

Section 4

Environmental Setting

Preamble

This section describes the environmental setting within and surrounding the Site for the proposed Karuah South Quarry.

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, geology, meteorology, land ownership and land use.

Other features of the surrounding environment that would or may be affected by the proposed Quarry are detailed in Section 5 in conjunction with the design and operational safeguards and impact assessment for those features.

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4.1 TOPOGRAPHY

4.1.1 Regional and Local Topography

The Site lies on the eastern side of the Great Dividing Range within the Karuah River Basin. The topography of the region is notable for its steep, rugged terrain in the Barrington Tops (northern section), approximately 68km north-northeast of the Site where the headwaters of the Karuah River are situated. Between the Barrington Tops and the Site, the regional topography features generally north / south trending ridges with elevations between approximately 680m AHD (Black Bulga State Conservation Area) to 390m AHD (Lawlers Range). In the southern section of the Karuah River Basin, these ridges generally give way to more isolated topographic features such as Billy Goat Hill which is located approximately 2.3km north northwest of the Site (see **Figure 4.1**).

The topography in the area in the vicinity of the Site comprises a combination of often steep-sided ridges and hill (which are often vegetated) with intervening gently sloping land which is often cleared.

The most notable topographic feature in the vicinity of the Site is Karuah Hill, which has an elevation of 246m AHD and is situated approximately 1.7 south of the Site (see **Figure 4.1**).

Figure 4.1 displays the local topography, watercourses and catchments within the local area.

4.1.2 Site Topography

The Site is located within an area of elevated terrain within a prominent northeast / southwest ridgeline approximately 4km northwest of Karuah. Elevations range from approximately 13m AHD to 125m AHD at the highest point within the Site (see **Figure 4.2**).

The topography of the Site slopes steeply from north to south where the Yalimbah Creek traverses the southern edge of the Site before draining into the tidally influenced Karuah River / Port Stephens system.

4.2 GEOLOGY

4.2.1 Regional and Local Geology

The Site is located in the Myall Structural Block, part of the Tamworth Belt in the southern part of the New England Fold Belt. The principal unit in the region is the Nerong Volcanics which comprise dominantly dense terrestrial rhyodacitic ignimbrite. The Nerong Volcanics is disconformably overlain by the Karuah Formation and the Booti Booti Sandstone and conformably overlies the Conger Formation and Boolambayte Formation. The stratigraphic sequence beneath the Site dips gently to the south-southeast. The local geology is shown in **Figure 4.3**.

