



Taronga Wildlife Hospital, Sydney

16/08/2022

## Environmentally Sustainable Design Strategy LCI

Prepared for

Taronga Conservation Society Australia

B

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## Revision Information

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<b>Title</b>	Environmentally Sustainable Design Strategy
<b>Client</b>	Taronga Conservation Society Australia
<b>Prepared By</b>	Garry Luu

## Revision Schedule

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## 1 Introduction

This Report has been prepared by LCI for the Taronga Conservation Society Australia (Taronga). This Report provides an overview of the Ecological Sustainable Design (ESD) initiatives considered for The Wildlife Hospital (TWH), Sydney, and to address the Requirement 9 (Ecologically Sustainable Development (ESD) and Climate Change) of the Secretary's Environmental Assessment Requirements (SEARs). This report focuses on the ESD initiatives proposed for the Wildlife Hospital. This report will be included within the Environmental Impact Statement (EIS) that will accompany a State Significant Development Application (SSDA).

Taronga is proposing to construct a new Wildlife Hospital and Nutrition Centre to enable Taronga to respond to an emerging wildlife crisis and provide new educational wildlife experiences to Taronga Zoo's guests and students. This centre will replace existing facilities.



Figure 1: Regional Context (source: Urbis)

## 2 Site Description

Taronga Zoo is located at Bradleys Head Road, Mosman and is situated in the Mosman Local Government area (LGA). The site is bounded 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. Taronga Zoo is legally described as Lot 22 on DP843294 and is Crown Land managed by Taronga (the Zoological Park Board).



### 3 Overview of Proposed Development

Taronga is the leading provider of veterinary services to the zoo's resident animals, wildlife rescue and rehabilitation in NSW. With the Taronga Zoo caring for over 1500 sick, injured and orphaned native animals each year. During the 2020 bushfires, the Wildlife Hospitals played a leading role in both the immediate rescue of wildlife and the rehabilitation of injured animals.

The proposed Taronga Wildlife Hospital (TWH) leverages from this expertise to deliver better outcomes and to train the next generation of wildlife vets and vet nurses. The TWH will support the health and wellbeing of wildlife, and Taronga Zoo's animals, through the provision of upgraded veterinary services and facilities. The proposed development will replace the existing Wildlife Hospital providing a new state of the art treatment and teaching animal hospital. The facility will provide dedicated and purpose built spaces for the husbandry, treatment, diagnostics and education specifically related to the care of wildlife. The spaces include rehabilitation facilities (including wildlife intensive care and Marine turtle facilities), surgeries, necropsy room/s, pathology labs, medical equipment and supplies storage, medical equipment and quarantine facilities to replace existing facilities on site.

The TWH will include upgraded animal quarantine facilities to assist in the management of Taronga Zoo's animals and to support the conservation partnerships and animal management with other zoos. The new TWH will also include upgraded clinical diagnostic facilities that will assist in the forensic activities of the Taronga's clinical team and the Australian Registry of Wildlife Health. The new facilities will ensure the safety and welfare of wildlife in care but also for Taronga's staff. The TWH will strengthen Taronga's existing educational facilities by offering learning and training spaces that will enable training specific to veterinary treatment and wildlife care.

The TWH will be located in the heart of the zoo, to become part of every zoo guests experience. The TWH will be positioned at a strategic location to allow access by all guests to experience and engage with the day to day activities that occur within the Hospital. General guests will not access inside the TWH but be able to view into Marine Rescue, Animal Treatment and Diagnostic spaces, as well as Clinical Pathology and Nutrition Spaces. The public area will create a sheltered plaza that enables guests to watch Taronga's medical team at work. Back of house access to the TWH will only be accessible to staff and escorted visitors, and is accessed via the existing zoo roadway network.

The TWH will replace existing veterinary facilities that have exceeded their lifecycle, and enhance the operations of Taronga's veterinary services as well as contribute to the ongoing education and advocacy for Wildlife Conservation.



