APPENDIX D

ESD Report

CUNDALL

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The Northern Beaches Hospital (Stage 2)

Environmental Impact Statement
Appendix D – ESD Report

Prepared for

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Revision	Description	Date
SN	Final Draft	07/10/2014

The success and realisation of the proposed initiatives will be dependent upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved. The use of computer simulation is by its nature predictive with output based on historic weather data and standard assumptions. The results of any computer simulations within this report do not guarantee future performance.

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Executive Summary

Healthscope and Thiess, are part of a consortium to deliver The Northern Beaches Hospital (NBH) located in Frenchs Forest.

The development comprises the project site area of 6.3ha bounded by the following roads:

- Warringah Road
- Wakehurst Parkway
- Frenchs Forest Rd West

Stage 2 scope relates to the following:

- Bulk excavation works
- Construction of an nine storey Hospital building
- Staff, patient and visitor car parking, including construction of an eight storey multi-deck Car Park
- Site works including internal roads, pathways and landscaping
- Utility amplification works

This report provides information to support the ***Environmental Impact Statement*** as necessary to respond to the Director General's Environmental Assessment Requirements (DGRs), which requires detail on how the development will incorporate ESD principles.

The Northern Beaches Hospital (NBH) (Stage 2) addresses the requirement for incorporating ESD with an underlying goal to achieve a holistic environmental design response for the project that finds a balance between the following key criteria:

- cost — capital, maintenance, energy life cycle and related building costs
- flexibility — operational, layout / load adaptability and future expansion
- reliability — ease of maintenance, resilience and use of proven technology
- environmental — CO_2 emissions, occupancy comfort and user controls
- operation — security, user interaction, training and education
- health benefits — daylight, thermal / visual comfort, air quality and noise

The decision making process on the sustainable and environmental initiatives adopted has been an integrated one that has considered all of the ESD influences as they impact on one another and to resolve the conflicts in an optimal fashion. This approach is often referred to as holistic design and looks at the entire site as a whole from its initial conception, design documentation, construction, delivery and importantly its operation.

This approach is crucial to delivering sustainable building and infrastructure projects. Through this proactive and mutually respectful approach, the NBH (Stage 2) project will attain a balanced outcome for the development in respect to:

- cost effectiveness
- practicality
- energy efficiency
- climatically responsive
- local benefits
- low environmental impact
- indoor environmental quality
- healing environment.

Environmental benchmarking

A ***4-Star*** or '***Best Practice***' formal Design and As-Built rating against the Green Building Council of Australia's (GBCA) Green Star – Healthcare (v1) rating tool will be achieved by the proposed design.

The 4-Star rating will be achieved through a holistic, integrated and whole-of-life targeting of credits within the environmental categories as outlined in the Green Star tool:

- *Management*
- *Indoor Environmental Quality (IEQ)*
- *Energy*
- *Transport*
- *Water*
- *Materials*
- *Ecology*
- *Emissions*
- *Innovation*

1. Ecologically Sustainable Development (ESD)

As part of the Director General's Environmental Assessment Requirements (DGRs) there is a need to demonstrate how the development has addressed the issue of Ecologically Sustainable Development (ESD) in developing the Design Proposal for the Northern Beaches Hospital (NBH) (Stage 2) development.

1.1 Approach

The underlying goal for this project has been to achieve a holistic design response for the precinct that finds a balance between the following key categories:

- cost — capital, maintenance, energy life cycle and related building costs
- flexibility — operational, layout / load adaptability and future expansion
- reliability — ease of maintenance, resilience and use of proven technology
- environmental — CO_2 emissions, occupancy comfort and user controls
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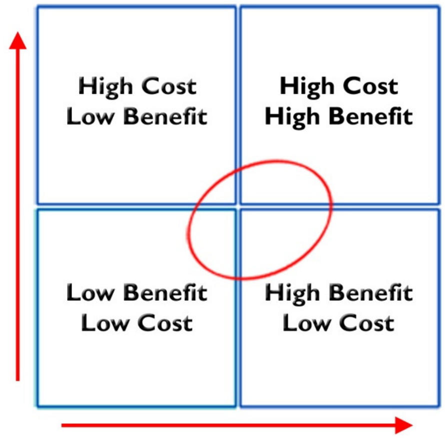
The decision making process on the sustainable and environmental initiatives adopted has been an integrated one that has considered all of the ESD influences as they impact one another to resolve them in an optimal fashion. This approach is often referred to as holistic design and looks at the entire precinct as a whole from its initial conception, design documentation, construction, delivery and importantly its operation.

