The engineer in his own way is an artist too - and not just a dead fish with a slide rule.
Jørgen Varming

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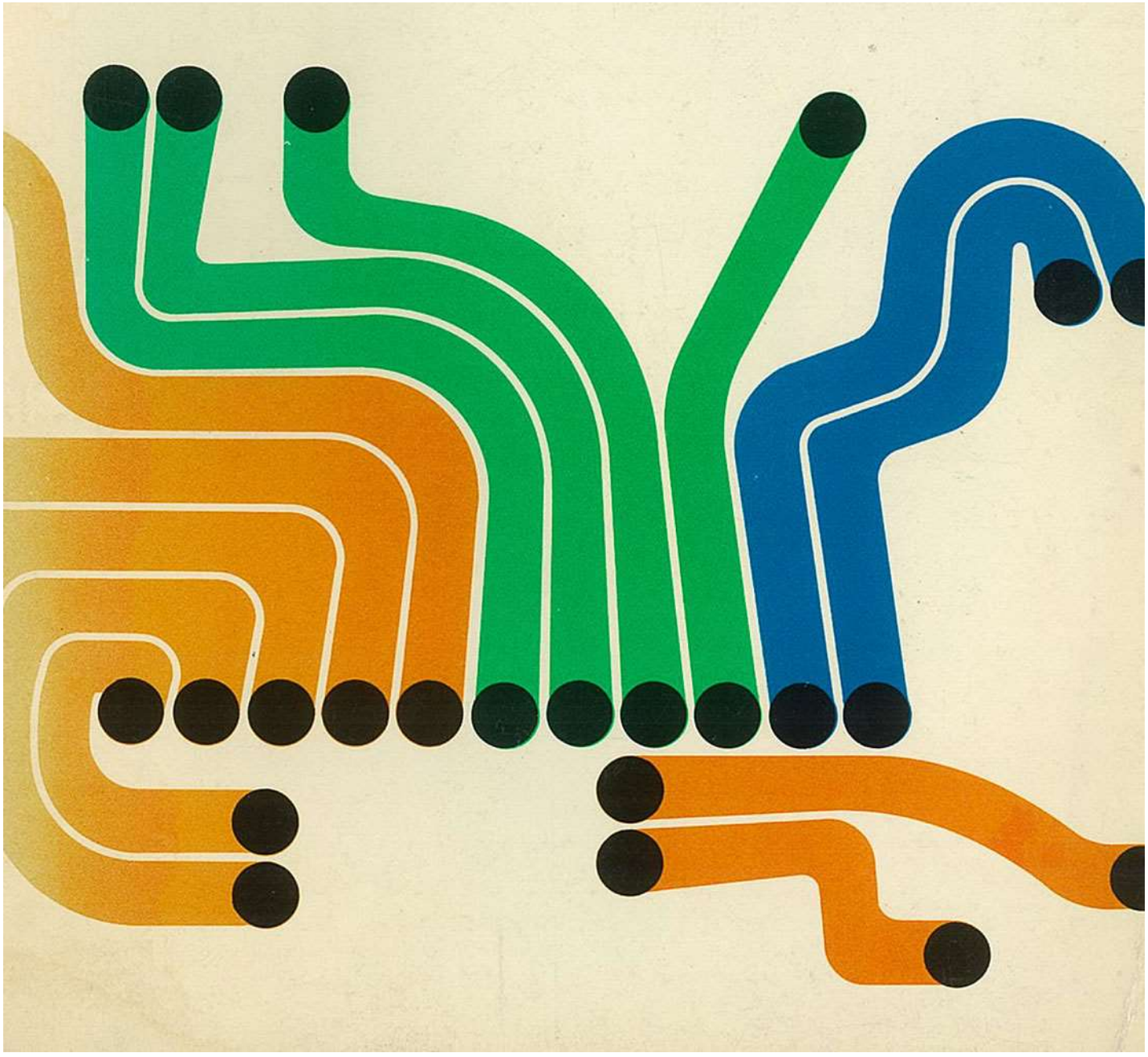
SUSTAINABLE DESIGN

