State Significant Development Application 8008
Environmental Impact Statement

Taronga Zoo
African Savannah and Congo Forest Exhibits

Submitted to Department of Planning and Environment
On Behalf of Taronga Zoo Conservation Society Australia

July 2017 ▪ 16527

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JBA operates under a Quality Management System. This report has been prepared and reviewed in accordance with that system. If the report is not signed below, it is a preliminary draft.

This report has been prepared by:

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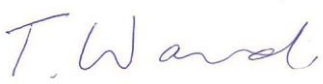

Tim Ward 25/07/2017

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Development Application Details	Asset upgrades works for new African Savannah and Congo Forest exhibits at Taronga Zoo
Applicant name	Taronga Conservation Society Australia (TCSA)
Applicant address	Bradleys Head Road, Mosman, NSW 2088
Land to be developed	Lot 22 DP843294
Proposed development	African Savannah and Congo exhibits as described in Section 3.0 of this Environmental Impact Statement

Prepared by		
Name	Christopher Curtis	Alicia Baker
Qualifications	BUrbanEnvPlan (Hons)	BDesArch MPlan
Address	173 Sussex Street, Sydney	
In respect of	State Significant Development - Development Application	

Certification

I certify that I have prepared the content of this EIS and to the best of my knowledge:

- it is in accordance with Schedule 2 of the Environmental Planning and Assessment Regulation 2000;
- all available information that is relevant to the environmental assessment of the development to which the statement relates; and
- the information contained in the statement is neither false nor misleading.

Signature		
Name	Christopher Curtis	Alicia Baker
Date	25/07/2017	25/07/2017

Executive Summary

Purpose of this Report

This Environmental Impact Statement (EIS) has been prepared on behalf of Taronga Zoo Conservation Society Australia (TCSA) in support of a State Significant Development Application under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP& A Act). The application relates to the development of two new animal exhibits, known as the African Savannah and Congo Forest exhibits within Taronga Zoo, Sydney.

Under Clause 2 of Schedule 2, of the *State Environmental Planning Policy (State and Regional Development) 2011*, development on the Taronga Zoo site with a capital investment of more than $10 million is deemed State Significant Development (SSD). The proposed new exhibits will have a capital investment value of approximately $37.5 million, and are therefore considered to be SSD.

A request for the issue of Secretary's Environmental Assessment Requirements (SEARs) was sought on 5 October 2016. Accordingly, the SEARs were issued on 2 November 2016. This submission is in accordance with the Department's guidelines for SSD applications lodged under Part 4 of the EP&A Act, and addresses the issues raised in the SEARs.

Overview of the Project

Taronga Zoo is one of Australia's most popular attractions and together with the Taronga Western Plains Zoo attracts more than 1.5 million visitors annually (2014-2015).

The proposed development results from a $164.5 million capital works development program to transform zoo facilities and visitor experiences over the next 10 years. The program is co-funded by the NSW Government and will deliver eight major wildlife exhibits at Taronga Zoo, including the African Savannah and Congo Forest exhibits, Wildlife Hospital upgrades and nine exhibit upgrades at Taronga Western Plains Zoo.

The Development Application (DA) seeks approval for two new animal exhibits, known as the African Savannah and Congo Forest exhibits. The project scope, for which approval is sought, includes the following:

- Partial demolition of the existing African Safari exhibit, including the removal of:
  - Giraffe House (1940) and back-of-house;
  - Zebra back-of-house;
  - Meerkat exhibit, back-of-house and yards;
  - Octagonal Shelter (northern);
  - Public amenities; and
  - Paths, steps, ramps, fencing, garden beds and kerbs.
- Partial demolition of the existing Orangutan Rainforest exhibit and aviaries; including the removal of:
  - Orangutan exhibit, enclosure and back-of-house;
  - Turner House; and
  - Paths, bitumen road, steps, ramps, fencing, garden beds and kerbs.
- Construction of a new African Savannah exhibit for Giraffe, Zebra, Lion, Ostrich Meerkat and Fennec Fox species. The new exhibit will include:
  - 2,881m^2 Giraffe and Zebra exhibit;
  - 2,821m^2 Lion exhibit;
  - 394m^2 Meerkat/ Fennec Fox exhibit;
  - Holding dens and back-of-house facilities;

  - Animal food preparation area / equipment store;
  - Animal management infrastructure;
  - Containment fences;
  - Themed landscaping;
  - Public viewing, milling and seating areas; and
  - Visitor and staff circulation and access paths.
- Construction of a new Congo Forest exhibit for, Eastern Lowland Gorillas and Okapi. The new exhibit will include:
  - 2,726m^2 Gorilla exhibit;
  - 929m^2 Okapi exhibit;
  - Holding dens and back-of-house facilities;
  - Animal food preparation area / equipment store;
  - Animal management infrastructure;
  - Containment fences;
  - Themed landscaping;
  - Public viewing, milling and seating areas;
  - Visitor and staff circulation and access paths.
- Cliff Edge Village visitor amenities;
- Interpretative and directional signage; and
- Relocation, upgrade and augmentation of services as required.

The Site

Taronga Zoo is located approximately four kilometres north of the Sydney Central Business District (CBD), on the northern shore of Sydney Harbour within the Mosman Council Local Government Area (LGA). The Zoo, comprising approximately 21 hectares, is divided into eight zoogeographic regions and is home to over 4,000 animals of 340 species.

Irregular in shape, the Zoo is bound by Bradleys Head Road to the east, Athol Wharf Road and Sydney Harbour to the south, Little Sirius Cove to the west and Whiting Beach Road to the north. Access to and from Taronga Zoo is generally provided by Bradleys Head Road, which connects to Military Road to the north via the Mosman Town Centre.

Taronga Zoo is legally described as Lot 22 on DP843294. The zoo is located on NSW Crown Land which is vested with the Zoological Parks Board of NSW, trading as the TCSA.

Planning Context

Section 5.0 of the EIS considers all applicable legislation in detail. The proposal is consistent with the requirements of all relevant State Environmental Planning Policies (SEPPs). The site is zoned SP1 Zoological Gardens under the Mosman Local Environmental Plan 2012 (MLEP 2012). The proposal is permissible with consent and meets the objectives of the subject zone.

Environmental Impacts and Mitigation Measures

This EIS provides an assessment of the environmental impacts of the project in accordance with the SEARs and sets out the undertakings made by TCSA to manage and minimise potential impacts arising from the development.

Noise

Potential noise impacts resulting from the construction of the proposed Zoo and the housing of lions may affect nearby sensitive receivers, located at Whiting Beach Road and Rickard Road.

Potential exceedances of project Noise Management Levels (NMLs) have been identified. It is anticipated that operational noise including mechanical plant and patron noise will be managed to comply with all criteria at the receiver boundaries at all times. Animal noise, such as lions roaring, may exceed sleep disturbance levels. The lions will be kept indoors during the night. A full enclosure should achieve an overall noise reduction of 20dB which would allow the night-time sleep disturbance criterion to be met even for the loudest lion roar. Appropriate mitigation measures recommended to reduce potential impacts.

Traffic, parking and access

The proposal seeks to redevelop existing zoo exhibits. As such, vehicle access and parking will remain unchanged as a result of the proposal. Whilst it is considered that the proposed exhibits will not result in a long-term increase to zoo visitation numbers, a short-term increase of up to 10 per cent may occur during the weeks following the exhibits opening. This may have a minor impact on traffic generation. However, it is considered that the local traffic conditions will not be significantly impacted. It is considered that the current parking supply is appropriate for the existing parking demand. As the proposed African Savannah and Congo Forest exhibits will not generate any long-term increases in parking demand, the current parking supply is considered to be appropriate for the proposed development. Cumulative construction traffic impacts will be managed accordingly.

Vegetation and biodiversity

The proposal will result in the removal of 196 trees, the relocation of multiple trees and vegetation clearing. This will result in the loss of minor foraging habitat for nectivorous and frugivorous fauna. It is noted that no hollow-bearing trees will be removed as a result of the proposal. In order to compensate for the loss, ecologically equivalent foraging trees and vegetation, including locally indigenous species and native rainforest trees will be planted. In total, the proposal seeks to revegetate the exhibit enclosures and surrounding circulation areas with some 28,000 plants, including 226 trees.

It is concluded that the proposal will have no significant impacts on any threatened species, ecological communities or populations such that a viable local population will be placed at risk of extinction. Additionally, an Impact Assessment was undertaken in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Significant Impact Guidelines. The proposal will have no significant impacts on any Matters of Environmental Significance (NMEs), for both threatened and migratory species.

Landscape character and visual impacts

A visual impact analysis has been undertaken to assess potential impacts on views to and from Taronga Zoo and the unique visual qualities of Sydney Harbour and from Harbour vantage points. The proposed exhibits have been designed to integrate with the existing zoo landscape, being of a scale and bulk that is consistent with surrounding built form and located so not to protrude above the ridgeline. These impacts will be mitigated accordingly. The proposal will have a moderate impact on the existing zoo landscape, modifying existing exhibits, circulation pathways and views to and from the zoo. Construction of the proposal will have a minor temporary impact on the zoo's existing landscape and views to and from.

Stormwater and waste water management

Taronga Zoo is serviced by an existing stormwater and waste water treatment system, including a Waste Water Treatment Plant which operates in accordance with an existing Environmental Protection Licence (EPL) (No. 1677). Stormwater collected from the proposed exhibits will be directed through existing drainage infrastructure to the treatment plant. Due to the existing treatment facilities and EPL requirements, the impacts of water discharge to Sydney Harbour and Little Sirius Cove are considered negligible. No changes are anticipated to be required to the EPL as a result of the proposal.

Aboriginal heritage and archaeology

Only one known Aboriginal heritage site (AHIMS Site #45-6-1959) has been identified within Taronga Zoo. The proposal will not result in an adverse impact on this item. No previously documented Aboriginal Archaeological sites or 'objects' are known to occur within the exhibit precinct. No specific areas of potential Aboriginal archaeological sensitive relative to the proposal have been identified through consultation with the *Metropolitan Local Aboriginal Land Council* (MLALC).

European heritage and archaeology

The proposal will result in significant modifications to the existing zoo's built form and natural landscapes through the removal of components which depict the zoo's original uses, form and circulation. These changes will alter existing views to and from heritage places internally and externally to the zoo. However, these modifications are considered necessary to provide modern zoo facilities improving animal welfare and keeper safety, which are key drivers for the proposal. The report concludes that the proposal will result in moderate impacts to items of heritage significance. Mitigation measures have been identified will be implemented accordingly.

Conclusion and Justification

This EIS addresses the SEARs, and the proposal provides for the proposed African Savannah and Congo Forest Exhibits at Taronga Zoo. The potential impacts of the development are able to be managed as outlined within the safeguard and mitigation measures contained within this EIS and its appended technical reports. Given the planning merits of the proposal, the proposed development warrants approval by the Minister for Planning and Environment.

1.0 Introduction

This Environmental Impact Statement (EIS) is submitted to the Department of Planning and Environment pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in support of an application for State Significant Development (SSD).

Under clause 2 of Schedule 2, of *State Environmental Planning Policy (State and Regional Development) 2011*, development on the Taronga Zoo site with a capital investment of more than $10 million is considered to be SSD. The proposed new exhibits will have a combined capital investment value of approximately $37.5 million, and are therefore considered to be SSD for the purposes of the EP&A Act.

The report has been prepared by JBA on behalf of Taronga Conservation Society Australia (TCSA) and is based on the Architectural and Landscape Drawings provided by Tonkin Zulaikha Greer (TZG) and Green & Dale Associates (GDA) (refer to **Appendix D** and **Appendix E** respectively) and other supporting technical information appended to the report (see Table of Contents).

This EIS has been prepared in accordance with the requirements of Part 4 of the EP&A Act, Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation), and the Requirements of the Secretary of the Department of Planning and Environment for the preparation of the EIS, which are included at **Appendix B**. This EIS should be read in conjunction with the supporting information and plans appended to and accompanying this report.

1.1 Overview of Proposed Development

The proposed development will provide two new animal exhibits known as, the African Savannah exhibit and Congo Forest exhibits. The proposal seeks to revitalise existing exhibits improving animal welfare and the visitor experience.

The development will include the following key components:

- Partial demolition of the existing African Safari exhibit, including the removal of:
  - Giraffe House (1940) and back-of-house;
  - Zebra back-of-house;
  - Meerkat exhibit, back-of-house and yards;
  - Octagonal Shelter (northern);
  - Public amenities; and
  - Paths, steps, ramps, fencing, garden beds and kerbs.
- Partial demolition of the existing Orangutan Rainforest exhibit and aviaries; including the removal of:
  - Orangutan exhibit, enclosure and back-of-house;
  - Turner House; and
  - Paths, bitumen road, steps, ramps, fencing, garden beds and kerbs.
- Construction of a new African Savannah exhibit for Giraffe, Zebra, Lion, Ostrich Meerkat and Fennec Fox species. The new exhibit will include:
  - 2,881m^2 Giraffe and Zebra exhibit;
  - 2,821m^2 Lion exhibit;
  - 394m^2 Meerkat/ Fennec Fox exhibit;
  - Holding dens and back-of-house facilities;
  - Animal food preparation area / equipment store;
  - Animal management infrastructure;
  - Containment fences;
  - Themed landscaping;

  - Public viewing, milling and seating areas; and
  - Visitor and staff circulation and access paths.
- Construction of a new Congo Forest exhibit for, Eastern Lowland Gorillas and Okapi. The new exhibit will include:
  - 2,726m^2 Gorilla exhibit;
  - 929m^2 Okapi exhibit;
  - Holding dens and back-of-house facilities;
  - Animal food preparation area / equipment store;
  - Animal management infrastructure;
  - Containment fences;
  - Themed landscaping;
  - Public viewing, milling and seating areas;
  - Visitor and staff circulation and access paths.
- Cliff Edge Village visitor amenities;
- Interpretative and directional signage; and
- Relocation, upgrade and augmentation of services as required.

1.2 Background to the Development

Taronga Zoo Capital Works Program

Taronga Zoo is one of Australia's most popular attractions and together with the Taronga Western Plains Zoo attracts more than 1.5 million visitors annually (2014-2015). Taronga Zoo has a world class reputation in education and the immersion of people with wildlife. A core function of the zoo is to increase visitor understanding of conversation practices and increase awareness of the importance of conservation and preservation of animal species.

The proposed development results from a $164.5 million capital works development program to transform zoo facilities and visitor experiences over the next 10 years. The program is co-funded by the NSW Government and will deliver eight major wildlife exhibits at Taronga Zoo (including the African Savannah and Congo Forest exhibits), and nine exhibit upgrades at Taronga Western Plains Zoo.

Animal Welfare

As a conservation organisation with the responsibility for care of wildlife, TCSA ensure that at all times the needs, interests and welfare of the animals is a primary consideration. Many zoo exhibits, including the existing Savannah exhibit, created more than 20 years ago, cannot achieve these aims, and as such have to evolve with modern welfare science.

To persevere with old exhibit designs, layouts and features is likely to put Taronga Zoo not only at odds with modern welfare science, but existing and emerging animal welfare legislation, including the expectations, guidelines and requirements established under the *Exhibited Animals Protection Act 1986* (EAPA).

The primary drivers for promoting animal welfare for the large animal species that will be housed within the African Savannah and Congo Forest exhibits can be distilled to three inter-related primary considerations:

- The provision of large amounts of space that provide choice for the animals, such as shade or sun, shelter or open elements, dense foliage or open space, sharp or gentle gradients and aspects with height or lower exhibit areas;
- The provision of environmental complexity, including different sights, sounds, smells, textures and mediums; and

- The provision of socially appropriate group structures with the capacity to seek isolation or refuge from group activity and natural aggression when desired.

The proposed exhibits seek to employ current thinking in animal housing to ensure TCSA are leaders within this space, and providing exhibits designs beyond minimum National Animal Welfare Standards compliance requirements. The proposal will result in new purpose-built facilities which will provide modern enclosures, allowing functional, best-practice and safer day-to-day operations and management and substantial increases in animal enclosure footprints and amenity.

Visitor Experience

TCSA's vision for the visitor is to provide a shared future for wildlife and people, creating custodians for the wild. The current animal exhibits no longer meet local and international tourist experience expectations. As such, they require upgrades to improve visitor experience, access and circulation.

The proposal seeks to deliver a choreographed, craft journey that turns guests into custodians for the wild, incorporating interpretative and educational signage and intimate animal encounters throughout. A primary driver of the proposal is compliance with the *Disability Discrimination Act 1992*, providing accessible pathways throughout the exhibits.

1.3 Objectives of the Development

The proposal has a number of key issues and drivers which need to be addressed. Project objectives include:

- Maintain a high standard of animal welfare and care;
- Provide an enhanced visitor experience;
- Ensure DDA compliant site access for all throughout new exhibit areas;
- Protect items of heritage and cultural significance;
- Capitalise on existing topography, vegetation landscape features within the proposal;
- Engage and consult with multiple stakeholders;
- Address operational and attendance issues to ensure ongoing viability of the zoo;
- Address site access and construction issues to mitigate potential impacts of the development;
- Utilise existing services by locating, capping and/or re-routing services; and
- Ensure visitor and staff safety during construction and operation.

1.4 Structure of this Report

The EIS provides the following sections:

- Section 2 Site Analysis: Provides a description of the site, the regional and local context and surrounding development.
- Section 3 Description of the Project: Provides a description of the proposal.
- Section 4 Consultation: Outlines the consultation undertaken during the preparation of this EIS.
- Section 5 Statutory and Strategic Context: Provides a detailed review of the project against the relevant planning framework.
- Section 6 Environmental Assessment: Provides an in-depth assessment of the existing environment, potential impacts and the mitigation measures for each.

- Section 7 Environmental Risk Assessment: Provides a detailed environmental risk assessment of the proposed Zoo.
- Section 8 Mitigation Measures: Provides a list of recommendations and mitigation measures based on the technical studies undertaken.
- Section 9 Justification of the Proposal: Outlines the justification behind the proposal based on the assessment within this EIS.
- Section 10 Conclusion.

Technical studies prepared to support this EIS are appended to this report.

1.5 Project Team

An expert project team has been formed to deliver the project and includes the consultants listed in **Table 1**.

Table 1 – Project team

Consultant	Role
Taronga Zoo Conservation Society Australia (TCSA)	Applicant Construction and Operational Management
JBA	Urban Planning Community and Stakeholder Engagement
Tonkin Zulaikha Greer Architects (TZG)	Architects and Master Plan Designer
Green & Dale Associates (GDA)	Landscape Designers and Zoo Specialist Consultant
Frank M Mason & Co. Pty Ltd	Surveyors
Narla Environmental	Biodiversity Assessment
Earthscape Horticultural Services	Aboricultural Assessment
Australian Bushfire Assessment Consultants	Bushfire Assessment
Acoustic Studio	Acoustic Assessment
GTA Consultants	Traffic and Transport Assessment
Dominic Steele Consulting	Aboriginal Archaeological Assessment
Geoffrey Britton, Nicholas Jackson & Ashley Built	European Heritage Assessment
Blackett Maguire + Goldsmith	Building Code of Australia (BCA)
Accessibility Solutions Pty Ltd	Access
Douglas Partners	Contamination/ Geotechnical Assessment
Pickford & Rhyder Consulting Pty Ltd	Hazardous Materials Assessment
AJ Whipps Consulting Group	Hydraulic Services
Jones Nicolson Consulting Engineers	Electrical Services
Evolved Engineering	Environmentally Sustainable Design (ESD)
MBM	Development Cost Report

1.6 Secretary's Environmental Assessment Requirements

In accordance with Section 89G of the EP&A Act, the Secretary of the Department of Planning and Environment issued the requirements for the preparation of the EIS on 2 November 2016. A copy of the Secretary's Environmental Assessment Requirements (SEARs) is included at **Appendix B**.

Table 2 provides a detailed summary of the individual matters listed in the SEARs and identifies where each of these requirements has been addressed in this report and the accompanying technical studies.

Table 2 – Secretary's Environmental Assessment Requirements

Requirement	Location in Environmental Assessment	
General		
The Environmental Impact Statement (EIS) must address the E*nvironmental Planning and Assessment Act 1979* and meet the minimum form and content requirements in clauses 6 and 7 of Schedule 2 the Environmental Planning and Assessment Regulation 2000.	**Environmental Impact Statement**	
A detailed description of the development	**Section 3.0**	
Consideration of all relevant guidelines and environmental planning instruments, including identification and justification of any inconsistencies with these instruments	**Section 5.0**	
A risk assessment of any potential environmental impacts of the development, identifying the key issues for further assessment	**Section 7.0**	
A detailed assessment of the key issues specified below and any other significant issues identified in this risk assessment: ▪ Adequate baseline data; ▪ Consideration of potential cumulative impacts due to other development in the vicinity; and ▪ Measures to avoid, minimise and if necessary, offset the predicted impacts, including detailed contingency plans for managing any significant risks to the environment.	**Section 6.0**	
The EIS must be accompanied by a report from a qualified quantity surveyor providing: ▪ A detailed calculation of the capital investment value (as defined in clause 3 of the *Environmental Planning and Assessment Regulation 2000*) of the proposal, including details of all assumptions and components from which the CIV calculation is derived; and ▪ Certification that the information provided is accurate at the date of preparation.	**The proposed exhibits have an approximate CIV of $37.5 million.**	
The EIS must provide an estimate of the jobs that will be created by the development during the construction and operational phases of the development.	**Section 3.7.2** **Section 9.1**	
Key Issues		
Statutory and Strategic Context	**Report / EIS**	**Technical Study**
The EIS shall address the statutory provisions applying to the site contained in all relevant environmental planning instruments (EPIs), including: ▪ State Environmental Planning Policy (State and Regional Development) 2011;	**Section 5.3.1**	**-**
▪ State Environmental Planning Policy No. 55 – Remediation of Land;	**Section 5.3.3**	**Appendix S**
▪ State Environmental Planning Policy (Infrastructure) 2007;	**Section 5.3.2**	**-**
▪ Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005; and	**Section 5.3.5**	**-**
▪ Mosman Local Environmental Plan 2012.	**Section 5.3.7**	**-**
The EIS shall address the relevant planning provisions, goals and strategic planning objectives in the following: ▪ A Plan for Growing Sydney;	**Section 5.1.4**	**-**
▪ NSW Heritage Manual;	**Section 5.2.9**	**-**
▪ Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation 2005;	**Section 6.10**	**Appendix L**
▪ Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010;	**Section 6.10**	**Appendix L**
▪ Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011);	**Section 6.10**	**Appendix L**
▪ Interim Construction Noise Guidelines (DECCW, 2009);	**Section 6.1**	**Appendix J**
▪ Taronga Zoo Conservation Strategy 2002; and	**Section 5.1.5**	**Appendix M**
▪ Mosman Development Control Plan 2012.	**Section 5.3.7**	**-**

Requirement	Location in Environmental Assessment	
Heritage	**Report**	**Technical Study**
Prepare a Heritage Impact Statement by a suitably qualified heritage consultant which identifies: ▪ All heritage items (state and local) including built heritage, landscapes and archaeology, and detailed mapping of these items, and why the items and site(s) are of heritage significance; ▪ What impact the proposed works will have on their significance; and ▪ Measures to avoid and/or mitigate impacts	**Section 6.10**	**Appendix N**
Address Aboriginal cultural heritage impacts of the proposal, including: ▪ Identifying and describing the tangible and intangible Aboriginal cultural heritage values that exist across the area affected by the development. This may require the need for surface survey and test excavation; ▪ Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people who have a cultural association with the land must be undertaken and documented in the EIS. Additionally, the significance of the cultural heritage values for Aboriginal people who have a cultural association with the land must be identified and documented in the EIS; and ▪ Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impacts upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measure proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.	**Section 6.9**	**Appendix L**
Prepare an archaeological assessment of the likely impacts of the proposal on any Aboriginal cultural heritage, European cultural heritage and other archaeological items and outline proposed mitigation and conservation measures.	**Section 6.9**	**Appendix L**
Prepare a Visual Impact Statement demonstrating how the development would affect views to and from heritage places in the vicinity and especially the unique visual qualities of Sydney Harbour and from Harbour vantage points, including Curraghbeena Point and Cremorne Point. If impact is likely, appropriate mitigation measures are to be identified commensurate with the significance of the views.	**Section 6.4.3**	**-**
Built Form, Urban Design and Visual Impacts	**Report**	**Technical Study**
The EIS must address the height, bulk and scale of the proposed development within the context of the locality. The EIS must also address design quality with specific consideration of the use of colours, materials, finishes, landscaping and public domain.	**Section 3.2.4**	**Appendix D**
Ecologically Sustainable Development (ESD)	**Report**	**Technical Study**
The EIS shall: ▪ Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the *EP&A Regulation 2000*) will be incorporated in the design, construction and ongoing operation of the development;	**Section 3.5** **Section 6.7**	**Appendix T**
▪ Demonstrate how the proposed development responds to sustainable building principles and best practice, and improves environmental performance through energy efficient design, technology and opportunities for renewable energy; and	**Section 3.5** **Section 6.7**	**Appendix T**
▪ Provide an integrated water management plan that considers water, wastewater and stormwater, including an assessment of water demand, alternative water supply, proposed end uses of potable and non-potable water, water sensitive urban design and water conservation measures.	**Section 6.6**	**Appendix Q**

Requirement	Location in Environmental Assessment	
Landscaping and Tree Removal	**Report**	**Technical Study**
The EIS must include a landscaping plan that: ▪ Assesses the arboricultural significance of trees potentially affected by the proposal; ▪ Clearly identifies the trees to be retained, removed or protected; ▪ Nominates landscaping themes and planting species; ▪ Justifies proposed species; and ▪ Considers proposals to mitigate adverse project impacts and in particular canopy loss.	**Section 0** **Section 6.3**	**Appendix E** **Appendix H**
Traffic, Parking and Access	**Report**	**Technical Study**
The EIS must include a Car Parking and Traffic Impact Assessment (CPTIA) that evaluates: ▪ Daily and peak traffic movements likely to be generated by the project during construction and operation (including during the opening period of the new exhibit) and provide details of any impacts to the road network located adjacent to the proposed development and details of any proposed mitigation measures; ▪ Demonstrate the provision of sufficient car parking during construction and operation in accordance with the relevant guidelines/standards and/or justification for any inconsistencies; and ▪ The cumulative traffic and parking impact of other Taronga Zoo projects under assessment or construction.	**Section 6.2**	**Appendix K**
The EIS must include details of expected public transport demand generated by the project and provide justification that sufficient public transport capacity exists to meet the demand.	**Section 6.2**	**Appendix K**
Bushfire and Safety	**Report**	**Technical Study**
Demonstrate compliance with the relevant provisions of *Planning for Bushfire Protection (PBP) 2006* and detail any bushfire management and/or mitigation measures.	**Section 6.4**	**Appendix G**
Prepare an assessment on the emergency planning and management measures required to facilitate an emergency services response and the other obligations imposed by clause 43 of the Work Health and Safety Regulation 2000.	**Section 6.4** **Section 3.9**	**-**
Noise	**Report**	**Technical Study**
Identify and provide a quantitative assessment of the noise generating sources and activities during operation. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land, including the scheduling of intra-day 'respite periods' from noise-generating construction activities that may impact on adjoining properties.	**Section 6.1**	**Appendix J**
Prepare an assessment of possible noise impacts associated with the operation of the new facilities together with designs for feasible and reasonable noise impact avoidance and mitigation.	**Section 6.1**	**Appendix J**
Waste Management	**Report**	**Technical Study**
Identify all potential sources of liquid waste and non-liquid wastes as defined in the EPA's waste guidelines. The EIS should identify any waste that will be stored, separated or processed on the site and identify the procedures to be adopted to minimise, manage, transport and dispose of this waste in accordance with the relevant standards and guidelines.	**Section 6.6** **Section 6.12**	**Appendix Z**

Requirement	Location in Environmental Assessment	
Construction Impacts	**Report**	**Technical Study**
The EIS shall assess, quantify, report on and identify measures to ameliorate potential construction impacts during the demolition, site preparation and construction phases of the development, including, traffic, access, noise and vibration, air quality, erosion and sediment control, water quality, waste management and transportation of waste, management and disposal of hazardous materials (including asbestos and lead-based paint), management and disposal of concrete waste and rinse water, and other cumulative environmental impacts. This shall include consideration of potential construction impacts on adjacent exhibits and visitors to the zoo.	**Section 6.13**	**Appendix X**
Infrastructure Servicing	**Report**	**Technical Study**
Detail the existing infrastructure on site and identify possible impacts on any such infrastructure from the proposal.	**Section 3.6**	**Appendix Q** **Appendix S**
Detail measures to mitigate the impacts of the proposal on any infrastructure items, including proposed relocation/augmentation.	**Section 3.6**	**Appendix Q** **Appendix S**
Provide details of water supply, consideration of water sensitive urban design and water conservation measures.	**Section 3.6**	**Appendix Q**
Water, Drainage and Stormwater	**Report**	**Technical Study**
Prepare a Stormwater and Drainage Assessment to assess the impacts of the proposal on surface and groundwater hydrology and quality including the waters of Sydney Harbour and Little Sirius Cove.	**Section 6.6**	**Appendix Q**
Identify appropriate water quality management measures focussing on the management of the impacts from the proposed works.	**Section 6.6**	**Appendix Q**
Prepare a Water Management Plan. This should include stormwater and wastewater management, including any re-use and disposal requirements, details of any proposed alternative water supply, proposed end uses of potable and non-potable water, demonstration of water sensitive urban design and any water conservation measures.	**Section 6.6**	**-**
The EIS shall also provide details of the proposed effluent collection, treatment and disposal related to the operation of the exhibit, and any associated implications for the sewerage treatments systems at the site and the Environmental Protection Licence No.1677.	**Section 6.6**	**Appendix R**
Building Code of Australia	**Report**	**Technical Study**
Prepare a BCA and access report demonstrating compliance with the Building Code of Australia.	**Section 6.8**	**Appendix O**
Staging	**Report**	**Technical Study**
Provide an outline of any proposed staging of the works, if proposed.	**Section 3.8**	**Appendix X**
Plans and Documents	**Report**	**Technical Study**
The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the *EP&A Regulation 2000*. Provide these as part of the EIS rather than as separate documents.	**Section 3.0**	**-**

Requirement	Location in Environmental Assessment
In addition, the EIS must include the following: ▪ A clear and concise summary; ▪ Architectural drawings (to a usable scale at A3); ▪ Architectural design statement; ▪ Landscape drawings (to a usable scale at A3); ▪ Landscape design statement; ▪ Site survey plan, showing existing levels, location and height of existing and adjacent structures/buildings; ▪ Site analysis plan; ▪ Shadow diagrams; ▪ Arboricultural assessment; ▪ ESD statement; ▪ Pre-submission consultation statement; ▪ Heritage impact assessment; ▪ Archaeological impact assessment; ▪ Bushfire assessment ▪ Access impact statement; ▪ Traffic and parking assessment; ▪ Visual and view impact analysis and photomontages; ▪ Stormwater concept plan (if required); ▪ Sediment and erosion control plan (if required); ▪ Operational management plan; ▪ Construction management plan, including a construction traffic management plan, construction noise and vibration management plan, construction waste management plan and cumulative impact of construction activities on other nearby sites; ▪ Geotechnical and structural report; ▪ Services and infrastructure report; ▪ Contamination assessment; and ▪ Schedule of materials and finishes.	**See lodged EIS package including appended technical reports.**

Consultation	Report	Technical Study
During the preparation of the EIS, you are required to consult with the relevant local, State or Commonwealth Government authorities, service providers, and the local community. The EIS must describe the pre-submission consultation process, issues raised and how the proposed development has been amended in response to these issues. A short explanation should be provided where amendments have not been made to address an issue.	**Section 4.0**	**Appendix I**

Further consultation after 2 years	Report	Technical Study
If you do not lodge a development application and EIS for the development within 2 years of the issue date of these SEARs, you must consult further with the Secretary in relation to the preparation of the EIS.	**Noted.**	

2.0 Site Analysis

2.1 Site Location and Context

Taronga Zoo is located approximately four kilometres north of the Sydney Central Business District (CBD), on the northern shore of Sydney Harbour within the Mosman Council (LGA). Irregular in shape, the Zoo is bound by Bradleys Head Road to the east, Athol Wharf Road and Sydney Harbour to the south, Little Sirius Cove to the west and Whiting Beach Road to the north. The Zoo is divided into eight zoo-geographic regions, over 21 hectares and is home to over 4,000 animals and 340 species. The site's locational context is shown at **Figure 1** and **Figure 2**.

Vehicle access to and from Taronga Zoo is generally provided by Bradleys Head Road, which connects to Military Road via the Mosman Local Centre. Additionally, secondary access is available via surrounding residential streets, although this is discouraged. The site is also accessible via local bus and ferry services.

The Taronga Zoo site has significant mature sub-tropical vegetation and multiple heritage items, with the entire site being identified as having local heritage significance under the *Mosman Local Environmental Plan* 2012 (MLEP 2012). The zoo contains some unique structures, which represent present and past zoological practices. The site contributes significantly to the value of the Sydney Harbour landscape.

Immediate neighbouring land uses of Taronga Zoo are limited to residential dwellings to the north. Elsewhere the zoo is surrounded by the foreshore of Sydney Harbour and the Sydney Harbour National Park. Further afield are residential areas of Mosman to the north-east and the western side of Little Sirius Cove. The boundary of the African Savannah exhibit is located approximately 80 metres from the nearest residential boundary.

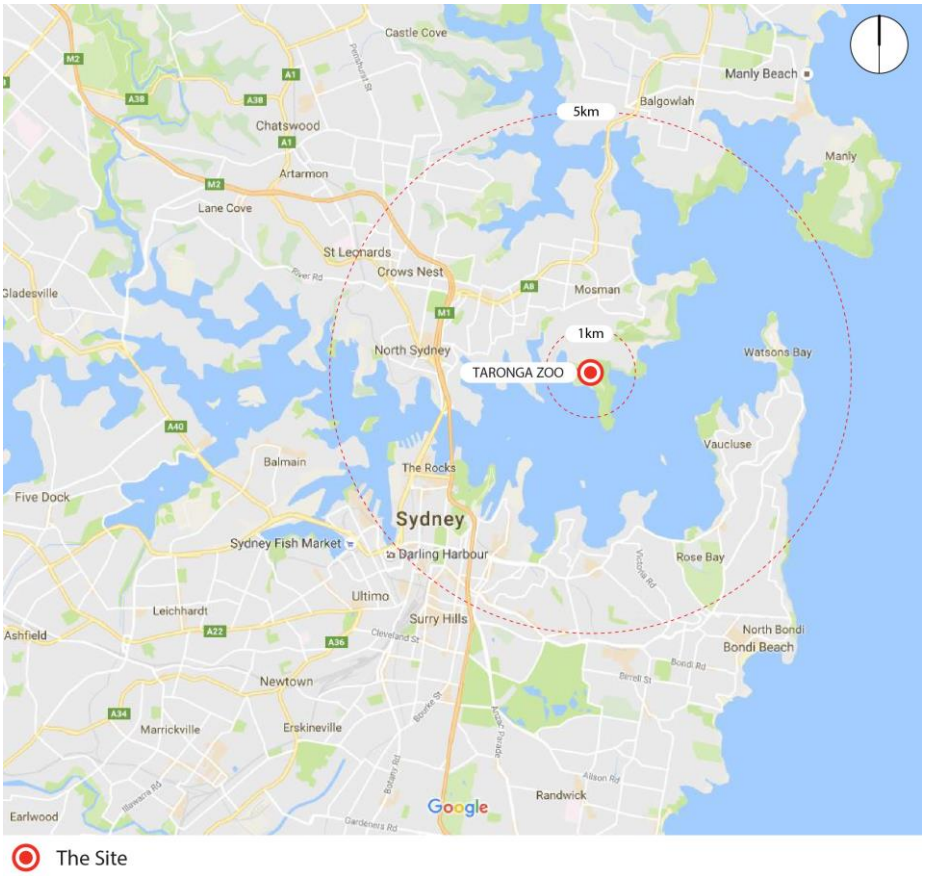


Figure 1 – Taronga Zoo Context Map
Source: JBA/ NearMap

Figure 2 – Aerial Context Map
Source: JBA/ NearMap

2.2 Land Ownership and Legal Description

Taronga Zoo is legally described as Lot 22 in DP843294, and is Crown Land managed by the Taronga Conservation Society Australia (TCSA).

2.3 Site Description

The new African Savannah and Congo Forest exhibit sites are located within the central area of Taronga Zoo. The Savannah exhibit area will replace the existing African Safari exhibits, including the Giraffe Encounter, Zebras, Himalayan Tahr, Barberry Sheep, Fennec Fox and Meerkats and is located on the western side of the Zoo towards Little Sirius Cove. The Congo Forest exhibit area will replace the existing Gorilla and Orangutan Facility exhibit. It is located to the east of the Savannah exhibit, centrally to the Zoo site, approximately 175 metres south of the main entrance. The location of the new exhibit sites relative to the overall Taronga Zoo grounds is shown in **Figure 3** below. Photos of the existing exhibits and site conditions are shown in **Figure 4** and **5**.

