Garvan Institute

Garvan St. Vincent's Campus Cancer Centre

ESD Project Application Report

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May 2009

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1 Introduction

Arup has been commissioned by both the Garvan Institute and St Vincent's Hospital to provide an Ecologically Sustainable Development (ESD) strategy for the new Garvan St. Vincent's Campus Cancer Centre (GSVCCC) located in the St Vincent's Research Precinct on Victoria Street, Darlinghurst, Sydney. The proposed GSVCCC site is on Victoria Street, between Burton and Liverpool streets, in the Darlinghurst neighbourhood.

This document describes the key features of the ESD strategy for the purposes of the Project Application submission.

The building is a new eleven (11) storey medical facility and provides five (5) levels of basement car parking.The building generally comprises consultation areas and research laboratories. Research laboratories are to be designed to PC2 levels.

The project will strive to meet national and international standards for sustainable building performance and operation, whilst giving consideration to whole of life costs and the project's capital budget.

2 Summary Response to the Director-General's Requirements

►ESD Principles include the investigation of national and international rating tool guidelines to measure sustainability with the intention of defining a sustainability plan, the reduction of energy consumption, water conservation, bio-diversity, and carbon reduction.

►Water-sensitive Urban Design Measures include proposals for rainwater capture, storage, and reuse; water-efficient tapware; green roofs to reduce stormwater runoff; and low or no-water irrigation.

►Energy Efficiency initiatives include proposals for efficient equipment selections, high-performance façade materials, and the investigation of solar photovoltaics.

►Materials initiatives will aim to include the reduction of Volatile Organic Compounds to improve indoor air quality and aim to reduce the release of known carcinogens into the biosphere.

3 Report Scope

This report is written in response to the Department of Planning Director-General's Requirements for the Project Application for the Garvan St. Vincent's Campus Cancer Centre.

4 Ecologically Sustainable Development Principles

Ecologically sustainable development aims to sustain and conserve natural resources through *'using, conserving and enhancing the communities' resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased'* (Commonwealth Government of Australia, 1990).

The principles of ecologically sustainable development will be an integral consideration throughout the process of developing the GSVCCC and assessing its benefits and impacts. In addition, the preparation and exhibition of the environmental assessment in itself contributes to the consideration of the principles of ecologically sustainable development.

5 Garvan and St. Vincent's in the Sydney Context

As two of Sydney's major institutions with public service missions, Garvan and St. Vincent's will respond to the challenges outlined in the *Sustainable Sydney 2030 City of Sydney Strategic Plan*. This comprehensive plan is driven by increasing concern with global climate change and resource scarcity; the plan outlines the sustainable development around the

core of Sydney, which includes the Garvan Institute and the St. Vincent's Campus. The SS2030 Plan sets ambitious targets and these will be used, to the extent appropriate, to guide the design team as it develops the building design:

► A 70 percent reduction and offset of greenhouse gas emissions from the City by 2050 based on 1990 levels.

► A target to ensure 25 percent of electricity used in the local government area comes from renewable energy by 2020.

► No increase in mains water consumption by both the City of Sydney as an organisation, and by the City itself by 2015 based on 2006 levels.

► A 66 percent resource recovery of residential waste from the City by 2014.

6 ESD Process

The GSVCCC design team will incorporate sustainability principles into the integrated design process for the project. This process includes stakeholder feedback and workshops, the development of a Sustainability Design Plan to set goals and track accomplishments, and the review and benchmarking of national and international sustainable design rating tools for use as guidelines for the GSVCCC's development.

6.1 ESD Workshop and Sustainability Design Plan

An ESD workshop was held on 9 March 2009 to identify the key goals of the project. The following is a list of the key priorities identified during that workshop:

- Commissioning, monitoring and maintenance.
- Design longevity.
- The ability to attract world-class researchers.
- Integrated services/structure/architecture.
- Energy minimisation.
- A building that delights all of its stakeholders: users, public, financial sponsors alike.
- Innovation: improving on current best practice by looking at the challenge in a new way.
- Air-conditioning and ventilation efficiency.
- Campus model: shared space such as cafes, break-out spaces and meeting rooms.
- Community benefits: gives back to the community through research and energy production.

These priorities will be referred to throughout the design process and progress on each target will be reported back on a regular basis through the *Sustainability Design Plan*.

