APPENDIX H

Building Services and ESD Report

The Chris O'Brien Lifehouse at RPA

PART 3A PROJECT APPLICATION
BUILDING SERVICES

- Rev 3
- 11 June 2010

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Executive Summary

The Chris O'Brien Lifehouse at RPA project is a major redevelopment of a new site at RPA Hospital.

The building services to be provided include:

- Environmental Sustainable Design (ESD);
- Mechanical Services;
- Electrical Services and Communication Services;
- Hydraulic Services;
- Fire Protection Services;
- Vertical Transportation Services; and
- Building Control and Security Services.

Standards/Guidelines

The engineering services shall be designed with reference to the following:

- The NSW Health Engineering Services Guidelines TS11 2007;
- The Building Code of Australia 2010;
- Relevant Australian Standards;
- Fire Engineering Report; and
- Government Department's Regulations.

Authorities and Councils requirements include:

- The requirements of relevant Local Councils and Local Water Corporation; and
- Energy Australia, NSW Fire Brigades and Environmental Protection Authority.

Environmental Sustainable Design (ESD)

Environmentally Sustainable Design for the facility is governed by the specific functional and maintenance requirements. Options are considered appropriate that balance the functional requirements and ESD outcomes. The building is orientated with longer E-W axis. The building's footprint is to admittance of natural lighting and views and connectivity to outside.

There will be a strong focus on engineering solutions that complement passive design outcomes and reduce reliance on artificial means of heating, cooling, ventilation and lighting, while providing desirable levels of thermal, acoustic and visual comfort.

A large roof area is available for rainwater catchment, which will be collected through rainwater harvesting and used for toilet flushing and limited irrigation.

The building will be designed to achieve a minimum GBCA 4 star rating.

The feasibility for the provision of co-generation plant is currently being assessed.

Mechanical Services

The following mechanical services systems will be provided:

- Central chilled water plant including chillers, cooling towers, pumps and pipework reticulation. The fire hydrant/sprinkler tank will be utilised for chilled water storage to reduce the peak load of Lifehouse. The cooling towers are located on Level 9 below the roof level.
- Central hot water heating system including natural gas hot water boilers (which would also provide heating for domestic hot water), pumps and pipework reticulation;
- Central natural gas steam generators for steam sterilisation in the CSSP.
- Central chilled water and hot water variable air volume air and constant volume handling systems located in plantrooms on Level 4 and 5. Air intakes will be on the western side of the plantroom and exhausts discharge on the south and north aspects or at roof level as required by AS1668.2. Dedicated local fan coil units will be provided for areas with high internal heat loads or high fluctuating occupancy. Negative pressure isolation rooms and operating theatres will also be provided with dedicated fan coil units to eliminate cross infection via the air conditioning system;
- Dedicated exhaust systems will be provided for toilets, garbage rooms, pathology, cytotoxic, plaster rooms, laundry isolation rooms, mortuary, recovery, kitchen, cafe and carpark. The carpark exhaust system will be designed in accordance with AS1668.2-2002.

Building Management Control System – Lifehouse will be provided with a dedicated Building Management Control System (BMCS) to control the operation of the mechanical and hydraulic services, monitor medical gases, lifts, fire services, lighting and energy consumption.

Acoustic Control - All intake and discharge air handling paths for air handling plant, cooling towers etc are proposed to have acoustic treatment in order to meet the site boundary noise level requirements.

Smoke Control – Lifehouse will be provided with a fire engineered smoke management system. The three (3) above ground fire stairs and the three (3) below ground fire stairs will be provided with dedicated stair pressurisation systems.

Medical Gases

Medical gases supply for Lifehouse will be shared with the existing RPA supply from their loading dock and reticulated through the RPA tunnel network. Medical air and suction will be provided from dedicated plant located on Level 8 of Lifehouse. The medical gases will be designed to comply with AS2896.

Electrical Services

The electrical services shall be designed and constructed in accordance with the requirements of the Building Code of Australia; NSW Health Department Engineering Services Guidelines TS11- 2007; NSW Fire Brigades' requirements; NSW Local Government Act; Local Area Health requirements and Energy Australia Supply Authority requirements and relevant Australian Standards.

Electrical Supply – To ensure reliability a new 11kV supply will be provided by the supply authority from their area network and will terminate in a new basement sub-station containing three transformers. Energy Australia are still investigating the point of connection to their network and this will be advised in due course. Consideration for Co-generation would also form part of this design philosophy.

Sub-mains - Sub-mains cabling shall originate from the main switchboard and be reticulated throughout the building generally via cable tray located within the ceiling space along accessible locations such as corridors, and within a dedicated electrical riser (located in the central core of the building).

Switchboards –The Main switchboard shall be constructed to a minimum of Form 4 in accordance with AS 3439, fitted with air circuit breakers, (800A and above) and moulded case circuit breakers, (below) 800A all designed for back connection.

Distribution Switchboards -Sub-mains cabling shall terminate at distribution boards which in turn will supply lighting and power sub-circuits as required. Distribution boards shall be provided for each fire compartment in accordance with TS11 2007.

Power Factor Correction - Equipment, complete with facilities to reduce problematic harmonic effects, shall be provided to improve the electrical installation power factor to 0.98 lagging or better, to minimize the demand charge in accordance with TS11 (2007) and NSW Service & Installation Rules. It is intended that PF equipment be located in the main switch room.

Standby Power – Will be provided in accordance with the Building Code of Australia requirements and requirements of TS11 (2007).

Fuel storage for a minimum of 48 hours continuous full load operation shall be provided, with automatic refill facilities from a new bulk diesel tank located in the vicinity of the Loading Dock area, adjacent to the access road for tanker fuel delivery.

UPS Supplies - It is proposed that power supplies requiring battery or similar storage systems to meet required response times would be provided, in accordance with AS 3009.

The UPS will be sized to suit the load requirements of the equipment to be served in an N+1 configuration, with varying battery autonomy in accordance with standards and particular applications.

At this stage there will be the following separate UPS systems:-

- Critical power supplies for medical purposes (N + 1)
- ICT equipment (Floor distributors, Building Distributor and Campus Distributor) (N + 1)
- Data Centre File server room (N + 1)
- Each surgical light in the operating theatres (N)

Lighting - Artificial lighting will be provided throughout Lifehouse at RPA in accordance with the relevant Australian Standards, BCA and TS 11 2007.

External lighting will be designed in accordance with AS 1158, AS 4282 Obtrusive Lighting Code and AS 4485, for new car-park areas, pedestrian pathways, and stairs.

Emergency exit lighting and emergency lighting is to be provided throughout the new complex in accordance with the requirements of the Building Code of Australia and AS/NZS 2293.

Lightning Protection - Should lightning protection be recommended then it shall be designed and constructed in accordance with the requirements of Australian Standard AS 1768.

Communications

Site Infrastructure and Reticulation - Within Lifehouse at RPA a structured telecommunications system would be provided to support the various telecommunications requirements of the new complex. The communications system shall be provided in accordance with the requirements of TS11 2007- the relevant Australian Standards, local area health services' requirements and the functional requirements of the hospital.

Communication Rooms - A Main Communications Room (carrier distributor) is to be located at Level B1. This room is to incorporate all service provider/carrier equipment and is the main

connection pathway outside the building. The new incoming carriers' cables shall be provided from Missenden Road which will then run along Salisbury Road and then enter the building from Susan Street directly into the carrier distributor.

A main Building Distributor will also be located at Level B1 adjacent to the Carrier room. This room will house all the main data switches and is the termination point for all the fibre optic backbone cabling to all the floor distributors located throughout the building.

Wireless Networks - Wireless local area networks (WLAN) would be proposed to all floor areas of the new complex to provide wireless and mobile access to data, voice and video services.

MATV - A new central MATV / Radio system is proposed to be provided within Lifehouse to suit the requirements of the facility. It should be noted that digital free-to-air TV channels will replace analogue services in 2010.

Master Clock System - A centralised master clock system, powered from the UPS system, shall be provided to specific departments of Lifehouse.

Call Systems - A Nurse Call system shall be provided to comply with the requirements of the medical staff and AS 3811, Australasian Health Guidelines including Fire Management Guidelines. The nurse call system shall comprise, but not limited to, management systems, nurse call stations, annunciators, call points, over door indicators, pendants, patient entertainment handsets, power supplies and interface units.

Hydraulic Services

Sewer - The proposed sewer pipe work shall connect to the existing Authority sewer main, located on the north-west side of the development.

Sanitary Plumbing - The system will be installed in accordance with AS 3500.2 – 2003, and the NSW Code of Practice 2006. Materials will be Poly Ethylene and / or cast iron tube and fittings.

Trade Waste Plumbing - Fixtures and equipment that generate grease and/or high temperature discharges will be treated on site to the requirements of the Lifehouse at RPA trade waste policy. Materials will be high density polyethylene (HDPE) tube and fittings.

Potable Cold Water - The proposed potable cold water will be connected to the Riverina Council water mains l and reticulated to all fixtures and equipment that requires cold water. Fixtures and equipment that may present a source of contamination will be fitted with a backflow prevention device suitable for the hazard rating of the procedure.

Hot and Warm Water Systems - The proposed potable hot/warm water will be generated by means of mechanical services boilers and heat exchangers and reticulates to all fixtures and

equipment that requires hot water. Warm water will be generated by means of a centralized warm water plant, to NSW Hearth requirements and guidelines and will reticulate warm water to all fixtures and equipment that requires warm water.

Rainwater Harvesting - Rainwater collected from roof areas will be harvested, surface water drainage will discharge into the storm water system on site. A roof rainwater catchment harvesting tank with first flush facility will be located at low level to capture roof rainwater for toilet flushing, cooling tower use and general utility use, such as hosing down paved areas and limited irrigation.

Fire Services

The fire and life safety services shall be designed and constructed in accordance with the requirements of the BCA 2010, NSW Health Engineering Services and Sustainability Development Guidelines, Technical Services TS 11 2007, NSW Fire Brigades, relevant Australian Standards and Fire Engineering Report.

Combined Fire Sprinkler / Fire Hydrant System - A combined fire sprinkler / fire hydrant system will be installed throughout the building to BCA 2010, AS 2118.1 - 1999, AS 2419.1 - 2005 and AS 2118.6 - 1995 requirements.

Fire Hose Reel System - A fire hose reel system will be installed throughout the building to BCA 2010, AS 2441 - 2005 requirements.

Smoke Detection System - A smoke detection system will be installed throughout the building (with the exception of the atrium void) to BCA 2010, AS 1670.1 - 2004 and AS 1668.1 - 1998 requirements. Video Smoke Detection (VSD) complying with NFPA 72 is proposed to protect the atrium void as conventional smoke detectors are unsuitable for such a space. Although not compliant with the Australian Standard the VSD system will be subject to approval by the Fire Engineer, Building Certifier and the NSWFB.

Sound System and Intercom System for Emergency Purposes - A sound system and intercom system for emergency purposes will be installed to the building to comply with BCA 2010 and AS 1670.4 - 2004 requirements.

Fire Extinguishers -Portable fire extinguishers will be provided throughout the building to comply with BCA 2010 and AS 2444-2001 requirements.

Passive Fire Protection - All fire services passing through any walls, floors and ceilings required to have a fire resistance level (FRL) rating will be sealed with approved passive fire protection systems to satisfy BCA Part C3.15 and Spec C3.15, AS1530.4 and AS4072.1 requirements.

Fire Safety Management - A comprehensive set of fire safety management and evacuation plans will be developed which are consistent with all fire and life safety protection equipment to be installed and EPA regulations relating to OH&S and fire safety. AS 3745 and AS 4083 would be used as a guide.

Lifts

Within Lifehouse new lift services shall be provided to suit the functional requirements of the building.

Security

Health care facilities need to provide a safe and secure environment for staff, patients and visitors. The electronic security system shall be provided in accordance with the requirements of TS11 2007 and the NSW Health Department Security Guidelines.

1. Introduction

The Chris O'Brien Lifehouse at RPA is a major redevelopment of a new site at RPA.

The Services to be provided include:

- Environmental Sustainable Design (ESD);
- Mechanical Services;
- Electrical Services;
- Communication Services;
- Hydraulic Services;
- Fire Protection Services;
- Vertical Transportation Services; and
- Building Management Control System and Security Services.

Standards / Guidelines

The engineering services shall be designed with reference to the following:

- The NSW Health Engineering Services Guidelines TS11 2007;
- The Building Code of Australia 2010;
- Relevant Australian Standards;
- Fire Engineering Report; and
- Government Department's Regulations.

Authorities and Councils requirements include:

- The requirements of relevant Local Councils;
- Local Water Corporation;
- Energy Australia;
- NSW Fire Brigades; and
- Environmental Protection Authority.

2. Environmental Sustainable Design (ESD)

2.1. ESD Objectives for Lifehouse

Environmentally sustainable design is a strong focus for the project design. At the outset of the project, ESD objectives were established with an aim to maximise long term benefits for the project i.e. operating costs, improved well-being for the occupants and future flexibility. The key objectives for ESD were set out to be as follows:

- **L**ow life cycle costs: Solutions that will bring long term benefits for Lifehouse.
- **I**ndoor Environmental Quality: Solutions that will improve the sense of well-being of patients and staff.
- **F**lexibility and adaptability: Solutions that will enable future flexibility for the facility.
- **E**nvironmental performance benchmark (using Green Star with minimum 4 star rating): Design that will achieve an overall environmental performance.

