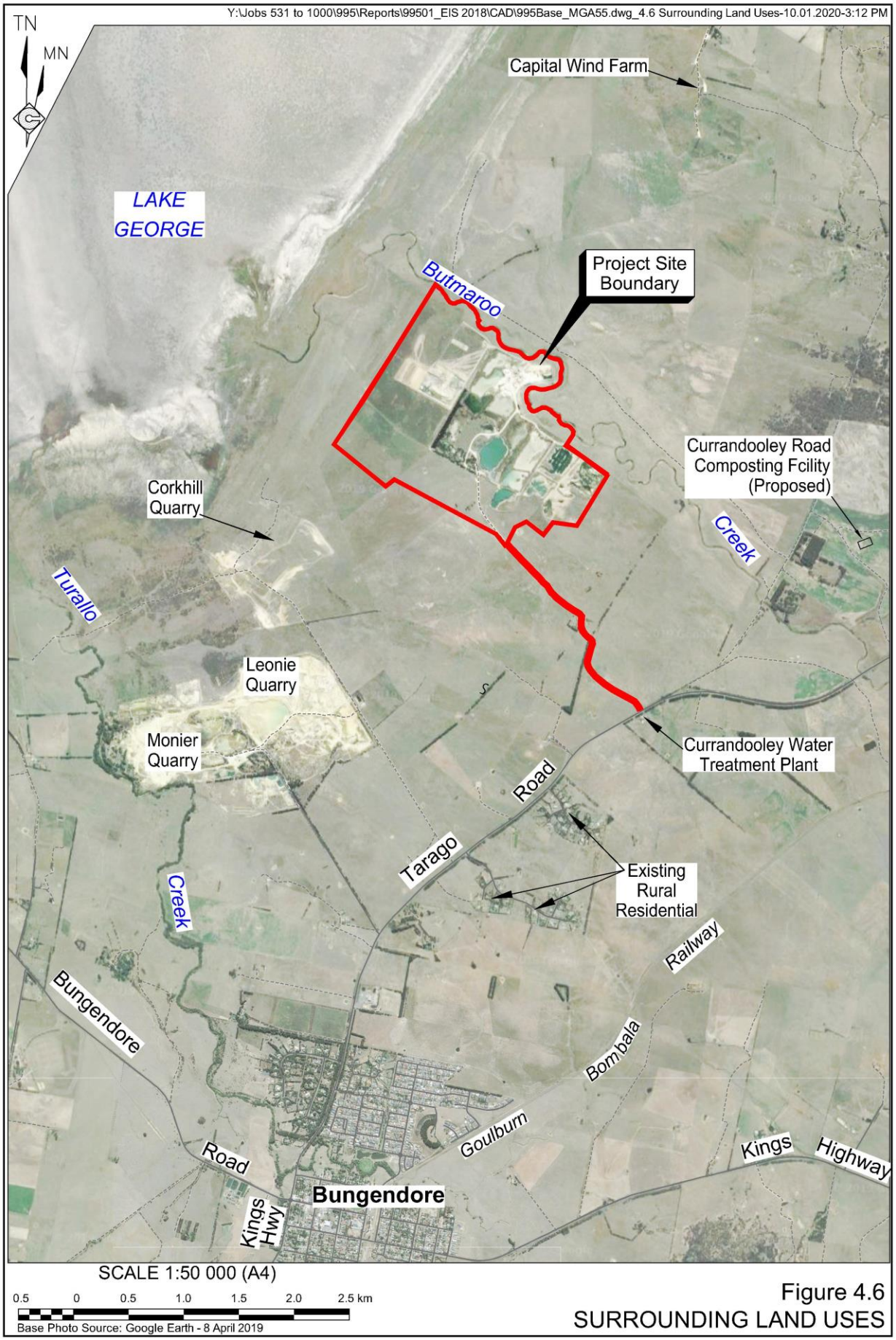



Figure 4.6
SURROUNDING LAND USES

- Rural residential – Rural residential dwellings occur in two estates accessed via around Hope and McDonell Drives, located approximately 1.2km and 2km by road from the Site Entrance and 2.75km and 3.5km south of the proposed Extraction Area.
- Residential - Bungendore township is located approximately 5km to the south of the Project Site.
- Infrastructure and services
  - Tarago Road is the principal access for the Project Site and joins the Kings Highway approximately 7km south of the Project Site.
  - The Currandooley Water Treatment Plant is located immediately opposite the Site Entrance.
  - The Canberra to Capital Wind Farm 330kV transmission line passes over the Quarry Access Road.

The Proposal, representing the expansion of an existing extraction operation, is unlikely to conflict with those land uses immediately adjacent to the Project Site. Possible amenity issues associated with the Proposal are discussed in the remainder of Section 4.

## 4.2 Aboriginal Heritage

### 4.2.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify heritage as a key issue for assessment in the EIS. Matters to be addressed include:

- "an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage."

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

Dr Amy Way prepared a Heritage Assessment Report for the Proposal. Dr Way completed her PhD thesis on the archaeology of Lake George and is a well-respected archaeologist with detailed knowledge of the archaeological setting of the Project Site. That report, hereafter referred to as Way (2020), is presented as **Appendix 4**. This subsection provides an overview of the Aboriginal Cultural Heritage Assessment Report and describes operational safeguards and management measures to be implemented by the Applicant and Operator.

### 4.2.2 Consultation

Consultation with the local Aboriginal community was undertaken by Way (2020) generally in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010). Section 3 of Way (2020) provides a full description of the consultation undertaken. However, in summary, consultation with the Aboriginal community consisted of the following.

- Stage 1: Identification of Aboriginal community groups and individuals.

  Letters were provided to a range of organisations and a notice was published in the *Bungendore Weekly* in November 2018. The following Aboriginal parties registered interest in the Proposal.

  – Onerwal Local Aboriginal Land Council.
  – Ngambri Local Aboriginal Land Council (registered on 17 March 2020 as part of the Stage 4 consultation).
  – Didgengunawal.
  – Corroboree Aboriginal Corporation.
  – Merrigarn Indigenous Corporation.
  – Janine Thompson.
  – Murra Bidgee Mullangari.
  – Bungarabung/Koomurri Ngunawal Aboriginal Corporation..
  – Thunderstone (Ngunawal)
  – Buru Ngunawal.
  – Muragadi.
  – Gooba.

- Stages 2 and 3: Presentation and gathering of information

  An information package was provided to each of the registered Aboriginal parties (RAPs) on 13 December 2018. The package outlined the proposed methodology and sought information about places and objects of cultural value to Aboriginal people in the Lake George area. The following responses were received.

  – Corroboree Aboriginal Corporation (22 November 13 and 17 December 2018).
  – Koomurri Ngunnawal Aboriginal Corporation (20 December 2018).
  – Murra Bidgee Mullangari (23 December 2018).

  The responses indicated the following.

  – Disappointment that sites are lost to development.
  – Endorsement for the establishment of a Conservation Area.
  – Support for the Proposal.
  – That the groups would like to be involved in the Proposal, including salvage excavation.

An onsite meeting was scheduled for 18 December 2018 but no RAPs attended the meeting.

Further consultation was undertaken on 15 July 2019, with a Project update provided to each of the RAPs.

- Stage 4: Review of draft assessment report

  A draft of the Heritage Assessment Report was provided to the RAPs on 1 February 2020, with a request to provide responses by 6 March 2020. This date was subsequently extended to 17 March 2020 to permit the Ngambri Local Aboriginal Land Council to register and provide a response. Responses were received from four RAPs. All responses accepted the recommendations of Way (2020), with additional comments summarised as follows.

  – The proposed Heritage Conservation Area should be fenced and signposted immediately. This commitment was already embodied in the EIS (see Section 4.2.6), however the Applicant and/or Operator committed to doing so immediately on receipt of Development Consent.

  – It was requested that all salvaged artefacts be managed in accordance with Requirement 26 of the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales permitting management of the artefacts by the Aboriginal community or return to Heritage Conservation Area.

### 4.2.3 Desktop Review

Way (2020) states that the Lake George area has been occupied for many thousands of years by members of the Ngunawal Group. Reports from the time of first European contact describe the area as abundant in bird and animal life, with many camp fires seen on the hills around the Lake. It is likely that the Lake supported large groups of people at times as the area has fresh water and abundant food resources.

A substantial number of heritage assessments have been completed in the vicinity of Lake George and the Project Site. **Figure 4.7** presents the location of Aboriginal sites recorded on the Aboriginal Heritage Information Management System (AHIMS) database. The majority of these sites consisted of concentrations of stone artefacts. Way (2020) states that most of the recoded sites have been identified through development-related studies and that the potential for additional sites in areas that have yet to be surveyed is high.

Four AHIMS-registered sites exist within the Project Site as follows (**Figure 4.8**).

#### Site 57-2-0791 – Wood Duck Potential Archaeological Deposit (PAD) 1

This site consists of a concentration of sub-surface stone artefacts associated with the Wood Duck strandline. An archaeological identified that approximately 200mm of post settlement material, interpreted to be mobilised sand and silt as a result of the removal of the areas vegetation. This was underlain by an archaeological deposit comprising 789 artefacts in one 12.75m$^2$ excavation and 1,463 artefacts recorded in a second 15.5m$^2$ excavation. The objects recovered included axe blanks, two grinding stone fragments, three hammerstones and multiple backed artefacts, including evidence for the on-site manufacture of backed artefacts.

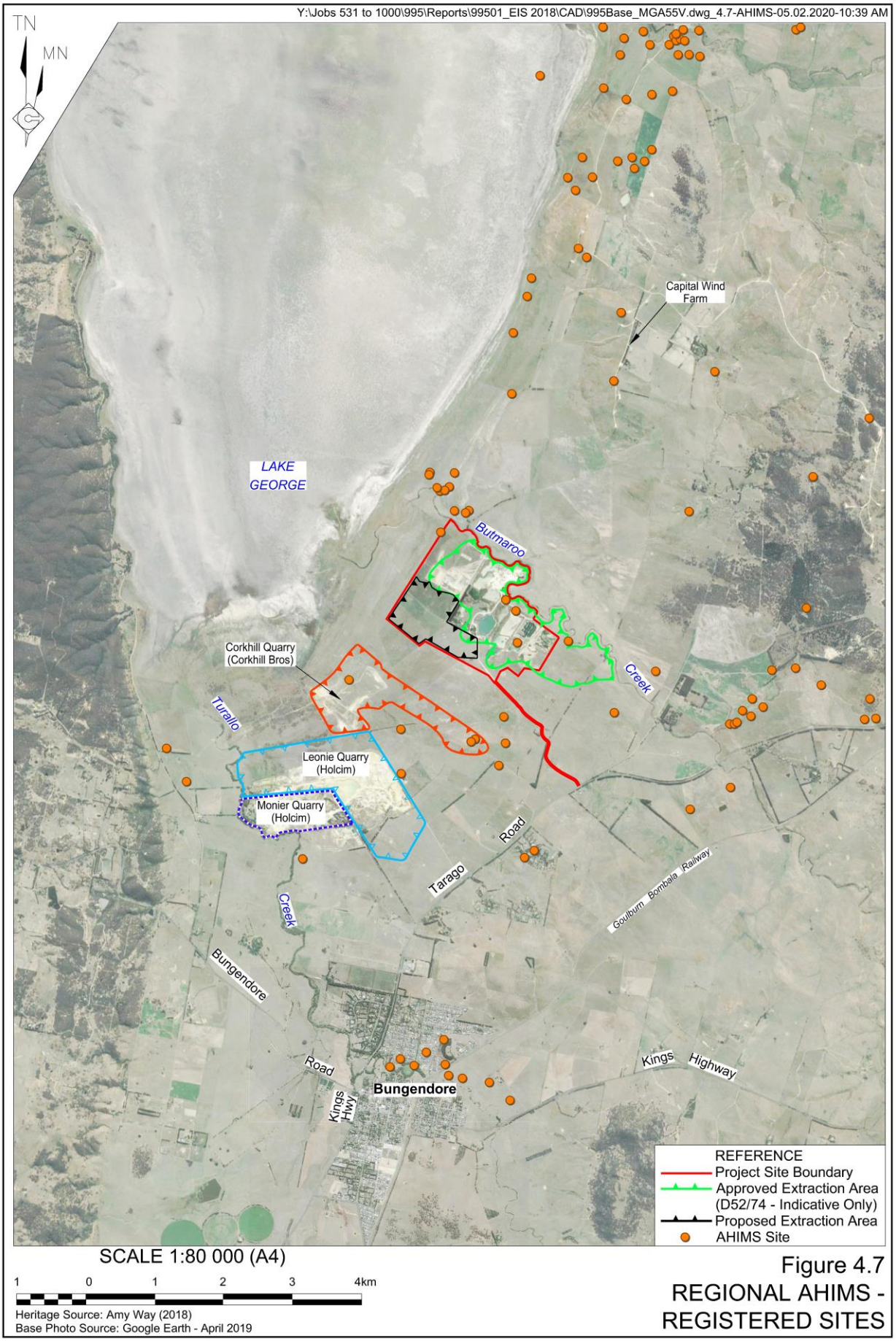
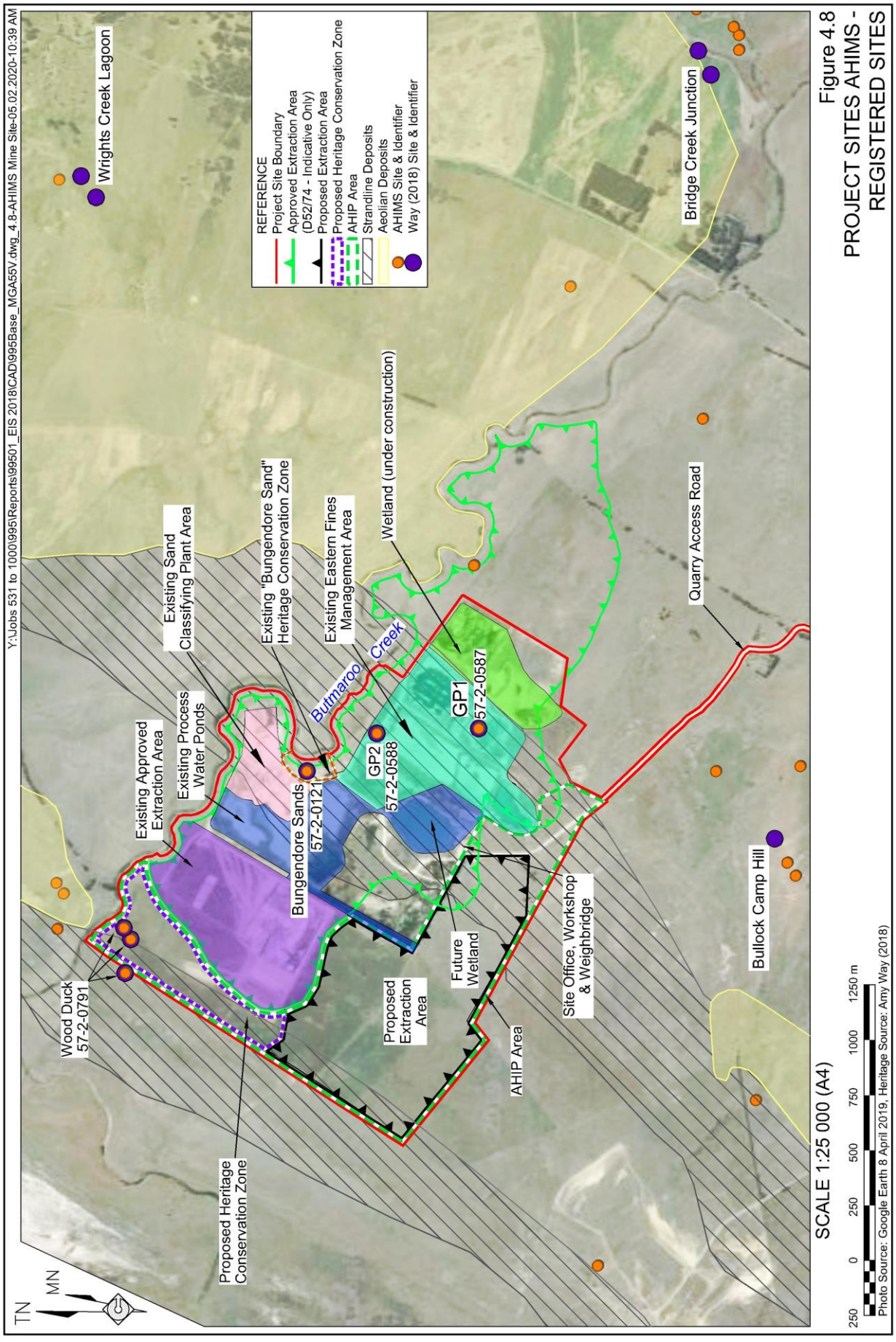



Figure 4.7
REGIONAL AHIMS - REGISTERED SITES


Y:\Jobs 531 to 1000\995\Reports\99501_EIS 2018\CAD\995Base_MGA55V.dwg_4.8-AHIMS Mine Site-05.02.2020-10:39 AM
REFERENCE
Project Site Boundary
Approved Extraction Area (D52/74 - Indicative Only)
Proposed Extraction Area
Proposed Heritage Conservation Zone
AHIP Area
Strandline Deposits
Aeolian Deposits
AHIMS Site & Identifier
Way (2018) Site & Identifier
Wrights Creek Lagoon
Bridge Creek Junction
Existing Sand Classifying Plant Area
Existing "Bungendore Sand" Heritage Conservation Zone
Existing Eastern Fines Management Area
Wetland (under construction)
Quarry Access Road
Butmaroo Creek
GP1 57-2-0587
GP2 57-2-0588
Existing Approved Extraction Area
Existing Process Water Ponds
Bungendore Sands 57-2-0121
Wood Duck 57-2-0791
Proposed Extraction Area
Future Wetland
Site Office, Workshop & Weighbridge
AHIP Area
Bullock Camp Hill
Proposed Heritage Conservation Zone
TN
MN
SCALE 1:25 000 (A4)
250 0 250 500 750 1000 1250 m
Photo Source: Google Earth 8 April 2019, Heritage Source: Amy Way (2018)
Figure 4.8
PROJECT SITES AHIMS - REGISTERED SITES

### Site 57-2-0121 – Bungendore Sands

This site was first excavated in 1992, with further excavation undertaken in 2009 and 2015. The combined excavation programs yielded more than 5,000 artefacts. The highest artefact densities were found on the slightly elevated sandy ground near Butmaroo Creek. The lowest densities were in the areas furthest from the creek where the sand body was thinnest. All of the artefacts were found in the upper aeolian sand deposit to the depth of 100cm, although most of the artefacts came from 20cm to 45cm below the surface.

Dating of hearth material within the excavations returned dates ranging between 126 years and 378 years before present.

The Bungendore Sands deposit is protected by a deed between the Applicant, the Operator and the Minister administering the *National Parks and Wildlife Act 1974.* A copy of that deed is presented as Annexure 8 of Way (2020)

### Sites 57-2-0587 and 57-2-0588 – Grantham Park 1 (GP1) and Grantham Park 2 (GP2)

The GP1 and GP2 sites were excavated in 2008 and returned a low to moderate density of artefacts, although Way (2020) stated that the assessment methodology was likely to substantially underestimate the density of objects within the PADs. These PADs were subsequently removed during excavation operations.

## 4.2.4 Survey Methodology and Results

The Aboriginal heritage survey for the Proposal was undertaken by Dr Way on 18 December 2018. Dr Way inspected all areas of strandline and aeolian deposits on foot using 10m spaced transects, as well as other areas with suitable surface exposure.

**Figure 4.9** presents the results of the survey. In summary, no artefacts were observed at the surface. Way (2020) states that this result is unsurprising given the previously recorded approximately 200mm of post-settlement deposition. Notwithstanding this, Way (2020) identified two PADs based on landform assessment as follows.

- Wood Duck South PAD (PAD1) – this PAD comprises the southeastern extension of the known Wood Duck PAD. Way (2020) states that this landform is not as pronounced as the northern end of the strandline.
- Currandooley South PAD (PAD2) – this PAD consists of an elevated area near the Quarry Access Road.

## 4.2.5 Significance of Observed Sites

### 4.2.5.1 Cultural Significance

Way (2020) notes that the area surrounding Lake George was likely an important meeting place for Aboriginal people. The cultural significance of an area and sites within that area is a matter for the Aboriginal community to determine. However, Way (2020) states that the RAPs during the consultation phase for the Proposal identified that the area and contained sites are of high cultural significance to the Aboriginal community.

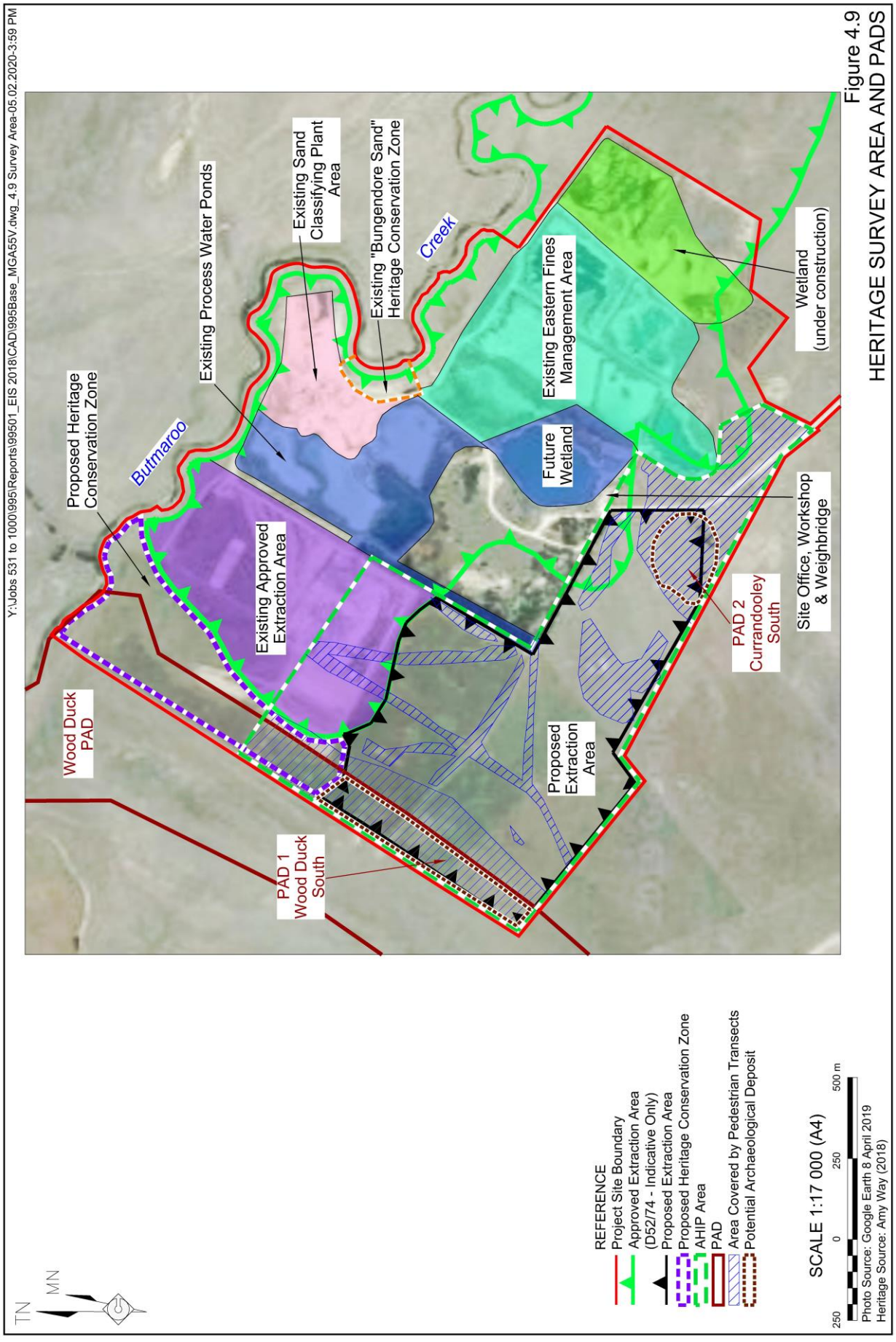



Figure 4.9
HERITAGE SURVEY AREA AND PADS

#### 4.2.5.2 Archaeological and Scientific Significance

Way (2020) states that Lake George is an archaeologically significant area with extensive aeolian sand sheets and strandline deposits with rich, dense and stratified archaeological deposits.