6.2 Benchmarking and Compliance Requirements

This development, while part of a larger health care facility, will be primarily a research centre containing laboratory and office space, as well as clinical care, retail and car park spaces. Currently a wide selection of 'green design' rating tools exist for commercial, retail, residential and healthcare developments, with less information available for laboratory spaces. The approach to benchmarking this project will be to identify the most relevant rating tools to healthcare and laboratory spaces and apply the concepts where applicable. The following tools will be investigated:

6.2.1 Green Star Health Care Pilot

The Green Star rating schemes are voluntary holistic sustainable design rating tools which have been set up and are managed by the Green Building Council of Australia. These tools are used to guide the design process, and address a wide spectrum of environmental performance measures dealing with social, economic, and environmental issues.
The Green Star Health Care Pilot tool has target performance levels in the general areas of water, waste, IEQ, management, energy, emission and transport and with specific targets for medical equipment and trade waste pollution. The GSVCCC design team cannot pursue a formal Green Star rating for the project, since as a combination of laboratory and office, it does not qualify as a health care facility as defined by the GBCA.

6.2.2 LEED Health Care

The United States Green Building Council produces a suite of tools called LEED, which is a third-party certification program and an internationally accepted benchmark for the design, construction and operation of high-performance green buildings. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. The LEED program includes a specific health care system that mostly addresses acute care hospital design, however there are many worthwhile credits and benchmarks included in the program. For the GSVCCC project, however, LEED is considered within the context of two other relevant tools—the Green Guide to Health Care and LABS 21—explained below. Since the LEED tool does not address laboratory buildings, the GSVCCC design team will not pursue a formal certification.

6.2.2.1 Green Guide to Health Care

The Green Guide to Health Care is a voluntary, self-certifying metric toolkit of best practices used to guide and evaluate progress towards high-performance healing environments.

The tool was developed in collaboration with LEED by health care design and industry experts. Many of the concepts outlined in this tool translate well to the GSVCCC. The goal of providing superior indoor air quality, a fundamental requirement for health care facilities, by eliminating most carcinogenic indoor emissions is one that is particularly appropriate for a world-class cancer research centre. Again, because this tool does not specifically address laboratory buildings, a formal certification will not be pursued.

6.2.2.2 Labs 21

The most comprehensive lab benchmarking program underway—Laboratories for the 21st Century (www.labs21century.gov)—is in the United States, although many international projects have relied on the program. A joint venture between the U.S. Government's Department of Energy and the Environmental Protection Agency and recently expanded to the U.K., the Labs21 program has collected information on hundreds of new laboratory buildings in public, private, and institutional sectors to create a benchmarking database for a variety of metrics. The energy metrics are based on the American Society of Heating, Refrigerating, and Air Conditioning Engineer's Standard 90.1-2004 Energy Efficiency in Buildings (ASHRAE 90.1).

The approach to lab design contained within Labs21 will allow the design team to set realistic energy benchmarks to an agreed set of perimeters, providing a design target that can be measured against throughout the design phase. It has been determined that the GSVCCC cannot participate as a Labs21 pilot, since it's a foreign project, but the Labs21 program can still be used as a guideline for design.

6.2.3 NABERS Energy

The NABERS Energy program, formerly known as the Australian Building Greenhouse Rating (ABGR), is widely recognised for energy emissions rating. It was born from the perceived need to encourage existing buildings to reduce their energy-related impact on the

environment. The scheme rates a building's Green House Gas (GHG) emissions, which lead to global warming compared to other buildings.

Currently NABERs provides rating schemes for commercial, residential, retail buildings and hotels and is developing a tool for health care. However, achieving a NABERs rating for the GSVCCC will not be a key goal for this project. The design team will track the progress of the NABERS health care tool as it is developed and otherwise strive to incorporate NABER's key goal of reducing operation energy consumption as a fundamental design target.

6.2.4 TS-II

The NSW Government and NSW Health developed the Engineering Services and Sustainable Development Guidelines Technical Series TS11 to address the design and construction process of public health care facilities in NSW. These guidelines address a full range of services, including mechanical, electrical, hydraulics, and communications, as well as including an overview of good sustainable design practice. These guidelines refer to other documents, as well, such as the Environmental Performance Guide for Buildings (EPGB).

The key objectives of TS11 are to design a building that results in the following:

- Comfortable and healthy indoor environment (in terms of thermal comfort, visual comfort and indoor air quality)
- Minimised non-renewable resource consumption (e.g. energy, water) and environmental impacts (e.g. greenhouse, other air and water emissions, solid waste)
- Cost-effectiveness over its whole life cycle.

These objectives will inform the ESD design of the building. One of the key requirements of TS11 is to establish early on and consistently report the ESD objectives throughout the design process. The *Sustainability Design Plan* will be consistently updated throughout design to reflect the goals, decisions, technical details, and analysis as developed by all members of the client, design, and construction teams.