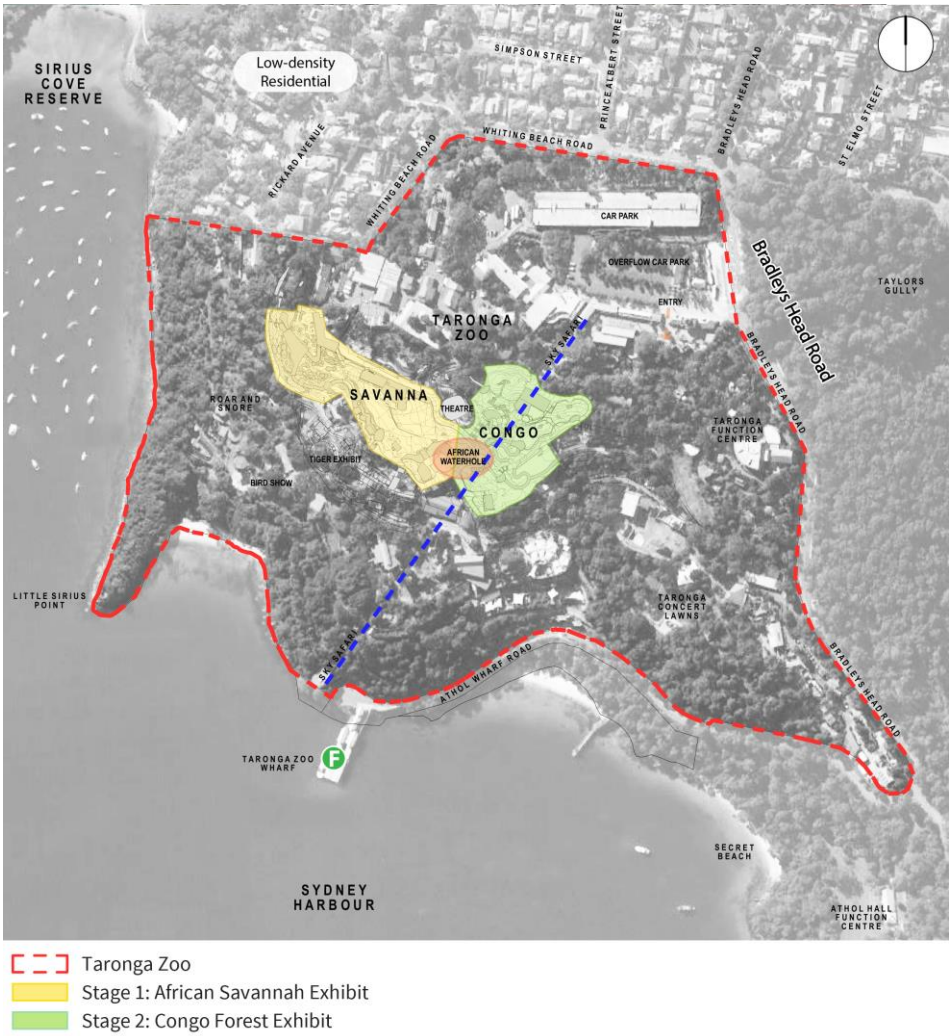


Figure 3 – Location of Savannah and Congo Forest exhibit sites within Taronga Zoo grounds
Source: Taronga Zoo/ JBA

Existing Giraffe Exhibit and Giraffe House

Existing Giraffe Exhibit, Giraffe House and viewing platform

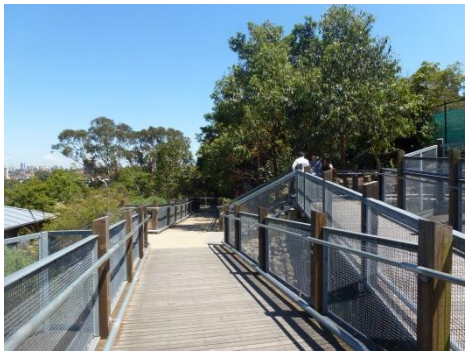
Existing structure adjacent Giraffe Exhibit

Existing public circulation the north of existing Giraffe and Bush Bird Exhibit and northern boundary of future African Savannah Exhibit

Existing public circulation path and African Safari entry at the northern boundary of future African Savannah Exhibit

Existing African Safari entry to be demolished

Existing African Safari exhibit looking east



Existing African Safari public circulation looking west to be retained in African Savannah Exhibit

Existing vegetation looking west from African Safari to be retained in new Lion Exhibit

View looking south from African Safari towards Tahr Mountain and Sumatran Tiger Exhibit

Existing African Safari public circulation looking west

Existing Zebra Exhibits looking north-east

Existing Fennel Fox exhibit looking south-west

Existing Meerkat Exhibit looking north

Existing African Safari public circulation and Zebra exhibits

Existing African Safari exit looking east to be demolished

Figure 4 – The African Savannah exhibit development site
Source: JBA

Existing circulation and zoo structures

Existing structure and vegetation through new Congo Forest Exhibit

Existing heritage stairs looking north

Exhibit located to the north of the Taronga Theatre looking west

Existing stairs looking south-west adjacent the Taronga Theatre

Existing public circulation looking east adjacent Lemur Exhibit

Figure 5 – The Congo Forest exhibit development site
Source: JBA

2.3.1 Topography

Overall, the Taronga Zoo site grades steeply from the ridge at its entrances in the north down to the southern boundary adjacent Sydney Harbour, at an average grade of about 1:10. The natural watercourse, running diagonally across the site, has created a concave landform for the site, which has been gradually manipulated over time, through construction works.

The proposed African Savannah exhibit site is located on the southern side of a steep slope that dips towards Athol Bay. The exhibit site is a relatively flat area having been extensively terraced, with significant level changes on three sides with sharply falling cliffs towards the southern end. The site has limited existing vegetation except along the western boundary where some small areas of vegetation still exists. The surface levels in the area of the development vary from approximately RL 55 m relative to the Australian Height Datum (AHD) in the north-east portion to approximately RL 40 m AHD in the south-west.

The proposed Congo Forest exhibit site sits on moderately sloping ground, sloping towards the south-west. The site has been extensively terraced and numerous

retaining walls provide level areas which house relatively level exhibits and walking paths/roadways. The surface levels in the area of the proposed development vary from approximately RL 67 m (AHD) in the north portion to approximately RL 48 m AHD in the south.

A Site Survey is included at **Appendix C**.

2.3.2 Soils and Ground Conditions

Preliminary geotechnical investigations for the exhibit sites have been undertaken by Douglas Partners and are included at **Appendix V**. The Sydney 1: 100 000 Geological Series Sheet shows that the site is underlain by Hawkesbury Sandstone which typically comprises medium to coarse-grained quartz sandstone with minor shale and laminate lenses. In the developed areas, the site has been reworked.

Within the African Savannah exhibit site investigations indicate a layer of fill consisting of asphalt and concrete surfacing, road base, organic silt/sand, underlain by clayey sand and silty sand to depths of 0.3m to 1.8m. The sandstone bedrock is generally initially of extremely low strength from depths of 0.2m to 1.5m increasing in strength with depth.

Within the African Congo Forest exhibit site investigations indicate a layer of fill consisting of asphalt and concrete surfacing, road base, buried paths and silty and sandy filling, underlain by natural sandy and clayey soils to depths of 0.8m to 1.5m and sandstone bedrock generally initially of extremely low strength from depths of 0.2 to 1.5m increasing in strength with depth.

The regional groundwater table is expected to be well below the bedrock surface and flow in a southerly direction towards Athol Bay. Seepage through and along strata boundaries and jointing in the rock has been identified.

2.3.3 Heritage and Archaeology

Multiple items within and surrounding the proposed exhibit footprints are identified as having heritage significance under the Zoological Parks Board (ZPB) Section 170 Heritage and Conservation Register but are not listed within *Mosman Local Environmental Plan 2012* (MLEP 2012). The first giraffe enclosures, which form part of the Savannah exhibit area, were erected between 1923 and1925. Many of the original paths connecting the exhibits through the Taronga Zoo grounds remain. The design and construction of the original pathways contribute to the significant character to the area. Furthermore, an area to the south of the Savannah site, adjacent the Free-flight Bird Show, has been identified as an Aboriginal archaeological site.

Further discussion is provided at **Section 6.9** and **Section 6.10**.

2.4 Surrounding Development

The proposed exhibit sites lie within the heart of the Zoo and are surrounded by other Zoo exhibits and visitor circulation routes. Immediate neighbouring land uses of Taronga Zoo are limited to single dwellings to the north, north-east and west on the other side of Little Sirius Cove. The nearest residential boundary to the proposed exhibit sites is located approximately 80 metres to the north. Ancillary Zoo facilities separate the exhibit sites from the neighbouring residential properties.

Located adjacent the Savannah exhibit to the north is ‘Reptile World’. Further to the north adjacent the Zoo boundary are multiple low-density residential dwellings. To the east of the site is the new Centenary Theatre. To the south is the new Sumatran Tiger Adventure Exhibit opening in 2017. To the west, adjacent the zoo boundary and Little Sirius Cove sits the Roar and Snore accommodation facility.

To the east of the Congo Forest exhibit site is the Lemur Forest Adventure exhibit and to the west the ‘Wild Theatre’. To the east are multiple exhibits including the male elephants and crocodiles. To the south of the site is the Seal Show exhibit. To the

south west is the Taronga Zoo Food Market, Sumatran Tiger Adventure Exhibit and proposed Savannah exhibit.

Images of the surrounding development are included at **Figure 6**.

Taronga Zoo iconic entry building

Koala Walkabout looking west to the north of the new African Savannah Exhibit

Public circulation adjacent Reptile World to the north-west of the new African Savannah Exhibit

Public circulation looking south-west adjacent Wild Australia Exhibit

Construction of the Taronga Theatre to the north of the new African Savannah Exhibit

Public circulation looking west adjacent the Taronga Food Market

Public circulation looking east adjacent the Taronga Food Market

Lemur Forest Adventure looking north-east

Figure 6 – Surrounding development
Source: JBA

3.0 Description of the Project

This chapter of the report provides a detailed description of the proposed development. Architectural and Landscape drawings are included at **Appendix C** and **Appendix D** respectively. This application seeks approval for two new animal exhibits known as the African Savannah and Congo Forest exhibits, which include the following key components:

- Partial demolition of the existing African Safari exhibit, including the removal of:
  - Giraffe House (1940) and back-of-house;
  - Zebra back-of-house;
  - Meerkat exhibit, back-of-house and yards;
  - Octagonal Shelter (northern);
  - Public amenities; and
  - Paths, steps, ramps, fencing, garden beds and kerbs.
- Partial demolition of the existing Orangutan Rainforest exhibit and aviaries; including the removal of:
  - Orangutan exhibit, enclosure and back-of-house;
  - Turner House; and
  - Paths, bitumen road, steps, ramps, fencing, garden beds and kerbs.
- Construction of a new African Savannah exhibit for Giraffe, Zebra, Lion, Ostrich Meerkat and Fennec Fox species. The new exhibit will include:
  - 2,881m^2 Giraffe and Zebra exhibit;
  - 2,821m^2 Lion exhibit;
  - 394m^2 Meerkat/ Fennec Fox exhibit;
  - Holding dens and back-of-house facilities;
  - Animal food preparation area / equipment store;
  - Animal management infrastructure;
  - Containment fences;
  - Themed landscaping;
  - Generous public viewing, milling and seating areas; and
  - Visitor and staff circulation and access paths.
- Construction of a new Congo Forest exhibit for, Eastern Lowland Gorillas and Okapi. The new exhibit will include:
  - 2,726m^2 Gorilla exhibit;
  - 929m^2 Okapi exhibit;
  - Holding dens and back-of-house facilities;
  - Animal food preparation area / equipment store;
  - Animal management infrastructure;
  - Containment fences;
  - Themed landscaping;
  - Generous public viewing, milling and seating areas;
  - Visitor and staff circulation and access paths.
- Cliff Edge Village visitor amenities;
- Interpretative and directional signage; and
- Relocation, upgrade and augmentation of services as required.

The Proposed Landscape Plan is shown at **Figure 7**.

Figure 7 – Proposed Landscape Plan
Source: GDA

3.1 Demolition, Tree Removal and Site Preparation and Earthworks

3.1.1 Demolition

The proposal requires the demolition of the following elements:

- 1940 Giraffe House;
- Partial demolition of 1924 Giraffe House;
- Giraffe back-of-house;
- Giraffe viewing decks;
- Octagonal Shelter (northern);
- Shade shelter (north);
- Zebra back-of-house;
- Meerkat exhibit, back-of-house and yards;
- Orangutan exhibit, enclosure and back-of-house;
- Aviaries;
- Turner House;
- Public amenities; and
- Paths, bitumen road, steps, ramps, fencing, garden beds and kerbs.

A detailed Demolition Plan is provided at **Appendix D**.

It is noted that demolition of the existing exhibits and enclosures may require the relocation of some species either internally within Taronga Zoo or externally, off site. Relocation of animals impacted by the proposal will be done in accordance with best practice animal management procedures.

3.1.2 Tree Removal

To facilitate the expansion and reconfiguration of the existing exhibits, the proposal seeks the removal of 196 native and non-native tree species of varying sizes, heights and retention value. Additionally, multiple trees capable of transplantation will be relocated to alternative locations within the new exhibits and zoo site.

A detailed Tree Removal and Transplant Plan (A-600) is provided at **Appendix E**.

The proposed tree removal is discussed further in **Section 6.3** and within the Arboricultural Report prepared by Earthscape Horticultural Services and included at **Appendix H**.

3.1.3 Site Preparation/ Earthworks

There will be some preparation works required prior to the construction of the exhibits. These will include earthworks to provide minor regrading of the site for various exhibit features including the African Waterhole. It is proposed to retain, where possible, excavated material on site to maintain a net balance. However, the works employ a 'light touch' approach through the minor modification of the existing exhibit landscapes and zoo topography. Where the existing topography is retained, bridging structures are proposed to provide access through the exhibits.

3.2 Exhibit Design

The proposal includes two new animal exhibits known as the African Savannah and Congo Forest exhibits. Detail on the design, layout and landscaping features of the proposed exhibits is detailed within the Architectural Report and Drawings (**Appendix D**) and the Landscape Report and Drawings (**Appendix E**).

3.2.1 Design Objectives

The Taronga Zoo Centenary Master Plan 2015 has been prepared with the objective of ensuring the delivery of a modern zoo facility that provides an environment where animals thrive through the promotion of positive animal welfare. The primary drivers for promoting animal welfare for the large animal species that will be housed within the African Savannah and Congo Forest exhibits can be distilled to three inter-related primary considerations:

- The provision of large amounts of space that provide choice for the animals, such as shade or sun, shelter or open elements, dense foliage or open space, sharp or gentle gradients and aspects with height or lower exhibit areas;
- The provision of environmental complexity, including different sights, sounds, smells, textures and mediums; and
- The provision of socially appropriate group structures with the capacity to seek isolation or refuge from group activity and natural aggression when desired.

The proposed exhibits, in response to the Master Plan, seek to employ current thinking in animal housing to ensure TCSA are leaders within this space, and providing exhibits designs beyond minimum National Animal Welfare Standards compliance requirements. This ensures ongoing animal welfare, safe egress for staff and positive visitor experiences.

3.2.2 Exhibit Layout and Size

The proposed layout of the exhibits is designed to follow a linear sequence, passing through five different zones. These zones are:

- Zone 1: Savannah – Giraffe, Zebra and Ostrich.
- Zone 2: Kopje Country – Lions.
- Zone 3: Cliff Edge Village – Public amenities, education and viewing opportunities.
- Zone 4: The African Waterhole – Meerkat, Fennec Fox and Okapi.
- Zone 5: The Congo Forest – Gorillas.

The Savannah zone acts as a gateway to the new exhibits – an introduction to Africa. It features landscaping and built form elements that are reflective of traditional African Savannah villages and life. The entry to this zone benefits from the iconic views across Sydney Harbour. The following Lion exhibit explores the relationship between the traditional Massai warriors and lions.

Cliff Edge Village, which is situated on the southern side of the Zebra and Giraffe enclosure, includes multiple smaller structures and attractions which represent traditional, richly layered African Villages.

The Waterhole is the central piece, joining the two exhibits. The Waterhole embodies the nature of coming together, and provides visitors with the opportunity to gather, rest, refresh and view the surrounding exhibits.

Upon entering the Congo exhibit visitors will experience a change in environment, a dramatic shift from the open plains to lush dense jungle. The proposed pathways, which wind through the exhibit, offer multiple opportunities for visitor engagement with the Gorillas.

Figure 8 – African Waterhole
Source: GDA

A comparison of the existing and proposed exhibit areas are provided in **Table 3** below.

Table 3 – Exhibit are comparison – existing and proposed

Exhibit	Existing	Proposed	Outcome
Zebra	742m^2	1248m^2	Increase in exhibit area.
Giraffe	773m^2	1633m^2	Increase in exhibit area.
Fennec Fox	107m^2	130m^2	Increase in exhibit area.
Meerkat	99m^2	264m^2	Increase in exhibit area.
Lion	-	2821m^2	Re-introduction of exhibit.
Barbary Sheep	474m^2	-	Removal of exhibit. Opportunities to house the Barbary Sheep in alternative exhibit areas away from construction disruption to continue their breeding and increase diversity have been found and will be utilised to ensure Taronga continue to practice the highest level of animal welfare.
Gorilla	926m^2	2726m^2	Increase in exhibit area.
Squirrel Monkey	427m^2	-	Removal of exhibit. The Squirrel Monkey was moved into its current exhibit location temporarily during the construction of the Institute building. It was always planned to return the Squirrel Monkey to its original exhibit location.
Bongo	489m^2	-	Removal of exhibit. Opportunities to house the Bongo in alternative exhibit areas away from the proposed exhibits to reduce disruption to breeding programs and to continue advocacy of conservation and animal welfare.
Okapi	-	929m^2	Introduction of exhibit
Total	**4037m^2**	**9751m^2**	The proposal results in a significant increase in exhibit area through the consolidation of existing exhibit areas, circulation pathways and zoo facilities.

3.2.3 Exhibit Landscaping

The overall landscape design seeks to integrate realistic landscape and architecture which depicts the natural habitats of the Serengeti, Kenya and the eastern zone of the Congo, Central Africa.

The African Savannah is a tropical or subtropical woodland ecosystem characterised by vegetation being smaller and widely spaced so that the canopy does not close. The African Savannah exhibit is located within an area ideal for representing an open grassland environment due to its open flat nature and mature plantings of sub-African vegetation.

African tropical forests are characterised by extremely lush growth, high species diversity and complex structure. Within the forest relatively large trees, such as Ironwood, Iroko, and Sapele predominate. The proposed Congo Forest utilises a semi-steep site with a high density of existing vegetation. Much of the existing vegetation will be retained to create a mature closed canopy.

Figure 9 – Congo Forest Exhibit
Source: TZG

The proposed exhibits incorporate a variety of landscaping elements including significant vegetation, natural rock structures and water bodies. Water sensitive urban design (WSUD) initiatives are proposed to be incorporated into the exhibit landscaping to manage stormwater and exhibit pollutants.

Exhibit Surface Treatment

The landscaping treatment of each exhibit seeks to reflect the natural habitats of each animal species to encourage natural behaviour. A detailed Surface Treatment Plan is provided in the Landscape Report (**Appendix E**).

The key surface treatments of each exhibit area are outlined below:

- Giraffe/ Zebra enclosure:
  - Textured concrete bases;
  - Crushed gravels, decomposed granite, granitic sand, asphalt and loose sand spread over concrete; and
  - Sandy soils with grassy cover slightly elevated above main traffic routes.
- Lion enclosure:
  - Deep soils to allow growth of grass and herbs; and
  - Informal pathways cut into escarpments to allow accessibility for older animals.
- Meerkat enclosure:

  - Sandy substrate; and
  - Mockrock landscape with tunnels and termite mounds.
- Fennec Fox enclosure:
  - Sandy substrate with gravel and clay content; and
  - Mockrock windblown eroded cave shelters.
- Okapi enclosure:
  - Decomposed organic forest mulch for majority of the ground cover, over deep organic soils to encourage vegetation; and
  - Mulched trails to encourage movement.
- Gorilla (bachelor) enclosure:
  - Decomposed organic forest mulch as ground cover, over deep organise soils to encourage dense vegetation; and
  - Mulched trails to encourage movement.
- Gorilla (family) enclosure:
  - Decomposed organic forest mulch as ground cover, over deep organise soils to encourage dense vegetation;
  - Mulched trails to encourage movement; and
  - Constructed creek line.

Public Domain Treatment

The publicly accessible areas of the exhibits been designed to seamlessly integrate with the animal enclosures providing visitors with an immersive and engaging experience. A combination of raised timber decks, themed concrete pathways, concrete pavers and existing pathways form the public circulation routes. Pathways, viewing areas and gathering spaces will include interpretative, educational and way-finding signage

Vegetation

The proposal has been developed around 11 distinct planting zones, these being:

- Zone 1: Giraffe/ Zebra Savannah Grasslands.
- Zone 2: African Waterhole.
- Zone 3: Cliff Edge Village.
- Zone 4: Rocky Hillside.
- Zone 5: Lion Kopje Country.
- Zone 6: Lion Kopje and Woodland Edge.
- Zone 7: Edge of the Forest.
- Zone 8: Central Visitor Path.
- Zone 9: Congo Forest.
- Zone 10: Gorilla Forest.
- Zone 11: Congo Forest Edge.

These zones are characterised by various vegetation, from tall grasses of the Savannah, low dense shrubland and succulents within the Cliff Edge Village and Rocky Hillside, to dense forest canopy made up of existing ficus species and other evergreen species in the Congo Forest.

The Lion exhibit maintains a natural escarpment of existing sandstone which provides an interesting contrast to the flat Savannah (Giraffe and Zebra exhibits) to the east. The exhibit is surrounded by an existing open eucalypt woodland edge to the west and

southern edges. This vegetation will be retained and enhanced as part of the lion exhibit.

In total, the proposal seeks to revegetate the exhibits with more than 28,000 plants, including 226 trees (**Table 4**). Detailed planting schedules are included at **Appendix E**.

Table 4 – Proposed planting quantities

Type	Quantity
Trees	226
Shrubs	6,559
Grasses	18,653
Succulents	2,220
Aquatics	251
Vines	364
Epiphytes	80
Total site plants	**28,352**
Total site planting area	**7,365m^2**

Figure 10 – African Savannah grassland and Acacia trees
Source: GDA

3.2.4 Exhibit Built Form

The built form of the exhibits has been designed to complement the wider landscaping and design of Taronga Zoo and to create a single interwoven environment. Built form has been designed to integrate with the surrounding landscape, maintain a high standard of animal welfare and ensure animal, staff and visitor safety. The following built structures are proposed:

- African Savannah exhibit:
  - Giraffe House (viewing area and back-of-house);
  - Zebra back-of-house;
  - Lion viewing area;
  - Lion back-of-house;
  - Cliff Edge Village;
  - Meerkat back-of-house;
  - Fennec Fox back-of-house; and
  - African Waterhole.
- Congo Forest exhibit:
  - Okapi back-of-house;

– Gorilla viewing areas; and
– Gorilla back-of-house.

Giraffe House

The new Giraffe House is the primary focal point of the Savannah exhibit. The building occupies the northern end of the Giraffe enclosure, and is situated a full storey below the visitor circulation path.

The form and location of the new Giraffe House, has been selected with consideration to the iconic views to Sydney Harbour, Giraffe welfare, staff access and safety, visitor experience and the existing 1924 Giraffe House. The building is defined by its vaulted roof, broken up into segments which provide good cross ventilation and reduce the visual bulk of the building. The roof partially covers the altered existing Giraffe Mock Rock house to tie all new Giraffe facilities together.

The back-of-house area consists of an enclosed giraffe house, indoor yard and stores and are sized to provide required accommodation.

Figure 11 – Giraffe House looking southwest towards Sydney Harbour
Source: TZG

Zebra Back of House

The Zebra back-of-house area is located immediately west of the Giraffe back-of-house. Store rooms and keeper areas are shared with the Giraffe House (refer to **Figure 12**). Four interlinked holding areas exit into an external raceway. The building is covered by a green roof edge. Internal walls are 1800mm tall with mesh above to provide maximum natural ventilation. The southern façade is clad in timber, to minimise its visibility.

Figure 12 – Giraffe and Zebra back-of-house cross section (Section A)
Source: TZG

Lion Viewing Area and Back of House

The lion enclosure has been designed to provide an immersive visitor experience. Visitors enter an enclosed pathway, covered by a safety mesh, which separates them from the animals (refer to **Figure 13**). The form and shape of the main viewing area replicate the existing rocky ground plain with the addition of a very light sculpted enclosing structure.

The lion back-of-house comprises a two-storey building; the lower storey forms part of the visitor circulation path and the upper storey contains eight (8) lion dens, keeper working areas, stores and circulation. Two (2) separable lion exhibits plus a holding yard are connected to the back-of-house building. To the south, the only public viewpoint, the mass of the building is broken up by the use of a steel mesh screen on the lower level and a green wall and roof edge above.

Figure 13 – Lion viewing shelter
Source: TZG

The Cliff Village

The Cliff Village comprises a series of re-interpreted African Huts. These are connected to the main visitor circulation route and provide opportunities for interpretative and educational signage. These buildings reflect traditional African shapes, forms and materials. Roof materials are timber shingles, Corten Steel and corrugated iron on timber and steel structures. Highly textured walls provide further identity to each structure.

Meerkats and Fennec Fox Back of House

The Meerkat back-of-house features a green roof mound and has been designed to integrate with the exhibit landscape, with minimal visual impact. The structure contains two holding areas and a store. Additional storage for the meerkat exhibit is provided within the existing Hippo House further to the south.

The Fennec Fox viewing structure is integrated within the animal containment strategy (refer to **Section 0** below). It has been conceived as a lightweight canopy common to both visitor and fennec fox to enable intimate interaction between the two. The sunken back-of-house area is not visible from the visitor pathway. The back-of-house area consists of an internal enclosure, dark room and keeper area.

African Waterhole

The African Waterhole is the central point between the African Savannah and Congo Forest exhibits. The concrete plan path from east to west is combined with a neutral tree-like timber structure to provide shading and shelter. New toilet amenities are located along the path. The structures reflect a Burkina Faso type building typology with textured organic masonry and painting patterning.

Okapi Back of House

The Okapi back-of-house area has been designed as a simple and discreet structure. It contains three animal stalls, storage and circulation areas. Vehicle access is provided by the existing roadway.

Gorilla Viewing Area and Back of House

Upon entering the Congo Forest exhibit, visitors will follow raised pathways which wind up to the gorilla enclosure and viewing shelters. The viewing shelters are proposed to be constructed of timber roofs with ramped earth walls to provide shade and space for interpretive and education signage.

The Gorilla back-of-house area has been designed to provide best practice animal handling, visitor and staff safety, road access and shielding from the overhead cable car. The facility contains ten family dens and four bachelor dens, which connect to three separate exhibit areas, staff areas, store and vehicle loading dock.

Separate exhibit areas, including the 'Gorilla Bachelor Exhibit' have been designed in accordance with the requirements of the Western Lowland Gorilla Program which calls for all participants to ensure the capacity to manage all male offspring born and the safety and wellbeing of all animals. This significantly increases the footprint required to manage this species in accordance with global breeding program objectives.

The Rainforest Room allows for a more intimate visitor experience. A green roof ensures the back-of-house building integrates with the surrounding landscape.

Figure 14 – The Congo Forest exhibit aims to emulate a natural rainforest
Source: GDA

All materials and finishes will be refined during detailed design prior to issue of a Section 109R Crown Certificate.

3.3 Access and Accessibility

3.3.1 Accessibility

The Premises Standards 2010 set performance requirements and provides references to technical specifications to ensure dignified access to, and use of, buildings for people with a disability. They clarify the general non-discrimination provisions of the *Disability Discrimination Act 1992* (DD Act) in relation to the design construction and management of buildings. The requirements of the Premises Standards 2010 mirror the requirements of Building Code of Australia compliance, and under that Code the buildings are required to be accessible to and within all areas normally used by occupants. Compliance with these requirements is a key driver for the proposal.

Access has been considered with regard to providing compliant access throughout the new exhibits. The existing visitor pathways have been rationalised to provide a single circulation route. Access within the exhibit areas and back-of-house has been considered to ensure safe egress for staff. The existing small caves and animal dens do not provide a safe working space in accordance with modern workplace practices.

A review of the proposed plans has been undertaken by Blackett Maguire + Goldsmith (BM+G) (refer to **Appendix O**) which confirms that the design of the exhibits, both built form and circulation pathways can comply with the requirements, subject to detailed design.

3.3.2 Pedestrian Access

Pedestrian access from Taronga Zoo will remain unchanged as a result of the proposal. The primary zoo entry is located to the north of the proposed exhibits. As outlined above, the proposal seeks to rationalise the existing pedestrian pathways throughout the zoo providing increased levels of access.

It is noted, that Taronga Zoo as a whole is consistent with the following guidelines:

- Planning Guidelines for Walking and Cycling;
- Sydney's Cycling Future 2013; and
- Sydney's Walking Future 2013.

3.4 Vehicular Access and Parking

Vehicle access to and from Taronga Zoo is generally provided by Bradleys Head Road, which connects to Military Road via the Mosman Local Centre. Public parking is provided within a multi-storey car park and overflow parking area to the north of the zoo, adjacent Bradleys Head Road and Whiting Beach Road. A total of 846 parking spaces (general, accessible and motorcycle) are provided. Public vehicle access and parking will remain unchanged as a result of the proposal.

TCSA staff and contractor vehicles enter the zoo via Whiting Beach Road, to the north of the proposed African Savannah exhibit. Internal pathways double as vehicle access routes for construction, exhibit back-of-house servicing and animal care. Vehicle loading areas are proposed within the Gorilla back-of-house, Okapi back-of-house and lion back-of-house areas. It is noted that TCSA employee access from Whiting Beach Road may be temporarily restricted during the works as a result of construction management measures.

3.5 Ecologically Sustainable Development

The proposal has been developed with consideration to Ecologically Sustainable Development (ESD) strategies and principles as defined in clause 7(4) of Schedule 2 of the EP&A Regulations, where appropriate to the scope of the development.

The key ESD features implemented in the proposed development include:

- Energy Efficiency:

  - Use Evacuated Tube Solar Collectors to either pre-heat or provide the complete heating of potable water (depending on solar exposure and demand).
  - Use of LED lighting technologies.
  - Use of automated controls and metering systems connected to the existing Taronga building management system.
  - Passive thermal and ventilation control.
  - Utilising materials with high insulation properties.
- Water Resourcefulness:
  - Water efficient fixtures.
  - Water recycling and reuse through the existing Waste Water Treatment Plant.
  - Incorporate WSUD strategies to improve stormwater quality.
- Waste Minimisation:
  - Use of locally sourced materials.
  - Target a net balance of soil.
  - Use of recycled materials including recycled/ sustainable timber.
  - Target the recycle/ reuse of 90% of construction materials.
  - Reduce the use of products containing Polyvinyl Chloride (PVC).
  - Supplement the existing recycling points for visitors to dispose of recyclable materials
- Education and Information Technology:
  - Development of smart technology wayfinding and education.

Detailed explanation is provided in **Section 6.7.**

3.6 Infrastructure and Services

The proposed exhibits will utilise existing water, sewerage, gas, electricity and communications infrastructure which service the current exhibits. Required, relocation, upgrades and augmentation of these services and infrastructure will occur as required subject to detailed design and construction.

3.6.1 Electrical Services

Taronga Zoo owns and maintains multiple electricity substations situated within the zoo grounds. At each substation the voltage is stepped down from the 11 kV (from the high voltage Substation No.1 at the top of the site) to 415 volts and distributed to the various buildings by a series of pillars and switchboards.

An Electrical Report has been prepared by Jones Nicolson Consulting Engineers and is included at **Appendix S**. The report details the electrical works to be carried out as part of the proposal. These works include:

- Relocation of Substation No.7 and associated underground cables from within the proposed Congo Forest development site;
- Replacement of the existing Substation No. 7 (dated 1985);
- Replacement of the existing generator within the Gorilla enclosure; and
- Installation of conduits and pits to enable low voltage and communications cabling to the proposed buildings.

The proposed exhibits will be supplied from the new Substation No. 7. Final loads will be calculated during detailed design to support the new areas with additional capacity for future expansion. It is not anticipated that the proposal will require upgrades to the external electricity network.

3.6.2 Potable and Recycled Water

Potable and recycled water is provided to the site via separate 100mm mains which traverse the area. Potable water will be reticulated to drinking fountains, hose taps and specialised animal drinking fountains, and sinks in food preparation areas.

Taronga Zoo is serviced by a stormwater system that includes a Waste Water Treatment Plant located at the southern end of the site. The Treatment Plant collects wash down water from cleaning exhibits, water from moats and stormwater runoff from the entire zoo site (some 28 hectares). It provides a secure water supply to meet 1/3 of the 600 kL/d of total water demand. It is not anticipated that the proposal will result in additional demand on potable and/or recycled water.

The resulting mixed wastewater and stormwater is characterised by gross pollutant and organic nutrient loads higher than typical stormwater, but weaker than typical sewage. After purification in an advanced onsite treatment system, the recycled water is used for:

- Hose down of animal exhibits;
- Filling of exhibit and ornamental moats and wetlands;
- Flushing of toilets and urinals; and
- Irrigation of gardens and lawns.

3.6.3 Stormwater

The proposal seeks minor upgrades of existing services only. All proposed stormwater lines within the exhibits will be designed to the 1 in 20 year ARI level. The stormwater system is designed to maximise the area of water catchment directed to the existing onsite harvesting system. It is noted that the proposal will not result in substantial changes to the existing areas of hard/ soft scapes within the zoo.

All stormwater from roadways and pathways will be directed to the Zoo's existing water treatment plant for recycling. The harvested water is filtered, and if necessary, treated with ozone to remove organic wastes.

3.6.4 Sewerage

An authority sewerage line traverses the site draining from the eastern side then down along Athol Wharf Rd before turning north along the western boundary. The site wide sanitary system network connects to the Sydney water system in several different locations. It is proposed to extend this sewer as required to service the exhibits including public drinking foundations and amenities, drainage of animal enclosures and staff amenities. The sewer will be serviced by the existing site sanitary service which runs through the Sumatran Tiger Exhibit (adjacent the African Savannah). It is not anticipated that the proposal will result in additional demand on the existing sewerage network.

3.7 Exhibit Operations

3.7.1 Operating Hours

The proposed African Savannah and Congo Forest exhibits will operate in accordance with the zoos existing opening hours. Taronga Zoo is open daily including Christmas Day. Hours are seasonal, as follows:

- 9:30am – 4:30pm (May – August)
- 9:30am – 5:00pm (September – April)
- 9:30 – 4:00pm (New Year's Eve).

3.7.2 Employment

The proposal seeks to redevelop existing zoo facilities and exhibits. As such, it is not anticipated to generate additional employment during operation.

The proposal is anticipated to generate approximately 375 construction jobs over the life time of the project.

3.7.3 Animal Welfare

An Animal Husbandry Operational Management Plan has been prepared by TCSA and is included at **Appendix Y**. The Plan details the animal husbandry policies, guidelines and practices specific to each exhibit and animal. The Plan seeks to provide all staff with clear guidelines and parameters when working with and around animals and associated facilities, ensuring work practices are safe and make efficient use of time.

For each animal, the Plan details procedures relating to:

- Animals classification and staff parameters;
- Species/ specimen specific notes;
- Facility operations and security;
- Work procedures;
- Shifting procedures;
- Security, locking systems/ slides and enclosure mechanisms;
- Animal escape briefs;
- Animal incident briefs; and
- Authorisation and report.

TCSA is required, under the EAPA 1986 to submit an application known as a “Form G – Application” to the Department of Primary Industries (DPI) for approval to construct or alter an animal enclosure or facility.

Prior to the animals being able to occupy the exhibit, the general standards and provisions for exhibiting animals (specifically for exhibiting carnivores in NSW) outlined within EAPA 1986 are required to be met and approval granted.

Taronga Zoo, as built, holds existing approval under the EAPA 198*6* to exhibit the animals. TCSA will continue to liaise with DPI in respect to the physical characteristics of the exhibits to ensure approval will be granted and the highest standards of animal care are met.

Animal Containment

All exhibits and off-exhibit holding areas are designed to provide the highest level of security for the animals, staff and visitors. Animal containment measures have been located to integrate with the surrounding landscape and built form. An overview of the containment measures for each enclosure is provided within the Landscape Report (**Appendix E**) and is summarised below.

- Giraffe/ Zebra/ Ostrich enclosure:
  - Vertical external fences 1.8m height with horizontal 6mm steel cables at 600mm intervals. With the waterhole, the fence will be located central to the waterbody, which will have a depth of 150mm to 500mm.
- Lion enclosure:
  - Vertical external 4.5m high fences, with 1.0m 45-degree overhang and X-tend tensile stainless-steel mesh (as seen within the Sumatran Tiger exhibit);
  - Underside of elevated deck, tensile mesh to underside of deck with horizontal arm extension for electric hot wires;

  - At overhangs for the main fence structure secondary barriers such as electric/hot wires to reduce access to the tensile wire;
  - Back of House enclosed yard - 75 X 50mm apertures - bars 5mm thickness weldmesh panels, with 45-degree angle overhang with electric hot wires; and
  - Curved visitor viewing structure will have 45-degree angle overhang with electric hot wires.
- Meerkat enclosure:
  - Vertical mock rock themed wall or safety glass to a height of 1.2m – 1.5m high and non-climbable.
- Fennec Fox enclosure:
  - Vertical mock rock themed wall or safety glass to a height of 2.4m fully enclosed with light rodent/bird proof steel mesh roof and sides.
- Okapi enclosure:
  - Vertical external fences 1.5m height, with horizontal 6mm steel cables at 400mm intervals.
- Gorilla enclosure:
  - Vertical external fences 5.0m high (4.5m with 1.0m 45-degree overhang) with perforated structural steel plate (un-climbable surface).

3.8 Construction Management

A Preliminary Construction Management Plan (PCMP) has been prepared by TCSA and is included at **Appendix X**. The PCMP outlines the broad construction methodology and mitigation measures to be undertaken to support the delivery of the proposed exhibits. Further discussion is provided at **Section 6.13**. Additional project management protocols for construction traffic and noise have been identified within the appended technical studies included at **Appendix K** and **Appendix J** respectively.

3.8.1 Construction Staging

The proposal will be constructed within the environment of an existing operational zoo. As such, existing accesses, services and facilities are required to be maintained during the construction process.

The proposed works will be carried out in two distinct stages:

- Stage 1 – African Savannah Exhibit; and
- Stage 2 – African Congo Forest Exhibit.

Table 5 outlines the primary works associated with and proposed timing of each stage.

Table 5 – Construction Staging

Stage	Timing
Stage 1 – African Savannah Exhibit	
Site establishment	February 2018
Commencement on site	March 2018
Commissioning	November 2019
Animal establishment	December 2019
Opening of exhibit	February 2020
Stage 2 – African Congo Forest Exhibit	
Site establishment	April 2021
Commencement on site	May 2021
Commissioning	August 2022
Animal establishment	September 2022
Opening of exhibit	October 2022

Source: TCSA

3.8.2 Hours of Construction

Construction activities will generally occur during the proposed work hours outlined below:

- Between 7:00am and 6:00pm, Monday to Friday.
- Between 7:00am and 1:00pm, Saturdays (7am to 8am is outside standard construction hours; works will only take place during this hour if inaudible at affected residential receivers).
- No work or deliveries on Sunday and/or public holidays.

3.8.3 Construction Activities

Site Establishment

Site establishment activities will include:

- Location of site sheds and construction areas within the unused holding areas at the north end of the site;
- Location of site sheds once demolition works have been completed and as soon as is practical;
- Erection of hoardings and scaffolds for safety and site demarcation; and
- Establishment of security protocols, check points, crane and loading zones.

Service Diversions

All services located within the construction site will be located and capped as required. Service diversions will be undertaken to ensure minimal disruption to other areas of the zoo.

Demolition and Deconstruction

Demolition and deconstruction activities will include:

- Undertake a hazardous materials assessment;
- Removal of hazardous materials;
- Demolition of existing concrete structures using a combination of concrete saws, crushers and rock breakers;
- Undertake a comprehensive survey of the existing site for materials suitable for reuse or recycling and reuse/ recycle where appropriate; and
- Develop a Waste Management Plan (WMP) to manage all waste streams.