The Wood Duck PAD in particular has been protected by an approximately 20cm deep layer of sand deposited following settlement of the area by Europeans. The deposit has excellent preservation of lateral positioning of artefacts with some vertical artefact migration. As a result, the Wood Duck South and Currandooley South PADs are considered to be in very good condition with a very high probability of containing Aboriginal objects.

### 4.2.6 Management and Mitigation Measures

The Applicant and/or Operator would implement the following management and mitigation measures to ensure that the Proposal would not have unacceptable adverse impacts on Aboriginal heritage.

- Establish a Heritage Conservation Zone generally as shown on **Figure 4.9**. The Zone would be protected under a Deed or similar arrangement that protects the Bungendore Sands Conservation Zone. The following measures would be implemented within the proposed Heritage Conservation Zone to ensure the preservation of buried artefacts within the Zone.
  - Immediately on receipt of Development Consent fence the Heritage Conservation Zone.
  - Erect signage identifying the area as a Heritage Conservation Zone and prohibiting surface disturbance of more than 10cm within the Zone without suitable approvals under the *National Parkes and Wildlife Act 1974.*
  - Ensure that ongoing grazing and other agricultural practices do not result in disturbance of the ground surface to more than 10cm depth.
- Undertake a salvage program within the Wood Duck South and Currandooley South PADs. The program would be completed prior to the commencement of Extraction Cells E4, E5, E9 or E10 and would indicatively comprise the following.
  - Obtain an AHIP for the salvage and subsequent disturbance of both PADs.
  - Undertake a hand dug test pitting program of up to 50 test pits approximately 50cm x 50cm in size to identify the location, extent and density of sub-surface artefacts. Test pits are to be spaced approximately 5m apart.
  - Based on the results of the test pitting program, select one area on each PAD for a salvage program comprising one or more test pits with a combined area of approximately $50m^2$.
  - Collect all artefacts and complete a detailed excavation report for submission to Biodiversity and Conservation.
  - Manage all artefacts in accordance with Recommendation 26 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.* Should the Aboriginal community so desire, the Applicant would permit reburial of any salvaged artefacts within the proposed Heritage Conservation Area.

- Ensure, following acceptance of the test pitting and excavation report, that the RAPs are contacted and offered the opportunity to undertake ad hoc salvaging of artefacts during initial soil and vegetation stripping operations prior to the commencement of extraction operations within the area of the Wood Duck South and Currandooley South PADs.
- Prepare and implement an Unanticipated Finds Protocol consistent with that identified in Section 9 of Way (2020). In summary, should a suspected Aboriginal object be identified during extraction operations, work would cease immediately in the vicinity of the object and advice sought from a suitably qualified archaeologist, the RAPs and/or Biodiversity and Conservation officers.

### 4.2.7 Assessment of Impacts

The Proposal would result in disturbance of two PADs, namely the Wood Duck South and Currandooley PADs. The Applicant and/or Operator would obtain the required AHIP to permit disturbance of the PADs and would undertake a program of test pitting and excavation prior to disturbing the PADs. In addition, the Application would establish a Heritage Conservation Zone to protect the northern section of the Wood Duck PAD in perpetuity.

Consultation with the Aboriginal community indicated that the community accepted the results of Way (2020). In particular, the community supported the recommendation to establish the proposed Heritage Conservation Area. That recommendation has been accepted in full by the Applicant and Operator.

In light of the above, the Applicant and Operator contend that the Proposal would not result in unacceptable impacts to Aboriginal objects or sites.

## 4.3 Traffic and Transportation

### 4.3.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify traffic and transportation as a key issue for assessment in the EIS. Matters to be addressed include:

- accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products;
- an assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads;
- a description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development;

- evidence of any consultation with the relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and
- a description of access roads, specifically in relation to nearby Crown roads and fire trails.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

Constructive Solutions Pty Ltd (Constructive Solutions) prepared a Traffic and Transport Assessment for the Proposal. The Traffic and Transport Assessment, hereafter referred to as Constructive Solutions (2020), is presented as **Appendix 5**. This subsection provides an overview of the Traffic and Transport Assessment and describes operational safeguards and management measures to be implemented by the Operator.

## 4.3.2 Existing Traffic Environment

### 4.3.2.1 Roads and Intersections

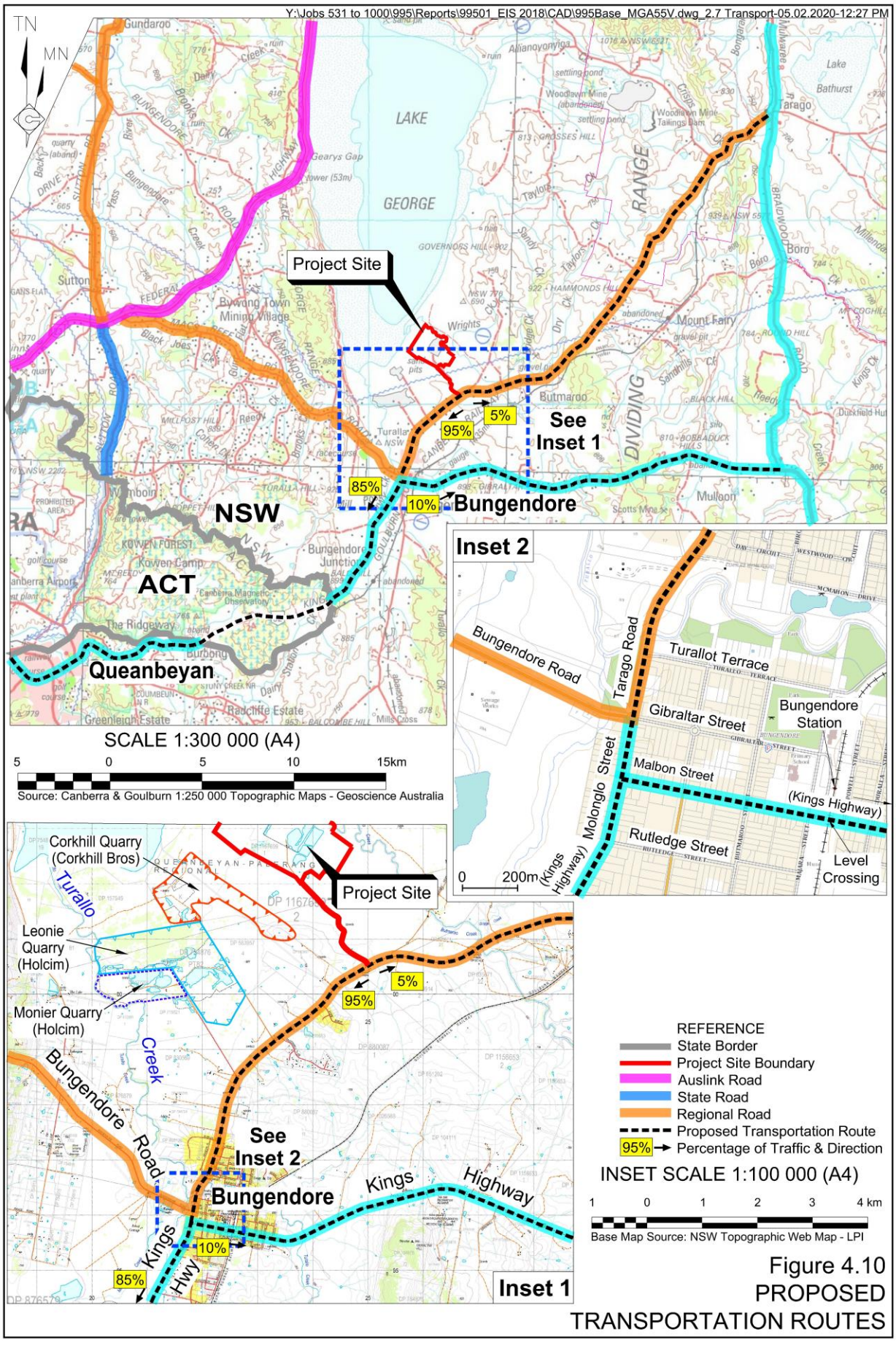
The Quarry Access Road, Site Entrance and the intersection of the Quarry Access Road and Tarago Road are described in Section 2.7.2 and 2.7.3. The proposed transportation routes are presented in **Figure 4.10** and are described in Section 2.7.4.

**Table 4.2** summarises the characteristics of Tarago Road, Molonglo Street and the Kings Highway. The Kings Highway along the proposed transport route is characterised both by two distinct travel directions through Bungendore township (north/south and east/west) and distinct formations and associated speed zones as the road enters and exits Bungendore township.

The intersection of the Quarry Access Road and Tarago Road is a rural type access on the northern side of Tarago Road within a 100km/h speed zone. The Quarry Access Road is sealed to a single lane cattle grid set back approximately 30m from the edge line of Tarago Road. A 3m widened sealed shoulder approximately 100m long is located adjacent to the northbound lane on the approach to the Quarry Access Road, however this shoulder is not used by vehicles turning left onto the Quarry Access Road as an existing transverse pipe culvert located immediately southwest of the Quarry Access Road/Tarago Road intersection has not been extended.

Sight distance at the Quarry Access Road/Tarago Road is approximately 300m and greater than 400m to the north and southwest respectively. Advanced track warning signs are located on Tarago Road on both approaches to the Quarry Access Road.

The intersection of Molonglo Street and Malbon Street has a T-junction configuration within an urban road formation. Molonglo Street is the priority road and Give Way control, including Give Way signs and a hold line, is provided on Malbon Street. A widened shoulder adjacent to the northbound lane of Molonglo Street may provide an informal Basic Right (BAR) turn lane, however, this is limited due to adjacent property access and unrestricted street parking in this area.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TN
MN
Project Site
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5%
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85%
10%
Bungendore
NSW
ACT
Queanbeyan
LAKE GEORGE
RANGE
DIVIDING
Inset 2
Bungendore Road
Tarago Road
Turallot Terrace
Gibraltar Street
Bungendore Station
Malbon Street
Molonglo Street
(Kings Highway)
Rutledge Street
Level Crossing
0 200m
SCALE 1:300 000 (A4)
5 0 5 10 15km
Source: Canberra & Goulburn 1:250 000 Topographic Maps - Geoscience Australia
Corkhill Quarry (Corkhill Bros)
Turallo Creek
Leonie Quarry (Holcim)
Monier Quarry (Holcim)
Project Site
See Inset 2
Bungendore Road
Kings Highway
Kings Hwy
Inset 1
REFERENCE
State Border
Project Site Boundary
Auslink Road
State Road
Regional Road
Proposed Transportation Route
95% Percentage of Traffic & Direction
INSET SCALE 1:100 000 (A4)
1 0 1 2 3 4 km
Base Map Source: NSW Topographic Web Map - LPI
Figure 4.10
PROPOSED
TRANSPORTATION ROUTES

**Table 4.2**
**Existing Roads Along the Proposed Transport Route**

| Road | Classification | Description[1] | Speed Limit[1] (km/h) |
|---|---|---|---|
| Tarago Road | Regional | Two way, two lane road. | 80 - 100 |
| | | Rural formation with a sealed width of 7.5m to 8m, marked centre lines and edge lines in some sections. | |
| | | Longitudinal table drains with pipe culvert transverse crossings. | |
| | | Pavement in fair to good condition with some evidence of rutting, flushed seal and potholing. | |
| | | Approved B-double route with conditions. | |
| Molonglo Street | Regional Road | Two way, two lane road. | 50 |
| | | Urban formation with a sealed width of 12m, marked centre lines and edge lines, provision for parallel parking on both sides. | |
| | | Kerb and gutter on both sides. | |
| | | Pavement in reasonable condition with evidence of flushed seal and minor rutting. | |
| | | Approved B-double route with conditions. | |
| Kings Highway[2] | State Road | Two way, two lane road. | 50 - 100 |
| | | Urban and rural formations with a sealed width of 9m to 12m, marked centre lines and edge lines, provision for parallel parking on both sides. | |
| | | Kerb and gutter on both sides, transitions to longitudinal table drains. | |
| | | Pavement in reasonably good condition with evidence of flushed seal and minor rutting. | |
| | | Approved 26m B-double route. | |

Note 1: Along the proposed transport route.

Note 2: The Kings Highway transitions between urban and rural formations, and from 50km/h to 100km/h speed zones, as vehicles pass through Bungendore township. This section includes both the Kings Highway in a north/south direction as well as the Kings Highway (and Malbon Street) in an east/west direction.

Source: Constructive Solutions (2020) – After section 2.

#### 4.3.2.2 Traffic Volumes

Constructive Solutions (2020) used 2019 traffic data obtained by Queanbeyan-Palerang Regional Council to estimate 10 year traffic forecasts based on assumed growth rates of 1% per year for Tarago Road and Molonglo Street and 2% per year for the Kings Highway. **Table 4.3** provides a summary of the existing and 10 year forecast traffic volumes on the proposed transport routes.

**Table 4.3**
**Background and Forecast Daily Traffic Volumes**

| Location | | Background Traffic (2019) | | Forecast Traffic (2029) | |
|---|---|---|---|---|---|
| **Road** | **Site** | **AADT[1]** | **HV[2] (%)** | **AADT[1]** | **HV[2] (%)** |
| Kings Highway (Malbon Street) | Between Molonglo Street and Ellendon Street | 6874 | 6.0% | 7593 | 6.0% |
| Kings Highway (Molonglo Street) | South of Malbon Street | 8424 | 9.1% | 9305 | 9.1% |
| Molonglo Street | Between Malbon street and Bungendore Road | 6335 | 8.5% | 6998 | 8.5% |
| Tarago Road | Approximately 3.5km northeast of the Site Access Road | 1667 | 10.6% | 1841 | 10.6% |
| Note 1: AADT = Annual average daily traffic.<br>Note 2: HV = Heavy vehicles. | | | | | |
| Source: Constructive Solutions (2020) – After Table 10. | | | | | |

**Table 4.4** summarises the morning and afternoon peak hour times for the proposed transport route roads.

**Table 4.4**
**Peak Hour Traffic Volumes**

| Road | Site | AM Peak Hour | VPH[1] | PM Peak Hour | VPH[1] |
|---|---|---|---|---|---|
| Kings Highway (Malbon Street) | Between Molonglo Street and Ellendon Street | 10:00am – 11:00am | 477 | 5:00pm – 6:00pm | 647 |
| Kings Highway (Molonglo Street) | South of Malbon Street | 7:00am – 8:00am | 671 | 4:00pm – 5:00pm | 762 |
| Molonglo Street | Between Malbon street and Bungendore Road | 7:00am – 8:00am | 505 | 4:00pm – 5:00pm | 538 |
| Tarago Road | Approximately 3.5km northeast of the Site Access Road | 7:00am – 8:00am | 154 | 5:00pm – 6:00pm | 165 |
| Note 1: VPH = Vehicles per hour. | | | | | |
| Source: Constructive Solutions (2020) – After Table 11. | | | | | |

#### 4.3.2.3 Public Transport and School Bus Services

A public bus service, route 844/D841, is operated by Qcity Transport between Queanbeyan and Bungendore on weekdays. Intersections utilised by buses to turn do not coincide with proposed turning intersections for Project-related trucks. A daily train service is also operated by Transport for NSW between Sydney and Canberra, with trains passing through Bungendore using the rail level crossing on the Kings Highway (see **Figure 4.10**).

School bus services for the Bungendore Public School are provided by Stevens Charter Service, with three services operating Monday to Friday during school periods (**Table 4.5**).

**Table 4.5**
**School Bus Service Routes and Times**

| Route | Service Number | Times |
|---|---|---|
| Malbon Street, Molonglo Street, Tarago Road | 1 | 8:40am – 9:00am |
| | | 3:15pm – 3:30pm |
| Malbon Street, Molonglo Street (Kings Highway north/south) | 2 | 6:25am – 7:30am |
| | | 8:00am – 9:00am |
| | | 3:10pm – 4:00pm |
| | | 4:30pm – 5:50pm |
| Source: Constructive Solutions (2020) – After Table 13 | | |

### 4.3.2.4 Pedestrian and Cycling Activity

**Table 4.6** summarises the pedestrian and cyclist infrastructure features and anticipated pedestrian and cyclist usage of various road sections which form part of the proposed transport route.

**Table 4.6**
**Pedestrian and Cyclist Infrastructure and Usage**

| Location | Pedestrian / Cyclist Infrastructure | Pedestrian / Cyclist Usage |
|---|---|---|
| Tarago Road | Nil | Some pedestrian and cyclist activity expected due to proximity of residential areas to the south. |
| Molonglo Street (including the Kings Highway) | Footway area (unpaved) defined by verge. | Numerous pedestrians accessing residential and commercial areas. Expected cyclist use of both the verge and road pavement. |
| Malbon Street (Molonglo Street to Rail Level Crossing) | Paved footpaths on both sides between Molonglo Street and Majara Street. Pedestrian refuge on each approach to the Ellendon Street intersection. No formal bike paths. | Numerous pedestrian and cyclists expected due to proximity of residential and commercial areas and Bungendore Public School. |
| Malbon Street (Rail Level Crossing to Bungendore Town Limits) | Pedestrian refuge located east of the Powel Street intersection. | Numerous pedestrians and cyclists expected due to adjacent residential areas. |
| Source: Constructive Solutions (2020) – After Section 3.8. | | |

### 4.3.2.5 Road Safety History

Constructive Solutions (2020) reviewed available crash data from the 5-year period from 2014 to 2018 and noted the following.

- A total of 15 crashes were reported during the 5-year period, including:
  - 5 on Tarago Road;
  - 1 on Molonglo Street; and
  - 9 on Malbon Street

- One fatality occurred following a rear end collision on Tarago Road in 2018.
- Of the 15 reported crashes, only one occurred at the Molonglo Street/Malbon Street Intersection.
- None of the reported crashes involved heavy vehicles.

The number of reported crashes is considered to be relatively minor given the volume of traffic utilising the proposed transportation route (Constructive Solutions, 2020).

### 4.3.3 Predicted Changes to the Traffic Environment

#### 4.3.3.1 Traffic Volumes and Destinations

The Proposal would not increase haulage vehicle volumes associated with the existing Quarry, with Proposal-related traffic consisting of the following.

- An average of 30 to 35 laden movements per day.
- A maximum of 70 laden movements per day on occasion during periods of high demand.
- A maximum of 8 laden vehicle movements per hour.
- Up to 20 employee/maintenance light vehicle movements.

Loading and transportation operations would be undertaken between 6:00am and 5:00pm on weekdays and between 6:00am and 2:00pm on Saturdays, with no loading or transportation activities occurring on Sundays or Public Holidays. These hours are consistent with those of the existing Quarry.

The proposed increase in maximum production up to 400 000tpa would be accounted for through the increased use of General Mass Limit (GML) vehicles which have a capacity of up to 38t, including truck and 4-axel dog trailer (38t capacity) over smaller truck and dog (28t to 32t capacity) and rigid trucks (3t to 12t capacity) that currently access Project Site.

It is anticipated that Proposal-related transport routes would be the same as those associated with the existing Quarry, with 5% of vehicles travelling north on Targo Road and the remaining 95% travelling south on Tarago Road (see **Figure 4.10**). Of the 95% travelling south on Tarago Road, 10% would travel east on Malbon Street / the Kings Highway whilst 85% would travel south on the Kings Highway.

**Table 4.7** provides the current background (existing Quarry and background traffic) and forecast peak hour traffic volumes for roads which form part of the proposed transport routes.

**Table 4.7**
**Background and Forecast Peak Hour Traffic Volumes**

| Location | | Background Traffic[1] (2019) | | Forecast Traffic (2029) | |
|---|---|---|---|---|---|
| **Road** | **Site** | **Peak AM (vph[2])** | **Peak PM (vph[2])** | **Peak AM (vph[2])** | **Peak PM (vph[2])** |
| Kings Highway (Malbon Street) | Between Molonglo Street and Ellendon Street | 477 | 647 | 527 | 715 |
| Kings Highway (Molonglo Street) | South of Malbon Street | 671 | 762 | 741 | 842 |
| Molonglo Street | Between Malbon street and Bungendore Road | 505 | 538 | 558 | 594 |
| Tarago Road | Approximately 3.5km northeast of the Site Access Road | 154 | 165 | 170 | 182 |

Note 1: Background traffic includes Proposal-related traffic as no increase to traffic volumes is proposed compared to the existing Quarry.

Note 2: vph = Vehicles per hour.

Source: Constructive Solutions (2020) – After Table 15.