Environmental performance, the fourth objective, focuses on achieving a holistic outcome across all aspects of sustainability such as energy, water, sustainable transport, ecology and sustainable management etc. Green Star Healthcare v1 has been utilised as the framework for the project with an aim to achieve a Green Star 4 Star design or higher.

A Green Star Action Plan has been prepared for project that provides the basis to track the Green Star credits, design progress and responsibilities and actions for the design team.

The following sections provide a summary of the key ESD initiatives adopted in the design, which will contribute to the facility's sustainability and will contribute to Green Star rating. The current status of Green Star rating (based on self-assessment and not GBCA assessment) is also provided in this section.

2.2. Thermal efficiency

The building is orientated E-W, presenting challenges for solar and glare control. To address this challenge, the façade is being designed with particular focus on aspects such as external shading, glazing area ratio and performance of glazing. The East façade will be provided with extensive external shading. To minimise solar radiation, the glazing area on the Western façade has been reduced to a maximum 30% at the façade area.

An internal atrium will be provided facilitating potential for natural lighting, natural ventilation and will form a place of respite for the occupants with direct physical connections to the outdoor environment.

For the in-patient units, the option to use natural ventilation and connectivity to outdoor terraces is considered. Access to outdoors and openable windows has proven links with faster recovery periods and improved sense of well-being.

2.3. Energy efficiency

Energy efficiency will be addressed by considering mechanical systems, light fittings and controls, and domestic hot water system that meet the functional/ maintenance requirements while using energy efficiently.

The atrium will be naturally ventilated, with supplementary cooling and heating for days of extreme temperature.

After-hour controls and zoning will be provided to minimise after-hour energy consumption. A thermal storage system for chilled water will be provided using the fire water tank system – this will reduce peak cooling demand.

In-patient units will be provided with individual fan-coil units to provide individual comfort conditions and control for the patients. The rooms will have the provision to use natural ventilation mode when the ambient conditions are suitable. Interface between air conditioning and openable windows will be provided to effectively switch between the two modes.

Energy efficient lighting will be provided with automated after-hour controls. Lighting design will provide a maintained illuminance of not greater than 25% above the minimum illuminance levels recommended in AS standard AS1680.2.5.

To reduce energy consumption related with domestic hot water system, small bore pipes will be specified (to be included in AS3500). This will save many litres of wasted hot and warm water at no added capital cost and save waiting time of doctors and nurses when hand-washing between patients.

It is also proposed that hydraulics hot cold and warm water systems utilise the lighting and power PLC driven system, incorporated to shut down those zones of the building that operate in 9 to 5 working hours. This will minimise any undetected leakage and thermal loss and circulating pump energy.

2.4. Alternative power Options

A co-generation system is being investigated for the hospital to provide a low carbon energy supply option for the facility and would future-proof the facility against rising electricity costs.

Co-generation is relevant for hospitals where electricity and thermal demand is high because of additional steam and hot water requirements. Those features and the longer facility operation hours provide a load profile that are ideal for a co-gen system so that the energy saving, environmental, and financial advantages of the system are maximized.

Potential Benefits:

The benefits of the co-gen system will include:-

- Higher total energy efficiency
- Lower operation costs
- Reduced peak power demand
- Reduced water consumption of the cooling towers
- Reduced CO_2 emissions

2.5. Water efficiency

Potable water use will be minimised by means of following measures:

- Rainwater harvesting from the roof for toilet flushing, irrigation and cooling towers
- Storage of fire test water
- Provision of low-flow taps and fittings (minimum 3 WELS rated)

A storage tank of 192,000 Litres will be provided for the purpose of toilet flushing, irrigation demand and at least 50% of cooling tower demand. The tank also has the capacity to store 15 m^3 fire test water.

During the operation phases of the building, to enable monitoring of different water uses, separate metering will be provided by means of BMS monitoring including hot water plant, sterilisation plants, kitchens, cooling towers, and mechanical system.

AAA (or higher) rated or taps and fittings

Highest possible WELS rated fixtures, taps and showerheads for the patient areas and public areas will be specified. To reduce the occurrence of blockage in patient areas, toilet flush will be 3 Star WELS instead of 4 Star WELS.

2.6. Indoor Environment Quality

Access to natural light and external views will be enabled by a thin floor plate and a central atrium. Elements such as natural lighting, external views and natural ventilation have proven links with well-being and patient recovery.

The atrium will be a place of respite for staff and patients providing direct physical connection to the natural environment. Natural ventilation of the atrium is part of the strategy to create a natural environment in the atrium, which is the central spine and key connecting element of the facility.

Low VOC paints, sealants and adhesives and flooring will be specified to minimise off-gassing from the materials.

2.7. Recycling and waste

Waste management in the context of medical facilities is extremely complex with the waste stream covering clinical and chemical waste in addition to recyclables, paper, general and organic waste. It is therefore an important aspect of the efficient and environmentally responsible operation of the facility.

To allow a sustainable operation of the facility, dedicated facilities will be provided for waste management and sorting.

It is recommended that a waste management policy is adopted during the operation of Lifehouse. Some of the recommended strategies for the effective management of waste are:

- Waste management committees, plans and waste audits
- Waste minimisation, avoidance, segregation, recycling and re-use
- Waste labelling and containment
- Proper waste handling, storage and transport
- Correct waste treatment / disposal
- Staff training and education

specific credits that are being pursued under this category.

2.8. Other ESD Initiatives

In addition to energy, water and indoor environmental quality initiatives, the following initiatives are also included:

- Sustainable management initiatives including the following:
  - Requirement to include quarterly commissioning (as part of Defects Liability for Handover) will be specified for tuning the building system to suit the seasonal requirements
  - Development of management plans such as Environmental Management Plan, Waste Management Plan, Construction Air Quality Plan and Sustainable Procurement Guide.

- Building User Guide will be provided as part of the handover

- All refrigerant will be zero ODP (R407 C or R134 A).
- Sustainable timber will be specified for all timber products in the project.
- Pre-treatment equipment will be installed for trade-waste e.g. kitchen and labs.
- A refrigeration detection system will be installed (for safety purposes).
- Cyclists facilities will be provided for the staff and public.
- Whole of life stewardship of products and materials will be considered where possible.
- Stormwater pollution will be minimised by providing stormwater detention tank and appropriate filter and treatment of stormwater.
- Cement will have 15-20% recycled aggregates (e.g. fly ash).
- Where possible, subsoil drip irrigation with automatic timer will be provided for irrigation.
- Where the depth of soil allows, native plants will be provided.

2.9. Innovation pursued on this project

The following are innovative design issues that secure Green Star innovation points.

- **Small bore pipes**: The design team will specify small bore pipes for domestic hot water system. If the revised edition of AS3500 includes the utilisation of 7.5 mm pipes for domestic water systems with a maximum dead leg drain down waste water limitation of two litres, this will save many litres of wasted hot and warm water at no added capital cost.

- **Zone Control:** In the electrical design, a lighting and power programmable logic control (PLC) driven system is incorporated to shut down those zones of the building that operate in 9 to 5 working hours. The hydraulics hot, cold and warm water systems can utilise this partial shutdown system. This will minimise any undetected leakage and thermal loss and circulating pump energy.

- A dedicated community bus service will be provided for easy commute and connectivity to major public transport routes.

2.10. Green Star Rating Assessment (Green Star Healthcare V1)

To benchmark the environmental performance of the facility against industry best practice, Green Star Healthcare v1 tool is being used to assess the building development throughout the design process. The target for the project is to achieve a minimum of 4 Star rating or higher.

2.11. Initiatives to be Investigated Further

As the design is developed further in the subsequent design stages, any additional relevant initiatives will be investigated, including but not limited to the following:

- **Power Purchase Agreement (PPA) for solar power**: PPA schemes involve an external provider to come in and install and maintain PV cells, with Lifehouse only paying for green power. This initiative will contribute to Ene-3 (Peak Demand Reduction).
- **Transport Natural gas driven vehicles:** Natural gas should be considered for the community transport currently being planned for the facility.

3. Mechanical Services

3.1. Scope

The mechanical services for Lifehouse will provide a comfortable indoor climate which will assist with infection control and the medical treatment of patients and ensure that expensive medical diagnostic and communications equipment runs at its optimum design.

The mechanical services will be designed in accordance with the Building Code of Australia 2010, relevant Australian Standards and Handbooks, NSW Health Engineering Guidelines TS-11 2007 and Room Data Sheets specific to the project.

3.2. Design Parameters

3.2.1. Façade Performance

The building façade thermal performance is still being determined.

Glazing with frame	U factor = 2.3
	Shading co-efficient = 0.27
Skylights	TBC
Roof	as per BCA deemed to satisfy
Floor	as per BCA deemed to satisfy
Walls	as per BCA deemed to satisfy

3.2.2. Design Temperatures

The mechanical air conditioning systems are designed to meet the indoor temperature requirements at the designated outdoor design conditions.

Should the ambient temperature exceed the designated outdoor design conditions, indoor temperatures may be expected to rise in summer and fall in winter.

Summer Outside Temperature - standard	33°CDB/23°CWB
Summer Outside Temperature - critical	36°CDB/24°CWB

(Critical Areas include operating theatres and Intensive Care Units.)

Winter Outside Temperature	6°C

Indoor Design Conditions

Area	Temperature °C	Relative Humidity
Standard Operating Theatres	19 °C - 25 °C (adjustable in theatre)	50% ± 10%
Intensive Care Unit	23 °C ± 1 °C	50% ± 10%
Pharmacy	18 °C ± 1 °C	50% ± 10%
Category 1 Areas	23 °C ± 1 °C	50%±10%
Category 2 Areas	23 °C ± 1 °C	50%±10%
Category 3 Areas	27 °C max 20 °C min	Not controlled
Comms Rooms	22 °C ± 1 °C	50%±10%

3.2.3. Indoor Air Quality

Indoor air quality is a contributing factor in infection control. The following table summarises the minimum circulation rates, quantity of outside air, relative room pressure, dedicated exhaust and filtration requirements.

Area	Circulation Rate AC/hr	Outside Air	Pressure	Dedicated exhaust	Filtration
Operating Theatres	20	50% and capable of 100%	+	Purge	Prefilter Bag filter and terminal HEPA
Sterile Stores			++	No	Prefilter & Bag filter
Protective Isolation Room	15	100%	+	No	Prefilter Bag filter and terminal HEPA
Recovery Areas	10	100%	Not controlled	Yes	Prefilter & Bag filter
Infectious Isolation Room	12	100%	-	Yes	50mm pleat filter
Pharmacy-Clean Area	20	30%	++	No	Prefilter

3.3. Chilled Water System

Lifehouse base building air conditioning systems will be cooled by chilled water plant located on Level 4 plantroom. The chilled water plant will operate on a temperature differential of 7ºC – 14ºC. The chiller plant will consist of two (2) centrifugal chillers and one (1) screw chiller sized to meet the low load demand. A chilled water riser will be located in the central riser adjacent to the lift core. The fire sprinkler/storage tank will be double as a chilled water storage tank, chilled water is generated when electricity tariffs are off peak and stored. The stored chilled water is then injected

into the chilled water reticulation system during peak load periods to reduce the peak load demand of the site, reduce chiller size and minimise electricity cost of the cooling system. .

The chillers will have a zero ozone depletion potential (ODP) and a refrigerant leak detection will be provided to the chiller plantroom.

Heat is rejected from the chillers via forced draft cooling towers located in wells sunk into the Level 9 floor plate. Four (4)cooling towers will be provided to meet the cooling demand. Forced draft cooling towers are preferred to induced draft cooling towers due to their sunken location and better configuration for air circulation with the ability to be provided with attenuators and easier maintenance. The cooling towers are designed with centrifugal fans with variable speed drives to minimise noise and energy consumption water cooled chiller plant has been selected for cooling the building over air cooled systems as it is more energy efficient, requires less plant space, is generally easier to control noise and has a longer life expectancy.

A dedicated chilled water system will be provided for the data centre and the comms rooms to meet the project brief. This system will also provide cooling for the diagnostic imaging equipment. This system will consist of a small chiller, connected to a dedicated cooling tower and have an independent riser through the building. As this chiller will be operating 24 hours/day, there is an option that this chiller incorporate heat rejection to pre-heat the domestic hot water. The chilled water header will be designed such that the base building chillers can be utilised as back up for the dedicated system in the event of shutdown maintenance or system failure. The dedicated Data/Comms chilled water system will be backed up by the emergency diesel generators.

The diagnostic imaging equipment require higher chilled water temperatures to eliminate the risk of condensation. A medical imaging loop will be connected to the data/comms systems separated by a heat exchanger and have a dedicated duty/standby pump. The medical imaging loop will be reticulated on B2 and serve the medical imaging from below, limiting the risk of water leaks into the medical imaging rooms in the event of a system failure.

Space and valved connection on the condenser water header will be provided for a dedicated chiller required to generate very low temperatures for the proposed 13°C operating theatres.

3.4. Hot Water System

Hot water is generated by two natural gas forced draft hot water boilers with heat recovery condensation units (HRCU) of 50% capacity each located on B2 in the 5m slab to slab area. The HRCU collects waste heat discharged through the flue system and preheats the return hot water to increase the thermal efficiency of the hot water system by approximately 9%. The Boiler flues are located in the southern riser and discharge at roof level. Hot water is generated at 80ºC and

provides domestic hot water through a plate to plate heat exchanger and space heating. Water is returned to the boilers at approximately 60ºC.

