Umow Lai Enginuity Pty Ltd
Consulting Engineers

Justinian House Development

Mechanical & Electrical Engineering Services and Ecologically Sustainable Development

Schematic Design Report

St Vincents & Mater Health Sydney

Report No 5808/M2R001
Date 12 October 2007

REPORT AUTHORISATION

PROJECT: **JUSTINIAN HOUSE DEVELOPMENT**
SCHEMATIC DESIGN REPORT

REPORT NO: **5808/M2R001**

Date	Rev	Comment	Prepared by	Checked by	Authorised by
08/10/2007	A	Preliminary Issue	AM	PD	AM
12/10/2007	B	Final Issue	AM	PD	AM

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1 EXECUTIVE SUMMARY

The following is a summary of the engineering service systems proposed for the Justinian House Redevelopment for St Vincent and Mater Health Services. These proposals should be read in conjunction with the Daryl Jackson Robin Dyke Schematic Design drawings.

All the engineering works will comply with the Building Code of Australia, all relevant Australian Standards Association, the Health guidelines and the specific requirements of the Sydney Melanoma Unit and the Mercy foundation.

1.1 MECHANICAL SERVICES

New Mechanical services systems will be provided including:

- Chilled water plant.
- Heating hot water boiler plant.
- Air handling systems.
- Server Room Air conditioning
- Laboratory Services such as Fume Cupboards
- Exhaust and ventilation systems
- Stand alone Building Management Systems (BMS)

1.2 ELECTRICAL SERVICES

New electrical services systems will be provided including:

- Main switchboard including surge protection.
- Power factor correction.
- Separate electricity distributor metering of the main SMU facility and tenancies.
- Sub-metering of lighting, power and mechanical services for energy management.
- Standby diesel generator.
- Consumers mains and submains cabling.
- Distribution boards and small power.
- General internal and external lighting.
- Emergency lighting and exit signs.
- Uninterruptible power supplies.
- Small power services including connections to fixed equipment.
- CCTV, access control and intruder detection systems.
- Intercom and public address systems.
- MATV system.
- Communications, including a structured cabling system, PABX and paging systems.
- Audio-visual systems.
- Lightning protection.

2 INTRODUCTION

The following is a summary of the engineering service systems proposed for the Justinian House Redevelopment for St Vincent and Mater Health Services. These proposals should be read in conjunction with the Daryl Jackson Robin Dyke Schematic Design drawings.

All the engineering works will comply with the Building Code of Australia, all relevant Australian Standards Association, the Health guidelines and the specific requirements of the Sydney Melanoma Unit and the Mercy foundation.

2.1 SITE DESCRIPTION

The Justinian house development is a proposed medical research facility of approximately 4000m^2. Built over three levels with a 4000m^2 basement car park.

The site's primary use is to accommodate the Sydney Melanoma Unit, which will include consulting suites, clinical trials, administration, laboratory, database and educational facilities. The Mercy Foundation and NSW Melanoma Network will occupy office space within the building.

2.2 LIMITATIONS OF THE REPORT

Due care and skill has been exercised in the preparation of this report.

No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact Umow Lai Enginuity for detailed advice which will take into account that party's particular requirements.

3 MECHANICAL SERVICES

New Mechanical services systems will be provided including:

- Chilled water plant.
- Heating hot water boiler plant.
- Air handling systems.
- Server Room air conditioning.
- Laboratory Services.
- Exhaust and ventilation systems.
- Stand alone Building Management Systems (BMS).

3.1 CHILLED WATER SYSTEM (CHW)

A new chilled water system will be provided to serve the building located on Level 4 plantroom. Chilled water will be distributed to the new air handling units (AHU) plant located on level 1 and the roof plant rooms.

New air cooled chillers (approx 460kWr) will be provided with chilled water pumps, accessories, pipework reticulation and sundry items.

3.2 HEATING HOT WATER SYSTEMS (HHW)

Two new, gas fired, heating hot water boilers (368kW) will be provided for heating and distributed to the new air handling units (AHU) plant located on level 1 and the roof plant rooms.

Heating hot water pumps will be provided with accessories, pipework reticulation and sundry items. HHW plant will be located in an enclosed level 4 roof plant room.