#### 4.3.3.2 Road Network and Intersection Performance

***Site Access Road and Tarago Road Intersection***

The existing intersection of the Site Access Road and Tarago Road is generally in accordance with the dimensions of a rural property access to cater for articulated vehicles as outlined in the *Guide to Road Design – Part 4: Intersections and Crossings – General* (Austroads, 2017).

Accounting for Peak AM and Peak PM hour traffic volumes at background and forecast (i.e. 2029) levels, Constructive Solutions (2020) indicate that shoulder widening on Tarago Road is required to cater for expected non-Proposal related traffic growth in order to provide Basic Left (BAL) and Basic Right (BAR) turn treatments. Provision of an accelerating lane for heavy vehicles entering Tarago Road from the Site Access Road is not considered necessary due to relatively low traffic volumes and existing sight distances which permit heavy vehicles to enter Tarago Road safely.

***Kings Highway Intersection (Molonglo Street and Malbon Street)***

Approximately 10% of Proposal-related traffic would undertake left turn movements from Molonglo Street into Malbon Street and right turn movements from Malbon Street into Molonglo Street at the Kings Highway Intersection (i.e. the intersection of Molonglo Street and Malbon Street).

Constructive Solutions (2020) modelled the performance of the Kings Highway intersection using SIDRA Intersection 8 modelling software which summarises the performance of the intersection using the following four performance indicators.

- Level of Service (LoS) – ratings from LoS A (operating with spare capacity) to LoS E (operating above capacity) based on delays experienced by traffic utilising the intersection.

- Degree of Saturation (DoS) – the ratio of demand to flow capacity (0 – 1), with values approaching 1 indicating extensive delays and queues.
- Queue length – number of vehicles waiting at a hold line, typically quoted as the 95$^{th}$ percentile back of the queue (i.e. the value below which 95% of queue lengths fall).
- Average delay per vehicle (seconds per vehicle) – the difference between uninterrupted and interrupted travel times through an intersection.

Constructive Solutions (2020) completed the SIDRA analysis using the peak flow traffic volumes presented in **Table 4.7** and based on the following assumptions.

- Peak AM Hour (7:00am to 8:00am) – 80% of traffic originating from north of the intersection are travelling south towards Canberra.
- Peak PM hour (5:00pm to 6:00pm) – 55% of traffic from the south are continuing north.

**Table 4.8** summarises the performance of the Kings Highway intersection during peak hour conditions under both background and forecast traffic volumes. In summary, SIDRA analysis reveals that the Kings Highway intersection operates at LoS A at all times, indicating that the intersection is operating with minimal delay conditions and well below capacity.

**Table 4.8**
**Kings Highway SIDRA Analysis - Background and Forecast Peak Hour Traffic Volumes**

| Peak Hour | Performance Indicator | | | |
|---|---|---|---|---|
| | DoS[1] | Delay (sec) | LoS[2] | Queue (m) |
| **Background Traffic (2019)** | | | | |
| 7:00am to 8:00am | 0.25 | 3.0 | A | 8.0 |
| 5:00pm to 6:00pm | 0.37 | 3.8 | A | 15.7 |
| **Forecast Traffic (2029)** | | | | |
| 7:00am to 8:00am | 0.34 | 3.4 | A | 12.3 |
| 5:00pm to 6:00pm | 0.46 | 4.4 | A | 27.6 |
| Note 1: DoS = Degree of Saturation.<br>Note 2: LoS = Level of Service. | | | | |
| Source: Constructive Solutions – After Tables 18 and 19. | | | | |

### 4.3.4 Management and Mitigation Measures

The Operator would implement the following management and mitigation measures in order to ensure that any traffic and transportation impacts associated with the Proposal are minimised.

- Undertake shoulder widening on Tarago Road at the intersection of the Site Access Road and Tarago Road to provide Basic Left (BAL) and Basic Right (BAR) turn treatments.

- Develop a Driver's Code of Conduct to reflect Proposal-related loading and transportation operations, including:
  - vehicle inspection and maintenance procedures;
  - vehicle operational requirements (e.g. covered loads, clear signage);
  - school bus routes and pick up / drop off times and locations; and
  - driver behaviour requirements and consequences for breaches of the code.
- Negotiate a suitable road maintenance agreement with Queanbeyan – Palerang Regional Council for transportation operations on Tarago Road in accordance with the relevant contributions policy.

### 4.3.5 Assessment of Impacts

Based on the assessment provided by Constructive Solutions (2020) and the proposed management and mitigation measures, it is assessed that the Proposal would not result in significant traffic and transport impacts.

As the Proposal does not include increased traffic volumes, it would not impact existing road network and intersection performance, increase traffic noise beyond existing levels, or adversely impact road safety, school and public transport services or pedestrians and cyclists along the transport routes (Constructive Solutions 2020).

Finally, transportation by means of other than the public road network would not be feasible.

## 4.4 Biodiversity

### 4.4.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify biodiversity as a key issue for assessment in the EIS. Matters to be addressed include:

- accurate predictions of any vegetation clearing on site;
- a detailed assessment of the potential biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems undertaken in accordance with Section 7.2 and 7.7 of the *Biodiversity and Conservation Act 2016*, and
- a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

EnviroKey Pty Ltd (EnviroKey) prepared a Biodiversity Development Assessment Report (BDAR) for the Proposal. The BDAR , hereafter referred to as EnviroKey (2020), is presented as **Appendix 6**. This subsection provides an overview of the BDAR and describes the operational safeguards and management measures to be implemented by the Operator.

### 4.4.2 Assessment Methodology

The BDAR was completed in accordance with the *Biodiversity Assessment Methodology* (BAM) (OEH, 2017). The assessment was prepared by Mr Steven Sass, an Accredited Assessor (BAAS17047) under the NSW *Biodiversity Conservation Act 2016* (BC Act).

The Biodiversity Study Area for the assessment included all land within the Project Site and the approved Extraction Area as well as the Butmaroo Creek channel and north-eastern bank, areas which may be subject to indirect impacts associated with the Proposal (**Figure 4.11**).

In accordance with the BAM, the BDAR included a desktop assessment and a field survey component. The desktop assessment included a review of relevant biodiversity values maps, threatened species databases, and State and Commonwealth environmental classifications.

A field survey of the Study area was undertaken by EnviroKey on 3 and 4 September 2019 and included the following components.

- Vegetation surveys, including:
  - the establishment of eight BAM plots/transects;
  - targeted threatened species survey for Button Wrinklewort conducted using transects across the Biodiversity Study Area; and
  - random meanders across the Biodiversity Study Area to opportunistically identify any relevant species (**Figure 4.11**).
- Fauna surveys, including:
  - targeted threatened species field survey for Striped Legless Lizard, involving both active searches and the establishment of artificial shelter sites, in accordance with the *Survey Guidelines for Australia's Threatened Reptiles* (SEWP&C 2011);
  - bird surveys, consisting of bird-specific survey periods during which observations and calls were recorded as well as opportunistic observations;
  - frog surveys, consisting of active searches and call broadcasting;
  - nocturnal surveys, consisting of call playback, spotlighting transects, and
  - echolocation call recording (**Figure 4.12**).

Due to the relatively small size of the Biodiversity Study Area, field surveys were conducted on foot using pedestrian transects.

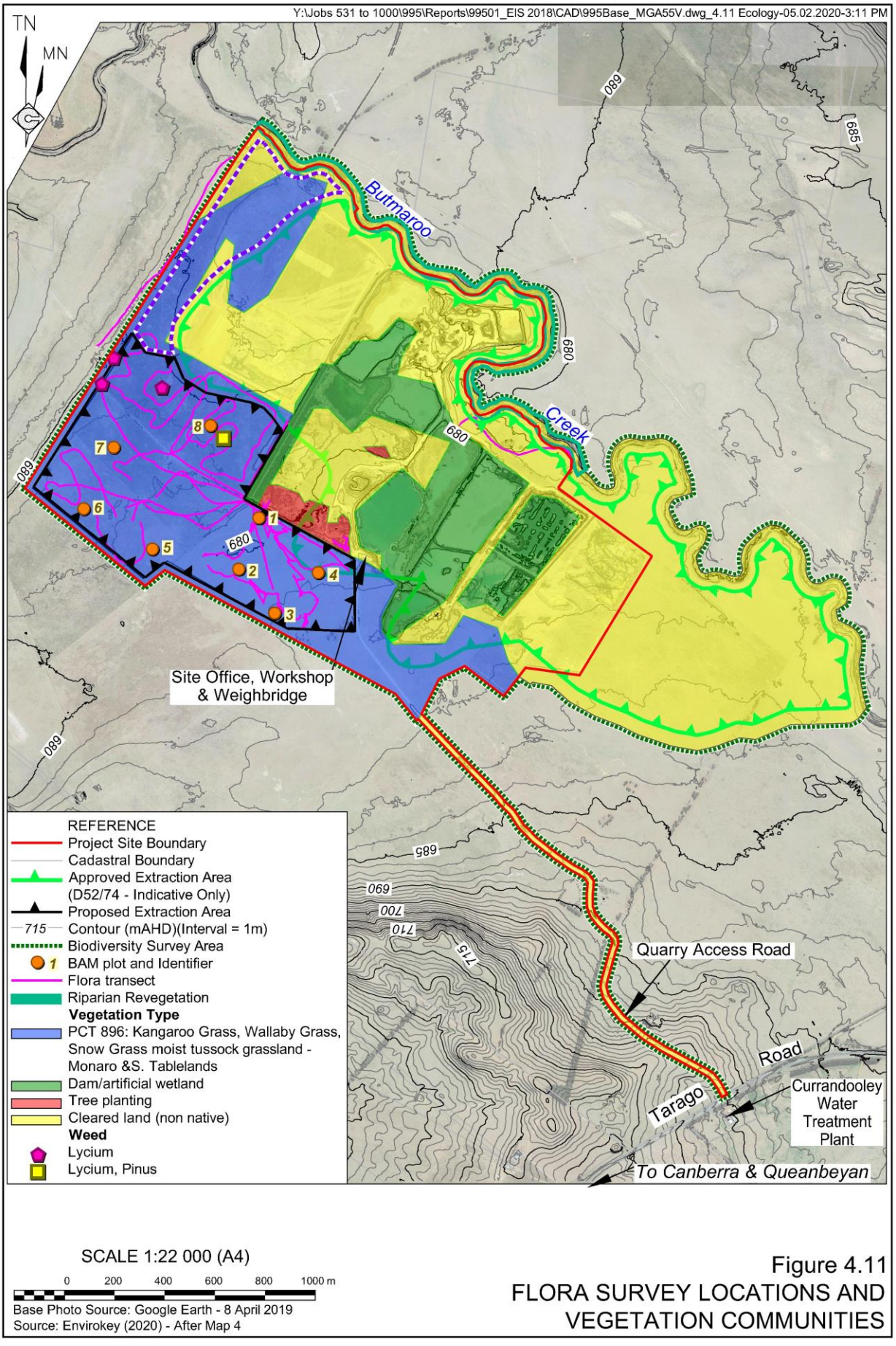



Figure 4.11
FLORA SURVEY LOCATIONS AND VEGETATION COMMUNITIES

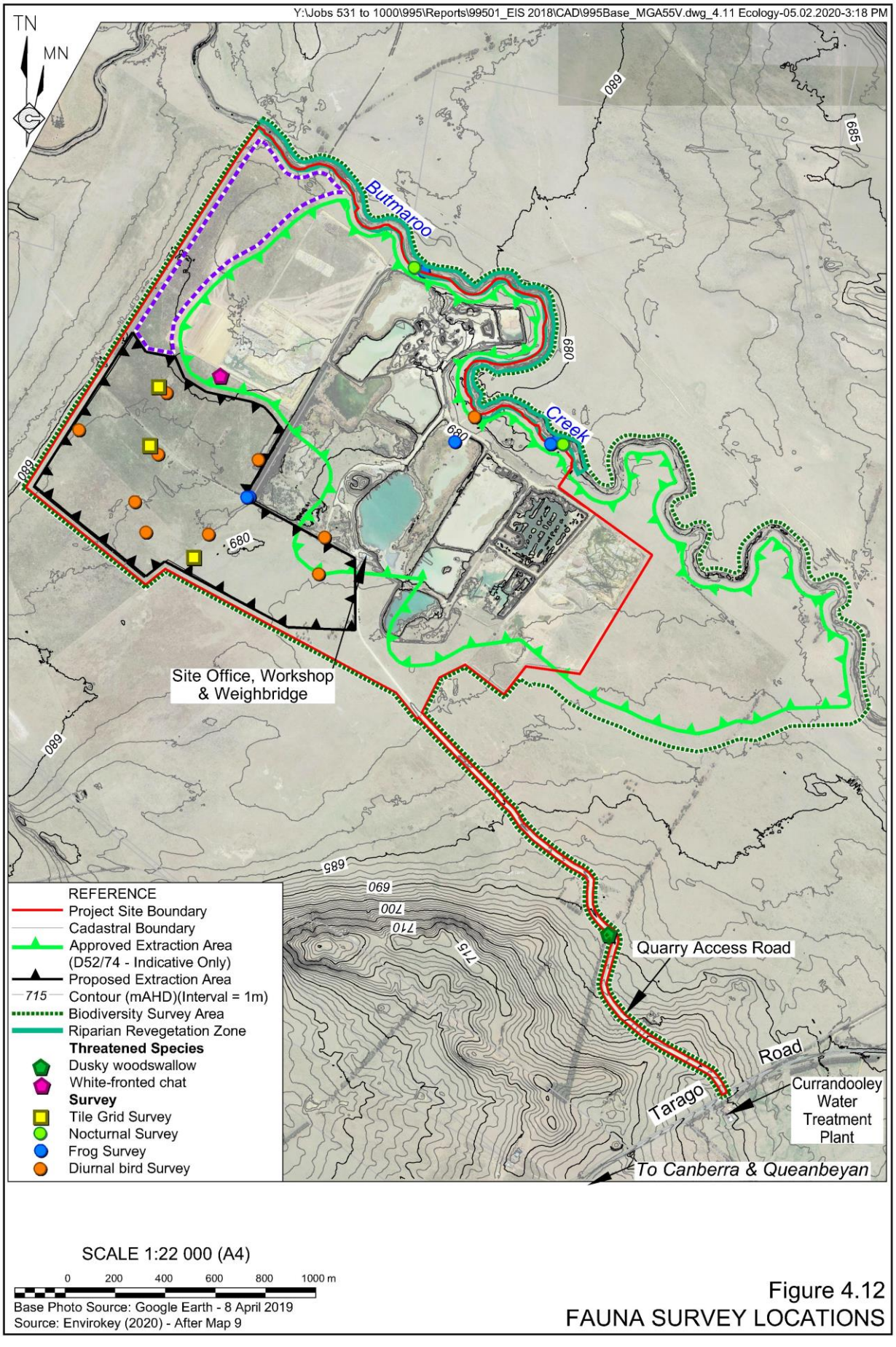



Figure 4.12
FAUNA SURVEY LOCATIONS

## 4.4.3 Existing Setting

### 4.4.3.1 Landscape Features

The Biodiversity Study Area is located within:

- the South East Highlands Bioregion and the Monaro Interim Biogeographical Regions of Australia (IBRA) subregion; and
- the Lake George Complex Mitchell Landscape.

Artificial habitat within the Biodiversity Study Area consists of existing Extraction Areas which form artificial ephemeral wetlands.

Butmaroo Creek, located approximately 800m north of the proposed Extraction Area, represents a highly modified drainage line which enters the southern end of Lake George approximately 1km to the northwest of the Biodiversity Study Area. EnviroKey (2020) note that the portion of Butmaroo Creek within the Biodiversity Study Area displays high levels of bank erosion and channel incision, with a channel width of approximately 10ms and steep banks between 3m and 4m high (**Plate 4.1**). Bank stability is likely to have been impacted by grazing land uses and historical land clearing activities within the broader catchment (EnviroKey, 2020).

**Plate 4.1**
**Butmaroo Creek in the Vicinity of the Existing Extraction Area**
**(Ref: E995A_077)**

Within the Butmaroo Creek channel, water occurred in isolated pools no greater than 1m deep at the time of the field survey (September 2019). The Operator notes that following the extended dry period in late 2019, prior to rainfall in mid-January 2020, no pools remained. No native vegetation cover, instream woody debris, or riffle habitat were observed, although exotic flora provided over 90% cover on bank surfaces (EnviroKey, 2020). Instream habitat consisted of

emergent aquatic flora representing approximately 20% coverage and submerged aquatic vegetation representing approximately 20% coverage (EnviroKey, 2020). Water quality was considered to be "relatively good" following visual inspections by EnviroKey (2020). Willows were observed to be present in upstream sections of Butmaroo Creek, with EnviroKey (2020) identifying willows becoming established within the Biodiversity Study Area.

No areas of outstanding biodiversity value as identified by the *Biodiversity Conservation Act 2016* (BC Act) occur within the Biodiversity Study Area (EnviroKey, 2020).

#### 4.4.3.2 Habitat Connectivity

EnviroKey (2020) note that the Biodiversity Study Area provides virtually no connectivity to surrounding areas due to the absence of native vegetation. Butmaroo Creek provides limited connectivity from upstream areas to Lake George, however flow within the creek channel is ephemeral.

Within a 1 500 metre buffer around the Biodiversity Study Area, representing an approximate area of 2 626ha, EnviroKey (2020) estimate that native vegetation cover is equal to less than 100ha or approximately 4% of the total area. Patch size within the single vegetation zone mapped by EnviroKey (2020) was therefore determined to be 100ha.

#### 4.4.3.3 Vegetation Communities

Vegetation mapping which covers the Biodiversity Study Area or the 1 500m buffer is limited to that provided in the Palerang Local Land Services Biometric_F_4209 vegetation dataset. The Biodiversity Study Area and adjacent areas represent highly modified landscapes, with historical land clearing activities and ongoing grazing land uses representing the primary source of disturbance.

EnviroKey (2020) determined that the Plant Community Type (PCT) which would most likely have occupied the Biodiversity Study Area prior to disturbance is PCT 896 - Kangaroo Grass – Wallaby Grass – Snow Grass moist tussock grassland in the Monaro and the Southern Tablelands regions of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion (PCT 896). PCT 896 is not listed as a Threatened Ecological Community under the BC Act.

#### 4.4.3.4 Threatened Species

**Table 4.9** presents a list of threatened species with the potential to occur within the Biodiversity Study Area. This list of candidate species was determined based on EnviroKey's experience and in accordance with the relevant BAM calculator criteria following an assessment of both geographic and habitat features as well as threatened species occurrence records. The candidate species are classified as belonging to either of the two following categories.

- Ecosystem Credit Species: species for which the likelihood of occurrence or the presence of potential habitat can be predicted based on vegetation proxies and landscape features, or species for which targeted surveys have a low probability of detection.

- Species Credit Species: species for which the likelihood of occurrence or the presence of potential habitat cannot be predicted based on vegetation proxies or landscape features and which can be reliably detected by targeted surveys.

**Table 4.9**
**Threatened Species with the Potenial to Occur**

| Common Name | Scientific Name | Ecosystem (E) or Species (S) Credit Species | Status | |
|---|---|---|---|---|
| | | | NSW[1] | Commonwealth[2] |
| Dusky Woodswallow | *Artamus cyanopterus* | E | Vulnerable | - |
| Flame Robin | *Petroica phoenicea* | E | Vulnerable | - |
| Large Bent-winged Bat | *Miniopterus orianae oceanensis* | E | Vulnerable | - |
| Scarlet Robin | *Petroica boodang* | E | Vulnerable | - |
| Striped Legless Lizard | *Delma impar* | S | Vulnerable | Vulnerable |
| Button Wrinklewort | *Rutidosis leptorrhynchoides* | S | Endangered | Endangered |
| Note 1: Status under the NSW *Biodiversity Conservation Act 2016*. Note 2: Status under the *Environment Protection and Biodiversity Conservation Act 1999*. | | | | |
| Source: EnviroKey (2020) – After Tables 3 and 5. | | | | |

## 4.4.4 Field Survey Results

### 4.4.4.1 Flora

A total of 28 flora species were recorded by EnviroKey (2020) during the field survey period, including 5 native species (one of which had been planted) and 23 exotic species. Two of the five native species, *Juncus sp.* and *Typha orientalis*, were located within the Butmaroo Creek channel. Two highly invasive weed species, *Nassella trichotoma* (Serrated Tussock) and to a lesser extent *Lycium ferocissimum* (African Boxthorn), were identified within the Biodiversity Study Area.

EnviroKey (2020) identified the following three vegetation communities, as well as one artificial habitat, within the Biodiversity Study Area (**Figure 4.11**).

- PCT 896 (see however discussion below).
- Planted tree vegetation.
- Cleared land (non-native)
- Dam/artificial wetland.

EnviroKey (2020) note that the recorded species richness, including the dominance of exotic species and the presence of highly invasive weed species, is considered typical of the area for sites which have been subject to disturbance associated with historical agricultural activities. A vegetation integrity score of 1.6/100 was assigned to the Biodiversity Study Area (EnviroKey, 2020). Given the definition of native vegetation provided in the *Local Land Services Act 2013* (LLS Act) and in support of the precautionary principle adopted for the BDAR assessment, EnviroKey (2020) have classified the proposed disturbance footprint as PCT 896.

A full list of flora species recorded within the Biodiversity Study Area is presented as Appendix 4 of EnviroKey (2020).

#### 4.4.4.2 Fauna

The following two threatened species were recorded by EnviroKey (2020) during the field survey period, both of which are ecosystem credit species.

- At least five individual Dusky Woodswallows (*Artamus cyanopterus*) were recorded on several occasions within a Radiata Pine (*Pinus radiata*) tree belt which crosses the existing Site Access Road (**Figure 4.12**). No individuals were recorded within the proposed Extraction Area.
- A single pair of White-fronted Chat (*Epthianura albifrons*), listed as Vulnerable under the BC Act and not listed under the EPBC Act, were recorded foraging to the north of the proposed Extraction Area within the existing approved Extraction Area (**Figure 4.12**).

A full list of fauna species recorded within the Biodiversity Study Area is presented as Appendix 5 of EnviroKey (2020).

### 4.4.5 Management and Mitigation Measures

The Applicant and/or Operator would implement the following management and mitigation measures to ensure that the Proposal would not have adverse impacts on biodiversity.