3.5. Pipework reticulation

Insulated chilled and hot water pipework will be reticulated throughout the building by risers located in the central riser adjacent to the central core riser. Each floor will be provided with pressure differential balancing valves and isolation valves to enable easier commissioning and floor by floor isolation should this be required for maintenance or future refurbishment.

The chilled water system will be provided with a primary/secondary pumping system with primary pumps to match the chillers and variable speed drive secondary pumping system. The hot water pumping system will be a primary variable speed pumping system.

3.6. Air Handling Systems

3.6.1. Base Building

The base building air conditioning is via central air handling units located on Levels 4 and 5. The plantroom is configured such that all air intakes are located on the west facade and all exhausts discharge on the south and north, or where required at roof level. The base building is provided with the following systems:-

- South Zone
- North Zone
- East Zone
- West Zone – 2 air handling units split into north and south.
- Centre Zone – 4 air handling units (SE, NE, SW, NW)

The perimeter zone systems air flow rates will be adjusted at the air handling unit to meet the heat load demand, operating similar to the variable air volume system. The centre zone system will be constant volume to ensure that a minimum circulation rate of 6AC/hr is maintained.

All base building air handling systems will be provided with carbon dioxide sensors at each return air duct to control the amount of outside air on a high select basis to match the actual occupancy requirements at the different times of the day.

The intensive care unit and SSD will be provided with dedicated air handling systems with the air handling units located on Level 5.

An outside air pre-conditioner will be provided to pre-cool the outside air for all fan coil units throughout the building (meeting rooms, inpatient rooms, medical imaging examination rooms etc).

This system will be provided with an air to air heat exchanger to reclaim heat from the toilet exhaust system. The heat exchanger will be designed to ensure that no cross contamination can occur.

3.6.2. Inpatient Rooms

In general, all air handling systems are provided with economy cycles to provide free cooling by outside air when the ambient air temperature is less than the return air temperature.

The inpatient rooms are served by individual chilled/hot water fan coil units located in the room entrance similar to a hotel. Occupants will be able to control supply air and room temperature. When the room is not occupied, the fan coil units will be turned off. When louvres to the room are open, the fan coil unit will automatically be turned off. This system maximises the control the patients have over their environment, allows the inpatient rooms to be naturally ventilated when the outside conditions are favourable saving energy and eliminates any cross contamination via the air conditioning system.

3.6.3. Atrium

It is proposed to naturally ventilate the atrium with supplementary cooling and heating to maintain acceptable temperatures on extreme days. Air will enter the atrium from the north and south ends and rise via natural buoyancy as the air warms up the central atrium to relieve through louvers at roof Level. This natural movement of air will provide good volumes of outside air and add to the street feel of the atrium ground floor. Temperatures in the atrium will be maintained between 20ºC -27 ºC as required by NSW Health Engineering Guidelines TS-11 2007. Supplementary cooling and heating options may be necessary to obtain final requirements.

3.6.4. Operating Theatres

Each operating theatre and sterile store will be provided with dedicated air handling units operating on 50% outside air with heat exchangers to maximise energy efficiency. When outside conditions are favourable, the systems will operate on 100% outside air. The operating theatres will be provided with filtered supply air through terminal HEPA filters to provide a laminar flow across the patient. Air will be drawn to the corners of the room and exhausted from low level. Exhaust air from the theatres will be ducted directly to the outside.

Each operating theatre (other than two future theatres which are required to achieve 13^{o}C) will have individual adjustable temperature control 19^{o}C – 25^{o}C The operating theatres will be designed to achieve approximately 15Pa pressure differential above the adjacent corridor. It is imperative that the staff keep the doors closed to achieve this pressure differential.

3.6.5. Mortuary

The mortuary will be air conditioned by a dedicated air handling unit located in the vicinity of the mortuary on B2. The system will provide 100% outside air at 20AC/hr and maintain the mortuary temperature at 22 ^{o}C± 1 ^{o}C.

3.6.6. Pharmacy – Clean area

The pharmacy clean area (aseptic and cytotoxic areas) will be provided with a dedicated air handling system located above the stores areas adjacent. The pharmacy will be provided with 20AC/hr supply air which will pass through terminal HEPA filters. Room pressures will be maintained as required by ISO14644. The pharmacy will be designed to maintain a room temperature of 18 ^{o}C.

The pharmacy will be provided with cytotoxic cupboards as required by ISO14644 and the Therapeutic Goods Act.

The pharmacy will be provided with a emergency push button to purge the area in the event of a cytotoxic chemical spill.

3.6.7. Negative Pressure Isolation Rooms

Each negative pressure isolation room will be served by a 100% outside air fan coil unit with a dedicated exhaust. The fan coil unit and exhaust fan are electrically interlocked so on event of an exhaust fan failure, the supply air is turned off to contain any infection within the room.

Negative pressure rooms will be commissioned to achieve a pressure differential with the doors closed off -15Pa compared with the corridor. Room pressure will be controlled by a variable speed drive on the exhaust fan. Isolation room exhaust will be discharged at roof level.

Nursing staff will be able to adjust the temperature in these isolation rooms 23 ^{o}C ± 2 ^{o}C and are encouraged to turn the system off when the room is unoccupied to save energy.

3.6.8. Meeting Rooms

Each meeting room is provided with a dedicated fan coil unit which can control room temperatures 23 ^{o}C ± 2 ^{o}C depending on the room occupancy levels. Each meeting room will have a local ON/OFF switch so that the system can be turned off when not in use.

3.6.9. Comms Rooms

Each comms room is provided with a dedicated chilled water fan coil unit which will operate 24 hours/day.

3.6.10. Data Centre

The data centre will be provided with downflow N+1 chilled water close control CRAC units. The units will discharge cold supply air under the raised floor which will then enter the air through trafficable floor grilles located in the cold aisle. The comms racks will draw the cool air through the racks and discharge the air into the hot aisle before it returns to the air handling unit.

The underfloor space will be provided with leak detection.

3.6.11. Medical Imaging Rooms

Diagnostic imaging services will be provided with dedicated fan coil units due to the high internal heat load of the imaging equipment. These systems will be provided with emergency generator power supply. Staff will be able to adjust the room temperature 23 ^{o}C ± 2 ^{o}C and can turn the system off when not required.

Purge systems where required by specific equipment will be provided.

3.6.12. Kitchen

The kitchen will be provided with a dedicated kitchen supply system. Outside air will be provide through a weatherproof louvre located in the eastern courtyard. The supply system will be interlocked to the kitchen exhaust system which will be provided with a local ON/OFF switch. The kitchen exhaust fan will be located in the kitchen area and a 2 hr fire rated kitchen exhaust riser will discharge at roof level.

3.6.13. Cafe

The cafe will be provided with a local dedicated air conditioning system. When the cafe is opened to the outside, the cafe air conditioning system will be shutdown and the cafe will be naturally ventilated. The supply system will be interlocked to the cafe exhaust system which will be provided with a local ON/OFF switch. The cafe exhaust fan will be located in the cafe area and a 2 hr fire rated cafe exhaust riser will discharge at roof level.

3.6.14. Tenancies

Each tenancy will be provided with chilled and hot water connections and outside air from the central pre-conditioned air handling system. Fitout of the air conditioning for the tenancies will be by the tenant.

3.7. Ventilation Systems

The following areas of the Lifehouse will be provided with a dedicated exhaust system:

- Carpark – The carpark will be supplied with from a louvre located in the eastern courtyard and distributed through high level ductwork along the eastern wall of the carpark. Air is drawn from the east to the west side of the carpark. A centrifugal fan is located in a dedicated plantroom in the centre of B2 and discharge the exhaust through the western facade 6m above the footpath. The carpark will be provided with carbon monoxide sensors to control the speed of the carpark fans via variable speed drives.
- Toilets, dirty utilities and cleaner stores will be exhausted by three (3) toilet exhaust fans. The risers will be located in the north, south and eastern risers.
- Photocopy exhaust – Photocopies generate ozone which will be exhausted by a dedicated photocopy exhaust system.
- Garbage rooms will be exhausted by a dedicated system with the riser located in the northern riser and discharging through the north facade at plantroom level.
- Workshops as required
- Plantrooms as required
- Kitchen – the kitchen will be provided with a 2 hour fire rated kitchen exhaust system discharging at roof level.
- Cafe– the cafe will be provided with a 2 hour fire rated kitchen exhaust system discharging at roof level.
- Mortuary – a dedicated mortuary exhaust will be provided and discharge at roof level.
- Isolation Rooms
- Recovery areas- the recovery area will be provided with a dedicated exhaust system as air cannot be recirculated from this area.
- Cytotoxic cupboard

3.8. Fire Mode

Lifehouse will be provided with a fire engineered solution which is under development. Generally, in the event of a fire, all air handling systems will be shut down with the exception of the operating theatres which will only be shutdown if there is smoke detected in this smoke zone.

All floors where patients are located must be maintained at a higher pressure than the atrium.

Stair pressurisation and stair lobby relief will be provided to the north, south and eastern fire stairs serving the upper levels.

Stair pressurisation will be provided for the north, south and eastern fire stairs that serve the basement floors.

3.9. Building Management Control System

Lifehouse will be provided with a new Building Management Control System (BMCS) which will be controlled by a head end computer. Location of the main control terminal is yet to be determined.

The new BMCS will have a flat screen head end computer terminal. The system will operate on a BAC net protocol which will provide high level interface compatibility with chillers, variable speed drives and generators. The head end computer will be connected to field sensors via a fibre optic backbone and field controllers located in the mechanical services plantrooms on each floor.

The BMCS will have an internet interface allowing maintenance technicians to log in from remote locations. Maintenance technicians may be notified of specific alarms as required via SMS, email, pager etc.

The new BMCS will control all mechanical services equipment and hydraulic pumps. It will provide the following monitoring for the following:

- Electrical Power Supplies;
- Diesel Generators (high level interface);
- Uninterruptible Power Supplies (UPS);
- Fire alarms;
- Fire hydrant and sprinkler pumps;
- Hydraulic Storage Tanks;
- Lifts;
- Medical gases;
- Blood fridge alarms;
- Specialist medical equipment.

The new BMS will monitor the energy and water consumption of the new facility.

In the event of a fire, the BMS will provide monitoring only and the ventilation systems will be controlled by the Fire Fan Control Panel.

4. Medical Gas Systems

4.1. Scope

Oxygen, Medical Air, Vacuum Suction, Scavenge, Nitrous Oxide and Carbon Dioxide will be provided to the Lifehouse in accordance with AS2896, TS-11 2007 and the Room Data Sheets specific to this project.

4.1.1. Oxygen

Oxygen will be supplied from the 30 000L RPA Hospital main vacuum insulated evaporator (VIE) oxygen tank located in the existing RPA loading dock. This tank is provided with a 3000L back up tank located on the eastern side of the main RPA Hospital campus. Currently the oxygen tank is filled weekly. The additional usage of Lifehouse is not expected to increase the frequency of filling of the tanks.

Oxygen will be delivered via the existing oxygen pipework which joins the tank to RPA Hospital.

A critical oxygen supply backup will be required to serve ICU and the operating theatres should the main and back up tanks fail to comply with AS2896. This is located in the Lifehouse loading dock.

4.1.2. Medical Air

Lifehouse will be provided with a dedicated medical air compressor plant consisting of 2 x 100% maximum demand medical air compressors (N+1 redundancy as per AS2896). The location is currently under review. Medical Air will be provided at +400kPa.

4.1.3. Vacuum Suction & Scavenging

A new vacuum suction plant, consisting of 4 x 33.33% maximum demand capacity oil-less claw vacuum suction pumps (N+1 redundancy as per AS2896). The final location is under review. Oil-less claw pumps require less maintenance and no oil changes, both reducing maintenance costs and system component shutdown periods. This system will also provide scavenging.

4.1.4. Nitrous Oxide

Nitrous oxide will be provided to Lifehouse via the RPA Hospital supply. This supply is a compliant nitrous oxide bottle manifold located at the existing loading dock on the western side of Lifehouse.

4.1.5. Carbon Dioxide

Carbon dioxide will be provided to Lifehouse via the RPA Hospital supply. This supply is a compliant carbon dioxide bottle manifold located at the existing RPA loading dock.

4.2. Pipework Reticulation

Medical gases will be reticulated throughout Lifehouse through medical grade copper pipework via a centre medical gas services riser located adjacent to the central patient lift core.

Medical Gas Valve Cupboard will be provided on each floor with main isolation valves controlling gas supply per floor.

Medical Gas Valve Boxes will be provided for:

- each operating theatre; and
- at the entry of each ward.

4.3. Medical Gas Alarm Panels and System Control

Medical gas alarm panels will be located at relevant staff stations. The medical gas system will be controlled in accordance to AS2896 requirements and monitored by the BMS.

4.4. Medical Services Pendants

Each operating theatre will require medical services pendants. The pendants will include oxygen, suction, medical air, nitrous oxide, carbon dioxide, scavenging gas outlets, emergency power, non essential power, UPS power and data outlets and nurse call and staff assist as per the room data sheets.

