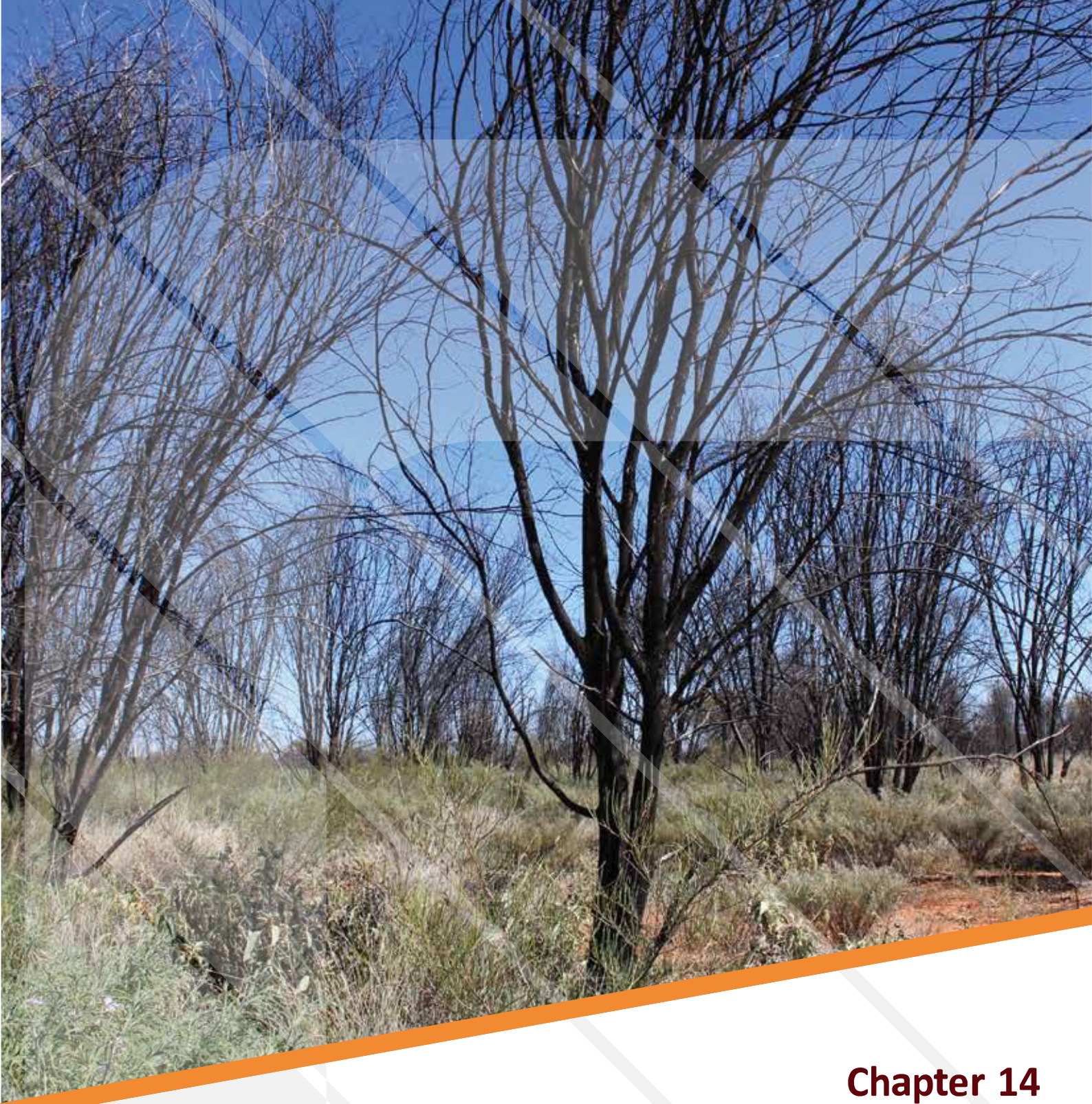




Chapter 14

Bushfire



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ABBREVIATIONS

CEMP	Construction Environmental Management Plan
DENR	Department of Environment and Natural Resources
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
GIS	Geographical Information System
NT	Northern Territory
OEMP	Operational Environmental Management Plan
PFS	Pre-Feasibility Study
RCP	Rehabilitation Closure Plan
ToR	Terms of Reference



