



Dandiiri Contact Centre (DCC) Zillmere, Queensland

Project Case Study Green Star Office Design V2

Project No: 50406
Site No: 25218

March 2011



DCC Main Entry

1.0 Project Details and Key Parties

Project Name: Dandiiri Contact Centre (DCC)

Office Design V2 submission Certified: September 2009

Office Design V2 submission Score: 92 points (weighted)

Office Design V2 Rating: 6 star Green Star rated

Address: Pineapple Street, Zillmere, Queensland

Development Site: The DCC is a new office building located as an infill development within a larger government precinct on Crown land.

DCC Building Owner: Accommodation Office (AO), Department of Public Works, Qld Government. DPW, represented by the AO are the owner of the DCC project and will ultimately become the manager for the new building .

DCC Tenants: there are **two initial tenants** for the DCC Project:

1. **Smart Service Queensland (SSQ)**
2. **Queensland Police Service (QPS)**

Main Contractor: Glenzeil Pty Ltd.

Secondary Contractor: Kane Constructions (QLD) Pty Ltd

DCC Project team: predominately Project Services employees, with Ecolateral (ESD Mentors), City Design (Civil) and Steele Wrobel (engaged to measure the BOQ).

Project Services is a multi-disciplinary consultancy service department within the Department of Public Works (DPW). For DCC internal resources were utilized for the Project Management, Architecture, Primary ESD Co-Ordinator, Quantity Surveyors, Structural, Electrical, Mechanical, Fire, Services, Environmental Engineers, Landscape Architecture and Interiors.

DCC project Program

- Project inception was in August 2007
- Contract Documentation stage ended December 2008.
- Glenzeil Pty Ltd was appointed as the DCC Contractor in late February 2009.
- Practical Completion for the building achieved in June 2010.
- Kane Constructions (QLD) Pty Ltd appointed contractor in January 2011 for Café Fitout and Northern Carpark PV Array.
- Carpark and Northern PV Array currently under construction and due for completion in July 2011.

The DCC procurement method used is a traditional lump sum AS2124 contract.

Rating Tools:

The DCC project is currently registered with the GBCA for three Green Star tools:

- Office Design V2;
- Office As Built V2 (submission currently in preparation); and
- Office Interiors V1.1 (submission currently in preparation).

The DCC project will also register for a NABERS ABGR Whole Building environmental rating.

2.1 A Qld Government (DPW Accommodation Office) Project

The Accommodation Office (AO) instigated the project in 2006 after recognizing the need for a Government Joint Contact Centre.

DPW, through the AO, is providing benchmark projects such as DCC to demonstrate to government agencies and industry that projects can achieve the highest ESD outcomes at a commercial cost.

2.2 DCC Building functional overview

- The proposed new DCC office building of 4686sqm of NLA, is a medium rise development consisting of three storeys and a basement carpark. It is divided into two wings each side of a central core, with open vertical atrium spaces between them.
- The fit out for the two tenants has been fully integrated with the base building design.
- SSQ and QPS will jointly operate a call centre for non-emergency police calls and general government services and have the ability to provide back-up to 000 services.
- The DCC building will cater for a maximum of 322 work points per shift.
- The basement comprises carparking, plant rooms, cycling facilities, recycling facilities and stores.
- The ground floor comprises the main entry foyer, training rooms, staff amenities, open plan office space, and plant rooms.
- The first and second floors comprise training rooms, staff amenities, large open plan office spaces, individual office spaces and stores.
- The third floor comprises plant spaces.

2.3 DCC Green Brief

As the long term owner of the DCC, AO has had a pivotal role in developing the green brief for the project along. Design decisions have been made in consideration of their “green” benefits, payback periods and quality.

The DCC project was earmarked to achieve and exceed the Qld Government’s benchmark of 5 Star Greenstar Office Design buildings, as well as mirroring current Qld Government Policy objectives in property development, construction, office accommodation and service delivery.

This included adherence to Queensland Government strategic policies relating to the reduced consumption of water and energy and the use of renewable / sustainable construction materials for existing and new building stock.

The overall building design brief and life cycle for the DCC project included:

- Minimise operating, maintenance and capital replacement costs.

- Maximise flexibility of space and services installation/operation to accommodate changes in use and operation.