STEENSEN VARMING

Tweed Valley Hospital Project Environmentally Sustainable Design (ESD) Report



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1.0 Executive Summary

This report has been prepared by Steensen Varming to accompany a staged State Significant Development (SSD) application for the proposed Tweed Valley Hospital Project which will consist of:

- A concept development application and detailed proposal for Stage 1 (early and enabling works); and
- A second development application for Stage 2 works which will include detailed design, construction and operation of the Tweed Valley Hospital (Project Application)

The primary purpose of this report is to provide a response to the Secretary's Environmental Assessment Requirements (SEARs) for environmentally sustainable design (ESD).

The report provides a summary of the relevant SEARs and outlines how the design team will respond to the requirements through the implementation of specific ESD measures and initiatives for the Concept Proposal and Stage 1 Early Enabling Works. The development of the detailed design for Stage 2 (main works / construction and operation) will further address ESD considerations and their implementation.

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2.0 Description of the proposal

2.1 Overview

On 13 June 2017, the NSW Government announced the allocation of $534 million for the development of a new state-of-the art hospital on a greenfield site in the Tweed, to be known as Tweed Valley Hospital (Project). The Project is located on a portion of 771 Cudgen Road, Cudgen, legally described as Lot 102 DP 870722 (Project Site).

This EIS has been prepared to accompany a State Significant Development Application for the Tweed Valley Hospital which will be assessed under Part 4 of the Environmental Planning and Assessment Act. The Project has been established based on the following supporting documentation:

- Tweed Valley Hospital Business Case
- Tweed Valley Hospital Masterplan
- Tweed Valley Hospital Concept Proposal and design.

The Tweed Valley Hospital Project for which a staged approval is sought consists of:

- Delivery of a new Level 5 major referral hospital to provide the health services required to meet the needs of the growing population of the Tweed-Byron region, in conjunction with the other hospitals and community health centres across the region;
- Master planning for additional health, education, training and research facilities to support these health services, which will be developed with service partners over time. These areas will be used initially for construction site/ compound and at-grade car parking;
- Delivery of the supporting infrastructure required for the new hospital, including green space and other amenities, campus roads and car parking, external road upgrades and connections, utilities connections, and other supporting infrastructure.

The development application pathway for the Project consists of a staged Significant Development Application under section 4.22 of the Environmental Planning and Assessment Act 1979 (EP&A Act) which will consist of:

- A concept development application and detailed proposal for Stage 1 (early and enabling works); and
- A second development application for Stage 2 works which will include detailed design, construction and operation of the Tweed Valley Hospital (Project Application)

A detailed description of the proposed staging of the development is provided in the following sections.

2.1.1 Concept Proposal and Stage 1 Early and Enabling Works

This component (and EIS) seeks approval for a Concept Proposal for the Tweed Valley Hospital and Stage 1 early and enabling works.

The Concept Proposal is informed by service planning to 2031/32 and has an expected gross floor area in the range of 55,000m^2 to 65,000m^2. The hospital is expected to include (with more detail to be confirmed/provided at Stage 2) the following components/ services:

- A main entry and retail area
- Administration Services
- Ambulatory Services
- Acute and Sub-Acute in-patient units
- Paediatrics
- Intensive Care Unit
- Close Observation Unit
- Mental Health Services
- Maternity Unit
- Renal Dialysis
- Pathology
- Pharmacy
- Cancer Services including Day Oncology and Radiation Oncology
- Emergency Department
- Integrated Interventional Services
- Interventional Cardiology
- Medical Imaging
- Mortuary
- Back of house Services
- Car parking
- Future expansion areas;

Stage 1 includes:

- Early and enabling works (for site clearance and preparation), generally comprising:

- Construction compound for Stage 1 Works
- Augmentation and connection of permanent services for the new facility (water, sewer, electricity, telecommunications)
- General clearance of site vegetation within the footprint of construction works, including tree stumps
- Chipping of cleared vegetation (excluding weed species) to use on site for ground stabilisation/ erosion control, or off-site disposal (as required)
- Bulk earthworks to establish the required site levels and create a stable landform in preparation for hospital construction
- Piling and associated works
- Stormwater and drainage infrastructure for the facility
- Rehabilitation and revegetation of part of the wetland area

- Construction of internal road ways for use during construction and in preparation for final road formations in Stage 2
- Retaining walls.