14 BUSHFIRE

14.1 Introduction

This chapter assesses the potential for an increased incidence of bushfire brought about by the Proposal. This chapter is based on the findings of a bushfire hazard analysis undertaken by the proponent and also draws on a comprehensive terrestrial ecological assessment, which is included as Appendix O. This chapter describes the local climatic conditions, vegetation and bushfire history within the proposed development footprint and vicinity. The potential for an increase in the incidence of bushfires are assessed during construction, operation and closure and rehabilitation of the Proposal. Mitigation and management measures are identified to reduce potential impacts. A draft Bushfire Management Plan is provided in Appendix O.

The bushfire hazard analysis has been prepared in consultation with government departments, pastoralists and Traditional Owners. It has also been prepared in accordance with the Terms of Reference (refer to Appendix A).

14.2 Methodology

The bushfire hazard analysis included a desktop assessment, field investigation, analysis and consultation with Traditional Owners.

14.2.1 Desktop assessment

The desktop assessment included the collation and analysis of:

- Mapping obtained from the North Australia and Rangelands Information website.
- Bushfire prone land by identifying fire scars via satellite imagery and aerial photography flown by the proponent.
- Vegetation, physical relief, tenure, roads and other descriptive features such as aspect, slope, temperature and wind direction.

14.2.2 Field investigations

Extensive field surveys have been undertaken within the proposed development footprint and vicinity over the past four years (between October 2012 and April 2016). The purpose of the field surveys was to document soil types, slope, access and vegetation type and to determine likely constraints with respect to bushfire and the development of the Proposal. Assessments were conducted within and on the boundaries of the following areas:

- The proposed Chandler Facility (including the accommodation village and mine infrastructure area).
- The proposed Chandler Haul Road.



- The proposed Apirnta Facility.
- The proposed Henbury Access Road.

The information recorded in each vegetation type included vascular plant species present, vegetation structure and density, the presence of woody debris and weeds, the impact of disturbance and current vegetation condition.

The above areas were traversed by foot via transect surveys and studied using a GIS.

14.2.3 Consultation

The bushfire hazard analysis was prepared in consultation with government departments, pastoralists and Traditional Owners. The DENR were consulted in order to determine whether the proposed development footprint or vicinity have a specific zoning under the NT Bushfire Regulations. General bushfire mitigation options and recommendations were also discussed considering the results of both the desktop assessment and field investigations. Pastoralists and Traditional Owners were also consulted on issues relating to plants, animals and bushfire history within the proposed development footprint and vicinity.

14.3 Existing environment

This section describes the local climatic conditions, vegetation and bushfire history within the proposed development footprint and vicinity. Fire protection zones are also discussed.

14.3.1 Climate

Climatic conditions influence the risk of bushfires. The highest risk time for bushfires is during periods of low humidity and high temperature. Wind is also an important factor in influencing the direction and speed of a bushfire.

Temperature and humidity

The temperature within the proposed development footprint and vicinity is characterised by distinct hot summers and cold winters, with a wide diurnal range in temperature. Winter months have mean minimum temperatures under 10 degrees Celsius. Summer months have mean maximum temperatures over 30 degrees Celsius.

Air temperatures measured within the proposed development footprint between 5 November 2015 and 31 July 2016 varied between -2.0 degrees Celsius (in winter) and 43.1 degrees Celsius (in summer). The average temperature measured over the year was 24.2 degrees Celsius. Average, maximum and minimum hourly temperatures measured during each season within the proposed development footprint are presented in Table 14-1.



Table 14-1 Observed temperatures - Chandler – 5 November 2015 to 31 July 2016

Season	Temperature (° C)		
	Maximum	Average	Minimum
Annual [partial]	43.1	24.2	-2.0
Spring [partial]	41.8	31.4	20.7
Summer	43.1	29.9	17.0
Autumn	39.9	24.0	6.3
Winter [Partial]	29.3	13.8	-2.0

The daily average temperature along with the observed range in daily temperature calculated between 5 November 2015 and 31 July 2016 is presented in Figure 14-1. As expected, the maximum daily average and maximum temperatures occur during the summer months with a daily average temperature of 29.9 degrees Celsius observed.