- Identify the limit of approved disturbance areas on the ground using permanent markers prior to commencing extraction.
- Ensure that all personnel are aware of approved areas of disturbance and of the legislative consequences of unapproved disturbance.
- Ensure that all ground-engaging machinery is cleaned prior to arriving at or departing the Project Site.
- Prepare and progressively implement a *Rehabilitation Plan* for the Proposal, outlining a final landform of artificial wetlands which include:
  - both shallow (10-15cm) and deep (more than 1.8m) wetland areas;
  - trees planted only on the southern and western sides of wetland areas to avoid excessive shading;
  - planted grassy areas adjacent to wetlands; and
  - plantings of sedges and rushes.
- Prepare and progressively implement a Riparian Revegetation Plan in consultation with the owner of Property 3 (see **Figure 4.5**) for that section of Butmaroo Creek adjacent to the Project Site (**Figures 4.11** and **4.12**), outlining proposed revegetation activities that would include progressive:
  - fencing of the Creek and adjacent banks and exclusion of stock;
  - revegetation of the banks of the Creek to re-establish native vegetation and habitat within and adjacent to the Creek.

- Ensure that surface water from disturbed sections of the Project Site is not permitted to flow to natural drainage to ensure the Proposal does not adversely impact upon aquatic flora and fauna within Butmaroo Creek.
- Manage weed species at the Quarry, with particular attention given to identified Weeds of National Significance and High Threat Exotic Species.

### 4.4.6 Assessment of Impacts

The proposed Extraction Area would result in the clearing and permanent loss of approximately 76.4ha of highly disturbed and modified vegetation currently subject to grazing activities. As the vegetation integrity score for the proposed Extraction Area (1.6/100) is below 17 and PCT 896 is associated with threatened species habitat represented by ecosystem credits, an offset for the proposed vegetation clearing is not required (EnviroKey, 2020).

The habitat types associated with threatened fauna species recorded within the Biodiversity Study Area, including degraded vegetation dominated by exotic species utilised by *Epthianura albifrons* (White-fronted Chat) and Radiata Pine tree belts utilised by *Artamus cyanopterus* (Dusky Woodswallow), are not limited to within the Biodiversity Study Area (EnviroKey, 2020). No threatened species were recorded within the proposed Extraction Area and no species credits are relevant to this area.

Due to the presence of the existing Quarry and nearby extractive industries, it is unlikely that the Proposal would have significant adverse impacts on adjacent vegetation and fauna habitat as a consequence of indirect impacts including noise, dust and edge effects. Additionally, EnviroKey (2020) note that whilst sections of the proposed Extraction Area are mapped as 'Terrestrial Biodiversity' under the Palerang LEP (see **Figure 3.1**), the Proposal would not have an adverse impact on matters required to be considered under Part 6.3(3) of the Palerang LEP as the Proposal:

- occupies an area of highly disturbed and modified vegetation with a very low vegetation integrity score;
- would not affect any listed threatened species;
- would not affect connectivity through the isolation or fragmentation of habitat areas; and
- would not remove habitat important to the long-term viability of flora and fauna in the vicinity of the Quarry.

## 4.5 Surface Water Resources

### 4.5.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify water as a key issue for assessment in the EIS. Matters to be addressed include:

- a detailed site water balance and an assessment of any volumetric water licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;

- identification of any licensing requirements or other approvals required under the *Water Act 1912* and/or *Water Management Act 2000*;
- demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)
- a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo;
- an assessment of activities that could cause erosion or sedimentation issues, and the proposed measures to prevent or control these impacts;
- an assessment of any likely flooding impacts of the development;
- an assessment of potential impacts on the quality and quantity of existing surface and ground water resources;
- a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts;

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed

The following sub-sections have been prepared by RW Corkery & Co Pty Limited and consider the existing surface water environment, the potential impacts related to surface water, proposed management and mitigation measures and assessment of surface water-related impacts. Section 2.6.3 presents an overview of the management of operational and process water.

## 4.5.2 Existing Environment

### 4.5.2.1 Hydrological Setting

Regional, local and Project Site drainage is described in Section 4.1.2 and **Figures 4.1** to **4.3**. In summary, the existing surface water environment may be summarised as follows.

- The Project Site occurs within the Lake George Catchment, an internally draining catchment.
- The Project Site is located adjacent to Butmaroo Creek, a sixth order stream, with its headwaters on the southeastern section of the Lake George Catchment. The area of the Butmaroo Creek Catchment up stream of its confluence with Lake George is approximately 176km$^2$. Butmaroo Creek in an ephemeral, highly disturbed creek.
- Within the Project Site surface water flows are typically overland flows, with slopes in places substantially less than 1% resulting in significant ponding of surface water following substantial rainfall.
- Disturbed sections of the Project Site are bunded, with clean water flows diverted around the site, while potentially sediment-laden water within the Project Site is not permitted to be discharged from site.

- During the Operator's long association with the Project Site and experience since the commencement of extraction operations in 1975, flooding has not impacted on the operation of the existing Quarry. Similarly, the Quarry has not resulted in altered flood behaviour that has adversely impacted on surrounding landholders or the stability of the Creek.
- Prior extraction operations have resulted in the establishment of a number of ponds and artificial wetlands. These are used as part of the existing operational water management system.

RWC prepared a Surface Water Monitoring Procedure in September 2019. That Procedure identifies two surface water sampling locations within Butmaroo Creek, one immediately upstream and one immediately downstream of the existing Extraction Area. The Procedure requires samples to be collected on the first working day of each month when there is flow in the Creek. If there is no flow, no samples are to be taken. The Creek is to be reinspected following rainfall anywhere within the catchment and if flow is observed, samples are to be collected at that time. The Creek has not flowed between September 2019 and finalisation of this document.

#### 4.5.2.2 Water Sharing Plan and Licences

The Project Site lies within the Lake George Water Source under the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012*. The Water Sharing Plan identifies that stock and domestic water rights within the Lake George Water Source account for approximately 178ML of water per year. A search of the NSW Water Register maintained by WaterNSW indicates that 13 Water Access Licences (WALs) have been issued under the Lake George Water Source for a total of 403.5 shares. **Table 4.10** presents available information for each WAL. The Operator holds WAL33014 and associated Works Authority 40WA413508 with an allocation of 3 shares. The Works Authority permits extraction of water from Butmaroo Creek.

The Proposal would not require additional surface water or water allocations under the above Water Sharing Plan.

**Table 4.10**
**WALs issued under the Lake George Water Source**

| WAL | Share Component[1] | Purpose | Associated Works Approval | Location |
|---|---|---|---|---|
| 33016 | 79 | Irrigation | 40CA413498 | Lot 2, DP 548291 |
| 33013 | 9 | Irrigation | 40CA413500 | Lot 3, DP 876579 |
| 33018 | 14 | Irrigation | 40CA413502 | Lot 2, DP 1119227 |
| 33022 | 14 | Irrigation | 40CA413504 | Lot 1, DP 743064 |
| 33023 | 25 | Irrigation | 40CA413506 | Lot 1, DP 812981 |
| 33014 | 3 | Not specified | 40WA413508 | Lot 31, DP 634213 |
| 33019 | 26 | Not specified | Not specified | |
| 33020 | 2.5 | Irrigation | 40CA413512 | Lot 1, DP 817342 |
| 33017 | 154 | Irrigation | 40CA413515 | Lot 3, DP 876579 |
| 33024 | 4 | Irrigation | 40CA413517 | Lot 73, DP 754873 |
| 35290 | 7 | Not specified | 40WA414693 | Lot 21, DP 1044788 |
| 33021 | 5 | Irrigation | 70CA614363 | Lot 5, DP 717984 |
| 33015 | 61 | | | |
| **Total** | **403.5** | | | |
| Note 1: One Share Component typically permits extraction of 1ML of water per annum. | | | | |
| Source: WaterNSW Water Register – accessed 4 January 2020 | | | | |

### 4.5.3 Management and Mitigation Measures

The Operator would implement the following management and mitigation measures to ensure that the Proposal would not have adverse impacts on surface water.

- Ensure that active sections of the Project Site are fully bunded and potentially sediment laden water is not permitted to be discharged to natural drainage. As the Operator proposes that disturbed sections of the Project Site would be a nil-discharge site, no *Erosion and Sediment Control Plan* would be required.
- Ensure that water extracted from Butmaroo Creek is extracted in accordance with the existing WAL and Works Authority. In the event that insufficient water is available for processing of dust suppression operations, reduce or cease such operations until a suitable, licences water source is obtained.
- Ensure that the existing Surface Water Monitoring Procedure is fully implemented throughout the life of the Proposal.
- Engage a suitably qualified and experienced person to prepare a Riparian Revegetation Plan in consultation with the owner of Property 3 (see **Figure 4.5**) for that section of Butmaroo Creek adjacent to the Project Site (**Figures 4.11** and **4.12**), outlining proposed progressive revegetation activities including:
  - fencing of the Creek and adjacent banks and exclusion of stock;
  - revegetation of the banks of the Creek to re-establish native vegetation and habitat within and adjacent to the Creek.

  Ensure that the Riparian Revegetation Plan is progressively implemented as climatic conditions permit during the initial 3 years of the Proposal.

### 4.5.4 Assessment of Impacts

The Proposal would not result in additional adverse surface water impacts for the following reasons.

- The Proposal would not result in an intensification of the existing approved operations, with the proposed rate of extraction and processing largely unchanged from the existing rate.
- All water required for processing and dust suppression purposes would continue to be obtained from existing on-site and licenced water sources.
- Disturbed sections of the Project Site would continue to be bunded and potentially sediment-laden water would not be permitted to be discharged to natural drainage. Similarly, site bunding would prevent surrounding surface waters, including flood waters, from flowing into the active operational areas.
- The Proposal would not result in additional disturbance in the vicinity of Butmaroo Creek and there would be no change to the existing flow and flooding regime for the Creek.

Indeed, the Operator notes that the Proposal would likely result in an improved surface water environment for the following reasons.

- The Applicant and/or Operator would, in consultation with the owner of Property 3, establish riparian vegetation on both banks of Butmaroo Creek adjacent to the existing Extraction Area, resulting in improved riparian habitat in an area that is otherwise heavily degraded.
- The Operator would establish a series of wetlands that would provide habitat for a range of wetland species, including birds, fish and amphibians.
- The Operator would monitor water quality within Butmaroo Creek upstream and downstream of the existing Extraction Area, ensuring that water quality within the Creek remains unchanged as it flows past the Project Site.

## 4.6 Groundwater

### 4.6.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify water as a key issue for assessment in the EIS. Matters to be addressed are identified in Section 4.5.1.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed

This sub-section has been prepared by RW Corkery & Co Pty Limited and considers the existing groundwater environment, proposed management and mitigation measures and assessment of groundwater-related impacts.

### 4.6.2 Existing Environment

#### 4.6.2.1 Hydrogeological Setting

The geological setting of the Project Site is described in Section 1.5.3. In summary, the Project Site is underlain by a series of sedimentary units, including:

- alluvial and colluvial sediments;
- lake sediments;
- strandline sediments associated with former lakeshore deposits; and
- aeolian or wind-blown deposits.

Douglas Partners (2006) and (2017) determined that the material within the proposed Extraction Area included variably interbedded clay, silt, sand and gravel. The Applicant and Operator note that the sediments within and surrounding the existing and proposed Extraction Areas are typically highly variable over short distances, with sand, silt and clay-rich layers from several centimetres to several metres thick common. Each layer may also vary laterally over scales of several metres to tens of metres. **Plate 1.1** presents a typical extraction face, with interbedded, light-coloured sandy units separated by darker, clay-rick units.

As a result, the conceptual hydrogeological model for the Project Site may be described as follows.

- The aquifer underlying the proposed Extraction Area comprises thin and laterally discontinuous zones of permeable sand-rich and impermeable silt and clay-rich material.
- Where the permeable sand-rich layers are saturated, it is likely that the volume of contained water is limited and, once removed during extraction operations, intervening layers of impermeable or low-permeability material would limit the lateral flow of groundwater into the excavation.
- The transmissivity of the aquifer is likely to be very limited, with numerous, short scale impermeable layers separating layers of higher permeability. As a result, transfer of groundwater through the aquifer is likely to be limited

The Applicant and Operator note that this conceptual model is consistent with observations at the Project Site. As described in Section 2.6.3.2, the Operator under average climatic conditions pumps approximately 5.2ML of water per year from the active Extraction Area. This includes:

- incident rainfall within the Extraction Area;
- seepage from the adjacent Process Water Ponds; and
- seepage of groundwater from the surrounding aquifer.

Under the drought conditions that applied in late-2019, the Operator pumped at a rate that was approximately 1/3 of the average rate, or 1.4ML per year. During this period, incident rainfall was limited and, for the purposes of this assessment, it has been assumed that the pumped water comprised a mixture of seepage from the adjacent Process Water Ponds and groundwater.

Based on available information, it is not possible to determine what proportion of the 1.4ML per year comprises seepage from the adjacent Process Water Ponds and what proportion is seepage of groundwater from the surrounding aquifer. However, the Applicant and Operator note that the current Extraction Area is located 30m from the existing Process Water Pond. The elevation difference between the water level within the Pond and the floor of the Extraction Area is in excess of 10m. Notwithstanding this close proximity and substantial head, the volume of water removed from the active Extraction Area during late 2019 is not substantial. This fact supports the conceptual hydrogeological model and assumed limited aquifer transmissivity.

#### 4.6.2.2 Surrounding Groundwater Users

The WaterNSW Groundwater Database was accessed on 14 January 2020 date and identified 16 registered bores within 3km of the Project Site. **Figure 4.13** and **Table 4.11** present available information in relation to the registered bores. In summary, the registered bores typically had multiple water bearing zones consistent with the conceptual hydrogeological model. Standing water levels were typically shallow, around 3m below ground level, with two exceptions with standing water levels 11m and 54m below ground level.

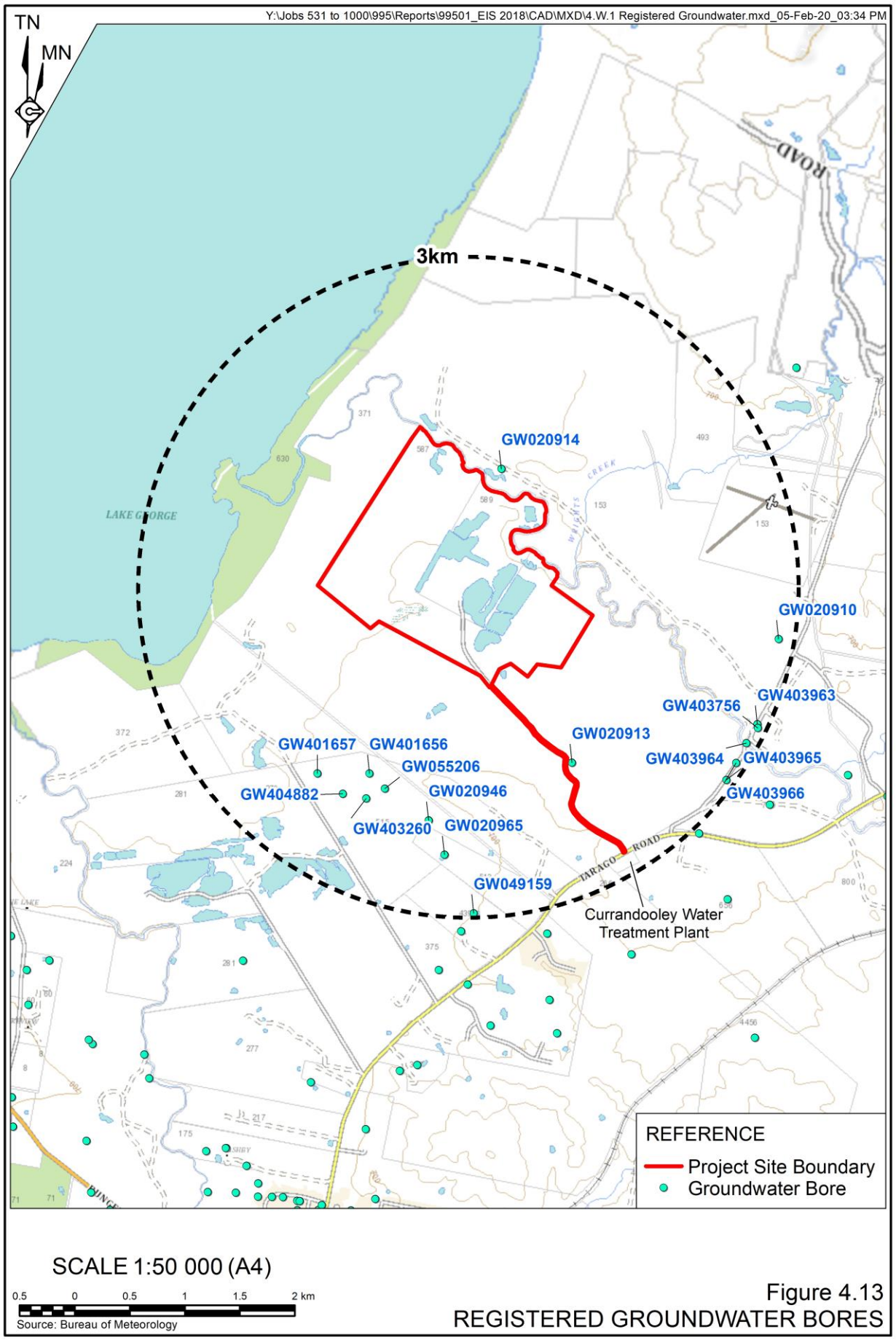



Figure 4.13
REGISTERED GROUNDWATER BORES

**Table 4.11**
**Registered Groundwater Bores in the Vicinity of the Project Site**

| Bore ID | Depth (m) | Yield (L/s) | Purpose | Water Bearing Zone(s) (m) | SWL (mbgl) |
|---|---|---|---|---|---|
| GW020914 | 34.4 | - | - | 9.1, 3.2, 34.4 | - |
| GW020910 | 17.7 | - | - | 17.7 | 3.7 |
| GW403963 | 40.0 | 20 | Test Bore | 23.0 – 30.0 | 3.0 |
| GW403756 | 43.5 | - | Water Supply | - | - |
| GW403964 | 41.0 | 20 | Test Bore | 31.0 – 41.0 | 3.0 |
| GW403966 | 36.0 | 30 | Test Bore | 10.0 – 15.0, 15.0 – 36.0 | 3.0 |
| GW403965 | 24.0 | 2 | Test Bore | 5.0 – 6.0, 19.0 – 24.0 | 3 |
| GW020913 | 61.3 | - | - | 25.9, 39.0, 52.7, 61.3 | - |
| GW049159 | 84.0 | - | Stock, Domestic | 61.0 – 61.3, 63.1 – 63.3 | 54.0 |
| GW020965 | 11.0 | - | Stock | - | - |
| GW020946 | 11.0 | - | Stock | 11.0 | - |
| GW055206 | 22.9 | - | Stock, Domestic | 10.7 – 11.0, 18.3 – 18.6 | - |
| GW403260 | 47.0 | | Domestic | - | - |
| GW401656 | 28.5 | 0.38 | Stock, Domestic | 21.0 – 24.0 | - |
| GW404882 | 72.0 | 2.66 | Stock, Domestic | 32.0 – 34.0, 50.0 – 51.0 | 11.0 |
| GW401657 | 42.0 | - | Domestic | - | - |
| GW020914 | 34.4 | - | - | 9.1, 3.2, 34.4 | - |

Note 1: SWL = Standing water level (metres below ground level).

Source: WaterNSW Groundwater Database – Accessed 14 January 2020 and BOM Australian Groundwater Explorer – Accessed 5 February 2020.

The closest registered bore is GW020914, located approximately 200m to the north of the Project Site on land registered to LA Mora and CV Osborne, related parties to the Applicant. The owners of this bore advise that the bore is used infrequently and that its operation would not appear to be adversely impacted by the existing operation.

Bore GW403756, located approximately 2.75km from the proposed Extraction Area, is listed as a water supply bore and it is assumed that this bore supplies water to the Currandooley Water Treatment Plant. This bore is located in close proximity to Butmaroo Creek and is assumed to access the alluvial aquifer associated with the Creek.

#### 4.6.2.3 Surrounding Groundwater Dependent Ecosystems

The Bureau of Meteorology Groundwater Dependent Ecosystem Atlas identifies Butmaroo Creek as an area of High Potential for Groundwater Dependent Ecosystems. As identified in Section 4.5.2.1, Butmaroo Creek is an ephemeral watercourse that typically flows following rainfall only. Standing pools are typically present between rainfall events, but during the very dry period in late 2019, these also dried up. EnviroKey (2020) describe the Creek as a highly modified watercourse with high levels of bank erosion and channel incision and limited to no riparian vegetation.

Lake George is identified as having Moderate Potential for Groundwater Dependent Ecosystems.

#### 4.6.2.4 Water Sharing Plan and Licences

The Project Site lies within the Bungendore Alluvial Groundwater Source under the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* (the Water Sharing Plan). The Water Sharing Plan identifies that stock and domestic water rights within the Lake George Water Source account for approximately 25ML of water per year. A search of the NSW Water Register maintained by WaterNSW indicates that six WALs have been issued for the Bungendore Alluvial Groundwater Source for a total of 1,238 shares. **Table 4.12** presents available information for each WAL. Neither the Applicant nor the Operator hold a licence under the Bungendore Alluvial Groundwater Source.

**Table 4.12**
**WALs issued under the Bungendore Alluvial Groundwater Source**

| WAL | Share Component[1] | Category | Associated Works Approval | Location | Registered owner of Land |
|---|---|---|---|---|---|
| 32744 | 705 | Aquifer | 40CA412629 | Lot 3, DP876579 | Davey Family |
| 32743 | 29 | Aquifer | 40CA412633 | Lot 170, DP 754893 | Davey Family |
| 36132 | 2 | Aquifer | 40WA415813 | Lot 21, DP 715621 | Holcim Australia |
| 36178 | 30 | Aquifer | 40CA415883 | Lot 21, DP 835671 | V Suraci |
| 36260 | 150 | Water Utility | 40CA415918 | Lot 1, DP 1154765 | |
| 32742 | 322 | Water Utility | 40CA412631 | Lot 23, DP 800095 | |
| **Total** | **1238** | | | | |
| Note 1: One share component typically permits extraction of 1ML of water per annum. | | | | | |
| Source: WaterNSW Water Register – accessed 4 January 2020 | | | | | |

WAL36260 and WAL32742, with a combined allocation of 472 shares. are issued for the purposes of "Local Water Utility" and are therefore not available for trading. WAL36260 is associated with the Currandooley Water Treatment Plant, located on Tarago Road opposite the Site Entrance.

The remaining four WALs are associated with land held by Holcim Australia, V Suraci and the Davy Family. The Applicant has consulted with the latter two licence holders and those consultations are ongoing.