5. Electrical

5.1. Design Principles and Codes

5.1.1. Scope

The electrical engineering scope includes:

- High voltage supply intake from the Energy Australia Network
- High voltage Energy Australia Substation
- Consumer mains
- Low voltage switchgear, energy consumption metering and reticulation
- Emergency standby power supply system
- Uninterruptible Power Supply (UPS) systems
- Power Factor Correction (PFC) equipment
- Lighting control systems
- General small power
- Earthing
- Lightning protection system
- Low voltage sub and check metering
- General internal and external lighting
- Emergency evacuation and exit lighting
- Specialist medical examination and procedure lighting
- Patient treatment areas, cardiac and body protected areas.
- Master clock system
- Medical service panels
- Medical services pendants
- X-Ray viewing services

Note that a number of further specialist systems are covered in the Information and Communications Technology sections eg CCTV, MATV and Pay TV, Patient Call Systems, etc.

5.1.2. Design Criteria

The basic design criteria will be as follows:

- Design life for electrical components, excluding consumables, of 15 to 25 years.
- Reliability of electricity supply to essential services.

- Continuity and restoration of electricity supply in the event of loss of electricity service to Lifehouse.
- Use of low energy systems and equipment. Energy efficiency to be maximised within the financial constraints of lowest life cycle costing and capital constraints.
- Ergonomic prudence in terms of life-cycle costs (including capital expenditure, operating, maintenance and replacement costs).
- Commonality of systems and technology utilised.
- Flexible design with redundant plant and equipment to ensure integrity of supply and to allow for changes in the usage of areas.
- Adequate provision of spare capacity for the designed life of the services installation.
- Selection of plant, systems and equipment that are compatible and in harmony with the aims of the building designers in making each facility comfortable, harmonious, interesting and healthy for patients, visitors and staff.

Details of the particular design criteria are expanded upon in each of the following sections.

5.1.3. Standards and Codes

The electrical services will be designed in accordance with but not limited to the following. The design will take into account and cover all statutory requirements. The whole of the work will be designed strictly in accordance with the latest and current edition of:

- Building Code of Australia (BCA) – 2010 edition
- New South Wales Department – Engineering Guidelines Technical Series TS-11 2007
- AS/NZS 3000.2007 – SAA Wiring Rules, and all applicable standards within, including standards mentioned in Appendix A – Normal and Informative
- Service Rules, Regulations and Requirements of Energy Australia
- WorkCover Authority requirements
- Local Council regulations having jurisdiction on this project
- Local water and gas supply authorities' requirements
- Requirements of the Installation Inspectors of Energy Australia
- Issue of relevant Australian Standards
- Australian Health Facility Guidelines
- Environmental Consideration documents
- Requirements of the NSW Fire Brigade
- Rules of the Council of Fire and Accident Underwriters of Australia
- Requirements of the Australian Telecommunications Commission (Austel)

- AS/M25 1044 – EMI and RFI Requirements
- AS/NZS 1044 – Limits of radio disturbance characteristics of electrical appliances for household and similar purposes
- AS/NZS 1158 – Lighting for Roads and Public Spaces
- AS/NZS 60598 – Luminaires
- AS/NZS 4703 – Electrical Wiring in Modular Furniture
- AS 1449 – Surge Protection
- AS 1657 – Fixed Access Ways
- AS 1680 – Interior Lighting and Visual Environment
- AS 1765 – Artificial lighting for clinical observation and all other relevant standards as further described or as applicable directly or indirectly.
- AS 1768 – Lightning Protection
- AS 1939 – Degree of Protection
- AS 1940 – The Storage and Handling of Flammable and Combustible Liquids
- AS 2293 – Emergency Lighting to Buildings
- AS 2500 – Guide to the safe use of electricity in patient care areas
- AS 3000 – Wiring Rules
- AS 3003 – Patient treatment areas of hospitals, medical and dental practices
- AS 3008 – Electrical installations - Selection of cables
- AS 3009 – Emergency Power Supplies in Hospitals
- AS3010.1 – Supply by Generating Sets - Part 1 (Internal Combustion Engine Driven Sets)
- AS 3137 – Approval and test specification – luminaires
- AS 3439.1 – Low Voltage Switchgear and control gear assemblies

Consideration will be given in the design to the requirements for plant and reticulation supports and fixings to incorporate relevant seismic restraints to comply with AS 1170.4.

5.2. Proposed Services

5.2.1. Incoming Electricity Supply

The power supply to Lifehouse will be derived from the Energy Australia 11kV network. Their point of connection into their network is still being assessed. Energy Australia will establish an 11kV basement substation at level B1 with transformer access direct from Brown Street. The substation will be fitted with 3 x 1500kVA transformers to cater for the electrical demand.

It is expected that the initial maximum demand for the project will be 3400kVA.

It is expected to operate the three transformers in parallel which will give a good redundancy (should a transformer fail then the remaining two transformers will maintain the supply to the building while the faulty transformer is replaced).

5.2.2. Spare Capacity

The electrical systems will have a minimum of 30% spare capacity.

The current estimated maximum demand for the completed project is 3400 kVA. After an additional allowance for future growth of 30% we have allowed a site intake capacity of 4400 kVA.

The LV main switch board, sub mains and distribution boards will include a minimum of 30% spare capacity. Distribution boards will have the rating sized to include this spare capacity and also have 30% spare ways included. These spare ways will not include spare circuit breakers.

5.2.3. Energy Australia Substation

This will be located at Level B1 with direct transformer hatch access from Brown Street.

The substation will be configured as follows:

- The substation will be approx 150m^2 and shall be 3 hour fire rated as a minimum.
- 11kV/415V oil cooled distribution transformers, rated at 1500kVA each
- All three transformers will be configured to operate in parallel.
- Each transformer will be totally enclosed in its own housing, be of an oil type construction.
- Each transformer will be provided with protection via electronic IDMT protection relays
- Inter tripping will be used between HV and LV circuit breakers
- LV cabling or bus-duct with direct connection from the Energy Australia LV switchboard (located in the sub station) to the adjacent Low Voltage Main Switch Board (MSB), will run at high level.
- Cooling of this substation will be via natural ventilation.

5.2.4. Main LV Switchboard

A dedicated low voltage Main Switch Board will be provided directly adjacent to the substation. This switchboard will be supplied from the sub station by 415 volt cables or bus-duct consumer mains.

The electrical main switch room will be approx 18m x 5m and shall be 2 hour fire rated as a minimum. This room will be provided with mechanical cooling to ensure that all switch gear is maintained at acceptable temperatures recommended by the manufacturers.

The main switchboard will include non essential bus sections and switchgear connected to each of the transformers via a main switch for each transformer section and will include the following features:

- Cabinet construction, for free standing with rear connection of all incoming and outgoing cables.
- Copper busbars.
- Form 4 construction complying with AS 3439.
- Fault Level of 65kA.
- Withdrawable air circuit breakers for all incoming supplies and bus section switches.
- Moulded case circuit breakers for all outgoing supplies up to 800 amps and withdrawable air circuit breakers for all outgoing supplies above 800 amps.
- HRC fuses will not be used for sub main circuit protection.
- Power factor correction will be provided to correct the power factor to a minimum of 0.97 lag.

5.2.5. Electrical Supply Characteristics

The electrical supply characteristics for this building will be:

- 415 volts, 3 phase, four wire, 50 Hz.
- MEN earthing throughout.
- The fault level at the point of supply to the main switchboard has been assessed at 35 kA (which is based on the condition that the individual transformers in the substation are not operated in parallel).

The maximum voltage drop related to the furthest point (final sub-circuit) shall not exceed 5% from the substation low voltage terminals on each transformer.

Generally the maximum voltage drop allowances are made up from the various components of the reticulation and will not exceed the following:

Consumer mains	-	0.5%	Total = 5%
Sub mains	-	2%	
Sub circuits	-	2.5%	

5.2.6. Sub Main Reticulation System

Generally

The design objectives for the low voltage distribution throughout the building will generally be as follows:

- A Main Switch Board will be provided adjacent to the substation at Level B1.
- Low voltage supplies from the main switch board by 415 volt cables on cable ladder or cable tray.
- Switch board design will be developed during Design Development to asses the opportunities for maintenance and remodelling of switchgear whilst complying with electrical safety regulations
- Electrical risers shall be vertical and stack one on top of the other
- The sub main cable reticulation design will include multiple sub mains serving each area/department of the building, to minimise the impact of any one failure. This will also allow for regular maintenance, alterations and equipment failures with minimal loss of supply to a specific area/department.
- Spare capacity in the network to allow for flexibility of use of the spaces and load growth. Design spare capacity to the network of at least 30%.

Risers

Two dedicated electrical risers will be provided in the core of the building for the running of dedicated sub mains and rising sub mains with individual floor tap off units. Both electrical risers will be vertically stacked and aligned.

Sub mains

Sub mains will consist of cabling run on cable trays and or cable ladder in dedicated electrical risers, cable on ladder or tray in accessible ceiling spaces and in HDUPVC conduit where underground. Generally sub mains cables will be installed in accordance with the requirements of the BCA, AS 3000, AS 3008 and AS 3009.

Sub mains will generally be installed in such a manner as to minimise electromagnetic fields and ensure compliance with the requirements of the National Health and Medical Research Council, OH&S requirements, and to ensure that the normal operation of items of office and medical equipment is not in any way affected.

Generally sub mains will be installed only within vertical risers and shall be cleated to supports (eg 'Unistrut' or fixed to cable trays/ladders) in accordance with manufacturer's requirements.

A limited number of sub mains may be run on cable tray above corridors or other areas not normally or continuously occupied by staff or patients. All horizontal cable runs shall be kept to an absolute minimum in staff and patient areas.

All sub mains shall be sized so as to have minimum spare capacity to comply with the requirements of TS-11 in addition to the calculated AS 3000 maximum demand, after de-rating factors as noted in AS 3008 have been applied.

Sub mains to a number of clinical departments such as Operating Theatres, ICU, and other Critical Care areas shall be dedicated and not shared with other departments.

Sub main cables required by either BCA (essential services) or AS 3009 shall be of fire rated construction, whether by use of low halogen polymeric insulation, MIMS or by enclosure complying with the requirements of AS 3008 and be installed entirely in accordance with manufacturers' recommendations with penetrations sealed where run through fire walls. Generally sub mains cables of low smoke zero halogen will be considered as an additional fire precaution during the design development stage.

5.2.7. Emergency Power Generation

Emergency Power Generation Design Approach

Standby generator sets will be provided to supply power, in the event of emergency or normal mains failure, to essential loads.

Essential loads have been based on strict adherence with AS3009 1997, the BCA and Emergency Power Supplies in Hospitals. In addition, the recommendations of TS11 will be adopted. The basis of distribution of standby/emergency power is that the immediate safety of patients and people in general is not jeopardised in the event of normal mains failure or emergency.

Two standby generators will be installed each rated at approximately 800kVA. Both sets will operate in parallel to provide a total output of 1600kVA.

These generator sets are located at Level Basement B2.

Bulk diesel fuel storage will be provided with an in-ground tank located below Basement B3 which will have capacity for 48 hours continuous operation of the two diesels at full load.

The anticipated load supplied from generating sets in the event of normal mains failure or an emergency is listed below:

- Lifts, all will be connected to allow discharge of each lift down to the entry floor level and then one lift in each group will continue to operate

- General lighting ranging from 25% to 100%
- General Power, ranging from 10 % to 100% in selected areas
- All emergency and egress lighting
- Fire alarm and protection systems
- Specific Medical Imaging Equipment
- All communications systems including patient alarm, voice and data systems
- All monitoring, metering and alarm systems, including medical gases, fire and security alarms
- All ventilation (no cooling) to operating theatre suite, ICU, isolation rooms and diagnostic imaging other than below
- Air conditioning/cooling to the following areas only, including:
  - Comms Rooms
  - Data Centre
  - Medical Imaging Treatment/X-Ray Rooms
- Atrium Exhaust (still to be confirmed)
- Stair pressurisation
- BMCS
- All UPS supplies
- Domestic hot water circulation pumps
- Space heating circulation pumps
- PACS Computers and associated equipment, fully supported
- Fridges, blood fridges, mortuary refrigeration
- All medical gas systems.

The amount of emergency standby power available, as outlined above, is anticipated to equate to approximately 33-35% of Lifehouse's maximum demand, a level that is considered appropriate for this type of facility.

Categories

Electricity supplies can be divided into the following categories:

- Essential Instantaneous; with restoration of supply without a break. This requires an Uninterruptible Power Supply (UPS) incorporating battery storage for a minimum period of 30 minutes, to ensure no loss of supply between loss of grid supply and the response by diesel generator(s). Emergency lighting required under the BCA and AS 2293.1 is required to be instantaneous. This will be supplied from local battery inverter changeover systems

- Essential; restoration of supply within 60 seconds. This will be provided by automatic changeover to emergency standby diesel generation plant.
- Non Essential – The remainder of the load (not connected to the standby diesel generator).