Excavation

Excavation activities will include:

- Excavation for the foundations and site levels; and
- Reuse of excavated material as controlled fill where required and removal of excess off-site.

Foundations

Foundations will be constructed in such a way as to mitigate the risk of noise and vibration that may affect adjacent areas.

Building Structures

Construction of the proposed exhibit structures will occur using a variety of materials including masonry block construction and light weight construction methods.

Enclosures

The proposed enclosures will be comprised of a combination of physical barriers such as fencing, water bodies and tensile stainless-steel mesh.

Landscaping

The existing landscape character of the precincts provides a mature foundation for the proposed exhibit designs which emulate the natural habitats of the Serengeti/ Kenya and the eastern zone of the Congo, Central Africa. Landscaping will consist of built structures, fencing and vegetation.

Finishes and Fit Out

Finishing and fit out of the proposed exhibits will occur once the buildings are watertight. This stage of work will proceed in a conventional sequence with the partitions, services rough-ins and wet trades followed by the dry finishes and services.

Services

In-ground infrastructure services including water, stormwater drainage, sewer drainage and electrical reticulation will be installed at the same time as the structure is commenced. The services design will determine the location of mains connections and also the need, if required, of any upgrades to these mains. The rough-in and fit out of services within the exhibit buildings and spaces will be undertaken with the fit out and finishes of the relevant areas. The commissioning of these services will be required before completion and handover of the facility. Integration of the exhibit buildings and spaces services with the control systems for the entire zoo will be form part of completion for the services to the project.

Materials Handling

Materials for the project are proposed to be hoisted and moved by a combination of mobile cranes and forklifts. Concrete pumping for the new structures will generally take place from within the site. Any impact on the surrounding zoo operations will be addressed prior to concrete pours. The Head Contractor will facilitate.

The size and weight of materials deliveries will be considered to ensure viable access to the site via the existing internal and external road networks.

3.9 Emergency Management

Taronga Zoo operates under the TCSA Emergency Response Plan (TERP) prepared in accordance with Clause 43 of the Work Health and Safety Regulations 2011 and Australian Standard AS 375-2010 '*Planning for emergencies in facilities'*. The proposed exhibits will operate in accordance with this plan.

The plan sets out the guidelines to enable Taronga Zoo to plan for and respond to an internal and external emergency. It contains information which is designed to:

- Ensure the safety and wellbeing of workers, including students, contractors and visitors during an emergency incident; and
- Protect the site from theft or further damage during and after the incident.

An emergency incident can include:

- Dangerous Animal Emergency;
- Hazardous Animal Emergency;
- Bushfire;
- Civil Disorder;
- Evacuation;
- Gas leak; and

- Personal threat (armed or unarmed).

It is noted that Gorillas and lions are considered dangerous animals and as such any emergency will be treated in accordance with the dangerous animal emergency protocol. The TERP will be updated to reflect the reintroduction of lions to the zoo.

In the event of evacuation, staff, visitors and other personnel will be required to move from an area of danger to an area of safety in as rapid and safe a manner as possible. Evacuation of the zoo may be full evacuation, partial evacuation, use of safe houses or other appropriate action. The TERP outlines procedures for all instances. An Evacuation Diagram is provided at **Appendix AA** which details the location of muster points, assembly areas and evacuation routes.

A Project Specific Safety Management Plan (PSSMP) and control measures will be implemented by the Principal Contractor prior to commencement of construction works. The document will be prepared in accordance with the TERP. The scope of PSSMP will address management of activities during construction of the project.

Documentation and document control for the PSSMP, including issue of any amendments will be done generally in accordance with safety regulations and maintained by Principal Contractor and kept up to date through regular reviews.

The reviews will be aimed at verifying the suitability and effectiveness of the Plan in ensuring compliance with legislative, contractual, and best practice requirements. This Project Safety Management Plan will also be reviewed if:

- There is a significant change in the project scope
- There are significant and relevant changes in applicable legislation during the lifetime of this Plan
- Safety impacts associated with project activities changed due to any other reason
- Major omission or non-conformance identified by the Principal or relevant regulatory agencies
- A major incident or emergency event occurred on the project site.

At all times, an up to date copy of the plan will be kept in the project office and made available to all employees and contractors involved in the project.

3.10 Analysis of Alternatives

Strategic Need

Taronga Zoo is one of Australia's most popular attractions, contributing significantly to tourism offerings within Sydney and the NSW economy. The proposal forms part of the centenary Capital works development program which seeks to transform the zoo facilities and visitor experiences over the next 10 years. The African Savannah and Congo Forest exhibits have been identified within the Centenary Master Plan as strategic wildlife exhibit upgrades required for the Zoos long-term operation and performance.

Alternative Design Options

Three primary options were available to TCSA in respect to the need for updated Savannah and Congo exhibit areas.

Option 1 – Do Nothing

As a conservation organisation with the responsibility for care of wildlife, TCSA ensure that at all times the needs, interests and welfare of the animals is a primary consideration. An approach to articulate animal welfare outcomes in the agricultural industry was developed into the Five Freedoms, which have been widely used since the mid 1960's. Within these freedoms was: *Freedom to express normal behaviour - by providing sufficient space, proper facilities and company of the animal's own kind*. This

remains highly relevant; however, a marked increase in scientific understanding over the last two decades has extended the breadth and depth of current knowledge of the biological processes that are connected to animal welfare and to guiding its management.

A contemporary approach to animal welfare is critical to achieving industry accreditation in Australia. Modern animal welfare has shifted from 'Freedoms' to 'Domains' which seek to ensure, not only that an animal is not suffering, but that it is thriving and welfare is beyond the absence of the negative, and is in fact positive.

Many exhibits created more than 20 years ago cannot achieve these aims, and as such, Taronga (and all modern zoos) must evolve with modern welfare science. To persevere with old exhibit designs, layouts and features is likely to put a zoo not only at odds with modern welfare science, but existing and emerging animal welfare legislation, including the EAPA 1986.

Under the 'do nothing' scenario, the zoo would continue to operate with existing facilities that no longer meet local and international animal care standards and visitor experience expectations. Major impacts of not proceeding with the redevelopment include:

- Continued operation of out dated and substandard exhibits;
- Ongoing maintenance, access and safety issues for both the animals and staff; and
- Uncompetitive experience offerings for local, national and international visitors.

Option 2 – Refurbishment

As part of long-term planning for the proposed exhibits, consideration was given to the viability of refurbishing the existing exhibits and associated amenities. The refurbishment option offered various cost saving opportunities including:

- Re-use of existing animal enclosures;
- Re-use and adaption of existing back-of-house and staff area; and
- Re-purposing of visitor amenities.

However, the option for refurbishment also presented multiple constraints. Animal welfare legislation, including the National Animal Welfare Standards have been identified for revision in the near future. The current Master Plan needs to employ modern thinking in animal housing to ensure that TCSA are leaders in this space, and beyond simple compliance. Refurbishment of the existing exhibits is consequently not responsive or forward thinking enough. Additional constraints include:

- Built-in limitations due to the existing size and access opportunities to the exhibits;
- Requirements for compliant access pathways;
- Logistical construction and access issues; and
- Reduced overall lifespan of the new exhibits for to refurbishment of existing structures.

These space constraints outweighed the identified benefits.

Option 3 – Alternative Designs

The proposed exhibit designs have undergone multiple iterations. Various considerations influenced the design iterations and subsequent amendments including:

- Retention versus removal/ relocation of items of heritage and cultural significance;
- Retention versus removal/ recreation of existing topography, vegetation and landscape features;
- Retention of existing pathways versus provision of new accessible circulation routes;
- Evolving animal welfare standards and legislative requirements;

- Evolving workplace practices and standards; and
- Societal and visitor expectations.

Previous iterations were not selected as they did not balance the required project objectives and resulted in undesirable outcomes, for example heritage impacts.

Options 4 – The Proposal

The proposal as outlined in this SSD report. It is considered that the redevelopment of the existing exhibits and surrounding areas presents as the most strategically viable of all the options. The proposal will result in:

- New purpose-built facilities which will provide modern enclosures, which allow for functional, best-practice and safer day-to-day operations and management;
- Substantial increases in animal enclosure footprints and amenity;
- Innovative animal and visitor experiences and interactions;
- Improved visitor access, including rationalised circulation routes satisfying BCA requirements;
- Retention and/or relocation of significant vegetation and structures;
- Incorporation of sustainable building materials and systems for ongoing performance; and
- Ongoing viability of Taronga Zoo.

4.0 Taronga Zoo Communications and Stakeholder Consultation

Taronga Zoo engaged JBA to provide communications and stakeholder engagement services prior to the lodgement of the State Significant Development Application (SSDA) for the African Savannah and Congo Forest Exhibits. The consultation program included engagement with the local community, neighbours and key stakeholders to present the proposal and gather feedback.

The following stakeholders were invited to attend a briefing session about the proposed development, as outlined in the SEARs. A copy of this letter can be found in **Appendix I.**

- Department of Planning and Environment;
- Environmental Protection Agency;
- Transport for NSW;
- Roads and Maritime Services;
- Office of Environment and Heritage;
- NSW Fire Brigade;
- NSW Rural Fire Service;
- Mosman Mayor and Councillors;
- Mosman Chamber of Commerce;
- RSPCA;
- PETA; and
- Animals Australia.

A briefing session was held between the project team and the Department of Planning and Environment on 24 May 2017.

In addition, surrounding residents and landowners were invited to a community information session which was held on Wednesday 10 May 2017 at Taronga Zoo, from 6pm to 7:30pm. Six interested stakeholders attended, and had the opportunity to ask questions and provide comment directly to the project team and via feedback forms provided at the session.

Key issues raised during communications and stakeholder engagement activities included:

- The height of the new Giraffe canopy;
- The design of the new theatre;
- Impact of construction upon local traffic;
- Ensuring that animal welfare standards were being maintained or improved;
- Strategic tree removal, relocation and replanting;
- Protecting Heritage features;
- Noise management; and
- Improving accessibility.

A detailed explanation of all communications and stakeholder and engagement activities is provided in the Consultation Outcomes Report (refer to **Appendix I**)

4.1 Secretary's Environmental Assessment Requirements Consultation

As part of the SEARs received for the project, a number of key public authorities provided comment and requested various inputs be provided as part of the EIS documentation. These have been summarised in **Table 6** below, with reference to the relevant section of this EIS where applicable.

Table 6 – Public authorities SEARs requested information

Requirement	Location in Environmental Assessment	
Environmental Protection Agency		
General	**Report/ EIS**	**Technical Study**
The EIS should both: ▪ Describe mitigation and management options that will be used to prevent, control, abate or minimise identified environmental impacts associated with the project and to reduce risks to human health and prevent the degradation of the environment; and ▪ Include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	**Section 8.0**	**-**
Construction Phase – Site Investigation	**Report/ EIS**	**Technical Study**
The EIS should provide sufficient information on the contamination status of soils to enable the EPA to provide meaningful comments.	**Section 6.11**	**Appendix X**
This EIS should include detailed information about: ▪ (a) Groundwater (example: depth and any likely impact to groundwater); ▪ (b) Any fill material; and ▪ (c) Potential impacts from demolished buildings and infrastructure.	**Section 6.11**	**Appendix U** **Appendix V**
Construction Phase – Waste Control and Management (General)	**Report/ EIS**	**Technical Study**
The proponent should commit to ensuring that: ▪ All waste generated during the project is assessed, classified and managed in accordance with the *"Waste Classification Guidelines Part 1: Classifying Waste"* (Department of Environment Climate Change and Water, December 2009); ▪ The body of any vehicle or trailer, used to transport waste or excavation spoil from the premises, is covered before leaving the premises to prevent any spill or escape of any dust, waste, or spoil from the vehicle or trailer; and ▪ Mud, splatter, dust and other material likely to fall from or be cast off the wheels, underside or body of any vehicle of trailer or motorised plant leaving the site, is removed before the vehicle, trailer or motorised plant leaves the premises.	**Section 6.13**	**Appendix X** **Appendix Z**
Construction Phase – Asbestos and lead-based paint	**Report/ EIS**	**Technical Study**
The proponent should confirm whether asbestos containing material is evident on the site.	**Section 6.11.2**	**Appendix W**
The proponent be required to satisfy the requirements of the Protection of the Environment Operations (Waste) Regulation 2014 with particular reference to Part 7 'asbestos wastes'.	**Section 6.11.2**	**Appendix W**
The proponent should be required to consult with WorkCover NSW concerning the handling of any asbestos waste.	**Section 6.11.2**	**Appendix W**
Construction Phase – Dust control and management	**Report/ EIS**	**Technical Study**
The proponent should commit to: ▪ (a) Minimising dust emissions on the site; and ▪ (b) Preventing dust emissions from the site.	**Section 6.13**	**Appendix X**

Requirement	Location in Environmental Assessment	
Construction Phase – Erosion and sediment control	**Report/ EIS**	**Technical Study**
The EIS should identify how the proponent will implement erosion and sediment control measures consistent with the practices and principles in - ▪ Managing Urban Stormwater Soils and Construction, Volume 1, 4th Edition, 2004, and ▪ Managing Urban Stormwater Soils and Construction Volume 2A Installation of Services.	**Section 6.13**	**Appendix X**
Construction Phase – Noise	**Report/ EIS**	**Technical Study**
The EIS should: ▪ (a) Identify surrounding noise sensitive land uses, and ▪ (b) Incorporate a comprehensive noise impact assessment of site preparation, bulk earthworks, construction and construction-related activities, especially any such activities – likely to generate noise with annoying or intrusive – characteristics, or – proposed to be undertaken outside the recommended – standard hours discussed in Table 1 to the Interim Construction Noise Guideline (ICNG).	**Section 6.1** **Section 6.13**	**Appendix J** **Appendix X**
Construction hours The proponent should be required to undertake all demolition, site preparation and construction during standard construction hours as recommended in Table 1 Chapter 2 of the Interim Construction Noise Guideline, July 2009.	**Section 6.1**	**Appendix J** **Appendix X**
Intra-day respite periods The proponent should be required to schedule intra-day 'respite periods' for construction activities identified in the Interim Construction Noise Guideline as being particularly annoying to surrounding sensitive receivers, including surrounding residents.	**Section 6.1.4**	**Appendix J** **Appendix X**
Queuing and idling construction vehicles and vessels The proponent should be required to ensure construction vehicles (including tipper trucks and concrete agitator trucks) involved in construction and construction-related activities do not arrive at the project site or in surrounding residential precincts outside approved construction hours.	**Section 6.1.4**	**Appendix K** **Appendix X**
Reversing and movement alarms The proponent should commit to undertaking a safety risk assessment of construction activities to determine whether it is practicable to use audible movement alarms of a type that would minimise the noise impact on surrounding noise sensitive receivers, without compromising safety.	**Section 6.1.4**	**Appendix K** **Appendix X**
The proponent should commit to: ▪ (a) Complying with the standard construction hours as recommended in Table 1 Chapter 2 of the Interim Construction Noise Guideline, July 2009; and ▪ (b) Scheduled intra-day 'respite periods' for construction activities identified in the Interim Construction Noise Guideline as being particularly annoying to surrounding residential and other noise sensitive receivers.	**Section 6.1.4**	**Appendix X**
Operational Phase – Noise Impacts	**Report/ EIS**	**Technical Study**
The EIS should include a comprehensive assessment of noise impacts associated with the operation of the new facilities together with design for feasible and reasonable noise impact avoidance and mitigation, including but limited to: ▪ (a) Potential sleep disturbance impacts on surrounding residents; and ▪ (b) The need to apply 'modifying factors' (see INP chapter 4) to noise monitoring data and associated noise impact assessment.	**Section 6.1**	**Appendix J**
Prepare a detailed operational noise impact statement that	**Section 6.1**	**Appendix J**

Requirement	Location in Environmental Assessment	
incorporates feasible and reasonable measures to avoid, minimise and manage noise and incorporate those noise avoidance and minimisation measures at the design stage of the project.		
Establish and foster a good relationship with surrounding residents (including facilitation of the logging noise complaints and of obtaining an active and timely response to those complaints).	**Section 6.1.4**	**-**
Undertake a noise monitoring program to 'ground truth' noise impact predictions at set periods following commencement of operation of the new facilities.	**Section 6.1**	**Appendix J**
Operational Phase – Water Quality	**Report/ EIS**	**Technical Study**
The EIS should provide a detailed assessment of potential operational impacts on water quality in Sydney Harbour, including Little Sirius Cove. Identify feasible and reasonable measures including rainwater re-use to minimise those impacts.	**Section 6.6**	**Appendix R** **Appendix Z**
Identify pollutants likely to be generated by project activities, including stormwater run-off, and estimate the concentration and quantity of those pollutants.	**Section 6.12**	**Appendix R** **Appendix Z**
Assess the impact of any pollutants on Harbour waters.	**Section 6.6**	**Appendix R** **Appendix Z**
Include details of practical measures proposed to be adopted to prevent, control, abate and mitigate any water pollution arising from the project activities, including upgrades to the existing water treatment and recycling works.	**Section 6.6**	**Appendix R** **Appendix Q** **Appendix Z**
Operational Phase – Energy and Water Conservation	**Report/ EIS**	**Technical Study**
The EIS should identify and evaluate: ▪ Practical opportunities to minimise energy use; and ▪ Practical opportunities to conserve water and maximise water re-use.	**Section 6.7**	**Appendix T**
Office of Environment and Heritage		
Heritage	**Report/ EIS**	**Technical Study**
Prepare a Heritage Impact Statement (HIS) which assesses how the development may impact on places of heritage significance in the vicinity of the SSD site.	**Section 6.10**	**Appendix N**
Prepare a detailed Visual Assessment demonstrating how the development would affect views to and from heritage places in the vicinity and the qualities of Sydney Harbour.	**Section 6.4.3**	**Appendix D**
Prepare a Historical Archaeological Assessment to inform the HIS.	**Section 6.9**	**Appendix N**
Aboriginal Cultural Heritage	**Report/ EIS**	**Technical Study**
The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW, 2011).	**Section 6.9**	**Appendix L**
Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.	**Section 6.9**	**Appendix L**
Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts	**Section 6.9**	**Appendix L**

Requirement	Location in Environmental Assessment	
are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.		
Transport for NSW		
Relevant Policies and Guidelines	**Report/ EIS**	**Technical Study**
Address: ▪ NSW 2021; ▪ NSW Long Term Transport Master Plan; ▪ Sydney's Cycling Future 2013; ▪ Sydney's Walking Future 2013; ▪ Guide to Traffic Generating Development (RMS); ▪ EIS Guidelines – Road and Related Facilities (DoPI); ▪ NSW Planning Guidelines for Walking and Cycling; ▪ Mosman Local Environmental Plan 2012 car parking rates; and ▪ Austroads Guide.	**Section 6.2**	**Appendix K**
Traffic, Parking and Access	**Report/ EIS**	**Technical Study**
The EIS must include a Car Parking and Traffic Impact Assessment (CPTIA) that evaluates: ▪ Daily and peak traffic movements likely to be generated by the project during construction and operation (including during the opening period of the new exhibit) and provide details of any impacts to the road network surrounding Taronga Zoo and details of any proposed mitigation measures; ▪ Demonstrate the provision of sufficient car parking during construction and operation in accordance with the relevant guidelines/ standards and/or justification for any inconsistencies; ▪ Detail access arrangements for workers to/from the site during construction and operation, including access for emergency vehicles; and ▪ Provide details of the proposed transportation of materials to/from the site during construction including haulage routes, type of vehicles accessing the site and proposed locations for handling materials.	**Section 6.2**	**Appendix K**
Consultation	**Report/ EIS**	**Technical Study**
Consultation is to occur with: ▪ Transport for NSW ▪ Roads and Maritime Services	**Section 4.0**	**Appendix I**
Mosman Council		
General	**Report/ EIS**	**Technical Study**
The parking and traffic impacts of the development should take into account the impacts associated with the construction of the proposed exhibits. This should include the potential overlap of other construction projects being undertaken at the Zoo at the same time.	**Section 6.13**	**Appendix K**
The visual impact assessment of the development should take into account views from Sydney Harbour as well as other vantage points on land including Curraghbeena Point and Cremorne Point.	**Section 6.4.3**	**Appendix D**
The heritage impact assessment should take into account Taronga Zoo Conservation Strategy, prepared by GML, dated 2002.	**Section 6.10**	**Appendix N**
The landscape plan should clearly identify trees to be retained and removed.	**Section 6.3**	**Appendix E**
Fire and Rescue NSW		
General	**Report/ EIS**	**Technical Study**
Include an assessment on the emergency planning and management measures required to facilitate an emergency services response and other obligations imposed by Clause 43 of the Work Health and Safety Regulation 2000. In particular,	**Section 3.9** **Section 6.4**	-

Requirement	Location in Environmental Assessment	
the frequency of emergency planning exercises involving FRNSW and any procedures developed pursuant to meeting those regulations.		

5.0 Strategic and Statutory Context

5.1 Strategic Planning

The relevant state and local strategic planning documents applying to the Proposal are:

- NSW State Plan 2021;
- NSW Making It Happen – Premier's Priorities;
- NSW Biosecurity Strategy 2013-2021;
- NSW Heritage Manual;
- A Plan for Growing Sydney 2014;
- Draft North District Plan 2016;
- Zoo 2000 'The View to the Future' – Master Plan; and
- Taronga Zoo Centenary Master Plan 2015.

The Proposal's consistency with these strategies is discussed below.

5.1.1 NSW State Plan 2021

The NSW State Plan 2021 (released in 2011) is the overarching strategic document for policy in the State with regards to the economy, infrastructure development, housing, transport, health, community services and education. One of the five key strategies is to improve the performance of the NSW economy, with a priority of increasing NSW tourism. The proposal responds to this by providing new facilities at Taronga Zoo to enhance tourism offerings in NSW for the international and domestic market.

5.1.2 NSW Making It Happen – Premier's Priorities

The NSW Making It Happen Plan is the 2015 revision of the NSW 2021 Plan as discussed above. This revised plan sets more targeted, specific goals and priorities for the State. The Priorities include key areas of focus such as, transport, health, education, environment, police and justice, infrastructure, economy and accountability. One of the key Priorities is to improve the performance of the NSW economy, with a priority action being to accelerate major project assessment. The proposal aligns with this and other priorities of the State, by contributing to the growth of the NSW economy via enhanced tourism offerings at Taronga Zoo, providing for the international and domestic market.

5.1.3 NSW Biosecurity Strategy 2013-2021

The NSW Biosecurity Strategy outlines the overall direction for the management of animal and plant pests, diseases and weeds in the terrestrial and aquatic environments of NSW. It seeks to help achieve the priorities of the State Government outlined in the NSW State Plan 2021, and to maintain and improve the capacity of NSW to respond to, manage and control any biosecurity threats.

The Strategy focuses on biosecurity risks that impact:

- Animal and plant industries such as agriculture, aquaculture, recreational and commercial fishing, and forestry;
- Biodiversity and the natural (terrestrial and aquatic) and built environment;
- Human health;
- Lifestyle, recreation and social amenity; and
- Infrastructure and service industries including energy, water supplies and shipping.

The Strategy outlines goals and measures to be implemented to reduce and manage the risk of any biosecurity impacts to ultimately protect the environment,

economy and community. The proposed African Savannah and Congo Forest exhibits will meet the requirements of this Strategy as outlined within this SSD EIS.

5.1.4 A Plan for Growing Sydney

The NSW Government's A Plan for Growing Sydney (2014) outlines the future vision for Sydney, providing a strategy to manage the city's change and growth over the coming 15 years. The Plan responds to Sydney's needs as a growing global city, establishes broad spatial principles for land use change, and sets out a framework to facilitate growth through coordination of planning and infrastructure delivery.

The proposed African exhibits will be consistent with the various objectives of A Plan for Growing Sydney. Specifically, the exhibits will:

- Contribute to the development of Sydney as a premier visitor destination by enhancing tourist opportunities at Taronga Zoo, showcasing educational and cultural facilities;
- Enable sustainable visitor and tourism experiences on the foreshore of Sydney Harbour National Park; and
- Contribute to the protection of Sydney Harbour and its foreshore through sensitive environmental design and considered design of proposed built form.

Towards Our Greater Sydney 2056

In November 2016, the Greater Sydney Commission (GSC) released Towards Our Greater Sydney 2056, which provided a draft outline of the proposed amendments to A Plan for Growing Sydney foreshadowing the comprehensive review of the metropolitan plan in 2017.

Draft Central District Plan

Structured around the Greater Sydney Commissions (GSC) three key themes, of a 'Liveable City', a 'Sustainable City' and a 'Productive City', the draft District Plans (released for public comment in November 2016) aim to fill the gap between the metropolitan plan and Council's Local Environmental Plans giving effect to the metropolitan goals and planning priorities from A Plan for Growing Sydney by setting out priorities and actions for each of the six districts across the Sydney metropolitan area. In particular, the draft District Plans:

- Set out principles and guidance for the preparation of local environmental plans;
- Establish strategic planning criteria to assess planning proposals;
- Guide strategic land use, transport and infrastructure planning across local government areas; and
- Inform infrastructure delivery priorities.

Taronga Zoo is located within the North District. The Central District forms part of the established *Eastern City,* which includes Sydney City and the economic corridors to its north through the Macquarie Park and south through to Sydney Airport and Port Botany. The draft North District Plan outlines the following key priorities:

- Grow jobs in centres and on urban services land.
- Leverage investment in transport infrastructure.
- Optimise Northern Beaches Hospital as a catalyst for a new centre.
- Plan for demographic change.
- Create affordable and diverse housing.
- Protect the natural landscape.
- Manage natural hazards.
- Protect heritage, character and liveability.

It is considered that the Proposal is consistent with the draft District Plans priorities and actions in that it will:

- Support economic development and tourism within the Central District;
- Provide leisure, recreation and education opportunities for the wider community and visitor population; and
- Contribute to the ongoing operation of a historically significant facility.

5.1.5 Zoo 2000 'The View to the Future' – Master Plan for the process of renovation, refurbishment and redevelopment

The Taronga Zoo Master Plan 'Zoo 2000 - The View to the Future' was prepared and adopted in 2002 by the Minister for Planning. The Master Plan comprised of the following documents:

- Zoo 2000 'The View to the Future' December 1999;
- Taronga Zoo Master Plan Urban Design Principles and Visual Analysis (UDAS Guidelines) May 2001; and
- Taronga Zoo Conservation Strategy July 2002.

The proposed African Savannah and Congo Forest exhibits are consistent with the aims and objectives of these documents as outlined below.

Zoo 2000 'The View to the Future' 1999

The Taronga Zoo Master Plan 'Zoo 2000 - The View to the Future' was prepared to provide a holistic approach to future development of the Zoo and improved animal conditions and visitor experiences. The implementation strategy and future capital investments outlined under the Master Plan are now out dated and have been superseded by more recent development plans. However, the key principles of the Plan align with current development and management practices at the Zoo.

The proposal is generally consistent with the principles of the Master Plan in that it will:

- Support the desired visitor experience and sequence by maintaining key visitor circulation routes and public precincts;
- Maintain the existing zoographic precincts with the exhibit generally located within existing areas of the Zoo previously identified for African Savannah and Rainforests; and
- Provide interpretative elements and signage will be integrated with the existing landscape and will educate visitors on species conservation and habitat preservation.

Taronga Zoo Master Plan Urban Design Principles and Visual Analysis (UDAS Guidelines) 2001

The UDAS Guidelines which accompany the Master Plan seek to provide the framework to guide development within Taronga Zoo. The Proposal is generally consistent with these guidelines in that it seeks to:

- Support the ongoing operation of the site as a Zoological Park;
- Conserve significant bushland and other natural features;
- Protect the unique visual qualities of the Sydney Harbour by preserving the present view of "green vegetation from the harbour' and provide vistas over the harbour and Sydney CBD from various public spaces throughout the zoo;
- Provide well scaled and high quality built form which is compatible with the characteristics of the zoo; and

- Apply ESD principles within the development.

Taronga Zoo Conservation Strategy 2002

The *Taronga Zoo Conservation Strategy* was endorsed by the NSW Heritage Council in July 2002. The Strategy provides an integrated, multidisciplinary framework for the future management of the heritage resources at Taronga Zoo.

The proposal is generally consistent with the Conservation Strategy it that it will:

- Provide for the continued use of the site as a Zoological Park;
- Provide for the continued use of enclosures with the greatest historical significance including the giraffe enclosures;
- Retain elements of the original site and pathway design and layout;
- Preserve the unique topography and consequential movement throughout the site;
- Incorporate the natural gully/drainage swale which runs north-south through the central section of the Zoo, promoting a natural 'rainforest' ecosystem;
- Retain significant trees and remnant woodland;
- Retain significant architectural and heritage fabric throughout the site;
- Maintain significant views within and from the site including the west view across the giraffe house to the Opera House; and
- Promote the evolution of enclosure design with the exhibits improving animal conditions in accordance with best-practice.

In accordance with the Conservation Strategy a Heritage Impact Statement has been prepared for the proposal and is included at **Appendix N** and discussed further in **Section 6.10.**

5.1.6 Taronga Zoo Centenary Master Plan 2015

The Taronga Zoo Centenary Master Plan 2015 and the 2016-2020 Strategic Plan has been developed to document and communicate the Zoo's key priorities while building on the foundation of the 2001 Master Plan 'Zoo 2000 – The View to the Future' and the now superseded 2010-2015 Strategic Plan.

The Strategic Plan framework includes the Zoo's values and is supported by organisational commitments to conservation, animal welfare, guest experience, sustainability and work health and safety. In conjunction with the Strategic Plan, the Taronga Zoo Centenary Master Plan and Visitor Experience Program establishes objectives and goals to revitalise the zoo over the next 10 years. The program, announced by the NSW Government in March 2015, includes $150 million of Taronga funded and government co-funded projects to transform visit experiences and create vital animal habitats.

The African Savannah and Congo Forest exhibits are two of the proposed exhibits identified to meet the goals of the program. Other exhibits currently under development or to be developed include the Sumatran Tiger Experience, Taronga Institute of Science and Learning, Wildlife Hospital and Elephant Trail.

5.2 Legislation

The following state legislation applies to the proposed development of the Zoo:

- *Environmental Planning and Assessment Act 1979*;
- *Exhibited Animals Protection Act 1986*;
- *Protection of the Environment Operations Act 1997*;
- *Heritage Act 1977*;

- *Roads Act 1993*; and
- *Contaminated Land Management Act 1997*.

5.2.1 Environmental Planning and Assessment Act 1979

Development consent for the proposed exhibits is required under Part 4 of the EP&A Act. Pursuant to Clause 5 of Schedule 2 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) development that has a capital investment value of more than $10 million on land identified as being within Taronga Zoo is declared to be State Significant Development (SSD) for the purposes of Section 89C of the EP&A Act.

As the proposed development constitutes SSD the Minister for Planning (or delegate) will be the consent authority. An EIS that meets the requirements set out in Schedule 2 of the EP&A Regulation is required to support the State Significant Development Application (SSDA) for the development of the Zoo. This EIS satisfies this requirement.

5.2.2 Exhibited Animals Protection Act 1986

The *Exhibited Animals Protection Act 1986* (EAPA) identifies the need for approvals to be given for the Zoo to exhibit animals, with certain animals requiring specific permits. The EAPA ensures the safety and well-being of animals through the design and approval of animal enclosures.

TCSA sees animal welfare as being of paramount importance. Its enclosure designs will exceed the minimum specified standards by a considerable margin. The proposed exhibit designs seek to deliver high quality environments contributing to animal welfare.

An application to the DPI will be required to be made for approval of the proposal which seeks to construct and alter animal enclosures and facilities. The proposal will be assessed against the relevant policies and standards of the EAPA including the general standards for exhibiting animals in NSW.

5.2.7 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is a key piece of environment protection legislation administered by the Environmental Protection Authority (EPA). Taronga Zoo operates with an existing Environmental Protection Licence (EPL) (No. 1677) issued in accordance with Schedule 1 of the POEO Act (scheduled activities). The scheduled activity is 'sewerage treatment' relating to the existing Waste Water Treatment Plant located on site. The licence conditions require TCSA to monitor, provide certification of compliance with the licence, maintain monitoring and recording records and undertake annual returns. The proposal will not alter the operation of the EPL or existing licence conditions. TCSA will continue to consult with the EPA as required for the life of this licence.

5.2.8 Biosecurity Act 2015

The *Biosecurity Act 2015* assists in maintaining internationally recognised biosecurity measures and standards, facilitate faster and more targeted responses in emergency situations and support industry-led biosecurity solutions. Under the *Biosecurity Act 2015*, people carrying out relevant operations (including Taronga Zoo) have a range of obligations in terms of preventing biosecurity risks. Taronga Zoo will comply with its obligations under this Act.

5.2.9 Heritage Act 1977

There are a number of items located within the proposed exhibit areas which are listed on the TCSA s170 Heritage Register.

NSW Heritage Manual

The NSW Heritage Manual was published in 1996 as the primary reference for heritage management in NSW. Since this time, multiple amendments have occurred to the *Heritage Act 1977* and the manual replaced with new guidelines. However, much of the

information provided within the NSW Heritage Manual remains relevant and has been considered by the proposal. Refer to **Section 6.10** for further discussion.

5.2.10 Roads Act 1993

No road works are required as part of the proposal and the development is contained within the existing Taronga Zoo site.

5.2.11 Contaminated Land Management Act 1997

The site is not listed as a contaminated site under the *Contaminated Land Management Act 1997* and therefore the provisions of the Act do not apply to the proposal.

5.2.12 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* provides the legislative framework for clearing native vegetation and protecting threatened species, ecological communities and their habitats across NSW. The Act requires proponents to carry out a BAM assessment of native vegetation clearing if it exceeds certain thresholds (BOS threshold) established under the Act and draft Biodiversity Conservation Regulation 2017. Under Mosman LEP 2012 no minimum lot size applies to the site. The total site area of the zoo is approximately 21 hectares, and is therefore considered to be application minimum lot size when determining spatial thresholds. It is anticipated that the proposed tree removal and vegetation (native and non-native) associated with the development will not exceed the BOS threshold.

5.2.13 Legislation which is not applicable

Under Section 89J(1) of the EP&A Act, the approvals generally obtained through the following legislation do not apply to SSD:

- *Water Management Act 2000*;
- *Rural Fire Acts 1997*;
- *Fisheries Management Act 1994*;
- *Native Vegetation Act 2003*; and
- *National Parks and Wildlife Act 1974*.

5.3 Environmental Planning Instruments

The relevant state and local strategic planning documents applying to the Proposal are:

- *State Environmental Planning Policy (State and Regional Development) 2011*;
- *State Environmental Planning Policy (Infrastructure) 2007*;
- *State Environmental Planning Policy No. 55 – Remediation of Land*;
- *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*;
- *Sydney Harbour Catchment Regional Environmental Plan 2005*; and
- *Mosman Local Environmental Plan 2012*.

The Proposal's consistency with these strategies is discussed below.

5.3.1 State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) was adopted on 1 October 2011 and identifies State Significant Development (SSD).

Pursuant to Clause 5 of Schedule 2 of the SRD SEPP identifies that 'development that has a capital investment value of more than $10 million on land identified as being within Taronga Zoo is declared to be SSD for the purposes of Section 89C of the EP&A Act. Consequently, the new African Savannah and Congo Forest exhibits are SSD requiring assessment under Part 4 of the EP&A Act with the Minister as the consent authority.

5.3.2 State Environmental Planning Policy (Infrastructure) 2007

The aim of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) is to facilitate the effective delivery of infrastructure across the State, including providing for consultation with relevant public authorities about certain development during the assessment process.

Clause 104 and Schedule 3 of the ISEPP relates to traffic-generating development, and requires a proposal for new or expanded tourist and recreation facilities with 50 or more vehicles accessing a classified road to be referred to Roads and Maritime Services (RMS).

Taronga Zoo is an existing tourist facility with access via Bradleys Head Road, which is classified as a regional road under the *Roads Act 1993*. However, the proposed development will not result in additional parking or vehicle movements and as such does not trigger referral to the RMS.

Despite this, in their initial response to the SEARs Transport for New South Wales (TfNSW) requested ongoing consultation between TCSA and TfNSW and RMS.

5.3.3 State Environmental Planning Policy No 55 – Remediation of Land

This policy introduces state-wide planning controls for the remediation of contaminated land. It states that a consent authority must not permit development to occur on contaminated land under Clause 7 of the SEPP.

A preliminary contamination assessment was carried out for both the exhibit sites (refer to **Appendix U**). These assessments conclude that the site is not contaminated. The site is considered suitable for the continued use as an animal exhibit and no remediation is required.

5.3.4 State Environmental Planning Policy No 33 – Hazardous and Offensive Development

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP33) defines hazardous and offensive development and sets out requirements for considering an application for those development types.

The exhibits will not include the storage of substantial volumes of dangerous goods or create any offensive discharges. It is therefore not considered to be a potentially hazardous or potentially offensive. As such, it will not pose a significant risk to human health, life, property or the biophysical environment within the locality. No further assessment under SEPP33 is required.

5.3.5 Draft State Environmental Planning Policy (Vegetation) 2017

The Vegetation SEPP will apply to clearing vegetation on land in urban areas and on land in environmental zones under the *Biodiversity Conservation Act 2016*. The proposal will not result in the clearing of native vegetation above the BOS threshold. It is unlikely that the proposal would trigger the need for offset scheme, however this will be confirmed once the final SEPP and draft Biodiversity Conservation Regulation is finalised. It is also noted that any application for tree removal would be required under the SEPP, once it is gazetted.

5.3.6 Sydney Harbour Catchment Regional Environmental Plan 2005

The Sydney Harbour Catchment Regional Environmental Plan 2005 (SHREP 2005) is a deemed SEPP and applies to the Sydney Harbour, foreshores and catchment. SHREP 2005 provides planning principles to guide future development and a range of matters when considering development applications within the foreshores and waterways of Sydney Harbour, including planning controls for strategic foreshore sites.

Under SHREP 2005 the site is identified within the Foreshores and Waterways Area, listed as a "Strategic Foreshore Site". The site does not have any heritage listing under SHREP 2005. Development listed in Schedule 2 of the SHREP 2005 is required to be referred to the Foreshores and Waterways Planning and Development Advisory Committee (Foreshore Committee) prior to determination. The proposed zoological exhibits fall within the definition of a 'flora and fauna enclosure'. As such, the proposal may require referral to the Foreshore Committee.

Given the proposed 'flora and fauna enclosure' will replace existing facilities and its location, materiality and built form of proposed structures integrates with the harbour-side landscape, it is considered that the proposal will not result in significant visual, scenic or environmental impact on Sydney Harbour. A visual impact assessment has been undertaken for the project and is discussed at **Section 6.4.3** below. Any potential adverse impact to the visual quality of the site will be minimised and mitigated where possible. This will ensure that the proposed works are recessive in nature and maintains the sensitive amenity of the foreshore locality. Ongoing management and mitigation of potential construction impacts will be addressed as part of the EIS.