Property lifecycle approach

This approach is crucial to delivering sustainable building and infrastructure projects. Through this proactive and mutually respectful approach, the RFP Design Proposal has attained a balanced outcome for the precinct in respect to:

- cost effectiveness
- practicality
- energy efficiency
- climatically responsive
- local benefits
- low environmental impact
- indoor environmental quality
- healing environment.

Environmental design and sustainability initiatives are usually able to be categorised into one of the quadrants identified in the figure below, with benefits being financial and quantitative or subjective.



ESD opportunity assessment matrix

For example, day lighting, comfort and water conservation cut across multiple disciplines. Daylighting in particular affects virtually every discipline including:

- architecture — building envelope (i.e. glazing extent/ properties & solar shading), facade orientation and interior finishes (i.e. colours & reflectivity)
- mechanical — reduced internal heat loads and modified fabric loads
- electrical — lighting design and lighting controls
- structural — floor-to-ceiling heights and external shading
- facility management — monitoring and management of lighting use
- security — daylight glare
- maintenance — cleaning of windows and skylights
- operation — improved healing / reduced stay.

The proponent will commit to a wide range of additional environmental initiatives and outcomes, with the following being particularly worthy of note:

- climatically responsive design response for the buildings in respect to their built form, siting and solar shading and comfort control, including a high performance façade.
- adoption of a 'Right Sizing' approach to the design of the mechanical engineering services. By adopting this approach to the design of the mechanical engineering services it will reduce unnecessary higher energy consumption, operational energy costs and potentially reduced occupant comfort, as well as assist with managing the capital cost of systems.
- strong emphasis on energy efficiency, in particularly in part load of all mechanical engineering services, including inclusion of economy cycle on air handling units (AHUs); general use of variable speed drive (VSD) controllers; use of duct velocities to maximise fan performance sensitive location of outside air intakes and night time purge.
- high quality highly energy efficient lighting solution using LED and fluorescent lamps, to achieve a balance between patient comfort, creating a healing environment and whole-of-life (WoL) cost.
- general use of water efficient fixtures & fittings and on-site collection & re-use of rainwater for irrigation.

- an intelligent control system linked to motions sensors, local light switches and dimmers to provide excellent control for functions such as night lighting, as well as moderation during times where adequate daylight is present.
- integration of a 500 kW co-generation plant to the carbon intensity of the electrical supply.
- commitment to maximise recycling / re-use of construction waste to avoid waste to landfill, as well as provisions for effective recycling of operational waste.
- selection and use of low off-gassing materials, paints, sealants & adhesives to improve indoor environmental quality.
- international best practice approach to commissioning and commitment to building tuning.