This project enhances the Qld Governments commitment to Environmental Sustainable Design focussing on:

- Long Term Sustainability
- Environmental Protection and Quality
- Energy Reduction and Management
- Qualified Project Delivery Process

2.4 DCC Green Process

The DCC project team formulated numerous innovative building design and performance scenarios to develop, test, model and refine all the potential strategies before final design selection to resolve Green Star strategies through:-

- Stakeholder Workshops
- ESD Filter Group meetings
- Reviews by ESD Co-ordinator.

Ongoing support and commitment was provided by the AO throughout this process.

2.5 DCC Development Philosophy

The DCC builds on learnings from Research and Development, key projects and skills development within Project Services between 2000 and 2007.

The project team adopted the phrase “Passive Energy Design” to best describe the philosophy for the development of the Centre, where the realized building is the sum of a series of interdependent design features. Passive, in this context means, capture, reflect, store, minimise, reduce, position and generate/provide from the natural environment to supply sustainable energy for the operation of the facility.

Building Components, Building Services and Building Power Generation, are the three basic components which employ these synergies in a symbiotic relationship to make this a landmark energy efficient building.

2.6 DCC Key Building Features

The Queensland Government and the DCC project design team are confident that this building has been designed to ‘World’s Best Practice’ in the areas of:

- Innovative adaptations of proven engineering technologies for heating and cooling systems in a sub-tropic environment
- Daylight harvesting and glare control
- Research, development and testing of materials and systems including utilising waste products for cement, post consumer recycled or FSC timber and reduced use/emissions of PVC, formaldehyde and VOC.
- Development of microclimate personalised comfort controlled work point
- Integrated water management defining differing hierarchies of use and demand including rainwater, stormwater and greywater harvesting, treatment and reuse within the site
- Significant reduction in potable water consumption

- Revegetation of a large area within the DCC site, including a vast tract of native regenerated habitat
- Electrical generation on site through a PV array has reduced the need for grid power supply, reduced CO2 emissions, and reduced peak load
- Exceeding where possible, benchmarks within the applicable Green Star and other rating tools.
- Building Information Modelling, Web Based Site Management, and Project Administration
- Thermal storage and overnight cooling system resulting in significant energy savings, CO2 reduction, reduced peak load and water savings.
- Additional 320kW PV array over carpark currently under construction is intended move the entire building to an energy neutral position – the first large scale office building to achieve this in Australia.

2.7 DCC Economic Value

The project will deliver substantial economic savings to Queensland Government, Owner and Tenants. The savings and the respective investment returns are a direct result of building an energy efficient, passive energy designed building;

- Reduction in capital cost of downsizing UPS hardware and standby generator \$185,000.00 ex.GST. Calculated power cost savings over 5 year \$379,307.00 excluding GST
- Average building energy consumption for a Government Office building in Brisbane 249 kWh/sq m/annum. The DCC calculated energy consumption is 109 kWh/sq m/annum, a saving of \$98,026.00 per annum excluding GST. (Note the Centre has 33% more IT Hardware compared to other offices) and the additional PV array currently under construction is intended to offset the rest of this electricity demand entirely.
- Cost of Government buildings in Brisbane for 2009 is \$3,100.00 p/m², and the DCC building at tender was \$3,600.00 p/m². The estimated return on additional capital investment is 10-15 years.

2.8 DCC Occupant Health Benefits summary

Measurable reduction in sick leave and increased productivity is expected due to features such as:

- Significantly improved air quality - filtered and cooled fresh air delivered to occupants at air rates 150% above the standard and not recirculated.
- Excellent acoustics
- Significantly reduced indoor pollutants with suitable material product selections minimising VOCs, PVC, and formaldehyde.
- Reduced risk of mould in occupied spaces
- Adjustable personal comfort levels at individual work points
- Less eye fatigue due to excellent natural daylighting, energy efficient lighting, and glare control
- Enhanced employee and visitor facilities – bike and changing facilities and indoor and outdoor breakout spaces.
- Internal voids and stairs promote visual interconnections between floors and a sense of community while improving natural lighting within the building.