3.3 AIR CONDITIONING SYSTEMS

The following types of air-conditioning system will be used within different areas:

- Ducted Fan Coil Units (FCU)
- Ducted Split system Air Conditioning Units
- Underfloor air distribution
- Displacement ventilation

3.3.1 Fan Coil Units (FCU)

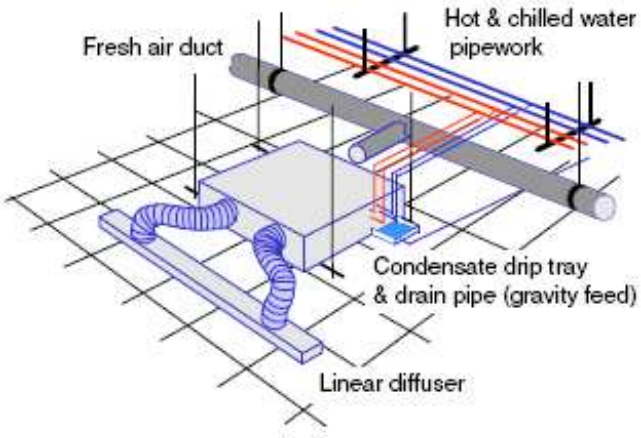
Fan coil units are particularly suited to laboratory installations and enable good building flexibility.

A typical fan-coil unit comprises a fan, heating coil, cooling coil and air filter, all housed in a metal casing.

Primary outdoor air quantities are delivered to the back of the fan-coils and mixed with the secondary recirculated room air to provide comfort conditions. Chilled water, heating water and condensate drainage pipework will be distributed across the floor in false ceilings to each fan-coil unit.

New Electronically Commutated, Direct Current (EC-DC) motors provide excellent part load characteristics and lead to around 50% reductions in fan-coil energy consumption.

Delivering water rather than air to the floors is highly energy efficient and can save on-floor plant area that may be leased to the tenant area.



3.3.2 Split System Air Conditioning units

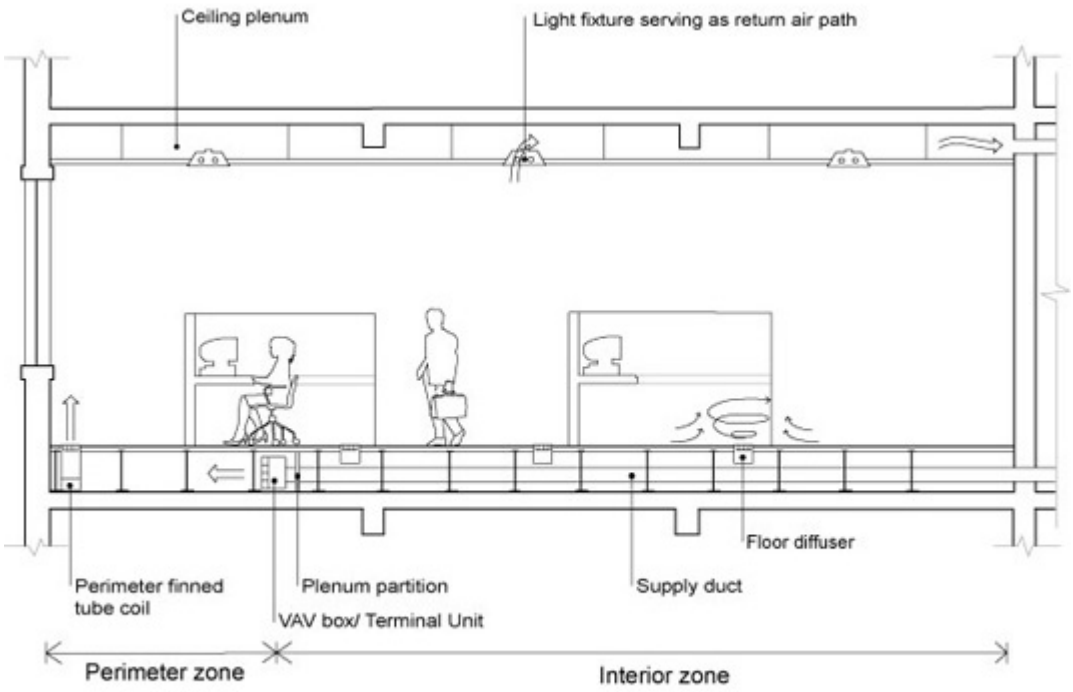
Split systems are stand alone systems and provide a convenient way to air condition specific areas within a building that may need cooling outside normal hours of operation. In this project, a system will be installed to cool the server room, which requires cooling 24x7.

Split systems are made up of two basic components: indoor room cooling units similar to the fan coil units above, and an outdoor refrigeration unit which rejects heat taken from the building. The indoor and outdoor units are linked by pipework which transport refrigerant between the units.