Figure 2: Concept Site Plan (source: DwP)



## 4 Assessment Requirements and Project Responses

### 4.1 SEARs

The Department of Planning and Environment have issued Secretary’s Environmental Assessment Requirements (SEARs) to the applicant for the preparation of an Environmental Impact Statement for the proposed development. This report has been prepared having regard to the SEARs as follows:

SEAR 7   Ecologically Sustainable Development (ESD) and climate change	Report Reference
Identify how ESD principles (as defined in clause 7(4) of Schedule 2 of the Regulation) will be incorporated into the design, construction and ongoing operation of the proposed development.	<p><b>See Section 5.0</b> regarding Clause 7(4) of the Schedule 2.</p> <p><b>See Section 6.0</b> for the Sustainability strategies considered in the project.</p> <p><b>See Section 7.0</b> for Design for Resilience to Climate Change.</p>
Demonstrate how future buildings will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	<p><b>See Section 5.3</b> for details regarding designing and constructing to achieve recognised building sustainability and environmental performance standards.</p> <p><b>See Section 6.0</b> for the Sustainability strategies considered in the project.</p>
Demonstrate how the development minimises greenhouse gas emissions (reflecting the Government’s goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	<p><b>See Section 6.3</b> for details regarding demand side operational energy reductions. The project will also be designed to be fully electric (no fossil fuels will be burned onsite) allowing for the building to achieve Net Zero Emissions in operation if supplied with 100% renewable energy.</p> <p><b>See Section 6.5</b> for potable water conservation strategies.</p> <p><b>See Section 6.7</b> for water sensitive urban design strategies.</p>

## 5 SEAR 7 | Ecologically Sustainable Development (ESD) and Climate Change

### 5.1 Clause 7(4) of Schedule 2

The ESD principles that are to be incorporated into the proposed development must be aligned with Clause 7(4) – Schedule 2 – Environmental Planning & Assessment Regulation (2000).

#### 5.1.1 The Precautionary Principle

The proposed Wildlife Hospital will be constructed on a previously developed site, consisting of existing animal exhibits, supporting buildings and hardscaping. This will not have an adverse environmental impact and therefore alleviates concern of serious or irreversible environmental damage. Proactive measures to prevent environmental degradation have been included within the design, construction and operational phases of the proposed development. During the design and construction phases the main contractor will implement an Environmental Management System that follows NSW Environmental Management System Guidelines. Taronga has several



ambitious sustainability targets that will drive efficient operation of the building, as well as and Environmental Protection Licence which ensures environmental risks are actively managed across the site.

### 5.1.2 Inter-Generational Equity

To uphold inter-generational equity, the proposed development minimises the consumption of energy and water resources while reducing waste.

The ESD principles incorporated into the proposed Wildlife Hospital facilitates the conservation of energy and water resources through energy and water efficiency measures. Energy reduction has been considered in the design of the building, through passive and active measures. The reduction in water use has been considered through high WELS equivalent water fixtures and fittings, low water demand landscaping and use of non-potable water sources where appropriate.

Waste generated during the construction and operational phases will be diverted from landfill to be recycled. An Environmental Management System (EMS) will be utilised to throughout construction. Operational waste streams will be separated to maximise recycled waste in accordance with ongoing Taronga environmental management practices.

Reducing energy, water and waste ensures that the health, diversity and productivity of the environment is maintained for the benefit of future generations.

### 5.1.3 Conservation of Biological Diversity and Ecological Integrity

The project's ESD principles to reduce energy, water and waste consumption have an indirect impact to conserve biodiversity and ecological integrity to the surrounding area. By minimising demand on energy and water resources, the need for land-clearing and the pollution generated from new Wildlife Hospital to support the surrounding area will be minimised.

### 5.1.4 Improved Valuation

The valuation of the project's assets and services consider environmental factors through the implementation of various ESD initiatives. An Environmental Management System will be adhered to during construction to ensure that contractors are responsible for costs associated with generating excessive pollution and waste. The project team will bear the extra cost of providing recycling and landfill waste streams during construction and operational phases. This creates a system where the polluter pays and creates an incentive to reduce pollution and waste.

The design of the project will be benchmarked against National Construction Code (NCC), Taronga Environmentally Sustainable Design Checklist and Green Star rating which will provide environmental goals for the project. Project requirements stipulate design teams are contractually required to deliver targeted ESD initiatives for the project.

Furthermore, Taronga Conservation Society Australia has achieved Carbon Neutral Status under the Climate Active Certification and will continue to maintain this certification. The new Wildlife Hospital will seek to firstly reduce carbon emissions through sustainable design followed by offsetting remaining operational emissions as part of their Climate Active Certification.



## 5.2 Sustainability at Taronga

Taronga's sustainability commitment is to showcase best practice across their Zoos by embedding environmental sustainability into all aspects of the organisation. Taronga strives to lead in the areas of resource efficiency, emissions reduction, recycling, behaviour change, and socially and environmentally sustainable supply chains.

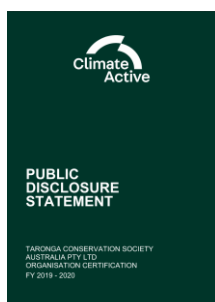
The following are several exemplary practices in Environmental Sustainability implemented at Taronga Zoo. These practices will be continued into the Wildlife Hospital.