Architectural plans for the Concept Proposal are attached at Appendix B. Further explanation of the Concept Proposal and an outline construction methodology for Stage 1 is provided at Sections 3.7 and 3.8 respectively.

2.1.2 Stage 2: Hospital Delivery – Main Works and Operation

Stage 2 (which will be subject to a separate application) would include the detailed design, construction and operation of the Tweed Valley Hospital. Stage 2 will be subject to a separate application following Stage 1.

2.1.3 Subsequent Stages: Potential Future Expansion

Any subsequent stages would be subject to a separate application(s) as required and would be related to works for potential future expansion of the facility. Details of this are unknown at this stage and would be developed as required.

3.0 ESD requirements

3.1 Concept proposal

The ESD requirements relating to the Concept Proposal as set out in the SEARs are as follows:

a) Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the development.
b) Provide a strategy outlining how the future development will be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on materiality assessment and include waste reduction measures, use of sustainable and low carbon materials, energy and water efficient design and technology and use of renewable energy.
c) Undertake a preliminary analysis of the likely service demands for drinking water, wastewater and recycled water services and outline the preliminary Integrated Water Management principles detailing any proposed alternative water supplies, proposed end uses of potable and non-potable water, and water sensitive urban design. This should include preliminary details of sustainability initiatives that will minimise//reduce the demand on supplies.

The ESD principles as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (e.g. precautionary principle; polluter pays principle etc) relate to sustainable development at a site level with a focus on the protection of ecological and biological value, and as such are beyond the scope of this report which focusses on the sustainable design, construction and future operation of the actual building. These broader environmental impacts are however considered in other supporting reports.

A detailed assessment of the likely demands for water, waste water and recycled water services are also beyond the scope of this report but covered in other supporting reports.

The Concept Proposal ESD approach outlined in Section 4 of this report focusses on the strategy for ensuring the future development is designed to consider and reflect national best practice building principles to improve environmental performance and reduce ecological impact.

The following Policies and Guidelines relating to sustainable building design are referenced in the SEARs as relevant to Concept Proposal:

a) NSW Energy Efficiency Action Plan 2013
b) NSW Government Resource Efficiency Policy (GREP)
c) NSW Climate Change Policy Framework
d) NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections

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The relevant ESD requirements of the above guidelines are summarised below.

NSW Energy Efficiency Action Plan 2013

The NSW Energy Efficiency Action Plan sets out a direction for efficient energy use in NSW. The plan incorporates a number of initiatives, including minimum energy efficiency standards for buildings.

NSW Government Resource Efficiency Policy (GREP)

The aim of the NSW Government Resource Efficiency Policy is to reduce the NSW Government's operating costs and lead by example in increasing the efficiency of the resource it uses.

The policy's measures, targets and minimum standards are intended to drive resource efficiency where significant opportunities for savings have been identified for energy, water, waste and clean air. The specific requirements that are relevant to this Project include:

Energy

- Minimum standards for new electrical appliances and equipment (e.g. Energy Star accredited)
- Minimum standards for new buildings which should be designed so that energy consumption is predicted to be at least 10% lower than if built to minimum compliance with the National Construction Code requirements

Water

- Minimum standards for new water-using appliances which should meet the average WELS star rating by product type

Clean air

- Requirements for low-VOC surface coatings

NSW Climate Change Policy Framework

The NSW Climate Change Policy Framework aims to maximise the economic, social and environmental wellbeing in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change. The framework sets out an aspirational objective to achieve net-zero emissions by 2050, which in the context of new developments, translates to a requirement to deliver energy efficient buildings.

NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections

The NARCLiM climate change projections can be used to inform designs with a view to mitigating the impacts of climate change.

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In addition to the above guidelines which are specifically referenced in the SEARs, the following guidelines are also considered relevant for demonstrating that best practice sustainable design principles have been adopted:

NSW Health Infrastructure Engineering Services Guidelines

The Engineering Services Guidelines provide a performance-based guide for the development of design and specification documentation for health care facilities.

The guidance document states that integrated built-environment sustainability must be considered, including appropriate designs for energy and water, using appropriate materials. In addition, the indoor environment must consider air quality, ventilation, daylight, and other factors that influence thermal, visual, acoustic, and psychological comfort.

The basic design principles also include the following guidance:

General

- Proposed designs should include passive sustainable design strategies such as daylighting, demand management, gravity systems, energy and water efficiency and conservation techniques, use of non-toxic environmentally sound materials and finishes, and consider life-cycle sustainability and maintenance implications.
- All new facilities will target a Green Star Health Care 4-star equivalence rating, this has been and will continue to be considered as aspirational within the context of project location, scope and budgetary allowances, no documentation or certification is required.

Energy

- All new standalone buildings will have a mandatory requirement of delivering a 10% improvement on national construction code (NCC) section J.
- Health Infrastructure is committed to delivering projects which will deliver the best value energy performance and will commit funding to implement initiatives and schemes which are economically responsible and deliver provide and significant energy improvements.
- Engineering design should be applied to reduce energy wastage and carbon dioxide emissions arising from the operation of the hospital, whilst maintaining clinical and functional standards.
- Energy efficient design should include:
    a. An enterprise-level energy management program integrated with other functions
    b. Integrated performance monitoring and controls
    c. The incorporation of variable speed pumps
    d. Efficient insulation of hot and warm water distribution pipework
    e. Consideration of opportunities for energy and heat recovery
    f. Appropriate system zoning and time control

Water

- The design of the water systems should include consideration of:
    a. Potential use of gravity systems
    b. Water (potable, grey, black) recycling options
    c. Options for maximising water conservation
    d. Appropriate metering and monitoring
    e. Opportunities for re-use of fire test water
    f. Rain water harvesting to reduce potable water consumption
    g. Installation of high efficiency fixtures, such as those covered by the High Water Efficiency Labelling and Standards scheme
    h. Efficiency irrigation systems

Materials

- Consideration should be given to materials of low embodied energy content; high recycled content; or that are highly recyclable
- Designers should consider the quantities of materials and investigate opportunities for alternative design solutions that may reduce material use (e.g. mass concrete versus post-tension designs)
- Material selection should focus on:
    a. Use of locally sourced materials
    b. Selection of low embodied energy materials
    c. Specification of products and materials that are either reused or contain high recycled content
    d. Promoting the specification of recyclable manufactured type materials and fittings
    e. Giving preference to materials manufactured using renewable energy sources
    f. Designing to minimise material use and improve material efficiency
- As a minimum the following design options should be considered as part of the material selection process:
    a. Use of structural steel products composed of recycled content
    b. Use of recycled concrete
    c. Minimisation of PVC products
    d. Specification of low VOC materials
    e. Giving preference to re-used timber, legally sourced timber, and timber sourced from forests whose conservation values are not degraded
    f. Designing to material sizes and common packaging quantities to avoid off-cut wastage and unnecessary consumption

BCA Section J Requirements

Section J sets out the minimum energy efficiency requirements of the National Construction Code, and the Building Code of Australia. The requirements set out in Section J include consideration of the following:

1. Building fabric
2. Glazing
3. Building sealing
4. Air conditioning and ventilation systems
5. Artificial lighting and power
6. Heater water supplies

7. Access for maintenance and facilities for monitoring
8. Material properties
9. Roof and ceiling insulation
10. Wall and floor construction
11. Ducting insulation and sealing
12. Insulation of piping vessels, heat exchangers and tanks
13. Lighting and power control devices

3.2 Stage 1 works

The ESD requirements relating to the Stage 1 works as set out in the SEARs are as follows:

a) Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated into Stage 1 of the development.
b) Address how the Stage 1 works will reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on materiality assessment and include waste reduction measures, use of sustainable and low carbon materials, energy and water efficient design and technology and use of renewable energy.

