



Bushfire Assessment

In relation to

African Savannah & Congo Exhibits

Taronga Zoo

Prepared for:

Taronga Conservation Society Australia



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1. Introduction

ABAC Australian Bushfire Assessment Consultants have been commissioned by Taronga Conservation Society Australia (TCSA) to carry out a bushfire assessment in relation to the proposed African Savannah and Congo Exhibits project at Taronga Zoo.

The scope of this assessment is limited to the consideration of the area involved in the proposed project only.

The following matters, inter alia, are outside the scope of this assessment:

- maintenance of vegetation on the site;
- emergency evacuation procedures;
- compliance or otherwise of the works with the relevant provisions of the Building Code of Australia (BCA).

A site inspection was carried out on 5 October 2016.

According to Mosman Council's bushfire prone land maps, the Taronga Zoo site is mapped as bushfire prone land.

2. The Proposal

The area of the site involved in the proposed African Savannah and Congo Exhibits project is shown on a drawing by GDA Landscape Architects and Zoological Designers (Job No.11898, 26 May 2017) entitled *The African Savannah & Congo Precinct – Taronga Conservation Society Australia, Taronga Zoo* (Proposed Landscape Plan, Drawing No.A-601, Issue/Rev 06, dated 26.05.17).

The Landscape Plan is reproduced in Figure 2.1 on the following page.

The African Savannah and Congo Exhibits project is not development for a special fire protection purpose as defined under the provisions of Section 100B of the *Rural Fires Act 1997* or as listed under Clause 46 of the *Rural Fires Regulation 2013*.

There are no final design details for the precinct proposed for the project. It is understood that planting of the area will involve vegetation to recreate the typical habitat of the African savannah environment.

There are no details available as to the design or location of any buildings within the project precinct.



Figure 2.1 Site/Landscape Plan Extract (Source: Client)

3. The Site

The African Savannah and Congo Exhibits precinct is to be located approximately centrally within the Taronga Zoo site. The African Savannah component of the project is to be located south of the existing Chimpanzee enclosure and will occupy the area north of the Roar 'n' Snore facility and Sumatran Tiger Adventure enclosure (which is presently under construction).

The Congo component of the project will occupy the eastern part of the area proposed for the project, generally north-east of the Taronga Food Market, north of the Seal Show exhibit and west of the Lemur Forest Adventure exhibit.

The project area will, itself, contain vegetation to depict the typical habitat and environment of the African savannah. This vegetation will be managed as part of the future exhibit and within the context of the overall vegetation management regime within the Zoo site.

Aside from managed areas of vegetation within the project area and adjacent and nearby exhibits/enclosures, any vegetation likely to pose any bushfire hazard to the African Savannah and Congo Exhibits project site is located generally along the western and south-western fringe of the Zoo (closer to the sewage treatment plant for the Zoo) and the foreshore to Little Sirius Cove and Whiting Beach.

The nearest areas of unmanaged vegetation to the east is within the area of National Park on the eastern side of Bradleys Head Road, in the area between the road and the western foreshore of Taylors Bay.

The following photographs show the area on and around the proposed African Savannah and Congo Exhibits site.



Photo 3.1 The Centenary Theatre under construction in the area adjacent to the northern part of the project site.



Photo 3.2 View of existing areas within the project site



Photo 3.3 View of existing areas within the project site



Photo 3.4 View of existing areas within the project site



Photo 3.5 View of existing areas within the project site



Photo 3.6 The existing Tahir Mountain to be retained in the western/African Savannah part of the project site



Photo 3.7 View of existing areas within the project site

4. Planning for Bush Fire Protection

In NSW, *Planning for Bush Fire Protection 2006* applies to all development on bushfire prone land. All development on bush fire prone land must satisfy the aim and objectives of *Planning for Bush Fire Protection 2006*.

The aim of *Planning for Bush Fire Protection* 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 bush fire, while having due regard to development potential, on-site amenity and protection of the environment.