*Taronga Conservation  
Annual Report 2019-2020*



*Taronga Conservation  
Society Strategic Report  
2019-2020*



*Taronga Conservation  
Society Climate Active /  
Carbon Neutral Certification*

### Resource Efficiency

- Behaviour Change practices
- Socially and Environmentally Sustainable Supply Chains
- Water Conservation (Wastewater treatment and reuse)

### Climate Mitigation

- Carbon Neutral in 2018 Taronga achieved Carbon Neutral status in December 2018 for both Taronga Zoo and Taronga Western Plains Zoo.
- Transition to renewable energy to power all operations.
- Resource Monitoring

### Environmental Protection License

- Pollution prevention and monitoring, and cleaner production through recycling and reuse and the implementation of best practice
- Taronga construction environmental audit checklists for contractors

### Diverting waste from Landfill

- 90% diversion from landfill (composting and litter prevention)
- Composting of food waste from public areas and kitchens, compostable packaging for use on Zoo pastures and gardens.
- Reuse of materials (End of Life Waste)

### Sustainable Procurement

- Assessing social and environmental sustainability along the supply chain, including all business units, using a Sustainable and Ethical Supply Chain framework. Alignment of Taronga's procurement processes and policies to ISO 20400 - Sustainable Procurement and meet the requirements of the Modern Slavery Act.
- Taronga is committed to sustainable purchasing and use of recycled materials, including purchasing 100% recycled paper for 95% of office paper supply at both Zoos.

### Education

- Global conservation and education
- Showcasing Environmental Sustainability (evidence-based application and communication of science to the community)

### Indigenous Reconciliation

- Reconciliation within their field; to respect, connect, consult and be led by the complex and vital knowledge(s) of First Nations Peoples
- Commitment to Country (Burbangana program)



## 5.3 Framework to Reflect Best Practice Sustainable Design Principles

### 5.3.1 Taronga Environmentally Sustainable Design Checklist

The Taronga has developed their Environmentally Sustainable Design Checklist to maximise sustainable design initiatives specific to Taronga's requirements and includes mandatory and commended measures related to the following categories.

- Water
- Energy Efficiency
- Passive Design
- Waste Management (Construction & Demolition) & Operational
- Materials
- Indoor Air Quality
- Other Considerations

The Environmentally Sustainable Design Checklist has been applied and considered in the design of the Wildlife Hospital.

### 5.3.2 Green Star Design and As-built V1.3

The Wildlife Hospital will target a 5 Star Green Star Certified Rating using the Design and As-built V1.3 rating tool in aligning with 'Australian Excellence' and targeting initiatives that exceed relevant sustainability performance standards, such as the National Construction Code 2019 Section J Energy Efficiency Provisions.

The Green Star Design and As-built rating system provides a framework to assess how a building reduces its impact on the environment while meeting the economic and social needs for its occupants and surrounding communities. Green Star's goal is to "lead the sustainable transformation of the built environment", by encouraging practices that:

- Reduce the impact of climate change.
- Enhance the health and quality of life of inhabitants and the sustainability of the built environment.
- Restore and protect the planet's biodiversity and ecosystems.
- Ensure the ongoing optimum operational performance of buildings.
- Contribute to market transformation and a sustainable economy.

The Green Star Design and As Built v1.3 rating system assessing buildings through the following categories:

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials & Construction Waste
- Land use and Ecology
- Emissions
- Innovation

Points are awarded for a building project's ability to secure as many credits as possible from each category. Each credit targets the environmental impact of a specific design feature. The total number of points awarded determines if the level of certification (star rating) as shown in 3.



Figure 3: Available Green Star Design & As Built Certification ratings

The Green Star Scorecard has been included in Appendix B for further information.

## 6 Sustainable Design Principles at the Wildlife Hospital, Sydney

The following sustainable design principles have been proposed for the Wildlife Hospital and can be addressed through the categories outlined within the Green Star Design and As Built v1.3 rating system. The following sections are structured as follows:

- 6.1 Management Practices
- 6.2 Indoor Environmental Quality
- 6.3 Energy Conservation
- 6.4 Transport
- 6.5 Water Conservation
- 6.6 Materials & Construction Waste
- 6.7 Sustainable Sites: Land use and Ecology, and Emissions

### 6.1 Management Practices

The following sustainable building design and construction management practices have been considered for the Wildlife Hospital project. These strategies seek to implement process and practices to maximise sustainable design opportunities from project design through to construction and operation.