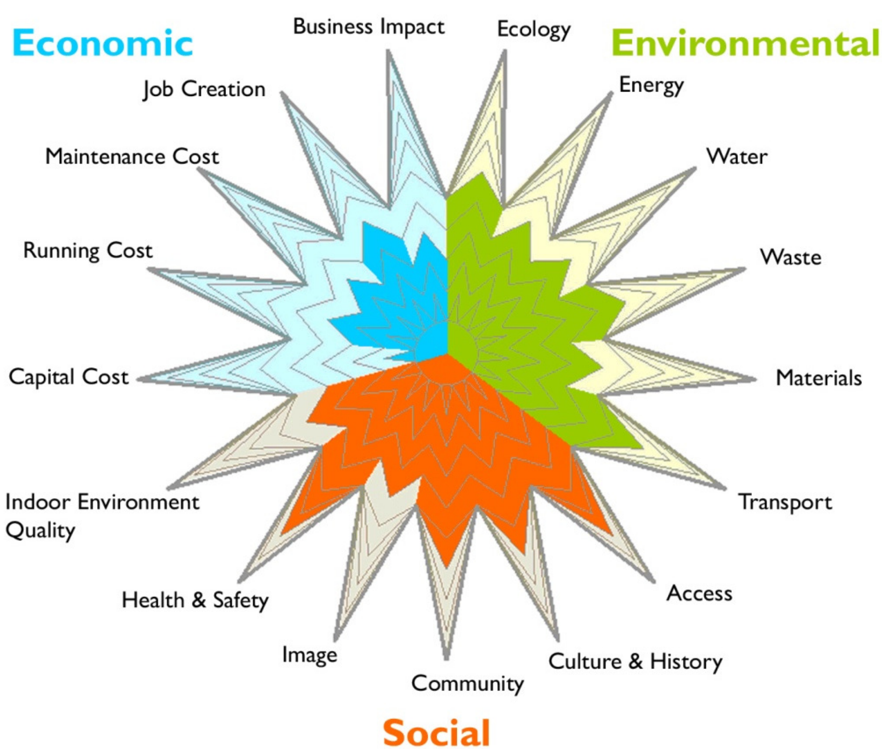
1.2 Integrated design approach

An integrated, holistic and well considered design outcome is to be achieved for the NBH (Stage 2) project.

In response to this challenge, the consideration and integration of sustainability in the design responses for the built form and engineering services has been a collaborative and integrated process which has sought to obtain a balanced sustainable design outcome with consideration of the following design considerations:

- local climate
- site constraints
- function and usage
- capital and recurrent costs
- comfort control
- waste and water management
- flexibility and reliability
- construction materials
- on-going environmental impact.

The considerations are graphically captured in the following diagram:



Spheres of ESD influence

2. ESD Principles

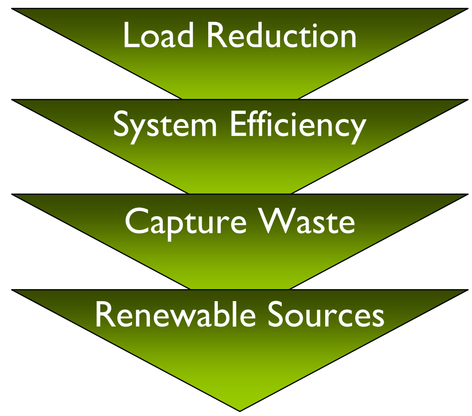
The following identifies how ESD principles have been incorporated in the development.

2.1 Greenhouse emission reduction and energy conservation

2.1.1 Design approach

The reduction of the Hospital's greenhouse emission or operation carbon footprint from its annual energy consumption as well as the reduction in the associated utility costs (i.e. maximum demand & utility usage) has been a key driver in the design approach adopted for the facility.

A 'right sizing' approach has been adopted that first seeks to reduce the inherent energy demand load within the facility, secondly to avoid unnecessary oversizing of plant, thirdly to look at system efficiencies, then look at opportunities to capture waste to further minimise energy demand before finally investigating through whole-of-life assessments opportunities for low carbon / renewable technologies.



Healthscope's approach and methodology to energy conservation

Load reduction

- adopt a climatically responsive design (shading, insulation, glazing type, etc.)
- challenging comfort criteria (widening of the design internal temperature bands)
- daylighting to reduce reliance on artificial lighting
- selection of energy efficient lighting and equipment (to reduce cooling loads).

System efficiency

- optimised selection of heating, ventilation and air conditioning (HVAC) systems to suit function, usage and building form of different spaces within the Hospital
- adoption of a 'right sizing' approach to the mechanical services plant selection
- general use of variable speed drives (VSDs) in pumps and fans to both minimise energy usage in operation but also to maximise initial operational efficiency through commissioning
- high efficiency lighting including T5 and light emitting diode (LED) lighting
- comprehensive building management system (BMS) and lighting control system that can control the operation of HVAC systems and lighting controls (i.e. timers, motion sensors, daylight dimming, etc.)
- careful selection of equipment and appliances in respect to their efficiency.