6.2.5 Building Code of Australia – Section J

Section J of the Building Code of Australia is concerned with energy efficiency of buildings. Minimum performance requirements have been set in regards to building fabric gain, external glazing, building sealing, air movement, HVAC systems, lighting and power, hot water supply and access for maintenance.

Section J is a minimum performance target for standard buildings. The GSVCCC is aiming to be a best practice sustainable building and should exceed the requirements for Part J.

6.2.6 Sustainability Design Plan and Design Integration

Due to the nature of GSVCCC, no single rating scheme will be appropriate. As such Arup will investigate the previously mentioned rating schemes and pull from each the most applicable and beneficial targets. This collection of targets will then become the basis against which the design process will be measured.

This system will be tracked as part of the *Sustainability Design Plan*, which will follow the integrated design process involving the architects, consultants, contractors, and client groups as required as part of true project integration and collaboration.

7 Resource Consumption

The driving force behind 'building green' is the need to minimise resource consumption. A number of strategies will be investigated in the context of the GSVCCC which will help to reduce the building's resource consumption.

7.1 Energy Efficient Design

Energy efficiency will be a key design target for the GSVCCC. Laboratory spaces are extremely energy intensive spaces due to their high ventilation requirements and equipment loads. By designing the building to be more energy efficient, the end result will be a more cost efficient building to operate especially in light of the likely increase in energy costs. A two pronged approach will be taken to reducing the energy consumption of the building.

7.1.1 Energy Reduction Strategies

Reducing the energy requirement of the building by using the most efficient equipment available is a fundamental approach for the sustainable design of the GSVCCC. The design of the GSVCCC will consider targetting the top 25% of performance when measured against benchmark labs in the Labs21 program. The design team will pursue this by incorporating daylighting and solar gain reduction initiatives, as well as through passive ventilation where appropriate.

In order to reduce energy loads, the design team will investigate the following initiatives:

- **General:**
  - A building management system for systems controls
  - Occupancy sensors for lighting
  - High-performance façade materials with shading devices to reduce cooling demand
  - Good insulation that exceeds Section J requirements
- **Central atrium:**
  - Tempered spill air from adjacent spaces.
  - Maximise daylighting to reduce electrical lighting energy consumption
  - Incorporation of planting to improve indoor air quality
  - Exterior sun shading to reduce solar gain and daylight glare
  - Ensure an “active” space that will be used by occupants
- **Office areas:**
  - Displacement ventilation system
  - Daylight optimisation and redirection systems
  - Minimal and high-efficiency lighting, coupled with task lighting
  - Exposed structure to reduce material use and improve thermal mass
  - Mixed-mode ventilation potential
- **Laboratory spaces:**
  - Maximise daylighting within the performance constraints of the laboratory’s environmental tolerance
  - Efficient ventilation systems and control

Refer to Figure 7.1.1 below for a conceptual diagram of how these strategies could be deployed in the building.