#### Sustainable Building Design and Construction Management Practices

#### Green Star Design & As-Built v1.3 Credit

Undertake Ecological Sustainable Design (ESD) workshops to identify valuable and appropriate sustainable design initiatives for the project. Inclusion of building services design workshops and reviews with the Taronga Zoo facility management teams.

Workshops pertaining to ESD design have been undertaken to define the ESD targets for the project, opportunities, and implementation. A Climate Resilience and Adaption workshop has been undertaken to identify the climate change risks, and associated control and mitigation/management measures to be incorporated in the project.

- 1.1 Accredited Professional
- 2.1 Services Maintainability Review
- 3.0 Climate Adaptation



<b>Sustainable Building Design and Construction Management Practices</b>	<b>Green Star Design &amp; As-Built v1.3 Credit</b>
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Ongoing operational performance is vital to ensure the building operates efficiently as intended. A services maintainability review led by an Independent Commissioning Agent will be undertaken, which involves reviews of systems and their characteristics that deliver on energy and water efficiency, as well as comfort for humans and animals.

Establish environmental performance targets for energy and water conservation, and reporting and tracking of consumption. Inclusion of sub-metering and monitoring to facility tracking and monitoring of energy and water consumption.	2.0 Environmental Performance Targets  5.1 Environmental Building Performance  6.0 Metering and monitoring
- Energy/Greenhouse Gas emissions reductions have been set, with a minimum 10% reduction compared to the NCC Section J 2019 will be achieved (refer to Section 6.3 Energy Conservation/GHG Emissions Reduction for further details)	
- Water reduction measures including fixture and fittings targets and initiatives have been defined (refer to Section 6.5 Water Conservation).	

Use durable and low maintenance materials which require very little energy to maintain over their life (such as painting, cleaning etc.)	5.2 End of Life Waste Performance
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Implementation of building commissioning to ensure the building is operating efficiently as intended as per the established energy and water targets. A commissioning plan will be developed for the project by an independent commissioning agent.	2.2 Building Commissioning
Any systems, attributes and characteristics that deliver on environmental performance and/or required to address climate risks will be captured within the commissioning plan.	

Building tuning practices during the first year of operation to rectify operation and efficiency issues from the building services.	2.3 Building Tuning
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Inclusion of contractual requirements for the contractor to provide building information in the form of Operations and Maintenance (O&M) Manuals , and the development of a building logbook for ongoing maintenance of the Wildlife Hospital .	4.1 Building Operations & Maintenance Information
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Contractual requirements for the head contractor to implement an Environmental Management Plan and management system in accordance with ISO14001 and adherence to Taronga’s construction environmental audit checklists.	7.0 Responsible Construction Practices
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Inclusion of adequate waste storage facilities to allow for waste separation, and collection to be further processed at the central waste storage facility. An operational waste management plan developed by an accredited waste auditor will be developed for the project, and will include strategies to reduce operational waste, including future recommendations to further review an improve on ongoing operational waste reduction.	8.0 Operational Waste
The Wildlife Hospital includes a waste storage area that will at a minimum allow for the sorting and separation of:	
<ul style="list-style-type: none"> <li>• General waste</li> <li>• Comingled Recyclables</li> </ul>	



<b>Sustainable Building Design and Construction Management Practices</b>	<b>Green Star Design &amp; As-Built v1.3 Credit</b>
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- Compostable packaging
- Organics
- Meat/Anatomical Waste

## 6.2 Indoor Environment Quality

The following Indoor Environment quality strategies have been considered to improve occupant comfort and wellbeing. The strategies seek to address visual comfort, thermal comfort, indoor air quality and acoustic comfort.