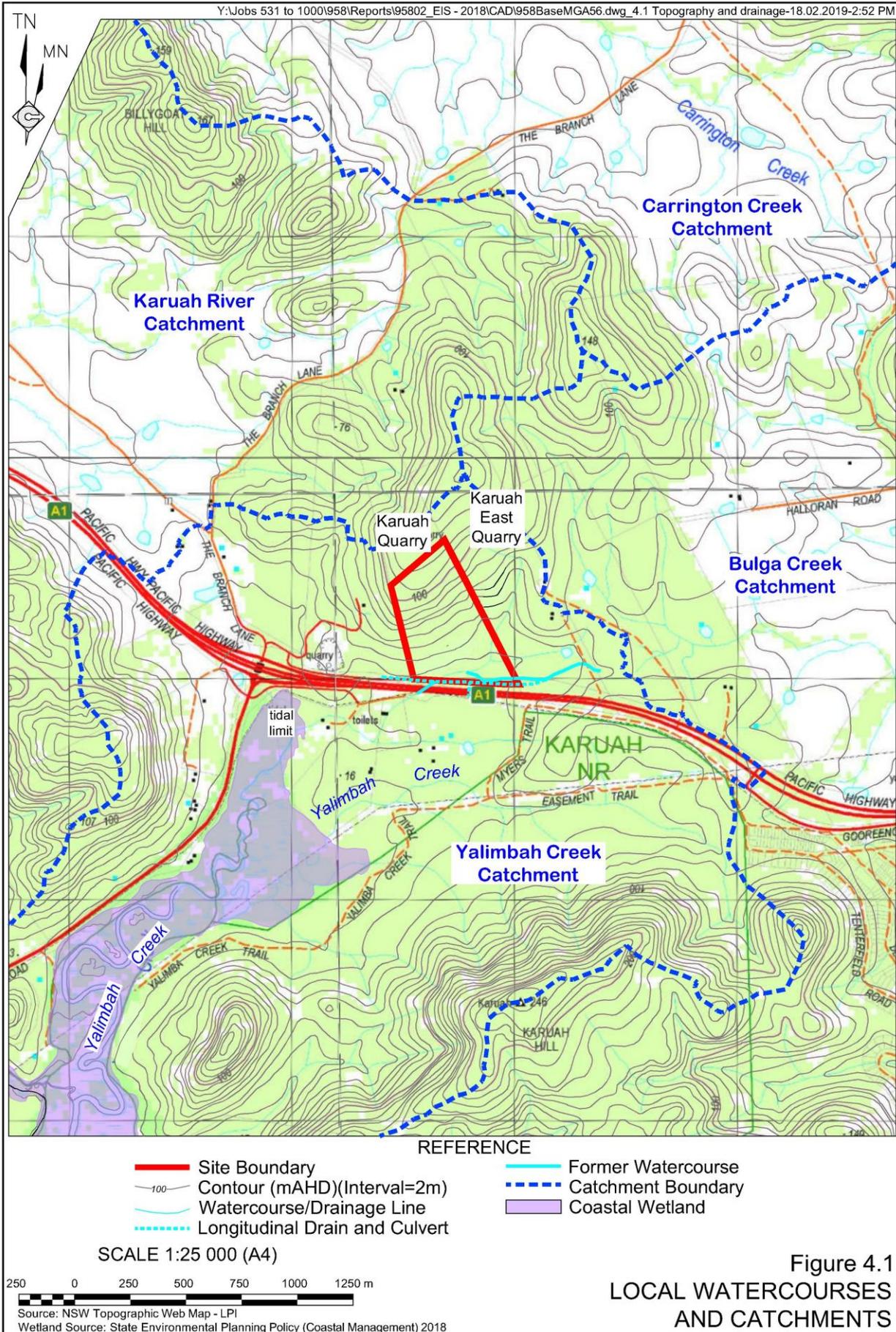
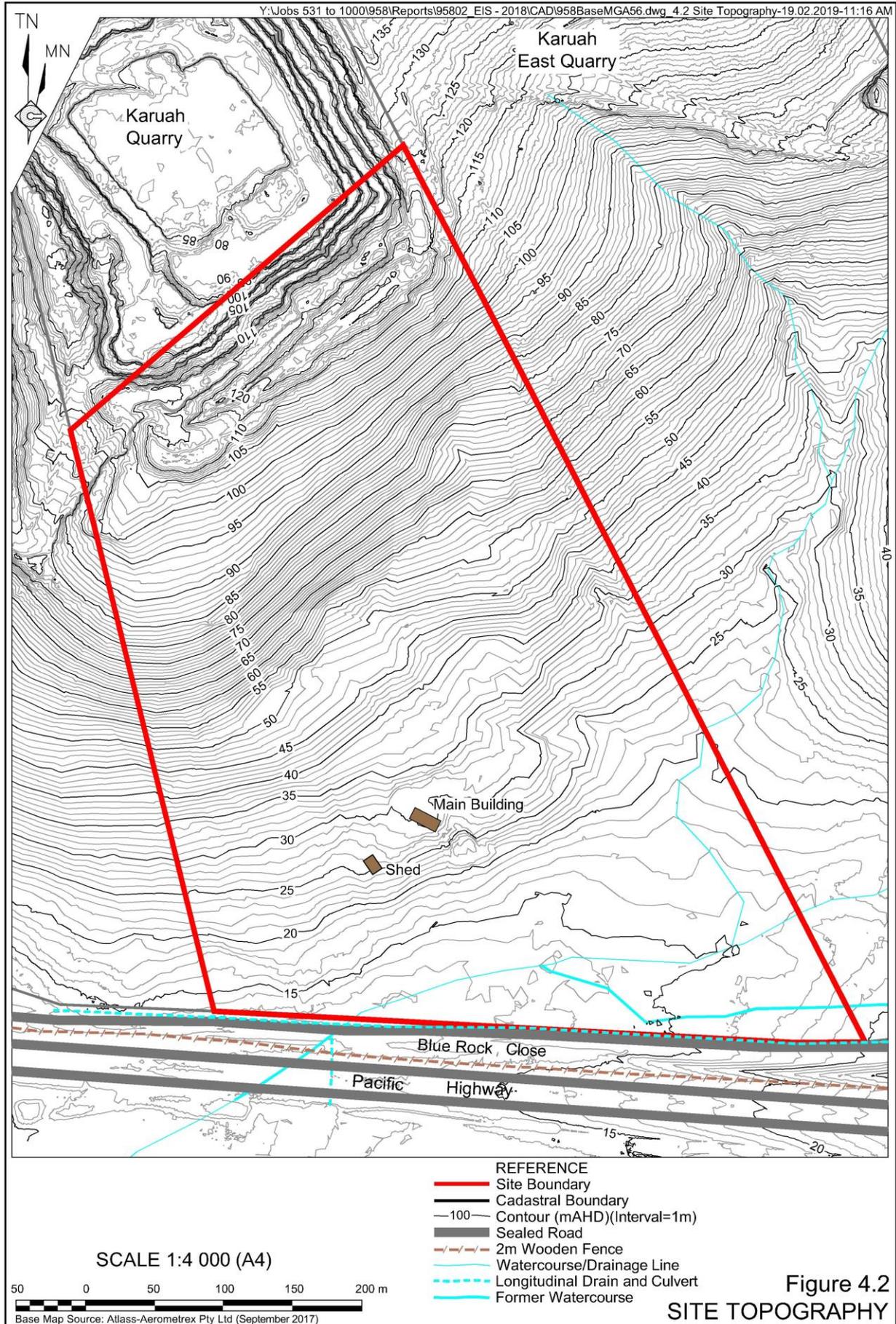