The objectives of *Planning for Bush Fire Protection* are to:

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

The controls outlined in *Planning for Bush Fire Protection* are based upon six (6) key Bush Fire Protection Measures (BPMs):

- a) The provision of clear separation of buildings and bush fire hazards, in the form of fuel-reduced APZ (and their subsets, inner and outer protection areas and defensible space);
- b) Construction standards and design;
- c) Appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation;
- d) Adequate water supply and pressure;
- e) Emergency management arrangements for fire protection and/or evacuation; and
- f) Suitable landscaping, to limit fire spreading to a building.

Planning for Bush Fire Protection applies specific controls to development for residential development/subdivision and other development that is defined as development for a “special fire protection purpose” (SFPP) under the provisions of Section 100B of the Rural Fires Act 1997 (NSW) and Clause 46 of the Rural Fires Regulation 2013.

The African Savannah and Congo Exhibits project is not development for a special fire protection purpose as defined under the provisions of Section 100B of the *Rural Fires Act 1997* or as listed under Clause 46 of the *Rural Fires Regulation 2013*. There are no specific controls applicable for the purposes of *Planning for Bush Fire Protection*.

The aim and objectives of *Planning for Bush Fire Protection* apply to the project.

Planning for Bush Fire Protection 2006 (and AS3959-2009) is adopted by reference for the purposes of Volume 1 of the Building Code of Australia 2014 (BCA 2014).

There are no details available as to the design or location of any buildings within the project precinct, or the likely classification of any proposed buildings for the purposes of the Building Code of Australia (BCA).

5. AS3959-2009 Construction of Buildings in Bushfire-prone areas

The objective of AS3959-2009 (Construction of Buildings in Bushfire Prone Areas) is to prescribe particular construction requirements/details for buildings to reduce the risk of ignition from a bushfire while the fire front passes.

The Standard notes that it is first necessary to determine the Bushfire Attack Level (BAL) – by an assessment of the site and classified vegetation impacting on the site – before construction requirements can be determined.

AS3959-2009 uses six (6) BALs, each of which are based on heat flux exposure standards. Table 3.1 of AS3959-2009 provides a description of the characteristics of each BAL used in the Standard. In summary, these are:

- BAL – LOW: there is insufficient risk to warrant specific construction requirements;
- BAL – 12.5 (heat flux exposure $\leq 12.5 \text{ kW/m}^2$): ember attack;
- BAL – 19 (heat flux exposure $> 12.5 \text{ kW/m}^2$ and $\leq 19 \text{ kW/m}^2$): increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux;
- BAL – 29 (heat flux exposure $> 19 \text{ kW/m}^2$ and $\leq 29 \text{ kW/m}^2$): increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux;
- BAL – 40 (heat flux exposure $> 29 \text{ kW/m}^2$ and $\leq 40 \text{ kW/m}^2$): increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux with the increased likelihood of exposure to flames; and
- BAL – FZ (heat flux exposure $> 40 \text{ kW/m}^2$): direct exposure to flames from fire front in addition to heat flux and ember attack.

Section 2 of AS3959-2009 provides the basis for the determination of bushfire attack level (BAL) for a site (or building). The BAL is influenced by:

- the type of and extent of potential bushfire hazard vegetation (classified vegetation);
- the distance of a site (or building) from classified vegetation; and
- the slope of the land under the classified vegetation.

Where buildings are located within 100 metres of classified vegetation, the construction of those buildings is required to comply with the construction requirements applicable for the identified BAL.

There are no details available as to the design or location of any buildings within the project precinct.

6. Assessment of vegetation

The Taronga Zoo site contains a considerable amount of vegetation mainly comprising landscaping and retained vegetation within the larger Zoo complex. Overall, this vegetation comprises maintained vegetation, managed as part of the operational procedures of the Zoo. The vegetation comprises some larger and smaller areas of remnant vegetation, fragmented by the constructed pathways, retaining structures, enclosures/displays and other structures and infrastructure associated with the Zoo and located within the site.