<b>Indoor Environment Quality Strategies</b>	<b>Green Star Design &amp; As-Built v1.3 Credit</b>
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<p>Design and installation of mechanical services in line with best practice design to reduce pollutants from sources and dust/particulates during installation. The design will incorporate the following measures:</p> <ul style="list-style-type: none"> <li>• maintaining separation distances between outdoor intakes and exhausts, with distances based on classification of exhaust types.</li> <li>• Inclusion of adequate access (access panels) to coils and filters in air-conditioning equipment for ease of cleaning and maintenance.</li> <li>• Provision of increased outdoor air (when compared to Australian Standards) to appropriate spaces.</li> <li>• Exhaust of indoor pollutants through dedicated exhausts.</li> <li>• Procurement of low emitting printers and photocopiers by Taronga.</li> <li>• Development of a Construction Indoor Air Quality Management Plan by the head contractor to reduce dust/particulate build-up in ventilation elements during construction.</li> </ul>	<p>9.1 Ventilation System Attributes</p> <p>9.3 Exhaust OR Elimination of Pollutants</p>
<p>Spaces designed in accordance with best practice noise levels. The building fabric (façade and internal surfaces/partitions) will include acoustic insulation and surface treatments to control noise levels from the exterior and mechanical plant, reverberation within the spaces, and acoustic separation between relevant spaces.</p>	<p>10.1 Internal Noise Levels</p> <p>10.2 Reverberation</p> <p>10.3 Acoustic Separation</p>
<p>All lighting will achieve a minimum Colour Rendering Index of 80 for lighting, include ballasts or drivers to reduce flicker in lighting and local occupant controls</p>	<p>11.1 General Illuminance &amp; Glare Reduction</p> <p>11.3 Localised Lighting Control</p>
<p>External shading and internal blinds to assist with glare control. Views and daylight to existing tree canopies and/or the harbour through windows and façade openings.</p> <p>Existing trees east of the building have also been considered as part of the solar shading strategy and adds to views/connection to nature.</p>	<p>12.0 Glare Reduction</p> <p>12.1 Daylight</p> <p>12.2 Views</p>
<p>Specification of low VOC paints, adhesives, sealants and carpets (where appropriate). Specification of low formaldehyde engineered wood products.</p>	<p>13.1 Paints, Adhesives, Sealants &amp; Carpets</p>



Indoor Environment Quality Strategies	Green Star Design & As-Built v1.3 Credit
	13.2 Engineered Wood Products
Design of building fabric to assist with improved thermal comfort, through appropriate window to wall ratios, insulation level, window U-values and solar control performance. See Section 6.3 for further details regarding the insulation and window performance.	14.1 Thermal Comfort
Implement electrolysed water (E-water) dispenser to reduce chemical footprint (especially applicable to kitchens and food prep areas).	Green Star Innovation
Mixed mode ventilation has been proposed the level 1 staff areas. Mixed mode ventilation uses natural ventilation when external and internal conditions are favourable and supported by mechanical air-conditioning and ventilation when conditions are not suitable for natural ventilation.	Aligns with credit 9.2 Increased outdoor air.



## 6.3 Energy Conservation/GHG Emissions Reduction

The Wildlife Hospital has adopted the energy hierarchy approach in reducing energy use. The energy hierarchy approach seeks to systematically targeting building energy use through passive means first, then supported by efficient active systems and renewable energy. The strategies will also contribute towards the NSW Government Goal of Net Zero Emissions by 2050. The energy conservation strategies considered for the Wildlife Hospital are included below.

Energy Reduction Hierarchy	Energy Conservation Strategies	Green Star Design & As-Built v1.3 Credit
Demand Reduction through high performance building envelope	<p>Passive Design</p> <ul style="list-style-type: none"> <li>- Appropriate window to wall ratios to ensure a good access to views, natural daylight, whilst balancing the thermal requirement of heat loss and heat gains.</li> <li>- Appropriate thermal performance through insulation performance. The project will target the following construction R-values:                             <ul style="list-style-type: none"> <li>o Roof Construction: R3.7 K.m<sup>2</sup>/W</li> <li>o Wall Construction: R1.4 K.m<sup>2</sup>/W</li> <li>o Floor Construction: R2.0 K.m<sup>2</sup>/W</li> </ul> </li> <li>- Window U-values and Solar Heat Gain Coefficients (SHGC) have been considered for the thermal zones. Double glazed units will be installed to façades to reduce solar heat gains whilst balancing visible light transmittance, as well thermal transmittance.</li> <li>- A dynamic thermal model will be produced to demonstrate the final construction R-values (insulation performance) and Window Performance (R-values and Solar Heat Gain Coefficients (SHGC)) perform better than the baseline NCC Section J 2019 deemed to satisfy building fabric requirements.</li> </ul>	<p>15A.0 Conditional Requirement</p> <p>15A.1 Building Envelope</p> <p>15A.2 Glazing</p>
Efficient Systems and Electrical Demand Reduction	<p>Active Design</p> <ul style="list-style-type: none"> <li>- High efficiency Air-conditioning equipment such as Air Cooled 4 Pipe Heat Pump Chillers, capable of simultaneous heating and cooling equipment has been considered</li> <li>- LED lighting throughout where appropriate including programmable lighting control system (intelligent lighting)</li> <li>- High efficiency domestic hot water technology (Heat Pumps) has been considered.</li> <li>- Energy efficient lifts have been considered.</li> <li>- Appliances must be a minimum of 4 energy star rating.</li> <li>- An energy model will be undertaken for the purposes of the Green Star rating to demonstrate the percentage reduction in Greenhouse Gas emissions when compared to the baseline NCC Section J 2019 deemed to satisfy requirements. A minimum 10% reduction compared to the NCC Section J 2019 will be achieved when comparing the following end use:                             <ul style="list-style-type: none"> <li>o Cooling</li> </ul> </li> </ul>	<p>15A.3 Lighting</p> <p>15A.4 HVAC</p> <p>15A.5 Domestic Hot Water</p> <p>15A.9 Vertical Transport</p> <p>15E GHG Emission Reduction</p>