5.2.8. Uninterruptible Power Supply

Emergency uninterruptible power supplies requiring battery storage systems to provide a "no break" response time will be provided as follows:

- Emergency evacuation and exit lighting systems, distributed battery systems located within the luminaires
- Central Medical UPS with a reticulated network to distribution boards in critical care areas such as Operating Theatres and ICU. This unit will be located at level B1. This medical UPS system will be sized to provide 60kVA of power continuously for a minimum of 30 minutes and have an (N+1) redundancy (ie 3 x 30kVA units).
- Individual UPS's for all medical procedure lighting in each Operating Theatre. These will be small local units sized to suit the individual theatre lights and have a 90 minute battery backup time.
- One dedicated UPS system for the Data Centre, rated at 60kVA for the IT equipment. This will be located in the plant room serving the data centre. This UPS system will be rated for 30 minutes continuous power and will have an (N+1) redundancy (ie 3 x 30kVA units).
- Communications Rooms will have a centralised UPS system serving the Building Distributor equipment and also each floor distributor rising (two per floor). This will be a 240kVA system with N+ 1 redundancy and will be rated for 30 minutes continuous power (ie 3 x 120kVA units).

The design life of the Uninterruptible Power Supplies, excluding batteries, will be twenty years, with the batteries having the following expected life:

- Batteries within emergency luminaires: 5 years
- Batteries for a UPS system: 10 years

5.2.9. Sub-mains

Sub-main cables shall originate from the main switchboard at level B1 main switch-room via the dedicated electrical risers to supply all new non-essential, essential, and safety services distribution boards.

Sub-mains will be divided into three categories as defined within the Engineering Guidelines, TS11:

GROUP A – Safety Services

- Fire Services
- Sprinkler Pumps
- Fire Detection and Alarms
- Air handling equipment for the control of the spread of fire and smoke
- EWIS
- Lifts

Note: All the above supplies will utilise fire rated cables connected to the non-essential and essential stand-by generator supplies.

GROUP B – Critical Care Services

- Operating Suite (Lighting and power)
- Intensive Care / High Dependency Units (Lighting and power)
- CT Scanner and Radiology Areas (Machines, lighting and power)
- Day Procedures Rooms
- Selected mechanical air handling plant to the above areas (including chilled water)

Note: All the above supplies will be connected to the non-essential and stand-by generator supplies with dedicated sub-mains to each area / department. Supplies to the above areas shall not be connected to common / shared risers.

GROUP C – General Services

- General lighting and power throughout areas not included above
- General mechanical plants, which are separate from the requirements for Category 1 and Category 2 systems
- Offices, Administration
- Hydraulics Services.

Note: The above supplies will be connected to the non-essential and stand-by generator supplies but will not be via dedicated sub-mains.

The sizing of sub-mains will be based on maximum demand, voltage drop and earth fault loop impedance, to comply with the requirements of the engineering guidelines and related standards.

5.2.10. Distribution Boards

Lighting and power circuits within each area shall be supplied from distribution boards located in local electrical cupboards on the floor and the electrical riser in the core. Separate distribution

boards will be provided for diesel generator supplies, non-essential supplies, and UPS-powered outlets where appropriate.

All distribution boards shall be fitted with a hinged lockable door, and fitted with the appropriate circuit breakers to control the circuits nominated, each chassis to have a minimum of 30% spare capacity as per TS-11. Each distribution board shall include a main isolator (minimum 250 amp) which shall not take up any of the pole capacity.

Generally, distribution boards will be constructed to Form 1 as detailed in AS 3439.1.

Basement Distribution Boards shall not be mounted lower than 1.0m AFFL. Horizontal mounting to be considered, having top row of circuit breaker toggles not exceeding 1.8m AFFL.

Within Lifehouse, it is proposed that one main electrical riser (located in the main core area) together with additional departmental electrical cupboards (non riser) be provided.

These risers / cupboards will house all sub-main cables as well as local distribution boards, all associated equipment and ancillary control facilities, and be positioned as generally located on the schematic design layouts. In addition some areas/departments will have distribution board cupboards located within the area/department (such as medical imaging, etc) to reduce the density of final circuits originating from the core as well as excessive cable lengths and associated voltage drop.

Generally all distribution boards will be fitted with circuit breakers with the appropriate RCD protection, together with a minimum fault rating of 10kA. Also, all distribution boards will be fitted with appropriate surge protection equipment.

5.2.11. Cable Tray and General Wiring

Cable tray will be installed throughout within cable risers / cupboards and for horizontal floor cabling (located in the ceiling voids). All to have a minimum of 30% spare capacity.

Separate cable trays in the above general locations shall be installed for the following services:

Sub-main Cable Trays:

- Electrical non essential sub-mains
- Electrical essential sub-mains
- UPS sub-mains

Lighting and Power Final Circuit Cable Trays:

- Non-essential, essential and UPS final circuits (all grouped on a common tray)

Communications and Miscellaneous Services Cable Trays:

- Communications backbone cabling for copper and fibre optic services
- Fire and Safety Services
- Nurse Call
- MATV / Pay TV
- Security
- BMCS

Colour coding of the outer sheath of final circuit cables and sub mains:

- All lighting final circuits - white
- All power final circuits - grey
- Temporary circuits for lighting and power - black
- Voice and data cabling to outlets - blue
- Sub mains - orange

5.2.12. Lighting

5.2.12.1. General

The general and specific lighting layouts will be designed in accordance with a number of lighting standards as part of detailed design as follows:

AS 1680 Part 1 and TS11	General lighting levels
AS 1680 Part 2 and TS11	Specific lighting levels
AS 1765	Artificial Lighting for Clinical Observation

In non-medical areas, lighting and switching controls shall comply with the requirements of the 2010 edition of the BCA Part J6.

RCDs shall be provided to comply with the current AS/NZS 3000 Wiring Rules.

5.2.12.2. Linear Fluorescent Lamps

Critical Care Areas

Due to the sealed nature of the luminaires in these departments and the utilisation of K19 prismatic diffusers, the fluorescent lamps will be T8 (20mm dia), tri-phosphor with a colour temperature of 4000°k and a Colour Rendering index (Ra) of at least 84. Operating Rooms shall use a colour rendering index of Ra = 94.

The luminaires will be complete with electronic ballasts that will provide a minimum lamp life of 14,000 hours.

The use of the new T5 (16mm diameter), tri-phosphor tube will be restricted due to the high surface brightness of the tube and the associated glare that it creates when used with prismatic diffusers.

Other Departments

The fluorescent lamps will be a mixture of T8 (20mm diameter) and T5 (16mm diameter). Generally the T8 lamp will be used in combination with prismatic diffusers and the T5 tube will be used with low brightness louvres in the administration/office and workstation areas.T5 lamps shall not be used where prismatic diffusers are employed but may be considered to be used in conjunction with the new technology Y5 and Y7 acrylic diffusers

All lamps will have a colour temperature of 4000°k with Ra of 84.

5.2.12.3. Compact Fluorescent Lamps

Compact fluorescent lamps will be used in conjunction with down lights and specific fluorescent luminaires, the range of which shall be as follows:

Up to 26 watt	TC/D type
36, 40 & 50 watt	TC/L type

The colour temperature of these lamps will be 4000°k with Ra of 84.

However in specific areas such as waiting rooms and grieving rooms, the colour temperature will be reduced to 2700/3000°k to provide a warmer, more relaxed environment.

5.2.12.4. Incandescent Lamps

These are generally discouraged and it is not expected to use these lamps due to their poor light output, high energy use and very limited lamp life.

Specific examination lights will use the 50 watt low voltage tungsten halogen lamp which has a very good light beam control and does not suffer from frequent lamp replacement due to its intermittent low usage.

5.2.12.5. L.E.D. Lamps

There is a gradual transition into the use of LED light sources associated with certain type of light fittings. The lighting efficiency and colour temperature has increased considerably over recent years which has made this new technology more viable. This type of light source will be investigated for use in specific areas during the design development stage.

5.2.12.6. Lighting Systems

General

In areas where the primary focus is on medical care, the main emphasis will be on the needs of staff to examine, treat and observe patients and to carry out procedures. The lighting schemes in these areas will reflect this.

In areas that are designed for patient occupation and not for treatment the main emphasis will be on creating a comfortable interesting visual environment that will aid the psychological well being of patients.

Factors to be taken into consideration in the lighting designs include:

- The use of natural daylight
- Design life for electrical components, excluding consumables of 15 to 25 years with refit at the end of this time
- Glare control
- Direct and indirect illumination
- Colour rendering and colour temperature
- Selection of a restricted range of lamp types, to minimise maintenance costs
- Architectural aesthetics
- Energy efficiency and management
- Switching & control

The illumination levels will be as laid out in the Australian Standard for Interior Lighting, AS 1680.1, 1680.2.1 and 1680.2.5, the standard for interior lighting of Hospitals and Medical premises.

The luminaires to office areas will be recessed low brightness luminaires using the high efficiency T5 fluorescent lamps.

In stores and general areas with no specific lighting or aesthetic requirements, recessed K19 or the new Y5 or Y7 diffuser luminaires using the T5 fluorescent tubes will be utilised.

In accordance with standard design practices, the design criteria for the maintained illuminance will be based on maintenance factors applicable with annual cleaning of lamps and luminaires, with bulk re lamping every two years. This will ensure that areas are not overdesigned.

The lighting design will consider the above factors and where appropriate design solutions will be selected with a view to overall energy efficiency whilst balancing operational, maintenance and functional requirements.

Examination Lighting

Specialist medical areas will require examination lighting. These will be wall or ceiling mounted on articulated arms in accordance with AS 2501 Surgical Luminaires, appropriate to the use of the space, as required by the Room Data Sheets:

- Ward areas may be provided with ceiling mounted recessed compact fluorescent luminaires
- Examination, consulting, clinics rooms by wall or ceiling mounted tungsten halogen spot luminaires on articulated brackets as indicated in the RDS
- Treatment rooms to be fitted with ceiling mounted single lamp head articulated arm with tungsten halogen examination luminaires as indicated in the RDS

Examination luminaires generally will not be supplied from separate battery backed power supplies.

In addition to the examination lighting, medical procedure luminaires will be used in specific areas such as Operating Theatres and other areas as required by the room data sheets. These luminaires will comprise multiple lighting heads depending on the area they are to be installed. These luminaires will comprise either LED or tungsten halogen light sources.

Patient Ward Rooms

Lighting to the ward areas will be designed to minimise the glare from ceiling mounted luminaires for patients in bed or being transported on trolleys. The designs will be warm, inviting and eliminate the institutional feel.

Generally wall mounted direct/indirect tubular fluorescent luminaires, with overbed luminaires incorporating a reading light, switched from the bedhead panel and/or the patient alarm pendant handset.

Night lighting will be provided by low level recessed wall lights, centrally switched from the staff station. Where possible utilisation of LED technology will be used for night lighting.

X-Ray Viewers

It is envisaged that digital radiology/PACS (picture archiving and communication systems) will progressively replace X-Ray viewers. Notwithstanding for viewing of existing technology films a limited number of X-Ray viewers will be required.

Illuminated X-Ray viewing panels will be provided in areas identified by the Room Data Sheets. These will generally comprise two types:

- Recessed units for Operating Theatres

- Surface mounted plug in types (in all other areas)

External

External lighting will be provided for the following areas:

- Roadways and access ramps
- Open court yards
- Verandahs and covered balconies
- External signage
- Landscaping

Illumination levels will be based on that recommended in AS 1158, P or V categories to be determined.

Additional lighting will be provided to facilitate disabled access to all public areas in accordance with AS 1438.1.

5.2.13. Emergency Evacuation Lighting and Exit Signs

5.2.13.1. General

Emergency lighting and Exit signs shall comprise self-contained individual units connected to a central computer monitored network.

The head end PC will be located in the Security Control Room, or as directed by "Facility Operations User Group".

The system to be used throughout Lifehouse shall be stand-alone and not link with the RPA Hospital.

The overall system will report only to, but not be controlled by the building's B.M.S. system. This would be a common alarm only, not individual lamp/fail/fault information.

5.2.13.2. Exit Signs (Computer Monitored)

One lamp shall be connected to the dedicated "Exit sign" and "Emergency Lighting" circuit so that it is permanently illuminated, the other lamp shall be illuminated by the self contained battery unit when the active conductor fails. (sustained fitting). Alternatively single lamp "cold cathode" lamps and/or "LED" lamps will be investigated for use during the design development stage.

5.2.13.3. Emergency Fittings (Computer Monitored)

- Recessed 1 x 10 watt tungsten halogen lighting fittings, arranged so that it is illuminated by the self contained battery unit when the active conductor fails (non-maintained fitting).
- Recessed and surface mounted fluorescent lighting fittings comprised an emergency lighting component. These shall be arranged to be illuminated by the self contained battery unit when the active conductor fails. These fittings shall be fitted with the emergency pack and connected to the computer monitoring system.

5.2.14. General Power Switched Socket Outlets and Permanent Connections

5.2.14.1. General

10 amp switched socket outlets shall be provided throughout Lifehouse. A maximum of twelve (12) single outlets (or six (6) twin outlets) shall be connected to any final circuit.

Power socket outlets shall be either HPM (Excel) range or the Clipsal (2000) series, with clip-on face plates.

Power socket outlets connected to the non-essential supply shall have a white face plate and outlet with a "white" operating switch.

Power socket outlets connected to the essential supply shall have a white face plate but have a "red" outlet and operating switch.

Power socket outlets connected to the UPS supply shall have a blue face plate, outlet and switch.

5.2.14.2. Electro Medical Installation

The protection of power outlets throughout the facility will be divided into the following categories:

1. Non-Patient Areas

   RCD protection for each power circuit will be provided by a 30mA earth leakage circuit breaker combined in the same circuit breaker as the overload protection to that circuit and occupying only one pole width at the distribution board.