The SEARs also reference the NSW and ACT Government Regional Climate Modelling (NARCLiM) climate change projections as guidelines relevant to the Stage 1 works.

As noted above, the ESD principles as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 relate to sustainable development at a site level with a focus on the protection of ecological and biological value, and as such are beyond the scope of this report which focusses on the sustainable design and future operation of the actual building. These broader environmental impacts are however considered in other supporting reports.

The Stage 1 works ESD approach outlined in Section 4 of this report focusses on the strategy for ensuring the future development is designed to reflect national best practice building principles to improve environmental performance and reduce ecological impact, with respect to the extent of the Stage 1 works. Due to the nature of the Stage 1 works, the proposed measures and initiatives outlined in this document are largely associated with ground works.

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4.0 ESD approach

The requirements set out in Section 3.0 can be categorised into several key areas as follows:

1. Reducing energy consumption and associated CO_2 emissions (e.g. implementing passive design measures to reduce energy demand; using efficient plant to meet reduced demand; considering installation of LZC technologies to make further savings)
2. Reducing potable water consumption
3. Reducing the impacts of materials specification (e.g. use of sustainable and low carbon materials; use of locally sourced materials; improving material efficiency)
4. Reducing the generation of waste associated with the Project

In addition to the above, best practice sustainable building principles would typically also address measures to improve the health and wellbeing of building users, and the reduction of pollution associated with the Project (e.g. surface water run-off, external lighting).

All design team members have responded to each of the above areas, where applicable, and will continue to do so as the design progresses.

The tables below set out a basic sustainable design framework covering these high-level objectives and summarising some of the specific measures and design principles which are currently proposed or are being considered by the respective design disciplines in the context of the Concept Proposal and the Stage 1 works. The 'consultant comments' column indicates where a specific measure is currently proposed, or subject to further investigation and consideration.

This framework will be taken forward into the development of the detailed design for Stage 2 (main works/construction and operation) which will further address ESD considerations and their implementation.

4.1 Concept proposal

Electrical Services

Initiative	Consultant comments
Designing internal lighting to improve occupant comfort and reduce energy consumption	Lighting shall be provided in all areas of the hospital in accordance with AS/NZS 1680. Internal lighting be designed to exceed minimum energy efficiency requirements. LED lighting shall be used where possible.
Designing external lighting to reduce energy consumption	External lighting shall be provided in accordance with AS/NZS 1158 and CEPTED External lighting will be designed to exceed minimum energy efficiency requirements, and limit light pollution to the surrounding areas, whilst maximising safety and security to patients and staff. LED luminaires shall be used where possible with photocell and manual override control.
Specification of lighting Control systems to reduce energy consumption	A mixture of control systems shall be proposed including: DALI, hard wired and manual switching where appropriate. Implementation of area dimming, time clock, and daylight sensing will be discussed with the user groups to identify opportunities for reducing energy consumption through the implementation of appropriate controls.
Reducing energy consumption through specification of energy efficient equipment	Energy efficient options will be investigated as part of the equipment selection and specification process. High Power Efficiency transformers shall be specified in accordance with AS/NZS 2374.
Reducing energy consumption through effective metering and monitoring	Major energy uses will be sub-metered by end use, and function area / department. An energy management systems shall be specified.