3.3.3 Under Floor Air Distribution (UFAD)

Underfloor air distribution enjoys wide popularity in Europe and is very rapidly growing in America where it is the predominant approach being taken to achieve “greener” office environments. While there are a number of designed or built UFAD projects in Australia it is still a relatively new approach in the commercial market. It is therefore not generally well understood among design professionals and the full potential of the additional benefits to other aspects of the building are fully realised.

Underfloor air conditioning enables higher air conditioning operating efficiencies to be realised over traditional variable air volume (VAV) approaches while introducing new flexibility in cabling design and improved occupant control of the environment. Many of the services traditionally installed within a ceiling void can now be installed within the floor, and floor to floor heights can be reduced improving other aspects of building efficiency. In many cases the requirement for a false ceiling can be eliminated.

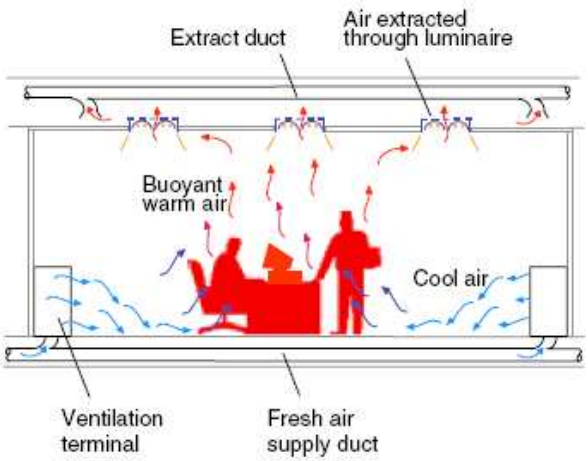


Multi-zoned, limited perimeter ductwork

With this approach air is introduced from air handling units to each floor through riser as with traditional systems. When the air reaches the floor it is distributed through the raised floor void with the floor void acting as an air distribution plenum. This offers immediate mechanical services savings as distribution ductwork across the floor is virtually eliminated.

3.3.4 Displacement System (DV))

Displacement system (DV) supplies air cooled to 18˚C at low velocities directly to the occupied zone from outlets at or near the floor level (supply air temperature for conventional air conditioning systems are 12˚C). The supply air spreads over the floor, forms thermal plumes upon encountering heat sources, and is exhausted by system returns located at or near the ceiling. DV systems purposefully minimize mixing and in fact, are designed to establish a stable thermal stratification level above the occupied zone such that no mixing occurs between the upper and lower zones.



Displacement ventilation – typical air flow pattern.

Both UFAD and DV systems utilize a similar low supply air temperature paired with high return pattern.

UFAD systems differ from DV systems because they typically supply air at higher velocities such that their higher supply volumes are able to meet larger cooling loads.

3.4 AIR HANDLING SYSTEMS

New air handling systems will be provided for the following areas:

- Level 1: Auditorium
- Level 1 Meeting Room And Breakout Area
- Level 1 Academic
- Level 1 Mercy Foundation
- Level 1 General Office
- Level 1 WET Laboratories And Bio Tissue Bank
- Level 2 Consulting Suites 1, Research and Consulting Suite 3
- Level 2 Consulting Suite 2 and Patent Lounge.
- Level 2 Consulting Suite 4, 5 and 6.
- Level 2 Clinical Trials and Dermatology.
- Level 3 Server Room
- Level 3 Dermatology
- Level 3 Database and NSW Melanoma Network

3.4.1 LEVEL 1 AUDITORIUM

One air handling unit will be provided for auditorium area. The system will be supplied with chilled water and heating hot water and will incorporate AHU, heating and cooling coils, filters, DV diffusers and grilles and return/relief fans. The new AHU will be located in the plantroom next to the auditorium.

3.4.2 LEVEL 1 MEETING ROOM AND BREAKOUT AREA

One air handling unit will be provided for these areas. The system will be supplied with chilled water and heating hot water and will incorporate AHU, heating and cooling coils, filters, UFAD system diffusers and grilles and return/relief fans. The new AHU will be located in the plantroom, next to the auditorium.

3.4.3 LEVEL 1 OFFICE AREA

Individual air handling units will be provided for Academic, Mercy foundation and general office area. Each system will be supplied with chilled water and heating hot water and will incorporate AHUs, heating and cooling coils, filters, UFAD, diffusers and grilles and return/relief fans. The AHUs will be located on the central level 3 plant platform.