2. Patient Areas

   All patient care and treatment areas will be either Body or Cardiac Protected as follows:

Body Protected Areas

Panel-mounted, 10 amp power socket outlets shall be provided in accordance with the installation requirements of AS3003. All outlets shall be protected by means of a 10mA earth leakage circuit breaker (RCD) which shall be located in the patient care area (and not at the distribution board).

Each patient location shall be connected to two separate essential circuits, each originating from different essential distribution boards.

Cardiac Protected Areas

Panel-mounted, 10 amp power socket outlets shall be provided in accordance with the installation requirements of AS3003. In addition to the requirements for Body Protection Areas, full emphasis shall be provided regarding earthing within the patient care area.

Each patient location shall be provided with a minimum of two dedicated essential circuits from different essential distribution boards, which shall not be shared with other patients.

Visual and audible alarm shall be provided at each staff station for each cardiac protected area to alert nursing staff when a circuit breaker trips in a patient area. The audible alarm would be muted at the staff station, but the alarm lamp would remain on until the relevant circuit breaker has been reset.

Specific Cardiac Protected areas such as Operating Theatres will be protected by means of Line Isolation Transformers and Monitors in accordance with AS 3003 and AS 2500.

Within Body and Cardiac Protected areas, cleaners GPO's shall be installed and be protected by a 10mA earth leakage current breaker at the non-essential distribution board.

Cleaners GPO's in non patient areas shall be protected by 30mA earth leakage circuit breakers at the non-essential distribution board.

5.2.14.3. Medical Services Panels and Pendants

Medical Services Pendants will be provided to the Operating Theatres.

Medical Services panels will be provided to all other areas as required during the design development stage.

Where medical service panels are to be installed they will include some or all of the following:

- Power outlets
- 10mA RCD's
- LIMs

- Switches
- Patient (Nurse) call points
- Staff assist points
- Communications points for voice data and patient telemetry
- Medical gas and suction outlets
- EP Terminals (in Cardiac Protected areas)
- EP Junctions (in Cardiac areas will be located on their own panel/face plate and will be separate from the patient medical panel)

5.2.15. Earthing Systems

A complete earthing system will be provided to all areas of the site to fulfil the protective requirements of AS 3000 and to provide an adequate functional earthing system to ensure correct operation of sensitive ICT equipment to be used across the site.

This will include substation earthing, main earthing bonded into the lightning protection system, local surge diverters and equipotential bonding throughout.

5.2.16. Lightning Protection and Surge Protection

Generally

Lifehouse will contain critical technical and communications equipment utilising sensitive electronic components. Therefore, it is proposed to provide a complete lightning protection and surge diverter system to the structure in accordance with AS 1768.

Lightning Protection

The lightning protection system will utilise steelwork within the buildings structure, steel beams/columns, re-bars, piles/foundations etc as down conductors and earthing points. Where possible, metallic roofs will be used as the air termination network supplemented with air termination finials. All roof-mounted plant will be bonded into the lightning protection system air termination network.

Surge Protection

Metal Oxide Varistor (MOV) type surge protection will be provided at each main switchboard and at all local distribution boards.

Local surge protection at the distribution board, will be provided to protect computers, monitoring and other related medical equipment.

5.2.17. Master Clock System

A synchronous master clock system will be provided to serve the following areas:

- Operating Rooms
- ICU
- Anaesthetic Rooms
- Recovery
- Radiology – Selected Areas

5.2.18. Energy Management and Control

Energy management associated with the electrical services will basically cover areas as follows:

- Lighting control
- The use of energy efficient luminaires, lamps and control gear

5.2.18.1. Lighting Control

General Patient Lighting in the inpatient units will be locally switched. Corridor lighting associated with these inpatient units will also be locally switched at the staff station.

Individual consulting rooms and offices will be individually switched however areas/departments that are not in use over a 24 hour period and or close down over the weekends will be PLC controlled to ensure these areas/departments are switched off after hours. Override switches will be provided to allow an area/department to be opened/operated after working hours which will provide a variable "on" time for up to 2 hours.

Entrance areas, atrium and large circulation spaces will be in 24 hour use but will have a degree of automatic control to adjust lighting levels between day and night time.

Specialist areas such as Medical Imaging Rooms, Ultrasound etc, will be locally switched and provided with dimming to adjust the lighting levels from 100% down to approximately 15%.

Operating rooms will be locally switched and provided with group switching of individual fluorescent lamps within fittings to provide up to 7 levels of lighting levels.

5.2.18.2. Energy Efficient Luminaires

All luminaires will be fitted with electronic control gear to provide the most energy efficient means of operation.

Lamps will be selected for their energy efficient operation. The use of the T5 fluorescent lamp will be utilised as stated previously; this lamp is rated at 28 watts compared with the T8 lamp rated at 36 watts.

6. Information and Communications Technology

6.1. Design Principles and Codes

6.1.1. Scope

The ICT engineering scope includes:

- Structured Cabling System
- Local Area Network (LAN)
- Network Monitoring System (NMS)
- Wireless LAN
- Wide Area Network Carrier Services
- Telephony using VoIP Technology
- Wireless Telephony
- Fax/Modem Lines
- Picture Archiving and Communication System (PACS)
- Patient (Nurse) Call System including Staff Assist and Emergency Call
- Public Address System
- Mobile Phone Coverage
- IP TV System (Free to air and Pay TV)
- Audio Visual and Videoconferencing
- Information Kiosks
- Public Information Displays
- Patient Queuing Systems
- Electronic Medical Records

6.1.2. ICT Strategy

ICT services will have a key role in service delivery for Lifehouse. To deliver up to date relevant technology services a flexible and forward looking ICT strategy is proposed.

The development of ICT services infrastructure recognises that specific ICT hardware, enterprise applications and specialist services such as picture archiving and communications systems (PACS) will continue to evolve and be upgraded throughout the life of this project. The requirement is therefore for high performance, flexible and standards based (rather than proprietary) solutions.

The design ICT services will include a structured cabling system (SCS), based on floor communications rooms, and linking to outlets. Rack mounted equipment will enable connection to backbone networks.

Increasingly individual application services will operate over this structured cabling network, either as part of the LAN or as segregated networks. For example patient (nurse) call systems will be integrated with the SCS and wireless LAN to provide interconnectivity with the Wi-Fi telephone handsets.

Lifehouse will also connect (via fibre optic and copper cables) to the main IT/Comms room in the RPAH.

6.1.3. Standards, Codes and Design Criteria

The communications systems will be designed to provide the Centre with the communications infrastructure that will complement the information technology and functional needs of the Centre. All communications services will be designed to:

- Provide flexibility, built-in spare capacity and expandability
- Provide ease of ongoing management
- Be cost effective (both in the initial installation and life cycle)
- Provide a suitable degree of backup facilities
- Support existing applications as well as emerging technologies and future applications so as to accommodate future expansions

The ICT strategy will be further developed during the design development stage in consultation with the user groups to rationalise the various types of fixed line and wireless communications technology to be adopted to support the ICT systems.

Discussions have taken place in relation to the following:

- The implementation of VoIP technology for the telephony services
- The configuration of the backbone infrastructure cabling (both fibre optic and copper) together with cable pathway redundancies
- The location of the individual Floor Distributors, Building Distributor and Carrier Distributor.
- The configuration of the layout, size and access of each Floor Distributor
- The type/class of horizontal cabling to be used

The communications installation will be designed in accordance with the above general requirements and the specific requirements of all relevant Australian Standards of which the following represent part but not necessarily a complete list:

- Meet all requirements of the local area health service current specification outlining standard requirements for their communications cabling infrastructure
- AS/NZS 3080 Integrated Communication Cabling Systems for Commercial Premises
- AS/NZS 3084 Telecommunications Pathways & Spaces, Commercial Buildings
- AS/NZS 3085.1 Administration of Communication Systems
- AS3260 Approval and Test specification-Safety of information technology equipment including electrical business equipment
- AS/NZS 61935-1 Telecommunications installations – Generic Cabling systems – Specification for the testing of balanced communication cabling
- AS/NZS 61935-2 Telecommunications installations – Generic cabling systems – Specification for the testing of patch cords in accordance with values set out in AS/NZS 3080
- AS/NZS 14763-3 Telecommunications installations – Generic cabling systems – Specification for the testing of optical fibre communication cabling
- AS 2834 Computer Installations
- AS/ACIF S008 Requirements for authorised cabling products
- AS/ACIF S009 Installation requirements for customer cabling (wiring rules)
- ACA TCPR Communications Cabling Provider Rules 2000
- ACA CRCPR Competency Requirements for Cabling Provider Rules 2000
- ISO/IEC 11801 Telecommunications installations – Integrated Telecommunications Cabling Systems for Commercial remise
- EIA/TIA 942 Infrastructure Standard for Data Centres
- AS/NZS 3000 Electrical Wiring Rules
- AS/NZS 4703 Electrical Wiring in Modular Furniture
- IEEE 802.11 a, b, g and n
- IEE 802.3
- Hard-wired patient alarm systems: AS 3811
- AS HB 29 Communications Cabling Manual
- The requirements of TS-11 (where relevant)

6.2. Proposed Services

6.2.1. Structured Cabling

A structured cabling system will be provided to support Lifehouse's ICT systems.

Horizontal cabling will be provided to all communications outlets and shall be the new Class Ea standard which supports 10Gbps to the technical outlet (TO) over copper. This standard uses 4 pair shielded twisted pair copper cable and terminates in shielded (metal) RJ45 Class Ea jacks. This new standard will provide a greater level of future proofing over the 15 to 20 years warranted lifetime of the cabling system and will be more appropriate for the expected greater bandwidths required by systems such as PACS and the emerging telemetry networks.

The IT/Comms riser will provide diverse redundant paths between the Floor Distributors and the Building Distributor to increase redundancy. Therefore each Floor Distributor will connect back to the Building Distributor as well as a minimum of two other floor distributors.

The Building Distributor will connect to the Carrier Distributor.

The Carrier Distributor will be provided for incoming carrier connections and any associated carrier active equipment.

Backbone cabling will comprise a combination of single mode optical fibre (OS1), multi-mode optical fibre (OM3), together with an allowance for Cat 3 voice cabling, all routed via dedicated risers.

VoIP telephony solution will be adopted for Lifehouse (which will operate over the fibre optic backbone), however Cat 3 voice backbone cabling will be installed to provide services for analogue technology and specific telephones as required.

A Local Floor Distributor will be provided on each and every level of the building for the distribution of telecommunications services throughout the floor.

Each Floor Distributor will stack vertically above each other so that their footprint overlays the room on the floor above and the room on the floor below. These Floor Distributors have been located so that they are not located adjacent to electrical risers. Each floor distributor will house the following services: -

- MATV
- Nurse Call
- BMCS
- Security

- Fire/ EWIS
- Voice
- Data
- Telemetry

Each Comms Riser (comprising the individual Floor Distributors) will connect back to the Building Distributor located on Level B1.

A Data Centre will be established and this will be connected back to the Building Distributor via single and multi mode fibre optic cables.

The maximum horizontal floor cabling including all wireless LAN access points will not exceed 100 meters and this length shall include all patch leads and connection fly leads. Therefore the fixed horizontal floor cabling (from the patch rack to the technical outlet) will be limited to a maximum of 90 meters.

All Floor Distributors shall be located accordingly to meet this requirement taking into account the cable pathways including all vertical routes on each floor.

A dedicated space will be provided for paging antennas, TV aerials, radio aerials, etc which neither impedes the intended helicopter flight path to the RPA Hospital, nor is affected by it in terms of potential reception quality for the services so located. The location will be easily accessible for maintenance and addition of future infrastructure.

All fibre optic cables will be capable of accommodating imaging traffic (PACS).

6.2.2. Fibre Optic Backbone Cabling

Multi core fibre optic cables will be installed throughout the Centre to provide the backbone cabling infrastructure. At this stage in the schematic design the size of these cables are as follows:

Fibre Optic cables connecting a Floor Distributor to the Building Distributor	18 core single mode + 12 core multi mode
Fibre Optic cables connecting a Floor Distributor to an adjacent Floor Distributor on the floor above and below	18 core single mode + 12 core multi mode
Fibre Optic cable connecting a Building Distributor to the Campus Distributor	36 core single mode + 18 core multi mode

Multi mode fibre optic cable shall be 50μm / 125μm.

Single mode fibre optic cable shall be 10μm / 125μm.

Copper Backbone Cabling

With the transition across to VoIP, which uses the common fibre optic backbone reticulation pathway, the use of the conventional copper backbone will be reduced considerably. However, at this stage in the transition process a reduced copper backbone to link from the Building Distributor to each Floor Distributor will be provided as follows:

- A minimum of 100 pair Category 3 backbone cabling system will be provided from the Building Distributor to each Floor Distributor complete with patch panels, patches and jumper connections.

6.2.3. Local Area Network (LAN)

Each floor of the building will be serviced by one Floor Distributor room.

This room will house all passive and active equipment for that floor.

All passive equipment including all cabling (backbone and floor distribution) patching, equipment racks, outlets and patch connectors will be provided under this work. All active equipment including all file servers, switches, hubs, routers and computers will be provided and installed by Lifehouse.