Passive Design Features

- The design of the DCC building has been driven by the briefed environmental strategies and energy efficient features rather than merely supporting them. Paramount within this was also the conflicting needs for security and the ability to maintain the building and service its plant and equipment both internally and externally.
- The DCC building is a long thin rectilinear building facing north with maximum glass areas to North and South with significantly more limited glazing to the East and West. Extensive and appropriately located shading significantly reduces occupant glare. The glazing types selected for the project have an excellent SHGC rating and U-Value and assist in significantly reducing the heat load into the building.
- The combination of well insulated roof and walls particularly on the east and west facades, suitably orientated building form, appropriately located external shading, double-glazing (to all A/C spaces) and thermal mass in the external building features support the energy efficiency of the mechanical systems.
- Horizontal and vertical fixed shading devices have a dual purpose; shading the occupant working plane from 91% of direct sun as well as providing a series of service access gantries for the external façade of the building and service risers.
- A series of external service risers have allowed an essentially column free space internally with all major plant able to be serviced without entry to the tenancy.
- The high floor to ceiling heights in the open plan offices (approx 3.7 metres) and extensive double glazing on the north and south facades (approx 720 sqm), combined with large south facing clerestory windows above the internal atrium spaces in both wings of the building, enables for the majority of the NLA to be primarily naturally lit reducing the need for artificial lighting. 77.6% of the NLA has a Daylight Factor of not less than 2.5% as measured at the floor level under a uniform design sky.
- The roof is designed to the ideal pitch for latitude to support direct fixing of more than 600m² of photovoltaic solar array panels.
- The building is a mixed mode design (in that it contains both mechanically ventilated and naturally ventilated spaces) as well as a naturally ventilated carpark in the basement.

DCC Green Star Office Design V2 Category Features

It is noted that features written in black text below do not rate to a specific green star credit, whereas those features described in brown text relate directly to the stipulated green star credit.

Management

- In relation to MAN-1, the **nominated Green Star Accredited Professional (GSAP) on the project is Ecolateral** (led by Mark Thomson), and in addition the **10 of the DCC key project team members are also registered GSAP's**. Ecolateral are engaged for all three tools registered for the DCC project primarily to provide expert sustainability advice in accordance with the requirements of MAN-1.

During the PD-CN stage, **Project Services appointed an in-house ESD Co-ordinator (Susan Mezger) and assistant Co-ordinator (Alysha Woodland) (also GSAPs)**, to co-ordinate the project team and undertake detailed reviews and compile the DCC Office Design V2 submission. **Liz Spooner and Lisa Britzman have undertaken this role for the Office As-built and Office Interiors submissions respectively.**

- The **contractors and trades on site performed comprehensive pre-commissioning, commissioning, and quality monitoring in accordance with the relevant CIBSE and ASHRAE codes** as outlined in the Technical Manual for MAN-2.
- A detailed **Design Intent document was developed and handed to the Building Owner prior to Practical Completion**. This document includes energy and environmental strategies employed, monitoring and targeting strategies and descriptions of the building services systems for mechanical, electrical, water (hydraulic and other water strategies) and fire.
- The **transferred information and documentation to AO regarding the design intent, as installed details, commissioning reports and training of building management staff** in accordance with the Technical Manual for Man-2.
- In accordance with MAN-3, a **12 month commissioning Building Tuning period as well as a re-commissioning period at the end of the Building Tuning period is currently underway**. This has included **minimum quarterly reviews and will see a final recommissioning after 12 months of operation**.
- An **Independent Commissioning Agent (ICA) was appointed to provide commissioning advice to the Building Owner (AO) and to the project design team, throughout the design and documentation stages**. The ICA's scope of works is to monitor and verify the commissioning of the HVAC and building control systems during the commissioning and recommissioning stages. Additionally the contractor appointed their own commissioning agent to ensure a smooth process.

- **A Building Users Guide** was provided to the owner prior to **Practical Completion** (MAN-5).
- The Contractor **reused and/or recycle more than 80% construction waste by weight and reported to the client monthly.**
- The **Contractor had ISO 14001 accreditation, and submitted and followed an EMP and EMS as part of their contractual requirements.** (MAN-6)

Indoor Environment Quality

Building Ventilation Strategies: DCC is a mixed mode building designed to maximise passive design and minimise the need for mechanical ventilation.