Capture waste

- use of waste heat from the co-generation plant to augment heating hot water

Renewable and low carbon technologies

- integration of a 500 kW co-generation unit to reduce the carbon intensity of the electrical supply
- co-generation heat recovery pre-boost for domestic hot water service (DHWS)
- Systematic selection of eco-friendly materials and furniture in design and procurement

2.1.2 Greenhouse emission reduction

A 10% reduction in greenhouse emissions associated with the Hospital's annual energy consumption is targeted through the combination of the following energy conservation, low carbon emission and operationally efficiency strategies:

- strong climatically responsive design response for the buildings in respect to their built form, siting and solar shading and comfort control, including a high performance façade
- adoption of a 'Right Sizing' approach to the design of the mechanical engineering services to reduce unnecessary higher energy consumption
- design of HVAC systems to provide for good zonal control
- AHUs to be provided with enthalpy controlled free cooling (i.e. economy cycle)
- general use of VSD's in both fans and pumps, designed and selected to meet or exceed the energy efficiency targets of the BCA Section J
- duct velocities and pressures calculated to maximise fan performance while insuring cost effective and achieve installation space efficiency
- after-hours turn down settings and night time purge settings to appropriate AHUs
- sensitive location of outside air intakes (e.g. location on southern façade) to reduce thermal load
- sequencing of chillers to maintain optimum efficiency and performance during load cycle
- artificial lighting design offering an overall 10 – 20% improvement in the allowable installed lighting power density (i.e. W/m^2) under the 'deemed-to-satisfy' provisions of BCA Section J Energy Efficiency
- limiting light switching zones to <$100m^2$ and having all enclosed rooms individually switched
- use of time clock, switching and motion sensor controls
- use of LED external within the perimeter fence lighting
- use of gas fired DHWS with pre-heat from cogeneration heat recovery system
- integration of a central BMS to enable effective control of energy use
- vertical transportation system with efficient variable frequency AC gearless drives, timers to shutdown lift car lighting and fans when not in use and utilisation of LED and LCD technology for signalisation
- use the 500 kW co-generation unit to reduce the carbon intensity of the electrical supply.

2.2 Water conservation

Maximising water conservation is a key consideration in the NBH (Stage 2) project, which will be achieved through assessment of the overall water balance for the precinct. The following water usage was factored into the assessment of the precinct's overall daily water demand:

- toilet / urinal water flushing and shower use
- hand basin and drinking water use
- water used in the preparation of food
- heat rejection water consumption
- landscape irrigation water.

To achieve a responsive water conservation outcome fixtures and fittings will be selected in respect to their water efficiency rating (i.e. (WELS ratings). To further minimise use of potable water within the facility, captured rain water will be re-used for irrigation.

2.3 Daylight availability

Considering the importance of daylight in aiding the healing process, daylight availability and quality throughout the Hospital has been a key consideration.

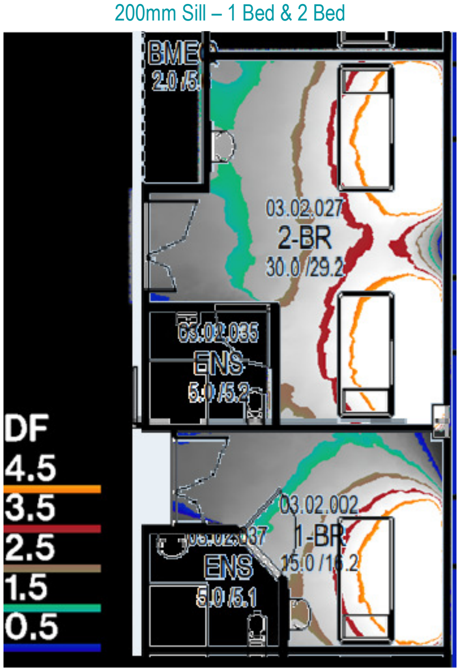
To achieve good daylight penetration the following approach and methodology has been adopted:

- functional planning and built form
  - Based on functional relationships the architectural design has sought to maximise daylight availability to all areas that need or would benefit from access to daylight
  - within the operational and usage constraints of each room, configure space and functional area to maximise ability to introduce perimeter fenestration
  - provision of effective external shading to reduce the penetration of unwanted solar heat gain in summer.
- perimeter fenestration
  - carefully consider the extent of perimeter glazing in respect to solar glare, occupant comfort and useful penetration of daylight
  - maximise the visual light transmission of the glass selections without compromising on solar glare, occupant comfort, air conditioning plant sizing and energy
- Internally
  - select internal blinds to provide for effective daylight glare control when drawn
  - within the constraints of function, usage and maintenance considerations maximise the surface reflectance of the floor, wall and ceiling finishes.