Furthermore, Clause 41 states development consent must not be granted for development identified as a strategic foreshore site, unless a master plan for the site has been prepared and consideration has been given to the plan by the consent authority. Taronga Zoo has an approved master plan, 'Zoo 2000 – The View to the Future' and the more recent Taronga Zoo Centenary Master Plan. These outline the ongoing redevelopment and refurbishment of the zoo site which includes the African Savannah and Congo Forest exhibits.

It is considered that the proposal is consistent with the requirements of SHSREP 2005.

Sydney Harbour Foreshores and Waterways Area Development Control Plan 2005

The Sydney Harbour Foreshores and Waterways Area Development Control Plan 2005 (DCP 2005) supports SREP 2005 through the provision of performance based criteria and guidelines. The relevant provisions of the DCP 2005 relating to ecology, landscape qualities and land based development have been considered throughout the proposals development. It is considered the proposal is consistent with the provisions of DCP 2005 in that it seeks to:

- Protect and enhance significant vegetation;
- Minimise impacts associated with soil erosion, water siltation and pollution;
- Protects a land use that is compatible with the harbour setting;
- Protects significant views to and from the zoo;
- Design built form to not visually impact on the foreshore setting;
- Utilise appropriate building materials and colours which complement the natural bushland settings; and
- Not impede on Sydney Harbour foreshore including public access.

5.3.7 Mosman Local Environmental Plan 2012

The *Mosman Local Environmental Plan 2012* (MLEP 2012) is the primary local environmental planning instrument applying to the site. The proposal is consistent with the relevant objectives of MLEP 2012 in that it will:

- Enhance an existing recreational and tourist facility;
- Protect and enhance the natural, visual, environmental and heritage qualities of the scenic areas of Mosman and Sydney Harbour;
- Contribute to the bushland character of the site by protecting significant vegetation and providing considered landscaping throughout the exhibits; and
- Maintain existing views from public streets and residential properties towards Sydney Harbour.

Key planning controls are discussed below.

Zoning and Permissibility

The site is zoned 'SP1 Special Activities – Zoological Gardens' under MLEP 2012. The objectives of the SP1 Special Activities zone are:

- To provide for special land uses that are not provided for in other zones.
- To provide for sites with special natural characteristics that are not provided for in other zones.
- To facilitate development that is in keeping with the special characteristics of the site or its existing or intended special use, and that minimises any adverse impacts on surrounding land.

The proposed African Savannah and Congo Forest exhibits are consistent with the zone objectives in that they:

- Will replace existing animal exhibits, thus keeping with the existing special use of the site;
- Will integrate with the natural bushland, heritage items and significant trees and landscape features of the site and its harbour-side location; and
- Will provide an immersive visitor experience enabling a unique opportunity for animal interaction whilst improving exhibit conditions and animal welfare.

The only uses permitted on the site with development consent is for the purpose shown on the Land Zoning Map including any development that is ordinarily incidental or ancillary to development for that purpose. The African Savannah and Congo Forest exhibits are permissible with consent.

Heritage

Taronga Zoo site contains several locally listed heritage items under the MLEP 2012, identified as Item I34 being the "Rainforest Aviary", "Elephant House", "bus shelter and office", "floral clock" and "upper and lower entrance gates". None of these items are located in or directly adjacent to the proposed development.

Taronga Zoo contains a number of archaeological items listed in MLEP 2012 including item A494 "Sites of Curlew and Mia Mia Camps" at Sirius Cove Road on Bushland between Little Sirius Cove and Whiting Beach. This item is situated on Lot 22 DP 843294 but is located outside of the Zoo's perimeter fence line.

Additional heritage items listed in MLEP 2012 which are located within the Taronga Zoo site include:

- Item A482 "Former Athol Wharf Tram Terminus, including escarpment and retaining walls" on Athol Wharf Road and is described as "Road Reserve adjacent to Taronga Zoo Ferry Wharf"; and
- Item A483 "Site of first wharf serving Taronga Zoo'' on Athol Wharf Road and is described as the Taronga Zoo Ferry Wharf.

However, none of these items are located in or directly adjacent to the proposed exhibits site.

Development Standards

Under the MLEP 2012 there are no building height or floor space ratio controls applying to the site.

The site is identified as a "Scenic Protection Area" under Clause 6.4 of MLEP 2012. The objectives of this clause are:

a) to recognise and protect the natural and visual environment of Mosman and Sydney Harbour;

b) to reinforce the dominance of landscape over built form; and

c) to ensure development on land to which this clause applies is located and designed to minimise its visual impact on those environments.

Clause 6.4 identifies development consent must not be granted to any development unless the consent authority is satisfied that:

a) measures will be taken, including in relation to the location and design of the proposed development, to minimise the visual impact of the development to and from Sydney Harbour, and

b) the development will maintain the existing natural landscape and landform.

The proposal maintains the visual connection between Taronga Zoo and Sydney Harbour without becoming overly dominant. The structures have been designed to a scale that with integrate with the existing natural landscape. Additionally, natural landform features have been used in the design of the exhibits.

Additionally, Clause 6.4 and Clause 5.9 of the MLEP 2012 require consideration of the preservation and protection of existing natural landscape and landforms, as well as the clearing of vegetation to make way for the new exhibits. The proposal includes the removal of various trees to accommodate the new exhibit buildings, pathways, fencing and other structures. An Arboricultural Impact Assessment has been prepared by Earthscape Horticultural Services and is included at **Appendix H**. A Landscape Report has been prepared GDA and is included at **Appendix E**. These documents assess the impact of the proposed tree removal and highlight tree protection, and vegetation replacement measures.

6.0 Environmental Assessment

This section of the report assesses and responds to the environmental impacts of the proposed DA, in response to the matters for consideration outlined within the SEARs (refer to **Section1.6**).

This chapter addresses the following matters:

- Noise;
- Traffic, parking and access;
- Vegetation and biodiversity;
- Bushfire management;
- Landscape character and visual impact;
- Stormwater and waste water management;
- Ecologically sustainable development (ESD);
- BCA and accessibility;
- Aboriginal heritage and archaeology;
- European heritage and archaeology;
- Contamination;
- Waste management;
- Construction management; and
- Operational management.

6.1 Noise

An Acoustic Report has been prepared by Acoustic Studio and is included at **Appendix J**. The report provides an acoustic assessment for the construction and operation of the proposed exhibits. The findings of the report are summarised below.

6.1.1 Existing Conditions

To determine the ambient and background noise levels affecting the site and the nearest sensitive receivers, noise monitoring was carried out at the site and its surroundings in April and May 2015 and April and May 2017. The noise monitoring periods met the NSW Industrial Noise Policy requirements.

Monitoring locations P1 and P2 – situated at the closest boundary of the residential properties on Whiting Beach Road (2015) and Rickard Road (2017) – are considered to be representative of the noise conditions at the neighbouring residential buildings (nearest sensitive receivers) which are located to the north of the zoo boundary, approximately 80 metres from the African Savannah exhibit.

The existing ambient noise levels at the sensitive receiver locations are outlined in **Table 7** with **Figure 15** indicating the noise monitoring locations. Importantly, the April-May 2017 unattended noise measurements demonstrate that background noise has not increased over the past two years.

Table 7 – Existing ambient noise levels at sensitive receiver locations

Monitoring Location	Represented Receivers	Time Period	Noise Levels (dBA)	
			RBL	L_{Aeq}
P1 (2015)	Residential Properties Whiting Beach Road	Day (7.00am-6.00pm)	41	53
		Evening (6.00pm-10.00pm)	40	48
		Night (10.00pm-7.00am)	37	47
P2 (2017)	Residential Properties Rickard Road	Day (7.00am-6.00pm)	41	56
		Evening (6.00pm-10.00pm)	38	45
		Night (10.00pm-7.00am)	37	49

Source: Acoustic Studio

Other nearby sensitive receivers considered as part of this general assessment include:

- Taronga Food Market (Receiver C1) – considered indicative of a commercial receiver within the zoo; and
- General Zoo Walkways (Receiver A1) – considered indicative of patron noise experience.

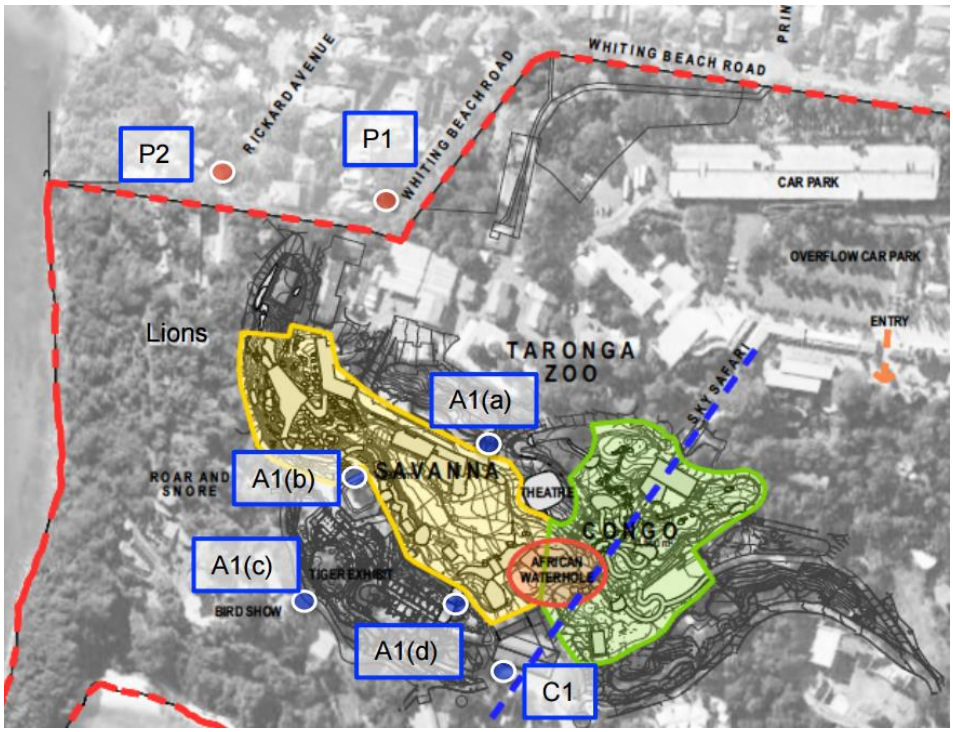


Figure 15 – Location of noise monitoring
Source: Acoustic Studio

6.1.2 Noise Criteria

Multiple standards and guidelines have been used to provide the framework for establishing operational and construction noise criteria and assessing impacts from the various noise sources associated with the development. These include:

- NSW *Industrial Noise Policy* (INP) (2000);
- Office of Liquor Gaming and Racing (OLGR) "Sound Advice, Reducing the Risk of Noise Disturbance" (2009);
- NSW EPA *Road Noise Policy (*2011);
- *Interim Construction Noise Guidelines* (2009); and
- *Assessing Vibration – a Technical Guideline* (2006).

The identified sources of noise emissions are:

- Construction machinery;
- Traffic movements internally and externally to the zoo;
- Mechanical plant;
- Zoo patrons and staff; and
- Animal noise, particularly lions roaring at night.

The INP outlines the framework for establishing noise criteria and assessing impacts from industrial noise sources. The INP applies to fixed facilities, commercial premises and individual industrial sources such as heating, ventilating and air-conditioning (HVAC) equipment. Under the INP, there are two noise criteria to be satisfied – intrusiveness or amenity.

Intrusiveness Criteria
The residential *intrusiveness* criterion aims to control short duration noise impacts and is based on the existing Background Noise Level (RBL). The criterion requires that that the L_{Aeq} noise level, from the development when measured over 15 minutes, does not exceed the Rating Background Noise Level (RBL) by more than 5 dBA.

Amenity Criteria
The *amenity* criterion aims to maintain noise amenity for a particular land use. It defines recommended noise levels, called Acceptable Noise Levels (ANL), for different neighbourhood types. For example, the suburban residential ANLs are:

- Day time (7am to 6pm): 40 dBL_{Aeq} (11hrs)
- Evening (6pm to 10pm): 45 dBL_{Aeq} (4hrs)
- Night time (10pm to 7am): 40 dBL_{Aeq} (9hrs)

There is no particular guidance for managing plant noise for patrons, staff and animals in the zoo. A 55dBL_{Aeq} criterion for plant noise emissions to walkways, outdoor public and staff areas, and animal enclosures has been adopted for the project, which is consistent with the acceptable suburban noise level under the INP. A suburban area is defined as '*an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:*

- *decreasing noise levels in the evening period (1800–2200); and/or*
- *evening ambient noise levels defined by the natural environment and infrequent human activity'.*

Sleep Disturbance
Sleep Disturbance is considered to occur when noise events of short duration but high intensity happen, without significantly affecting $L_{Aeq, 15min}$ noise levels. The World Health Organisation (WHO) "Guidelines for Community Noise" 1999 suggest external noise levels of 55dBL_{Aeq} will result in negligible sleep disturbance effects. A Sleep Disturbance criterion of – Event L_{Amax} or $L_{A1,1minute}$ > Night time RBL (background noise level) + 15 dB is recommended.

The proposed African Savannah and Congo Exhibit will not operate during night time hours (10pm – 7am) and with the zoo generally closing to patrons before 5:30pm; it is considered that Sleep Disturbance does not require assessment. The only plant which may operate 24 hours a day produces a steady noise which will have to meet INP Intrusiveness and Amenity criteria at residential receivers, and would therefore be at least 10dB below the applicable Sleep Disturbance Screening Levels.

The NSW INP is not strictly applicable to zoo activities, in particular animal noise sources. There is no criterion applying to lion noise however a potential sleep disturbance noise source is lions roaring at night. Based on the above criteria the sleep disturbance screening level at the nearest residential receivers at Rickard Avenue and Whiting Beach Road is 52dB(A).

From past experience with existing audio-visual displays and construction activities at the zoo, TCSA has advised that a Sleep Disturbance assessment is not specifically required for the zoo animals. A detailed animal disturbance assessment will be conducted based on observations during operation.

Project Specific Noise Criteria

Based on the measured noise levels outlined in **Section 6.1.1** and in accordance with the above standards and guidelines, the environmental noise criteria for all noise sources from the African Savannah and Congo exhibits, as they apply at the most-affected residential receiver boundaries, is shown in **Table 8.**

Table 8 – Summary of project noise criteria (overall levels) at nearest residential receivers

Period	Mechanical plant, cleaning and maintenance		Patrons/ sound system	Lions
	Amenity $L_{eq\ (period)}$, dBA ≤ ANL	Intrusiveness $L_{eq\ (15\text{-}minute)}$, dBA ≤ RBL + 5dB	OLGR $L_{10\ (15minute)}$, dBA ≤ RBL+ 5dB	Sleep Disturbance $L_{1\ (1min)}$, dBA ≤ RBL+ 15dB
Day (7am-6pm)	55 (nearest receiver) 55 (zoo outdoor areas)	46	46	n/a
Evening (6pm-10pm)	45 (nearest receiver) 55 (zoo outdoor areas)	43	43	n/a
Night (10pm-7am)	40	42	42 (n/a)	Sleep Disturbance 52 Sleep Awakening 65

Source: Acoustic Studio

Construction Noise Criteria

The NSW EPAs Interim Construction Noise Guidelines (ICNG) recommends noise management levels (NMLs) to reduce the impact of noise arising from construction activities. The ICNG defines standard construction hours during which the construction Noise Management Level (NML, $L_{Aeq,\ (15min)}$) is 10dB above the applicable period background noise level.

The ICNG further defines “Highly Affected” levels for daytime works, above which point there may be a strong community reaction against the noise. Outside of recommended standard hours (evening 6pm-10pm: night 10pm-7am) noise affected levels are equal to 10dB below the day time Highly Affected Level and 5dB below the Sleep Disturbance level, respectively.

Table 9 – Construction noise criteria overall levels, ($L_{Aeq,\ 15min}$) at nearest residential receivers

Period	Monday – Friday	Saturday	Sunday / Public Holiday	Highly Affected Level
Day: Standard construction hours	51 (7am-6pm)	51 (8am-1pm)	-	75
Day: Out of hours	-	44 (1pm-6pm)	45 (7am-6pm)	75
Evening (6pm-10pm)	44	43	42	65
Night (10pm-7am)	43	42	42	52

Source: Acoustic Studio

The ICNG recommends a 70dB$L_{Aeq,\ (15min)}$ external construction NML for commercial premises external to construction sites. The Taronga Food Market is considered a commercial receiver, as such this NML applies. Internal noise levels are referred to in AS2107:2016, with ICNG internal airborne NMLs set 5dB above those levels. An

internal construction NML for the food court has been set at 55dBL$_{Aeq, (15min)}$. Pedestrian pathways have also been allocated a construction NML of 60-65dBL$_{Aeq, (15min)}$.

The ICNG recommends ground-borne NMLs at residences affected by nearby construction activities. Ground borne noise levels have been identified to protect the amenity and sleep of nearby residents (**Table 10**).

Table 10 – Residential construction noise criteria for ground-borne noise

Time of Day	Noise Management Level $L_{eq(15min)}$
Evening (6pm-10pm)	40 dB(A) - Internal
Night (10pm-7am)	35 dB(A) – Internal

Source: Acoustic Studio

Vibration Criteria

Typically the applicable vibration criteria for cosmetic damage to historic or heritage structures are taken from German Standard DIN 4150: Part 3-1999 *Structural Vibration Part 3: Effects of Vibration on Structures*. A short-term vibration velocity limit of 3mm/a (<10Hz) and 3-8mm/s (10-50Hz) is typically applied to historic or heritage buildings. It is recommended this standard be adopted for heritage or historic structures within the Zoo. This should be the limiting criterion on site, and meeting this criterion will ensure that commercial vibration criteria are also met.

The DEC guideline "*Assessing Vibration: a technical guideline, 2006*" provides suitable criteria that can be applied to the assessment of vibration and human comfort. There is no direct reference for allowable vibration levels for zoo exhibits and back of house areas. As such, reference to criteria for human exposure to continuous, impulsive and intermittent vibration is recommended. **Appendix J** details further the appropriate criteria.

6.1.3 Potential Impacts

Construction Noise Impacts

The assessment identifies impacts where multiple noise generating activities are being undertaken simultaneously across the site. Construction activities will generally occur during the proposed work hours outlined below:

- Between 7:00am and 6:00pm, Monday to Friday.
- Between 7:00am and 1:00pm, Saturdays (7am to 8am is outside standard construction hours; works will only take place during this hour if inaudible at affected residential receivers).
- No work or deliveries on Sunday and/or public holidays.

The proposed works will be undertaken over four stages (to be confirmed as part of construction documentation preparation):

- Stage 1 – site preparation
- Stage 2 – demolition, excavation and rock breaking, tipping fill, piling
- Stage 3 – construction of new exhibits
- Stage 4 – landscaping.

Noise will be generated through the use of heavy equipment and machinery, including:

- Dump Truck;
- Front end/ Wheeled Loader;
- Piler (bored, impact sheet, vibratory);
- Rock Breaker;
- Excavator;

- Jack Hammer;
- Hammer/ percussive drill; and
- Compactor.

These items of plant all have varying sound power and sound pressure levels which contribute to noise emissions. All the predicted levels presented below are for the nearest work sites. This is a large site and the predicted levels at the receivers will vary with distance. As a guide, the distance attenuation as works are conducted farther from the receivers is approximately 6dB with every 10m from the site. Some works will be conducted over 200m distant from the sensitive receivers.

Table 11 and **Table 12** below identify the maximum range of predicted noise levels without and with proposed mitigation measures, respectively. This is based on the use of anticipated plant (as identified above) throughout the construction stages. Any exceedances of the project specific NMLs have been identified. Appropriate mitigation measures will be designed and implemented where necessary to address any adverse impacts. **Appendix J** further outlines potential sources of perceptible vibration. Vibration levels associated with plant typically depend on the material being worked on.

Table 11 – Predicted construction noise levels at representative receivers, for indicative construction stages and activities without noise mitigation

Construction Stage	Highest Predicted Level at Receivers – without noise mitigation ($dBL_{Aeq, (15min)}$)				NML ($dBL_{Aeq, (15min)}$)	Maximum Exceedance
	Stage 1 Site Preparation	Stage 2 Demolition Excavation	Stage 3 Construction	Stage 4 Landscaping		
Residential	44-60	48-84	49-59	49-60	51	+33
Zoo Markets	48-85	57-109	52-84	52-89	55	+54
Zoo Walkway	56-85	65-109	60-84	60-89	60-65	+49

Source: Acoustic Studio

Table 12 – Predicted construction noise levels at representative receivers, for indicative construction stages and activities with noise mitigation

Construction Stage	Highest Predicted Level at Receivers – with noise mitigation ($dBL_{Aeq, (15min)}$)				NML ($dBL_{Aeq, (15min)}$)	Maximum Exceedance
	Stage 1 Site Preparation	Stage 2 Demolition Excavation	Stage 3 Construction	Stage 4 Landscaping		
Residential	29-54	38-58	39-49	39-50	51	+7
Zoo Markets	38-79	47-83	42-74	42-79	55	+28
Zoo Walkway	46-79	55-83	50-74	50-79	60-65	+23

Source: Acoustic Studio

As shown in **Table 12** above, the implementation of mitigation measures reduces the maximum noise level exceedance and as such reduces potential impacts. It is noted that NML exceedances during stage 1 are unlikely to be significant given the exceedance is only marginal (3dBA) and would only occur when preparation works are being undertaken in locations throughout the construction area. Exceedances for stage 2 are noted to be up to 7dBA above the NML. However, these works will only occur for a portion of the overall construction programme.

It is considered that it is highly unlikely that structure-borne noise will be audible above airborne noise for commercial receivers within the Zoo site. There is considered no risk of structure-borne noise at the nearest residential receivers due to the distance attenuation through ground between the works location and receiving buildings.

Construction Vibration Impacts

Vibration levels are difficult to predict without detailed material and structural information which affects the vibration at source (related to the material being worked on), and the vibration transmission through the receiving structure. Once detailed design progresses, construction methodology including vibration monitoring for high vibration activities such as excavating will be determined. Assessment of whether levels are expected to exceed applicable criteria at heritage or historically significant structures will then be undertaken. It is noted that the ICNG imposes a 5dB penalty for sources associated with high vibration levels. Construction methods and other mitigation measures will be adopted to ensure that vibration criteria are met.

Operational Noise Impacts

The noise impacts have been predicted at the most sensitive boundary positions, considering distance attenuation, building and ground reflections, directivity and, where applicable, shielding by the zoo buildings / structures. There will be varying levels of noise emission from the exhibits. An assessment of the expected emissions against the above criteria is provided below.

Mechanical Plant Noise

Detailed design of the mechanical plant has not yet been completed and as such detailed assessment has not been carried out. It is understood that most plant will operate during visitor hours. Fridges, freezers and server room air-conditioning units will operate 24 hours a day.

In the absence of preliminary plant noise data or locations, the assessment concludes:

- The most restrictive criteria for the plant is 55dB(A) on open walkways and outdoor spaces nearest any mechanical inlet, outlet or outdoor unit. The nearest residential receiver is over 80m distant, with topographical screening. Achieving the 55dB(A) criterion within the zoo premises will ensure compliance with the relevant criteria at all other receivers.
- Attenuation and / or internally-lined ductwork may be required for fans to meet the both internal and environmental noise criteria.
- Noise emissions from the external plant may be controlled via a combination of:
  - locating the units as far from transient or occupied areas as possible;
  - with natural screening provided by existing zoo buildings, structure and
  - topography; and
  - additional localised acoustic screening as required.

The above will be incorporated into the mitigation measures for the operation of the project to ensure compliance with the required noise criteria.

Patron and Sound System Noise

Noise generated within and around the exhibits may include patron noise, public address systems and educational audio experiences. Based on the assumptions (worst-case scenario) outlined in the Acoustic Report **(Appendix J**). **Table 13** indicates the proposals compliance with the project criteria for the day period (7am-6pm) identified above. It is expected that all scenarios will comply with all criteria at the receiver boundaries at all times.

Table 13 – Predicted patron noise levels and allowable sound system noise levels to meet project specific MNLs

Noise Source	Location/ Condition	Direct Sound Level, L_{10} dB(A)	Max. Predicted at Receiver, L_{10} dB(A)	MNL, L_{10} dB(A)	Complies?
Patron Noise Levels (L_{10})	Outdoor, 100 people, raised voices	83	34	39	**Yes**
	Walkway, 60 people, moderate voices	73	27	39	**Yes**
Sound System Noise Levels (L_{10})	African Savannah (West)	85	35	39	**Yes**
	Congo (East)	90	37	39	**Yes**

Source: Acoustic Studio

While the sound system levels provided above would meet environmental noise targets at residential receivers, further consideration of noise impacts on zoo staff, patrons and animals will be required during detailed design.

Lion Noise

As mentioned above, roaring lions have the potential to cause sleep disturbance. A literature review of lions' roar noise levels indicates that the sound level at 1m may be up to 110-113dB(A).

Noise measurements of five lion roaring events at Perth Zoo on 3 October 2016 indicated that a single lion's roar may be as loud as 71dB(A) but would more typically be 58-61dB(A) at the nearest receiver window. This is above the 52dB(A) Sleep Disturbance Screening Level. The highest predicted level from a lion's roar outside a window is 6-11dB(A) above the Sleep Awakening Level. Noise measurements from Perth Zoo indicate noise levels below the Sleep Awakening Level.

The lion noise has also been assessed against night time INP criteria, as a guide for the assessment of noise impact; lion noise is not considered to be "industrial" type noise. If the lions roar twice an hour, which is the maximum observed in wild populations by Grinnell & McComb[1], the overall night-time noise generated by the lions at the nearest residential receiver would be 39dB$_{LAeq\ (9hour,\ Night)}$ or 42dB$_{LAeq(15min)}$. These levels comply with the INP Amenity Level (40dB$_{LAeq\ (9hour,\ Night)}$) and the Intrusiveness Level (42dB$_{LAeq\ (15min,\ Night)}$). It is noted that these calculations assume that lions roar as loud as possible each time, which appears to be unlikely based on the far lower levels indicated during at Perth Zoo.

It is noted that the lions will be kept indoors during the night. A full enclosure should achieve an overall noise reduction of 20dB which would allow the night-time sleep disturbance criterion to be met even for the loudest lion roar. For lions in outdoor areas, a reduction of 18dB is not achievable through screening. Although the lions will be kept overnight in their enclosures, they are released early in the morning and this may occur prior to 7am, i.e. during the standard definition of night time hours. The recommendations to reduce environmental noise levels from lions roaring in outdoor areas include:

- Install weather-proof sound absorptive screening on walls and structures facing the outdoor lion areas. Examples are 100mm thick rockwool behind wire mesh;
- Install solid walls or fences to act as sound barriers. The aim is to improve the sound attenuation through shielding to 10-15dB at mid- to high-frequencies, and 5-10dB at low frequencies; and

[1] *Roaring and social communication in African lions: the limitations imposed by listeners, J Grinnell & K McComb, Animal Behaviour 2001, 62, 93-98; Roaring and Numerical Assessment in contests between groups of female lions, Panthera leo, K McComb, C Packer, Anne Pusey, Animal Behaviour 1994, 47, p379-387.*

- Partial enclosures, with solid walls facing the Zoo boundaries and solid (e.g. colourbond) canopies may assist with keeping noise from outdoor areas from propagating toward residential areas.

The period from 6am-7am is considered to be a 'shoulder' period for the zoo, when a variety of animal management and operation activities are undertaken. This period results in higher background noise levels from these activities, with the general increase in these background levels likely to reduce the perceived impact of any lion roars during this timeframe.

Traffic Noise Levels

The proposal is not expected to result in a long-term increase of patron or staff numbers at the zoo. However, it is expected that during the first few weeks following the opening of the new exhibits, visitation to the zoo is likely to increase by up to 10 per cent before settling down to normal visitation numbers (refer to **Section 6.2** below). This translates to 25 to 30 additional vehicles per hour, resulting in a noise level increase of 0.4 dB $L_{Aeq(1hr)}$ which is unnoticeable.

6.1.4 Mitigation Measures

The safeguards and management measures that would be implemented to address the potential noise and vibration impacts are outlined in **Table 14** below.

Table 14 – Noise and vibration safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
The potential for exceedance of the NMLs across the proposal footprint	Prepare a construction noise and vibration management plan (CNVMP). It would be a sub-plan of the CEMP. As a minimum, the plan would: ▪ Map the sensitive receiver locations including residential properties ▪ Specific strategies for reducing construction noise including: – Quieter plant and equipment – Quieter work methods – Strategically locating equipment and plant, waste deposits, vehicle entries – Maximising shielding in the form of existing structures or temporary barriers – Respite periods – Specify the avoidance of activities that would generate impulsive noise ▪ Provide information for consultation, notification and complaints handling ▪ Ensure any potentially impacted receivers are informed ahead of any planned works taking place outside of the recommended standard hours for construction works ▪ Provide information about work scheduling ▪ Include safeguards and management measures to manage out of hours working if required ▪ Include an assessment to determine potential risk for activities likely to affect receivers, including for activities undertaken during and outside of standard working hours ▪ Include a process for assessing the performance of the implemented safeguards and management measures ▪ Specify the equipment restrictions that would be implemented at night if night	Construction contractor	Pre-construction

Impact	Environmental Safeguard	Responsibility	Timing
	works required ▪ Undertake noise monitoring and reporting throughout the construction period. *Note: The CNVMP would be routinely updated in response to any changes in noise and vibration. Tool box talks would be used to communicate constructor obligations and responsibilities under the plan.*		
The potential for exceedance of the NMLs across the proposal footprint	▪ Selection of equipment and plant to minimise impacts. ▪ Where possible, reduce the number of noise sources/activities running simultaneously at the same location. ▪ Screen or enclose plant and equipment. ▪ Plan truck access routes and times to minimise impacts. If truck routes are well managed it is considered that compliance at residential receivers can be achieved. ▪ Vehicle pathways around the site should be arranged to minimise the need for reversing. Where reversing is necessary, the contractor should consider whether non-tonal reversing alarms are an acceptable safety alternative to tonal "beeper" alarms. ▪ For zoo receivers, use local enclosures around generator, hammer and hand tools when within 30-40m of animal receivers. ▪ Consider quieter methods and scheduling least sensitive times for cutting/ breaking rock or masonry, compacting and for collecting and removing waste. ▪ Consider quieter methods for compacting and tipping fill. ▪ If generators are required for the site set-up, petrol generators should be used instead of diesel. ▪ The piling method needs to be selected to minimise both noise and vibration impacts and therefore bored or screw type piling methods should be implemented.	Taronga Zoo/ Construction contractors	Detailed design/ Construction
Construction noise impacts	Working hours are to be restricted in accordance with the EPA Interim Construction Noise Guideline. Working hours are to be in accordance with: ▪ Between 7.00am and 6.00pm, Monday to Friday. ▪ Between 7.00am and 1.00pm Saturdays. ▪ No work or deliveries on Sunday and/or public holidays. If work is required to be undertaken outside normal work hours, the Contractor will need approval from the Principal. The Contractor is to provide enough information for the Principal to evaluate any potential noise impact from the proposed works.	Construction contractor	Construction
Construction noise impacts	Community and business notification would be done prior to works commencing outlining the nature of the works, work hours and contact number. Additional community and business notification would be done at least five days before works outside standard hours that has a potential to cause any noise impact.	Construction contractor / Taronga Zoo	Pre-construction/ construction
Construction noise impacts	Any required night time work predicted to	Construction	Construction

Impact	Environmental Safeguard	Responsibility	Timing
	exceed the noise management level should aim to not affect residences for more than two consecutive nights or where possible, more than six nights over a one month period.	contractor / Taronga Zoo	
Construction vibration impacts	▪ Undertake a preliminary vibration assessment. ▪ Undertake a dilapidation survey up to 50m from the work site prior to high vibration works. ▪ Undertake vibration monitoring inside the Zoo.	Construction contractor/ Taronga Zoo	Pre-construction/ construction
Night time sleep disturbance from roaring lions.	Detailed design of lion dens and back-of-house areas should include appropriate sound absorptive materials, solid walls and/ or fences to act as sound barriers.	Taronga Zoo	Pre-construction
Night time sleep disturbance from roaring lions.	An appropriate operational management plan will be introduced for lion care including noise compliance monitoring.	Taronga Zoo	Operation

6.2 Traffic, Parking and Access

A Traffic Impact Assessment has been prepared by GTA Consultants and is included at **Appendix K**. The report provides an assessment of the traffic and transport implications of the proposed development. A summary of the assessment and proposed mitigation measures are provided below.

6.2.1 Existing Environment

Vehicle Access

The site is afforded access via Bradleys Head Road to the east (on which the main entry to the Zoo is located), which functions as a local collector road. Bradleys Head Road runs in a north-south direction along the eastern boundary of the site, and is a two-way road, with three lanes for traffic movement inclusive of a right turn lane into the Zoo's multi-storey car park and bus and taxi drop-off zone. Ticketed parking is provided on the eastern side of the road. Bradleys Head Road turns into Athol Wharf Road at the southern boundary of the Zoo, before accessing the Taronga Zoo Wharf at the south-western corner of the site.

Whiting Beach Road, situated to the north of the Zoo site is a local road that runs in an east-west direction. Whiting Beach Road provides service vehicle and back-of-house access to the general site. Unrestricted parking is provided on the northern side of the road.

Car Parking

Car parking for patrons of the Zoo is provided within the established multi-storey car park at the northern end of the Zoo site and the adjacent overflow area. Details of capacity are outlined in **Table 15.** The multi-storey car park uses an electronic ticketing system for access. It is noted that the overflow parking area is only made available once the multistorey parking area reaches its capacity.

Table 15 – Car park capacity

Location	General spaces	Accessible spaces	Motorcycle space	Total
Multi-storey	639	14	12	665
Overflow	176	5	-	181*
Total	**815**	**19**	**12**	**846**

Source: GTA Consultants

*This figure includes 50 overflow parking spaces currently occupied by temporary TCSA office buildings. This overflow parking will be re-established upon completion of the Taronga Institute of Science and Learning (TISL). The interim loss of overflow parking is offset by the provision of 55 spaces for contractor parking at the rear of the site.

Traffic Generation

An estimate of traffic generation has been calculated using the numbers of vehicles entering and exiting the multi-storey car park. Traffic data recorded at the site in the first two weeks of January 2017 indicates that:

- Weekday peak hour traffic generation of the zoo was 290 vehicles per hour, which occurred at 10am to 11am.
- Weekend peak hour traffic generation was 358 vehicles per hour, which occurred at 10am to 11am.
- The majority of vehicles entered the car park between 9am and 12pm.
- Profile of vehicles exiting the car park was more spread out i.e. between 1pm and 6pm.
- During the traffic network peak hour, the zoo generates in average of 20 vehicles (between 8am to 9am) and 100 vehicles (between 5pm to 6pm).
- Average daily traffic generation is approximately 1,550 and 1,910 vehicles during the weekdays and weekends, respectively.

Public Transport

The site is generally well serviced by public transport, with the 238 and 247 bus routes utilising the Zoos on-site bus stop area, and the 228 bus route using an on-street bus stop located 100m north of the Zoo along Bradleys Head Road. The F2 ferry service provides direct access across Sydney Harbour to the Taronga Zoo ferry wharf located to the south of the Zoo. TCSA actively encourages the use of public transport as the primary mode of travel to and from the zoo.

Pedestrian and Cycling Connectivity

There is pedestrian connectivity to the Zoo provided by formal footpaths on either side of Bradleys Head Road which provides access to the Mosman centre to the north. A safe pedestrian crossing point is provided across Bradleys Head Road, at the main entrance. An on-road marked bicycle route is also provided along Bradleys Head Road. This route provides good connectivity to on/off street cycle routes within the area.

6.2.2 Potential Impacts

The proposal will redevelop and consolidate existing zoo exhibits and as such is unlikely to result in a long-term intensification of existing zoo visitation numbers. However, it is acknowledged that during the first few weeks following the opening of the new exhibits, visitation to the zoo is likely to increase by up to 10 per cent before settling down to normal visitation numbers.

Car Parking Requirements

Taronga Zoo currently provides a total of 834 car parking and 12 motorcycle spaces in its multistorey and overflow parking areas. The results of the parking analysis (refer above) indicate that the 85th percentile peak parking occupancy was 618 spaces with minimum of 216 available car parking spaces. The number of days which the parking demand exceeded the capacity was in average of 5.6 days over a one year period.

In the weeks following the opening of the new exhibits, an increase in parking demand of approximately 10 per cent is expected to accommodate increased visitation numbers. This percentage is based on previous operational experiences of the zoo. Applying the 10 percent visitation surge to the 85th percentile demand of 618 spaces equates to an additional parking demand of approximately 62 spaces. Based on the availability of 216 spaces, this temporary surge can be easily accommodated within the existing multistorey car park.

It is noted that the zoo is conscious of the potential impacts associated with the opening of new exhibits. The zoo will undertake a ‘soft’ opening during non-peak periods to assist the animal adjust to the new exhibits and human interaction. This soft

opening will also allow the zoo to better manage any such surge in visitation and keep this period outside the peak school holiday periods.

Following opening the proposed exhibits are not expected to generate long-term parking demand. This is due to the fact that the majority of the animal that will inhabit the proposed exhibits are already present within the zoo. As such, the effect of any 'new' appeal is anticipated to be low.

Based on the above, the current parking supply is considered to be appropriate for the proposed development and additional parking is not required.

Operational Traffic Impacts

Whilst it is considered that the proposed exhibits will not result in a long-term increase to zoo visitation numbers or generate additional traffic, a short-term increase of up to 10 per cent may be experienced in the weeks following the exhibits opening.

As outlined above the daily traffic generation of the zoo is approximately 1,550 and 1,910 vehicles during the weekdays and weekends, respectively. Therefore, the temporary increase in daily traffic flows during the opening periods is expected to be up to about 160 to 190 additional vehicles per day.

The average peak hour traffic generation of the zoo is approximately 250 and 310 vehicles during the weekdays and weekends, respectively. The temporary increase in traffic generation is then expected to be some 25 to 30 additional vehicles per hour, being equivalent to one additional vehicle every two minutes.

Similarly, the average traffic generated by the zoo during the road network peak period is approximately 210 and 160 vehicles per hour during the morning and afternoon commuter peak hours, respectively. The temporary increase in peak hour traffic flows after the opening period is expected to be up to some 21 vehicles during the road network peak hour. This is equivalent to only one additional vehicle every three minutes. Additionally, it is noted that the traffic accessing the zoo would tend to be contra-flow to local peak hour movements focused inbound (AM) and outbound (PM) to Sydney CBD.

Based on the above, it is considered that the local traffic conditions near the site will not be adversely affected by the proposal and as such mitigation measures are not considered to be necessary.