- The **central air conditioning system is a constant volume displacement system that utilises heat recovery systems, desiccant dehumidifiers and passive chilled beams.** The two chiller sets are connected to a 750kl thermal storage tank which is to be charged at night in order to load-shift energy use to reduce peak demand and to operate the chiller and cooling towers in the cooler more economical night air.
- There are **four active humidity control units that use heat recovery and desiccant technologies to remove moisture from the outside air.** The heat recovery units recover heat from approximately 90% of the outside air that enters the building at an efficiency of 74% latent heat and 80% sensible heat. The desiccant unit utilises the waste heat from the DX unit to regenerate the chemical desiccant dehumidifier and remove moisture from the incoming outside air. The inbuilt controls in these units ensure constant moisture content in the supply air to the building.
- Air Handling Units: **Preconditioned dehumidified air is supplied to the local zone chilled water air handling units which trim the air down to the occupants' desired temperature.** The controls in the active humidity control units ensure a constant moisture content and can produce dry and warm air which needs to be cooled before entering the space.
- **Air delivery and extraction:** The mechanically ventilated components are designed with **100% pre-conditioned fresh outside air (IEQ-3) provided to internal spaces** via four outside air preconditioning air handling units located at roof level. This air is delivered via the service risers (visible exterior “turrets”) through underfloor ductwork/ displacement and is delivered to occupants via the personalised comfort controlled work points. A dedicated relief air system then removes the air from the spaces and exhausts it out of the building via heat exchangers ensures there is **no recirculated air component.**
- **Ventilation rates (IEQ-1):** Mechanically ventilated spaces utilise air handling systems designed to **deliver a minimum of a 150% improvement of fresh outside air at all times above the AS1668.2-1991 minimum outside air flow.** The actual improvement averaged over the entire NLA area is 182.5%. The naturally ventilated spaces (lunch rooms) have been designed in accordance with legislative standards.

- Air Change effectiveness (IEQ-2): **96.4% of the mechanically ventilated spaces effectively deliver clean air with the integrated base building (floor diffusers) and fitout design (personalised air delivery system to occupants) within the NLA.**
- The **base building mechanical ventilation system has been designed to allow for tenant installation of individual user control to each workspace for 97.5% of the NLA.** 100% of the naturally ventilated spaces within the NLA (lunch rooms) are provided with user controlled ventilation openings in accordance with the Technical Manual's credit criteria and to meet the AS AS1668.2-2002. In addition there are naturally ventilated foyers spaces and external staff lunch / breakout areas
- The **mechanical ventilation system is designed to actively control humidity to be no more than 60% relative humidity in the NLA spaces and no more than 80% relative humidity in the supply ductwork (IEQ-15)**
- **Two dedicated tenant exhaust risers located within each wing of the building exceed the requirements for IEQ-16** and effectively remove particles from copiers and printers.

Lighting

- For Daylight Glare Control (IEQ-5) the DCC project demonstrates that for each typical glazing configuration on each facade, **fixed shading devices shade the working plane 1.5m in from the centre of the glazing from 91% of direct sun** ensuring the occupants working conditions are ideal.
- **High frequency ballasts will be installed in fluorescent luminaries over 100% of the NLA (IEQ-8).**
- **77.6% of the NLA has a Daylight Factor of not less than 2.5%** as measured at the floor level under a uniform design sky.
- **Office lighting design has a maintained illuminance level of no more than 400 Lux for 100% of the NLA as measured at the working plane (IEQ-7).**

Materials

- Excellent indoor air quality: **All paints, carpets, adhesives and sealants specified are low VOC (IEQ-13).**
- Thermal modelling for DCC demonstrates the maximum Green Star points are achieved for IEQ-9 with **PMV levels between -0.5 and 0.5 ensuring excellent thermal comfort for occupants.**
- All **composite wood products** to be used internally are specified to be **low emission formaldehyde.**
- The DCC building is **exceptionally well sealed to reduce air leakage and ingress** thereby reducing pollutants from the exterior and is also

particularly **important for the successful application of chilled beam air conditioning** given the industrial neighbours and adjacent railway. The integrity of the external skin was tested to prove the building achieved the specified air-tightness during construction.

Energy

- The highest NABERS Energy (previously ABGR) rating of 5 Stars + 60% CO2 reduction has been achieved and exceeded on the DCC project. **The actual value of normalised CO2 emissions achieved for DCC is 8 kg.CO2/m2/year resulting in 5 star plus 90% reduction in CO2 (for ENE-1)** compared with the NABERS Energy Queensland greenhouse gas emissions value of 77 kg.CO2/m2/year for a 5 star rating + 60% CO2 reduction. This equates to 15 points for ENE-2. Two additional points are also achieved as the documented design provides at least 1 carpark space for each 100m2 of NLA in the DCC basement carpark.
- The state of the art **DCC HVAC system specifies a complex array of the most energy efficient components available on the commercial market.** A combination of all of the latest, cutting edge technology in indoor environmental, energy reduction components have been incorporated in the design providing a combination of innovative integrated components and using state of the art **Direct Digital Control systems** interfacing with the fully automated **Building Management System**. The total control system is set to optimise every component of the system including automatically adjusting set points to maintain ideal PMV conditions and optimise energy use.
- The **HVAC system specifies the highest efficiency available enthalpy air heat exchanges to reuse the previously used chilled water from the air handling units to supply the chilled beam system.** A total minimum efficiency of 70% provides massive energy savings on cooling costs particularly on a 100% fresh outside air delivery system. The enthalpy wheels form part of packaged pre conditioning units that use a combination of chilled water and direct expansion cooling coils. The waste heat from the condenser of the direct expansion components is used to regenerate a desiccant heat exchanger that provides free latent heat removal and dehumidification. The chilled beams are mounted high above the occupants driving a natural convection of cold air and moving the heat up and away from the occupants.
- The **highest efficiency central chilled water system available on the market has been specified for DCC with a separate Direct Digital Control system set to optimise the loading efficiency by ensuring that the chiller operates at the highest possible COP at all times.** Due to increased efficiency at part loads, a chiller will run to produce the highest efficiency operation at any given time. In addition the **chiller will charge the chilled water thermal storage tank at night in order to reduce peak demand by load shifting energy demand.** The night time operation further increases the efficiency of the chillers with the lower ambient temperatures providing lower condenser water temperature from the cooling towers which dramatically increase the efficiency of the chiller.