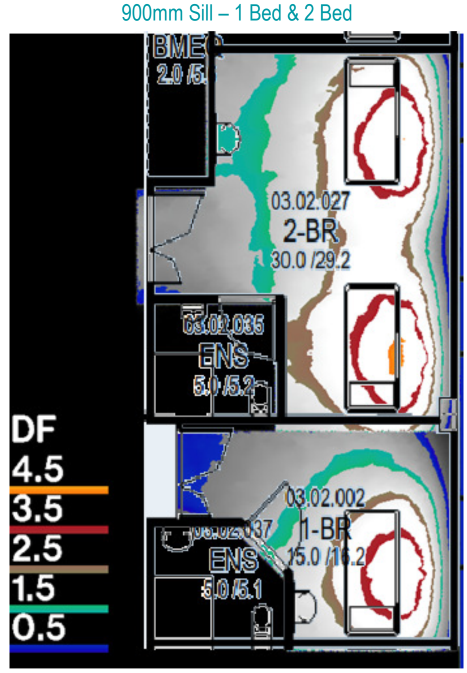
As part of optimising the design outcome, daylight availability modelling was carried out to determine the right balance between visual light transmission (VLT), thermal performance and solar control properties of the perimeter fenestration within the Hospital.

A sample of this daylight availability modelling undertaken is shown in Figure 6 below:

200mm Sill – 1 Bed & 2 Bed



900mm Sill – 1 Bed & 2 Bed



Sample results from daylight availability assessments

2.4 Indoor environmental quality

Considering the importance of indoor environmental quality (IEQ) in creating a healing environment for patients and productive working environment for staff, Healthscope has placed considerable emphasis on achieving a strong solution in respect to IEQ.

Specifically, the NBH (Stage 2) development will integrate and include the following measures, strategies and initiatives:

- external solar shading to protect occupants against solar glare and assist with achieving good thermal comfort
- climatically responsive HVAC to promote good ventilation effectiveness and thermal comfort control
- good daylight penetration within perimeter spaces, with particular emphasis on patient bed and recuperation areas
- use of low volatile organic compound (VOC) paints, sealants, adhesives and flooring
- use of low formaldehyde emission materials
- careful selection of furniture in respect to the environmental credentials and emissions
- select internal blinds so that they have <10% light transmission and good external solar reflective properties to assist with managing unwanted solar glare..

2.5 Emissions and atmosphere

To minimise the long term or on-going impact of the NBH Project on the environment:

- all refrigerants used will be zero ozone depletion potential (ODP)
- external lighting, excluding security lighting and functional lighting for such areas as the helicopter landing, will be designed so that no light spill occurs.

2.6 Solar glare and solar control

Considerable emphasis has been placed on providing good solar control both in respect to solar glare and occupant comfort.

The architectural design therefore exceeds current industry best practice in terms of solar control and provides an optimised solution for glare reduction and solar access, which contributes to improved occupant comfort.

The NBH (Stage 2) design has sought to combine the following to achieve effective seasonal solar control:

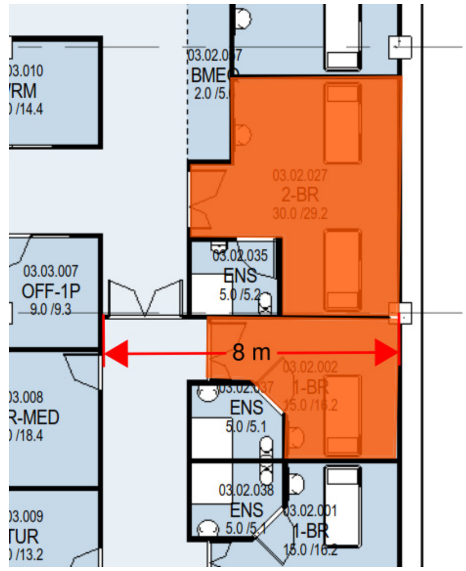
- limiting extent of perimeter fenestration
- provision of external solar shading to perimeter windows
- Inherent self-shading from building form
- solar control properties of glazing

To further assist with control of unwanted solar glare the internal blinds will be carefully selected so that they have <10% visual light transmission and have good external reflective properties.