Air temperatures during the winter months are, on average, 13.8 degrees Celsius but during the day have reached the high 20 degrees Celsius during the year of measurement. The coldest temperature observed was -2.0 degrees Celsius in winter 2016.

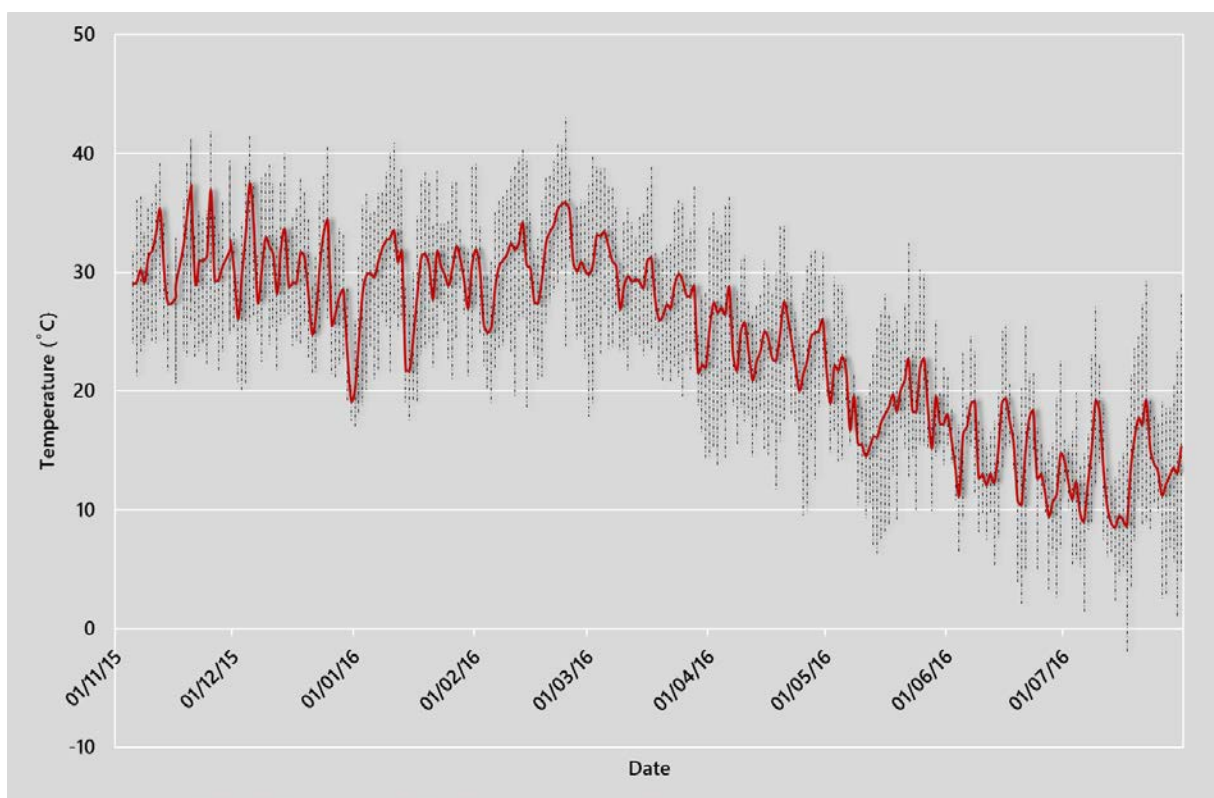


Figure 14-1 Daily average air temperature (red) and observed range in temperature (grey) - Chandler - 5 November 2015 to 31 July 2016

The highest humidity is during winter where it can reach 64% (June) with the lowest humidity at 30% (October to December).



Wind

Annual and seasonal wind roses for the proposed development footprint and vicinity are presented in Figure 14-2. The distribution of wind speed in a number of categories, including calm winds are presented in Figure 14-3.