Construction Traffic Impacts

Construction of the proposed exhibits will be undertaken over two stages. It is proposed that construction works will be carried out between the following hours:

- Mondays to Fridays: 7am to 6pm
- Saturdays: 7am to 1pm if inaudible on adjoining premises, otherwise 8am to 1pm.

No construction vehicle access is to be permitted on public holidays.

The construction vehicles would access the site via:

- Whiting Beach Road via the Taronga Zoo staff car park (to be used during work hours); and
- Bradleys Head Road (to be used outside of zoo operating hours).

No queuing of trucks would be permitted on public roads. Truck arrivals would be coordinated to ensure incoming trucks will not be required to wait for a truck space to be available on-site. All construction vehicles will be subject to Taronga Zoo's vehicle policy when operating within the grounds to ensure safety to staff and visitors. The vehicle policy is outlined in Section 6.4 of **Appendix K.**

Expected Cumulative Traffic and Parking Demands

It is acknowledged that the construction of the proposed exhibits will occur alongside the construction and operation of other Taronga Zoo redevelopment projects.

The zoo's peak operating periods on Saturdays are between 11am and 3pm. Construction activities are typically carried out from 7am to 1pm on Saturdays with peak vehicle movements generally occurring an hour before construction activities start at 7am as well as an hour after construction activities ends at 1pm, as workers enter and leave the site. As such, the report assesses the overlap between the zoo's peak operation and the Saturday construction peak periods, i.e. between 1pm and 2pm to determine the cumulative impact of construction. **Table 16** below outlines the expected cumulative traffic generation and parking demand during the peak period.

Table 16 – Saturday peak (1pm-2pm) traffic generation and parking demand

Project		Construction		Operation	
		Workers (Cars) [1]	Trucks	Staff [2]	Visitor
African Savannah	Traffic	Up to +6 vph	Up to +2 vph	No additional staff or parking demand	Up to +35 vph and up to 35 parking spaces required for the initial weeks of opening only, before returning to existing demand
	Parking	Up to 12 required	No parking demand		
Congo Forest	Traffic	Up to +6 vph	Up to +2 vph		
	Parking	Up to 12 required	No parking demand		
Sumatran Tiger	Traffic	Up to +5 vph	Up to +2 vph	No additional staff	Up to +30 vph
	Parking	Up to 12 required	No parking demand	No parking demand	Up to 30 required
TISL	Traffic	Up to +25 vph	Up to +2 vph	Up to +5 vph	Up to +2 vph [3]
	Parking	Up to 25 required	No parking demand	Up to 5 more occupied	Not applicable (coach parking)
Retreat	Traffic	Up to +25 vph	Up to +2 vph	Guest check in starts from 2pm therefore no/minimal overlap	
	Parking	Up to 25 required	No parking demand	Up to 9 parking spaces, accommodated within the staff car park	Up to 62 parking spaces. Parking demand expected to occur outside of peak period (1pm-2pm) therefore minimal impact/ overlap

[1] Construction workers are assumed with a vehicle occupancy rate of 2:1

[2] Staff volumes are included in 'Visitor' volumes for the African Savannah, Congo, Sumatran Tiger and Retreat projects

[3] TISL (Taronga Institute of Science and Learning) is only opened for school students and only comprised of arrivals/departures by coaches

[4] Construction traffic volumes have been estimated by the Zoo based on observations of existing condition

Source: GTA Consultants

Based on the above, the following observations can be made:

- The peak operational traffic occurs between 10am and 11am, and as such does not coincide with the peak construction period which is envisaged to occur between 1pm-2pm.
- Peak construction traffic (1pm-2pm), including an overlap with zoo operations will generate peak traffic flows of 322vph (i.e. existing 230vph plus 92vph cumulative traffic).
- This peak construction traffic generation is lower than the peak traffic generation of general operations of the zoo (10am-11am) being 388vph. As such, it is considered that the site and adjacent roads can accommodate the peak cumulative construction traffic from the site of 92vph.

- The extensive parking survey revealed an 85th percentile spare capacity of 216 spaces. The peak overlapping parking demand during construction, which totals 92 spaces, can be accommodated within the existing car parking capacity.

6.2.3 Mitigation Measures

Operational Traffic Management

Traffic levels during operation of the new exhibits are not anticipated to adversely impact on the surrounding road network, with no expected long-term increases in traffic volumes from the proposal.

Construction Traffic Impacts

A construction traffic management plan will be prepared to deal with impacts from construction vehicles on the road network. Whilst the findings presented above indicate that that additional construction traffic and parking demand can be accommodated within the site and surrounding roads, management of car park usage and in particular on-street parking is recommended.

Table 17 – Traffic, parking and access mitigation measures

Impact	Environmental Safeguard	Responsibility	Timing
Construction traffic impacts	A construction traffic management plan (CTMP) would be prepared as a sub-plan of the CEMP. As a minimum, the plan would include the following controls: ▪ Minimise use of heavy vehicles on local roads. ▪ Restrict deliveries to outside of peak traffic periods where possible. ▪ Ensure emergency vehicle access is maintained, including consultation with ▪ Emergency services. ▪ Identify haulage routes and minimise impacts on local routes. ▪ Provide warning and advisory signage. ▪ Providing safe access points to work areas from the adjacent road network. ▪ Safety barriers where necessary. ▪ Maintaining adequate sight distance. ▪ Displaying prominent warning signage. ▪ Covering truck loads. ▪ Avoiding vehicle idling. ▪ Deliveries planned to minimise the number of trucks arriving at site at one time. ▪ Materials delivered and spoil removed from the site during standard construction hours. ▪ Use of Traffic Controllers to ensure safe vehicle and pedestrian movements for example when trucks enter or leave the site. ▪ A Driver Code of Conduct plan. ▪ Provide for local community consultation and notification of local road network and traffic impacts.	Construction contractor	Pre-construction/ Construction
Management of on-street parking demand	The following initiatives are encouraged: ▪ Promote the avoidance of on street parking with Taronga Zoo employees and contractors. ▪ Promote the use of public transport.		

6.3 Vegetation and Biodiversity

A Biodiversity Impact Assessment has been prepared by Narla Consulting and is included at **Appendix F**. The purpose of the report is to assess any potential impacts associated with the proposed development on terrestrial ecology (biodiversity), particularly threatened species, populations and communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) and recommend appropriate measures to mitigate any potential impacts. The assessment has been informed by a literature review and site assessment undertaken over three days in May 2017.

The SEARs for the proposal require that the EIS addresses the statutory provisions applying to the site contained in all relevant environmental planning instruments (EPI's). Of these, the only two that relate directly to biodiversity protection on the subject site are:

- *Sydney Regional Environmental Plan (Sydney Harbour Catchment 2005)*; and
- *Mosman Local Environmental Plan 2012.*

The SEARS provide no request for any formal biodiversity assessment to be undertaken, outside what would be typically be required for any development pursuant to the above listed EPI's. The area of vegetation containing the development will not be impacted as only select trees and shrubs are likely to be removed and these will be replaced elsewhere within the subject site. Owing to the small size of the area of native vegetation present within the subject site, the small size of the proposed impact to native vegetation (selected tree removal only), and the lack of request for the project to be assessed pursuant to the Framework for Biodiversity Assessment (FBA), the decision was made to assess the impacts of the proposal on all potentially occurring TSC Act listed threatened species through implementation of an Assessment of Significance (7-Part Test) pursuant to section 5A of the EP&A Act (**Appendix F**).

Additionally, an Arboricultural Report has been prepared by Earthscape Horticultural Services and is included at **Appendix H**. The purpose of the report is to assess the potential impact of the proposal on the subject trees, and provide recommendations for amendments to the design, construction methodology or tree protection measures.

The findings and recommendations of the assessments are summarised below.

6.3.1 Existing Environment

Flora

Taronga Zoo was officially opened on the site in 1916. The zoo contains several unique structures demonstrating past and present zoological practices. Historically, the vegetation of the area originally consisted of open forest and woodland typical of Hawkesbury Sandstone areas. Most of this vegetation has since been cleared for urban development. Remaining 'bushland' areas within the zoo are fragmented and have been disturbed by current and former exhibits, pedestrian access, weed infestation and infill planting.

The zoo is located within an area nominated as an 'existing cosmopolitan habitat' as defined on Mosman Council's *Biodiversity Corridor and Habitat Link Ma*p which forms part of the *Mosman Open Space and Infrastructure Development Control Plan 2012* (MOSIDCP 2012). None of the subject trees are listed on Council's 'Urban Forest Management Register'.

For the purpose of assessment, the site has been divided into two portions, these being:

- The Western extent (Lion exhibit) – approximately 1,938m^2; and
- The Eastern extent (remaining exhibits) – approximately 35, 423m^2.

Sydney Metropolitan Vegetation Information System (VIS) Mapping (OEH 2013) designated vegetation within the western extent of the subject site as '*S_DSF06:*

Coastal Sandstone Foreshores Forest' (approximately 0.19ha). Vegetation throughout the remainder of the subject site is designated as '*Weeds and Exotics*' (approximately 3.54ha). Within the approximately 0.19ha site, a total of 18 positive diagnostic species were identified.

The dominant locally-indigenous tree species formerly occurring in the area include Sydney Red Gum, Red Bloodwood and Scribbly Gum. Other species occurring in this association include Grey Gum, White Stringybark and Port Jackson Fig. Locally-indigenous species, representative of the original vegetation of the area would be of benefit to native wildlife. Within the western extent of the site, remnant Eucalypt canopy with a mesic understorey was identified. Throughout the remainder of the site, vegetation is comprised of mature, planted landscaping trees, comprising both locally-indigenous species and ornamental exotic species (refer to **Figure 16**).

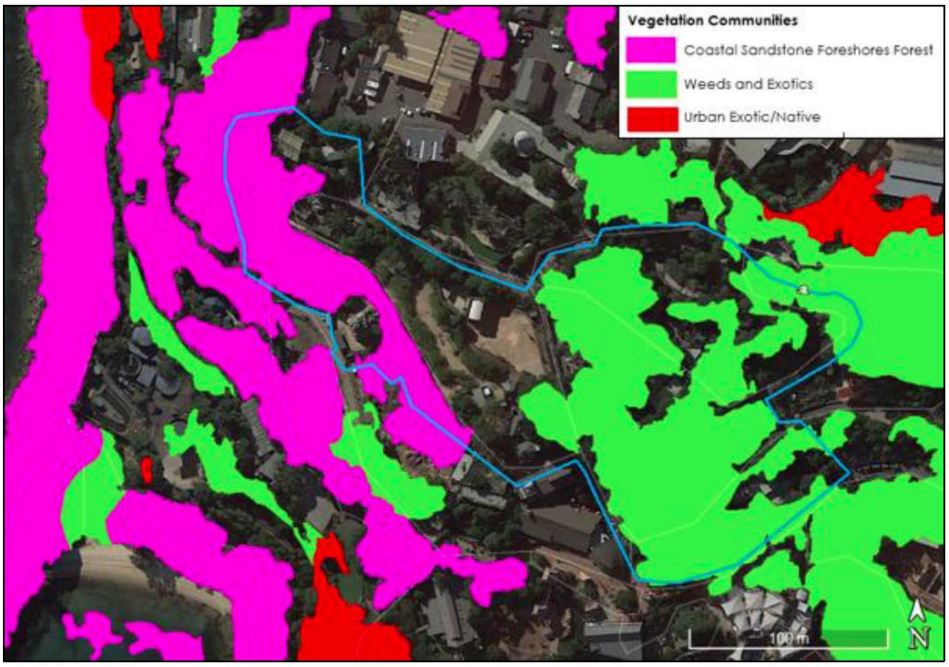


Figure 16 – Mapped vegetation
Source: OEH 2013

A single Narrow-leaved Black Peppermint (*Eucalyptus nicholii*), a vulnerable species under the TSC Act and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), was identified within the north-west of the site. This does not rule out the potential for some threatened species to still exist on the subject site in a state of dormancy (e.g. terrestrial orchids which may be present on site following suitable rainfall and warmer temperatures). Assessments of Significance (7-part tests and MNES) were conducted on all potentially occurring species.

A total of 12 noxious weeds were identified within the site, with 11 being listed as 'Class 4 (locally Controlled) Noxious Weeds' under the *NSW Noxious Weeds Act 1993* (NW Act). The assessment recommends ongoing management of these species.

Taronga Zoo maintains a NSW State Agency Heritage Conservation Register, as required under Section 170 of the Heritage Act 1977 (Refer to **Section 6.10** for further discussion). The Register contains a number of trees listed having heritage significance. Details of all heritage listed trees are provided within the Arboricultural Report (**Appendix H**) and Heritage Impact Assessment (**Appendix N**).

Fauna

Fauna Species

A total of 36 wild fauna species were encountered on the subject site during site assessment. Of these 29 fauna species encountered were listed as 'protected' under

the *NSW National Parks and Wildlife Act 1974*. Two (2) species encountered were listed as Vulnerable under the TSC Act (NSW). One (1) of these was also listed vulnerable under the EPBC Act. Two (2) exotic bird species, common in the area, were also encountered during survey.

Fauna encountered during the site assessment included:

- Sensitive insectivorous birds such as the Spotted Pardalote (*Pardalotus punctatus*), Eastern Whipbird (*Psophodes olivaceus*) and White-browed Scrubwren (*Sericornis frontalis*);
- Mammals, including the long-nosed Bandicoot (*Perameles nasuta*), Short-beaked Echidna (*Tachyglossus aculeatus*, Brushtail Possum (*Trichosurus vulpecula*), Common Ringtail Possum (*Pseudocheirus peregrinus*), Grey-headed Flying Foxes (*Pteropus poliocephalus*) and the Freetail Bat (*Mormopterus spp.*); and
- Reptiles including the Elegant Snake-eyed Skink (*Cryptoblepharus pulcher*) and Eastern Water Dragon (*Physignathus lesueurii*).

No frogs were recorded during the survey. This was expected, owing to the cool weather conditions.

The assessment revealed 18 threatened fauna species (including nine mammals, eight birds and one frog) had potential to utilise habitat on the subject site during part of their lifecycles. A detailed description of these species and their occurrence within the site is provided at Section 3.4.2 of the Biodiversity Impact Assessment (**Appendix F**).

Table 18 provides the total list of threatened species deemed as having potential to occur in the subject site.

Table 18 – Threatened fauna species deemed as having potential to occur within the site

Species	TSC Act	EPBC Act
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	Vulnerable	-
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	Vulnerable	-
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	Vulnerable	-
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	Vulnerable	-
Eastern Free-tailed Bat (*Mormopterus nofrolkensis*)	Vulnerable	-
Little Bent-wing Bat (*Miniopterus australis*)	Vulnerable	-
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Vulnerable	Vulnerable
Southern Myotis (Myotis macropus)	Vulnerable	-
Powerful Owl (*Ninox stenua*)	Vulnerable	-
Little Lorikeet (Glossopsitta pusilla)	Vulnerable	-
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	Vulnerable	-
Red-crowned Toadlet (*Pseudophryne australis*)	Vulnerable	-
Square-tailed Kite (*Lophoictinia isura*)	Vulnerable	-
Little Eagle (*Hieraaetus morphnoides*)	Vulnerable	-
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Vulnerable	Marine/Migratory
Swift Parrot (*Lathamus discolour*)	Endangered	Critically Endangered

Source: Narla Consulting

Fauna Habitat

The subject site provided some potential foraging, nesting and roosting habitat for a diverse suite of birds, mammals, reptiles, frogs and invertebrates. Such habitats include:

- Four prominent sandstone outcrops, which create a distinct gradient in elevation and associated ecological microhabitats;
- Sheaths of bush rock and fallen woody debris provided suitable shelter for small mammals, reptiles, tree frogs and invertebrates;

- Deep leaf litter provided shelter for invertebrates and small reptiles, as well as foraging habitat for the Long-nosed Bandicoot;
- Hollow-bearing trees provided a suite of different sized hollows that provide potential habitat for roosting microbats, tree frogs, small reptiles, small arboreal mammals;
- Artificial caves suitable for cave-roosting microbats;
- Waterbodies within animal enclosures, which may be inhabitated by wild frogs, titles and eels; and
- Abundant native and exotic fleshy fruit-bearing plants provided foraging habitat for parrots, bowerbirds, honeyeaters and pigeons throughout vegetated areas of the site.

6.3.2 Potential Impacts

Flora

Tree Removal
The proposal will result in:

- The removal of 88 trees of low and very low retention value;
- The removal of 72 trees of moderate retention value;
- The removal of 36 trees of high retention value;
- The relocation of a number of palm trees and Aloes; and
- Minor to be more significant works being undertaken within the Tree Preservation Zones (TPZs).

A detailed list of all trees included is provided within the Arboricultural Report (**Appendix H**). The location of each tree is shown within the Tree Removal and Transplant Plan (A-600) within the Landscape Plans (**Appendix E**).

A summary of the likely impacts of the proposal on each of the trees located within the site and proposed recommendations is provided within Appendix 4 of the Aboricultural Report. Specifically, the assessment concludes:

- Of the 88 trees of low and very low retention value proposed for removal none are considered significant or worthy of special measures to ensure their preservation. The removal of these trees to accommodate the proposed exhibits is considered warranted in this instance. It is also noted that a number of the trees identified are listed as Environmental Weed Species.
- The majority of the 72 trees of moderate retention value are in good health and condition and are considered to make a fair contribution to the amenity of the site. The report recommends replacement planting to compensate for the loss of amenity.
- Of the 36 trees of high retention value proposed to be removed several are listed on the s170 Register. It is likely that these trees are listed due to the uncommon use in Sydney and their association with existing exhibits. There are no feasible options that can be implemented that would permit the retention of the identified trees given the animal life sciences requirements. In order to compensate for loss of amenity, it is recommended that replacement planting be undertaken.
- The majority of the palm trees and Aloes proposed to be relocated are listed on the s170 Register, and as such should be retained. These species are capable of being transplanted with low risk of fatality provided that they are prepared and relocated in accordance with best practice (refer **Section 0** below).

- Where pruning of existing trees is required, no adverse impacts will occur if pruning is undertaken is accordance with the associated recommendations (refer **Section 0** below).
- *Syzygium paniculatum* (Magenta Cherry or Lilly Pilly) (T307a) is listed as a Vulnerable Species on Schedule 2 of the *Threatened Species Conservation Act 1995* (NSW) and a Nationally Vulnerable species under the *Environmental Protection and Biodiversity Conservation Act 1999*. Whilst this species is listed as vulnerable, it is a commonly planted ornamental tree and is not endemic to this area. As such, it does not have any ecological significance in the context of this site and its removal is warranted.
- The 'Area of Locally-Indigenous Vegetation' listed within the s170 Register, has been identified as being largely degraded with little remaining native understorey and few canopy trees. The majority of vegetation within this area consists of Sweet Pittsporum (*Pittosporum undulatum*), which is typical of the original vegetation community, however is a mesic species and becomes dominant (to the exclusion of other native plants) in the absence of periodic fires. As such, its removal is considered to be of little impact to existing biodiversity value of the site given its state.
- An existing building and associated paved areas and retaining walls are proposed to be demolished within the TPZs of a heritage Hoop Pine (T471) and Hills Fig (T472). The new structures and pavements are proposed to be constructed in a similar position to existing structures within the TPZs and will result in considerable disturbance within the TPZs. It is considered that the trees will tolerate the changes, provided all works are undertaken in accordance with the mitigation measures (refer **Section 0** below). Overall, the works will result in a reduction of hard landscaping and greater soft landscaping which will be beneficial to the trees long-term.
- The existing roadway is proposed to be widened within the TPZs of a heritage Hoop Pine (T95) and a Bullbay Magnolia (T96). Engineered fill and a fill batter will be required. The encroachment on T95 is considered within acceptable limits under AS 4970:2009, however the encroachment on T96 exceeds acceptable limits. Alternative locations were investigated, however due to site constraints this is the only location where the roadway can be located. Mitigation measures are included below to retain and manage these trees.
- A new water feature and associated rip-rap rock wall is also located within the TPZ of a heritage Hoop Pine (T95). The structures are located substantially within the footprint of an existing roadway and kerb. As such, it is considered the encroachment will be the same as the present situation and should not result in any adverse impact on this tree.
- New pavements and stairs are located within the TPZs of a Grey Gum (T97) and Bullbay Magnolia (T96). Whilst the works are largely isolated within the footprint of existing pavements, the proposed stairs and landing will require construction of a retaining wall and therefore excavations within the structural root zone (SRZ) are required. The extent and proximity of excavation and the overall encroachment is likely to result in some adverse impact on this tree. In order to minimise adverse impact, it is recommended that a post and caisson type wall (with post footings rather than a continuous strip) be constructed and all excavations for the wall footings and pavement sub-grade should be undertaken in accordance with the mitigation measures.
- A new section of road is proposed within the TPZ of a Hoop Pine (T111). The extent of the encroachment exceeds acceptable limits under AS 4970:2009, however, it is considered that this species will tolerate the level of encroachment, provided that all required excavation is undertaken in accordance with the mitigation measures (refer **Section 0** below).
- The proposed Okapi Back of House area (African Congo Forest exhibit) is located within the TPZs of a Brushbox (T500) and Fiddleleaf Fig (T501). The structure is

located beyond an existing retaining wall (which would inhibit root growth of these trees), excavations for the building foundations will not result in any actual incursion to the root zone and therefore this work will not result in any adverse impact on these trees.

- Two Fig trees (T131 and T44) are located close to proposed new pathways through the African Congo Forest exhibit. The pathways have been located as best as possible to minimise adverse impact on trees and many sections are elevated and supported on piers (forming elevated walkways) to achieve the required grades and minimise encroachments to TPZs. The excavations for the new pathways have the potential to result in some root damage to these trees, leading to an adverse impact. These impacts will be minimised through the implementation of various mitigation measures.

It is considered that no other trees other than those listed above will be adversely affected by the proposed development. TCSA have endeavoured where possible to design the new exhibits to avoid and minimise impacts on significant existing trees.

The proposed tree removal will result in the loss of minor foraging habitat for nectivorous and frugivorous fauna. It is noted that no hollow-bearing trees will be removed as a result of the proposal.

In order to compensate for the loss of amenity resulting from the removal of trees to accommodate the proposed exhibits, ecologically equivalent foraging trees and vegetation will be planted within the site. As outlined within **Section 3.0**, in response to recommendations from the project arborist, a Landscape Report (**Appendix E**) has been prepared to guide replacement planting and vegetation of the exhibits. Planting within the exhibits will occur within eleven distinct planting zones, as described in **Section 0**. The chosen planting is reflective of the habitat proposed within each zone.

Replacement planting and additional vegetation will include some locally indigenous species and native rainforest trees. These are considered most appropriate to the site conditions and the most valuable in terms of preserving the landscape character and wildlife habitat of the area. A detailed list of proposed species is provided with the Landscape Report (**Appendix E**). In total the proposal seeks to revegetate the exhibits with some 28,000 plants, including 226 trees (**Table 19**).

Additionally, it noted that the lion exhibit is located partially or fully within areas of mapped CSFF. The landscape plan notes that “vegetation will be retained and enhanced” as part of the exhibit. This will reduce potential impacts on the existing vegetation.

Fauna

The potential for significant impact upon all potentially occurring TSC Act and EPBC Act listed threatened species was assessed against under the ‘7-Part Test Assessment of Significance’ and the ‘EPBC Act Significant Guidelines’ respectively, as outlined above.

The assessment concludes that the proposal will have no significant impact such that a local viable population of a species will be placed at risk of extinction. Therefore, no SIS or EPBC Act Referral to Commonwealth are required for the proposed development.

Additionally, the following migratory fauna species listed under the EPBC Act were considered likely to occasionally use habitat within the subject site for foraging or passage:

- White-throated Needletail (*Hirundapus caudacutus*);
- Fork-tailed Swift (*Apus pacificus*);
- Satin Flycatcher (*Myiagra cyanoleuca*);
- Black-faced Monarch (*Monarcha melanopsis*); and

- Rufous Fantail (*Rhipidura rufifrons*).

The assessment concludes that the proposal will have no significant impact on these species. Therefore, an EPBC Act Referral to Commonwealth is not required.

The assessment provides several mitigation measures to further reduce the potential impact of the proposal on significant fauna species.

6.3.3 Mitigation Measures

Several mitigation measures are proposed to reduce the impacts on flora and fauna across the site.

Table 19 – Vegetation and biodiversity safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
Vegetation and Tree Removal	▪ Tree removal work shall be carried out by an experienced tree surgeon in accordance with the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998). Care shall be taken to avoid damage to other trees during the felling operation. ▪ Stumps located within the TPZs of trees to be retained shall be grubbed-out where required using a mechanical stump grinder (or by hand where less than 150mm in diameter) without damage to the root system of other trees. ▪ Where trees to be removed are within the SRZ of any trees to be retained, consideration should be given to cutting the stump close to ground level and retaining the root crown intact. ▪ Stumps within the Tree Protection Zone of other trees to be retained shall not be pulled out using excavation equipment or similar. ▪ Implement replacement planting with at a minimum the equivalent number of trees should be planted within the site. Replacement trees should preferably include some locally indigenous species. ▪ Where hollow-bearing trees are to be removal, suitable replacement hollow augmentation or next box installation will take place. ▪ A qualified Project Ecologist with experience in handling wildlife should be on site during all vegetation removal/ clearing to capture and relocate any displaced, healthy animals, or care for / rehabilitate any injured or orphaned animals.	Taronga Zoo/ Construction Contractor	Pre-construction/ Construction
Preservation of trees to be retained	Prepare and implement a Tree Protection Plan (TTP) which documents proposed tree protection devices including: ▪ Tree protection fencing; ▪ Trunk Protection; ▪ Ground Protection; ▪ A list of prohibited activities within the TPZ; and ▪ Other recommended measures to ensure the protection of TPZ of trees to be retained as part of the proposal.	Taronga Zoo/ Arborist/ Construction Contractor	Detailed design/ Pre-construction/ Construction
Removal of fauna habitat	Prior to removal of man-made structures that provide suitable roosting habitat for microbats, a pre-clearing ecological assessment should be undertaken by a suitably qualified ecologist to determine the presence or suitability of the artificial habitat for roosting microbats. An ecologist should then be on site during demolition works to capture and relocate any displaced fauna including bats	Taronga Zoo/ Ecologist	Pre-construction
Predation by Captive Fauna	Prior to construction one or more qualified Ecologists with wildlife handling experience	Taronga Zoo/ Ecologist	Pre-construction/

Impact	Environmental Safeguard	Responsibility	Timing
	should be engaged to capture and relocate any fauna from within the area of the proposed enclosure. This will include checking of all caves, crevices, tree hollows, nests, shrubs, pipelines and culverts for fauna hiding in situ. It is also advised that up to a week of targeted fauna trapping is undertaking to capture any native fauna (e.g. possums) traversing the site of the proposed enclosure. This effort should be repeated prior to the final release of any predatory fauna within a new exhibit.		Pre-operation
Targeted survey for Southern Myotis (Myotis macropus)	Detailed surveying including Harp-trapping and acoustic detection to determine the presence of this vulnerable species within the site and potential impacts.	Taronga Zoo	Pre-construction
Noxious weeds	Implement a noxious weeds management plan with bushland restoration (weed removal) strategies.	Taronga Zoo	On-going

6.4 Bushfire Management

A Bushfire Assessment has been prepared by Australian Bushfire Assessment Consultants (ABAC) and is included at **Appendix G**. The purpose of the assessment is to address bushfire risk for the proposed exhibit sites in accordance with *Planning for Bush Fire Protection 2006* and AS3959-2009 'Construction of Buildings in Bushfire-prone areas'.

It is noted that the proposal is not defined as development for a specific fire protection purpose under the provisions of Section 100B of the Rural Fires Act 1996 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*. A site inspection was carried out on 5 October 2016. The assessment findings are summarised below.

6.4.1 Existing Environment

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.

Any vegetation likely to present as a bushfire hazard to the exhibit sites is located along the western and south-western fringe of the Zoo and the foreshore of Little Sirius Cove and Whiting Beach. These areas are located downslope from the project site and existing Zoo facilities.

The nearest areas of unmanaged vegetation are to the east 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. This area of vegetation is some 200 metres from the eastern extent of the proposed Congo Forest exhibit.

The vegetation present within these areas can be classified as *rainforest* under AS3959-2009.

6.4.2 Potential Impacts

Following an assessment of the existing vegetation and the gradient of the surrounding landscape, the assessment concludes:

- Vegetation for a distance of 140m from the location of the exits is characterised as remnant vegetation and is therefore a low hazard for the purposes of A2.3 of *Planning for Bush Fire Protection 2006*.
- Any future buildings within the exhibits will be located at least 85 metres (and generally greater) from any unmanaged potential bushfire hazard vegetation

located to the west/south-west and east, however may be subject to some degree of ember attack in the event of a bushfire and as such any buildings should be constructed to meet BAL-12.5 as per AS3959-2009 to mitigate any effects arising from potential ember attack.

- The exhibits are located a sufficient distance from any large tracts of vegetation. This will ensure that significant defendable 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 firefighting 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.

As such, it is considered that the proposal is consistent with the aim and objectives of *Planning for Bush Fire Protection 2006*.

6.4.3 Mitigation Measures

The potential for an unplanned fire to occur within the exhibits, whilst unlikely, cannot be discounted entirely. The following measures are proposed to mitigate against potential fire.

Table 20 – Bushfire safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
Building design	Design and construction of any proposed buildings to comply with the construction requirements for BAL-12.5 as per *AS 3959-2009 Construction of buildings in bushfire-prone area*.	Taronga Zoo	Design/ construction
Maintenance of vegetation	Maintain access roads and tracks within the site and consider the following ongoing management of any buildings and landscaped areas: ▪ Removal of combustible material, particularly litter in gutters, near buildings. ▪ Removing excess amounts of fuel from garden areas (including organic mulch). ▪ Ensuring garden plantings do not overhang any buildings, tree canopies are discontinuous, and shrubs are not positioned within two metres of buildings.	Taronga Zoo	Operation
Bushfire Emergency Plan	Taronga Zoo operates in accordance with the TCSA Emergency Management Plan (TERP). The TERP outlines response guidelines in the event of a bushfire, including alert, evacuation and shelter procedures.	Taronga Zoo	Operation

6.5 Landscape Character and Visual Impact

A visual impact analysis has been undertaken to assess potential impacts on views to and from heritage places within the zoo, the unique visual qualities of Sydney Harbour and from Harbour vantage points as a result of the proposal.

The assessment has been informed by photomontages prepared by TZG (refer to **Appendix D**) and the Heritage Impact Assessment prepared by Geoffrey Britton Environmental Design & Heritage Consultant with Nicholas Jackson and Ashley Built Heritage (refer to **Appendix N**).

6.5.1 Existing Environment

Taronga Zoo is situated on Bradleys Head, Mosman on the northern side of Sydney Harbour. The site's southerly orientation and descending landform from north to south provides for iconic views to and from Sydney Harbour and beyond to Sydney Opera House, Sydney Harbour Bridge, Garden Island, Fort Denison, Botanic Gardens and Sydney CBD. The range of iconic views is one of the zoo's main attractions.

Views out over Sydney Harbour towards the Sydney Harbour Bridge and Sydney CBD were important to the original planning of the zoo with many iconic vistas and views resulting. Such iconic vistas and views include:

- From the main entry path over the Giraffe enclosure towards Sydney Harbour , Sydney Opera House, Sydney Harbour Bridge, Garden Island, Fort Denison, Botanic Gardens and Sydney CBD;
- From the Octagonal Shelter looking south across Sydney Harbour to Sydney Opera House; and
- From the main path along aviaries to Reptile World across the Giraffe House towards Sydney Harbour , Sydney Opera House, Sydney Harbour Bridge, Garden Island, Fort Denison, Botanic Gardens and Sydney CBD.

These view corridors contribute strongly to Taronga Zoos sense of place. The 2006 Taronga Zoo Landscape Master Plan, notes,

> *"the existing views out from the zoo site across Sydney Harbour should be retained, respected and managed to enhance the zoo's sense of place on the edge of Sydney Harbour. Views of the harbour should continue to be exploited in the development of new areas within the zoo site, maintaining the contextual relationship between the zoo and the harbour".*

The current zoo exhibits, including animal enclosures, public buildings and back of house areas are located within dense vegetation and are primarily obscured from view when viewing from Sydney Harbour. Visible structures, when viewed from Sydney Harbour and foreshore areas include:

- The Taronga Zoo Sky Safari;
- Bird Show Amphitheatre;
- Condor Exhibit;
- Seal Show;
- Taronga Food Market; and
- Taronga Concert Lawn.

Due to the existing topography of the zoo, it is noted that none of these existing buildings or structures are prominent in relation to the skyline of Bradleys Head ridgeline when viewed from the Harbour and its foreshores.

6.5.2 Potential Impacts

Views from Taronga Zoo

The proposal has been developed with respect to multiple significant views and vistas within and from the zoo. The 2006 Landscape Master Plan, 2002 Conservation Management Plan and Heritage Impact Assessment (**Appendix N**) have informed the selection of significant views from the Zoo.

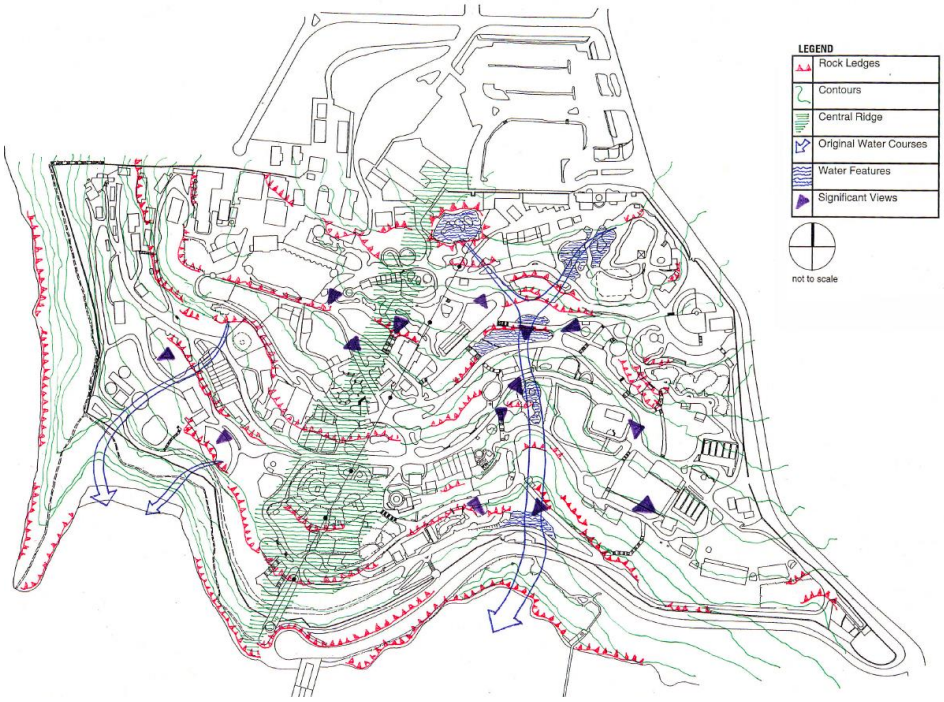


Figure 17 – Significant Heritage Views
Source: Conservation Management Plan, 2002

TZG have prepared photomontages from four key vantage points within the zoo to assess the landscape and visual impacts of the proposal (refer to **Appendix D**). These are the:

- View from Giraffe House (identified in the Conservation Management Plan as a significant heritage view - refer to **Figure 19**);
- View from the Octagonal Shelter (refer to **Figure 20**);
- View toward Tahr Mountain and the Sydney CBD beyond (**Figure 22**); and
- View from Reptile World (identified in the Conservation Management Plan as a significant heritage view – refer to **Figure 23**).

Construction

Temporary impacts on the visual landscape within and views from the zoo would occur during construction. This is due to necessary road and pathway closures, temporary construction fencing and the presence of construction equipment. This would introduce a short-term minor negative impact into the zoos landscape. These impacts will be mitigated throughout the construction period.

Operation

A key view point within the zoo is the giraffe enclosure, which combines views of the animals with views of Sydney Harbour and Sydney Harbour Bridge. The proposal seeks to remove the existing 1940s giraffe house, modify the existing 1924 giraffe house and introduce a new structure consisting of a curved timber frame roof, viewing platform and back of house facilities. As such, the proposal will modify the existing visual landscape of the zoo and views towards the Harbour over the existing Giraffe

House. As shown in **Figure 19**, the removal of part of the existing 1924 Giraffe House will increase existing views of the Sydney Harbour Bridge from the pedestrian pathway (to remain as part of the proposal). The new structure will reduce views of the trees and sky only when viewed from the existing pathway. The design of the Giraffe House, including location, extent and materiality of this structure has been considered so to reduce potential view impacts. The curved nature of the roof structure is sympathetic to the surrounding natural and built landscapes within the zoo and the dominant built form of the Sydney Harbour Bridge and Sydney Opera House across the Harbour.

The design intends to balance the need to provide new modern animal enclosures, whilst maintaining a sympathetic aesthetic to the existing heritage views of the Taronga Zoo site. It is considered these impacts are minor and are justified in that they directly result from the need to provide new modern animal enclosures.

Another key viewing experience is that from the pathway which leads you from the main arrival area at the north of the zoo down towards the Giraffe exhibit and past Reptile World and Centenary Theatre (refer to **Figure 23**). As a primary circulation pathway the viewing experience varies. No one key viewing platform or location is provided. Construction of the theatre has resulted in the expansion of the view line from the pathway allowing for wider views across the Giraffe exhibit toward CBD. Additionally, the new theatre includes a viewing platform which looks out over the African Savannah Precinct towards the CBD. As such, the visual impacts from the addition of the new Giraffe shelter are considered minor and have been offset by new viewing opportunities within the zoo.

The Octagonal Shelter is proposed to be retained and incorporated within the lion enclosure and visitor walkway. The shelter reinforces the zoos Sydney Harbour setting, being deliberately designed as a lookout point (and pedestrian pause point). However, modifications to the landscape and pathways surrounding the shelter will inevitably alter the viewing experience. The shelter is proposed to be enclosed by the lion enclosure structure resulting in the division of the existing view by the metal structure. The proposal will therefore retain the significant view albeit in a reconfigured format. As such, the proposal is considered to have a moderate impact on the views from this point.

The proposed African Waterhole precinct encompasses the head of the valley to the west of the main (central) ridge of the zoo. Its overall orientation allows various scenic view prospects across the harbour to the Sydney Opera House, CBD and Harbour Bridge. As shown in **Figure 22** the views from the existing pathway adjacent Tahr Mountain remain unchanged as a result of the proposal. Similar views are also possible within the Congo precinct where it encompasses the upper central ridge that follows the approximate line of the cable car route. The proposal seeks to maintain many of the significant views within and from this precinct. However, it is noted that pathway modifications and visitor access and movement will restrict views from certain areas (such as those resulting from the closure of Serpentine Path) and reconfigure others.