Mechanical Services

Initiative	Consultant comments
Reducing energy demand	Passive conditioning techniques will be incorporated where possible to reduce air conditioning loads, including: • Shading windows to prevent solar penetration in summer but allow passive heating in winter • Providing a high-performance thermal envelope • Optimising thermal mass and insulation combinations
Reducing energy consumption through the specification of energy efficient equipment	All equipment shall be specified to be energy efficient, subject to a life cycle cost analysis. Energy efficient fan coil units with EC/DC motors will be specified where appropriate.
Reducing energy consumption through energy efficient HVAC	Where appropriate, outdoor air will be pre-tempered with relief air, using heat exchangers to reduce cooling and heating loads.

system design and operation	Outside air shall be controlled via a time clock, occupancy sensors and CO_2 sensors to minimise energy intensive conditioning requirements when spaces are not fully occupied. Systems will be designed to maximise efficiency at both full and part load. A Building Management System (BMS) will be provided to schedule and optimise plant efficiency, Intelligent controls shall ensure that the air conditioning systems shall either shut down or operate within a relaxed temperature control band when spaces are unoccupied. Dedicated secondary chilled water (CHW) and heating hot water (HHW) circuits shall be provided to ensure that the campus has future means to interrogate and apportion building energy use.
Reducing energy consumption through effective metering and monitoring	Energy metering shall be provided to monitor electrical and gas usage associated with Heating, Ventilation and Air Conditioning (HVAC) equipment.
Reducing pollution associated with the Project	Where required, refrigerants will be specified to have low ozone depletion potential, and low global warming potential.

Hydraulic Services

Initiative	**Consultant comments**
Reduction of water consumption	Water and energy efficient fixtures and fittings will be specified throughout with a 4 Star Water Efficiency Labelling Scheme (W.E.LS) minimum rating (except showers which will be 3 Star).
Reducing potable water consumption through re-use of water	A rain water harvesting system will be installed to reduce the use of potable water for irrigation purposes. Fire test water will be recycled back into the fire services storage tank.
Reducing water consumption through effective metering and monitoring	Submetering will be installed to reduce wastage through identifying leaks, or poor operational performance. Submeters will be installed in the following locations: • Potable cold-water meter for each building. • Potable hot and cold-water meters for each building level. • Potable hot and cold-water meters for each major use department • Potable water meters to major usage equipment (mechanical plant, hot water plant, RO water plant)
Reducing energy consumption through the specification of efficient plant	High efficiency gas domestic hot water plant (minimum 83% efficient) will be specified, with consideration given to using solar pre-heat (subject to life cycle cost analysis).
Reducing the impacts of materials specification	Where possible, materials will be specified in accordance with best practice to reduce environmental impacts.

Architectural

Initiative	Consultant comments
Improving health and wellbeing	The following initiatives will be incorporated to help improve health and wellbeing for users of the Project Site: • Use of visible stairs as way-finding and healthier means for public access across levels • Design for cycle paths and EOT services to encourage staff cycle to work • Specification of low VOC emitting materials to improve indoor air quality In addition to the above, consideration will be given to potential opportunities for the development of structured walking paths around the hospital and within the environmental area to the north of the Project Site to encourage pedestrian activity.
Reducing daylight glare to improve occupant comfort	The following strategies will be used to help manage glare: • Selection of orientation appropriate window shade methods • Avoidance of direct sunlight on surfaces in the normal field of view • Avoiding the use of highly polished / reflective surfaces • Exploring options for incorporating deep eaves to provide shading • Optimising window to wall area
Facilitating external views to improve occupant comfort	The following strategies will be used to help increase prime external views: • Landscaped terraces to provide access to external views where terraces are internal facing • Considered patient bed orientation in IPUs; avoiding backing beds onto external walls • Internal planning to liberate opportunities for views • IPU wing separation consideration to maximise access to distant views • Orientating pedestrian journeys to take advantage of external views
Maximising daylight to improve occupant wellbeing, and reduce energy consumption for artificial lighting	The following strategies will be implemented where possible to maximise the use of daylighting / natural light: • Optimisation of building orientation in support of key functional areas • Where functionally appropriate, limiting floor plate depth to allow maximum gains from daylighting • Improving daylight penetration (and views out) through the specification of high window heads • The specification of internal finishes (e.g. light surfaces) to improve daylight penetration • The use of internal courtyards to allow daylight penetration • Internal planning to maximise the functionality of perimeter daylight zones, providing key patient, waiting and staff functional areas in locations with daylight • Selection of appropriate glazing to help optimise visual comfort In addition to the above, consideration will be given to the adoption of circadian lighting design where possible.