The wind roses indicate that over the course of a year, winds are predominantly from east north-east to south south-easterly directions. The majority of wind speeds experienced within the proposed development footprint are generally in the range 1.5 metres per second to 5.5 metres per second (frequency of 80.8% combined) with the highest wind speeds (greater than 10.5 metres per second) occurring from an east north-easterly direction. Winds of this speed are rare and occur for less than 0.1% of the observed hours during the year (less than eight hours per year). Calm winds (less than 0.5 metres per second) occur during 2.4% of the observed hours during the year.

The seasonal wind roses show a seasonality in wind speeds and direction:

- **Spring.** Winds are predominantly from the north-east to southerly directions with some observed winds originating from a northerly direction. Wind speeds are mainly in the range 3.0 metres per second to 5.5 metres per second (frequency of 46.9%) and 1.5 metres per second to 3.0 metres per second (frequency of 42.3%) categories. High wind speeds (8.0 metres per second to greater than 10.5 metres per second) have not been recorded within the proposed development footprint or vicinity, to date. Calm winds are experienced for 1.1% of the observed hours during the spring months.
- **Summer.** Winds are predominantly from the south south-east direction. Wind speeds during the summer months are predominantly in the range of 1.5 metres per second to 5.5 metres per second (frequency of 79.8%). Calm winds are experienced for 1.1% of the time during the summer months.
- **Autumn.** Winds are predominantly from the south to north-east directions. Wind speeds are predominantly in the 1.5 metres per second to 5.5 metres per second categories (frequency of 82.8%). Calm winds are experienced for 2.8% of the time during autumn months.
- **Winter.** Winds are predominantly from the east south-east direction. Wind speeds during the winter months are predominantly in the range of 1.5 metres per second to 5.5 metres per second (frequency of 75.3 %). Lighter winds (1.5 metres per second to 3.0 metres per second) are experienced for 46.1% of the observed hours during the winter months. Calm winds are experienced for 4.1% of the time during winter months.