The integration of iconic views with the animal exhibits is a major attraction of the zoo, and has been retained as a key design principle. All existing views are proposed to be retained albeit in a slightly modified format. The visual impact on views from the zoo towards the Harbour is considered to be low as that all existing views will be retained to some degree, the proposed modifications are fairly minor and all key aspects of each view are retained, and in one instance improved (the view from the Reptile World pathway).

Figure 18 – Significant heritage view locations
Source: TZG/ Nearmap

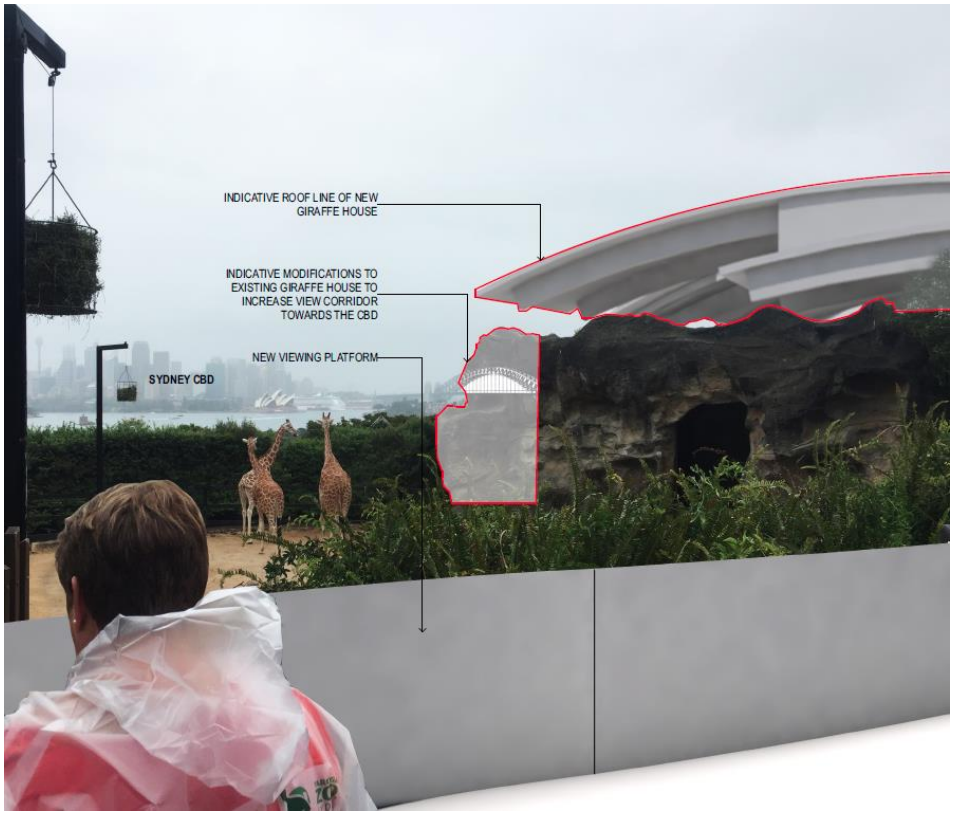


Figure 19 – Heritage view 2 from Giraffe House towards Sydney CBD
Source: TZG

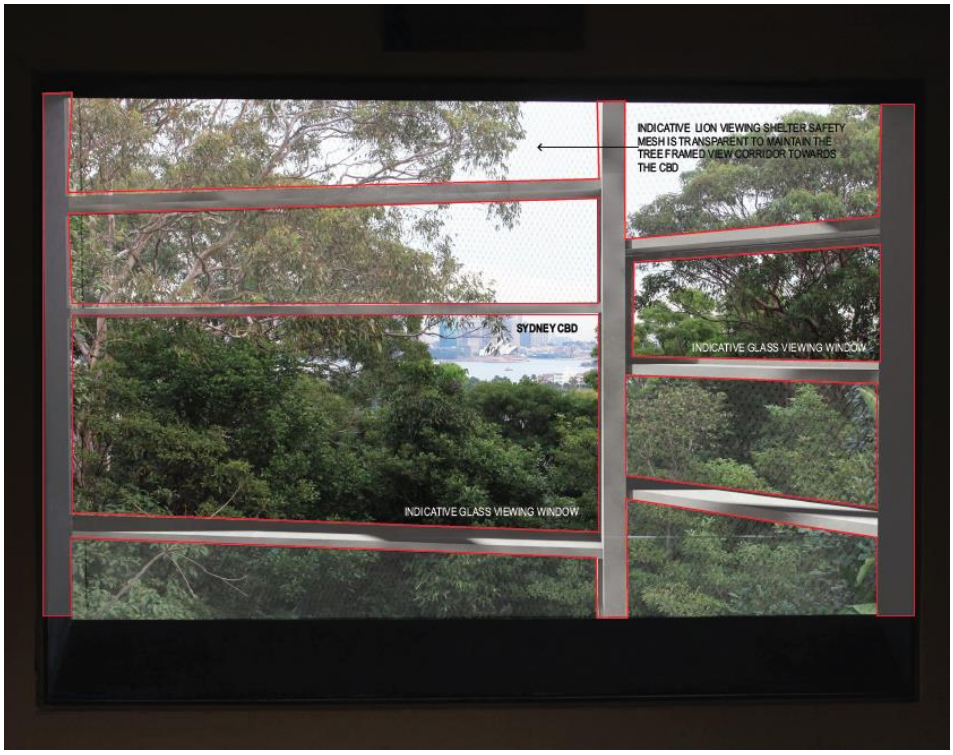


Figure 20 – Heritage view 4 from Octagonal Shelter towards Sydney CBD
Source: TZG

Figure 21 – Significant internal view locations
Source: TZG/ Nearmap

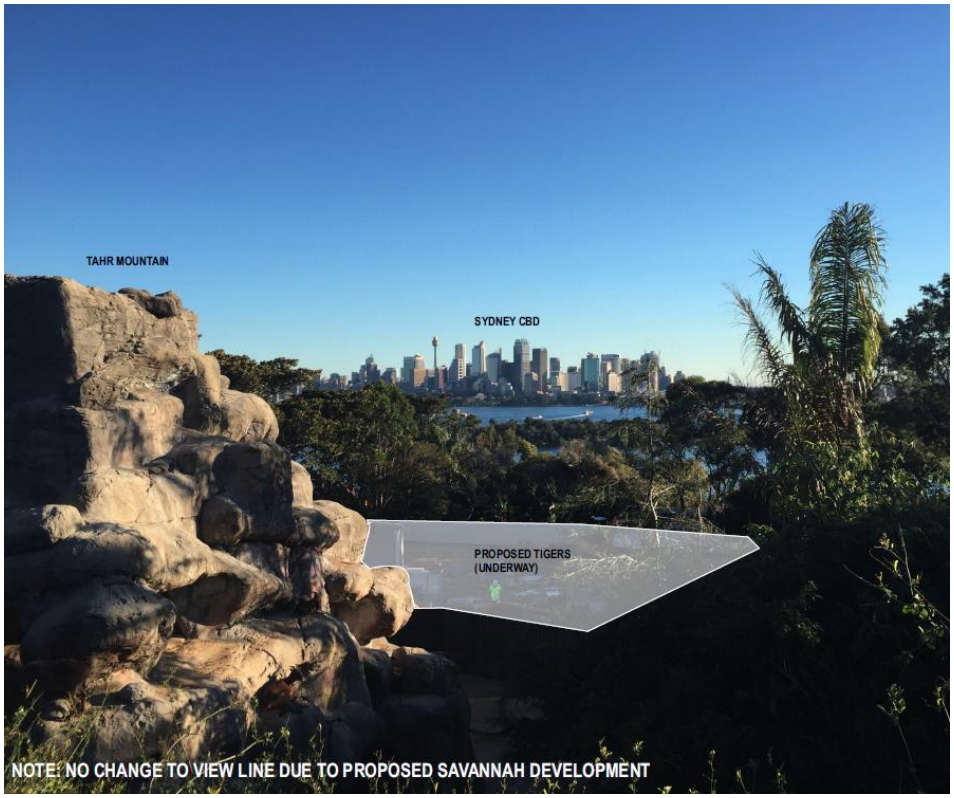


Figure 22 – Internal view 2 toward Tahr Mountain from existing pathways (to be retained)
Source: TZG

Figure 23 – Internal view 4 from existing pathway adjacent Reptile World looking toward the Giraffe House
Source: TZG

Views to Taronga Zoo

TZG have prepared photomontages from three key vantage points to assess the landscape and visual impacts of the proposal (refer to **Appendix D**). These being:

- View from Cremorne Point Lighthouse (refer to **Figure 24**);
- View from Athol Bay (refer to **Figure 25**); and
- View from Curraghbeena Point (refer to **Figure 26**).

The views represent the most comprehensive and readily accessible public view points. Consideration was given to views from private properties however access was not available.

Construction

During construction there would be a temporary impact on the visual character of the zoo when viewed from Sydney Harbour and relevant vantage points, due to the undertaking of earthwork activities and the presence of construction equipment. This would introduce a short-term minor negative impact into the landscape. These impacts will be mitigated throughout the construction period.

Operation

The proposed lions back of house, giraffe house and Congo viewing shelter will be visible from these harbour-side locations. However, the bulk and scale of these new structures are consistent with existing built form within the zoo. Additionally, the structures have been positioned so to integrate with the existing landscape and do not protrude above the ridgeline. As shown in **Figure 24**, **Figure 25** and **Figure 26**, the proposed exhibits will result in the addition of minor built form elements to the existing landscape.

To mitigate potential impacts of these visible structures, the following design decisions have been made.

- Proposed Giraffe House Roof: To minimise impact created by the visible portion of the new Giraffe House from the harbour, the roof materials have been chosen to blend in with the natural character of the foreshore. The roof will be clad in timber which is non-reflective, neutral and a natural product that complements the adjacent bushland. Any portion of the roof that is visible post-construction is therefore expected to recede from the foreground and not stand-out nor dominate the significant view corridors from the Harbour.
- Proposed Congo Shelter: The Proposed Shelter at the Congo Exhibit is visible from Athol Bay. The proposal includes a landscaped roof to assist the architectural forms to recede into the tree lined setting. Any impact from built form in this area will therefore be minimal. Considerations will be made to suitable planting that blends in with the existing landscape character. Any fences visible from the Harbour will recede due to a neutral colour and the semi-transparent nature of the perforated mesh to be installed at fencing.
- Proposed Lion Exhibit: The Lion exhibit is partially visible from Curraghbeena point however will have minimal impact on the view corridors from the Harbour. The viewing enclosure has been designed using a lightweight transparent wire mesh as animal containment, which recedes into the existing bushland when viewed from the Harbour. Where the Lion Back of House facade is visible, a green wall will be applied to assist the new construction to blend in with its surroundings.
- The proposal seeks to redevelop existing exhibits within the zoo site. As such, the proposed lighting will be reflective of existing light sources. The location and direction of exhibit lighting (including the use of exhibit lights at night for animal welfare purposes) will be designed to ensure the proposal does not result in a negative visual impact for surrounding properties and when viewed from the harbour.

As a result of the location, scale and materiality it is considered that the proposal will result in only a minor impact on the landscape character of Bradleys Head and the Zoo and will not dominate the visual landscape of the zoo.

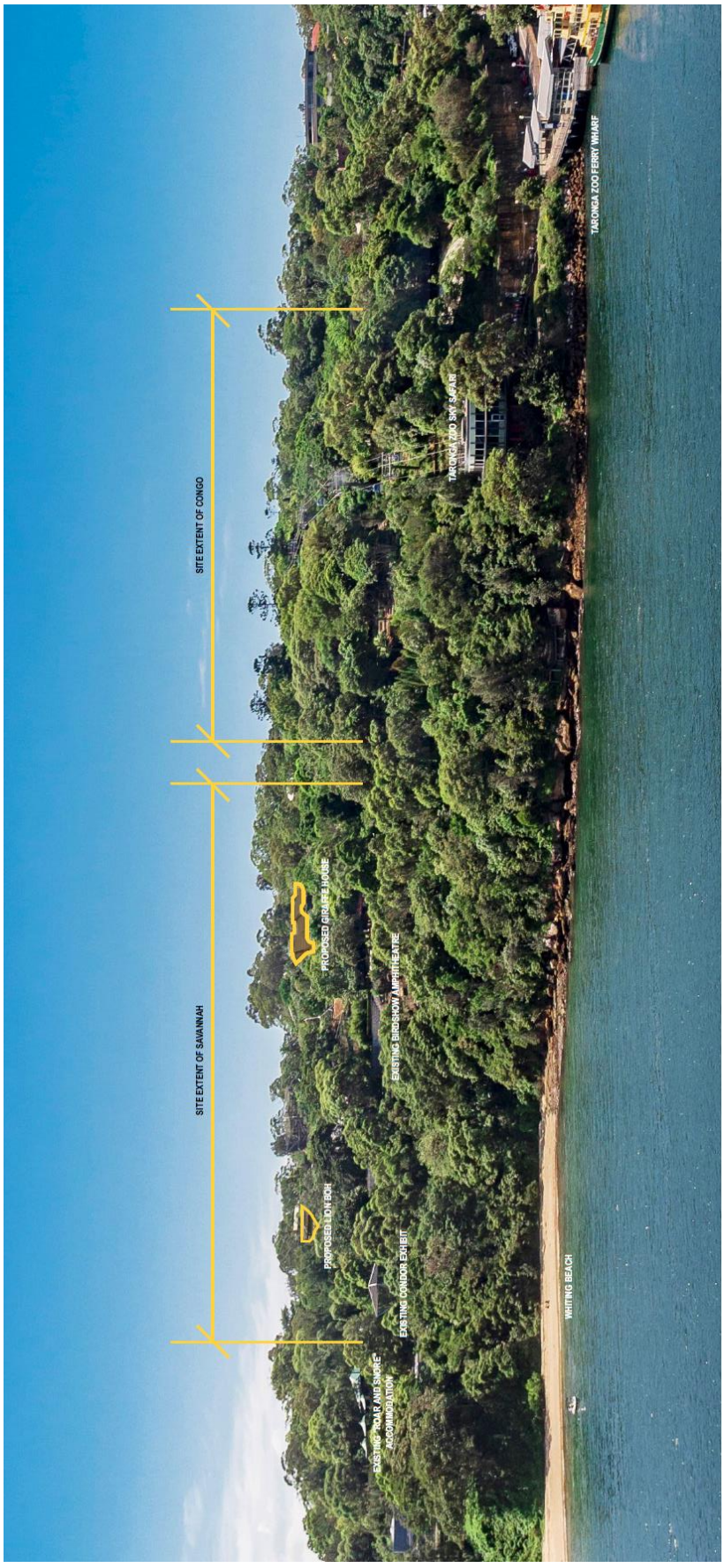


Figure 24 – View from Cremorne Point Lighthouse towards Taronga Zoo
Source: TZG

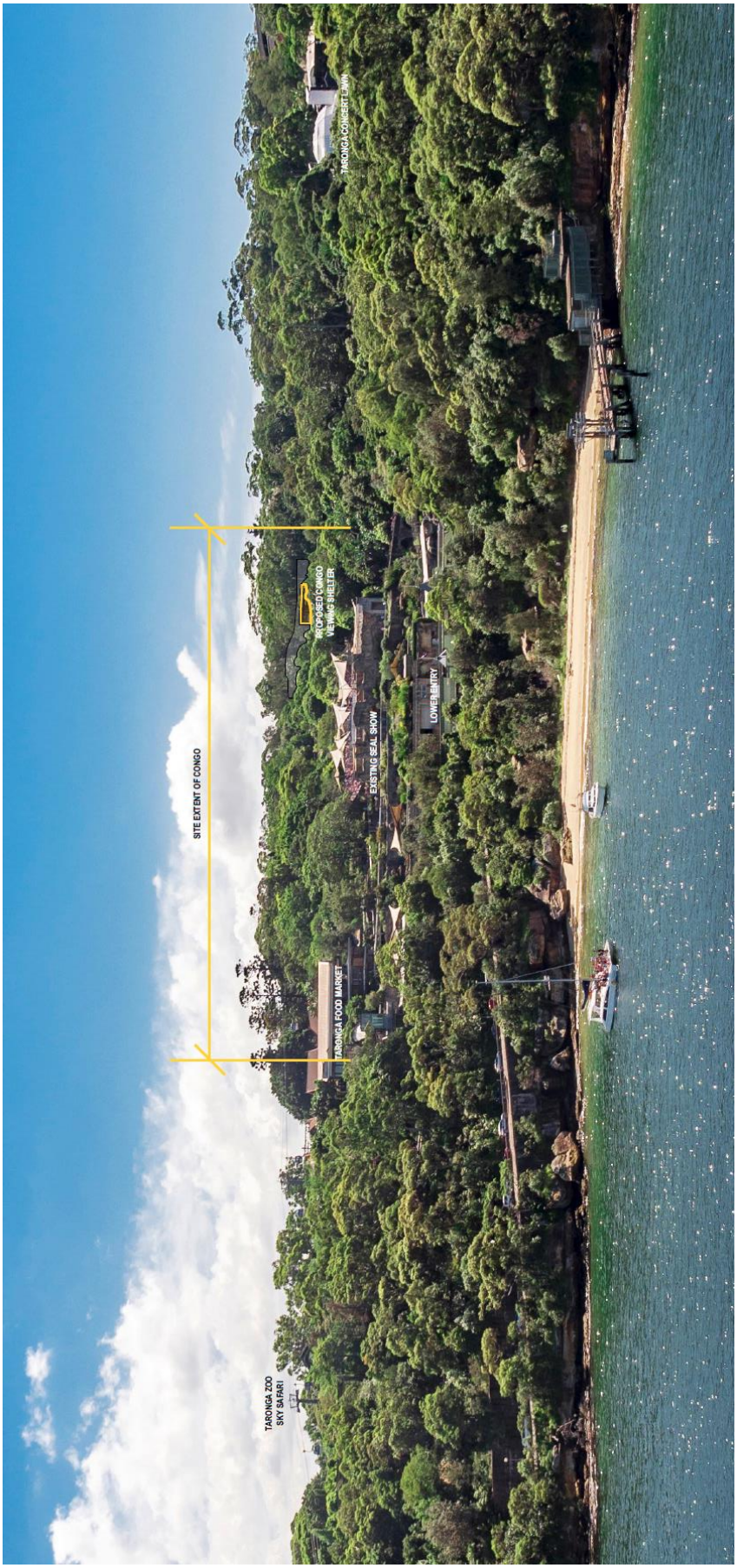


Figure 25 – View from Athol Bay towards Taronga Zoo
Source: TZG

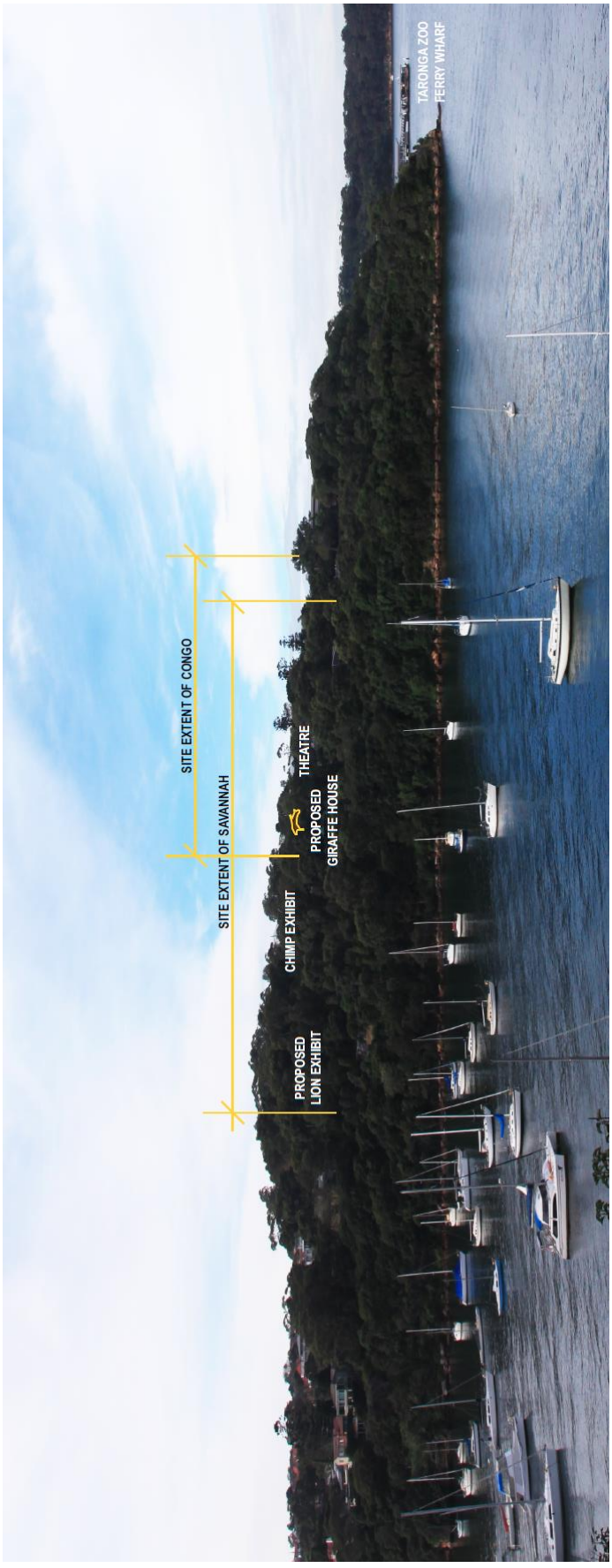


Figure 26 – View from Curraghbeena Point towards Taronga Zoo
Source: TZG

6.5.3 Mitigation Measures

Several landscape character and visual impact mitigation measures have been developed to reduce the impact of the Zoo on the surrounding aesthetics.

Table 21 – Landscape character and visual impact safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
Management of the construction works to minimise their visual impacts internally and externally to the zoo	▪ Consider non-reflective materials and equipment ▪ Consider screening methods to reduce the visual impact of the work site	Taronga Zoo/ Construction contractor	Pre-construction/ Construction
Design exhibits to prevent intrusive built form	▪ Consider non-reflective materials ▪ Location of vegetation and screening	Taronga Zoo	Detailed design/ pre-construction
Light spill impacts during construction across the proposal footprint	▪ Screen, shield and cut-off all temporary site lighting to prevent light spill where possible ▪ Use directional light sources where possible to reduce lateral light spill ▪ Use low luminescence lighting lights where feasible to reduce the lateral light spill ▪ Shield the top of all site lighting to prevent any upward light glare	Construction contractor	Construction
Operational light spill impacts on adjacent properties	▪ Follow the lighting design specification that aims to ensure any the height and direction of any lighting pole would not introduce sky glow or impacts on neighbouring residential properties or road users of the Great Western Highway ▪ Use directional lighting fixtures with cut-offs and filters as required	Construction contractor/ Taronga Zoo	Detailed design/ Pre-construction

6.6 Stormwater and Waste Water Management

6.6.1 Existing Environment

Taronga Zoo exhibits are serviced by an existing stormwater and waste water treatment system, including a Waste Water Treatment Plant. Stormwater collected from the proposed exhibits will be directed through existing drainage infrastructure to the treatment plant.

The treatment plan operates under an existing Environmental Protection Licence (No. 1677) issued by the NSW EPA (refer to **Appendix R**). This licence regulates the quantity and quality of water discharged from the site. There are five discharge points located around the foreshore of the zoo.

Discharges are not permitted to exceed the following concentration limits (**Table 20**) and volume and mass limits (**Table 21**).

Table 22 – Water and/or Land Concentration Limits

Discharge Point	Pollutant	Units of Measure	100 Percentile Concentration Limit
Point 1 and 2	BOD	Milligrams per litre	20
	pH	pH	6.5-8.5
	TSS	Milligrams per litre	50
Point 3 and 4	BOD	Milligrams per litre	15
	Entercocci	Colony forming units per 100 millilitres	40
	pH	pH	6.5-8.5
	TSS	Milligrams per litre	20

Source: EPL 1677

Table 23 – Volume and mass limits

Discharge Point	Unit of Measure	Volume/ Mass Limit
5	Kilolitres per day	2000

Source: EPL 1677

6.6.2 Potential Impacts

During construction potential sediment and erosion impacts may occur as a result of the bulk earth works proposed. These potential impacts will be managed through appropriate mitigation measures.

Due to the existing treatment facilities and EPL licence requirements, the impacts to Sydney Harbour and Little Sirius Cove from the proposal are considered negligible. Potential overflow of stormwater from the existing drainage system remains subject to stormwater treatment to remove gross pollutants before being discharged into Sydney Harbour. It is noted that the proposal will not result in any additional volume or pollutant levels and as such is not expected to affect the WWTP or conditions of the EPL.

6.6.3 Mitigation Measures

The following mitigation measures are proposed to ensure ongoing stormwater and waste water management in accordance with current practice.

Table 24 – Water, drainage and stormwater safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
General water cycle management	The operational, monitoring and recording, reporting and general conditions identified within the existing EPL 1677 will continue to be implemented.	Taronga Zoo	Pre-construction/ Construction/ Operation
Sediment-laden run off and associated water quality impacts management	Prepare a Soil and Water Management Plan as part of the CEMP and address the following: ▪ The NSW Soils and Construction – Managing Urban Stormwater Volume 1 'the Blue Book' (Landcom, 2004) and Volume 2 (DECC, 2008) Detail the following as a minimum: ▪ Identification of catchment and sub-catchment areas, high risk areas and sensitive areas ▪ Sizing of each of the above areas and catchment ▪ The likely volume of run-off from each road sub-catchment ▪ Direction of flow of on-site and off-site water ▪ Separation of on-site and off-site water ▪ The direction of run-off and drainage points during each stage of construction	Construction contractor	Pre-construction/ construction

Impact	Environmental Safeguard	Responsibility	Timing
	▪ Dewatering plan which includes process for monitoring, flocculating and dewatering water from site (i.e. formation or excavations) ▪ A mapped plan identifying the above ▪ Include progressive site-specific Erosion and Sedimentation Control Plans (ESCPs). The ESCP is to be updated at least fortnightly ▪ A process to routinely monitor the Bureau of Meteorology weather forecast ▪ Preparation of a wet weather (rain event) plan which includes a process for monitoring potential wet weather and identification of controls to be implemented in the event of wet weather. These controls are to be shown on the ESCPs ▪ Provision of an inspection and maintenance schedule for ongoing maintenance of temporary and permanent erosion and sedimentation controls.		
On-site sediment and waste laden run off and associated water quality impacts during construction	▪ Erosion and sediment control measures would be implemented to ensure no sediment leaves the site. ▪ All waste materials (such as demolition materials) would be contained to prevent possible run off prior to removal from the site.	Construction contractor	Construction
Erosion risk	▪ Disturbed surfaces would be reinstated as soon as possible. ▪ Erosion and sedimentation control measures would not be removed until disturbed areas have stabilised. ▪ Any damage from construction to the ground surface shall be restored to pre-construction condition on completion of works.	Construction contractor	Construction

6.7 Ecologically Sustainable Development

An Ecologically Sustainable Design (ESD) Report has been prepared by Evolved Engineering and is included at **Appendix T**. The purpose of the report is to provide a framework of ESD initiatives intended to be incorporated into the proposed exhibits. Final incorporation of these items will be subject to final architectural, landscape and services design, financial and environmental viability. A summary is provided below.

Energy

Hot Water Production

Hot water is traditionally produced using a submerged electric heating element or gas fired burner. The energy usage from these methods can be significantly reduced through the use of solar thermal energy collection. It is anticipated that the proposed exhibits will require hot water in significant quantities for back-of-house cleaning and animal care and for use in public amenities.

It is proposed to use Evacuated Tube Solar Collectors to either pre-heat or provide the complete heating of potable water (depending on solar exposure and demand). The solar collectors are required to be mounted in a sun exposed area, with minimal obstructions. It is proposed to locate the collectors on the roof of the gorilla back-of-house.

Lighting

It is proposed that all general lighting in the exhibits target usage of LED technology. LED technologies typically have higher lighting efficiency's that other traditional technology. LED design has significantly improved with respect to Colour Rendering Index (CRI) and choice of colour temperatures (i.e. warm or cool lighting) to a point where it is expected the aesthetic and functional output of the LED will not negatively impact on the resulting lighting in the space. LED fittings have a very high level of directional control, which can assist designers in minimising extraneous light leakage and thereby reducing light pollution.

Automated Controls and Metering

Substantial energy wastage can occur due to poor operation of equipment and the inability to identify issues in existing systems. The proposal seeks to incorporate automated controls to all lighting, hydraulic and mechanical equipment installed as part of the new exhibits. This will be connected to the existing Taronga building management system, to allow for holistic control and monitoring. Pre-programmed schedules and/or sensors for lighting and equipment can prevent the requirement for reliance on users to manually switching on and off. Measures will include:

- Scheduled lighting control to public accessibly spaces;
- Occupancy sensors to back-of-house areas to provide lighting only when staff are present;
- Automatically scheduled operation of mechanical ventilation equipment and hydraulic pumping and filtration equipment;
- Automatically scheduled and occupant sensitive control to mechanically heated/cooled spaces (i.e. Gorilla hydronic heating system); and
- Sub-metering of significant energy uses as to allow identification of idiosyncrasies and/or abnormal usage patterns.

Passive Thermal and Ventilation Control

Approximately 30% of energy within a typical commercial building is consumed by the HVAC (Heating, Ventilation and Air Conditioning) systems. As such, the proposal has been designed to maximise passive cooling, heating and ventilation of enclosed spaces. Additionally, it is proposed to remove all active HVAC systems, where it will not impact on the wellbeing of the animals. The Gorilla enclosure will be predominantly naturally ventilated with a local in-slab hydronic heating system to provide a comfortable space in cooler ambient conditions. Provision of heating hot waste will be derived from either an air-sourced heat pump or solar thermal hot water with gas boost.

Building Fabric and Insulation

The proposed roof structures will be fitted with insulation in line with the National Construction Code (NCC) requirements, with a total insulation value of R3.2. Wall construction is not considered relevant in the naturally ventilated spaces as the intent is to move as much ambient air through the space as possible. Thermal insulation will be required below the heated plinths used in the Gorilla enclosure. It is proposed an R2 level of insulation be constructed between the plinth and the main slab.

Water

Water Consumption

Water consumption will be minimised through the selection of water efficient fixtures throughout the proposed exhibits. It is proposed to target the highest commercially available Water Efficiency Labelling (WELs) rating bands for each category.

Waste Water

Stormwater runoff will be minimised where possible (refer to **Section 6.6**).

Where rainwater is not absorbed into permeable surfaces (i.e. on roofing), the rainwater is to be captured and directed into the existing Waste Water Treatment Plant. This will predominantly come from the roof structures that are not landscaped with plants.

For non-potable water usage, for example subterranean irrigation, toilet flushing etc. the reused water supply from the existing Taronga stormwater treatment and re-use plant will be used as the primary source. Reuse of water from the water bodies within each exhibit will be reviewed separately during operation to ensure safety for both the primary and secondary water consumers. It may not be feasible to treat and reuse the water from these sources.

Materiality and Embodied Energy

Locally Sourced Materials
It is proposed that the embodied energy of the built form is reduced by sourcing the raw materials (i.e. steel, concrete, timber, glass, etc.) from Australian suppliers only.

Net Balance of Soil
The proposal will require moderate earthworks and modifications to existing levels. It is proposed to retain, where possible, excavated material on site to maintain a net balance. It is recommended the project aim to maintain the balance of soil on site to within 10% of the original volume.

If required to be deposited off site, it is encouraged to transport fill the minimum distances possible. This reduction in relocation of soil minimises energy expenditure associated with relocating soil.

Recycled Materials
It is proposed to utilise recycled/sustainable timber in the construction of the exhibits. Timber products are likely to be sourced from Forest Stewardship Council (FSC) certified supply chains to ensure environmental impacts are minimised. It is recommended to recycle materials from the existing exhibits where feasible.

Demolition and Construction Waste
It is recommended to recycle/ reuse 90% of the material produced in the construction of the new exhibits. It is recommended that this requirement be captured within tender documentation for the preferred contractor. Refer to **Section 6.13** for further discussion.

Operational Recycling
It is proposed to supplement the existing recycling points for visitors to dispose of recyclable materials. General waste bins shall always be accompanied by a recycling collection point to reduce the likelihood of recyclables containers being sent to waste.

PVC Reduction
The production and disposal of products containing Polyvinyl Chloride (PVC) produces significant toxins that can be damaging to both human and animal life. Carcinogens, mutagens and teratogens are identified as some of the primary chemical components necessary for the manufacture of PVC products. It is proposed that:

- No PVC pipework be specified for the project;
- No PVC sheathing or conduits for electrical cables is specified for the project; and
- No floor or wall coverings containing PVC be specified for the project.

Furniture, Fixtures and Equipment

It is proposed that all new furniture and materials be selected from Good Environmental Choice Australia (GECA) recognised product lines.

All appliances required within back-of-house facilities and commercial buildings will be selected to ensure the highest commercially available energy efficiency.

Education and Information Technology

The Zoo is undergoing to the deployment of a smartphone application designed to accompany visitors to the zoo. The smartphone application is to include live mapping technology that will reduce the need to produce paper maps.

Information screens are to be installed in suitable locations as part of the interactive theatrical works. This will provide visitors information about conservation initiatives and cultural appreciation on topics such as poaching, recycling and deforestation.

6.7.1 Mitigation Measures

As outlined above, the following management measures are proposed to ensure sustainable development.

Table 25 – Ecologically sustainable development safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
Energy efficiency measures during operation	▪ Implement solar thermal energy collection measures ▪ Implement LED lighting fixtures ▪ Implement automated controls and metering ▪ Utilise energy saving furniture, fixtures and equipment ▪ Investigate opportunities for alternate energy provision after an initial review period of operation	Taronga Zoo	Operation
Building performance during operation	▪ Design for passive thermal and ventilation control ▪ Utilise building fabric and insulation to improve building performance ▪ Incorporate sustainable timbers ▪ Prepare a Section J energy efficiency assessment of the main buildings during the detailed design stage to determine possible energy saving measures	Taronga Zoo	Detailed design
Water usage	▪ Implement water efficient fittings and fixtures into building design ▪ Capture rainwater runoff and direct to existing stormwater and re-use plant	Taronga Zoo	Detailed design/ operation
Transport during operation	▪ Promote the use of public transport for patrons and staff	Taronga Zoo	Operation

6.8 BCA and Accessibility

6.8.1 Building Code of Australia

A BCA Compliance Statement and BCA Report have been prepared by Blackett Maguire + Goldsmith (BM+G) and are included at **Appendix O**. The statement concludes that the proposed development can satisfy the requirements of the relevant Deemed-to-Satisfy (DtS) provisions of the BCA, subject to the inclusion of the report's recommendations as part of detailed design development and prior to issue of the Section 109R Crown Certificate. It is considered that minor non-compliances can be addressed without giving rise to any inconsistencies with the SSD Application.

6.8.2 Access

An Access Statement has been prepared by Accessibility Solutions and is included at **Appendix P**. The Statement considers the proposed works and their compliance with the relevant access provisions of the Disability (Access to Premises) Standard 2010, BCA 2016, Accessibility Standards identified within the Australian Standards and MLEP 2012. It is concluded that based on the initial architectural drawings, the proposal complies or is capable of compliance with the relevant requirements subject to implementation of the recommendations and notations contained in the report prior to be addressed prior to the issue of a Section 109R Crown Certificate. As such, the proposal will provide equitable and inclusive access for people with disabilities.

6.9 Aboriginal Heritage and Archaeology

An Aboriginal Archaeological Assessment has been prepared by Dominic Steele Consulting Archaeology (DSCA) and is included at **Appendix L**. The assessment has been prepared in accordance with the requirements of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECW 2010) to identify potential Aboriginal archaeological constraints that may exist for the proposal and how to mitigate potential impacts to any documented or potential archaeological sites, objects or areas of sensitivity. The assessment findings are summarised below.

6.9.1 Consultation with MLALC

In accordance with the requirements of the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (2005) and *Aboriginal Cultural Heritage Requirements for Proponents* (DECCW 2010), TCSA have actively engaged with the *Metropolitan Local Aboriginal Land Council* (MLALC) regarding the proposal. An inspection of the study area was undertaken by DSCA and a representative of the on 15 July 2016. No Aboriginal archaeological or cultural heritage constraints have been identified by this due diligence assessment that has been completed with the MLALC.

6.9.2 Existing Environment

The background Aboriginal archaeological research, site inspection, and assessment of the study area undertaken for the current study indicate that:

- No *previously* documented Aboriginal archaeological sites or 'objects' are known to occur within the boundaries of the study area or in immediately adjacent areas.
- Only one known Aboriginal heritage site has been documented within the Taronga Zoo grounds. AHIMS Site #45-6-1959 forms part of a modified series of natural sandstone rock shelves that create a 2m-3m high cliff line. Seven white hand stencils were recorded on the rock surface. This rock shelter with art is currently being managed under an Aboriginal Heritage Impact Permit (AHIP) that has been issued by the Office of Environment and Heritage (OEH).
- No sandstone overhangs (generally created through processes of cavernous weathering and/or rock fall from extensive cliff-lines etc.) suitable for habitation or use by people in the past occur within the study area although small cliff faces may have formed part of the original topography.
- No rock engravings have been identified on the exposed vertical and sloping rock surfaces, although some surfaces partly exposed at ground level continue below ground and have buried portions below a mix of surface soil, sandstone pebble and cobble fragments, and leaf litter.
- No axe grinding grooves have been identified in the study area.
- None of the timber displays any evidence for cultural modification. In any case, the trees are either sapling re-growth or relatively immature specimens and not of sufficient age to display evidence of past Aboriginal scarification.
- No open campsites (or isolated finds of flaked stone etc.) have been identified.
- The study area itself would not seem to contain any 'stand out' or highly valuable resources suggesting the place may have been visited sporadically by people in the past as they moved to and from more attractive landscape contexts and resource zones. The terrain originally consisted of steeply benched and jumbled rock slopes with little or no flat ground.
- The study area is likely to possess minimal Aboriginal archaeological potential because of the accumulated impacts of multiple phases of historical construction that have disturbed or destroyed buried soils and both surface and subsurface sandstone elements as part of the progressive modification of the natural sandstone topography of the place.

- No specific areas of *potential Aboriginal archaeological sensitivity* relative to the proposal have been identified through consultation with the MLALC.

6.9.3 Potential Impacts

As a result of the above findings, the assessment concludes that no identified Aboriginal objects or areas of potential archaeological sensitivity will be impacted by the proposal.

It is therefore concluded that there are no Aboriginal archaeological or cultural heritage constraints for the proposal proceeding as planned and no further heritage assessment of the site is warranted.