The African Savannah and Congo Exhibits project will involve the areas presently occupied by the bush birds, Fennec Foxes, Himalayan Tahr, Bongo, Barbary Sheep, Zebra, Giraffe, Meerkats and Gorilla. The project will involve the demolition of existing structures and demolition and/or reconfiguration of existing roadways and walkways through and around the extent of the project area. It is likely that significant trees within the extent of project area will be retained subject to the occurrence of particular tree species within the typical environment of the Congo and African Savannah regions.

The largest area of unmanaged vegetation within the Zoo site in relation to the area proposed for the African Savannah and Congo Exhibits project is located to the west/south-west of the project site.

These areas are located downslope from the project site and existing Zoo facilities between the project site and these areas of vegetation provide a significant effective separation distance between the project site and any potential bushfire hazard vegetation.

This vegetation is located within the lower elevations of the Zoo site, nearer the sewage treatment plant for the Zoo. There is also vegetation located outside the Zoo site to the west and south-west, around the foreshore to Little Sirius Cove and Whiting Beach. This vegetation, together with other isolated remnant vegetation within the Zoo site, may have

some impact on the African Savannah and Congo Exhibits project area in terms of a potential for ember generation.

A further area of unmanaged vegetation is located outside the Zoo site, within an area of National Park on the eastern side of Bradleys Head Road, in the area between the road and the western foreshore of Taylors Bay. This area of vegetation is greater than 200 metres from the eastern extent of the proposed African Savannah and Congo Exhibits project.

The vegetation within the Zoo site, for a distance of 140 metres from the location of the African Savannah and Congo Exhibits project, has been considered as remnant vegetation given the characteristics of the vegetation as identified above and, therefore, a low hazard for the purposes of A2.3 of *Planning for Bush Fire Protection 2006*.

As such, building construction standards for this area of vegetation can be considered as the same as for rainforests. The vegetation formation converted to the AUSLIG (1990) vegetation classification utilised for AS3959-2009 is *rainforest*. There are no details available as to the design or location of any buildings within the project precinct.

7. Assessment of slope

The land within the Zoo site is steeply sloping in parts.

This slope is variable and has been both modified and influenced by the natural and man-made features within the site.

The assessment of effective slope in terms of the relationship between the African Savannah and Congo Exhibits project and any potential bushfire hazard vegetation, while an element to be considered in any bushfire assessment, is not considered critical in terms of the realistic bushfire hazard potential of vegetation within the Zoo site and the relationship or potential impact of same on the project site.

While the effective slope in relation to potential bushfire behaviour would be likely to be assessed as downslope – as areas of vegetation have been identified some distance to the west/south-west and east of the project site – the project site is located a sufficient distance from any large tracts of vegetation. Therefore, there is unlikely to be any situation arising where any buildings within the project site would be subject to any significant radiant heat impacts in the event of any unplanned fire occurring in vegetation on or around the site.

In recognition of the sloping nature of the site, however, the effective slope within 100 metres of the project site (that is, the slope of the land under vegetation most likely to influence bushfire behaviour in relation to the building, has been assessed as being >10-15° downslope.

The project site is generally in excess of 85 metres from any unmanaged vegetation located to the west/south-west or east of the project site.

8. Bushfire Assessment

In terms of a quantitative analysis for the African Savannah and Congo Exhibits project, the extent of the project area indicates that any future buildings within the project precinct will be at least 85 metres (and generally greater) from any unmanaged potential bushfire hazard vegetation located to the west/south-west and east.

The relevant fire danger index (FDI) is 100 for the purposes of assessment under AS3959-2009.

The classification of vegetation and assessment of effective slope have been based on the following assumptions:

- Predominant vegetation structure within 140 metres of the building is remnant vegetation;
- building construction standards for remnant vegetation can be considered as the same as for rainforests; and
- The effective slope of land under vegetation is >10-15° downslope.

Using Table 2.4.2 of AS3959, and on the basis that any future buildings within the project precinct will be at least 85 metres (and generally greater) from any unmanaged potential bushfire hazard vegetation located to the west/south-west and east, the likely BAL for any future buildings within the African Savannah and Congo Exhibits project site is BAL-12.5.