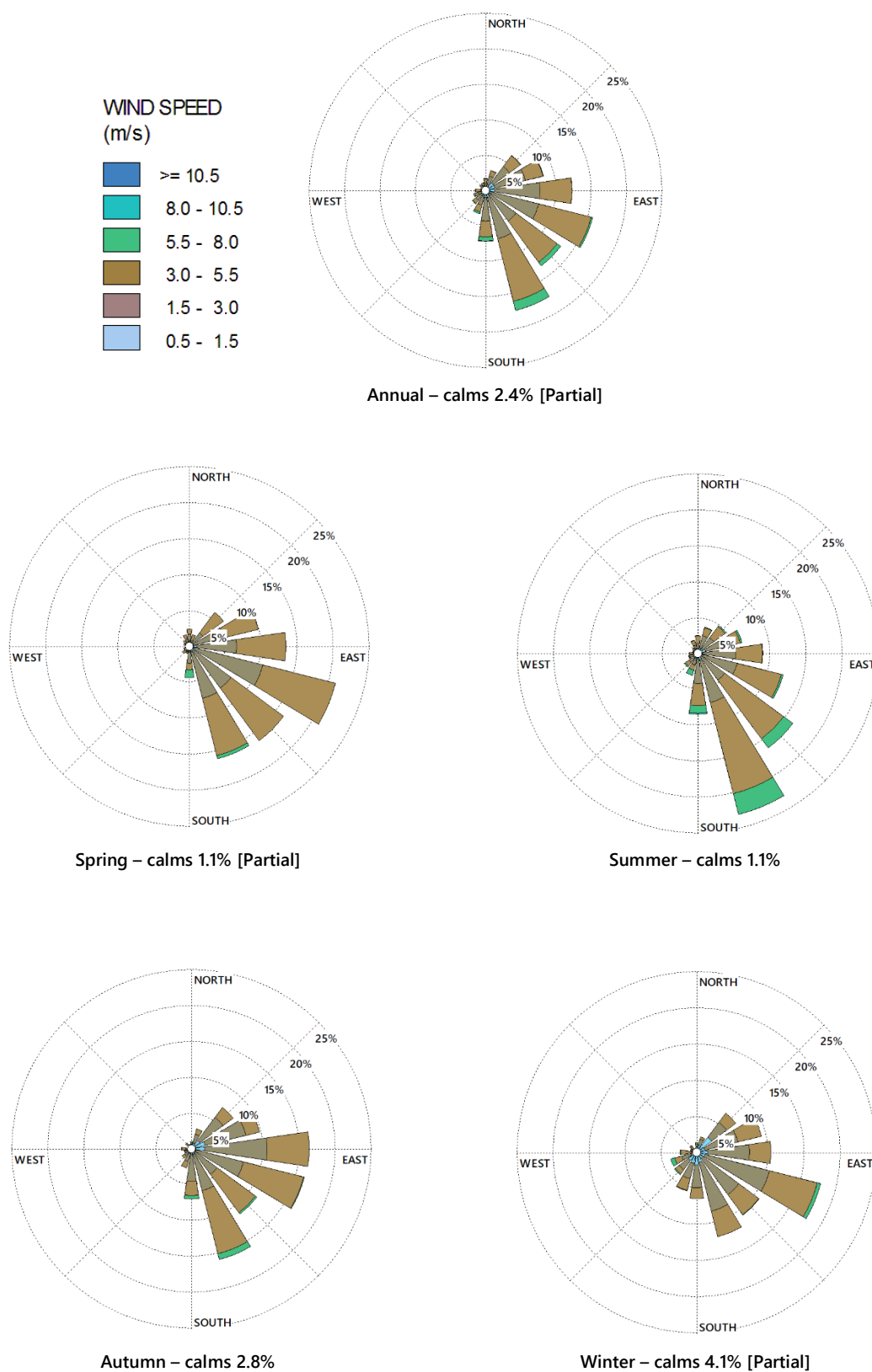


Figure 14-2 Annual and seasonal wind roses - Chandler – 5 November 2015 to 31 July 2016