Energy Reduction Hierarchy	Energy Conservation Strategies	Green Star Design & As-Built v1.3 Credit
	<ul style="list-style-type: none"> <li>○ Heating</li> <li>○ Fans</li> <li>○ Ventilation Fans</li> <li>○ HVAC Pumps</li> <li>○ Heat Rejection</li> <li>○ Domestic Hot water and Cold-water pumps and controls</li> <li>○ Lifts</li> <li>○ Internal Lighting; and</li> <li>○ External Lighting</li> </ul>	
Onsite Generation and Renewable Energy	<ul style="list-style-type: none"> <li>- Solar Photovoltaics (Electricity) have been considered for the project. The roof has been designed to allow for integration of solar panels.</li> <li>- The location of solar panels considers the impact of overshadowing and orientation to target optimum yield of onsite energy generation.</li> </ul>	15 Greenhouse Gas Emissions reduction
Building Networks	<ul style="list-style-type: none"> <li>- Energy metering, Sub-metering of Air-conditioning, general power, lighting, domestic hot water will be considered to allow for waste energy use and peak electricity demand. Metering and monitoring do not reduce energy; however, they facilitate energy management practices.</li> <li>- Building Management System to track power and energy use for ongoing monitoring and reporting</li> </ul>	6.0 Metering and Monitoring
Offsite Renewable Energy	<ul style="list-style-type: none"> <li>- Offsite renewable energy has been considered by Taronga as an operational opportunity to further reduce Scope 2 greenhouse gas emissions. Additional Offsite renewable energy will also contribute to Taronga’s Climate Active Certification.</li> </ul>	15A.10 Off-Site Renewables
Electrification	<ul style="list-style-type: none"> <li>- No fossil fuels (gas) equipment has been incorporated in the Wildlife Hospital. Minor fossil fuel use for diesel generator backup may not be feasible to electrify. Diesel generators will be used infrequently for the purposes of backup power only.</li> <li>- Electrification has been achieved through no use of natural gas in the building. Conventional buildings typically utilise gas boilers to provide heating hot water for air-conditioning as well as domestic hot water. The Wildlife Hospital will utilise electric heat pumps in lieu of gas fired equipment for heating hot water and domestic hot water.</li> </ul>	15A.8 Fuel Switching



## 6.4 Transport

The Wildlife Hospital has limited opportunities to provide low carbon transport initiatives as it is located within the Taronga Zoo site. The Zoo can be accessed via ferry, bus and driving. The Wildlife Hospital has considered end-of-trip facilities such as showers and lockers for staff to encourage active transport commuting. Bicycle racks are provided at the entrance to the Zoo. No additional carparking will be included as part of this development which continues to support access by public transport.

## 6.5 Water Conservation

The Wildlife Hospital has adopted the water hierarchy approach in reducing potable water use. The water hierarchy is similar to the energy hierarchy, and seeks to reduce potable water demand, then supported by efficient distribution systems and recycled water / non-potable water sources. The water conservation strategies considered for the Wildlife Hospital are included below.