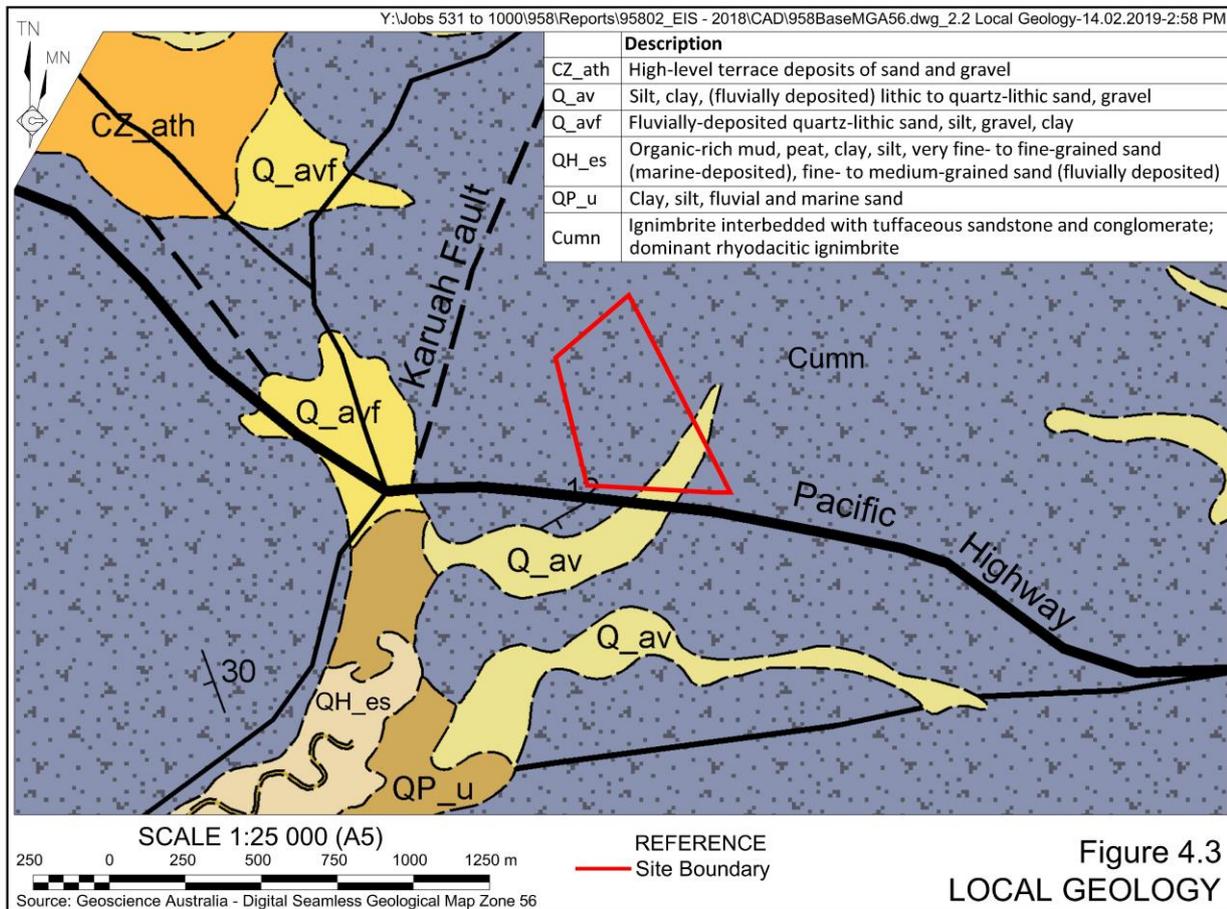