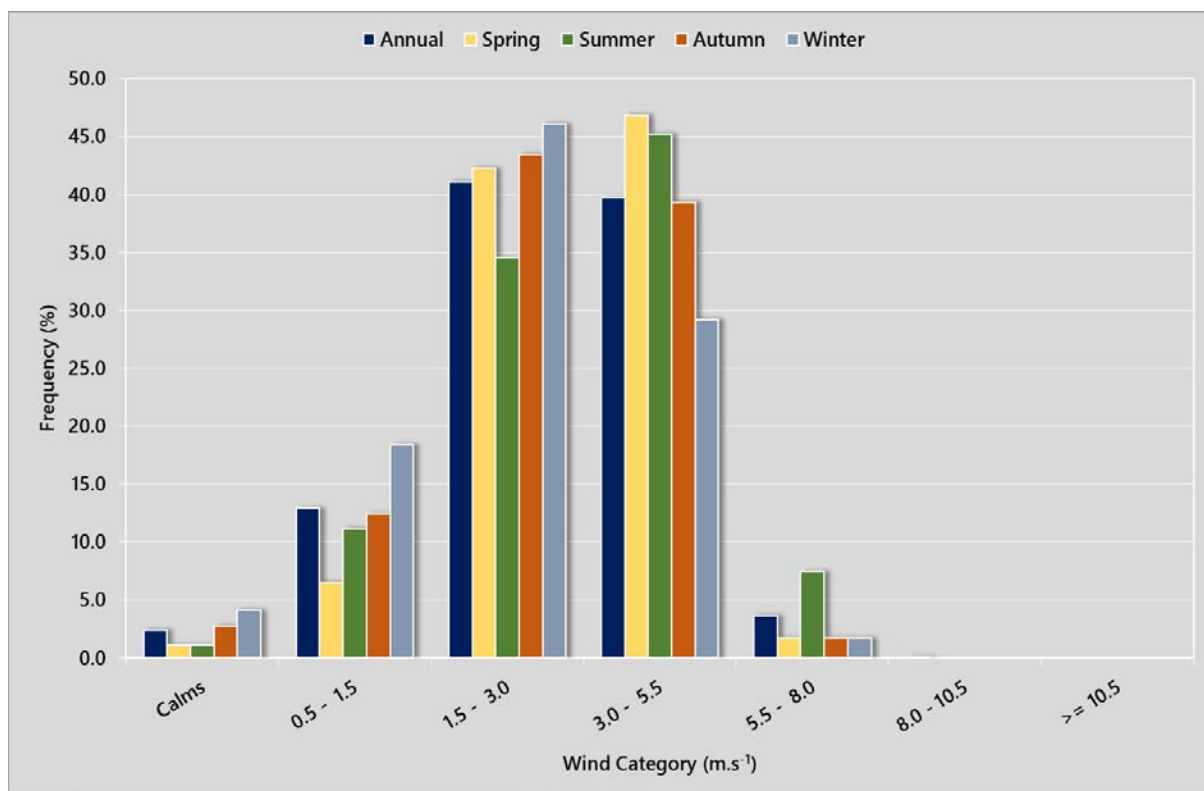


Figure 14-3 Annual and seasonal wind speed distribution - Chandler – 5 November 2015 to 31 July 2016

14.3.2 Vegetation

Vegetation within the proposed development footprint and vicinity is dominated by an understorey of short grasses and low to tall shrublands. The grasses consist of predominately *Aristida* and *Enneapogon* species, but also highly flammable soft and hard spinifex (*Triodia pungens* and *Triodia basedowii*). The shrublands consist primarily of mulga (*Acacia aneura*) or witchetty bush (*Acacia kempeana*) with scattered desert oak (*Allocasuarina decaisneana*). Vegetation is generally sparse and only after significant rainfall events does density become an issue for bushfires.

A detailed description of vegetation within the proposed development footprint and vicinity is provided in Chapter 7 and Appendix O.

14.3.3 Bushfire history

Mapping obtained from North Australia and Rangelands Information shows areas of fire scarring within the proposed development footprint and vicinity in 2011. The fire history of the proposed development footprint and vicinity is shown in Figure 14-4. Evidence of that fire and previous bushfires in the vicinity of the proposed development footprint are shown in Plate 14-1 and Plate 14-2. The fire had a significant adverse impact on the open mulga community in this area. Most of



the affected vegetation were mature species. Since then, little to no re-growth of that particular community has occurred in this area.

Desert oaks in the mine infrastructure area also show evidence of fire, but not at the proposed accommodation village. There is also no evidence of fire within the vicinity of the proposed Apirnta Facility. The majority of understorey plants, or those that depend on fire to regenerate, have regrown and now flourish since the bushfire in 2011. Note, the plant communities shown in Plate 14-1 lie outside of the proposed mine infrastructure area.

14.3.4 Fire protection zones

Certain areas have been declared fire protection zones in the NT. These fire protection zones are:

- All of the Vernon Region (essentially the greater Darwin and Batchelor/Coomalie areas).
- A 50 kilometre radius from Katherine Post Office.
- A 50 kilometre radius from Tennant Creek Post Office.
- A 50 kilometre radius from Alice Springs Airport.

Fires cannot be lit in these areas without a permit at any time of the year (DENR 2016).

