Building a Sustainable Library for Macquarie University

- Key Facts

Sustainability Representatives Network Meeting
1 February 2011
Key Design Principles

- A symbol of Macquarie’s new strategy
- A strong relationship with the campus
- A focus on people
  - Learner-centred design
  - Environmental sustainability
A focus on people

*Environmental sustainability*

**Aim to achieve a Five star Green Star rating using the Green Building Council of Australia Educational Tool**

- Minimise environmental impact of the building
- Healthy building
- Light, thermal comfort, ventilation
- Water and waste management
- Innovation
The Site and the Size

- The “Hole” – 8,000 sq m
  - One rugby field including in-goal areas or 6.5 Olympic size swimming pools
- The “Dirt” – 815.76 tonnes removed
- The new Library “footprint” – 6,776 sq m
  - About 5.5 Olympic size swimming pools
- Gross Floor Area - ~18,000 sq m
  - Total GFA of current Library ~20,000 sq m

... “smaller” but with room for almost double the collection and almost three times the client seats – how is this possible?
A symbol

- Aspiration: research intensive
- **Light and connection:** people focus
- Strong sense of place: environment

“a single gaslight stood at the corner of Balaclava Rd and Waterloo Rd....”
Light

- **Natural Light**
  - Courtyards and skylights
    - Natural light into deepest parts of the building
  - Good levels of daylight for building users
    - Glazing – variety of UVA filtering required by the Building Code
    - Shading – external “fins” – Building Code Part J modelling – shade the nominated area for at least 80% of the time
  - Reduce discomfort from glare
    - Blinds and double facades
Light

- **Artificial light**
  - High frequency ballasts to reduce “flicker”
  - Electric lighting levels – to make sure lighting is not “over-designed” while meeting lighting standards
  - Lighting control system – “zoned” controls so that energy is not wasted
  - External lighting is energy efficient but still meets AS1158 for lighting levels

- **Light pollution**
  - No direct light beam, generated from within the building or outside the building boundary, is directed at any point in the sky
Connection

• **Physical**
  - Walkways – internal and external
    - internal suspended walkways are 2m wide and Level 5 is fully enclosed
  - Landscaping – the “green roof”
  - Stairs – 22 – internal stairs: 3; egress stairs: 19
  - Lifts – 3: 1 dedicated to staff use
  - Security staff dedicated to and located in the Library
Connection

• **Virtual**
  – Wireless network
    • everywhere except plant rooms & ASRS – 75 WAPs on Levels 1-5
  – Wired network (data and phones)
    • Connected to the University via the service tunnel adjacent to the eastern end of Level 1

• Security
  • Camera locations and types worked out with Security
  • Cameras in client use areas
The Design

- Designed over 5 Levels
- Capacity for 3,000 seats and 2.3 million items
- Wireless access everywhere
- Power access for recharging portable devices
- Flexible, configurable, accessible spaces
Materials

- **Reduce waste going to landfill**
  - A dedicated storage area for the separation and collection of recyclable waste is provided in the new Library – required even though we have our current waste management regime in place
  - AWEdwards have re-used or recycled 80% of all demolition and construction waste.

- **At least 2% of the project’s total value has a post-consumer recycled content of at least 20%**
  - This is achieved with the ceiling tiles, carpet tiles, and water drainage cells on the roof
  - In addition the carpet tiles are classified as “environmentally innovative” and have been awarded an Environmental Choice Australia Eco-Label.
**Materials**

- **Concrete**
  - The absolute quantity of Portland cement has been reduced by the substitution of industrial waste products for 30% of the in situ concrete, 20% of the pre-cast concrete and 15% of the stressed concrete.
  - 20% of all aggregate in the concrete is recycled.

- **Steel**
  - The overall percentage of post consumer recycled content of all the steel in the project exceeds 45%.

- **“Dematerialisation” – use less materials than conventional designs**
  - 67% of the building roof area has a dual function i.e. roof and garden substrate. This is more than double the 25% requirement.
Innovation

• **Automated Storage & Retrieval System (ASRS)**
  - High density storage serviced by robotic cranes
  - First in Australia
  - Has environmental benefits through savings in area constructed, savings in ongoing Green House Gas Emissions, savings in ongoing Electricity Consumption
  - An automated storage and retrieval system (ASRS) allows reduction of the building footprint by 38 percent (11,000 sq.m.). This “dematerialisation” of the building results in savings of embodied energy of 211,717 gigajoules and an annual saving in greenhouse gas emissions of 817 tonnes per year.
Learning & Innovation