The chillers are connected to oversized primary and secondary chilled water reticulation systems that require very low pumping energy. By applying the fan/pump cube law it has been estimated that the pumping power has been reduced by approximately 50% by increasing the diameter of the pipe work by approximately 20%. The secondary reticulation system also utilises Variable Speed Drives (VSD) which automatically modulate to optimise energy reduction. The secondary chilled water system provides chilled water directly to preconditioners and room air handling units. The exhausted chilled water is recycled via heat exchangers to provide additional space cooling by passive chilled beams. The recycling of the return water from AHU's to supply the chilled beams both increases the efficiency of the chiller and the chilled water reticulation system.

- **The chilled beams and high efficiency chilled water system provides space cooling and thermal comfort by utilising natural convection currents with no additional energy use from fans.** All other auxiliary fans in the building have been specified with the highest efficiency, axial flow, and aerofoil blades. The combination of high efficiency fans and chilled beams significantly reduces ventilation system losses. The heating system provides individual heating through personalised, controllable delivery to both provide optimum environmental conditions in the working envelope and reduce energy consumption by heating all areas of the building and its structure.
- **Cooling Towers: The system uses wet cooling towers for heat rejection to the atmosphere; they are considered the most efficient heat rejection source commercially available.** The cooling towers selected for the building were considerably oversized to reduce energy consumption by the fan and noise generation. The units specified each uses 3.7 kW fan motors complete with VSD Drives.
- **Base Building Energy for Condenser Water Loop: All air conditioning services for tenants are supplied and sub-metered from the central energy plant and therefore have no direct impact on the condenser water loop.** This method ensures that the tenant utilises the most energy efficient system and does not connect low performance equipment into the condenser loop and reduce the whole building performance.
- The electrical system reduces energy by utilising high efficiency lighting combined with light shelves and sensor lighting. The project also incorporates a **diesel generator designed primarily for emergency back up power.** The generator has been designed to operate the building under full load conditions and during monthly testing will operate the building and reduce greenhouse gasses by running solely off the generator. **The final annual value for the net electrical output is 160,555 kW.hrs/annum prior to installation of the Northern Carpark PV array.**
- Natural ventilation of carpark and foyer spaces reduces demand.
- **Energy demand reduction systems will be installed to reduce peak demand on electricity infrastructure by a 29% reduction.** This energy reduction is achieved through the chilled water storage tank system design

(ENE-7). The storage tank essentially provides electrical power load shifting of the building refrigeration plant to minimise building peak power occurrences. Chilled water is generated at night after the building's inherent time of electrical peak demand and stored in the storage vessel available for use the next day on demand. The chilled water is produced with lower night time ambient conditions which results in lower condenser water temperature increasing the efficiency of the chillers.

- **ENE-5 lighting power densities for at least 95% of the NLA (100% is actually achieved) meet 1.5 W/m² per 100 Lux.**
- **ENE-3 The DCC Base Building documented design incorporates sub-metering for each substantive energy use within the building to meet Green Star requirements.** The design complies with the Green Star Ene-3 credit criteria which require meters for each separate load greater than 100 kVA. **Sub-meters for loads less than 100 kVA are also included in the design documentation.**

Transport

- **Improved access to public transport via a new secure pathway linking the DCC development site and the Zillmere Train Station.**
- For TRA-2, **26% (83 out of 465 combined DCC and precinct use) of all car spaces on the development site are for small vehicles in accordance with AS2890.1-993.** This will encourage the tenants to use more fuel efficient modes of transport. Additional motorcycle parks were installed during the construction phase.
- For TRA-3, there is **secure bicycle storage for 10% (33 no. in total) for the Building Staff**, 4 showers and 33 lockers (to meet the Green Star criteria) provided in the basement. A **7 capacity Visitor bike facility** is provided adjacent to the main entrance on ground level.
- As the DCC development site is not located in Brisbane's CBD and services are not as frequent but there is **reasonable access within 1km to either train or bus services**, 2/5 points were achieved for TRA-4.