Water Reduction Hierarchy	Water Conservation Strategies	Green Star Design & As-Built v1.3 Credit
Demand Reduction	<ul style="list-style-type: none"> <li>- Low flow fixtures, fittings and appliances rated to the WELS standard. The project will target the following WELs rated                             <ul style="list-style-type: none"> <li>o Taps: 5 Star or higher</li> <li>o Urinals: 5 Star or higher</li> <li>o Toilet: 4 Star or higher</li> <li>o Showers: 2 Star or higher</li> <li>o Dishwasher: 5 Star or higher</li> </ul> </li> <li>- Native landscape species selection will include native endemic species that require watering for establishment, and minimal watering (other than natural rainfall). Weather and moisture sensing technology for landscape irrigation</li> <li>- The air-conditioning system will utilise air-cooled chiller which requires no water for heat rejection.</li> </ul>	18B.1 Sanitary Fixture Efficiency
Efficient distribution	<ul style="list-style-type: none"> <li>- Landscape Irrigation will consist of a low water demand system, such as drip irrigation or sub-soil drip irrigation.</li> <li>- Water metering of equipment will also be included in the design for ongoing monitoring and tracking of any wasted water/water leaks</li> </ul>	18B.4 Landscape Irrigation
Fit for purpose water sources	<ul style="list-style-type: none"> <li>- Potable water will be avoided for uses that can be substituted for non-potable water. Water from Taronga Zoo's Wastewater Treatment Plant (WWTP) will be used for landscape irrigation and toilet flushing.</li> </ul>	18B.2 Rainwater Reuse 18A Reclaimed Recycled Water (performance pathway)
Water Recycling	<ul style="list-style-type: none"> <li>- Site level treated wastewater i.e. rain water, storm water will be diverted to the Taronga Zoo Waste Water Treatment Plant. Rainwater and Stormwater is collected and treated at site level and provides recycles water to the site</li> </ul>	18B.2 Rainwater Reuse 18A Reclaimed Recycled Water (performance pathway)



Water Reduction Hierarchy	Water Conservation Strategies	Green Star Design & As-Built v1.3 Credit
Discharge to Sewer	- Reduced discharge from low flow fixtures.	18A Discharge to Sewer (performance pathway)

## 6.6 Materials & Construction Waste

The following materials and construction waste strategies have been considered for the Wildlife Hospital to increase the uptake of environmentally preferable materials with a focus on reuse and recycle content, reduced embodied energy, greater transparency, and reduction of waste to landfill.

Indoor Environment Quality Strategies	Green Star Design & As-Built v1.3 Credit
Concrete mixes with Portland cement reduction, contains at least 50% captured or reclaimed water, and aggregates Reduction through course or fine aggregates.  The project will investigate the use of low carbon concrete during construction stage.	19B.1 Concrete
Reduce reinforcing steel use, sourced from a Responsible Steel Maker, and at least 60% of all reinforcing bar and mesh is produced using energy-reducing processes (such as Polymer Injection Technology)	19B.2 Steel 20.1 Structural and Reinforcing Steel
Timber products used are certified by a forest certification scheme such as Forest Stewardship Council (FSC) certified. Use rapidly renewable materials (eg. bamboo flooring) where possible.	20.2 Timber Products
All permanent formwork, cables, pipes, flooring and blinds do not contain PVC and have an Environmental Product Declaration (EPD) OR meet Best Practice Guidelines for PVC.	20.3 Permanent Formwork, Pipes, Flooring, Blinds & Cables
Preference for products and materials with sustainability credentials such as Reused Products, Recycled Content Products, Environmental Product, Declarations, Third Party Certifications (such as GECA) and Stewardship Programs.	21.1 Product Transparency
Commit to at least 90% of the waste generated during construction and demolition to be diverted from landfill for recycling. This includes re-use of onsite spoil where appropriate, or back fill aggregate with clean recycled content (e.g. Construction Demolition waste aggregate).	22.1 Demolition and Construction Waste
Minimise on site cutting noise and waste, standard size materials or prefabricated materials used, or materials cut to size at supplier's premises.	Not addressed in Green Star
Materials are sourced locally where possible to reduce emissions associated with transportation.	19A life Cycle Impacts



## 6.7 Sustainable Sites: Land use and Ecology, and Emissions

The following sustainable site strategies have been considered to:

- Reduce the negative impacts on sites as a result of construction and development and enhancing the local ecology.
- Reduce the negative impacts associated with buildings, such as refrigerant leaks, storm water peak discharge and pollution and light pollution disturbing native animals which is extremely important in context of Taronga Zoo.