Finally, it is noted that the Bungendore Alluvial Groundwater Source was not included in the controlled allocation order released by WaterNSW on 8 October 2019.

In light of the above and the fact that the Operator estimates that groundwater inflows to the existing Extraction Area over less than 1.4ML per year, the Operator contents that a Works Authority and associated WAL are not required for the Quarry. Alternatively, should a future allocation in the Bungendore Alluvial Groundwater Source be made available, the Operator would make an application for sufficient allocation to allow for the estimated groundwater inflow of less than 1.4ML per year.

### 4.6.3 Management and Mitigation Measures

The Operator would implement the following management and mitigation measures to mitigate the potential for adverse groundwater-related impacts.

- Ensure that the volume of all water pumped from the Extraction Area is monitored.
- Ensure that daily rainfall records are maintained for the Project Site to enable an accurate estimate of the proportion of water pumped from the Extraction Area that is groundwater.
- Refuel, where practicable, all equipment within designated, sealed areas of the Project Site.
- Ensure that all hydrocarbons and any other chemicals stored on site are stored within a bunded and covered storage area or in self bunded tanks.
- Ensure that should a suitable allocation within the Bungendore Alluvial Groundwater Source become available that an application of a Works Authority and Water Access Licence is submitted to Water NSW.

### 4.6.4 Assessment of Impacts

Section 2.6.3.2 and 4.6.2.1 presents the estimated rate of groundwater flow into the existing Extraction Area. In summary the Operator estimates that approximately 1.4ML per year of combined process water pond seepage and groundwater seepage is pumped from the Extraction Area.

The Operator contends that the Proposal would not result in adverse groundwater impacts for the following reasons.

- The aquifer to be disturbed is characterised by small, isolated layers of sandy material with moderate porosity and permeability separated by layers of clay and silt with poor to no permeability. As a result, measured rates of groundwater inflow to the existing Extraction Area are low (less than 1.4ML per year).
- The Proposal does not represent an intensification of the existing, approved operation, with the area of the active Extraction Area, rate of extraction and anticipated rate of groundwater inflow to the Extraction Area expected to remain largely unchanged.
- The Proposal would not result in discharge of poor quality water to the surrounding aquifer. As a result, there would be no adverse impacts on groundwater quality.
- Given the limited interconnection of sandy layers with moderate permeability, the zone of groundwater drawdown surrounding the proposed Extraction Area would be limited. As a result, there would be no adverse impacts to surrounding groundwater users, including bores associated with the Currandooley Water Treatment Plan.
- The Proposal would not result in reduced discharge of groundwater to Butmaroo Creek or adverse impacts to any associated groundwater dependent ecosystems because the proposed extraction operations would be undertaken approximately 800m from the Creek, substantially further than the existing approved operations.

# 4.7 Noise and Vibration

## 4.7.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify noise as a key issue for assessment in the EIS. Matters to be addressed include a quantitative assessment of the likely construction and operational noise and off-site transport noise impacts of the development in accordance with the *Interim Construction Noise Guideline, NSW Noise Policy for Industry* and *NSW Road Noise Policy* respectively. The assessment is to give particular attention to potential noise impacts on any nearby private receivers due to construction activities, the operation of the quarry and/or road haulage.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

A noise and vibration impact assessment for the Proposal was undertaken by Spectrum Acoustics Pty Limited. The resulting report is presented as **Appendix 7**. The outcomes of that assessment are presented in this subsection with the report hereafter referred to as Spectrum (2020).

## 4.7.2 Existing Environment

The noise environment surrounding the Project Site is typical of a rural setting, with some industrial noise from the existing quarries, including from within the Project Site. The noise which is currently audible at surrounding residences includes the following.

- Industrial noise from sand quarrying operations.
- Traffic on local roads, particularly Tarago Road.
- Agricultural and rural noises such as farm machinery, stock, birds and insects.
- Domestic noises such as lawn mowers, pumps, dogs, etc.
- Wind generated noises such as wind in trees.

As a result, Spectrum (2020) determined that the default *Noise Policy for Industry 2017* (NPI) background noise levels for the purpose of the noise assessment would apply, namely:

- 35dB(A) Leq (15 min) during the daytime (7:00am to 6:00pm); and
- 30dB(A) Leq (15 min) during the night-time (10:00pm to 7:00pm).[1]

## 4.7.3 Surrounding Residences

The residences surrounding the Project Site are presented in **Figure 4.5**. Operational noise levels were modelled to receivers R1 to R10. Predicted operational noise levels at Residence R8 were taken as a proxy for noise levels within the Buckingham large lot residential subdivision comprising Residences R11 to R22. Residence R22 was considered in the assessment of road traffic noise on Tarago Road.

[1] The only activities proposed during the night-time would be during the morning shoulder period from 6:00am to 7:00am.

## 4.7.4 Environmental Noise Criteria

### 4.7.4.1 Meteorology

Spectrum (2020) states that the atmospheric conditions most relevant to noise assessments are temperature inversions, gentle winds (indicative of possible wind shear) and relative humidity. The *NSW Noise Policy for Industry* 2017 (NPI) states wind effects need to be assessed where source to receiver winds (at 10m height) of 3m/s or below occur for 30% or more of the time in any season in any assessment period.

Spectrum (2020) assessed annual and seasonal wind roses for Canberra Airport and found that wind speeds up to 3m/s occurred significantly less than 30% of the time from all directions (**Figure 4.4**). As a result, adverse winds were not considered in the assessment.

Two atmospheric scenarios were considered for the noise modelling as follows.

- Neutral Scenario: Prevailing condition of neutral atmosphere (20°C, no wind). As extremes of relative humidity (RH) are rarely experienced during daytime hours, a value of 70% RH was adopted.
- Adverse Scenario: In the absence of atmospheric stability class data, a conservative approach has been adopted where a $+4^0$C/100m temperature inversion has been modelled to account for the proposed night-time operating times earlier than 7:00am. Air temperature was modelled at $5^0$C at 85% RH.

### 4.7.4.2 Existing Acoustic Environment

The default NPI defined minimum Rating Background Levels (RBL) for noise of 30dB(A) (6:00am – 7:00am) and 35dB(A) (7:00am – 6:00pm) were adopted for the purposes of setting project noise trigger levels.

### 4.7.4.3 Project Noise Trigger Levels

The potential noise generated by the Proposal was assessed against the Intrusiveness and Amenity criteria as required by the NPI.

The Intrusiveness Criterion limits the Equivalent Continuous Noise Level (Leq) from industrial sources to a value of 'background plus 5dB'. That is, the RBL for the time period, plus 5dB(A).

The Amenity Criterion aims to prevent excessive noise levels in areas of increasing development. Amenity criteria are dependent upon the nature of the receiver area and the existing level of industrial noise.

Time periods for assessment as defined by the NPI are:

- Daytime – 7:00am (8:00am on Sundays) to 6:00pm;
- Evening – 6:00pm to 10:00pm; and
- Night – 10:00pm to 7:00am (8:00am on Sundays).

Adoption of the default minimum RBL results in a minimum intrusiveness criteria of 35dB(A),$L_{eq(15min)}$ (6:00am – 7:00am) and 40dB(A),$L_{eq(15min)}$ (7:00am – 6:00pm). Spectrum (2020) state that if compliance is predicted during the worst case night period, then it can be reasonably assumed that compliance is assured for the day period and for neutral atmospheric conditions.

#### 4.7.4.4 Cumulative Noise Levels

In accordance with the NPI the cumulative amenity noise limit was set as 45dB(A),$L_{eq(day)}$ and 35dB(A),$L_{eq(night)}$, with the worst case night time period under inversion conditions trigger level as 38dB(A),$Leq_{(15min)}$.

#### 4.7.4.5 Maximum Noise Levels

The potential for sleep disturbance from maximum noise level events from the Proposal during the night-time period was assessed. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

The maximum noise level emissions were assessed against the following criteria.

- 40dB(A),$L_{Aeq(15min)}$ or the prevailing RBL plus 5dB, whichever is the greater, and/or
- 52dB(A),$L_{AFmax}$ or the prevailing RBL plus 15dB, whichever is the greater

#### 4.7.4.6 Traffic Noise

For vehicles travelling on a public road the *NSW Road Noise Policy* (RNP) criteria must be adopted. Roads along the proposed transportation route to the south of the Site Access Road are classified as sub-arterial roads, while roads to the north of the Site Access Road are classified as local roads for the purpose of the road noise assessment.

**Table 4.13** shows the relevant noise criteria for local and sub-arterial roads as defined by the RNP.

**Table 4.13**
**Road Traffic Noise Criteria**

| Situation | Recommended Criteria | |
|---|---|---|
| | Day (7:00am to 10:00pm) | Night (10:00pm to 7:00am) |
| Existing residences affected by additional traffic on existing freeway/ arterial/sub-arterial roads generated by land use developments | Leq (15-hour) 60 | Leq (9-hour) 55 |
| Existing residences affected by additional traffic on local roads generated by land use developments | Leq (1-hour) 55 | Leq (1-hour) 50 |
| Source: Spectrum (2020) – after Table 4 | | |

### 4.7.5 Assessment Methodology

Two worst case noise scenarios were modelled by Spectrum (2020) using the Renzo Tonin Associates Environmental Noise Model (ENM v3.06).

- Scenario 1 – extraction of material at natural ground level in Cells E2 – E4, operation of the Sand Classifying plant at its current location and product haulage trucks using the site access road (**Figure 4.14**). The maximum production rate of 400 000tpa was assumed.
- Scenario 2 – extraction of material at natural ground level in Cells E8 – E10, operation of a bulldozer on rehabilitation in cell E5, operation of the Sand Classifying plant (**Figure 4.15**). Site infrastructure area at its current location in the northwest corner of the Project Site. Product haulage trucks using the site access road. Maximum production rate 400 000 tonnes per annum.

#### 4.7.5.1 Noise Sources

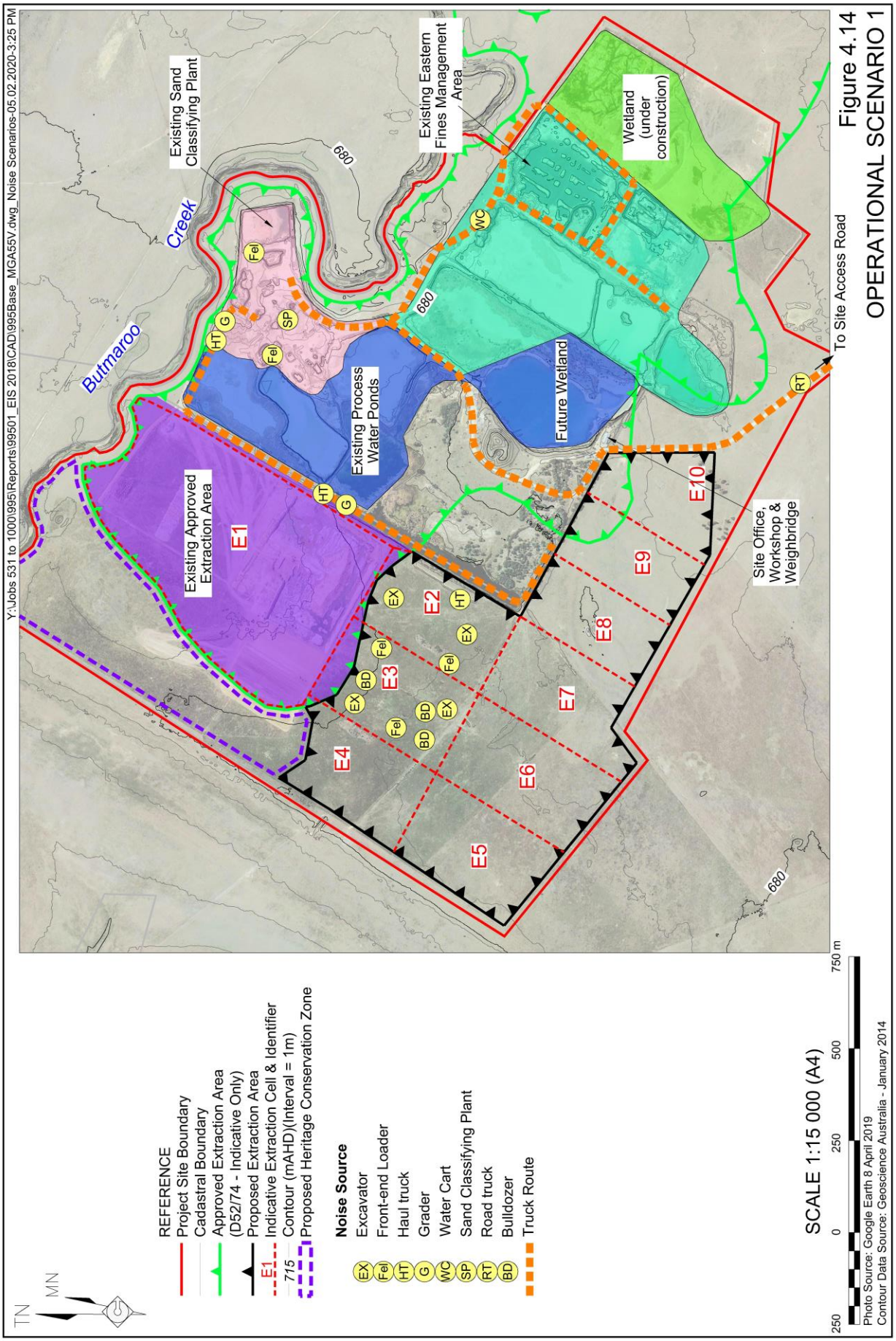
The sound power levels of the significant noise-generating equipment used in the modelling of each scenario are listed in **Table 4.14**.

**Table 4.14**
**Noise Source Sound Power Levels**

| Equipment | Number | Use/Activity | Source height, m | Lw, dB(A) | |
|---|---|---|---|---|---|
| | | | | Leq | Lmax |
| Hydraulic Excavator 30-35t | 4 | Resource extraction and haul truck loading | 5 | 108 | 112 |
| Bulldozer (Caterpillar D9T or similar) | 1 | Resource extraction (ripping/pushing), site works | 3 | 106 | 109 |
| Front-end Loader 25t | 5 | Haul truck and product truck loading | 2 | 110 | 112 |
| Articulated Haul Truck 40t | 3 | Raw material haulage to processing area | 3 | 98 | 112[#] |
| Water Truck (Minimum 12 000 L) | 1 | Dust suppression activities | 3 | 108 | 113 |
| Sand processing plant | 1 | Crushing and screening of raw material | 5 | 113 | 116 |
| Product truck | - | Hauling product to market | 2 | 96[1] | 102/112[2] |
| Grader | 1 | Internal road maintenance | 2 | 96 | 100 |
| Note 1: 15-minute Leq per 350m of access road at 400000tpa. | | | | | |
| Note 2: 102dB(A) on site access road, 112dB(A) impact from truck being loaded. | | | | | |
| Source: Spectrum (2020) – Table 5 | | | | | |

#### 4.7.5.2 Road Traffic Noise

Spectrum (2020) assessed road traffic noise using the methodology described in the US Environmental Protection Agency document No. 550/9-74-004 *Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974.*


Y:\Jobs 531 to 1000\995\Reports\99501_EIS 2018\CAD\995Base_MGA55V.dwg_Noise Scenarios-05.02.2020-3:25 PM
Existing Sand Classifying Plant
Existing Eastern Fines Management Area
Wetland (under construction)
Butmaroo Creek
Existing Process Water Ponds
Future Wetland
Existing Approved Extraction Area
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
680
To Site Access Road
Site Office, Workshop & Weighbridge
Figure 4.14
OPERATIONAL SCENARIO 1
REFERENCE
Project Site Boundary
Cadastral Boundary
Approved Extraction Area (D52/74 - Indicative Only)
Proposed Extraction Area
Indicative Extraction Cell & Identifier
Contour (mAHD)(Interval = 1m)
Proposed Heritage Conservation Zone
Noise Source
Excavator
Front-end Loader
Haul truck
Grader
Water Cart
Sand Classifying Plant
Road truck
Bulldozer
Truck Route
TN
MN
SCALE 1:15 000 (A4)
250 0 250 500 750 m
Photo Source: Google Earth 8 April 2019
Contour Data Source: Geoscience Australia - January 2014

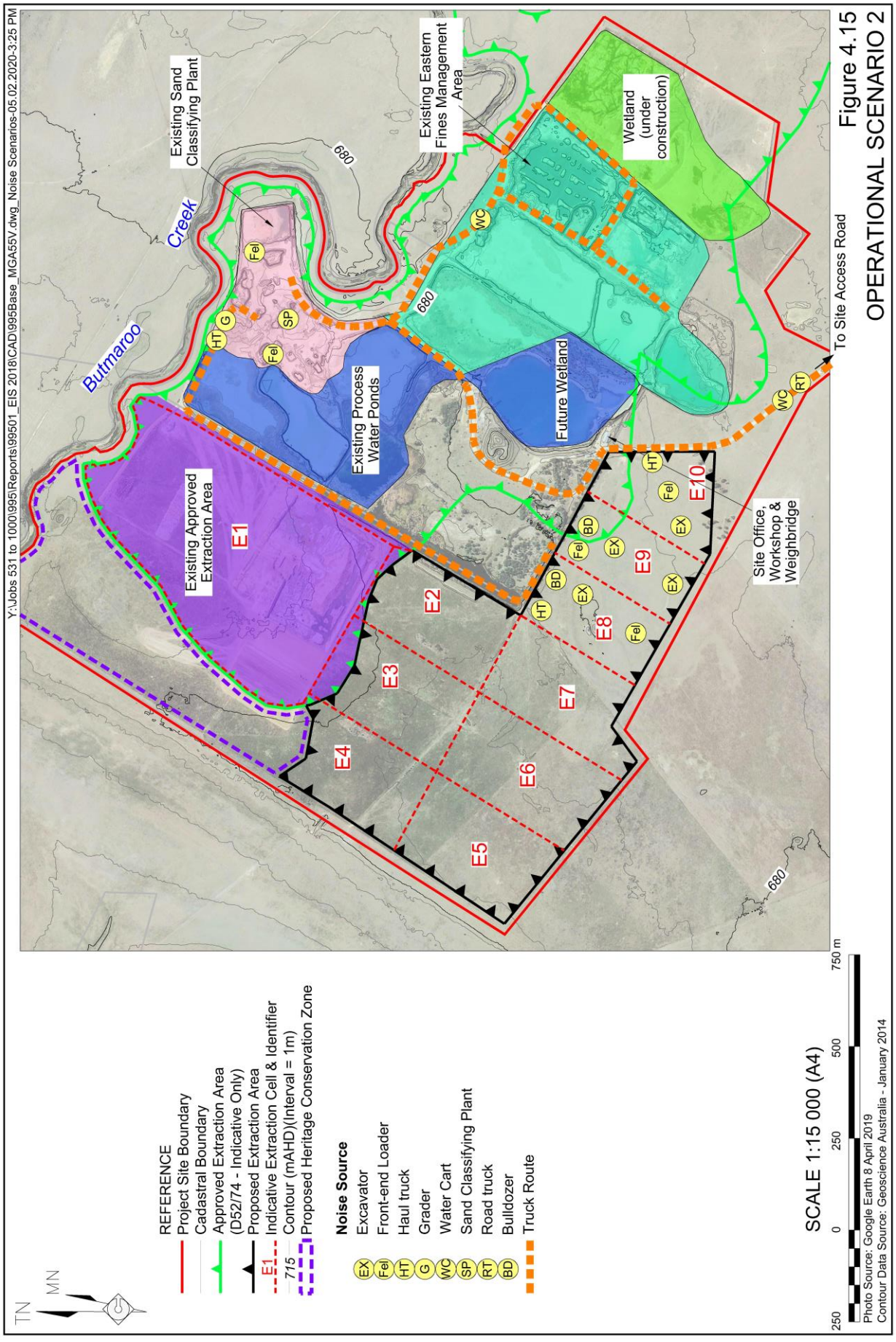



Figure 4.15
OPERATIONAL SCENARIO 2

### 4.7.6 Management and Mitigation Measures

The Operator would implement the following noise management and mitigation measures throughout the life of the Proposal.

- Strictly comply with the proposed hours of operation identified in **Table 2.2**.
- Install frequency modulated reversing alarms to all mobile equipment.
- Ensure that all truck drivers would be required to comply with the Operator's Driver's Code of Conduct outlining procedures for reducing noise impacts during transportation within the Project Site and off site.
- Maintain an open dialogue with the surrounding community and neighbours to ensure any concerns over noise or vibration are addressed.

### 4.7.7 Assessment of Impacts

#### 4.7.7.1 Operational Noise

The operational noise levels at receivers surrounding the Project Site as predicted by Spectrum (2020) are presented in **Tables 4.15**. In summary, the operational noise levels of the Proposal are not anticipated to exceed the relevant criteria at any residence.

**Table 4.15**
**Predicted Operational Noise Levels**

| Residence | Project Noise Trigger level | Meteorological condition | |
|---|---|---|---|
| | | Neutral | Inversion |
| **Scenario 1** | | | |
| R1 | 35 | <20 | <20 |
| R2 | 35 | <20 | <20 |
| R3 | 35 | <20 | <20 |
| R4 | 35 | <20 | <20 |
| R5 | 35 | 22 | 27 |
| R6 | 35 | 20 | 25 |
| R7 | 35 | 20 | 25 |
| R8 | 35 | <20 | <20 |
| R9 | 35 | <20 | <20 |
| R10 | 35 | <20 | <20 |
| **Scenario 2** | | | |
| R1 | 35 | <20 | <20 |
| R2 | 35 | <20 | <20 |
| R3 | 35 | <20 | <20 |
| R4 | 35 | <20 | 20 |
| R5 | 35 | 25 | 29 |
| R6 | 35 | 21 | 25 |
| R7 | 35 | 21 | 25 |
| R8 | 35 | <20 | 20 |
| R9 | 35 | <20 | <20 |
| R10 | 35 | <20 | <20 |
| Note 1: Units = dB(A),Leq(15min) | | | |
| Source: Spectrum (2020) –After Tables 6 and 7 | | | |

#### 4.7.7.2 Off Site Traffic Noise

Spectrum (2020) calculated a road traffic noise level at Residence R22 of 43dB(A),$L_{eq(15hour)}$ based on a sign posted speed of 100km/h. This is significantly below the criterion of 60dB(A),$L_{eq(15hour)}$ and also the night time criterion of 50dB(A),$L_{eq(1\text{-}hour)}$ for receivers near local roads.