Water

The **DCC water philosophy is a hierarchy of water management systems that aims to capture, treat and re-use as much of the site water as possible. As a result, there is a significant reduction in overall water consumption across the development site and within the DCC building.**

Some more detailed features include:

- The **water efficient features** of the DCC building which **significantly reduce occupant amenity potable water consumption** enable the project to claim maximum WAT-1 points, as the **estimated total potable water consumption for amenities is only 6L/person/day.** The 5 points for this credit are achieved by the combination of water reuse systems and installing efficient fixtures.

- Fixtures include - **Shower: 6 L/min, Basins: 4 L/min, Sinks in general areas: 4 L/min, Dishwashing machines: 1.5 L/min, Water Closets 4.5/3 L/flush, and Urinals 0.8 L / flush.**
 - **Grey water Reuse (with fire test and stormwater top-up):** Water required for sanitary flushing within the building is sourced through the collection of grey water from bathroom hand basins and showers within the building.
 - A **stormwater reuse system** is additionally provided. The project design allows for the collection of stormwater from two separate catchments (eastern and western carparks) on the site. Stormwater from these hardstand areas is harvested and drains by gravity to inground storage tanks (75kL each). The harvested stormwater is then either used for irrigation purposes or is treated through the grey water treatment plant and used to supplement the sanitary flushing within the DCC as required.
- **Sufficient temporary storage for fire protection system test water and maintenance drain downs for reuse** on the DCC development site is provided within the western stormwater storage tank (WAT-5). Fire testing will only be conducted when there is sufficient capacity within the stormwater tank (ascertained from Building Management System (BMS) readings).
 - **Water meters will be installed for all water uses and will be linked to the BMS to provide a suitable leak detection system (WAT-2).** Compliance requirements for this credit have been exceeded as all water uses (major and minor) for DCC are separately metered including personal ablutions (basins and showers), sanitary flushing, cooling towers, irrigation, grey water system, rainwater and stormwater collection system, and hot water services. The BMS leak detection is set to activate an alarm should the flows exceed the highest weekly reading + 2.5% over a 24 hour period for the office floor levels and the highest weekly reading + 2.5% over a 24 hour period for major plant.
 - For Wat-3, maximum points are claimed as the **consumption of potable water for landscape irrigation is reduced due to the provision of a water efficient irrigation system comprising subsoil drip systems and automatic timers with moisture sensor control override.** It is additionally noted that no potable water will be used for irrigation purposes. Irrigation will only be conducted by using the harvested stormwater.
 - In regard to WAT-4, the project demonstrates that the **cooling systems use 94% non-potable water** and maximum points (4/4) are achieved for Green Star. This is achieved by the design and documentation of a **rainwater harvesting and reuse system and a number of strategies to reduce cooling tower water usage** such as operating the building refrigeration system's cooling towers to maintain the highest possible water salt concentration levels without corrosion, with lowest possible mains water makeup consumption.

The DCC building's pitched roof enable more efficient waterproofing and capture of rainfall in the region's sub-tropical climate. The rainwater

harvesting system for the DCC project includes **syphonic drainage** (from 2125m² of roof area) to **rainwater storage tanks** with a total capacity of 135kL (3x45kL). The syphonic gutter system captures rainwater more effectively, reduces materials and uses Green Star friendly materials. The gutters have been designed for a 1:100 year storm to reduce losses from overflow.