• **Learning resources**
  – working with the Sustainability Office on these projects
  – will create learning resources for a minimum of 10 sustainable attributes of the building (only 3 required)
  – creation of an online induction guide
  – Integration of the new Library with the curriculum (student projects) and the campus sustainability tour and related outreach programs

• “Green lease” with the Cafe
• “Green roof” research
Water management

- Overall aims are to monitor water use and to use drinking water (potable water) for drinking – and recycled water for other uses
  - Water meters are installed to monitor water use in the Library
  - Sanitary fixtures and tapware are WELS rated (meet the Australian Government Water Efficiency Labelling Standards)
  - The whole of the roof area L3, L5, L6 (9,769m²) drains to a 272kL rainwater collection tank using a syfonic piping system – an Australian invention
  - A 371,000 litre sprinkler tank stores at least 80% of the water needed for testing and maintenance of the sprinkler system
  - The urinals on levels 3, 4 & 5 are waterless (total 16)
  - The urinals on levels 1 & 2 Caroma Cubes are sensor activated and are flushed with water from the rainwater collection system.
  - The harvested rainwater is used for flushing all the toilets and half the urinals, and for the irrigation of the landscape gardening.
Landscaping

- Four levels of irrigated landscaping
  - Level 1 Courtyards
  - Level 3 Podium
  - Level 5 Roof
  - Level 6 Roof
- All these areas have reticulated sub-surface drip irrigation systems with automated controllers incorporating moisture sensors
- Species planted are generally Australian natives requiring minimal watering
- Use of drinking water for irrigation reduced by more than 90%
Landscaping

• Plant Types
  – Level 1 Courtyards –
    • Timor Black bamboo (bambusa lako – clumping variety), mondo grass
  – Level 3 Podium
    • Round the Courtyards – dwarf varieties of callistemon, melaleuca, lillipilly
    • Shrub areas – kangaroo paws, banksia, westringia
    • Trees at western end – Eucalypts
    • Grass – Sir Walter Buffalo – soft buffalo
  – Level 5 Roof & Level 6 Roof
    • Grasses - themeda, dianella, poa
And a new member of Library staff?
Transport

• No car parking provided in the building for students or staff

• Number of bus/train routes available within 1 km of the building via a pedestrian route – and frequency during peak hour

• Cyclist Facilities
  – student facilities provided across the campus
  – minimum requirement for Greenstar is to provide cyclist facilities for 5% of staff (7.5) - the new Library provides for 10% of staff (15 spaces)
Amenities – Drinking Fountains - Chilled Water

Levels 1-2 near toilets
Levels 1-5 near accessible toilets
Levels 3-5 postgrad and staff areas
Amenities

• **Cafe** – Level 2 East near entrance
• **Kitchens** – Level 4 for staff and Level 5 for HDR students
• **Vending Machines** – Level 3 North and South East Pods
• **Agreements with U@MQ**
Indoor Environmental Quality – “Healthy Building”

- **Air Quality**
  - is provided by a VAV system (Variable Air Volume) air conditioning – the new Library system provides 50% more outside air than required, which helps to counteract the build-up of internal pollutants
  - The rate of “air change” is optimised
  - Monitoring and control systems are provided for Carbon Dioxide (CO2)
  - The use of Volatile Organic Compounds used in paint, adhesives, carpets, furniture is reduced
  - The use of PVC is minimised and hazardous materials are removed
  - All wood products used are within prescribed limits for formaldehyde content
Indoor Environmental Quality – “Healthy Building”

• **Temperature**
  – Temperature range for occupied areas will be maintained in the range 20C-25C consistent with *Macquarie University Energy Action Plan*
  – ASRS has separate air handling maintained 24/7 18-22 degrees and 50% RH for paper conservation
Indoor Environmental Quality – “Healthy Building”

- **Zoning**
  - Sensors and controls for air-handling units are in zones and/or individual rooms

- **Tuning**
  - Systems will be “fine-tuned” and then monitored monthly with full recommissioning after 12 months

- **Internal Noise Levels**
  - Noise of building systems does not exceed satisfactory levels and partitioning used decreases noise between adjacent spaces
Emission Control

- Heating, Ventilating, Air-conditioning (HVAC) systems have an Ozone Depleting Potential of zero
- A refrigerant leak detection system is provided for the chillers
- All thermal and acoustic insulants used in the building avoid the use of ozone depleting substances in both manufacture and composition
- The building does not increase peak stormwater flows
- All stormwater leaving the site is treated in accordance with CSIRO Environmental Management Guidelines 1999
Green Building Council Assessment

- Initial assessment of Round 1 Submission completed and feedback received
- Will work through this feedback to finalise Round 2 submission
- Minimum 60 points required to achieve five star rating