Figure 4.1
 LOCAL WATERCOURSES
 AND CATCHMENTS





4.2.2 Site Geology

The Site is underlain by a sequence of Carboniferous volcanics and interbedded tuffaceous and clastic sedimentary rocks. The rhyodacitic ignimbrite resource within and surrounding the Site is comparatively homogenous and broadly tabular in shape, consistent with the mode of formation – a spatially extensive, blanket type, ignimbrite eruption emanating from a nearby volcano or volcanoes.

The rhyodacitic ignimbrite within the proposed extraction area is an extension of the same unit that is the target resource of Hunter Quarries’ existing and future extraction operations at both the Karuah Hard Rock and Karuah East Quarries. These operations presently provide aggregates and construction materials for use in the construction industry.

4.3 METEOROLOGY

4.3.1 Introduction

Meteorological conditions have the potential to influence a range of Project-related impacts on surrounding residences and the environment. This subsection provides a brief overview of the meteorological conditions surrounding the Sites, focusing particularly on those aspects of the climate that are likely to influence the potential Project-related environmental impacts.

Temperature and rainfall data has been sourced from the Bureau of Meteorology’s (BoM) Nelson Bay (Nelson Head) (BoM ID 061054) weather station which is situated approximately 18km southeast of the Site – 1881 to present. Whilst rainfall data collection commenced in 1881, temperature data collection for this station only commenced in 1914.

Wind speed and monthly relative humidity data has been sourced from the BoM’s Williamtown RAAF (BoM ID 061078) weather station which is located approximately 23.7km southwest of the Site.

Monthly evaporation data was processed using information sourced from the Scientific Information for Land Owners (SILO) database, managed by the Queensland Department of Environment and Science (DES). The program uses historic Bureau of Meteorology datasets and interpolation techniques to generate continuous daily time step synthetic climate data for any given location in Australia. The SILO dataset for the period 1 January 1889 to 13 September 2018 was generated for the Site (Latitude -32.65, Longitude 152.00) on 14 September 2018.

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

Table 4.1
Monthly Meteorological Data

| | Jan | Feb | Mar | April | May | June | July | Aug | Sept | Oct | Nov | Dec | Annual |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Temperature (C°) – Nelson Head (BoM ID 074037) (1914 to present) | | | | | | | | | | | | | |
| Mean maximum temperature | 27.3 | 27.0 | 25.9 | 23.6 | 20.8 | 18.2 | 17.5 | 18.9 | 21.4 | 23.2 | 24.7 | 26.1 | 22.9 |
| Mean minimum temperature | 18.9 | 19.1 | 17.8 | 15.3 | 12.4 | 10.2 | 9.1 | 9.9 | 12.0 | 14.1 | 16.0 | 17.7 | 14.4 |
| Rainfall (mm) – Nelson Head (BoM ID 074037) (1881 to present) | | | | | | | | | | | | | |
| Mean rainfall | 100.5 | 111.3 | 117.5 | 129.4 | 150.2 | 157.9 | 137.5 | 101.7 | 89.2 | 77.9 | 80.2 | 93.2 | 1343.6 |
| Highest rainfall | 559.7 | 530.8 | 401.8 | 493.8 | 632.0 | 607.6 | 615.9 | 630.6 | 311.9 | 297.0 | 264.3 | 334.3 | 2335.9 |
| Lowest rainfall | 2.5 | 0.0 | 3.6 | 0.0 | 7.9 | 6.2 | 0.0 | 0.8 | 1.5 | 0.0 | 0.0 | 5.8 | 416.6 |
| Highest daily rainfall | 155.7 | 257.8 | 217.7 | 168.0 | 225.0 | 148.1 | 137.2 | 130.0 | 208.3 | 74.9 | 191.8 | 191.5 | 257.8 |
| Relative Humidity (%) Williamtown RAAF (Bom ID 061078) 1942 - 2010 | | | | | | | | | | | | | |
| Mean 9am relative humidity | 72.0 | 76.0 | 77.0 | 76.0 | 79.0 | 80.0 | 77.0 | 71.0 | 66.0 | 64.0 | 66.0 | 68.0 | 73.0 |
| Mean 3pm relative humidity | 59.0 | 62.0 | 61.0 | 59.0 | 60.0 | 60.0 | 55.0 | 50.0 | 50.0 | 54.0 | 55.0 | 56.0 | 57.0 |
| Wind Speed (km/h) Williamtown RAAF (Bom ID 061078) 1942 - 2010 | | | | | | | | | | | | | |
| Mean 9am wind speed | 11.9 | 10.6 | 10.2 | 11.4 | 13.7 | 15.9 | 16.4 | 16.8 | 15.3 | 14.4 | 14.4 | 12.9 | 13.7 |
| Mean 3pm wind speed | 21.9 | 20.6 | 18.9 | 17.2 | 15.8 | 17.5 | 18.7 | 20.9 | 22.0 | 22.5 | 23.5 | 23.5 | 20.2 |
| Evaporation (mm) – SILO (1889 to present) | | | | | | | | | | | | | |
| Mean daily evaporation | 5.9 | 5.1 | 4.2 | 3.2 | 2.3 | 2.0 | 2.2 | 3.0 | 4.1 | 4.9 | 5.4 | 6.1 | 4.0 |

It is noted that the Operator would establish an on-site meteorological station prior to the despatch of products to record site-specific data relating to temperature, rainfall, wind speed and direction and relative humidity.

4.3.2 Temperature and Humidity

Temperature data show that January is typically the warmest month with a mean maximum temperature of 27.3°C and mean minimum temperature of 18.9°C. The lowest temperatures are typically recorded in July which has a mean maximum temperature of 17.5°C and a mean minimum temperature of 9.0°C.

The lowest average relative humidity generally occurs in late winter and early spring, with August and September sharing the lowest relative humidity values throughout the year. The highest average relative humidity is typically experienced in June.