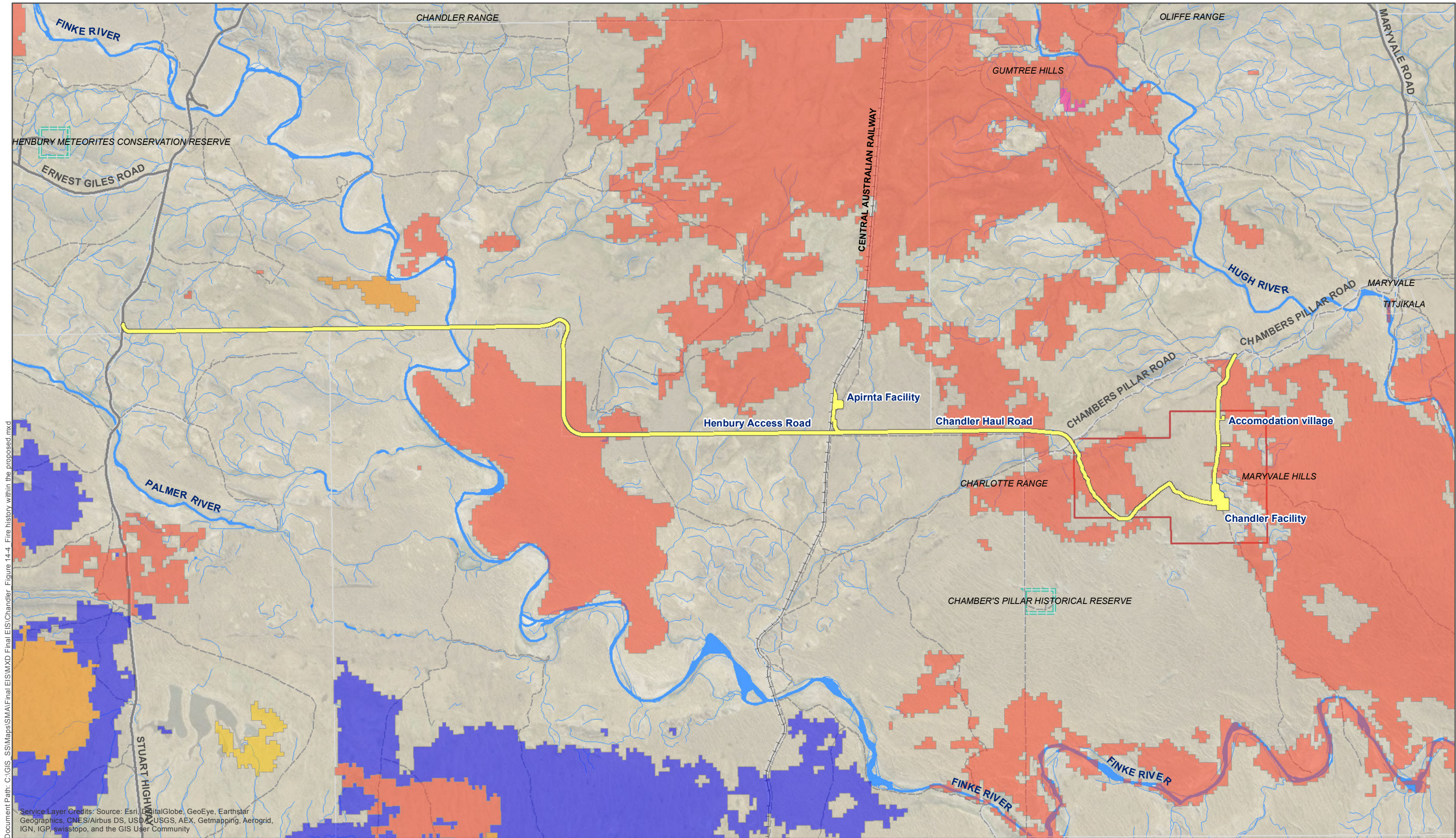
None of the above fire protection zones are located within the proposed development footprint or vicinity.



Plate 14-1 Evidence of past bushfire and regrowth of juvenile mulga in the foreground



Plate 14-2 Shrubs in the background scared by bushfire and understorey regrowth in the foreground



Document Path: C:\GIS_SSM\Maps\SMA\Final EIS\MXD Final EIS\Chandler_Figure 14-4_Fire history within the proposed mxd

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA/USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

 Proposed development footprint	Years since last burnt	 5
 Watercourse	 3	 7
 ML30612	 4	 14

Figure 14-4
Fire history within the proposed
development footprint and vicinity





14.4 Assessment of risk during construction, operation and closure and rehabilitation

There may be an increase in the incidence of bushfire from the accidental ignition of combustible fuels during construction, operation, and closure and rehabilitation of the Proposal. The causes of bushfire may be triggered as a result of:

- Hot works.
- Use/storage of flammable and/or volatile fuels.
- Smoking cigarettes.

Bushfires may also be triggered from natural events (e.g. lightning strike), from back burning on surrounding pastoral properties and from deliberately lit fires outside of the proposed development footprint. If a bushfire were to occur, humans, assets and the environment may be impacted.

The above factors may increase the likelihood of bushfires within or in the vicinity of the proposed development footprint, potentially near highly flammable plant species including soft and hard spinifex (*Triodia pungens* and *Triodia basedowii*) (refer to Plate 14-3).