6.2.4. Connection with the Royal Prince Alfred Hospital and Sydney University

Interconnection cabling (both fibre optic and copper) will be provided to connect Lifehouse with the RPAH. This will run from the Facility's main Building Distributor to the RPAH main IT/Comms room located on Level 1 of 'E' Block. The RPAH main PABX room is the point of connection/interface with the Sydney University and therefore this existing link will be used for connection pathway to the University.

6.2.5. Floor Distribution Cabling & Outlets

Fixed IT/Comms Outlets

An integrated Class Ea, shielded horizontal cabling communication system will be installed throughout the Centre. It will be reticulated between each Floor Distributor and the work area on designated cable pathways and spaces. It will be comprised of shielded 4 pair PiMF cable, shielded RJ45 modular patch panels and shielded RJ45 modular outlets at the work area. The "TERA" connector plug and socket will not be used.

All patch panels will be located in the Floor Distributor and will consist of shielded RJ45 patch panels. Shielded Cat 6a patch cords will be used.

In addition to the above copper requirement (which will cover the majority of floor technical outlets throughout the Facility), there may be a requirement for a number of floor technical outlets to be cabled with fibre optic cable. These outlets will be in addition to the copper cabled outlets and will be investigated during the design development stage.

Patch panels for both copper and fibre optic cable will be "intelligent ready" as a minimum to provide the Centre with a migration path to IIMS (Intelligent Infrastructure Management System) in the future without the need to replace the patch panels.

Communications outlets for voice and data connections shall comprise RJ45 jacks. Outlets located on medical services panels and pendants shall be fully recessed into the panel opening. Outlets located in all other areas (primarily not on a medical panel or pendant) will comprise RJ45 outlet sockets mounted using a standard outlet plates.

Medical Services Panels in each of the bedrooms/wards shall contain twin RJ45 shielded class Ea outlets.

At office and workstation areas there shall be triple RJ45 shielded Class Ea outlets.

Any outlets located externally will have weather protection.

6.2.6. Network Communications Equipment

The entire network equipment (including Hubs, routers, switches, file servers), desktop personal computers and printers including software configuration shall be purchased and deployed by Lifehouse.

6.2.7. Wireless Local Area Network (WLAN) and Mobile Phone Network

A wireless LAN will be provided to comply with IEEE802.11 a, b, g and n, to all floor areas of the Cancer Care Centre. See also clause 6.4

The final location and density of the associated ceiling access points shall be dependent on a finally agreed floor layout for each area and will be further developed during the design development stage.

In addition to the Wireless LAN, mobile phone coverage will also be required. This may use the existing external coverage from the mobile phone carriers if the signal strength (within the completed building is adequate):

- Telstra
- Optus
- Vodafone / Hutchison

Should the signal strength be insufficient for mobile phone access within the building then a mobile phone aerial network will be considered such as the Distributed Antenna System (DAS) and will be further developed during the design development stage.

6.2.8. Telephony

A VoIP telephony solution will be provided running over Lifehouse's fibre optic backbone cabling and horizontal STP copper cable to the Technical Outlet.

6.2.9. Fax / Modem Lines

A number of analogue telephone lines will be reticulated through the structured cabling system to support fax machines and XDSL services, as required.

6.2.10. Picture Archiving and Communication System (PACS)

The development of PACS, including digital radiology and medical record systems is an important development in ICT services delivery. The SCS and LAN system will support PACS and deliver high resolution images to the clinicians desktop. This will require significant enterprise system support by Lifehouse to compliment theFacility. The backbone and horizontal floor cabling will support the development of this installation. Active PACS equipment will be provided by Lifehouse.

6.2.11. Localised Self-Contained Pager/Bleeper Alert System

Self-contained pager/bleeper alert systems will be provided in specific reception waiting areas, pharmacy waiting areas, accounts and admission areas.

These shall comprise rechargeable pagers that vibrate, flash and give an audible sound when energised.

Allowance has been made for 6 discreet separate systems to be installed. Each system shall be complete with 30 rechargeable bleeper/pagers.

6.2.12. Hearing Loop System

A "T" loop hearing system will be provided within the public entry areas, all interview rooms and all patient lounges within the Facility, to comply with the requirements for aged care facilities as noted in BCA and NSW Health Guidelines.

6.2.13. Public Address System

Individual, self contained, localised PA systems will be provided in selected areas of Lifehouse with ceiling mounted speakers and a microphone point located at the local department reception counter.

6.3. Patient (Nurse) Call System

6.3.1. General

The patient (nurse) call systems shall be installed in all patient treatment areas.

The patient (nurse) call system shall comply with AS 3811 and the Australasian Health Guidelines, including Fire Risk Management Guidelines.

The system shall be self contained, but with capability for extension or integration into a larger site wide system at a later date, and be complete with all necessary high level interfaces for integration with the Wi-Fi phone system.

The system shall generally comprise:

- Central equipment located in the Floor Distributor on each floor, containing the system software complying to relevant industry requirements, with the ability to be networked throughout the Centre
- System software shall utilise an industry standard base such as Windows, NT, Unix etc and shall be complete with graphical user interfaces to facilitate ease of use by staff
- PC-based floor control panel, including local software, and touch screen, mouse and keyboard for mimic purposes and assignment of staff
- Over door wall or ceiling-mounted indicator lights with colour coded lamps to indicate type and status of call
- Tones and chimes sounding differently for each of the call types
- Pocket pager high level interface to pocket pager system
- Interface to the Centre's VoIP Wi-Fi handsets and equipment to provide a VoIP over IEEE 802.11b
- Three levels of calls:
  - Nurse call (patient to staff)
  - Staff assist (staff to staff)
  - Emergency call (cardiac arrest – staff to crash team)
- Monitor based annunciation screens showing indication of all calls at any one time displaying the room, bed number and priorities at each staff base for each ward or functional department,

and supplementary annunciator monitor screens positioned at all major intersections in that ward. These shall be positioned so that they are clearly visible within all corridors in that inpatient unit and/or department. (The scrolling alpha numeric annunciation panels will not be acceptable).

- Facility to program at the main staff base/work room control staff allocation to each bed, on a shift by shift basis, using mouse driven controls. This facility must be password protected to enable only designated staff to carry out the staff reallocations.
- Facility to program swing beds, and various bed configurations suitable for different team care configurations
- Facility for review of response times, and other relevant history, and interface to enable printing at nearest network printer
- System to be complete with UPS for 30 minute back up under normal traffic
- High level interface with the proposed Wi-Fi telephone system
- Interface and coordination with MATV system on handsets to include channel switching, speaker volume, jack for independent headset supplied by patient and on/off facility
- Interface with over-bed light on handset to operate low voltage (24 volt) relays controlling over-bed light
- Facility for software to be able to be loaded if desired onto hospital PCs so that PCs at staff bases may double as IT system PCs and as nurse call annunciators/control panels

6.3.1.1. Operation

The operation of the equipment shall be such that the pressing of any wall call station, bedside pendant pushbutton, entertainment, handset, or other system call device shall:

- Illuminate the local over door dome light, all annunciator monitor screens for each inpatient unit and/or department
- Initiate the electronic buzzers in supplementary locations and within the annunciator monitor screens
- Call the WiFi phones of the staff member(s) assigned to that bed or area (nurse call system calls that have been answered shall automatically be deleted from the pagers.)
- If the call is not cancelled or responded to within a prescribed (adjustable) time, call the pocket pager of the buddy of the staff member assigned to that bed or area
- A further lack of response will cause a further escalation of the call to an agreed procedure to be defined in the design development stage
- Upon release of the push button by the operator, the nurse call buzzers shall stop sounding but all the signal lights will remain "ON" until the nurse attends to the operator and cancels the

signal by the pressing of a cancellation device on the push button which originally made the signal

6.3.2. Central Equipment

The central equipment shall be located within the data/communications room (for that area) on each floor. The system shall be micro processor controlled.

Should the mains power fail, or a fault occur, the system shall operate, as a minimum, in a fail safe mode such that no calls are lost and that the system continues to operate as a basic hard-wired system i.e. annunciator lights, buzzers to operate.

The power supply shall be sized to suit the total current drain of the specified system and lightning protected. The system shall be supported by a UPS which is connected to the standby generators. Nurse call equipment shall be located in the local Floor Distributor room and therefore will obtain its UPS supply from the Floor Distributor central UPS supply.

The central equipment shall perform and comprise the following minimum functions:

- A main user monitor screen shall provide access to display, user set up, analysis and reporting and installation screens
- The main user monitor screen shall operate in real time to display calls in order of priority by call level, location, resident's/bed name, call initiated and attended times, and number of call repeats. It shall be able to show, at any one time, all calls related to that inpatient unit or department
- The user set up screen will allow specified staff to enter/change data within the system. This section will have various levels of password protection. It shall not be possible to alter staffing allocations at slave annunciators
- The analysis and reporting screen will allow specified staff to access reports and analysis of the facility in a variety of ways (e.g. By call type, room shift time, area etc). This section will have various levels of password protection
- The paging screen allows staff to send paging messages direct to individual pagers or groups of pagers which form part of the nurse call system
- All information shall be stored and logged, and able to be retrieved and copied to floppy disk or printed out as required. The software shall have the ability to print to the network or local printer. The logged data shall be able to be accessible (via password protection) from the Lifehouse IT network
- Central logging will be stored on a server located in the Data Centre. The server will be accessed from any PC by authorised personnel via a software client

The central equipment shall be provided with facility to be interrogated for maintenance and faultfinding purposes and software upgrade purposes from outside the site, via modem connection incorporated into the equipment. This connection would normally be enabled from either the nurse base control panel, or from the manufacturers. Secure access is to be utilised at both "ends".

6.3.3. Over Door Indicators

The over door indicators shall be constructed of an unbreakable heat resistant translucent material.

The lens shall be pyramid shaped dome or the "cherry" sized domes on a conventional flush plate, and shall provide clear indication when viewed from oblique angles.

The indicator lamps shall be LED type, colour coded to the requirements of AS3811, with flashing or still modes as designated in AS3811.

6.3.4. Call Points and Handsets

Patient (Nurse) Call – Green button plus cancel button
Staff Assist – Yellow buttons plus cancel button
Emergency Call – Red button plus cancel button

All call points and handsets must be able to be cleaned, ideally via dipping in antiseptic solution to maintain conformity with infection control guidelines. Call points shall respond to a pressure of approximately 50gm to 80gm, with a maximum of 100gm force being required to initiate a call. The pressure required shall be the same across the suite of call points, irrespective of whether they are pear shape push, wall mounted, or weatherproof type. Call points shall respond with a positive "click" to assist in providing user reassurance.

Provision shall be included for patients with limited or zero mobility (eg spinal patients) to be able to activate a nurse call by alternative means to the above described handset.

Typical bedroom nurse call arrangement shall comprise:

- Bed head pendant push call point, or combined entertainment services handset, with interface to over-bed light and TV controls and radio installation. Because of the installation of Foxtel, the integration of TV and Foxtel controls may not be possible with the bedside entertainment handset. Therefore an alternative will be provided using the Foxtel control handset
- Staff assist button (positioned as agreed during the user group process)
- Emergency call point at entry/beside bed as ultimately briefed
- Reassurance light
- Cancel point

- Toilet, ensuite and bathroom points (all wet areas) rated at IP65 to AS1939
- Over door light outside the bedroom

All calls shall only be cancelled from the point of origin.

Call points must alarm if handset/pendant push etc is removed from socket (with password protected over-ride & mute at nurse base).

Call stations in wet areas shall be waterproof type with in-built reassurance light and cancel facility. Call points must be IP65 rated, and must not rely on externally applied silicon sealing around the plates (water can run down the inside of the wall from ingress at another point). All wet area call points shall be installed in the NSW Health standard mounting positions.

Call handsets (combined services or pendant push), shall be connected via cable to the wall plate via a robust connection which is stiff to push on, but which will release when subjected to sustained pressure (e.g. if cord is caught in the bed's wheels). RJ-type connectors are not acceptable. (The use of dippable handsets is preferred to handsets which require plastic sleeves to maintain infection control regimes, as this consumable is an expensive recurrent cost).

6.3.5. Consolidation Points/Room Controllers

Room controllers shall be located in the local Floor Distributor room.

6.3.6. TV Screen Based Annunciator Screens

For each Inpatient Unit and/or department provide LED annunciator panels. These shall have colour graphics / numerals.

The screen based monitor shall show, at any one time, all calls related to that inpatient unit or department.

All nurse calls, staff assist calls and emergency calls shall be shown at a single time so that the staff can see at a single glance the total number of calls current as well as the number in each level of call (e.g. nurse calls, staff assist calls and emergency calls).

Annunciator screens shall be visible up to 30 metres from the screen and better than 80 degrees viewing angle from the face of the screen. There shall be a minimum of two annunciator screens per inpatient unit.

Tones shall be sounded in accordance with AS 3811 with "flashing" and/or "steady" characters to demonstrate status (e.g. emergency call).

6.3.7. Sounders

Sounders shall be of the chime, tone or buzzer type providing a different tone for each of the call types, and shall comply with AS3811. Sound level to be at least 65dBA at 1 metre, and at least 15dBA above ambient level within 1 metre.

Sounders shall be of the adjustable for volume, pitch and frequency, controlled from the central equipment in the local floor distributor room. Tones to be able to be programmed to be muted or diminished in volume for quiet periods or at night. It shall be possible to adjust the volume of each tone individually.