4.3.3 Rainfall

Rainfall data has been recorded at the Nelson Head weather station since 1881. Mean annual rainfall is 1 343.6mm. The distribution of rainfall is relatively even, although the autumn and winter (mean rainfall 794mm) months receive approximately 60% of the total rainfall experienced throughout an average year. On average, the driest month is October with 77.9mm of rainfall whilst the wettest month on average is June with 157.9mm (**Table 4.1**). The driest year on record was 1917 when 416.6mm of rain was recorded. By contrast, the wettest year on record was 1949 when 2 335.9mm of rain was recorded.

The maximum daily rainfall recorded is 257.8mm which was recorded on 9 February 1889. Maximum daily rainfall exceeds monthly average rainfall for all months, with the exception of August, indicating that high intensity storms with significant rainfall over a relatively short duration may occur, particularly in the summer months.

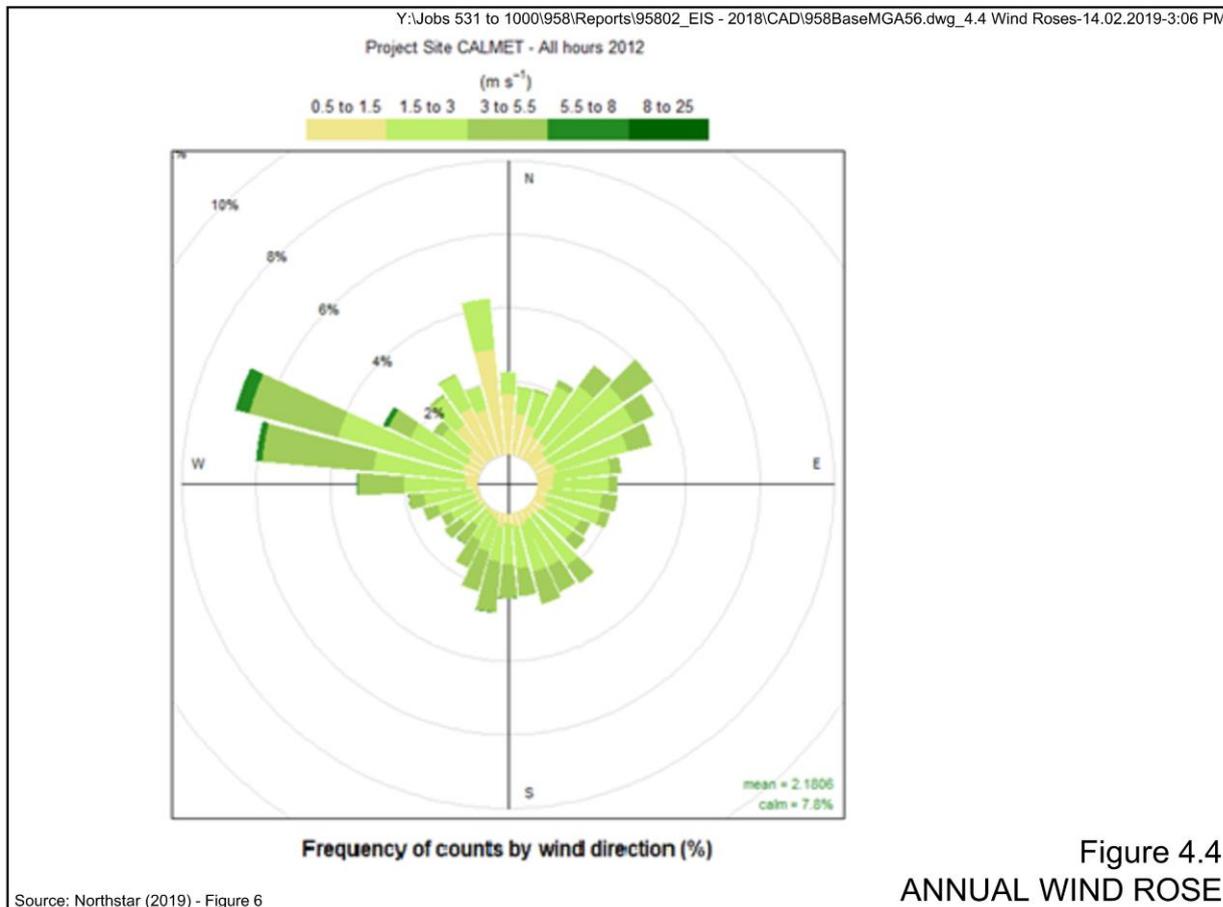
4.3.4 Evaporation

Mean evaporation data is not available from the Nelson Head weather station and the information presented in **Table 4.1** has been derived from SILO data. Mean evaporation at the Site is subsequently anticipated to be 4.0mm per day throughout the year or 1 510mm per year. Mean daily evaporation varies between 2.0mm per day in June and 6.1mm per day in December.