2.7 External visual connection

In recognition of the healing benefits from access to views for patients as well as health staff the NBH design seeks to maximise external views from patient spaces to aid the healing process.

Good perimeter fenestration within the 1 bed and 2 bed units is achieved as demonstrated in the adjacent diagram with external views as greater than 50% of nominated areas have access to external views.



Typical Access to views from single and double bedrooms

2.8 Materials and resources

Considerable attention and consideration has already been given to the choice of construction and fitout materials in terms of their environmental impact in respect to resource use, modularity, recyclability and manufacture.

As with the issue of IEQ, a strong emphasis has and will be given to the recycled content of construction materials used.

As part of the Non Clinical Support Services Delivery Plan, Healthscope has prepared a Waste Management Plan which addresses the on-going operational issues of recycling and waste management. Refer to Appendix Q of the Northern Beaches Hospital (Stage 2) EIS.

2.9 Landscape and ecology

To minimise the impact the construction of the NBH Project will have on the site ecology the proposed landscape solution has sought to address the following key strategies / aspirations:

- providing a strong pedestrian and visual connection through the Precinct
- retaining the existing Australian native landscape character and historical significance
- regenerating a new Australian native landscape corridor around the Precinct
- introduce an open space network that also acts as a retention basin to treat stormwater run off
- activating entry zones into the Precinct via a distinct and integrated planting palette and clever way finding techniques
- creating unified social and passive spaces that harness the power of healing and enrich the life of those who encounter it
- ensure safe and adequate access to landscape spaces within and around the NBH Project
- promoting safety through design
- rationalising pedestrian movements and associated pathways

- developing a planting strategy that is robust, low maintenance, native and locally significant
- providing facilities for external therapeutic exercise
- maintaining fire egress paths whilst not impacting upon the functional use of external spaces
- providing visual amenity for patients, visitors and staff to courtyards and rooftop gardens.

Community spaces

External Precinct landscape zones

2.10 Construction management

Strong emphasis has been placed on environmental management, building on the considerable experience of the Construction Contractor.

In summary, the NBH (Stage 2) project is committed to minimising the environmental impact of construction works through:

- adopting a strong emphasis on waste minimisation during the construction works
- comprehensive commissioning of the engineering services
- comprehensive building tuning during the first 12 month of occupancy to ensure systems are working optimally to minimise on-going environmental impact in operation moving forward.

2.11 Sustainable procurement

To help the NBH minimise its greenhouse emissions and environmental impact a Sustainable Purchasing Checklist (SPC) will be prepared and adopted.

The checklist will provide guidance and direction in the selection of equipment and materials in respect to their whole of life considerations, maintenance requirements, recycled content, recyclability, locally available and toxicity.

The checklist will provide a simple questionnaire and check list approach to the procurement of equipment.

To keep abreast of technological advancements and changes the checklist will be a live document that can be readily expanded to cover any additional items.

3. Environmental benchmarking

As part of the requirements of the RFP for the NBH Project, the Operator must demonstrate how their design response will achieve a 4-Star or 'Best Practice' rating against the Green Star – Healthcare (v1) rating tool.

Green Star Healthcare rating tool

A ***4-Star*** or '***Best Practice***' rating under the Design and As-Built tools will be achieved by the proposed design through the formal GBCA certification process.

The 4-Star Design and As-Built ratings will be achieved through a holistic, integrated and whole-of-life targeting of credits within the environmental categories as outlined in the Green Star tool:

- *Management*
- *Indoor Environmental Quality (IEQ)*
- *Energy*
- *Transport*
- *Water*
- *Materials*
- *Ecology*
- *Emissions*
- *Innovation*