6.9.4 Mitigation Measures

The following mitigation measures are proposed.

Table 26 – Aboriginal archaeology mitigation measures

Impact	Environmental Safeguard	Responsibility	Timing
Construction induction training to cover all works across the site	Briefing site contractors about the nature of archaeological sites and issues of potential sensitivity when sandstone surfaces previously obscured by vegetation for example are to be exposed.	Construction contractor	Construction
Limit areas of excavation	All efforts should be made to define *specific* and *limited* zones of impact within the study area where excavation is used only where crucial to design, and should be strictly adhered to throughout the course of future construction periods to limit impacts to existing vegetation and landforms.	Construction contractor	Construction
Avoidance and protection of sandstone elements	Avoidance and protection during future construction of the main sandstone elements on the site, and careful hand clearance of vegetation and rock where required.	Construction contractor	Construction
Unexpected finds discovery across the site	In the (largely) unexpected circumstance that any Aboriginal objects are unearthed during construction of the proposal, it is recommended that: ▪ Activities should immediately cease within the vicinity of the find locality; ▪ Activities be relocated to other areas of the subject site (allowing for a curtilage of at least 50m); ▪ The Office of Environment and Heritage be contacted to advise on the appropriate course of action to allow the MLALC to record and collect the identified item(s).	Construction contractor	Construction
Human remains discovery across the site	Handle human remains under the same process as an unexpected finds discovery; however, prior to the archaeologist recording the find contact the NSW Police, the OEH environment line and the OEH anthropologist.	Construction contractor	Construction

6.10 European Heritage and Archaeology

A Heritage Impact Assessment has been prepared by Geoffrey Britton Environmental Design & Heritage Consultant with Nicholas Jackson and Ashley Built Heritage and is included at **Appendix N**. The findings of the assessment are summarised below.

6.10.1 Previous Heritage Studies

Previous heritage studies of Taronga Zoo have provided considered assessments of the overall cultural significance of the zoo as well as its various individual components such as structures, landscape, vegetation, views and layout. As the first of the

comprehensive site assessment studies, the 2002 Conservation Strategy (GML) set the benchmark by describing the Taronga site as having national cultural significance for Australia as an urban zoo. Subsequent studies have come to similar conclusions confirming the status of Taronga Zoo within an Australian context. These studies include:

- Taronga Zoo Conservation Strategy, 2002 (GML);
- Taronga Zoo Archaeological Management Plan, 2004 (GML), Endorsed February 2004;
- Taronga Zoo Landscape Management Plan, 2006 (Design 5 Architects *et al*); and
- Taronga Zoo African Precinct, Strategic Heritage Advice, 2006 (GML).

The above studies have identified multiple components, both landscape and built form elements, within the Zoo as having exceptional or high cultural value and heritage significance.

The entire Taronga Zoo site (Lot 22, DP 843294) is listed as an item of local environmental heritage (Item 34) on Schedule 5 of the MELP 2012. Taronga Zoo as a whole, or any of its individual items, has not been listed on the NSW State Heritage Register (SHR). However, in accordance with Section 170 of the *Heritage Act 1977*, TCSA holds a Heritage and Conservation Register Taronga Zoo under the Zoological Parks Board. An assessment of the potential impacts of the proposal on the heritage items listed within the s170 Register is provided below.

6.10.2 Existing Environment

The origins of Taronga Zoo date back to the nineteenth century with the formation of the Society for Acclimatisation in 1879. In 1884 a small zoo was opened in Moore Park, Sydney. The current site at Bradleys Head was part of the 142½ acres the Government had resumed in 1908 for a public park to be known as Ashton Park. The area had previously been colonial military reserve and the Stock Quarantine Station (both roles assumed by the new Commonwealth Government after 1901). In the early 1910s, some 54 ¼ acres of the Ashton Park were dedicated as Zoological Gardens. The Zoo was officially opened in 1916. A full history of the Zoo and its development is provided at **Appendix N**.

Taronga Zoo's setting, including its physical context on the foreshore of Sydney Harbour, sloping topography, natural landscapes and vegetation and expansive views contribute to its significance. Given the zoo's history, the site contains built elements of heritage significance which reflect the progressive developments and upgrades following changing planning, practices and philosophies of modern zoos. These items have become iconic reference points within the zoo. These items of significance are listed in the current Taronga Zoo s170 Heritage and Conservation Register and are outlined within Section 5.3 of **Appendix N**.

African Savannah Precinct

The historical development of this precinct commenced in the mid-1920s. The existing exhibit was completed in 1984 in stages, and was then further developed in the early 1990s. Key items of significance located within the exhibit area include:

- Giraffe Enclosure and Giraffe Houses;
- Tahr Mountain;
- Barbary Sheep Enclosure;
- Fennec Fox Shelter; and
- Octagonal Shelter Shed.

Congo Forest Precinct

This area of the Zoo has long been associated the exhibit of birds. From the late 1920s and into the 1950s there were clusters of aviaries in an area to the north of the birds of

prey aviary and the neighbouring seal pond, and beside the northernmost pathway (opposite the present day nocturnal house). The balance of this zone housed exhibits of zebras, tapir, lamas (including guanaco), and peccary, in addition to the hippopotamus. Key items of significance located within the exhibit area include:

- Hoops Pines;
- Hallstrom Square;
- Multiple aviaries;
- Grand Staircase;
- Rustic Stone Seats;
- Curved Sandstone Steps and Walling;
- Original pathways; and
- Turner House.

6.10.3 Potential Impacts

The assessment has considered the potential impacts of the proposal on the existing heritage significance of the zoo from two perspectives – impacts of the removal or modification of significant items (or relocation of significant elements) and impacts of the introduction of new structures and elements. An assessment of heritage impact has been provided for items of significance listed within the Taronga Zoo s170 Register and is summarised below.

African Savannah Exhibit

The proposal will result in the loss of 9 (36%) of the total 25 significance items listed on the Taronga Zoo s170 Register– including 2 items of State heritage significance:

- 1940s faux-log giraffe house (Part 61B) (State/Exceptional significance);
- Original (1910s) and early (1920s) paths (Part 99L) (State/Exceptional significance);
- Original 1910s steel pipe fence (128L) (Local/Exceptional significance);
- African Tulip Tree (*Spathodea campanulata*) (251L);
- Date palm hybrid (*Phoenix x*) (255L);
- Date palm hybrid (*Phoenix x*) (256L);
- Floss Tree (*Ceiba speciosa*) (271L);
- Sweet Acacia (*Vachelia farnesiana*) (273L); and
- Pygmy Date Palm (*Phoenix roebelenii*) (277L).

A further 4 items are proposed to be modified in substantial ways (either physically or in their setting) – including 2 items of State heritage significance. These being:

- 1924 faux-rock giraffe shelter (part 61B) (State/Exceptional significance) – southern bay removed and a new large structure built adjacent;
- Buttressed retaining wall (74L) – sections removed for new exhibit expansion;
- Taronga Zoo as a whole will be affected by the loss/modification of its (African precinct) parts (82A) (State); and
- Octagonal shelter (144B) – structure proposed to be totally enveloped within a large new structure.

Congo Forest Exhibit

The proposal in its current form will result in the loss of 11 (44%) listed on Taronga Zoos s170 Register – including one item of State heritage significance as well as the removal and relocation of another:

- Turner House (54B) (Local/Some, but more likely at least Moderate, significance);
- Original (1910s) and early (1920s) paths (Part 99L) (State/Exceptional significance);
- Orang-utan rainforest (103B) (Local/High significance);
- Half of the Serpentine path (126L) (Local/Exceptional significance);
- Former elephant enclosure (1940) (95B) (Minimal value);
- Bush bird's aviary (97B) (Local/High value);
- Small aviary (159B);
- 2 x Silver Date Palms (*Phoenix sylvestris*) (183L & 184L) (Local/High value)
- Pygmy Date Palm (*Phoenix roebelenii*) (278L) (Local/High value);
- Bull Bay (*Magnolia grandiflora*) (161L) (Local/Exceptional significance); and
- Rustic stone seats (possibly 1930s) (55L) (Local/High significance).

Table 27 below indicates the potential impacts on the proposal on various items of significance listed on the Taronga Zoo s170 Register which are located within the proposed exhibition areas.

Table 27 – Heritage Impact Assessment

Item of Significance	Existing Policy Status	Proposed Works	Heritage Impact
African Savannah Exhibit			
1924 Giraffe House	Structure is State level listed outlined for conservation.	Partial demolition. Southern bay proposed to be removed and a new structure to be built adjacent.	The partial demolition of the 1924 Giraffe House is considered to result in a significant heritage impact both to the existing built form and fabric but also the surrounding area. Whilst some of the form will be retained to be appreciated, removal of the structure will result in the loss of its completeness as a house. Additionally, it is considered an adverse heritage impact would result from the new roof structure adjacent to and above the retained part of the structure. However, the proposed design seeks to create a visual relationship and connection between the new and old structures and the views to and from the zoo. It is considered a necessary development, from an animal management perspective, to adequately house and care for the giraffes into the future. Under the EAP Act `986, species like giraffes have no standards. New exhibits are approved by the Department of Primary Industries in accordance with contemporary understandings of best practice. Best practice has changed significantly since the current Taronga Zoo giraffe exhibit was constructed and as such the exhibit needs to be updated to meet contemporary standards.
1940 Giraffe House	Structure is State level listed, outlined for conservation.	Demolition of imitation log structure.	The demolition of the existing 1940 Giraffe House is considered to result in a significant heritage impact. The Giraffe House is identified as an iconic reference point within the Zoo, framing views over Sydney Harbour. The removal of the structure will result in the loss of historic significance as part of a post war phase of buildings constructed within the zoo. However, it is considered a necessary requirement in order to facilitate the development of improved animal welfare. As discussed above, from an

Item of Significance	Existing Policy Status	Proposed Works	Heritage Impact
			animal management perspective the enclosure no longer serves its required purpose.
Buttressed retaining wall	An element of early zoo planning outlined for conservation.	Removal of majority of existing wall.	The removal of majority of this wall is considered to result in an adverse heritage impact. However, removal of the retaining wall is considered necessary to facilitate the redevelopment of the exhibits and expansion of the current animal enclosures. This will have a positive impact on animal welfare and ongoing animal management, which is the primary driver for the project and as such is considered necessary for the longevity of the zoo.
Octagonal shelter	1930s structure reflective of early zoo planning outlined for conservation.	To be retained however enclosed within the proposed walkway through the lion enclosure.	The HIA notes that the retention of the shelter will have a positive heritage impact. However, it must be recognised that its former context and purpose as an outlook will be altered as part of the proposal, thus reducing some of its significance. The surrounding lion enclosure has been designed to integrate with the existing shelter, making it a defining experience in the visitor circulation pathway.
Pathways	State level listing outlined for conservation.	Partial retention and removal.	The proposal will result in the realignment of many of the existing original pathways throughout the exhibit areas. Whilst this will have an adverse heritage impact expansion of the existing exhibits to meet contemporary best practice in animal management.
Steel pipe fence	An element of the original/early zoo plan outlined for conservation.	Removal.	The proposed redevelopment of the Giraffe enclosure will result in the removal of the Edwardian-period metal handrail and gate, which defines part of the 1910s zoo circulation. This will inevitably result in some heritage impacts. The HIA recommends the reuse of these elements elsewhere within the zoo complex.
African Tulip Tree (251L)	Moderate significance at local level, conservation advisable.	Removal (Refer to Drawing A-600 Tree Removal & Transplant Plan within the Landscape Drawings (**Appendix D**)).	The removal of this tree is required for a new accessible pathway within the exhibit. Removing the tree will have a minor adverse impact on the significance of the area immediately surrounding the tree. The tree species however, is identified within the Landscape Report Plant Schedule (refer to **Appendix E**) for replacement planting. The HIA recommends replacement planting to occur.
Date Palms Hybrids (255L/ 256L)	Items of individual significance but not necessarily in present location. Conservation advisable.	Removal. (Refer to Drawing A-600 Tree Removal & Transplant Plan within the Landscape Drawings (**Appendix D**).	The removal of these trees is required for a new accessible pathway within the exhibit. Removing the trees will individually is considered to result in a minor heritage impact. The species is identified within the Landscape Report Plant Schedule (refer to **Appendix E**). The HIA recommends relocation and reuse of the existing palms.
Floss Tree (271L)	Item of high significance at a local level. Conservation advisable.	Removal. (Refer to Drawing A-600 Tree Removal & Transplant Plan within the Landscape Drawings (**Appendix D**).	The removal of this tree is required for a new accessible pathway within the exhibit. Removing the tree will result in a minor adverse heritage impact.

Item of Significance	Existing Policy Status	Proposed Works	Heritage Impact
Sweet Acacia (273L)	High significance at a local level. Conservation or replacement advisable.	Removal. (Refer to Drawing A-600 Tree Removal & Transplant Plan within the Landscape Drawings (**Appendix D**).	The removal of this line of trees is required to facilitate a new pathway through the exhibit and reconfiguration of the existing exhibit footprint to allow more space for animal habitat. The species is identified within the Landscape Report Plant Schedule (refer to **Appendix E**). The HIA recommends replacement of the species or alternative fast-growing woodland species.
Pygmy Date Palm (277L)	An item of individual significance but not necessarily in present location. Conservation advisable.	Removal. (Refer to Drawing A-600 Tree Removal & Transplant Plan within the Landscape Drawings (**Appendix D**).	The removal of this tree will result in a minor adverse heritage impact. The species is identified within the Landscape Report Plant Schedule (refer to **Appendix E**). The HIS recommends relocation and reuse of existing palm.
Taronga Zoo (whole)			However, the proposed works will facilitate the ongoing operation of the Zoo including the continued use of original enclosures e.g. Giraffe and Zebra exhibit. The addition of the waterhole is considered to have a positive heritage impact, improving the waterhole focus through coordinated design.
Congo Forest Exhibit			
Turner House	Some local significance.		Whilst the original purpose of Turner House is unknown, demolition will result in minor heritage impact as it will result in the loss of historic associations with various uses in the zoo. There will be an adverse impact from the loss of the building and its landscape setting that can be described as the Mosman vernacular that once typified the zoo and linking the zoo with its local urban context. However, demolition is considered necessary for the proposed redevelopment and expansion of the animal exhibit.
Orang-utan Rainforest			This enclosure represents an example of more recent approaches to designing minimal animal enclosures, where the structure is a secondary function to providing a natural environment. As such, the demolition of this structure will result in the loss of a more recent example of this 'non-architecture' or 'quiet architecture' and will have result in an adverse heritage impact. However, the redevelopment of the exhibit is required from an animal welfare perspective, with the new exhibit reflecting a natural habitat and passive form of enclosure.
Serpentine path		Reduction in path width.	The proposal will result in the reconfiguration of Serpentine Path, halving it in width and providing no public access. This will result in some heritage impacts. However, the realignment is considered necessary for the ongoing operation of the zoo, provision of larger enclosures and accessible access throughout exhibit area.
Bush bird aviaries	Conservation/ adaptive reuse advisable.	Removal.	The proposed removal of the original bush bird aviaries is considered to have an adverse heritage impact. The original exhibit area was associated with the exhibit of birds. The redevelopment for the Congo Forest

Item of Significance	Existing Policy Status	Proposed Works	Heritage Impact
			exhibit would result in the removal of bird enclosures from this area. However, the proposal seeks to facilitate larger enclosures improving animal welfare and maintaining current standards.
Small aviary	Conservation/ adaptive reuse advisable.	Removal.	The proposed removal of the original bush bird aviaries is considered to have an adverse heritage impact. The original exhibit area was associated with the exhibit of birds. The redevelopment for the Congo Forest exhibit would result in the removal of bird enclosures from this area. However, the proposal seeks to facilitate larger enclosures improving animal welfare and maintaining current standards.
Pathways	Refer above.	Refer above.	Refer above.
Stone seats	Conservation advisable.	Relocation.	The existing stone seats were located to address the original pathway. Removal of the seats will result in an adverse heritage impact on the fabric of that location. However, it is noted that these seats will be relocated within the zoo thus retaining some heritage significance.
Silver Date Palms (183L/ 184L)	Items of individual significance but considered valuable as part of stair/seat ensemble. Conservation through relocation and reuse advisable.	(Refer to Drawing A-600 Tree Removal & Transplant Plan within the Landscape Drawings (**Appendix D**).	The removal of these trees is required for new accessible pathways within the precinct. Removal will result in a minor heritage impact. The species is identified within the Landscape Report Plant Schedule (refer to **Appendix E**). It is noted that item 184L is to be relocated within the site.
Pygmy Date Palm (278L)	Refer above.	Refer above.	Refer above.

Conclusion

The proposal will result in significant modifications to the existing zoos built form and natural landscapes through the removal of components which depict the zoo's original uses, form and circulation. As such, the report concludes that the proposal will result in moderate impacts to items of heritage significance.

However, the proposed modifications are considered necessary to provide modern zoo facilities improving animal welfare and keeper safety. Taronga Zoo has and will continue to develop in accordance with contemporary animal management practices and zoo paradigms. New exhibits and zoo facilities are and will continue to be juxtaposed with existing structures and enclosures. This approach has influenced the current design approach. The proposal seeks to retain the existing historical value of the zoo, where possible, whilst incorporating new contemporary zoo design paradigms. In this context, it is not only the impact on items of heritage significance which warrant consideration, but also the positive evolution and ongoing viability of the zoo.

Notably, the proposal will result in the following:

- Retention of use – giraffes and zebras in same general area;
- Partial retention of the 1924 Giraffe House and integration of new structure;
- Retention of natural sandstone outcropping throughout much of the western section of the precinct;
- Retention of the former Pygmy Hippo shelter;
- Retention and incorporation of the 1932 Octagonal Shelter within African Savannah exhibit;

- Retention of an area of the remnant locally indigenous woodland community along the western part of the precinct.
- Retention of the early rendered stone wall (Item 132L) near the existing Safari Lodge;
- Retention of the original zoo path circulation between the giraffe and bongo enclosures and Chimpanzee Park;
- Part of the recent intrusive steel access ramp to be removed;
- Retention of the Grand Staircase; and
- Retention of the curved sandstone steps and their inclusion in the proposed new circulation layout.

6.10.4 Mitigation Measures

During ongoing design, development and construction of the proposal, potential heritage impacts will be addressed. The following mitigation measures are proposed.

Table 28 – Non-Aboriginal heritage mitigation measures

Impact	Environmental Safeguard	Responsibility	Timing
General	Implement recommendations of Heritage Impact Assessment as required.	Construction contractor	Pre-construction
Archival Recording	Undertake full measured drawing and photographic archival recording of items proposed to be removed.	Taronga Zoo	Pre-construction
Relocated Items	Ensure location of relocated and reused heritage items are appropriate in size, geometry and condition to support the ongoing heritage significance of these items.	Taronga Zoo	Pre-construction Construction
Interpretation	Include items of heritage significance within ongoing interpretation and education strategy for the zoo to enable visitors to understand these retained components and elements of zoo history.	Taronga Zoo	Pre-construction
Heritage induction training to cover all works across the site	▪ Provide non-Aboriginal heritage awareness training to the construction workforce prior to starting on site which would include: – the location of heritage items outside the study area, including the extant gate entrance for the former OTC transmission station – guidelines to follow if unanticipated heritage items or deposits are located during works – the procedure for managing any unexpected find, discovering human remains, or unearthing other archaeological remains. ▪ Provide the non-Aboriginal heritage awareness training to any person or visitor to the site during construction	Construction contractor	Construction
Unexpected finds discovery across the site	▪ If unexpected archaeological finds are discovered during the proposed works, immediately cease all works within 10 metres of discovering an unexpected find (e.g. archaeological remains, heritage item, and potential relic). ▪ Engage a heritage consultant to assess the find and the NSW Heritage Division would be notified of the discovery of a relic in accordance with Section 146 of	Construction contractor	Construction

Impact	Environmental Safeguard	Responsibility	Timing
	the NSW *Heritage Act 1977*		
Human remains discovery across the site	Handle human remains under the same process as an unexpected finds discovery; however, prior to the archaeologist recording the find contact the NSW Police, the OEH environment line and the OEH anthropologist.	Construction contractor	Construction

6.11 Contamination

6.11.1 Site Contamination

Preliminary site investigations for the exhibit sites have been undertaken by Douglas Partners and are included at **Appendix U**. The purpose of the assessment was to determine the potential for contamination within the exhibit areas. The assessment included a limited assessment of the site history, borehole drilling and chemical analysis of selected soil samples for potential contaminants of concern.

The site has operated as Taronga Zoo since 1916. Since the establishment of the zoo there have been a number of new exhibits and zoo buildings redeveloped and refurbished. The potential for contamination at the site was generally considered to be low; however the presence of imported filling across the site required further assessment. The findings of the reports are summarised below.

African Savannah Exhibit

Twenty-nine (29) soil samples were obtained and tested from the site. The recorded concentrations of metals BTEX, OCP, OPP, PCB, phenols and asbestos were below the laboratory practical quantitation limits (PQLs). The concentrations of heavy metals, TRH and PAH were generally low and within the site assessment criteria. However, it is noted that there were a number of exceedances of the human health based investigation levels and ecological investigation levels for heavy metals.
The fill encountered at the site is classified as General Solid Waste (non-putrescible) with the exception of the fill in the vicinity of A03 which is provisionally classified as Restricted Solid Waste (non-putrescible).

Based on the findings of the investigation it is considered that the site is suitable for the proposed development in terms of human health risk related to contamination subject to the appropriate removal and/or management of lead and zinc impacted soils in the vicinity of test bore A03 (refer to **Appendix U**).

The assessment recommends the following:

- The lead and zinc impacted material recorded within the area be either:
  - (a) managed on-site under the existing 1m deep fill layer (effectively a capping layer) with an appropriate environmental management plan/ management procedures in place in the site management plan, or
  - (b) excavated, disposed (off-site) and resultant excavation validated.
- Additional ex situ waste classification be undertaken on the fill soils in the vicinity of A03 prior to final classification and disposal to confirm the classification.
- Visual confirmation of the waste classification to be conducted during excavation and load out of the material.

This recommendation is included as a Mitigation Measure at **Section 8.0**.

Congo Forest Exhibit

Twenty-six (26) soil samples were obtained and tested from the site. The recorded concentrations of metals OCP, OPP, PCB, phenols and asbestos were below the PQLs and therefore below the site assessment criteria. The recorded concentrations of TRH and BTEX in a limited number of samples were above the laboratory practical quantitation limits (PQLs) but below the site assessment criteria.

The recorded concentrations of heavy metals and PAH were generally low and within the site assessment criteria. It is noted that the levels of Zinc and Benzo(a)pyrene exceeded ecological investigation/ screening levels. However, these exceedances are not considered to be significant and do not warrant management or remediation.

It is noted that while no asbestos was reported in the soil samples there were some precursor indicators of asbestos such as concrete present in some of the test bores. Therefore the possibility of asbestos being present cannot be entirely ruled out. The fill in the project area is classified as General Solid Waste (non-putrescible).

Based on the findings of the investigation it is considered that the potential contamination within the investigation area is low and that the levels of the contaminants of concern were generally within the adopted site assessment criteria.

The assessment recommends the following:

- Visual confirmation of the waste classification to be conducted during excavation and load out of the material. If signs of significant contamination are observed during excavation such as building rubble (including asbestos), significant anthropogenic materials, odorous or discoloured soils or materials that vary from those described in this report then further *ex-situ* waste classification should be undertaken on the impacted materials.
- Further assessment of the natural soil/sandstone be undertaken following removal of overlying fill soils to determine if the natural soil will classify as virgin excavated natural soil (VENM) if off-site disposal of the natural soils is required.
- Implementation of an Unexpected Finds Protocol (UFP) to report and manage any signs of potential environmental concern encountered during earthworks/ redevelopment works.

These recommendations have been included as Mitigation Measures at **Section 8.0**.

6.11.2 Hazardous Materials

A Hazardous Materials Report has been prepared by Pickford & Rhyder Consulting and is included at **Appendix W**. A hazardous materials survey was conducted on 29 September 2016 for three structures within the African Savannah and Congo Forest exhibit areas, these being:

- Turner House;
- The orang-utan exhibit office; and
- Giraffe House (1940).

The demolition of these structures forms part of the proposed scope of works.

The preliminary survey identified all three buildings as containing asbestos containing material (ACM). All of the ACM in the building is considered non-friable and is currently in good condition.

Taronga Zoo currently has an Asbestos Management Plan (AMP) for the site. The goal of the AMP is to guide the removal of ACM during renovation, refurbishment and/or maintenance in accordance with WorkCover NSW and the National Occupational Health and Safety Commission's *Code of Practice for the Safe Removal of Asbestos 2nd Edition*. Removal of ACM is preferred over other control controls measures such as enclosure, encapsulation or sealing.

At the time of the preliminary survey all three buildings were occupied and in use and as such a detailed survey of the structures were not undertaken. The When the buildings are no longer occupied a comprehensive survey for hazardous materials will be conducted for the purpose of the demolition.

A Safework NSW licensed asbestos removalist will be used to remove the ACM from the buildings and an Asbestos Clearance Report issued prior to demolition works.

Whilst air monitoring for airborne asbestos fibres is not required for non-friable removal work, Taronga Zoo has a policy of conducting air monitoring for asbestos removal work. All air monitoring will be conducted in accordance with the National Association of Testing Authorities (NATA) requirements, using the April 2005 National Occupational Health & Safety Commission 'Guidance Note on the Membrane Filter Method (MFM) for Estimating Airborne Asbestos Dust' (2nd Edition).

The above have been incorporated into the Mitigation Measures in **Section 8.0.**

6.12 Waste Management

Waste management legislation for NSW identifies waste generation and management, materials reuse and recycling, transport and disposal and outlines a hierarchy for waste minimisation. The hierarchy advocates:

- Avoidance, in preference to
- Recovery, including reuse, recycling, reprocessing and energy recovery, in preference to
- Responsible disposal.

Where disposal remains the only option, the Waste Classification Guidelines 2009 provide for classifying six types of waste: special, liquid, hazardous, restricted solid waste, general solid (putrescible) and general solid (non-putrescible). The classifications determine how the materials are to be stored, transported, management and disposed of.

6.12.1 Existing Environment

Taronga Zoo operates in accordance with relevant legislative requirements. Waste generated from the proposed exhibits will be managed in accordance with TCSA's Waste Management Policy and the Waste Management Operational Plan (WMOP) included at **Appendix Z**. The WMOP identifies projected waste generation streams, waste management measures, baseline targets and review processes. Broadly the targets sought will align with the NSW EPA's 2014-2021 Waste Avoidance and Resource Recovery Strategy (WARR strategy).

To ensure the highest standards in waste management are achieved TCSA has engaged the services of SUEZ Australia. Expanding the current service operation of Taronga Zoo to accommodate the additional requirements of the proposed exhibits will take full advantage of the existing in-house knowledge of both staff and the servicing contractor, SUEZ.

Taronga's overall waste management operation is a daily service conducted 365 days per year and is inclusive of public holidays. Waste operators are scheduled for work daily on a rotating roster basis.

6.12.2 Potential Impacts

Construction

Waste would be generated from several activities, generally grouped into the following broad waste streams:

- Excavation material including sandstone, rock and soil;
- Green waste;
- Construction wastes including offcuts;
- Packaging waste;

- Work compound (construction worker) waste; and
- Waste water.

It is proposed to recycle and reuse where possible, guided by a comprehensive survey of the existing site identifying existing materials for reuse or recycling. Materials from the existing exhibits will be reclaimed where possible and reused where possible.

Prior to the commencement of demolition and excavation works, a detailed hazardous materials assessment will be undertaken on all structures and soil materials. Refer to **Section 6.11** for preliminary hazardous materials assessment and findings.

A Construction Waste Management Plan (CWMP) will be prepared by the Head Contractor to manage waste streams, including those identified above, during construction.

Operation

There will be a number of potential waste sources during the operation of the exhibits generating the following broad waste streams:

- Animal faeces/manure and liquid sludge wastes;
- Food organics waste;
- Green waste;
- Beverage container recycling;
- General (residual waste);
- Animal carcasses in case of animal death;
- Medical wastes from on-site veterinary services;
- Wastewater (black water) from wash down of animal back of house and public amenities/toilets;
- Bulk packaging wastes including polystyrene and cardboard boxes; and
- Stores, plant and general maintenance wastes.

These waste streams are consistent with the existing waste streams within the zoo.

TCSA is committed to ensuring its waste is managed in an environmentally responsible manner and in accordance with legislative requirements, increased resource recovery and minimising environmental impact.

All waste generated from the proposed exhibits will be managed in accordance with TCSA's Waste Management Policy and the exhibits WMOP. Specifically:

- SUEZ will work with TCSA to position waste management stations (1 x 240L recycling bin and 1x 240L general waste bin) within the exhibits and in suitable proximity to waste generation points (e.g. Cliff Edge Village).
- Additional bins will be placed on site for specific events and concerts.
- Animal waste is collected in 120ltr and 240ltr carts, which are emptied each day and stockpiled at the zoo's recycle transfer area. There are approximately 70 animal waste bins located around the Zoo at each animal precinct. All animal waste bins are serviced, washed and changed over on a daily basis by SUEZ.
- Animal waste is transported from site every day (to a manage facility) to manage the quantity of waste stored on site and to control other issues such as pests, vermin and odour.
- Liquid wastes associated with the exhibit will include water from the various ponds and moats which use recycled water taken from the Zoo's water treatment plant. The water is filtered, and if necessary is treated with ozone to remove organic

wastes. Excess water (backwash from the filters) is returned to the recycling plant for further treatment. Water from animal holding washouts also connects to the water treatment plant for recycling.

- Green waste from the exhibits will be either added to the Zoo's bulk waste or if suitable for chipping, and will be chipped by a licensed contractor then reused for landscaping within the zoo grounds.
- Other materials such as soft stemmed weedy material, hay and shredded paper will be added to animal waste.
- Taronga Zoo's cardboard and paper is collected in separate blue bins and cardboard cages. The contents of the bins and cages are emptied daily into a 23 cubic metre on-site compactor. Once the compactor is full, the paper and cardboard is transported to either Visy Recycling or Orora Recycling (lawful recycling facilities).
- All stormwater from roadways and pathways will be directed to the existing Zoo's water treatment plan and is recycled for various uses around the Zoo (refer to **Section 6.6** for further discussion).
- All waste vehicles collecting from the exhibits will enter and exit via the Security Portal perimeter fence. Specific routes and access points for collection and delivery of any associated equipment will be determined during detailed design prior to operation of the exhibits.

It is considered that the waste management practices currently implemented will sufficiently accommodate the waste generation from the proposed exhibits. It is noted that the exhibits will replace existing exhibits and as such will not result in a substantial increase of operational waste.

6.12.3 Mitigation Measures

Several waste management mitigation measures and safeguards have been identified to address the impacts of the proposal during construction and operation.

Table 29 – Waste management safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
Waste generation during construction	Classify, handle and store all removed waste in the construction compounds/laydown areas in accordance with the NSW Waste Classification Guidelines 2009: Part 1 Classifying Waste (DECCW) and Storing and Handling liquids, Environmental Protection (DECC, 2007).	Construction contractor	Construction/ operation
Waste and resource management during construction across the proposal	Prepare a waste and resource management plan (WRMP) as a sub-plan of the CEMP. As a minimum describe the measures for handling, storing and classifying waste when 'onsite' and its subsequent disposal offsite to the relevant licenced facility.	Construction contractor	Construction/ operation
Waste disposal during construction across the proposal	Send all disposed materials to a suitably licenced waste management/landfill facility.	Construction contractor	Construction/ operation
Waste handling and storage during construction across the proposal	Store and segregate all waste at source (e.g. the construction compounds/laydown areas) in accordance with its classification. This includes recycled and reusable materials.	Construction contractor	Construction/ operation
Littering and site tidiness during construction and operation	Monitor for waste accumulation, littering and general tidiness to ensure operating standards of the zoo are maintained.	Taronga Zoo/ Construction contractor	Construction/ operation
Resource recovery during construction across the proposal	Apply resource recovery principles: ▪ Reuse proposal-generated waste materials onsite (e.g. topsoil, recycled aggregate) providing it meets with exemption and classification requirements	Construction contractor	Construction/ operation

Impact	Environmental Safeguard	Responsibility	Timing
	▪ Failing that, transfer the materials for use elsewhere on another site under a resource recovery exemption ▪ Employ waste segregation to allow paper, plastic, glass, metal and other material recycling. These materials could be either reused onsite or transferred to a recycling facility ▪ Consider composting general putrescible waste to allow recovery. Transfer these materials offsite to a composting facility.		
Reducing primary resource demand during construction across the proposal	Use recycled and low embodied energy products to reduce primary resource demand in instances where the materials are cost and performance competitive (e.g. where quality control specifications allow).	Construction contractor	Construction/ operation
Waste disposal in landfill	Implement targets for reduction and diversion following an initial waste audit of the exhibits once operational. Taronga employees are to be allocated responsibility for regular monitoring of the content of waste and recyclable materials being placed in bins. This will assist with target and KPI management and minimise the potential for contamination and inappropriate disposal activities. Based on the collected data reduced waste to landfill targets will be further reviewed every twelve-month period.	Taronga Zoo	Operation
Waste disposal in landfill	The service provider must if available and if it is financially viable propose lawful disposal alternatives that will offer additional diversion opportunities of waste materials to either re-use, processing and/or recycling.	Waste Contractor	Operation

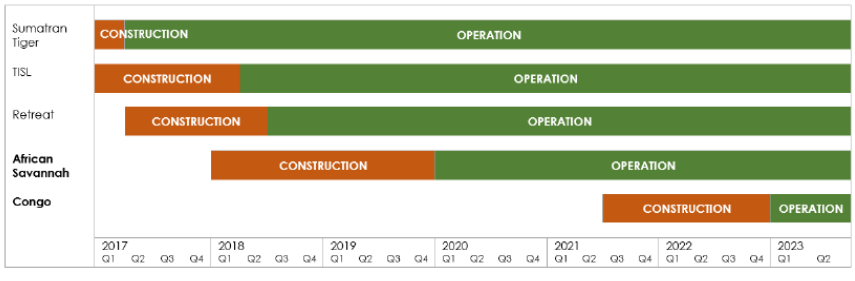
6.13 Construction Management

A Preliminary Construction Management Plan (PCMP) has been prepared by TCSA and is included at **Appendix X**. The PCMP outlines site management principles and measures to mitigate impacts during the construction period. These measures are outlined below in relation to potential construction impacts. A final CMP will be prepared once a Head Contractor is appointed.

6.13.1 Cumulative Impacts

Taronga Zoo is undertaking a number of development projects as part of the capital works program over the coming years. As shown in **Figure 27** below, some of these projects will occur simultaneously.

Figure 6.3: Project timeline



Source: Taronga Zoo

Figure 27 – Proposed works program
Source: TCSA

To minimise the cumulative impacts of concurrent works TSCA intends to:

- Stage work programmes so that the minimum overlap of concurrent works occurs;
- Conduct weekly construction impacts meetings that will foresee possible construction impacts and develop programme strategies to mitigate the effects of these conflicts; and
- Provide information to interested community groups where appropriate and early notifications to neighbours if upcoming construction impacts anticipated.

6.13.2 Construction Traffic Management

The PCMP and Transport Impact Assessment (**Appendix K**) outline appropriate construction traffic management measures. These are outlined below.

Construction Vehicle Access

Construction vehicles will only be permitted to enter the Zoo between the hours of 6:00am to 5:00pm Monday to Fridays inclusive and 7:00am to 1:00pm Saturdays, but excluding public holidays. However, vehicle access within the zoo grounds would be generally limited to 6:00am – 10:00am and 3:00pm and 6:00pm, outside peak operating times.

Construction vehicles, including articulated trucks, will use the following access points:

- Whiting Beach Road access via the staff car park (to be used during work hours); and
- Bradley's Head Road access (to be used outside of zoo operating hours).

Taronga Zoo implements a strict vehicle policy within the zoo grounds. This is detailed within the PCMP (**Appendix X**). This policy will be implemented to management construction vehicle access during the construction period.

Construction Traffic Volumes

It is estimated that the construction activities would generate construction vehicles peaking at 10 to 20 deliveries per day (i.e.: 1 to 2 vehicles per hour). This low volume of construction vehicle flow is unlikely to present any road capacity problems in the vicinity of the site. For further discussion of expected traffic volumes refer to **Section 6.2**.

Car Parking

The number of workers likely to work on the site will vary throughout the project, however it is anticipated that up to 50 workers may be present at any one time. Construction vehicles will park in the available car parks which would be designated parking section for contractors only. For further details of car parking capacity refer to **Section 6.2**.

6.13.3 Construction Waste Management

The PCMP identifies practices and procedures for the identification, management and reuse (where practical) of waste streams and materials resulting from the demolition of existing structures and general construction.

6.13.4 Construction Noise Management

A full construction noise and vibration impact assessment and management plan will be prepared by the contractor once the structure and likely construction methods are developed. The Contractor will be responsible for preparing a detailed Works Plan and Schedule, including updated noise and vibration impact assessments for proposed methods and timing of each stage of work. This will build upon the Acoustic Report (**Appendix J**) and noise mitigation measures outlined in **Section 6.1**.

6.13.5 General

Consultation

TCSA and its Contractor will establish appropriate Liaison Groups to keep its residential neighbours informed of the construction works. A complaints register will be implemented to record details of during construction.

Workplace Health and Safety

The Contractor is to be appointed the Principal Contractor under the WH&S Act and is to prepare a Site Specific WH&S Management Plan. Specific areas that have been identified of particular importance are:

- Preventing falls from height;
- Preventing electrocution from existing, future and construction power supply;
- Ensuring adjacent structures remain safe and stable;
- Providing adequate side support to excavations;
- Providing hoarding to ensure public protection; and
- Controlling public pedestrian and vehicle traffic around perimeter of site.

Emergency Access

Emergency access to the construction area will be provided via two points, at Bradleys Head Road and Whiting Beach Road.

6.13.6 Environmental Construction Impacts

Table 30 below identifies potential environmental impacts/ risks resulting from the proposed construction and identifies appropriate mitigation and management measures.