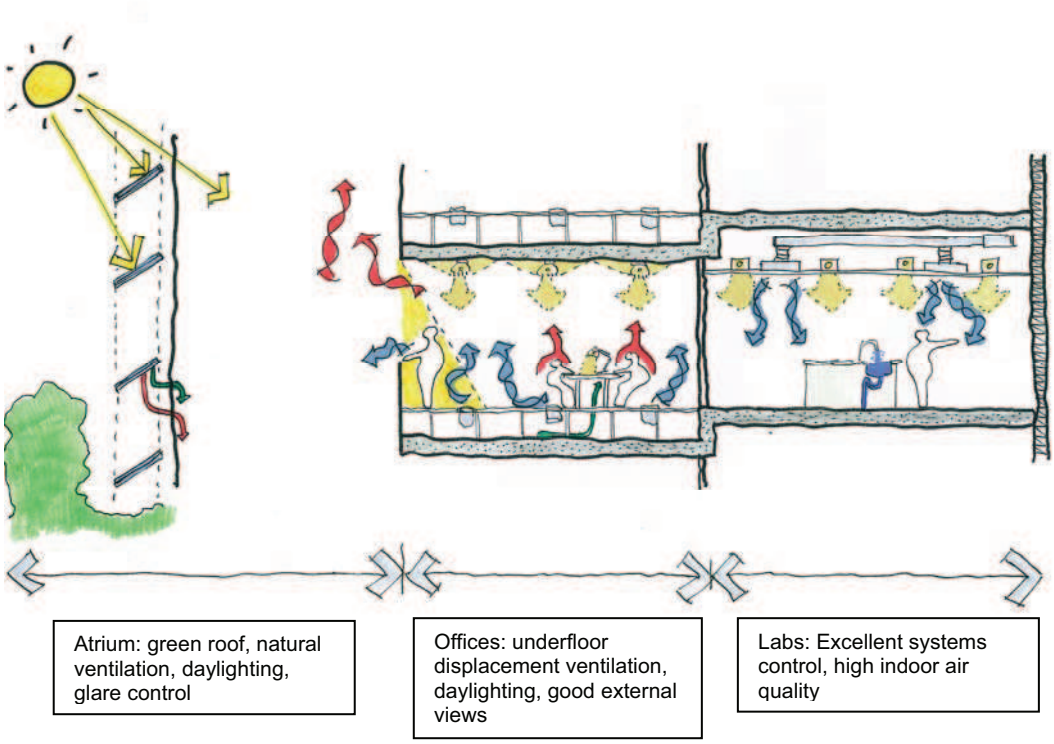

Figure 7.1.1 A north-south section through the proposed GSVCCC indicating different environmental conditions for the building.

7.1.2 Renewable Energy Generation

The following initiatives will be investigated for the GSVCCC, in part to address the need for innovation for the project:

- Photovoltaic panels (possibly integrated with shading devices)
- Solar thermal hot water.

7.1.3 Energy-efficient Equipment and Controls

The design team will target specifying and select all new equipment so that it meets current best practice for energy efficiency. For appliances, products supplied with the Energy Star or TESAW labels will be used, where possible and appropriate. These should mostly be within 1 Star of the best available appliance on the market based on Australian Government standards.

The design team will investigate reducing car park ventilation energy consumption through the use of variable speed drives (VSD) and carbon monoxide sensors. The use of occupancy sensors to reduce lighting and fan use will be investigated during detailed design to further reduce energy use.

Systems containing refrigerants will be housed in a moderately air-tight container and the design team will investigate the use of a refrigerant leak detection system at all critical points. In such a system, upon alarm, factory-installed standard refrigerant recovery systems will ensure no leakage occurs.

7.1.4 Metering and Commissioning

The design team will consider the installation of real-time, digital electricity usage meters to engage users with the energy consumption patterns of the GSVCCC. Metering of major electrical loads will be specified in order to improve performance over time. The design team will incorporate a commissioning and building tuning plan into the building's design, construction, and operation.

7.1.5 Energy-efficient Lighting Strategies

It is proposed that the GSVCCC will use occupancy sensors and high-efficiency lighting. The design team will avoid using incandescent or halogen lamps and instead design with T5 fluorescent fixtures in offices, labs and conference rooms. The design team will use LED light fixtures where possible to extend lamp life and reduce re-lamping costs and waste. For corridors, the design team will use high-efficiency fixtures with maximum on-centre spacing to reduce energy use and will avoid using purely decorative luminaires or light sources with poor efficacy. High-frequency ballasts (at least 32,000 Hertz) for fluorescent light fixtures will be specified.

The GSVCCC will be designed to take advantage of maximum daylight, while avoiding glare and thermal comfort issues.

7.1.6 Dark Sky Lighting Requirements

The design team will attend to diurnal patterns and biodiversity by minimising dark sky issues by installing low cut-off luminaires that direct light on surfaces and not toward the sky. The team will also design site lighting in accordance with Australian Standard 4282-1997 (*Control of Obtrusive Effects of Outdoor Lighting*) and, where possible, ensure that at least 95 percent of outdoor spaces do not exceed the minimum requirements of AS1158 for illuminance levels.

7.2 Water-Sensitive Urban Design Measures

Water consumption is always a key focus of sustainable developments in Australia – one of the driest continents in the world. As such, the design team will seek to reduce potable water consumption as much as possible using a variety of methods:

Rainwater Capture: The design team will review the feasibility of using rain water for toilet flushing and irrigation purposes. If appropriate, the GSVCCC will provide for dual-reticulation of hydraulics services throughout the building.

Water Efficiency: The GSVCCC will use water-efficient tapware based on the Water Services Association of Australia's National Water Conservation Rating and Labelling Scheme. The potable water use for irrigation and recycled water will be metered for the building and site.

Fire System Water Consumption Minimisation and Capture: A bypass valve and a storage tank will be included in the design of the fire water system such that testing any ater used for testing will be able to be salvaged and reused on site.

Water Monitoring: Water meters will be installed for all large-scale water uses and linked back to the BMS.

Targeted Water Reduction: Using the water meter data, a baseline will be set for the building's water consumption and strategies will be considered to reduce consumption by 20% over an agreed period.