3.4.4 LEVEL 1 WET LABORATORIES AND BIO TISSUE BANK

A dedicated FCU will be installed in the ceiling space to serve these areas.

The FCU will comprise cooling and heating coils. Chilled water and heating water will be supplied from the central plant system to the FCU.

Zone smoke control and after-hours operation will require the use of adjustable shut off dampers. Supply air fans will be provided with variable frequency speed controllers for control.

Air distribution will utilise conventional rigid duct system. Supply air ductwork will be insulated sheet metal construction with flexible duct run outs to light air boots.

3.4.5 LEVEL 2 OFFICE AREA

Individual air handling systems shall be provided for:

- Consulting Suite 1, Research and Consulting Suite 3.
- Consulting Suite 2 and Patent Lounge.
- Consulting Suite 4, 5 and 6.
- Clinical Trials and Dermatology.

Each system will be supplied with chilled water and heating hot water and will incorporate AHU's, heating and cooling coils, filters, UFAD, diffusers and grilles. The new AHU's will be located on the central level 3 plant platform.

3.4.6 LEVEL 3 OFFICE AREA

Individual air handling systems shall be provided to serve Dermatology, Database and NSW Melanoma Network. Each system will be supplied with chilled water and heating hot water and will incorporate AHUs, heating and cooling coils, filters, UFAD, diffusers, grilles and return/relief fans. The new AHUs will be located on the central level 3 plant platform.

3.4.7 LEVEL 3 SERVER ROOM

The server room will require cooling 24 hours per day.

This space will be served by individual split DX unit with one condenser mounted on the roof within the chiller enclosure.

3.5 MECHANICAL VENTILATION SYSTEMS

Mechanical ventilation systems have fans to supply and/or extract air to and from the building and can thus maintain specific internal temperatures and remove unwanted contaminants.

The three main categories of mechanical ventilation are:

- Extract only such as toilet extract system, gas exhaust and garbage exhaust system
- Supply only which would not be used in this project.
- Supply and extract, such as fume cupboard, car park ventilation and general/utility exhaust systems.

3.5.1 Car park Ventilation

The proposed two levels underground car park will be provided with a mechanical supply and exhaust ventilation system.

3.5.2 Toilet exhaust

It is proposed that the new toilets be served from a centralised system, or a number of systems zoned dependant on layout of the building and available riser space.

3.5.3 Gas Storage Room exhaust

Dedicated exhaust system will be installed to serve this room.

The exhausts will be operated by local manual on/off switches or via a time clock.

3.5.4 Fume cupboard ventilation

Dedicated fume supply and exhaust systems will be installed to serve the fume cupboard.

The exhausts will be operated by local manual on/off switches or via a time clock.

3.5.5 Garbage room exhaust

It is proposed that the new garbage room be served from a centralised system, or a number of systems zoned dependant on layout of the building and available riser space.

3.5.6 General/utility exhaust

Dedicated general exhaust systems will be installed to serve these rooms.

It is proposed that the general extracts be served from a centralised system, or a number of systems zoned as appropriate to the extract point locations and dependant on co-ordination issues. The exhausts will be operated by local manual on/off switches or via a time clock.

3.6 ELECTRICAL SUPPLIES AND CONTROLS

A new stand alone mechanical services building automation system (BAS) will be provided. In consultation with Mater Engineering Staff the system monitoring shall have the capacity to interface with the main Mater Hospital system.

A new Mechanical Services Switchboard will be located in the Level 4 roof plant room. Mechanical systems for each tenancy will be provided off individual tenant switchboards which will be individually metered.

4 ELECTRICAL SERVICES

4.1 GENERAL

The installation will generally comply with:

- The Building Code of Australia.
- Relevant Australian and International Standards and Codes.
- NSW Service and Installation Rules.
- Other requirements of regulatory authorities having jurisdiction over the works.

The design of electrical services must consider the following factors:

- Quality of workplace environment.
- Environmental and ecological sustainability.
- Life cycle cost optimisation.
- Avoidance of obsolescence.

Electrical equipment selected will, wherever feasible and practicable, be of the same or similar manufacturer and model to existing equipment installed within the Mater Hospital.

4.2 SUBSTATION

The electricity distributor, EnergyAustralia, has confirmed that the existing chamber substation No. 3195, located at the site perimeter, is able to supply the anticipated maximum demand of the new building. The existing EnergyAustralia LV switchboard located within the substation chamber must be upgraded to accommodate the new supply. Application has been made for the said works to be carried out at the earliest available opportunity.