4.3.5 Wind

Figure 4.4 presents a summary of the site-specific wind conditions predicted by CALMET based upon data drawn from the Nobbys (Newcastle), Williamtown RAAF and Paterson (Tocal) meteorological stations. A full description of the modelling undertaken to establish site-specific wind conditions is presented in Annexure 1 of Northstar (2018).

Prevailing wind directions at the Site predominantly originate from the western quadrant. The Site experiences a mean wind speed of approximately 2.2m/s with calm conditions experienced approximately 8% of the time.



4.4 LAND OWNERSHIP AND SURROUNDING RESIDENCES

The existing land ownership within and surrounding the Site is shown on **Figure 4.5**. Residences on properties surrounding the Site are also shown in **Figure 4.5**. The Site is located between two existing quarries and the Pacific Highway. A total of fourteen privately-owned rural-residential properties are located within a 2km radius of the Site largely south of the Site on the southern side of the Pacific Highway. Larger rural properties are located to the north and west of the Site. Four residences are located east of the Site but are closer to the existing Karuah East Quarry.

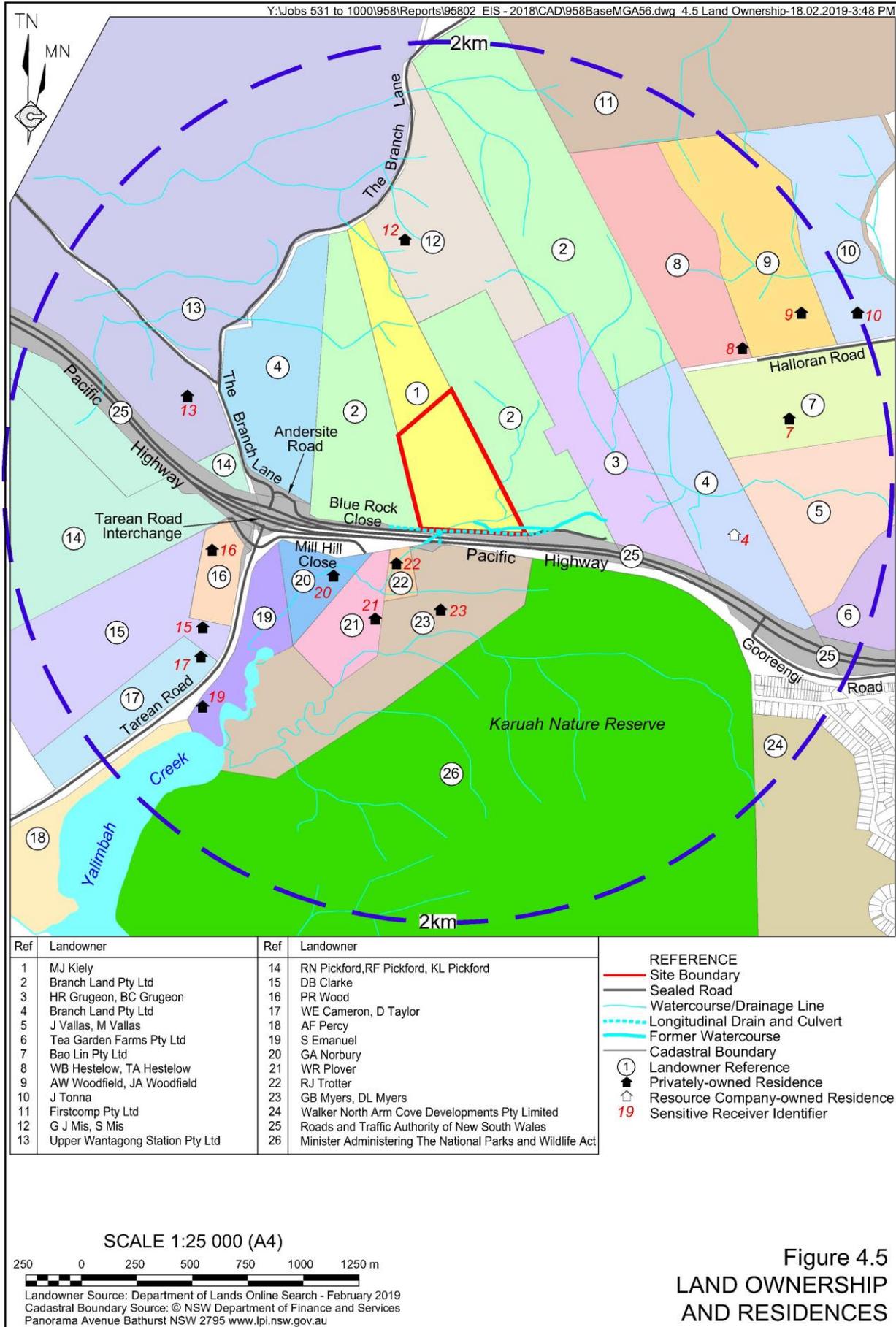
4.4.1 On-site Land Uses

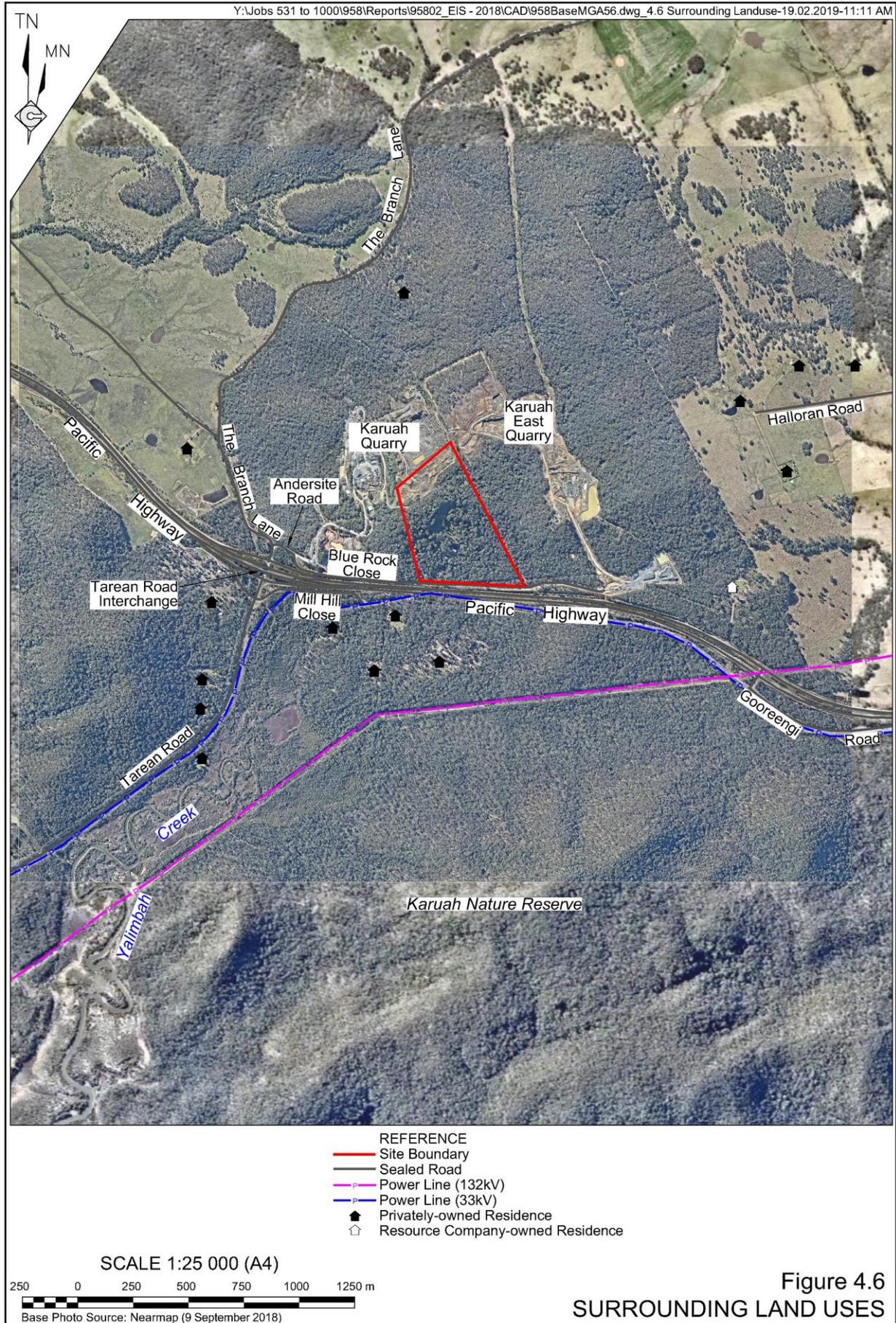
The Site is currently used for passive nature conservation and exploration activities. Selective logging has historically occurred on the Site however, the extent of logging has been limited due to the comparatively steep nature of the topography.

4.4.2 Surrounding Land Uses

Figure 4.6 shows the land uses surrounding the Site.

The Site is bordered on three sides by existing or prospective quarry operations worked by Hunter Quarries. Extractive industry is the only known industry proximal to the Site.





The Pacific Highway is located immediately to the south of the Site. Land to the south of the Pacific Highway generally comprises a small number of medium sized landholdings, substantial areas of which are heavily vegetated. These landholdings primarily consist of residential lifestyle lots ranging between 2ha to 10ha. The Karuah Nature Reserve adjoins many of these lots and comprises heavily vegetated land spanning to the Karuah River approximately 4km to the southwest of the Site. North Arm Cove, a residential suburb within the MidCoast LGA, extends to within approximately 1.5km southeast of the Site.