Sustainable Site Strategies	Green Star Design & As-Built v1.3 Credit
Pavement surfaces are to be directed into adjacent garden areas to enable percolation and infiltration of rainwater into soft landscape. A vegetated swale is also provided along the base of the existing rock cutting (building east façade) to entrain and filter water both from side passage pavements and flows off the retained bushland area. High flow events will be captured for re-use with Taronga Zoo's stormwater wastewater treatment plant.	26.1 Peak Discharge 26.2 Stormwater Pollution Targets 18B.4 Landscape Irrigation 25.1 Heat Island effect
Native landscape species selection will include native endemic species that require watering for establishment.	23. Ecological Value
No critically endangered, endangered, vulnerable species or ecological communities were present on the site at the time of purchase.	23.0 Endangered, Threatened or Vulnerable Species
The site does not include old growth forest or wetland of 'High National Importance', or did not impact on 'Matters of National Significance'	24.0 Conditional Requirement
Site contamination is identified with remedial steps undertaken to decontaminate site prior to construction.	24.2 Contamination and Hazardous Materials
Consideration of site surface treatments to reduce heat island effect, such as vegetation and light-coloured roofs to reflect solar radiation. The roof colour will incorporate a light colour such as Colourbond Surfemist which has a high Solar Reflectance Index (SRI).	25.1 Heat Island effect
Achieve a reduction in peak sewer discharge comparing pre-development to post-development discharge. Achieve a reduction in pollution levels.	26.1 Peak Discharge 26.2 Stormwater Pollution Targets
All outdoor lighting to comply with AS4282:1997 to reduce light pollution, downlighting for external light fixtures including external pathway.	27.0 Light Pollution Neighbouring Properties 27.1 Light Pollution Night Sky
Zero ozone depletion potential (ODP) and Low Global Warming Potential (GWP) refrigerant will be considered for all refrigerant based systems where available.	29.1 Refrigerants
Glycol Refrigerant (Zero ODP and Low GWP) has also been considered for animal feed and process cooling equipment. Glycol has been considered as a	



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**Sustainable Site Strategies**

**Green Star Design & As-Built  
v1.3 Credit**

means of heat exchange reticulation between refrigeration compressors and cool room evaporators.

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Minimise on site cutting noise and waste, standard size materials or prefabricated materials used, or materials cut to size at supplier's premises.

Not addressed in Green Star

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## 7 Design for Resilience to Climate Change

The Wildlife Hospital will be designed to future-proof itself from the potential impacts of climate change. A climate adaptation and resilience workshop has been proposed to address climate risks posed to the project.

### NARCLiM Climate Change Projections

The NSW Office of Heritage and Environment, now part of the NSW Department of Planning, Industry and Environment, has developed the NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections to provide a dataset for detailed near future (2020-2039) and far future (2060-2079) projections. Generally, it determines that there will be:

1. more hot days and fewer cold nights;
2. an increase the number of heatwave events;
3. more hot days above 35°C; particularly in Spring and Summer;
4. an increase in rainfall in Summer and Autumn and a decrease in Winter and Spring; and
5. a change in rainfall patterns that will affect drought and flooding events.

### CSIRO Climate Future Projections

In addition, the Intergovernmental Panel on Climate Change (IPCC) published four greenhouse gas (GHG) concentration trajectories known as Representative Concentration Pathways (RCPs) which are used by CSIRO for climate projection modelling at a regional scale within Australia. The four RCPs and its definitions include:

- **RCP 2.6** – Emissions peak 2010-2010, decline substantially – 1.0°C of Global Warming Mean and likely temperature range of 0.3°C – 1.7°C
- **RCP 4.5** – Emissions peak around 2040, then decline – 1.8°C of Global Warming Mean and likely temperature range of 1.1°C – 2.6°C
- **RCP 6.0** – Emissions peak around 2060, then decline – 2.2°C of Global Warming Mean and likely temperature range of 1.4°C – 3.1°C
- **RCP 8.5** – Emissions continue to rise throughout the 21<sup>st</sup> century – 3.7°C of Global Warming Mean and likely temperature range of 2.6°C – 4.8°C

The series of climate futures matrices representing the combination of time periods and greenhouse gas scenarios and classified by the combined changes of the climate variables identified above are provided in Table 1.

Table 1. Climate futures matrices for RCP 4.5 and RCP 8.5 at East Coast

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Source: CSIRO and Bureau of Meteorology, Climate Change in Australia website (<http://www.climatechangeinaustralia.gov.au>)

These projections will have an impact on operational costs and occupancy comfort and safety. Hotter days with more heatwaves will particularly affect staff, visitors and wildlife and the operation of building services equipment. This will also require higher capacity and operational costs for mechanical services to maintain occupancy comfort. Increased drought events will require provisions to supplement shortages in potable water. Stronger and reinforced façade components will be required to withstand increased rainfall and wind gust events.

## 7.1 Climate Change Risk Workshop

A Climate Change Risk Workshop was held on 7/10/2021 by LCI in which the objective was to analyse the current and future climate risks to the Nutrition Centre and Wildlife Hospital. Climate risks were identified during the workshop, as well as any current controls and future management or mitigation strategies to be further investigated.

The risks identified from the series of workshops are summarised in Appendix A.



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## 8 Appendix A – Climate Change Risk Register



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## 9 Appendix B – Green Star Scorecard