Spectrum (2020) calculated a road traffic noise level at a distance of 15m from Tarago Road in Bungendore, the calculated road traffic noise level is 45dB(A),$L_{eq(15hour)}$ based on a sign posted speed of 50km/h. This is also significantly below the criterion of 60dB(A),$L_{eq(15hour)}$ for receivers near sub-arterial roads.

Consequently, there is minimal potential for adverse traffic noise impacts from the Proposal.

## 4.8 Air Quality

### 4.8.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify air quality as a key issue for assessment in the EIS. Matters to be addressed include an assessment of the likely air quality impacts of the development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities, the operation of the quarry and/or road haulage.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

An air quality impact assessment for the Project was undertaken by Todoroski Air Sciences Pty Ltd. The resulting report is presented as **Appendix 8**. The outcomes of that assessment are presented in this subsection with the report hereafter referred to as Todoroski (2020).

### 4.8.2 Existing Environment

The area surrounding the Project Site lies within a setting used primarily for agricultural activities, quarrying, and transportation (See Section 4.1.4.2). The primary sources of particulate emissions include particulates generated from:

- existing quarrying operations;
- agricultural activities such as stock movements, ploughing, and cultivation;
- vehicle exhaust;
- vehicle movements along unsealed and sealed roads; and
- wind on exposed areas within and surrounding the Project Site.

**Figure 4.5** presents the location of non-project related residences in the vicinity of the Project Site. No sensitive receivers such as schools, churches or major urban development are located in close proximity to the Project Site. The township of Bungendore is located approximately 5km south-southwest of the Project Site.

Finally, as local air quality monitoring data for the Project Site are not available data from the Australian Capital Territory (ACT) Health Protection Service (HPS) air quality monitors were used to quantify the existing background dust levels at the Project Site. The Civic, Florey and Monash monitors, located approximately 31.9km west-southwest, 38.8km southwest and 42.5km south-southwest from the Project Site, respectively, were used for the assessment.

The background air quality levels from the Civic monitor for the year 2017 were selected to represent the background levels for the Project Site as follows.

- 24-hour average $PM_{2.5}$ and $PM_{10}$ concentrations ..... variable
- Annual average $PM_{2.5}$ concentrations ..... 5.9µg/m³
- Annual average $PM_{10}$ concentrations ..... 9.5µg/m³
- Annual average TSP concentrations ..... 34.2µg/m³
- Annual average deposited dust levels ..... 1.5g/m²/month

### 4.8.3 Potential Sources of Air Contaminants

The following potential sources of operational emissions were considered by Todoroski (2020). Appendix B of Todoroski (2020) presents a detailed emissions inventory for each of these activities.

- Scraper stripping
- Loading overburden to haul truck
- Emplacing overburden
- Loading interburden to haul truck
- Emplacing interburden
- Hauling on unsealed surfaces
- Hauling on sealed surfaces
- Dozers on overburden/interburden
- Loading raw sand to haul truck
- Unloading raw sand at processing plant
- Screening
- Unloading processed sand at stockpile
- Loading product to haul truck
- Grading roads
- Wind erosion on stockpiles
- Exhaust Emissions

### 4.8.4 Assessment Criteria

Pollutants of potential concern for the Proposal include the following.

- Deposited dust (DD) – that fraction of suspended particulates that settles out of the air and is deposited on surfaces.
- Total Suspended Particulates (TSP) – that fraction of dust suspended in the air. TSP typically has an aerodynamic diameter of 30 micrometres (µm) or less as any larger particulates settle out of the atmosphere too quickly to be regarded as pollutants.

- $PM_{10}$ – suspended particulates with an aerodynamic diameter of 10µm or less. $PM_{10}$ is a subset of TSP. $PM_{10}$ may settle in the lungs, resulting in damage and health-related impacts.
- $PM_{2.5}$ – suspended particulates with an aerodynamic diameter of 2.5µm or less. $PM_{2.5}$ is a subset of $PM_{10}$ and TSP. $PM_{2.5}$ is small enough to enter the bloodstream via the lungs and cause health-related impacts. $PM_{2.5}$ is typically a combustion-related pollutant.

**Table 4.16** presents the air quality criteria listed in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2017a) which were adopted for the Proposal. It is noted that the criteria are based on reducing any potential impacts to human health and amenity.

**Table 4.16**
**Air Quality Assessment Criteria**

| Pollutant | Averaging Period | Impact | Criterion |
|---|---|---|---|
| TSP | Annual | Total | 90µg/m$^3$ |
| $PM_{10}$ | Annual | Total | 25µg/m$^3$ |
| | 24 hour | Total | 50µg/m$^3$ |
| $PM_{2.5}$ | Annual | Total | 8µg/m$^3$ |
| | 24 hour | Total | 25µg/m$^3$ |
| Deposited dust | Annual | Incremental | 2g/m$^2$/month |
| | | Total | 4g/m$^2$/month |
| Source: Todoroski (2020) – Table 3.1 | | | |

## 4.8.5 Assessment Methodology

### 4.8.5.1 Modelling Software

A dispersion modelling assessment was completed by Todoroski (2020) using a combination of the NSW EPA approved CALPUFF atmospheric dispersion modelling system and The Air Pollution Model (TAPM). Information relating to the local topography and available meteorological data for 2017 from nearby BoM weather meteorological monitoring stations were included in the simulations.

CALPUFF is an advanced "puff" air dispersion model which can calculate the effects of complex local terrain on the dispersion meteorology over the entire modelling domain in a three-dimensional, hourly varying time step.

### 4.8.5.2 Meteorological Modelling

A statistical analysis by Todoroski (2020) of the meteorological trends from latest five years found that the conditions recorded in 2017 would be most representative for the assessment.

TAPM was applied to the available data to generate a 3D upper air data file for use in CALMET. CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET.

Todoroski (2020) used CALMET generated meteorological data which was visually represented as wind roses and graphs of temperature, windspeed, mixing heights and stability. The wind roses generated reflected the expected wind distribution patterns and the graphs showed sensible trends which can be considered to be representative of the area.

#### 4.8.5.3 Dispersion Modelling

Dust emissions from operational activities and meteorological conditions associated with dust emissions were included by Todoroski (2020) in the CALPUFF model to produce hourly varying emission rates for each dust source.

It is noted that the effect of rainfall in reducing dust emissions was not included in the model as a conservative measure.

#### 4.8.5.4 Modelling Scenarios

Three operational scenarios were considered for the Proposal to represent the existing baseline from the Project Site and those that would likely represent worst-case scenario. These include:

- existing operations – sand extraction from the current extraction area E1;
- Scenario 1 - sand extraction from the extraction cells E2 and E3; and
- Scenario 2 - sand extraction from the extraction cells E9 and E10.

Each scenario was modelled for the following production scenarios.

- Maximum annual production rate - spread evenly across all operations periods.
- Peak daily production rate – based on the maximum daily truck movements. This production scenario is representative of the likely maximum 24-hour dust emissions for the Proposal but would result in an annual production rate substantially higher than the proposed maximum annual production rate of 400,000tpa of sand products.

#### 4.8.5.5 Emission Inventory

Todoroski (2020) determined dust emissions for the various dust generating activities described in Section 4.8.3 based on the Office of Environment and Heritage document, *NSW Coal Mining Benchmarking Study: Best Practice Measures for Reducing Non-Road Diesel Exhaust Emissions, Final Report* (EPA NSW, 2015) and the United States (US) EPA AP42 Emission Factors (US EPA, 1985 and Updates).

A summary of the total emission for the maximum annual and maximum daily scenarios is presented in **Table 4.17**.

**Table 4.17**
**Summary of estimated TSP emissions for the Project Site**

| Activity | Average TSP Emissions (kg/year) | | |
|---|---|---|---|
| | Existing | Scenario 1 | Scenario 2 |
| Maximum Annual | 90,795 | 139,485 | 136,754 |
| Peak Daily | 129,867 | 240,435 | 233,380 |
| Source: Todoroski (2020) – Table 5.2 | | | |

### 4.8.6 Management and Mitigation Measures

The Operator would implement the following management and mitigation measures to ensure that the Proposal would not have adverse impacts on air quality.

- Ensure that dust generating activities during adverse weather conditions, including strong winds from the northwest, are modified or halted in the event that dust is observed leaving the Project Site.
- Ensure that the exhausts of earthmoving equipment would be diverted away from the ground surface so as not to generate dust.
- Ensure that completed sections of the Project Site are progressively rehabilitated to reduce the potential for wind erosion.
- Ensure that water is applied to internal roads, stockpile areas and other disturbed surfaces during operations and during dry and/or windy conditions to prevent wind erosion.
- Ensure that drop heights during material handling operations are minimised to limit dust generation.
- Ensure that material is dampened prior to handling to limit dust generation.
- Ensure that soil stockpiles achieve an effective 70% cover within 10 days of formation. This may be achieved using mulches, spray on polymer-based products or hessian that would allow a vegetative cover to become established.
- Spread seed of a suitable cover crop on all soil stockpiles to facilitate revegetation.
- Ensure that all product trucks have their loads covered prior to exiting the Project Site.
- Respond promptly to any air quality-related complaints, including modifying on-site operations if dust emissions from those operations are not acceptable.
- Ensure that the Quarry Access Road is sealed for a minimum distance of 60m from the Site Entrance to minimise the potential for dust generation on Tarago Road.

## 4.8.7 Assessment of Impacts

**Tables 4.18** and **4.19** present incremental and cumulative dust dispersion modelling results for Scenarios 1 and 2 respectively. In summary, the Proposal would not result in exceedance of the air quality assessment criteria at any surrounding residence. Todoroski (2020) also determined that the Proposal would not increase the number of days above the 24-hour average criterion for $PM_{2.5}$ and $PM_{10}$ at the assessed receptors.

**Table 4.18**
**Dust dispersion modelling results – Scenario 1**

| Residence ID[1] | $PM_{2.5}$ (µg/m³) | | $PM_{10}$ (µg/m³) | | TSP (µg/m³) | DD (g/m²/mth) | $PM_{2.5}$ (µg/m³) | $PM_{10}$ (µg/m³) | TSP (µg/m³) | DD* (g/m²/mth) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Incremental | | | | | | Cumulative | | | |
| | 24-hr average | Annual average | 24-hr average | Annual average | Annual average | Annual average | Annual average | Annual average | Annual average | Annual average |
| | Air quality impact criteria | | | | | | | | | |
| | - | - | - | - | - | 2 | 8 | 25 | 90 | 4 |
| R2 | 0.4 | <0.1 | 2.0 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R3 | 0.4 | <0.1 | 2.3 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R4 | 0.4 | <0.1 | 2.4 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R5 | 0.6 | <0.1 | 3.5 | 0.2 | 0.5 | <0.1 | 5.9 | 9.7 | 34.7 | 1.5 |
| R6 | 0.4 | <0.1 | 3.0 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R7 | 0.4 | <0.1 | 2.7 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R8 | 0.3 | <0.1 | 1.4 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R9 | 0.2 | <0.1 | 0.7 | <0.1 | <0.1 | <0.1 | 5.9 | 9.5 | 34.3 | 1.5 |
| R10 | 0.3 | <0.1 | 1.4 | <0.1 | 0.1 | <0.1 | 5.9 | 9.5 | 34.3 | 1.5 |
| R11 | 0.3 | <0.1 | 2.0 | <0.1 | 0.2 | <0.1 | 5.9 | 9.6 | 34.4 | 1.5 |
| R12 | 0.3 | <0.1 | 2.0 | <0.1 | 0.2 | <0.1 | 5.9 | 9.6 | 34.4 | 1.5 |
| R13 | 0.3 | <0.1 | 2.0 | <0.1 | 0.2 | <0.1 | 5.9 | 9.6 | 34.4 | 1.5 |
| R14 | 0.3 | <0.1 | 1.9 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R15 | 0.3 | <0.1 | 1.9 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R16 | 0.3 | <0.1 | 1.8 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R17 | 0.3 | <0.1 | 1.9 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R18 | 0.3 | <0.1 | 2.0 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R19 | 0.3 | <0.1 | 2.1 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R20 | 0.3 | <0.1 | 1.9 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R21 | 0.3 | <0.1 | 1.8 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R22 | 0.3 | <0.1 | 1.7 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |

Note 1: See **Figure 4.5**

Source: Todoroski (2020) – Table 6.1

**Table 4.19**
**Dust dispersion modelling results – Scenario 2**

| Residence ID[1] | $PM_{2.5}$ (µg/m³) | | $PM_{10}$ (µg/m³) | | TSP (µg/m³) | DD (g/m²/mth) | $PM_{2.5}$ (µg/m³) | $PM_{10}$ (µg/m³) | TSP (µg/m³) | DD* (g/m²/mth) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Incremental | | | | | | Cumulative | | | |
| | 24-hr average | Annual average | 24-hr average | Annual average | Annual average | Annual average | Annual average | Annual average | Annual average | Annual average |
| | Air quality impact criteria | | | | | | | | | |
| | - | - | - | - | - | 2 | 8 | 25 | 90 | 4 |
| R2 | 0.4 | <0.1 | 2.0 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R3 | 0.4 | <0.1 | 2.3 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R4 | 0.4 | <0.1 | 2.5 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R5 | 0.6 | <0.1 | 3.7 | 0.2 | 0.5 | <0.1 | 5.9 | 9.7 | 34.7 | 1.5 |
| R6 | 0.5 | <0.1 | 3.1 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R7 | 0.5 | <0.1 | 2.9 | 0.1 | 0.3 | <0.1 | 5.9 | 9.6 | 34.5 | 1.5 |
| R8 | 0.3 | <0.1 | 1.3 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R9 | 0.1 | <0.1 | 0.7 | <0.1 | <0.1 | <0.1 | 5.9 | 9.5 | 34.3 | 1.5 |
| R10 | 0.3 | <0.1 | 1.4 | <0.1 | 0.1 | <0.1 | 5.9 | 9.5 | 34.3 | 1.5 |
| R11 | 0.4 | <0.1 | 2.2 | <0.1 | 0.2 | <0.1 | 5.9 | 9.6 | 34.4 | 1.5 |
| R12 | 0.4 | <0.1 | 2.1 | <0.1 | 0.2 | <0.1 | 5.9 | 9.6 | 34.4 | 1.5 |
| R13 | 0.4 | <0.1 | 2.1 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R14 | 0.3 | <0.1 | 2.0 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R15 | 0.3 | <0.1 | 2.0 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R16 | 0.3 | <0.1 | 1.9 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R17 | 0.3 | <0.1 | 2.0 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R18 | 0.3 | <0.1 | 2.1 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R19 | 0.4 | <0.1 | 2.2 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R20 | 0.4 | <0.1 | 2.0 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R21 | 0.3 | <0.1 | 1.9 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |
| R22 | 0.3 | <0.1 | 1.8 | <0.1 | 0.1 | <0.1 | 5.9 | 9.6 | 34.3 | 1.5 |

Note 1: See **Figure 4.5**

Source: Todoroski (2020) – Table 6.2

**Table 4.20** presents the incremental change for Scenarios 1 and 2 compared to the modelled existing scenario for Residence R5, the most affected residence surrounding the Project Site. In summary, the Proposal would result in a modelled increase in annual average TSP concentration of less than 0.3µg/m$^3$, or 0.3% of the relevant assessment criterion. As a result, Todoroski (2020) state that it would be reasonable to expect that any change to the existing cumulative level of dust emissions due to the Proposal would have a minimal impact and would likely go unnoticed.

**Table 4.20**
**Incremental change in annual average dust levels at Residence R5**

| Dust metric | Units | Scenario | Predicted annual average level for R5 | Incremental change compared to Existing scenario | Assessment Criteria | Percentage of criteria (%) |
|---|---|---|---|---|---|---|
| TSP | µg/m³ | Existing | 0.2 | - | 90 | - |
| | | Scenario 1 | 0.5 | 0.3 | | 0.3 |
| | | Scenario 2 | 0.5 | 0.2 | | 0.3 |
| $PM_{10}$ | µg/m³ | Existing | 0.1 | - | 25 | - |
| | | Scenario 1 | 0.2 | 0.1 | | 0.4 |
| | | Scenario 2 | 0.2 | 0.1 | | 0.4 |
| $PM_{2.5}$ | µg/m³ | Existing | 0.02 | - | 8 | - |
| | | Scenario 1 | 0.03 | 0.01 | | 0.2 |
| | | Scenario 2 | 0.03 | 0.01 | | 0.1 |
| DD | g/m²/month | Existing | 0.02 | - | 4 | - |
| | | Scenario 1 | 0.04 | 0.02 | | 0.5 |
| | | Scenario 2 | 0.03 | 0.02 | | 0.4 |

Source: Todoroski (2020) – Table 6.3

In relation to cumulative impacts, Todoroski (2020) notes that insufficient information in relation to the operation of the Corkhill or Holcim Quarries was available to include these operations in the air quality modelling. However, it has been assumed that emissions from these Quarries would be unchanged as a result of the Proposal and, as the modelled Proposal-related impacts would be negligible, Todoroski (2020) determined that the cumulative impacts of the Proposal would also be negligible.

Finally, the Operator notes that the proposed activities would be broadly consistent with the existing, approved activities and would be relatively small scale in nature. As a result, the greenhouse gas emissions associated with the Proposal would not be significant.

## 4.9 Historic Heritage

### 4.9.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify heritage as a key issue for assessment in the EIS. Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

Dr Amy Way prepared a Heritage Assessment Report for the Proposal. That report, hereafter referred to as Way (2020), is presented as **Appendix 4**. This subsection provides an overview of the Heritage Assessment Report as it pertains to historic heritage and describes operational safeguards and management measures to be implemented. Section 4.2 presents a summary of Way (2020) as it pertains to Aboriginal Heritage.

### 4.9.2 Existing Environment

**Figure 4.16** and **Table 4.21** presents the heritage sites identified on the *Palerang Regional Local Environmental Plan 2014.* In addition, a set of stone ruins occur approximately 1km to the east of the Project Site, in close proximity to the southern bank of Butmaroo Creek. Three sites are also listed on the NSW State Heritage Register.

The heritage sites as described as follows on the NSW State Heritage Register and the Heritage Inventory prepared for Palerang Council by Victoria Design & Management Pty Ltd in April 2009. These sources did not include information in relation to Turralla and Minarry.

- Ashby – Ashby is one of the district's earliest buildings and is associated with pioneer pastoralist Richard Brooks and John Dwyer who was Bungendore's first property developer. The building is a single storey stone homestead with additions added in 1975, 2001 and 2008. The fenced homestead site is approximately 2ha and includes the outbuildings, orchard and elm grove.
- Currandooley – Currandooley is a substantial and conventional two storeyed Victorian country stone house completed in 1873, with further additions in 1890 and during the 1930s and 1940s. The house was built for Pat Hill Osborne, (1832-1902) who purchased the property in 1866 and is still owned and occupied by the Osborne family.
- Werriwa – Werriwa was built in about 1882 as a four-room stone house with wide main hall and a kitchen at the back, constructed of stone from the property. Further additions were made in 1906, 1918, 1927 and 1990s.
- Douglas – Douglas two storey house built in 1883 as a 20 room guesthouse on the western shores of Lake George, with the steamer to take visitors sightseeing around the lake. The lake eventually dried up for an extended period and the house has remained a private residence since that date.

**Table 4.21**
**Listed Historic Heritage Sites**

| Historical site | Address | Historical significance | Palerang LEP Identifier |
|---|---|---|---|
| Ashby | 175 Tarago Road, Bungendore | State | I231 |
| Currandooley | Currandooley Road, Bungendore | State | I175 |
| Turalla | Bungendore | State | - |
| Werriwa | 660 Tarago Road, Bungendore | Local | I233 |
| Douglas | 565 Lake Road, Bungendore | Local | |
| Minarry | 307 Tarago Road, Bungendore | Local | I232 |
| Note 1: Winderadeen is located approximately 3km to the north of Lake George and is not shown on **Figure 4.HH1.** | | | |
| Source: Way (2020) – After Table 5 | | | |

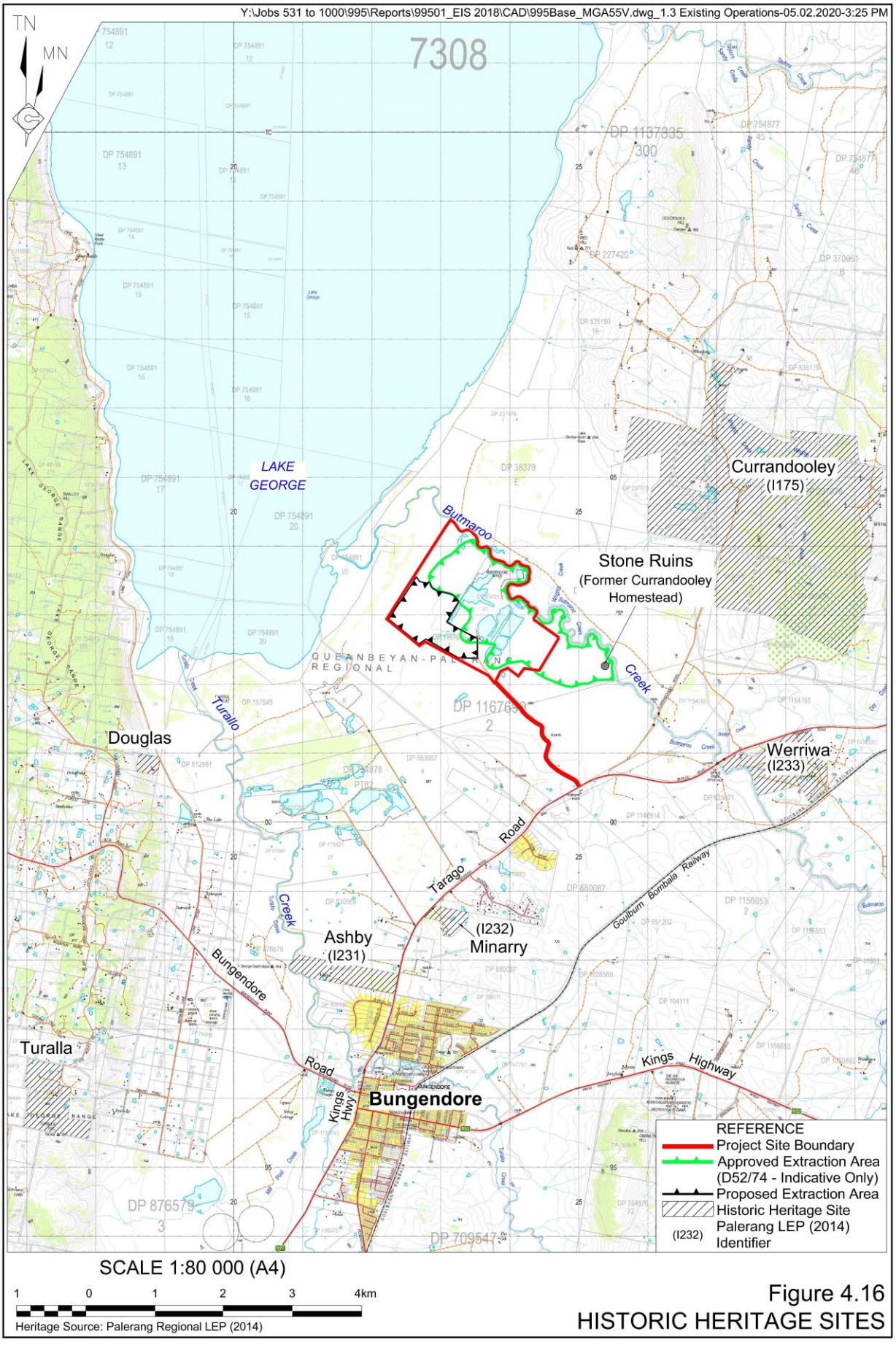



Figure 4.16
HISTORIC HERITAGE SITES

### 4.9.3 Assessment of Impacts

None of the identified historic heritage sites are located within the Project Site and the proposed activities would not adversely impact on the heritage character of the sites. As a result, the Proposal would not result in significant adverse impacts on historic heritage within or surrounding the Project Site,

## 4.10 Visibility

### 4.10.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify visibility as a key issue for assessment in the EIS. Matters to be addressed include an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, including with respect to any new landforms.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

The following sub-sections have been prepared by RW Corkery & Co Pty Limited and consider the existing visual environment, the potential impacts related to visibility, proposed management and mitigation measures and an assessment of visual-related impacts.