Using passive design strategies to reduce energy demand	The following passive design strategies will be incorporated to help reduce energy demand: • Shading of windows to prevent solar penetration in summer but allow passive heating in winter • Building thermal mass and insulation combinations • Promotion of shading from vegetation • Maximising air tightness to reduce air infiltration • High performance building fabric to reduce thermal conductance
Reducing operational energy consumption	The following strategies will be implemented to help reduce operational energy consumption: • Appropriate zoning of departments so that areas of the hospital not in use after daytime business hours may be shut down
Reducing the impacts of materials specification	The following strategies will be used to reduce the impacts associated with the specification of materials: • Where possible, priority will be given to timber from renewable sources; salvaged and recycled materials • Where possible, materials sourced with cradle to cradle credentials • The use of locally sourced materials will be prioritised
Reducing construction waste	The following techniques will be used to minimise the generation of waste during the construction of the Project: • Reuse of materials on the Project Site to limit waste e.g. excavated bulk soil used in the formation of landscaped landforms for playgrounds around hospital • Efficient selection of materials to limit offcut wastage during construction • Promotion of off-site prefabrication to limit construction waste impacts to the Project Site • Provision of flexible floor plates to reduce the construction waste associated with future refurbishments
Improving ecological value	Steps to enhance the existing Project Site ecological value will include promoting the use of native plant species in landscaping.
Reducing pollution associated with the development	The following strategies will be used to help reduce different types of pollution associated with the Project: • Promotion of surface permeability to reduce hard surface rainwater run-off • The use of low light external architectural lighting (e.g. carparking lamp standards) • Improving public transport infrastructure locally, as an alternative to private vehicle use by staff and patients

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Structural / Civil Services

Initiative	Consultant comments
Reducing the impacts of materials specification – high recycled content.	Where possible, recycled content will be used. In concrete, recycled aggregates will be investigated, with respect to steel, structural steel containing recycled or reuse materials will be specified, if locally available.
Reducing the impacts of materials specification – materials efficiency.	Post tensioned concrete will be used to reduce the volume of concrete and reinforcement that is required. Where steel framing is specified, mass of steel will be reduced by specifying high strength steel.
Reducing the impacts of materials specification – locally sourced materials	The use of readily available materials will be encouraged.
Reduction in energy use	Water quality measures will be designed and constructed with the aim of minimising associated energy consumption and maintenance requirements.
Reducing construction waste	Permanent formwork will be specified (where suitable).

4.2 Stage 1 works

Hydraulic Services

Initiative	Consultant comments
Reducing the impacts of materials specification -	Pipe material selection will be based on current best practice. PVC-u will be specified based on the GBCA guidelines. Polyethylene material will be specified for pressure water and gas services, as Polyethylene is recyclable and has significantly lower environmental impact than the alternative ductile iron material. Pipe bedding materials will be specified to be locally sourced where practical.

Architectural

Initiative	Consultant comments
Improving ecological value	The impacts of the Project on existing ecology will be mitigated through: • The use of stone sub-bases for construction traffic • The appropriate protection of natural features on good on-site tree specimens

Structural / Civil Services

Initiative	Consultant comments
Reducing the impacts of materials specification – materials efficiency.	Site earthworks will be designed to achieve a balance between cut and fill to minimise transportation of materials to / from site.
Reducing the impacts of materials specification – locally sourced materials	Locally excavated rock will be specified to be used as a road base.
Reducing construction waste	Any surplus material will be separated into usable and unusable. The usable material may be offered for local use/reuse.
Reduction in energy use	Site earthworks will be designed to minimise the amount of site material that is handled or double handled.
Reducing pollution associated with the construction and future operation of the Project	Water discharge into the receiving waters will be controlled to minimise erosion and designed to mimic natural flows for the designed storms. Water quality measures will be installed to reduce pollutant runoff into the receiving waters. The works will utilise the existing basins and catch drains to manage pollution runoff.