A **transfer pump** then feeds the collected roof water from the storage tanks to the cooling towers located on the roof of the building. This volume of rainwater storage will provide non-potable water for 94% of the total cooling system water demand per year. There is also a back-up supply of mains water for use during prolonged dry periods or periods where the building requires intense water use for heat rejection. The following aspects relate to the rainwater harvesting system:

Cost Saving Relating to Water:

The real cost of providing water to communities is not reflected in the tariff charged, as Government subsidises the cost to the head end suppliers. The cost savings listed below therefore cannot reflect the true economic value of the project's extensive water reduction and water reuses systems but demonstrates how efficient design can reduce water demand and the true savings far exceed those identified below:

- Average water consumption per annum in Government buildings 2004/05 was 1.81 kl/m². Water consumption per annum in Government buildings after water consumption policies were implemented in 2007/08 was 0.88 kl/m²
- **Water demand per annum in the DCC building is forecasted to be 0.64 kl/m² and the DCC demand on mains water supply (in consideration of water reuse systems) will be reduced to 0.21 kl/m². This represents 3.6 times less demand on the mains water supply, not only delivering reduced recurrent costs but conserving a valued commodity.**

Materials

- The building frame is constructed from a mixture of **reinforced insitu concrete and precast prestressed hollow core floor planks. The roof is constructed from structural steel.**
- A considerable amount of **research has been undertaken during the sketch design and design development stages to select products and materials that comply not only with Green Star criteria, but also address other sustainable environmental considerations** such as to improve thermal comfort to occupants, minimise material use, improve internal acoustics and minimise toxic emissions (before, during and after construction) and to minimise embodied energy.
- **Regarding embodied energy**, the Qld Government's procurement policy requires the selection of locally manufactured products over interstate or international suppliers and design durability and easily maintained systems/products were also other important considerations. Overall, a significant reduction in emissions, environmental impact and waste during construction and after due to material selection, and sourcing and due to recycling systems built into building.

- The insitu reinforced concrete specified incorporated industrial waste products. **Industrial waste products such as Blast Furnace Slag and Fly Ash** significantly reduced the quantity of Portland cement on the project. **A saving of 741 tons of CO2 in the specified concrete has been achieved.**
- **Reinforcing steel manufactured from steel scrap and with a post consumer recycled content greater than 50% has been used in the insitu concrete. Smaller structural steel sections that are manufactured with steel containing a post consumer recycled content greater than 50% have been substituted for steel sections made from steel that is made from iron ore with little post consumer recycled content.** A trussed roof structure was used to reduce the weight of steel where high recycled steel components could not be sourced. **A saving of 362 tons of CO2 in the specified post consumer recycled steel has been achieved.**
- **All timber in the building was either post consumer recycled timber or FSC timber.**
- **Total PVC content cost for all DCC base building services and building fabric elements across the entire project was be reduced by 76%.** The project team consulted directly with product manufacturers. As a result, many alternatives to standard benchmarked PVC items have been sourced and other products that have significantly reduced the total PVC content across the entire project have been specified. We believe this process will continue to help transform the nature of building processes and the market for PVC alternatives.
- The building was designed to accommodate **standard sized sheets** where applicable to minimise waste. Standard sized panels used throughout. A custom profile was been developed for the acoustic panels to allow one common sheet to be used in all locations throughout the building, thereby minimizing waste.
- The use of **access flooring with integrated ‘on-grid’ omni-directional carpet system allows removal of single tiles for easy reconfiguration**

Acoustics

- Given the nature of the facility and its location adjacent a railway line a specialist acoustic consultant was employed to engineer the spaces appropriately such that **at least 95% of the building NLA achieves the ambient internal noise levels in accordance with the Green Star credit criteria.**
- **Several acoustic treatments (e.g. suspended acoustic ceiling panels) are employed throughout the building to minimise noise transmission from external, occupants and plant between spaces.**
- **Exceptional building sealing** for acoustic benefits as well as for air leakage and ingress which will reduce pollutants from exterior. This is particularly important for successful application of chilled beam air

conditioning given the industrial neighbours and adjacent railway and hot humid summer environment.

Other Design Features

- **A dedicated storage area was be provided in the DCC building basement (near the external loading bay) level for the separation, collection and recycling of office consumables with good access for all building occupants and for collection by recycling companies.** The storage area has been adequately sized to allow for recycling of paper, glass, plastics, metals, and organic (compost) waste (MAT-1). Staff are encouraged to recycle waste with the installation of separate waste bins located in each tenancy area for waste including paper/ cardboard, metal, glass, plastics, compost and other materials destined for landfill.
- **Flexibility of building design layout** to suit both current known tenants and unknown future uses, and ease of servicing of building plant and equipment.
- **Uni-strut and other modular suspension systems** allows for future ceiling mounted services as needed.
- **Service access gantries are provided to the façade and high level interior spaces for ease of maintenance**
- Permanent services and all plant not associated with workstation areas is either external or against the core leaving the tenancy space open and infinitely configurable. Access floor contains 'dry' services. Slab soffit contains 'wet' services.
- Termination points within the access floor located around the tenancy for air, data, and power allow simple reconfiguration of spaces. Effectively all services are "soft" connections.
- **Additional capacity** within personalized air system allows additional workstations to be added with minimal mechanical modifications by connection to end of a run of workstations or via flexi-duct to termination points within floor.
- **Reduction in equipment sizing equating to a reduction of 920 tonnes of CO2 per annum**