### 4.10.2 Existing Environment

**Plates 4.2** to **4.5** present views of the visual setting surrounding the Project Site. In summary, the land immediately surrounding the Project Site is flat to gently undulating rural land, with local close to the Project Site, with views limited to the upper sections of the Classifying Plant and stockpiles. Views of the Project Site are available from elevated residences and publicly accessible vantage points along the Lake George Range from distances of 5km and more.

### 4.10.3 Management and Mitigation Measures

The Operator would implement the following management and mitigation measures to ensure that the Proposal would not have adverse impacts on visual amenity.

- Implement active dust suppression measures and management protocols to minimise the potential for the generation of a ‘dust cloud’ over the Project Site.
- Progressively revegetate disturbed areas of the Project Site as soon as practicable to minimise the area of exposed surfaces.

Y:\Jobs 531 to 1000\995\Reports\99501_EIS 2018\CAD\995Base_MGA55V.dwg_Plates-05.02.2020-3:40 PM

**Plate 4.2**: Rural land surrounding the project site
(Ref: E995A_130)

**Plate 4.3**: View of the Lake George Range from the project site with Holcim's Sand Quarry in the mid-ground
(Ref: E995A_071)

**Plate 4.4**: View of the Capital Wind Farm looking northeast
(Ref: E995A_127)

**Plate 4.5**: View of the Classifying Plant and Stockpile Area looking west
(Ref: E995A_065)

### 4.10.4 Assessment of Impacts

The Proposal would not result in an intensification of the existing extraction operations within the Project Site. As a result, there would be no increase in the number or type of vehicle movements, material generated, size of stockpiles or height or bulk of the Classifying Plant. In addition, the Proposal, with permitting an approximately 76ha increase in the size of the Extraction Area, would result in existing Extraction Areas and Fines Management Areas being rehabilitated.

Observers located in close proximity to the Project Site would be unlikely to notice any change in the visual character of the Project Site because there is insufficient elevation to be able to see into the active sections of the Project Site.

Observers at residences and publicly accessible vantage points along the Lake George Range may notice a gradual expansion of the Extraction Area. However, this would be offset by progressive rehabilitation of disturbed sections of the Project Site. In addition, the proposed extension of the Extraction Area would be unlikely to be noticeable to the casual observer because the Range is located a minimum of 5km from the Project Site.

As a result, the Proposal would not result in significant adverse impacts on visual amenity surrounding the Project Site,

## 4.11 Soil and Land Capability

### 4.11.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify land resources as a key issue for assessment in the EIS. Matters to be addressed include:

- potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate);
- potential impacts on landforms (topography), paying particular attention to the long-term geotechnical stability of any new landforms (such as overburden dumps, bunds etc); and
- the compatibility of the development with other land uses in the vicinity of the development, in accordance with the requirements of Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007;

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

This sub-section has been prepared by RW Corkery & Co Pty Limited and presents an overview of the existing soils and land capability of the Project Site, a brief description of the land management and mitigation measures that would be implemented, and the residual land resources-related impacts associated with the Proposal.

## 4.11.2 Existing Environment

### 4.11.2.1 Soil Landscape

The Project Site is located within the Coopers Soil Landscape unit. Jenkins (2000) states that this associated with former lake beaches, dunes and sand sheets on Quaternary alluvium on Lake George and the Bungendore Plain. Soils within this unit consist of:

- deep to very deep (>100cm), very poorly drained Hydrosols and Stratic Rudosols (Alluvial Soils) on Lake George;
- moderately deep to very deep (>90 cm), imperfectly drained Brown Chromosols (Yellow Podzolic Soils) on old beaches;
- well-drained Stratic Rudosols (Siliceous Sands) on beach dunes; and
- moderately deep to very deep, poorly drained Stratic Rudosols (Alluvial Soils) on swales.

Limitations associated with the Coopers Soil Landscape Unit include soils which are non-cohesive, infertile, highly erodible and have low water holding capacity and permeability, including localised waterlogging.

### 4.11.2.2 Soil Capability Class

Soil capability assessment is based on the slope, wind hazard, soil pH, surface structural stability, salinity, rocky outcrop, waterlogging potential and existing erosion of a landform. This eight-class system indicates the inherent physical capability of the land and soil to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources.

The NSW Soil and Land Information database eSPADE, managed by OEH, identifies the Project Site within Land and Soil Capability (LSC) Class 6, namely land generally only suitable for grazing and is not suitable for cultivation (**Figure 4.17**). In addition, disturbed sections of the Project Site would be classified as Class 8, namely lands incapable of sustaining any agricultural land use and best left undisturbed and managed for conservation.

## 4.11.3 Management and Mitigation Measures

The Operator would implement the following management and mitigation measures throughout the life of the Proposal to minimise the potential for unacceptable land resource-related impacts.

- Clearly delineate areas subject to vegetation clearing, soil stripping and stockpiling activities using markers.
- Strip soil from all proposed areas of disturbance.
- Undertake soil stripping activities during periods which are conducive to the preservation of soil structure (i.e. conditions must not be excessively wet or dry).

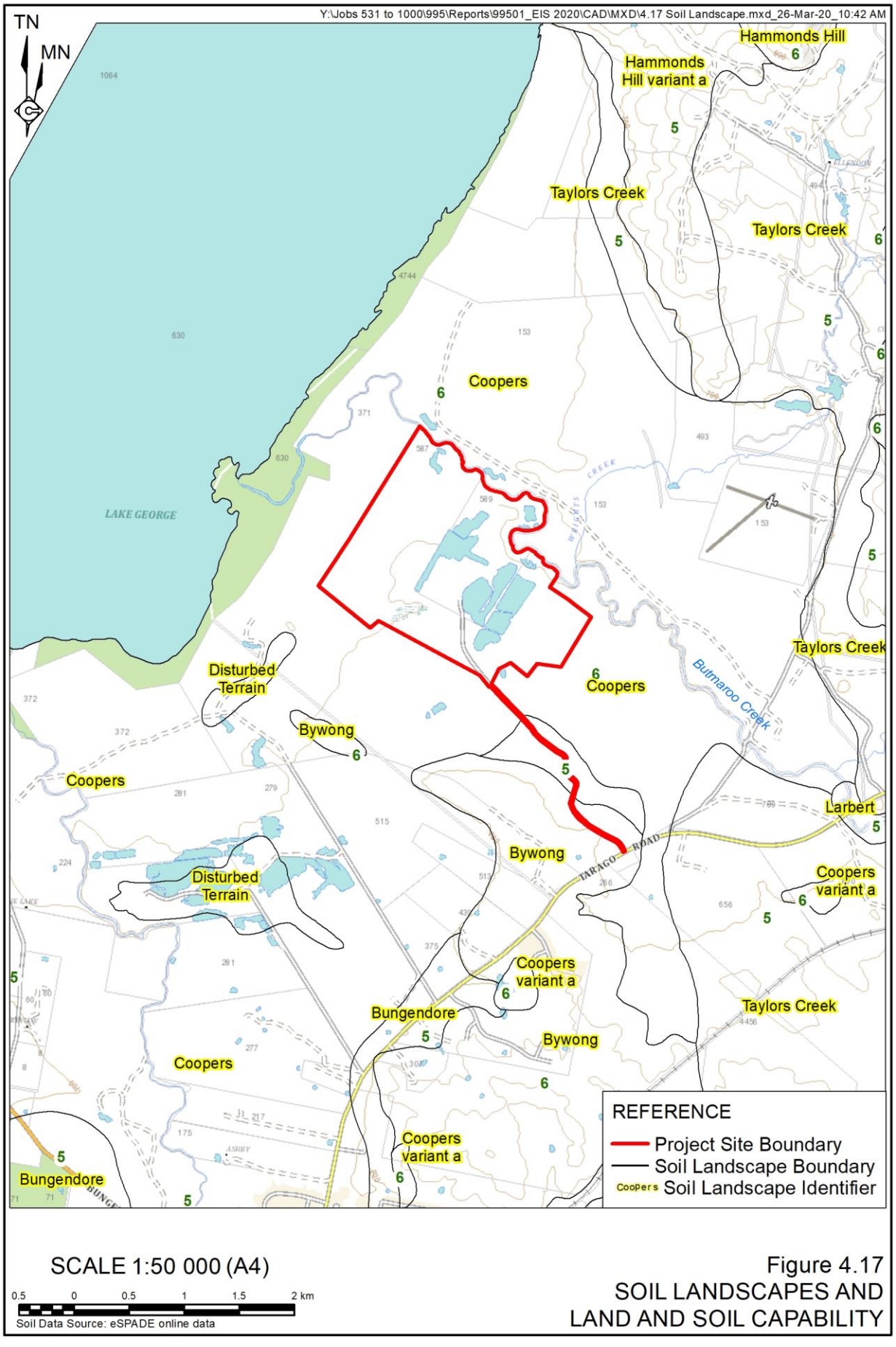



Figure 4.17
SOIL LANDSCAPES AND
LAND AND SOIL CAPABILITY

- Construct soil stockpiles to a height no greater than 2m, with side slopes no more than 1:3 (V:H).
- Ensure that soil stockpiles have a surface that is as 'rough' as possible in the micro-scale to assist in surface water runoff control and seed retention and germination.
- Stabilise soil stockpiles through the establishment of groundcover vegetation, achieving a coverage equivalent to 60% within 10 days of establishment.
- Signpost soil stockpiles and restrict the operation of machinery on soil stockpiles during and following the formation of stockpiles other than immediately prior to excavation for use in rehabilitation.
- Rip and scarify all areas to be respread with topsoil to allow the respread material to be keyed into the underlying material.
- Ensure that regular consultation with surrounding landholders is undertaken to ensure that the proposed activities are not adversely impacting on surrounding land uses.

### 4.11.4 Assessment of Impacts

Adherence to the recommended soil and growth medium stripping, handling, stockpiling and respreading procedures and other management practices, together with appropriate rehabilitation practices, would result in a minimal impact to soils and land capability within the Project Site.

The implementation of appropriate erosion and sediment controls targeting the effective management of surface water would further minimise the loss of topsoil resources required for rehabilitation activities. Additionally, no waste material emplacements are proposed as part of the final landform. The potential impact of the Proposal on land resources is therefore assessed to be negligible.

## 4.12 Hazards

### 4.12.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify hazards as a key issue for assessment in the EIS. Matters to be addressed include an assessment of the likely risks to public safety, paying particular attention to potential bushfire risks, and the transport, storage, handling and use of any hazardous or dangerous goods.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed

This sub-section has been prepared by RW Corkery & Co Pty Limited and considers the existing groundwater environment, proposed management and mitigation measures and assessment of groundwater-related impacts.

### 4.12.2 Bush Fire Protection

The NSW Rural Fire Service (RFS) document Planning for Bush Fire Protection (PBP) (RFS 2006) provides a guide to the management of bushfire risks and the protection of life, property and the environment. Online mapping for the Queanbeyan-Palerang Local Government Area (accessed 11 February 2020, available: https://www.qprc.nsw.gov.au/Building-Development/ Planning-Zoning/Online-mapping) indicates that the Project Site is located partially within Bushfire Prone Land.

The aim of PBP is "to use the NSW development assessment system to provide for the protection of human life (including firefighters) and to minimise impacts on property from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment." Additionally, the objectives of PBP are to:

- "afford occupants of any building adequate protection from exposure to a bush fire;
- provide for a defendable space to be located around buildings;
- provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;
- ensure that safe operational access and egress for emergency service personnel and residents is available;
- provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ); and
- ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bush fire fighting)."

The Proposal does not include changes to existing structures such as the site office within the Project Site. Measures which address the objectives of the PBP are outlined in Section 4.12.3.

### 4.12.3 Management and Mitigation Measures

The Operator would implement the following management and mitigation measures throughout the life of the Proposal to minimise the potential for unacceptable public safety and hazard-related impacts.

- Ensure that the Project Site remains fenced, disturbed areas are bunded, suitable signage is erected and that the entrance gate is locked when the Project Site is not occupied.
- Store hydrocarbons and hazardous materials in bunded, impervious areas undercover in accordance with the relevant Australian Standard, including *AS1940 – The Storage and Handling of Flammable and Combustible Liquids*.
- Remove waste oils from the Project Site as soon as practicable after they are generated.

- Undertake all hot works within cleared areas and cease such activities on days when the fire danger rating is "Severe" or above.
- Ensure that no materials likely to exacerbate bushfire risk, including felled vegetation or excessive quantities of hydrocarbons would be stored within the Project Site.
- Ensure that fuel loads in undisturbed sections of the Project Site are managed through grazing or slashing to minimise the potential for bushfire and provide adequate asset protection zones.
- Ensure that all plant is fitted with appropriate fire suppression equipment.
- Ensure that a water cart is available during operations, thereby providing firefighting capabilities if required.
- Ensure that water and a suitable filling point is made available to emergency service vehicles as required in the event of a bushfire emergency
- In the event that the Project Site is threatened by a bushfire, site personnel would be evacuated to the nearest safer place. Alternatively, if evacuation were not possible or safe, the Classifying Plant and Stockpiling Area would provide a cleared area for personnel to shelter.

### 4.12.4 Assessment of Impacts

In relation to public safety risks associated with unauthorised access to the Project Site, the Operator notes that the Project Site is fenced, and gates would be locked when not in use. In addition, there has been no history of unauthorised access to the Project Site. As a result, public safety risks associated with unauthorised access to the Project Site are considered negligible.

In relation to risks associated with hydrocarbons, based on the proposed management and mitigation measures, the risk of hydrocarbon contamination of land are considered to be negligible.

Finally, the Operator contends that the Proposal would not result in an increased risk of bushfire. Furthermore, the Proposal would not require construction of infrastructure that would require protection from bushfire attack.

## 4.13 Socio-economic

### 4.13.1 Introduction

The SEARs, presented in full as **Appendix 2**, identify social and economic impacts as a key issue for assessment in the EIS. Matters to be addressed include an assessment of the likely social and economic impacts of the development, including consideration of both the significance of the resource and the costs and benefits of the project.

Additionally, **Appendix 3** presents an overview of the SEARs and any additional government agency requirements, as well as where each of these has been addressed.

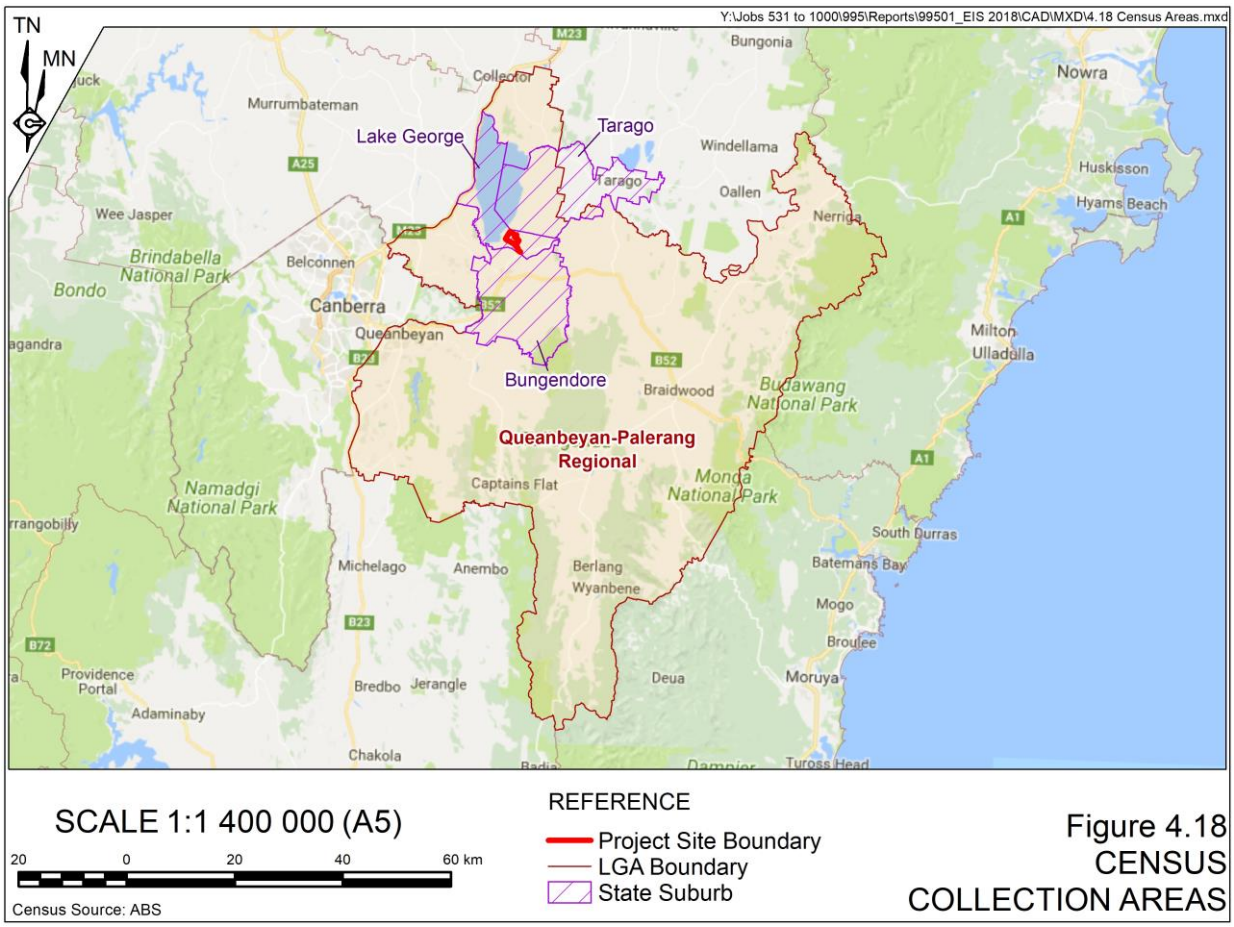
This sub-section has been prepared by RW Corkery & Co Pty Limited and describes and assesses the existing socio-economic setting, the social and economic contributions that would be made by the Proposal, the management and mitigation measures to be implemented and assesses the residual impacts following the implementation of these management and mitigation measures.

## 4.13.2 Community Profile

### 4.13.2.1 Surrounding Communities

Communities surrounding the Site include the following (**Figures 4.5** and **4.18**).

- Immediate neighbours and local residents surrounding the Project Site.
- Residents of the State Suburbs of Lake George, Tarago and Bungendore.
- Residents within the Queanbeyan-Palerang LGA.




Each of these communities would be impacted to a greater or lesser degree depending on their proximity to the Project Site or transportation route and the size, resilience and cohesiveness of the relevant community and its economy. For the purpose of this assessment, particular focus is

placed on those communities most likely to be impacted by the Proposal, including the sparsely populated Lake George and Tarago State Suburbs in which the Project Site is located, the Bungendore State Suburb which is the principal population centre in the vicinity of the Project Site, as well as the Queanbeyan-Palerang LGA (see **Figure 4.18**).

#### 4.13.2.2 Development and Growth of Surrounding Communities

Section 4.2.3 presents a brief overview of the Aboriginal history of the area surrounding the Project Site. In summary, the Lake George area has been occupied for many thousands of years by members of the Ngunawal Group. European settlement commenced in the early 1800's, with substantial agricultural enterprises established by the 1870's when a number of significant buildings were erected.

Bungendore was first settled by Europeans in the 1820s and was proclaimed a town in 1837 when the mail service was introduced. By 1848 the population was 30 people with seven buildings in the town of Bungendore. As part of the construction of the railway, the population of Bungendore rose to approximately 700 people in 1885, making it one of the major towns in the area. At the time of the 2016 census the population of Bungendore was 4 178.

The Queanbeyan-Palerang LGA (**Figure 4.18**) covers an area of 5 319km$^2$ and is located within the Southern Tablelands of NSW, between the eastern boundary of the ACT and the western boundary Great Divining Range. The LGAs surrounding Queanbeyan-Palerang LGA are:

- Goulburn Mulwaree; Upper Lachlan and Yass Valley LGAs located to the north;
- City of Shoalhaven and Eurobodalla Shire LGAs to the east;
- Snowy Monaro Regional LGA to the south; and
- Australian Capital Territory to the west (**Figure 1.1**).

The population of the Queanbeyan-Palerang LGA was recorded at the 2016 census as 56 031 people. The LGA is generally supported by agricultural production, grazing of sheep and cattle and cropping, primarily wheat, as well as mining activities.

#### 4.13.2.3 Community Statistics

The following demographic data was sourced primarily from the Australian Bureau of Statistics (ABS) 2016 and 2011 census data. All data has been gathered from the community profile tables and quick data sets from the ABS website (http://www.abs.gov.au/). While the Site is located within the 'Lake George State Suburb' (Lake George SS), it is noted that due to the small population size (98 people at the time of the 2016 census) there is limited information available on the ABS website.