The determination as to whether buildings within the project area would be technically subject to the provisions of AS3959-2009 (Construction of Buildings in Bushfire-prone areas) would depend on their ultimate use and classification for the purposes of the BCA. Irrespective, and as the bushfire assessment has indicated that the project site is likely to be subject to some degree of ember protection in the event of a bushfire, however, the adoption of the construction requirements for BAL-12.5 is to be recommended for the buildings.

The aim and objectives of *Planning for Bush Fire Protection 2006* are also relevant to any future buildings within the African Savannah and Congo Exhibits project site

The aim of *Planning for Bush Fire Protection 2006* 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 bush fire, while having due regard to development potential, on-site amenity and protection of the environment.

The objectives of *Planning for Bush Fire Protection 2006* are to:

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

In relation to the objectives of *Planning for Bush Fire Protection 2006*, the following points are relevant:

- The location of the project area is such that it may be subject to some degree of ember attack in the event of a bushfire occurring within vegetation on and around the site. It is to be recommended that any buildings within the project site be constructed to meet the

requirements for construction for BAL-12.5 as per AS3959-2009 to mitigate any effects arising from potential ember attack.

- Any future buildings within the African Savannah and Congo Exhibits project site will be constructed to meet all relevant requirements of the BCA as applicable to individual buildings within the project site including construction, fire detection and suppression measures.
- In the event of a bushfire impacting on the Zoo, emergency procedures will apply to ensure the safety of any patrons present in the African Savannah and Congo Exhibits, and patrons present within the overall Zoo site as a whole.
- The project site is located a sufficient distance from any large tracts of vegetation. This will ensure that significant defensible space is available within the project site and there is unlikely to be any situation arising where any buildings within the project site would be subject to any significant radiant heat impacts in the event of any unplanned fire occurring in vegetation on or around the Zoo site.
- Access will be available for the purposes of an emergency response in the event of a bushfire. The Zoo is subject to emergency management and response procedures and has its own fire fighting capability.
- The Zoo site is subject to detailed operational procedures and is stringently managed and monitored to ensure public safety and the safe and efficient operation of the Zoo. Aspects of this management include maintenance of the vegetation within the site, as well as the maintenance of buildings within the complex.

The proposal is consistent with the aim and objectives of *Planning for Bush Fire Protection 2006*.

9. Conclusion & Recommendation

The context and setting of the Zoo site is characterised by vegetation interspersed throughout the site. This vegetation establishes the character of the site and provides the backdrop for the displays and exhibits that comprise the Zoo.

The project area will contain vegetation to depict the typical habitat and environment of the African savannah. This vegetation will be managed as part of the future exhibit and within the context of the overall vegetation management regime within the Zoo site.

Aside from managed areas of vegetation within the project area and adjacent and nearby exhibits/enclosures, any vegetation likely to pose any bushfire hazard to the African Savannah and Congo Exhibits project site is located generally along the western and south-western fringe of the Zoo (closer to the sewage treatment plant for the Zoo) and the foreshore to Little Sirius Cove and Whiting Beach.

The nearest areas of unmanaged vegetation to the east is within the area of National Park on the eastern side of Bradleys Head Road, in the area between the road and the western foreshore of Taylors Bay.

It has been identified that the main mode of bushfire attack that may potentially impact upon buildings within the African Savannah and Congo Exhibits project site is likely to be ember attack in the event of an unplanned bushfire occurring in the vegetation on and around the site.

The potential for an unplanned fire to occur within the site, while unlikely, cannot be discounted entirely. Therefore, it is important that the potential for ember generation to impact on the African Savannah and Congo Exhibits project site be recognised, and measures adopted to mitigate against these impacts.

As such, it is recommended that the construction of the buildings proposed for the project site comply with the construction requirements for BAL-12.5 as per AS 3959-2009 *Construction of buildings in bushfire-prone area*.

References

NSW Rural Fire Service (2006)
Planning for Bush Fire Protection.

AS 3959, "Construction of buildings in bushfire-prone areas" (incorporating Amendments Nos. 1, 2 and 3), Standards Australia, 2009.