4.3 MAIN SWITCHBOARD AND POWER FACTOR CORRECTION

New underground consumers mains will be provided from the substation to the new main switchboard.

The main switchboard, located in a main switchroom on the Level B1, will be constructed to Form 3B AS/NZS 3439.1. Surge diversion will be provided to reduce the risk of damage resulting from lightning strikes and other transient overvoltages. The main switchboard will be divided into emergency and non-emergency sections. The emergency section will be provided with an automatic transfer switch to enable automatic switching between mains and generator power sources following mains failure.

A combined meter panel will be provided for the provision of electricity distributor meters to the building's tenants. Spaces for the future provision of automatic meter readers will be provided to comply with EnergyAustralia's requirements.

A power factor correction unit will be installed within the main switchroom to ensure compliance with the NSW Service and Installation Rules.

Miscellaneous control panels will also be located within the main switchroom.

4.4 SUBMAINS CABLING

Submains cables shall generally emanate directly from the main switchboard and meter panel to their respective distribution boards and mechanical control panels. Fire-rated cables shall be provided as necessary to comply with AS/NZS 3000 and the Building Code of Australia.

4.5 STANDBY GENERATOR

A standby diesel generator in an acoustic enclosure will be mounted on the roof of the new building. It is envisaged that a load bank will be installed adjacent to the new generator to ensure the routine testing of the generator at a minimum of 40% of rated load. Details of the testing arrangement for the diesel generator will be agreed with the client and the building manager. A bulk diesel fuel storage tank will be provided, complete with a filling point in an accessible location.

Submains and control cabling will be provided from the generator to the main switchboard and load bank.

The standby generator shall provide power on mains failure to biospecimen bank freezers, selected laboratory lighting and power circuits, sprinkler pumps, carpark exhaust, lifts, communications racks and associated mechanical services.

4.6 DISTRIBUTION BOARDS

All distribution board submains will be derived from the main switchboard or meter panel and will be protected by individual circuit breakers. Each distribution board and substantive individual load will be provided with sub-metering to enable building managers to fine-tune operational procedures to minimise consumption and to detect any operational problems early. Submetering will be interfaced with the Intelligent Building Management System for ease of monitoring.

4.7 SMALL POWER AND MISCELLANEOUS SYSTEMS

Socket outlets and isolators will be provided to the new building. The installation must comply with AS/NZS 3000 and AS/NZS 3003. All 10A, 15A and 20A socket outlets will be colour coded to distinguish between those connected to a normal supply, essential supply, uninterruptible supply and those that are for cleaning purposes only, in order to comply with the requirements of AS/NZS 3003.

All socket outlet circuits in body-protected areas will be protected by 10mA residual current devices.

An alarm system must be provided to ensure that biospecimen freezer malfunctions are immediately reported to the relevant service personnel. Intercom and public address systems will be provided as briefed.

4.8 LIGHTING

Internal and external lighting shall be provided to comply with the requirements of AS 1680 and AS 2713.

Light sources shall be energy efficient and provided with the appropriate colour rendering. Maintained illuminance values will be designed to meet AS 1680 Section 2.5. High-efficacy linear fluorescent lamps will be installed extensively within the building. Ballasts are to be electronic wherever possible.

Automatic switching and dimming in conjunction with daylighting will be employed wherever practicable to minimise energy consumption.

Security and access lighting will be installed at the building perimeter. External lighting will generally consist of high-efficacy light sources controlled by photoelectric cells and time clocks. Feature lighting will be installed at main pedestrian entrances.

Carpark lighting will consist of fluorescent luminaires with wire-guard protection.

4.9 EMERGENCY LIGHTING AND EXIT SIGNS

A new centrally monitored and tested emergency lighting and exit sign system will be provided to new and existing areas to comply with the requirements of AS 2293.

Emergency luminaires will generally consist of non-maintained self-contained units. Exit signs will consist of maintained internally-illuminated self-contained fittings.

4.10 UNINTERRUPTIBLE POWER SUPPLIES

Uninterruptible power supplies (UPS) will be provided to building distributor and floor distributor rooms and to the proposed server room. UPS units will be served by submains derived from the essential busbar, thereby ensuring continued operation in the event of mains failure. UPS systems will be remotely monitored.

4.11 VOICE AND DATA SYSTEMS

New voice and data lead-in cables will be provided to the premises. A PABX system will be installed within the Level 1 building distributor room. The existing Sydney Melanoma Unit PABX will be relocated and reused if possible.