Baseline wind data indicates that during summer, wind speeds between 3.0 metres per second to 5.5 metres per second occur for 45% of the season and originate from the south south-east. The existing Maryvale Hills would act as a natural buffer to any fires spreading from this direction.



Plate 14-3 Spinifex grass within the proposed accommodation village.

14.5 Mitigation and monitoring

Mitigation and management measures proposed to reduce the incidence of bushfire during construction, operation, and closure and rehabilitation of the Proposal are listed in Table 14-2. These measures would be incorporated into the CEMP, OEMP and/or RCP for the Proposal. A draft Bushfire Management Plan has also been prepared for the Proposal (refer to Appendix O).



Table 14-2 Mitigation and management measures (bushfire)

ID	Outcome	Mitigation/management measure	Timing
BF.1	Reduced incidence of bushfire (protection of human life, assets and the environment)	Finalise draft Bushfire Management Plan prior to construction and incorporate into the CEMP, OEMP and RCP. The plan collates measures to mitigate and manage potential impacts on the humans, assets and the environment.	Pre-construction
BF.2	Reduced incidence of bushfire (protection of human life, assets and the environment)	Undertake fuel load assessments annually to assess bushfire potential and need for pro-active controls, e.g. back burning.	Construction, operation, closure and rehabilitation
BF.3	Reduced incidence of bushfire (protection of human life, assets and the environment)	Create fire breaks/asset protection zones with reference to prevailing wind directions, highest wind speeds and vegetation types. Preliminary asset protection zones are provided in Table 14-3.	Construction, operation, closure and rehabilitation
BF.4	Reduced incidence of bushfire (protection of human life, assets and the environment)	Consult with the NT Fire and Rescue Service on issues relating to: • Strategic planning of bushfire with respect to the layout of the Chandler Facility. • Fire safety. • Hazard abatement. • Firefighter training. • Operations support and administration.	Pre-construction, construction and operation
BF.5	Reduced incidence of bushfire (protection of human life, assets and the environment)	Ensure bushfire suppression equipment is available on-site.	Construction, operation, closure and rehabilitation
BF.6	Reduced incidence of bushfire (protection of human life, assets and the environment)	Ensure fuels and other flammable materials are stored appropriately and in accordance with applicable regulations.	Construction, operation, closure and rehabilitation

Table 14-3 Preliminary asset protection zone (setbacks)

Area	Vegetation class	Slope class	Asset protection zone setback
Accommodation village	Spinifex grassland and open woodland	Upslope	20 metres
Chandler Facility	Grasses and shrub land	0 - 5°	30 metres
Chandler Haul Road	Grasses and shrub land	0 - 20°	15 metres
Apirnta Facility	Grasses and shrub land	0 - 5°	30 metres
Henbury Access Road	Varied (grassland/shrubland/open woodland)	0 - 45°	15 metres



14.6 Summary of risk assessment

A summary of the risk assessment undertaken for bushfires during construction, operation, and closure and rehabilitation of the Proposal is provided in Table 14-4.

Table 14-4 Summary of risk assessment (bushfire)

Hazard	Pre-mitigated risk			Post-mitigated risks			Risk outcome
	Likelihood	Consequence	Risk ranking	Likelihood	Consequence	Risk ranking	
Natural bushfires occurring	Possible	Major	High	Unlikely	Major	Medium	Risk reduced
Back burning on surrounding pastoral land	Possible	Major	High	Possible	Major	High	Risk same
Hot works resulting in spontaneous ignition	Possible	Major	High	Unlikely	Major	Medium	Risk reduced
Smoking cigarettes	Likely	Major	High	Likely	Major	High	Risk same
Increased ignition sources	Likely	Major	High	Unlikely	Major	Medium	Risk reduced
Flammable and/or volatile fuels	Likely	Major	High	Unlikely	Major	Medium	Risk reduced

14.7 Conclusion

A bushfire hazard analysis was undertaken to assess the potential for an increased incidence of bushfire brought about by the Proposal. While the threat of naturally occurring bushfires and/or human influenced fires is a residual risk, the proposed mitigation and management measures outlined above are considered sufficient to manage the identified risks during construction, operation and closure and rehabilitation of the Proposal.