Table 30 – Environmental construction impacts safeguards and management measures

Impact	Environmental Safeguard	Responsibility	Timing
Demolition/ Site Establishment			
Noise from demolition work (see also Section 6.1.4)	▪ The construction equipment (such as the excavator, small rock breaker, concrete pulveriser) will be fitted with noise mitigation equipment where possible. ▪ Noisy work will be identified and advised to stakeholders in advance, to inform when noise may affect their operations.	Construction Contractor	Construction
Dust from demolition and construction works	▪ Screens to be placed around the site. ▪ If / where possible, large concrete elements to be crushed off site. ▪ Construction activities and vehicle access routes to be hosed down. ▪ Construction vehicles to be hosed down when leaving site. ▪ Adjacent roadways approaching site to be regularly cleaned.	Construction Contractor	Construction
Hazardous materials being removed (see also Section 6.11.2)	▪ Hazardous material assessment to be undertaken to define removal and disposal methods. ▪ On approval, works to be undertaken as per the assessment / recommendation report.	Taronga Zoo/ Construction Contractor	Pre-construction
Sediment-laden run off and associated water quality impacts management	Prepare a Soil and Water Management Plan as part of the CEMP and address the following: ▪ The NSW Soils and Construction –	Construction contractor	Pre-construction/ construction

Impact	Environmental Safeguard	Responsibility	Timing
(see also Section 6.6.3)	Managing Urban Stormwater Volume 1 'the Blue Book' (Landcom, 2004) and Volume 2 (DECC, 2008) Detail the following as a minimum: ▪ Identification of catchment and sub-catchment areas, high risk areas and sensitive areas ▪ Sizing of each of the above areas and catchment ▪ The likely volume of run-off from each road sub-catchment ▪ Direction of flow of on-site and off-site water ▪ Separation of on-site and off-site water ▪ The direction of run-off and drainage points during each stage of construction ▪ Dewatering plan which includes process for monitoring, flocculating and dewatering water from site (i.e. formation or excavations) ▪ A mapped plan identifying the above ▪ Include progressive site-specific Erosion and Sedimentation Control Plans (ESCPs). The ESCP is to be updated at least fortnightly ▪ A process to routinely monitor the Bureau of Meteorology weather forecast ▪ Preparation of a wet weather (rain event) plan which includes a process for monitoring potential wet weather and identification of controls to be implemented in the event of wet weather. These controls are to be shown on the ESCPs ▪ Provision of an inspection and maintenance schedule for ongoing maintenance of temporary and permanent erosion and sedimentation controls.		
On-site sediment and waste laden run off and associated water quality impacts during construction (see also Section 6.6.3)	▪ Erosion and sediment control measures would be implemented to ensure no sediment leaves the site. ▪ All waste materials (such as demolition materials) would be contained to prevent possible run off prior to removal from the site.	Construction contractor	Construction
Erosion risk (see also Section 6.6.3)	▪ Disturbed surfaces would be reinstated as soon as possible. ▪ Erosion and sedimentation control measures would not be removed until disturbed areas have stabilised. ▪ Any damage from construction to the ground surface shall be restored to pre-construction condition on completion of works.	Construction contractor	Construction
Construction Works			
Noise from construction work (see also Section 6.1.4)	▪ Construction equipment to be fitted with noise mitigation equipment. ▪ Location of concrete pump to be considered to minimise noise to adjacent neighbours. ▪ Noisy work will be identified and advised to stakeholders in advance, to inform when noise may affect their operations.	Construction contractor	Construction
Vibration during	▪ Bored piles to be used, instead of driven	Taronga Zoo/	Construction

Impact	Environmental Safeguard	Responsibility	Timing
construction (see also Section 6.1.4)	piles. ▪ Work will be identified and advised to stakeholders in advance, to inform when noise may affect their operations.	Construction contractor	
Use of construction traffic/ plant (see also Section 6.1.4)	▪ Construction activities and public to be separated with appropriate traffic control measures. ▪ Safe public access routes to be pre-agreed provided and maintained. ▪ Construction work not to be undertaken on Major Event days, in consultation with stakeholders.	Construction contractor	Construction
Waste water from construction activities (see also Section 6.6.3)	▪ Waste water to be collected and treated prior to disposal.	Construction contractor	Construction
Flora and Fauna Protection			
Loss of habitat (see also Section 0)	▪ Retain, where possible, significant trees and animals in existing locations.	Construction contractor	Construction
Loss of species (see also Section 0)	▪ Determine existing populations of non-threatened endemic plants and animal species, transplant where possible.	Construction contractor	Construction
Soil Classification			
Lead contaminated soil (see also Section 6.11.1)	▪ It is recommended that the lead and zinc impacted material in the vicinity of test bore A03 be either (a)managed on-site under the existing 1m deep fill layer (effectively a capping layer) with an appropriate environmental management plan/ management procedures in place in the site management plan, or(b) excavated, disposed (off-site) and resultant excavation validated.	Taronga Zoo/ Construction contractor	Pre-construction
Contaminated soil (general) (see also Section 6.11.1)	▪ An unexpected finds protocol (UFP) should be prepared which outlines the steps to be undertaken to identify, report and manage any signs of potential environmental concern encountered during earthworks/redevelopment works. These usually comprise notifying workers during the standard site induction of whom to report finds to, and then the protocol for isolating the find, organising investigation and management and notifying appropriate personnel/ organisations.	Construction contractor	Pre-construction

7.0 Environmental Risk Assessment

The Environmental Risk Assessment (ERA) establishes a residual risk by reviewing the significance of environmental impacts and the ability to manage those impacts. The ERA for the African Savannah and Congo Exhibits, Taronga Zoo has been adapted from Australian Standard AS4369.1999 Risk Management and Environmental Risk Tools.

In accordance with the SEARs, the ERA addresses the following significant risk issues:

- the adequacy of baseline data;
- the potential cumulative impacts arising from other developments in the vicinity of the site; and
- measures to avoid, minimise, offset the predicted impacts where necessary involving the preparation of detailed contingency plans for managing any significant risk to the environment.

Figure 28 indicates the significance of environmental impacts and assigns a value between 1 and 10 based on:

- the receiving environment;
- the level of understanding of the type and extent of impacts; and
- the likely community response to the environmental consequence of the project;

The manageability of environmental impact is assigned a value between 1 and 5 based on:

- the complexity of mitigation measures;
- the known level of performance of the safeguards proposed; and
- the opportunity for adaptive management.

The sum of the values assigned provides an indicative ranking of potential residual impacts after the mitigation measures are implemented.

Significance of impact	Manageability of impact				
	5 Complex	4 Substantial	3 Elementary	2 Standard	1 Simple
1 – Low	6 (Medium)	5 (Low/Medium)	4 (Low/Medium)	3 (Low)	2 (Low)
2 – Minor	7 (High/Medium)	6 (Medium)	5 (Low/Medium)	4 (Low/Medium)	3 (Low)
3 – Moderate	8 (High/Medium)	7 (High/Medium)	6 (Medium)	5 (Low/Medium)	4 (Low/Medium)
4 – High	9 (High)	8 (High/Medium)	7 (High/Medium)	6 (Medium)	5 (Low/Medium)
5 – Extreme	10 (High)	9 (High)	8 (High/Medium)	7 (High/Medium)	6 (Medium)

Figure 28 – Risk Assessment Matrix

				Risk Assessment		
Item	**Phase**	**Potential Environmental Impact**	**Proposed Mitigation Measures and / or Comment**	**Significance of Impact**	**Manageability of Impact**	**Residual Impact**
Noise	Construction	Construction noise on nearby sensitive receivers.	Refer to Section 8.0. A Construction Noise and Vibration Management Plan will be prepared.	Moderate (3)	Elementary (3)	Medium (6)
Noise	Operation	Operational noise on nearby sensitive receivers.	Refer to Section 8.0. Appropriate plant and public sound system will be selected and installed to comply with the specific NMLs.	Low (1)	Standard (2)	Low (3)
Noise	Operation	Night time sleep disturbance from roaring lions.	Refer to Section 8.0. Detailed design of lion dens and back-of-house areas should include appropriate sound absorptive materials, solid walls and/ or fences to act as sound barriers. An appropriate operational management plan will be introduced for lion care.	Moderate (3)	Elementary (3)	Medium (6)
Traffic	Construction	Temporary increase in construction vehicles on local roads and car parking demand.	Refer to Section 8.0. A Construction Traffic Management Plan containing a variety of traffic management measures will be prepared and implemented.	Moderate (3)	Standard (2)	Low/ Medium (5)
Traffic	Operation	Temporary increase in visitor vehicles on local roads and car parking demand.	Refer to Section 8.0. It is considered that the temporary increase can be accommodated on the local roads and within existing parking facilities.	Low (1)	Simple (1)	Low (2)
Vegetation	Construction	Removal of significant trees.	Refer to Section 8.0. Relocation of trees to alternative locations within the zoo (where viable) will be undertaken. Replacement planting will be undertaken to offset the loss of significant trees and vegetation.	Moderate (6)	Elementary (3)	Medium (6)
Biodiversity	Construction	Vegetation and tree removal	Refer to Section 8.0. Vegetation and tree removal will occur in accordance with a Tree Removal Plan and replacement planting will occur.	Moderate (6)	Elementary (3)	Medium (6)
Biodiversity	Construction	Preservation of vegetation retained	Refer to Section 8.0. A Tree Protection Plan will be implemented. Construction mitigation measures relating to works within the TPZ and stockpiling around existing native vegetation will be implemented	Minor (2)	Standard (2)	Low/ Medium (4)
Biodiversity	Construction	Removal of fauna	Refer to Section 8.0. A pre-clearing ecological assessment will be undertaken and all fauna will be captured and relocated if displaced from the works.	Minor (2)	Standard (2)	Low/ Medium (4)
Biodiversity	Operation	Predation by captive fauna	Refer to Section 8.0. Relocation of native flora from exhibit areas prior to occupation by captive fauna e.g. lions.	Low (1)	Standard (2)	Low (3)
Bushfire	Operation	Access and safety during bushfire events.	Refer to Section 8.0. It is considered the potential for bushfire within the site is low.	Minor (2)	Standard (2)	Low/ Medium (4)
Landscape character/ visual impact	Construction	Removal and introduction of elements within the visual landscape.	Refer to Section 8.0. The proposal will result in a modified visual landscape.	Moderate (3)	Elementary (3)	Medium (6)
Landscape character/ visual impact	Construction/ Operation	Modification of views from the zoo.	Refer to Section 8.0. The proposal will result in a modified visual landscape and changes to views within and from the zoo.	Moderate (3)	Elementary (3)	Medium (6)

				Risk Assessment		
Item	**Phase**	**Potential Environmental Impact**	**Proposed Mitigation Measures and / or Comment**	**Significance of Impact**	**Manageability of Impact**	**Residual Impact**
Landscape character/ visual impact	Construction / operation	Modification of views to the zoo.	Refer to Section 8.0. The proposal will result in a modified visual landscape and changes to views to the zoo.	Low (2)	Elementary (3)	Low/ Medium (5)
Stormwater and waste water management	Construction	Erosion and sediment run-off during construction.	Refer to Section 8.0. A Construction Environmental Management Plan will be prepared.	Low (1)	Standard (2)	Low (3)
Stormwater and waste water management	Operation	Discharge of waste water into Sydney Harbour.	Refer to Section 8.0. Taronga Zoo operates a Waste Treatment Plant in accordance with an EPL (No. 1677).	Low (1)	Standard (2)	Low (3)
Aboriginal Heritage and Archaeology	Construction	Impact on existing landscape elements.	Refer to Section 8.0. All efforts should be made to define specific and limited zones of impacts, to protect and avoid exiting landscape elements such as sandstone cliffs.	Low (1)	Standard (2)	Low (3)
Aboriginal Heritage and Archaeology	Construction	Unexpected heritage find during construction.	Refer to Section 8.0. Works would cease immediately.	Low (1)	Standard (2)	Low (3)
Non-Aboriginal Heritage and Archaeology	Construction	Removal of items of heritage significance.	Refer to Section 8.0. All efforts will be made to relocate items of significance (where viable) within the zoo for educational and interactive purposes. Interpretative signage and recording will be used to document items proposed to be removed.	High (4)	Elementary (3)	High/ Medium (7)
Contamination	Construction	Presence of contaminated materials.	Refer to Section 8.0.	Minor (2)	Standard (2)	Low/Medium (4)
Hazardous Materials	Construction	Exposure to asbestos containing materials.	Refer to Section 8.0. All works will be undertaken in accordance with Taronga Zoo's Asbestos Management Plan (AMP). A Safework NSW licensed asbestos removalist will be used to remove the ACM from the buildings and an Asbestos Clearance Report issued prior to demolition works.	Minor (2)	Standard (2)	Low/Medium (4)
Waste Management	Construction	Inappropriate disposal of construction waste.	Refer to Section 8.0. A Waste Management Plan (WMP) will be prepared by the Head Contractor to manage waste streams, including those identified above, during construction.	Low (1)	Standard (2)	Low (3)
Waste Management	Operation	Inappropriate disposal of exhibit waste.	Refer to Section 8.0. Exhibits will operate in accordance with TCSA's Waste Management Operation Plan.	Low (1)	Standard (2)	Low (3)
Waste Management	Operation	General site littering and inappropriate disposal of public waste.	Refer to Section 8.0. Provision of public waste and recycling bins will be placed within the exhibits in accordance with existing waste management policies.	Low (1)	Standard (2)	Low (3)
Construction Management	Construction	Cumulative construction impacts of various projects occurring simultaneously.	Refer to Section 8.0. Project construction programmes will be coordinated to minimise potential cumulative impacts.	Minor (2)	Standard (2)	Low/Medium (4)
Construction Management	Construction	Dust and particulate matter impacts on nearby sensitive receivers.	Refer to Section 8.0. A Construction Noise and Vibration Management Plan will be prepared.	Low (1)	Standard (2)	Low (3)

				Risk Assessment		
Item	**Phase**	**Potential Environmental Impact**	**Proposed Mitigation Measures and / or Comment**	**Significance of Impact**	**Manageability of Impact**	**Residual Impact**
Operational Management	Operation	Animal care and safety.	Refer to Section 8.0. TCSA will obtain relevant approvals as required under the EAPA.	Low (1)	Standard (2)	Low (3)
Operational Management	Operation	Staff and public safety.	Refer to Section 8.0. The exhibits have been designed with the required animal containment measures.	Minor (2)	Standard (2)	Low/Medium (4)

8.0 Mitigation Measures

The collective measures required to mitigate the impacts associated with the proposed works are detailed in **Table 31** below. These measures have been derived from the previous assessment in Section 5.0 and those detailed in appended consultants' reports.

Table 31 – Mitigation Measures

Impact	Environmental Safeguard	Responsibility	Timing
Noise			
The potential for exceedance of the NMLs across the proposal footprint	Prepare a construction noise and vibration management plan (CNVMP). It would be a sub-plan of the CEMP. As a minimum, the plan would: ▪ Map the sensitive receiver locations including residential properties ▪ Specific strategies for reducing construction noise including: – Quieter plant and equipment – Quieter work methods – Strategically locating equipment and plant, waste deposits, vehicle entries – Maximising shielding in the form of existing structures or temporary barriers – Respite periods – Specify the avoidance of activities that would generate impulsive noise ▪ Provide information for consultation, notification and complaints handling ▪ Ensure any potentially impacted receivers are informed ahead of any planned works taking place outside of the recommended standard hours for construction works ▪ Provide information about work scheduling ▪ Include safeguards and management measures to manage out of hours working if required ▪ Include an assessment to determine potential risk for activities likely to affect receivers, including for activities undertaken during and outside of standard working hours ▪ Include a process for assessing the performance of the implemented safeguards and management measures ▪ Specify the equipment restrictions that would be implemented at night if night works required ▪ Undertake noise monitoring and reporting throughout the construction period. *Note: The CNVMP would be routinely updated in response to any changes in noise and vibration. Tool box talks would be used to communicate constructor obligations and responsibilities under the plan.*	Construction contractor	Pre-construction
The potential for exceedance of the NMLs across the proposal footprint	▪ Selection of equipment and plant to minimise impacts. ▪ Where possible, reduce the number of noise sources/activities running simultaneously at the same location. ▪ Screen or enclose plant and equipment.	Taronga Zoo/ Construction contractors	Detailed design/ Construction

Impact	Environmental Safeguard	Responsibility	Timing
	▪ Plan truck access routes and times to minimise impacts. If truck routes are well managed it is considered that compliance at residential receivers can be achieved. ▪ Vehicle pathways around the site should be arranged to minimise the need for reversing. Where reversing is necessary, the contractor should consider whether non-tonal reversing alarms are an acceptable safety alternative to tonal "beeper" alarms. ▪ For zoo receivers, use local enclosures around generator, hammer and hand tools when within 30-40m of animal receivers. ▪ Consider quieter methods and scheduling least sensitive times for cutting/ breaking rock or masonry, compacting and for collecting and removing waste. ▪ Consider quieter methods for compacting and tipping fill. ▪ If generators are required for the site set-up, petrol generators should be used instead of diesel. ▪ The piling method needs to be selected to minimise both noise and vibration impacts and therefore bored or screw type piling methods should be implemented.		
Construction noise impacts	Working hours are to be restricted in accordance with the EPA Interim Construction Noise Guideline. Working hours are to be in accordance with: ▪ Between 7.00am and 6.00pm, Monday to Friday. ▪ Between 7.00am and 1.00pm Saturdays. ▪ No work or deliveries on Sunday and/or public holidays. If work is required to be undertaken outside normal work hours, the Contractor will need approval from the Principal. The Contractor is to provide enough information for the Principal to evaluate any potential noise impact from the proposed works.	Construction contractor	Construction
Construction noise impacts	Community and business notification would be done prior to works commencing outlining the nature of the works, work hours and contact number. Additional community and business notification would be done at least five days before works outside standard hours that has a potential to cause any noise impact.	Construction contractor / Taronga Zoo	Pre-construction/ construction
Construction noise impacts	Any required night time work predicted to exceed the noise management level should aim to not affect residences for more than two consecutive nights or where possible, more than six nights over a one month period.	Construction contractor / Taronga Zoo	Construction
Construction vibration impacts	▪ Undertake a preliminary vibration assessment. ▪ Undertake a dilapidation survey up to 50m from the work site prior to high vibration works. ▪ Undertake vibration monitoring inside the Zoo.	Construction contractor/ Taronga Zoo	Pre-construction/ construction
Night time sleep disturbance from roaring lions.	Detailed design of lion dens and back-of-house areas should include appropriate sound absorptive materials, solid walls and/ or fences	Taronga Zoo	Pre-construction

Impact	Environmental Safeguard	Responsibility	Timing
	to act as sound barriers.		
Night time sleep disturbance from roaring lions.	An appropriate operational management plan will be introduced for lion care including noise compliance monitoring.	Taronga Zoo	Operation
Traffic			
Construction traffic impacts	A construction traffic management plan (CTMP) would be prepared as a sub-plan of the CEMP. As a minimum, the plan would include the following controls: ▪ Minimise use of heavy vehicles on local roads. ▪ Restrict deliveries to outside of peak traffic periods where possible. ▪ Ensure emergency vehicle access is maintained, including consultation with ▪ Emergency services. ▪ Identify haulage routes and minimise impacts on local routes. ▪ Provide warning and advisory signage. ▪ Providing safe access points to work areas from the adjacent road network. ▪ Safety barriers where necessary. ▪ Maintaining adequate sight distance. ▪ Displaying prominent warning signage. ▪ Covering truck loads. ▪ Avoiding vehicle idling. ▪ Deliveries planned to minimise the number of trucks arriving at site at one time. ▪ Materials delivered and spoil removed from the site during standard construction hours. ▪ Use of Traffic Controllers to ensure safe vehicle and pedestrian movements for example when trucks enter or leave the site. ▪ A Driver Code of Conduct plan. Provide for local community consultation and notification of local road network and traffic impacts.	Construction contractor	Pre-construction/ Construction
Management of on-street parking demand	The following initiatives are encouraged: ▪ Promote the avoidance of on street parking with Taronga Zoo employees and contractors. ▪ Promote the use of public transport.		
Vegetation and Biodiversity			
Vegetation and Tree Removal	▪ Tree removal work shall be carried out by an experienced tree surgeon in accordance with the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998). Care shall be taken to avoid damage to other trees during the felling operation. ▪ Stumps located within the TPZs of trees to be retained shall be grubbed-out where required using a mechanical stump grinder (or by hand where less than 150mm in diameter) without damage to the root system of other trees. ▪ Where trees to be removed are within the SRZ of any trees to be retained, consideration should be given to cutting the	Taronga Zoo/ Construction Contractor	Pre-construction/ Construction

Impact	Environmental Safeguard	Responsibility	Timing
	stump close to ground level and retaining the root crown intact. ▪ Stumps within the Tree Protection Zone of other trees to be retained shall not be pulled out using excavation equipment or similar. ▪ Implement replacement planting with at a minimum the equivalent number of trees should be planted within the site. Replacement trees should preferably include some locally indigenous species. ▪ Where hollow-bearing trees are to be removal, suitable replacement hollow augmentation or next box installation will take place. A qualified Project Ecologist with experience in handling wildlife should be on site during all vegetation removal/ clearing to capture and relocate any displaced, healthy animals, or care for / rehabilitate any injured or orphaned animals.		
Preservation of trees to be retained	Prepare and implement a Tree Protection Plan (TTP) which documents proposed tree protection devices including: ▪ Tree protection fencing; ▪ Trunk Protection; ▪ Ground Protection; ▪ A list of prohibited activities within the TPZ; and Other recommended measures to ensure the protection of TPZ of trees to be retained as part of the proposal.	Taronga Zoo/ Arborist/ Construction Contractor	Detailed design/ Pre-construction/ Construction
Removal of fauna habitat	Prior to removal of man-made structures that provide suitable roosting habitat for microbats, a pre-clearing ecological assessment should be undertaken by a suitably qualified ecologist to determine the presence or suitability of the artificial habitat for roosting microbats. An ecologist should then be on site during demolition works to capture and relocate any displaced fauna including bats	Taronga Zoo/ Ecologist	Pre-construction
Predation by Captive Fauna	Prior to construction one or more qualified Ecologists with wildlife handling experience should be engaged to capture and relocate any fauna from within the area of the proposed enclosure. This will include checking of all caves, crevices, tree hollows, nests, shrubs, pipelines and culverts for fauna hiding in situ. It is also advised that up to a week of targeted fauna trapping is undertaking to capture any native fauna (e.g. possums) traversing the site of the proposed enclosure. This effort should be repeated prior to the final release of any predatory fauna within a new exhibit.	Taronga Zoo/ Ecologist	Pre-construction/ Pre-operation
Targeted survey for Southern Myotis (Myotis macropus)	Detailed surveying including Harp-trapping and acoustic detection to determine the presence of this vulnerable species within the site and potential impacts.	Taronga Zoo	Pre-construction
Noxious weeds	Implement a noxious weeds management plan with bushland restoration (weed removal) strategies.	Taronga Zoo	On-going
Bushfire Management			
Building design	Design and construction of any proposed	Taronga Zoo	Design/

Impact	Environmental Safeguard	Responsibility	Timing
	buildings to comply with the construction requirements for BAL-12.5 as per *AS 3959-2009 Construction of buildings in bushfire-prone area*.		construction
Maintenance of vegetation	Maintain access roads and tracks within the site and consider the following ongoing management of any buildings and landscaped areas: ▪ Removal of combustible material, particularly litter in gutters, near buildings. ▪ Removing excess amounts of fuel from garden areas (including organic mulch). ▪ Ensuring garden plantings do not overhang any buildings, tree canopies are discontinuous, and shrubs are not positioned within two metres of buildings.	Taronga Zoo	Operation
Bushfire Emergency Plan	Taronga Zoo operates in accordance with the TCSA Emergency Management Plan (TERP). The TERP outlines response guidelines in the event of a bushfire, including alert, evacuation and shelter procedures.	Taronga Zoo	Operation
Landscape Character and Visual Impact			
Management of the construction works to minimise their visual impacts internally and externally to the zoo	▪ Consider non-reflective materials and equipment ▪ Consider screening methods to reduce the visual impact of the work site	Taronga Zoo/ Construction contractor	Pre-construction/ Construction
Design exhibits to prevent intrusive built form	▪ Consider non-reflective materials ▪ Location of vegetation and screening	Taronga Zoo	Detailed design/ pre-construction
Light spill impacts during construction across the proposal footprint	▪ Screen, shield and cut-off all temporary site lighting to prevent light spill where possible. ▪ Use directional light sources where possible to reduce lateral light spill. ▪ Use low luminescence lighting lights where feasible to reduce the lateral light spill. ▪ Shield the top of all site lighting to prevent any upward light glare	Construction contractor	Construction
Operational light spill impacts on adjacent properties	▪ Follow the lighting design specification that aims to ensure any the height and direction of any lighting pole would not introduce sky glow or impacts on neighbouring residential properties or road users of the Great Western Highway. ▪ Use directional lighting fixtures with cut-offs and filters as required	Construction contractor/ Taronga Zoo	Detailed design/ Pre-construction
Stormwater and Waste Water Management			
General water cycle management	▪ The operational, monitoring and recording, reporting and general conditions identified within the existing EPL 1677 will continue to be implemented.	Taronga Zoo	Pre-construction/ Construction/ Operation
Sediment-laden run off and associated water quality impacts management	Prepare a Soil and Water Management Plan as part of the CEMP and address the following: ▪ The NSW Soils and Construction – Managing Urban Stormwater Volume 1 'the Blue Book' (Landcom, 2004) and Volume 2 (DECC, 2008) Detail the following as a minimum:	Construction contractor	Pre-construction/ construction

Impact	Environmental Safeguard	Responsibility	Timing
	▪ Identification of catchment and sub-catchment areas, high risk areas and sensitive areas ▪ Sizing of each of the above areas and catchment ▪ The likely volume of run-off from each road sub-catchment ▪ Direction of flow of on-site and off-site water ▪ Separation of on-site and off-site water ▪ The direction of run-off and drainage points during each stage of construction ▪ Dewatering plan which includes process for monitoring, flocculating and dewatering water from site (i.e. formation or excavations) ▪ A mapped plan identifying the above ▪ Include progressive site-specific Erosion and Sedimentation Control Plans (ESCPs). The ESCP is to be updated at least fortnightly ▪ A process to routinely monitor the Bureau of Meteorology weather forecast ▪ Preparation of a wet weather (rain event) plan which includes a process for monitoring potential wet weather and identification of controls to be implemented in the event of wet weather. These controls are to be shown on the ESCPs ▪ Provision of an inspection and maintenance schedule for ongoing maintenance of temporary and permanent erosion and sedimentation controls.		
On-site sediment and waste laden run off and associated water quality impacts during construction	▪ Erosion and sediment control measures would be implemented to ensure no sediment leaves the site. ▪ All waste materials (such as demolition materials) would be contained to prevent possible run off prior to removal from the site.	Construction contractor	Construction
Erosion risk	▪ Disturbed surfaces would be reinstated as soon as possible. ▪ Erosion and sedimentation control measures would not be removed until disturbed areas have stabilised. ▪ Any damage from construction to the ground surface shall be restored to pre-construction condition on completion of works.	Construction contractor	Construction
Ecologically Sustainable Development			
Energy efficiency measures during operation	▪ Implement solar thermal energy collection measures ▪ Implement LED lighting fixtures ▪ Implement automated controls and metering ▪ Utilise energy saving furniture, fixtures and equipment ▪ Investigate opportunities for alternate energy provision after an initial review period of operation	Taronga Zoo	Operation

Impact	Environmental Safeguard	Responsibility	Timing
Building performance during operation	▪ Design for passive thermal and ventilation control ▪ Utilise building fabric and insulation to improve building performance ▪ Incorporate sustainable timbers ▪ Prepare a Section J energy efficiency assessment of the main buildings during the detailed design stage to determine possible energy saving measures	Taronga Zoo	Detailed design
Water usage	▪ Implement water efficient fittings and fixtures into building design ▪ Capture rainwater runoff and direct to existing stormwater and re-use plant	Taronga Zoo	Detailed design/ operation
Transport during operation	▪ Promote the use of public transport for patrons and staff	Taronga Zoo	Operation
Aboriginal Heritage and Archaeology			
Construction induction training to cover all works across the site	▪ Briefing site contractors about the nature of archaeological sites and issues of potential sensitivity when sandstone surfaces previously obscured by vegetation for example are to be exposed.	Construction contractor	Construction
Limit areas of excavation	▪ All efforts should be made to define *specific* and *limited* zones of impact within the study area where excavation is used only where crucial to design, and should be strictly adhered to throughout the course of future construction periods to limit impacts to existing vegetation and landforms.	Construction contractor	Construction
Avoidance and protection of sandstone elements	▪ Avoidance and protection during future construction of the main sandstone elements on the site, and careful hand clearance of vegetation and rock where required.	Construction contractor	Construction
Unexpected finds discovery across the site	In the (largely) unexpected circumstance that any Aboriginal objects are unearthed during construction of the proposal, it is recommended that: ▪ Activities should immediately cease within the vicinity of the find locality; ▪ Activities be relocated to other areas of the subject site (allowing for a curtilage of at least 50m); ▪ The Office of Environment and Heritage be contacted to advise on the appropriate course of action to allow the MLALC to record and collect the identified item(s).	Construction contractor	Construction
Human remains discovery across the site	▪ Handle human remains under the same process as an unexpected finds discovery; however, prior to the archaeologist recording the find contact the NSW Police, the OEH environment line and the OEH anthropologist.	Construction contractor	Construction
European Heritage and Archaeology			
General	▪ Implement recommendations of Heritage Impact Assessment as required.	Construction contractor	Pre-construction
Archival Recording	▪ Undertake full measured drawing and photographic archival recording of items proposed to be removed.	Taronga Zoo	Pre-construction

Impact	Environmental Safeguard	Responsibility	Timing
Relocated Items	▪ Ensure location of relocated and reused heritage items are appropriate in size, geometry and condition to support the ongoing heritage significance of these items.	Taronga Zoo	Pre-construction Construction
Interpretation	▪ Include items of heritage significance within ongoing interpretation and education strategy for the zoo to enable visitors to understand these retained components and elements of zoo history.	Taronga Zoo	Pre-construction
Heritage induction training to cover all works across the site	▪ Provide non-Aboriginal heritage awareness training to the construction workforce prior to starting on site which would include: – the location of heritage items outside the study area, including the extant gate entrance for the former OTC transmission station – guidelines to follow if unanticipated heritage items or deposits are located during works – the procedure for managing any unexpected find, discovering human remains, or unearthing other archaeological remains. ▪ Provide the non-Aboriginal heritage awareness training to any person or visitor to the site during construction	Construction contractor	Construction
Unexpected finds discovery across the site	▪ If unexpected archaeological finds are discovered during the proposed works, immediately cease all works within 10 metres of discovering an unexpected find (e.g. archaeological remains, heritage item, and potential relic). ▪ Engage a heritage consultant to assess the find and the NSW Heritage Division would be notified of the discovery of a relic in accordance with Section 146 of the NSW *Heritage Act 1977*	Construction contractor	Construction
Human remains discovery across the site	▪ Handle human remains under the same process as an unexpected finds discovery; however, prior to the archaeologist recording the find contact the NSW Police, the OEH environment line and the OEH anthropologist.	Construction contractor	Construction
Waste Management			
Waste generation during construction	▪ Classify, handle and store all removed waste in the construction compounds/laydown areas in accordance with the NSW Waste Classification Guidelines 2009: Part 1 Classifying Waste (DECCW) and Storing and Handling liquids, Environmental Protection (DECC, 2007).	Construction contractor	Construction/ operation
Waste and resource management during construction across the proposal	▪ Prepare a waste and resource management plan (WRMP) as a sub-plan of the CEMP. As a minimum describe the measures for handling, storing and classifying waste when 'onsite' and its subsequent disposal offsite to the relevant licenced facility.	Construction contractor	Construction/ operation
Waste disposal during construction across the	▪ Send all disposed materials to a suitably licenced waste management/landfill	Construction	Construction/

Impact	Environmental Safeguard	Responsibility	Timing
proposal	facility.	contractor	operation
Waste handling and storage during construction across the proposal	▪ Store and segregate all waste at source (e.g. the construction compounds/laydown areas) in accordance with its classification. This includes recycled and reusable materials.	Construction contractor	Construction/ operation
Littering and site tidiness during construction and operation	▪ Monitor for waste accumulation, littering and general tidiness to ensure operating standards of the zoo are maintained.	Taronga Zoo/ Construction contractor	Construction/ operation
Resource recovery during construction across the proposal	Apply resource recovery principles: ▪ Reuse proposal-generated waste materials onsite (e.g. topsoil, recycled aggregate) providing it meets with exemption and classification requirements ▪ Failing that, transfer the materials for use elsewhere on another site under a resource recovery exemption ▪ Employ waste segregation to allow paper, plastic, glass, metal and other material recycling. These materials could be either reused onsite or transferred to a recycling facility ▪ Consider composting general putrescible waste to allow recovery. Transfer these materials offsite to a composting facility.	Construction contractor	Construction/ operation
Reducing primary resource demand during construction across the proposal	▪ Use recycled and low embodied energy products to reduce primary resource demand in instances where the materials are cost and performance competitive (e.g. where quality control specifications allow).	Construction contractor	Construction/ operation
Waste disposal in landfill	Implement targets for reduction and diversion following an initial waste audit of the exhibits once operational. Taronga employees are to be allocated responsibility for regular monitoring of the content of waste and recyclable materials being placed in bins. This will assist with target and KPI management and minimise the potential for contamination and inappropriate disposal activities. ▪ Based on the collected data reduced waste to landfill targets will be further reviewed every twelve-month period.	Taronga Zoo	Operation
Waste disposal in landfill	▪ The service provider must if available and if it is financially viable propose lawful disposal alternatives that will offer additional diversion opportunities of waste materials to either re-use, processing and/or recycling.	Waste Contractor	Operation

9.0 Justification of the Proposal

In general, investment in major projects can only be justified if the benefits of doing so exceed the costs. Such an assessment must consider all costs and benefits, and not simply those that can be easily quantified. As a result, the EP&A Act specifies that such a justification must be made having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development.

This means that the decision on whether a project can proceed or not needs to be made in the full knowledge of its effects, both positive and negative, whether those impacts can be quantified or not.

The proposed development involves the redevelopment of existing zoo facilities, for an African Savannah and Congo Forest exhibits. The assessment must therefore focus on the identification and appraisal of the effects of the proposed change over the site's existing condition.

Various components of the biophysical, social and economic environments have been examined in this EIS and are summarised below.

9.1 Social and Economic

Taronga Zoo is one of Australia's most popular attractions and together with the Taronga Western Plains Zoo attracts more than 1.5 million visitors annually (2014-2015). The proposed redevelopment of existing zoo exhibits will have many positive socio-economic impacts. Notably the proposal will:

- Facilitate the ongoing commercial operation of Taronga Zoo contributing to the NSW economy;
- Contribute to promoting Taronga Zoo as a vibrant tourist destination in Sydney, specifically the return of lions to the zoo;
- Facilitate education and immersion experiences currently offered by the zoo;
- Continue the promotion of public transport as the primary mode of travel to and from the zoo contributing further to the economy; and
- Generate approximately 375 construction jobs over the life time of the project.

9.2 Biophysical

This assessment has found that while there may be minor to moderate impacts as a result of the proposal, the impacts are not considered to be of sufficient significance, either in nature or extent to be regarded as unacceptable. On balance, the beneficial outcomes of the continued operation of Taronga Zoo with world-class facilities and visitor experience offerings substantially outweigh any negative impacts that may arise. Mitigation and management measures outlined in **Section 8.0** and appended technical reports will further ameliorate and minimise any potential impacts.

Furthermore, the proposal is unlikely to affect threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required. The proposal will not affect Commonwealth land, or have a significant impact on any matters of national environmental significance and therefore a referral to the Australian Minister for Environment is not required.

9.3 Ecologically Sustainable Development

The EP&A Regulation lists 4 principles of ecologically sustainable development to be considered in assessing a project. They are:

- The precautionary principle;

- Intergenerational equity;
- Conservation of biological diversity and ecological integrity; and
- Improved valuation and pricing of environmental resources.

An analysis of these principles follows.

Precautionary Principle

The precautionary principle is utilised when uncertainty exists about potential environmental impacts. It provides that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. The precautionary principle requires careful evaluation of potential environmental impacts in order to avoid, wherever practicable, serious or irreversible damage to the environment.

This EIS has not identified any serious threat of irreversible damage to the environment and therefore the precautionary principle is not relevant to the proposal.

Intergenerational Equity

Inter-generational equity is concerned with ensuring that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. The proposal has been designed to benefit both the existing and future generations by:

- maintaining heritage listed items for future generations to appreciate and enjoy;
- implementing safeguards and management measures to protect environmental values; and
- Improving the public domain and amenity in The Haymarket precinct.

The proposal has integrated short and long-term social, financial and environmental considerations so that any foreseeable impacts are not left to be addressed by future generations. Issues with potential long-term implications such as waste disposal would be avoided and/or minimised through construction planning and the application of safeguards and management measures described in this EIS and the appended technical reports.

Conservation of biological diversity and ecological integrity

The principle of biological diversity upholds that the conservation of biological diversity and ecological integrity should be a fundamental consideration.

The proposal would not have any significant effect on the biological diversity and ecological integrity of the site. The proposed safeguards and mitigation measures prepared as part of this EIS and appended technical reports provide for management of the identified potential impacts.

Improved valuation, pricing and incentive mechanisms

The principles of improved valuation and pricing of environmental resources requires consideration of all environmental resources which may be affected by a proposal, including air, water, land and living things. Mitigation measures for avoiding, reusing, recycling and managing waste during construction and operation would be implemented to ensure resources are used responsibly in the first instance.

Additional measures will be implemented to ensure no environmental resources in the locality are adversely impacted during the construction or operational phases.

10.0 Conclusion

The Environmental Impact Statement (EIS) has been prepared to consider the environmental, social and economic impacts of the proposed African Savannah and Congo Forest exhibits within Taronga Zoo, Sydney. The EIS has addressed the issues outlined in the Secretary's Environmental Assessment Requirements (**Appendix B**) and accords with Schedule 2 of the EP&A Regulation as required for the submission of this SSD application.

Having regards to biophysical, economic and social considerations, including the principles of ecologically sustainable development, the carrying out of the project is justified for the following reasons:

- The proposed exhibits will replace exhibits which no longer meet best practice regarding animal conditions, access and circulation and visitor experience;
- The proposed works will resolve current maintenance, access, fire safety, Building Code of Australia (BCA), and Workplace Health and Safety (WH&S) issues that are required to be resolved for both animals and staff;
- The proposed purpose-built facilities will provide modern enclosures, which allow for functional, best-practice and safer day-to-day operations and management;
- The exhibits will maintain high standards of animal welfare as required under the EAP Act and participate within existing conservation programs to ensure the intergenerational wellbeing of native and exotic flora and fauna species;
- The proposal will facilitate education and immersion experiences currently offered by the zoo;
- The proposals design and construction seeks to protect, retain or incorporate items of heritage and cultural significance;
- The proposal will capitalise on existing topography and landscape features maximising and protecting iconic views and vistas without substantially impacting on viewings from Sydney Harbour towards the zoo;
- The proposal will facilitate the ongoing commercial operation of Taronga Zoo contributing to the NSW economy; and
- The proposal will contribute to promoting Taronga Zoo as a vibrant tourist destination in Sydney, specifically the return of lions to the zoo.

Given the merits described above it is requested that the application be approved.