Ecology

- The DCC project meets the ECO-1 conditional requirement in that **the development site is not on land of high ecological value; the site is not prime agricultural land and is not land on or within 100m of a natural wetland.**
- The DCC project utilises the principal of infill development, and as part of the **wider development site area project philosophy of biodiversity, has designed extensive areas of revegetation including a vast tract of regenerated native habitat of approximately 7600m²**

and regenerated drought tolerant native garden areas of approximately 3000m². Species for the regenerative native habitat were selected from regional ecosystem mapping to recreate the type of ecosystem located on the site before it was cleared. Once established, this area will not require irrigation and will rely on naturally occurring rainfall (ECO-4).

- Landscaping is also provided within the two bio-retention/detention basins which are part of the site's stormwater management system (refer to emissions summary below).
- **Cut and fill requirements are balanced on the DCC development site area** and it has been documented there was **no importation or exportation of fill or topsoil from the site.** (ECO-5)

Emissions

- EMI-1: the **HVAC refrigerants have an Ozone Depletion Potential (ODP) of zero.**
- EMI-3: The DCC project has been constructed with **refrigeration systems that are contained within moderately air-tight enclosures and refrigerant leak detection systems covering high risk parts of the plant** (eg. chillers). In the event of a leak, refrigerants within the chiller plant room on the ground floor will be contained within the enclosure to allow the concentration of leaked refrigerant to build up to a detectable level. A **permanently installed multipoint refrigerant leak detection system** is provided within the chiller plant room.
- EMI-4: **Automatic refrigerant pump-down is made to the heat exchanger/condenser.** The chillers have been designed with oversized condensers capable of holding the full refrigerant charge and motorised control valves to enable the chillers to pump down the refrigerant charge to the condenser vessel.
- EMI-5: **All stormwater leaving the DCC development site, at any time up to a 1 in 20 year storm event, is treated/ filtered in accordance with the applicable guidelines (ANZECC) and the development does not increase peak stormwater flows for rainfall events of up to a 1 in 2 year storm.** The stormwater treatment system includes the following elements: **grassed conveyance swales, kerb inlets, pipe connections, oil and sediment separators, rainwater and stormwater storage tanks, roof water collection tanks and biofiltration/detention basins.** Refer to water section for further details on rainwater and stormwater reuse systems.
- EMI-6: 3 out of 4 points are achieved for this credits as **annual flows to sewer will be reduced through the adoption of a building plumbing design that allows grey water to be separated from blackwater and reused and the installation of water efficient toilets, urinals and fixtures. Grey water collected from wash basins** (excluding kitchen areas) and **showers will be directed to a grey water treatment plant** adjacent to the DCC building to be treated prior to being reused for toilet

flushing. Toilet/urinal water, kitchen water and cooling tower bleed water will discharge directly to sewer (blackwater).

- EMI-7: The DCC base building external lighting design documentation includes luminaries and lighting control measures to prevent the emission of spill lighting to neighbouring properties and upwards without falling directly on a surface with the explicit purpose of illuminating that surface. The **design of lighting is in compliance with AS 4282-1997 - Control of the Obtrusive Effects of Outdoor Lighting.**
- EMI-9: **All DCC building insulation products have zero insulant ODP to minimise air pollutants in both their manufacture and composition.**

Innovations

Project Services and their Client (Accommodation Office) embarked on creating the DCC project as a 'living breathing green building', with a particular focus on incorporating proven systems in a new and novel way. This has led to some significant innovations being incorporated into this building. A total of 4 innovation points were awarded as it has been demonstrated that certain design initiatives provide additional environmental benefit by exceeding the current benchmarks in Green Star – Office Design V2. The following initiatives were awarded innovation points:

- CO₂ emissions – 2 innovation points awarded for ultra-low CO₂ emissions.
- Peak load reduction – 1 innovation point awarded for 78% reduction in peak load and flat load profile
- Water consumption - 1 innovation point awarded for exceeding the benchmark for potable water reduction and for being as close to 'water neutral' as possible.