Much of the land to the north of the Pacific Highway comprises large lifestyle lots (up to ~40ha) with many owners only present on the weekend. These lots are typically heavily vegetated. Extensive areas to the north of the Pacific Highway have also been cleared and are utilised for grazing. These lots typically range from between 40ha to >250ha.

4.5 BUSH FIRE HAZARD

For the management and mitigation of bushfires, MidCoast Council refers to assessments conducted by the NSW Rural Fire Service (RFS). The RFS mapping tool, accessed on 4 April 2018, identifies the Site as being within a designated bush fire prone area. **Figure 4.7** displays the bush fire prone land within and surrounding the Site.

A detailed bush fire hazard analysis is provided in Section 5.11.3 of the EIS.

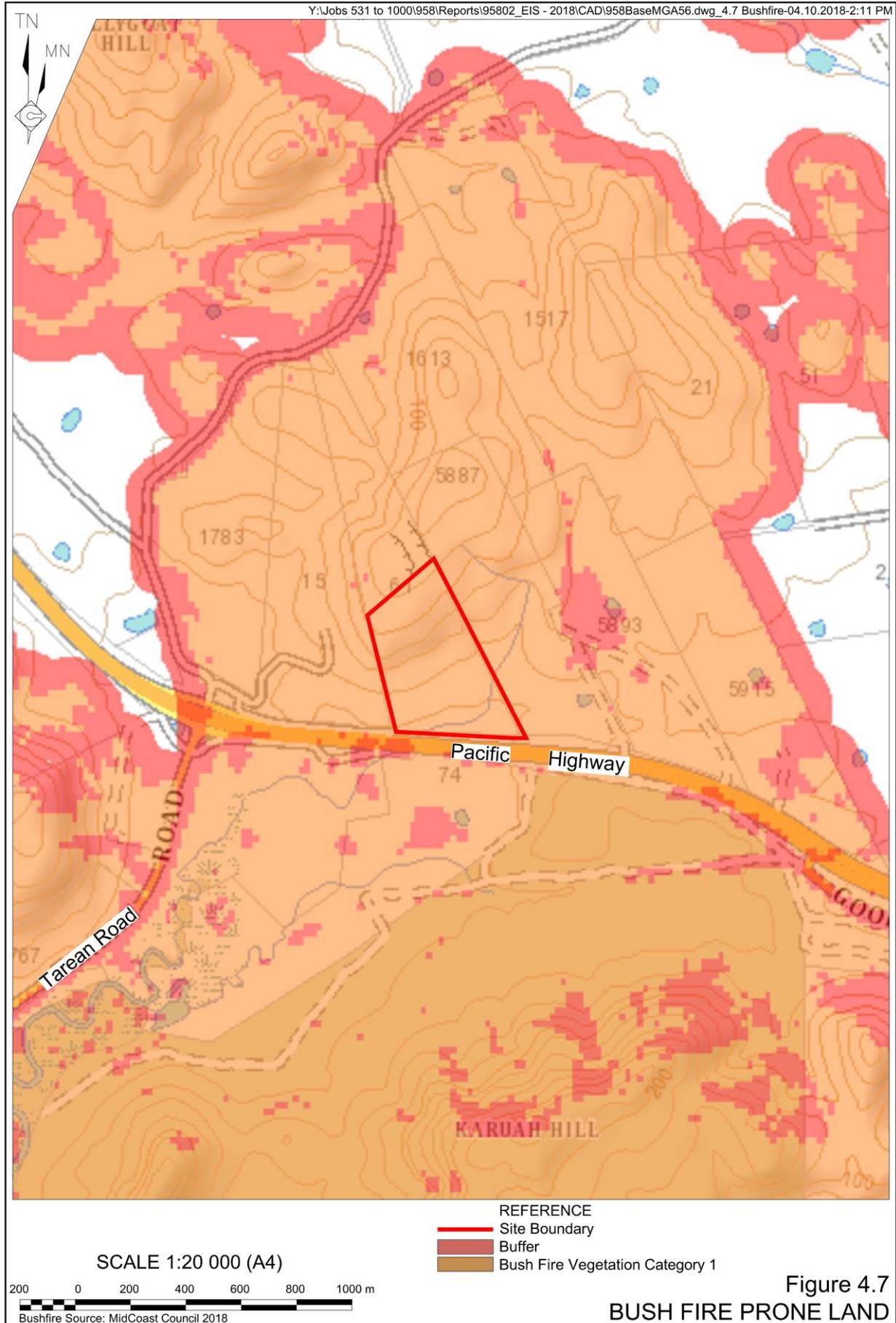
4.6 SERVICES

The following services are located within the proposed Site.

- Two utility power poles located in the southwestern corner of the Site. Power is supplied to the main building on the Site from a transformer near the proposed Quarry entrance.
- Direct buried Telstra cables traversing the southern end of the Site with two cable jointing pits also situated near the southern boundary.

Amendments to the alignment and structures for these services may be required during the site establishment and construction stage.

No other services are located within the Site boundary.



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