As the Site is also located in close proximity to the Tarago and Bungendore State Suburbs (SS) (see **Figure 4.18**), information is provided for these areas as well. Additionally, data from the Queanbeyan-Palerang LGA, ACT, and NSW is displayed for comparison purposes. Data presented for the Queanbeyan-Palerang LGA from 2011 represents the combined data from the Queanbeyan LGA and the Palerang LGA which were merged in 2016.

## Population and Age Characteristics

**Table 4.22** presents the population data from both the 2011 and 2016 census. In summary, the populations of the Lake George SS, Bungendore SS and Tarago SS in 2016 were 98, 4 178 and 426 respectively, with Bungendore SS and Tarago SS displaying population growth of 17.6% and 21.4% respectively between 2011 and 2016. The population of the Queanbeyan-Palerang LGA in 2016 was 56 031, displaying population growth of 7% between 2011 and 2016 compared with increases of 8.1% and 11.2% in NSW and the ACT over the same period. The higher population growth experienced for the Tarago SS and Bungendore SS may reflect growth associated with residential development, catering particularly for residents commuting to Canberra and other areas for work.

**Table 4.23** presents the 2016 Census population data broken down by age. In summary, the average proportion of people aged between 0 and 14 (i.e. children) in the Lake George SS, Bungendore SS and Tarago SS (19.9%) was slightly higher than that of Queanbeyan-Palerang LGA, NSW the ACT (18.5% – 19.5%). The average proportion of people aged between 15 and 54 (i.e. studying or working) in the Lake George SS, Bungendore SS and Tarago SS (49.8%) was significantly lower than that of the Queanbeyan-Palerang LGA, NSW and ACT (53.2% - 58.3%). The average proportion of people aged over 55 in the Lake George SS, Bungendore SS and Tarago SS (25.9%) was slightly higher than that recorded for the Queanbeyan-Palerang LGA (24.6%) and the ACT (22.9%) but lower than that recorded for NSW (28.1%).

At a regional and state level, the proportion of the population aged between 0 and 14 (19.5%) is slightly higher in the Queanbeyan-Palerang LGA when considered against the proportions for NSW (18.5%) and the ACT (18.7%). The proportion of the population in the Queanbeyan-Palerang LGA in age groups between 15 and 54 (55.9%) and 55 and over (24.6%) falls between the proportions recorded for ages between 15 to 54 (53.2% – 58.3%) and ages 55 and over (22.9% - 28.1%) for NSW and the ACT. The relative similarity in population age distributions observed at regional and state levels potentially reflects levels of economic and employment opportunities within the Queanbeyan-Palerang LGA which are comparable to those available in both NSW and the ACT.

## Employment

**Table 4.24** presents employment statistics from the 2016 Census. These indicate that the percentages of people engaged in full-time employment within the Lake George SS (67.9%), Bungendore SS (66.1%) and Tarago SS (66.8%) are slightly higher than those observed in the Queanbeyan-Palerang LGA (65.6%) and significantly higher than those observed in both NSW (59.2%) and the ACT (63.5%). Conversely, levels of part-time employment recorded in the Lake George SS, Bungendore SS, Tarago SS and the Queanbeyan-Palerang LGA (19.6% - 25.3%) were lower than those recorded for NSW and the ACT (26.4% - 29.7%). Unemployment levels within the Lake George SS, Bungendore SS, Tarago SS and the Queanbeyan-Palerang LGA (0% - 4%) are significantly lower than those recorded for NSW and the ACT (4.7% - 6.3%). This may be a reflection of the fact that many of those who live and work in Bungendore and surrounds commute to nearby centres for work, meaning that casual or part-time work is less attractive to those residents.

## Industry of Employment

**Table 4.25** presents employment by industry statistics from the 2016 Census. The most significant industries of employment in the Lake George SS, Bungendore SS and Tarago SS include public administration and safety (10.5% - 26.8%), construction (5.4% - 10.1%) and professional, scientific and technical services (7.1% - 7.7%).

**Table 4.22**
**2016 and 2011 Census Population Statistics**

| | Lake George SS | | | Bungendore SS | | | Tarago SS | | | Queanbeyan-Palerang LGA | | | NSW | | | ACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2011 | 2016 | % Change | 2011 | 2016 | % Change | 2011 | 2016 | % Change | 2011[1] | 2016 | % Change | 2011 | 2016 | % Change | 2011 | 2016 | % Change |
| Total | - [2] | 98 | - | 3 553 | 4 178 | 17.6 | 351 | 426 | 21.4 | 52 343 | 56 031 | 7.0 | 6 917 662 | 7 480 228 | 8.1 | 357 224 | 397 397 | 11.2 |
| Male | - [2] | 49 | - | 1 769 | 2 101 | 18.8 | 186 | 223 | 19.9 | 26230 | 28 133 | 7.3 | 3 408 880 | 3 686 014 | 8.1 | 176747 | 195793 | 10.8 |
| Female | - [2] | 49 | - | 1 784 | 2 083 | 16.8 | 165 | 205 | 24.2 | 26 113 | 27 899 | 6.8 | 3 508 782 | 3 794 217 | 8.1 | 180477 | 201653 | 11.7 |

Note 1: 2011 data for the Queanbeyan-Palerang LGA represents the combined data from the Queanbeyan LGA and the Palerang LGA which were merged in 2016 to form the Queanbeyan-Palerang LGA.

Note 2: 2011 data is not available for the Lake George SS.

Source: Australian Bureau of Statistics – 2011 and 2016 Census Data

**Table 4.23**
**2016 Census Age Statistics**

| Age Range | Lake George SS | | Bungendore SS | | Tarago SS | | Queanbeyan-Palerang LGA | | NSW | | ACT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| **Children** | | | | | | | | | | | | |
| 0 – 4 | 3 | 3.1 | 325 | 7.8 | 30 | 7.0 | 3 648 | 6.5 | 465135 | 6.2 | 26795 | 6.7 |
| 5 - 14 | 13 | 13.3 | 665 | 15.9 | 54 | 12.7 | 7 317 | 13 | 921193 | 12.3 | 47686 | 12.0 |
| **Studying or Working** | | | | | | | | | | | | |
| 15 – 19 | 5 | 5.1 | 288 | 6.9 | 15 | 3.5 | 3 523 | 6.3 | 448 425 | 6.0 | 24 507 | 6.2 |
| 20 – 24 | 4 | 4.1 | 173 | 4.1 | 10 | 2.3 | 3 237 | 5.8 | 489 673 | 6.5 | 31 430 | 7.9 |
| 25 – 34 | 8 | 8.2 | 468 | 11.2 | 57 | 13.4 | 7 671 | 13.7 | 1 067 521 | 14.2 | 66 119 | 16.7 |
| 35 – 44 | 13 | 13.3 | 667 | 16.0 | 42 | 9.9 | 7 895 | 14.1 | 1 002 893 | 13.4 | 58 409 | 14.7 |
| 45 – 54 | 17 | 17.3 | 692 | 16.6 | 74 | 17.4 | 8 954 | 16 | 977 986 | 13.1 | 50 989 | 12.8 |
| **Approaching Retirement** | | | | | | | | | | | | |
| 55 – 64 | 10 | 10.2 | 507 | 12.2 | 66 | 15.5 | 6 969 | 12.5 | 889770 | 11.9 | 41 501 | 10.4 |
| 65 – 74 | 13 | 13.3 | 283 | 6.8 | 55 | 12.9 | 4 264 | 7.6 | 677026 | 9.0 | 29 453 | 7.4 |
| 75 – 84 | 0 | 0 | 89 | 2.0 | 15 | 3.5 | 1 873 | 3.3 | 373114 | 5.0 | 14 358 | 3.6 |
| 85+ | 0 | 0 | 25 | 0.6 | 3 | 0.7 | 680 | 1.2 | 167506 | 2.2 | 6 158 | 1.5 |
| **Total** | **98** | | **4 178** | | **426** | | **56 031** | | **7 480 228** | | **397 397** | |

Source: Australian Bureau of Statistics – 2016 Census Data

**Table 4.24**
**2016 Census Employment Statistics**

| | Lake George SS | | Bungendore SS | | Tarago SS | | Queanbeyan-Palerang LGA | | NSW | | ACT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Employment Status** | **No.** | **%** | **No.** | **%** | **No.** | **%** | **No.** | **%** | **No.** | **%** | **No.** | **%** |
| Full-time | 38 | 67.9 | 1 535 | 66.1 | 145 | 66.8 | 20 096 | 65.6 | 2 134 523 | 59.2 | 137 058 | 63.5 |
| Part-time | 11 | 19.6 | 562 | 24.2 | 55 | 25.3 | 7 595 | 24.8 | 1 071 151 | 29.7 | 57 064 | 26.4 |
| Employed, Away from Work | 5 | 8.9 | 156 | 6.7 | 17 | 7.8 | 1 702 | 5.6 | 174 654 | 4.8 | 11 506 | 5.3 |
| Unemployed | 0 | 0 | 68 | 2.9 | 5 | 2.3 | 1 235 | 4.0 | 397 397 | 6.3 | 10 205 | 4.7 |
| **Total Labour Force** | | **56** | | **2 321** | | **217** | | **30 628** | | **3 380 328** | | **215 833** |
| Source: Australian Bureau of Statistics – 2016 Census Data | | | | | | | | | | | | |

**Table 4.25**
**2016 Census Industry of Employment Statistics**

| | Lake George SS | | Bungendore SS | | Tarago SS | | Queanbeyan-Palerang LGA | | NSW | | ACT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Industry** | **No.** | **%[1]** | **No.** | **%[1]** | **No.** | **%[1]** | **No.** | **%[1]** | **No.** | **%[1]** | **No.** | **%[1]** |
| Agriculture, forestry & fishing | 0 | 0 | 51 | 2.3 | 21 | 9.6 | 496 | 1.7 | 72 625 | 2.1 | 590 | 0.3 |
| Mining | 0 | 0 | 10 | 0.4 | 4 | 1.8 | 73 | 0.2 | 31 736 | 0.9 | 115 | 0.1 |
| Manufacturing | 0 | 0 | 77 | 3.4 | 7 | 3.2 | 1 066 | 3.6 | 197 331 | 5.8 | 3 377 | 1.6 |
| Electricity, gas, water & waste services | 0 | 0 | 29 | 1.3 | 3 | 1.4 | 311 | 1.1 | 31 881 | 0.9 | 1 451 | 0.7 |
| Construction | 3 | 5.4 | 229 | 10.1 | 21 | 9.6 | 2 961 | 10.1 | 282 491 | 8.4 | 12 029 | 5.8 |
| Wholesale trade | 0 | 0 | 45 | 2.0 | 3 | 1.4 | 483 | 1.6 | 103 722 | 3.1 | 2 041 | 1.0 |
| Retail trade | 0 | 0 | 135 | 6.0 | 17 | 7.8 | 2 376 | 8.1 | 326 396 | 9.7 | 14 601 | 7.1 |
| Accommodation & food services | 3 | 5.4 | 110 | 4.9 | 13 | 5.9 | 1 563 | 5.3 | 239 222 | 7.1 | 13 401 | 6.5 |
| Transport, postal & warehousing | 0 | 0 | 77 | 3.4 | 16 | 7.3 | 1 011 | 3.4 | 158 760 | 4.7 | 4 715 | 2.3 |
| Information media & telecommunications | 3 | 5.4 | 40 | 1.8 | 0 | 0 | 416 | 1.4 | 73 398 | 2.2 | 3 628 | 1.8 |
| Financial & insurance services | 0 | 0 | 36 | 1.6 | 0 | 0 | 373 | 1.3 | 167 259 | 4.9 | 3 171 | 1.5 |
| Rental, hiring & real estate services | 0 | 0 | 45 | 2.0 | 4 | 1.8 | 443 | 1.5 | 59 652 | 1.8 | 2 665 | 1.3 |
| Professional, scientific & technical services | 4 | 7.1 | 173 | 7.7 | 16 | 7.3 | 1 981 | 6.7 | 274 078 | 8.1 | 19 290 | 9.4 |
| Administrative & support services | 0 | 0 | 62 | 2.7 | 8 | 3.7 | 829 | 2.8 | 117 482 | 3.5 | 5 236 | 2.5 |
| Public administration & safety | 14 | 25 | 605 | 26.8 | 23 | 10.5 | 7 481 | 25.4 | 204 173 | 6.0 | 63 286 | 30.8 |
| Education & training | 3 | 5.4 | 179 | 7.9 | 14 | 6.4 | 2 111 | 7.2 | 282 568 | 8.4 | 19 647 | 9.6 |
| Health care & social assistance | 3 | 5.4 | 166 | 7.3 | 15 | 6.8 | 2 814 | 9.6 | 422 195 | 12.5 | 21 319 | 10.4 |
| Arts & recreation services | 0 | 0 | 20 | 0.9 | 0 | 0 | 422 | 1.4 | 51 775 | 1.5 | 3 590 | 1.7 |
| Other services | 3 | 5.4 | 91 | 4.0 | 9 | 4.1 | 1 071 | 3.6 | 124 477 | 3.7 | 6 111 | 3.0 |
| Inadequately described/Not stated | 3 | 5.4 | 80 | 3.5 | 19 | 8.7 | 1 121 | 3.8 | 159 108 | 4.7 | 5 363 | 2.6 |
| **Total** | **56** | | **2 251** | | **219** | | **29 402** | | **3 380 329** | | **205 626** | |

Note 1: Percentage of the Labour Force

Source: Australian Bureau of Statistics – 2016 Census Data

These proportions are largely consistent with key industries of employment observed within the Queanbeyan-Palerang LGA, NSW and the ACT, with the exception of public administration and safety in NSW which represents a significantly smaller proportion of employment (6%). Proportional employment recorded for the Queanbeyan-Palerang LGA, NSW and the ACT in industries including retail trade (7.1% - 9.7%) and health care and social assistance (9.6% - 12.5%) display significantly higher proportions compared to the Lake George SS, Bungendore SS and Tarago SS. This is likely to be a reflection that many residents of Bungendore and surrounds are employed in Canberra, with its higher proportion of public servants than other areas of the country.

The mining and construction industries employ between 0% and 1.8% and between 5.4% and 10.1% of the labour force respectively in the Lake George SS, Bungendore SS and Tarago SS. In comparison, the mining and construction industries employ between 0.1% and 0.9% and between 5.8% and 8.4% of the labour force in NSW and the ACT.

## Income

**Table 4.26** presents income statistics from the 2016 Census. The data indicates that the median individual, family, and household incomes in the Lake George SS, Bungendore SS and Tarago SS are generally higher than those in the Queanbeyan-Palerang LGA, NSW, and ACT.

**Table 4.26**
**2016 Census Income Statistics**

| Income | Lake George SS | Bungendore SS | Tarago SS | Queanbeyan-Palerang LGA | NSW | ACT |
|---|---|---|---|---|---|---|
| Median individual income ($/weekly) | 1 202 | 1 096 | 803 | 933 | 664 | 998 |
| Median family income ($/weekly) | 2 750 | 2 710 | 1 792 | 2 303 | 1 780 | 2 445 |
| Median household income ($/weekly) | 2 625 | 2 514 | 1 645 | 1 882 | 1 486 | 2 070 |
| Source: Australian Bureau of Statistics – 2016 Census Data. | | | | | | |

## Housing Cost

**Table 4.27** presents housing cost statistics from the 2016 Census. The data indicates that the median housing loan monthly repayment was higher in the Lake George SS and Bungendore SS ($2 383 - $2 600) compared to the Tarago SS, Queanbeyan-Palerang LGA, NSW and the ACT ($1 578 – $2 100). Median weekly rent was lower in the Lake George SS and Tarago SS ($220 - $250) compared to the Bungendore SS, Queanbeyan-Palerang LGA, NSW and the ACT ($300 - $450).

**Table 4.27**
**2016 Census Cost of Housing and Household Size Statistics**

| Household Statistic | Lake George SS | Bungendore SS | Tarago SS | Queanbeyan-Palerang LGA | NSW | ACT |
|---|---|---|---|---|---|---|
| Median housing loan repayment ($/monthly) | 2 600 | 2 383 | 1 578 | 2 100 | 1 986 | 2 058 |
| Median rent ($/weekly) | 250 | 450 | 220 | 300 | 380 | 380 |
| Average number of persons per bedroom | 0.9 | 0.8 | 0.9 | 0.8 | 0.9 | 0.8 |
| Average household size (persons) | 2.9 | 2.9 | 2.6 | 2.6 | 2.6 | 2.5 |
| Source: Australian Bureau of Statistics – 2016 Census Data. | | | | | | |

## Education

**Table 4.28** presents post-school education statistics from the 2016 Census. The data indicate that fewer people hold bachelor degrees level qualifications in the Lake George SS, Bungendore SS, Tarago SS and the Queanbeyan-Palerang LGA (14.6% - 22.4%) compared to those in NSW and the ACT (26.3% - 32.6%). However, a slightly greater average proportion of people in the Lake George SS, Bungendore SS and Tarago SS (12%) hold postgraduate degree level qualifications compared to the Queanbeyan-Palerang LGA, NSW and the ACT (11.6%).

**Table 4.28**
**2016 Census Post School Level of Education**

| | Lake George SS | | Bungendore SS | | Tarago SS | | Queanbeyan-Palerang LGA | | NSW | | ACT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Education level** | **No.** | **%** | **No.** | **%** | **No.** | **%** | **No.** | **%** | **No.** | **%** | **No.** | **%** |
| Postgraduate Degree Level | 11 | 17.5 | 246 | 11.2 | 15 | 7.3 | 2 725 | 9.6 | 344 490 | 9.3 | 34 819 | 15.9 |
| Graduate Diploma / Graduate Certificate Level | 0 | 0 | 108 | 4.9 | 7 | 3.4 | 1 261 | 4.4 | 103 340 | 2.8 | 13 412 | 6.1 |
| Bachelor's degree Level | 14 | 22.2 | 449 | 20.4 | 30 | 14.6 | 6 372 | 22.4 | 976 888 | 26.3 | 71 685 | 32.6 |
| Advanced Diploma / Diploma Level | 12 | 19.0 | 386 | 17.5 | 28 | 13.6 | 4 482 | 15.8 | 543 142 | 14.6 | 29 758 | 13.5 |
| Certificate Level | 20 | 31.7 | 691 | 31.4 | 86 | 41.7 | 8 973 | 31.6 | 1 100 959 | 29.7 | 43 625 | 19.9 |
| Level of Education Inadequately Described | 0 | 0 | 22 | 1.0 | 0 | 0 | 305 | 1.1 | 58 379 | 1.6 | 2 548 | 1.2 |
| Level of Education Not Stated | 7 | 11.1 | 293 | 13.3 | 46 | 22.3 | 4 312 | 15.2 | 582 903 | 15.7 | 23 803 | 10.8 |
| **Total** | **63** | | **2 204** | | **206** | | **28 434** | | **3 710 095** | | **219 643** | |
| Source: Australian Bureau of Statistics – 2016 Census Data. | | | | | | | | | | | | |

A significantly greater proportion of people in the Lake George SS, Bungendore SS, Tarago SS and the Queanbeyan-Palerang LGA hold certificate level qualifications (31.4% - 41.7%) compared to NSW and the ACT (19.9% - 29.7%). These statistics may potentially reflect the professional opportunities available to those in the Queanbeyan-Palerang LGA, with positions requiring a bachelor degree being more limited whilst more positions requiring certificate level qualifications are available.

### 4.13.3 Adverse and Beneficial Socio-economic Impacts

In order to assess the overall impact of the Proposal on the socio-economic environment, the various adverse and beneficial impacts are considered as follows.

#### Adverse Impacts

Considering the relative isolation of the Project Site, the previously considered impacts on local noise, air quality and traffic would each have a minor impact on the properties within and adjacent to the Project Site.

The aesthetic appeal of the local setting, when viewed from the residences and properties surrounding the Project Site, may be reduced. It is noted, however, that the Project Site represents an existing extractive operation and would only be visible from locations that currently have a view the existing Quarry. Furthermore, the proposed rehabilitation activities would convert disturbed areas to a landform and vegetation type similar to surrounding land uses including pasture suitable for grazing and wetlands.

As a result, adverse socio-economic impacts are likely to be negligible.

#### Beneficial / Positive Impacts

The Proposal would provide direct full-employment for between 10 and 12 people throughout the life of the Proposal. As it is the intention of the Operator to source the majority of the Proposal workforce from the Lake George and Bungendore areas, this would have a positive impact on economic activities within the Queanbeyan-Palerang Local Government Area and the Southern Tablelands region of NSW.

The Proposal would contribute approximately $17 million in total to the local, regional, State and National economies through the purchase of consumables and the payment of wages. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities. The Proposal would also generate ongoing support for training and education of employees.

Furthermore, the Proposal would contribute to the local, national and State economies through the provision of high quality sand products for the construction and infrastructure industries.

### 4.13.4 Management and Mitigation Measures

In addition to the mitigation measures and management procedures relating to amenity aspects such as noise, air quality, visibility, transportation etc., described previously in Section 4, the Operator would implement the following management and mitigation measures to ensure that Proposal-related benefits for the community surrounding the Project Site are maximised and adverse impacts are minimised.

- Proactively consult throughout the life of the Proposal with those residents who could potentially be adversely impacted by the Proposal.
- Continue to engage the community surrounding the Project Site through the use of an “open door” policy for any member of the community who wishes to discuss any aspect of the Proposal.

- Maintain a community complaints telephone line and ensure that the existence of the number is advertised widely.
- Give preference when engaging new employees, where practicable, to candidates from the surrounding communities over candidates with equivalent experience and qualifications from elsewhere and ensure that the contractors do so as well.
- Encourage and support participation of locally-based employees and contractors in training or education programs to impart the appropriate skillsets and qualifications in them for continued development and economic growth within the surrounding communities following completion of the Proposal.
- Give preference, where practicable and cost-competitive, to suppliers of equipment, services or consumables located within the surrounding communities.
- Support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance.
- Ensure that the land capability of those sections of the final landform to be used for grazing is similar to the current land capability.

### 4.13.5 Impact Assessment

Based on the consultation process identified in Section 3.2, the potential impacts relating to socio-economic issues after the adoption of the management and mitigation measures presented in Section 4.13.4 are as follows.

- Direct establishment of employment for between 10 and 12 persons, with additional employment for contract transportation personnel.
- Ongoing contributions to the local, regional, State and National economies, including contributions of approximately $17 million through wages and salaries and purchase of goods and services respectively, with additional indirect contributions.
- Continued support for local community organisations and services.

Assessment of the potential socio-economic impacts demonstrates the beneficial impacts of the Proposal far outweigh any minor adverse impacts associated with the operations.