Stormwater: Consideration will be given that all stormwater leaving the site will be treated in accordance with the *Urban Stormwater Best Practice Environmental Management Guidelines* (CSIRO 1999) and *Australian Runoff Quality, A Guide to Water Sensitive Urban Design* (Engineers Australia, 2006), for all 1-in-20-year storm events. This may require the use of sand filters or other such devices, mainly targeted for the plaza proposed on the ground level between the existing Garvan Institute to the south, the Victor Chang building to the east, and the GSVCCC.

7.3 Commissioning

One of the key objectives for the GSVCCC is to include building commissioning and tuning, beginning as part of the integrated design process and following through into building operation. Commissioning will occur for all major systems, such as mechanical, hydraulics, and controls.

7.4 Materials, Recycling and Waste Disposal

The material strategy for the GSVCCC will target the minimisation of the use of all products with harmful, carcinogenic emissions such as VOCs, formaldehyde, and chromium. Lists of all known carcinogens have been compiled from sources such as the United States National Toxicology Program, the World Health Organisation and the U.S. and Australian Environmental Protection Agencies. These lists will inform the material selection process where possible. In general, the following areas and principles will be considered when making material selections:

- Minimisation, reuse and recycling
- Embodied energy
- Transportation
- Carcinogens used in manufacturing
- Carcinogens emitted once created

Improving the ecological value of the site will also be a key target of the site with the construction of a green roof garden.

7.5 Transport

Since the GSVCCC will be located in central Sydney with easy access to a number of major transport hubs such as Victoria road, Oxford Street and Kings Cross train station, the project stands to gain from a relatively low energy expenditure tied to the transport of its occupants and visitors. The site is also surrounded by residential areas with Elizabeth Bay, Edgecliff, Paddington and Darlinghurst all within one kilometre or the site, as such it could be reasonably expected that a large portion of employees and visitors would be in the position to walk and cycle to the building (see Figure 7.5 below).

The following areas will be investigated as possible ways in which to reduce the transport footprint of the building:

- Bicycle racks for staff and visitors
- Cyclist changing facilities including showers
- Small car parking spaces to encourage more fuel efficient cars
- Infrastructure for electric car charging points
- Dedicated car share parking spaces

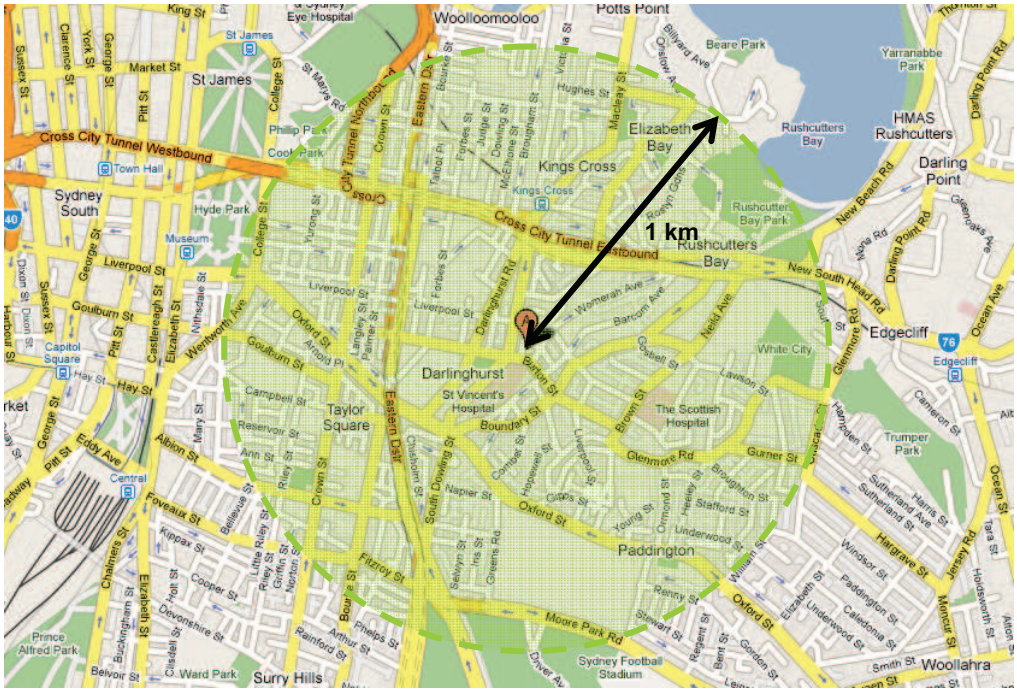

Figure 7.5 A 1-kilometre radius from the proposed site extends into some of Sydney's densest neighbourhoods, thereby increasing the likelihood that visitors and occupants of the building will walk or ride their bikes (Courtesy Google Maps).