An integrated structured cabling system will be provided for voice and data systems. Horizontal cabling will consist of unshielded twisted pair Category 6/Class E cabling. Backbone data cabling will generally comprise OM3 50/125µm optic fibre.

Voice over IP (VoIP) is to be provided to enable cost-effective and interoperable data and voice communications, as required to comply with the Functional Brief. Analogue PSTN telephone services will be required for the emergency lift telephones.

4.12 SECURITY

The building will be provided with electronic intruder detection, CCTV, duress alarm and access control as ultimately briefed.

4.13 MASTER ANTENNA TELEVISION

A master antenna TV system, including all necessary antennae, amplifiers, splitters, cabling and outlets, will be provided to serve television outlets at selected positions within the building.

4.14 AUDIO-VISUAL SYSTEMS

Audio-visual systems will be provided within the Conference and Education Complex as ultimately briefed.

4.15 LIGHTNING PROTECTION

A risk assessment for lightning protection will be carried out in accordance with AS/NZS 1768:2007. If necessary, a lightning protection system will be provided to cover the entire building.

5 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The building will be designed to achieve a 4-star Greenstar rating.

A range of design initiatives and elements are being considered to ensure the proposed development optimises its sustainability. A summary of these initiatives are as follows:

5.1 ENERGY EFFICIENCY

The Development will be designed to maximise energy efficiency within. Energy efficiency will be considered in two categories; passive and active systems.

Energy efficient passive design reduces the building's reliance on active mechanical air conditioning and ventilation systems and artificial lighting. Consideration will be given to the following passive design initiatives:

- Optimised façade and window properties to maximise day light, while minimising summer cooling loads.
- Improved envelope sealing and thermal insulation
- Mixed mode/naturally ventilated - cross flow ventilation where possible

Energy efficiency active systems, which complement the passive initiatives, will be adopted for the project. Consideration will be given to the following:

- High efficiency air conditioning systems which:
  - Condition only the occupied zone and displacing heat from the glazed roof.
  - Optimised outside air loads based on occupancy
  - Economy Cycles and/or Night Purging
- High efficiency motors and/or variable speed drives for cooling, heating and mechanical ventilation systems
- High efficiency lighting with reduced lighting power density
- Lighting Control Systems, including:
  - Daylight harvesting
  - After hours controls
- Optimised zoning and control of ventilation, air-conditioning and lighting systems
- Intelligent Building Management System for optimised energy and comfort
- Sub-metering for improved energy management

5.2 OPTIMISED INDOOR ENVIRONMENTAL QUALITY (IEQ)

On average 95% of our time is spent in buildings, therefore as part of a sustainable building the indoor environment should be designed to minimise adverse effects on the occupants. Consideration will be given to the following:

- Improved outside air and ventilation rates
- Low toxicity finishes
- CO2 monitoring and control mechanical ventilation systems
- Dedicated utility room exhaust risers

- Optimised day lighting. Consideration will be given to daylight glare control and direct solar ingress control for visual and thermal comfort
- Optimised artificial lighting levels for visual comfort
- Optimised thermal environment. Consideration will be given to use of passive and/or active thermal mass for improved thermal comfort
- External views/spaces for visual/physical connectivity with outdoors

5.3 WATER MANAGEMENT

Practical water saving measures will be considered to minimise the development's demands on water resources.

- Water efficient design
- Installation of water efficient fixtures and fittings
- Water meter monitoring for improved water management
- water harvesting and re-use systems
- Water efficient landscape irrigation
- Water efficient or no cooling towers systems

5.4 MATERIALS SELECTION

Materials selection will consider the total life material from its creation, adaptability during use and final disposal.

Consideration will be given to:

- Sustainable materials selection, including products with all of life stewardship and post-consumer recycled content
- Recycling waste areas in construction and operation

5.5 EMISSIONS REDUCTION

Consideration will be given to the following:

- Reduced greenhouse gas reduction through energy efficiency initiatives
- Use of Zero Ozone Depletion Potential (ODP) materials and reduction of Global Warming Potential (GWP) materials
- Reduced flow to sewer through water management initiatives
- Light pollution reduction
- Legionella risk minimisation. Consideration will be given to cooling without the use of cooling towers

5.6 SUSTAINABLE CONSTRUCTION MANAGEMENT INITIATIVES

Consideration will be given to the following:

- Waste and Environmental Management
- Comprehensive Commissioning Plan to optimise energy efficiency
- Building Users Guides and operation manuals
- Building tuning.

The final design initiatives and elements being considered for this project will be selected on the basis of environmental, social and financial criteria.