Supplementary buzzers/sounders with independent volume control shall be provided in noisy environments e.g. in dirty utility rooms.

6.3.8. System Wiring

All wiring shall be carried out using 4 pair Cat 6 UTP cabling as a minimum and in accordance with the manufacturer's requirements. Cabling shall be segregated from all other power and communications cabling, and run on dedicated catenaries.

6.4. Wi-Fi Telephone Handsets

The infrastructure will be provided for a Wi-Fi telephone handset system/network to run over the Wireless LAN.

All active equipment associated with this will be provided by Lifehouse which will also include the provision of all Wi-Fi handsets.

When installed by Lifehouse the Wi-Fi handsets will be able to be used for:

- Make and receive external telephone calls
- Make and receive internal telephone calls
- Provide a mobile duress alarm system
- Be integrated with the nurse call system to allow the staff member to receive a nurse call, staff assist call and also acknowledge the call by talking to the patient (who has instigated a nurse call)
- Provide the Centre with the building wide paging system
- Interface with the BMS system
- Interface with the Fire Alarm system

- Interface with the Security system

6.5. Paging System

A paging system will use a non-intrusive method of rapidly summoning key and emergency staff in all areas of the hospital and its grounds. This shall be carried out using the Wi-Fi telephone handsets.

The system will provide coverage within the hospital and hospital grounds. An interface to the voice server system and Nurse Call System will be incorporated as well as alarm inputs from the building management system.

The paging system will include:

- Wireless base stations installed as part of the wireless LAN
- Nurse Call interface
- BMS Interface
- Fire System Interface

The paging system will be incorporated into the Wi-Fi network and will be transmitted over the LAN and wireless LAN.

6.6. MATV System

The extent of MATV services and the type of TV presentation (with the conventional flat screen TV or the new Patient Entertainment Terminal) still requires agreement with Lifehouse and the TV service provider. It is envisaged that the following system capability may be provided, noting that digital free to air TV channels will replace analogue services in 2010.

An IP-based TV system will provide the following services:

- Free to Air TV Channels (digital)
- Pay TV (minimum of 10 channels)
- Hospital DVD content (e.g. Educational/informational videos)
- AM, FM Analogue and Digital Radio
- Stored Audio Content (music, audio books etc)

A video/audio content management system will control delivery of continuously streamed and on demand media, and will provide billing information for integration with other hospital administration systems.

Pay TV will be received via satellite of fixed cable, whilst Free to Air analogue and digital radio and TV will be received via roof top aerials.

Patients will have access to the radio system and in-house educational TV programs irrespective of whether they select to receive television.

General waiting areas will be provided with a centrally located TV which would be controlled from the local reception/staff station. TV loudspeakers shall operate in these locations.

MATV hardware will be located in the local Floor Distributor Room and local cabling shall be distributed from this room. MATV hardware shall be equipment rack mounted.

The complete system will be installed to comply with AS/NZS 1367.

The MATV system is not required to be connected to the emergency power system.

6.7. Audio Visual and Videoconferencing

Audio Visual and Videoconferencing systems will be provided by others.

6.8. Information Kiosks

Information Kiosks will be provided in the inpatients and outpatients lobbies and other selected areas, to provide:

- Directional information including from/to directions
- Telephone directory
- Time synchronised to the Master Clock System
- Weather information
- Services information (café, gift shop)
- IP TV

Information Kiosks will be relocatable free-standing units with robust touch screen displays that connect back to a central configuration server via the Hospital's Wireless LAN.

Information Kiosks will be multi-lingual supporting six of the most commonly read languages in the vicinity.

6.9. Provision for Future Redundancy and Capacity

Redundancy will be designed into each ICT system to meet the required level of operational availability.

The Structured Cabling System will use diverse redundant paths for all backbone connections, with single feeds limited to the final horizontal runs feeding individual telecommunication outlets.

6.10. Data Centre

A data centre will be provided to accommodate server equipment including, administrative, medical and associated servers for the security and building services.

The data centre will generally meet TIA/EIA 942 and comply with a Tier 2 construction and AS3084 requirements except for the steel framed building construction component (this building construction is reinforced concrete and not covered by the standard).

The data centre will comprise the following:

- Data Server/Computer Room
- Support areas for workstations etc
- Storage and circulation.

7. Hydraulics

7.1. Scope

The hydraulic services design for this project comprises the following systems:

- New connections to Sydney Water water main.
- New connections to Sydney Water sewer main in Susan Street.
- New Authority Gas connection in Susan Street.
- Sanitary plumbing and sewer drainage, including subsoil drainage.
- Trade Waste plumbing and drainage.
- Roof drainage.
- Rainwater collection and treatment for the use of non-potable water service.
- Rainwater re-use for Sanitary Flushing systems, Cooling towers, and waste holding room wash down.
- Non Potable Water Service (NPCW).
- Domestic Cold, Warm and Hot Water Services.
- Reverse Osmosis Water.
- Incoming water supply service for Fire Sprinkler service.
- Natural Gas Services.
- Sanitary Fixtures and associated equipment.
- Taps and Water outlets.

7.2. Standards and standards

7.2.1. General standards

- AS1170 Earth Quake Code.
- AS3500 – National Plumbing Code all parts.
- AS5601- Australian Gas Installation Code.
- NSW Code of Practice (Plumbing and Drainage).
- Building Code of Australia 2010.
- Safety and occupational health: The requirements of the New South Wales Work Cover Authority and New South Wales Occupational Health and Safety Act.
- Sydney Water requirements and Trade Waste Guidelines.
- The NSW Health Engineering Services Guidelines - TS11 2007.

- NSW Fire Brigade.

7.3. Services to be provided

7.3.1. Sewer

The sanitary drainage pipe work shall connect to the Sydney Water sewer main located in Susan Street on the western side of the development. Two sewer connections on opposing sides of Susan Street are envisaged to accommodate the new development.

7.3.2. Sanitary plumbing and Drainage

Where gravity drainage is possible it will be utilised for sanitary drainage and pre-treated trade waste drainage. The sanitary plumbing and drainage system will be constructed of durable material with proprietary fittings and a material suited for purpose.

Where sanitary fixtures are located below the level of gravity sewer drainage, a sewage pump out system will be installed.

For all above ground areas, there will be soil and vent stacks located at various locations, to allow where practical, all parts of the usable floor area to be within a 15m range from the point of connection.

Stack vents are to be interconnected to terminate above the roof at a single point of discharge. The vent is to be located as far as practically possible from any air intakes or building openings, and in accordance with AS3500 and AS1668.2.

Sanitary stacks will be accessible and the access will be from a non-patient non-medication area such as a corridor or similar utility area.

All synthetic pipe penetrations through fire rated walls and floors will maintain the integrity of the building fabric by means of approved fire collars.

Where plumbing pipes are located in area which may be considered noise sensitive, the soil and waste pipes will be acoustic treated to comply with BCA minimum noise levels and or acoustic engineers report.

It will not be permitted to allow horizontal pipe work within the following rooms:

- Operating theatres.
- Substations.
- Comms rooms.

- UPS rooms.
- Switch room.
- Generator room.
- Magnetic imaging systems.
- Waste pipes above potable water storage tanks.

Materials will comply to Australian Standards and will, where required, be compliant with and approved by MP52 as approved for use by Sydney Water. PVC pipe work within the building is considered a toxic fume hazard and contrary with the environmental requirement of this building.

7.3.3. Trade Waste plumbing and Drainage

Fixtures and equipment that generate non domestic waste are considered Trade Waste discharges. Typically wastes being grease and/or high temperature discharges will be treated on site to the requirements of Sydney Water Corporation before discharging to the Authority Sewer.

No radioactive waste from nuclear medicine treatment is currently envisaged for the development.

No Chemical waste from Laboratory is currently envisaged for the development.

Materials will comply with Australian Standards and will where required be compliant with and approved by MP52 as approved for use by Sydney Water. Trade waste pipe work will be selected based on its resistance to the effluent it is collecting.

7.3.4. Rainwater Collection from Roof catchment

The minimum design criteria for any roof collection calculation will be as followed:

- 1:100 year 5-minute duration storm event for box gutters.
- 1:20 year 5 minute duration storm event for all eaves gutters.

The installation of a siphonic rainwater system will be considered to limit the pipe sizes, number of downpipes, and to increase horizontal distances in the ceiling.

Rainwater down pipes will be located in the central services risers and will connect to the rainwater harvest tank adjacent to the onsite storm water detention (OSD) tank.

Remote downpipe serving balconies will connect directly to the OSD.

The requirement for OSD will be determined by the Civil Engineer.

7.3.5. Harvested Rainwater

Rainwater from the roof will be collected, stored, treated and re-used for sanitary flushing and cooling tower make up supply. Harvested water will be filtered and dosed before used within the building.

Refined Potable water make-up will be substituted in the event of low storage or pump failure and will be connected downstream of the pump system.

A dedicated non-potable storage tank will be provided to service the Essential Air Conditioning cooling tower. The size of the tank will be calculated based on the reduced load sheeded cooling tower water usage.

The overflow of the tanks will be connected to the storm water system provided by the civil contractor.

7.4. Water Services

7.4.1. Cold Water Service Design

The Building domestic cold water supply will be fed from a new connection to the Sydney Water mains reticulation supply in Salisbury Street (subject to Sydney Water approval). A Sydney Water approved meter assembly dedicated for this development will be provided that includes a high hazard backflow prevention device.

A second dedicated new incoming water connection to Sydney Water main will supply the fire services.

7.4.2. Water Storage

It is considered that a storage tank capacity of 4 hours, excluding cooling tower make-up to be suitable for the potable water reserve. Additional storage tanks will be provided to service the non-potable water and the cistern flushing demands.

All tanks will be complete with a divisional wall with dedicated inlets and outlets to allow continued operation during tank cleaning and maintenance.

The hot and cold water potable services will be supplied from the potable water storage tank. Sanitary flushing devices are considered to be reticulated from the rainwater re-use storage tank.

7.4.3. Water Service Reticulation

Individual water services to fixtures and laboratory appliances will be fitted with WELLS Rated tap ware. All water services will reticulate from a central hydraulics riser that will contain the hot and cold water, non-potable water and flushing water.

Water supplies will originate on each floor at the main hydraulic vertical riser shaft. Isolation valves will be provided to isolate wings or departments during periods of shut down or refurbishment.

Reticulation of all water services will be in a common path within the ceiling space.

Fixtures and equipment that may present a source of contamination will be fitted with zone and local backflow prevention device suitable for the hazard rating of the procedure in compliance with AS/NZS 3500 and local Water Authority.

7.4.4. Hot Water Service Design

The domestic hot water will be generated by a centralised hot water plant. Solar pre-heat or waste heat from Co Generation plant will be considered. Hot water distribution will reticulate at 65^{o}C and will utilise a flow and return circulated system to reduce the temperature drop.

Hot water will be supplied to ablution fixtures through temperature control valves or a warm water centralised system which will provide a tepid water supply at approximately 43.5^{o}C at the fixture. In the case of the former they will be located at load points servicing up to four fixtures subject to flow rates.

Reticulation of all hot water services will be in a common path within the ceiling space.

The system reticulation design will minimise dead leg branch services to reduce water and energy waste.

Individual water services to fixtures and laboratory appliances will be fitted with WELLS Rated tap ware.

7.4.5. Domestic Warm Water

Warm water for domestic ablution use will be generated by an approved method comprising one of the following:

- A central system with Thermostatic mixer valves and circulation through an Ultra Violet light radiated dry lamp system. Warm water will be circulated by a pumping unit to maintain the

warm water temperature within the mandatory tolerances (or less than) of the NSW Health memorandum directing the maximum acceptable temperature loss.

- Local Thermostatic Mixing valves of approved design to individual fixture points or single person use basin and shower combinations.

The system reticulation design will minimise dead leg branch services to reduce water and energy waste.

7.4.6. Reverse Osmosis Water (RO)

Where required the supply and installation of ultra pure water plant and reticulation will be a feature of the internal supply system serving specialised locations in wards for recovery and pharmacy. The ultra pure water system will comprise pre filtration, reverse osmosis membrane filtration ultra violet sterilisation and daily high temperature reticulation pipe work sterilisation.

RO Water reticulation will be a ring main system located at high level on the same floor dropping to each user point.

The pipe system will be an approved Polyethylene (PEX) system; no other than grade 316 stainless steel components will be in contact with the RO water.

7.5. Natural Gas Services

The Natural Gas service will be extended from the existing Authority gas main located in Susan Street as required to service the Mechanical services boilers or Co-generation plant (if required), Kitchen equipment and any other fixture or fitting requiring natural gas.

Natural Gas will be supplied to mechanical boilers in the plant room on Level 4. Thermal demand for Domestic hot water consumption will be satisfied by primary heating from the Mechanical Services system.

Gas safety switch shut-off valves will be provided to all gas equipment when not provided with flame failure devices.

Materials will comply with the AS 5601 and to the requirements of the Gas Supply Authority.

7.6. Certification

The design will be certified in accordance with the conditions of contract and Preliminaries:

- AS3500.1 -4 National Plumbing Code all parts;
- AS 5601 Australian Gas Installation Code;

- NSW Code of Practice (Plumbing and Drainage);
- NSW Health Engineering Services and Sustainable Development Guidelines – TS11 2007.
- Building Code of Australia - 2010 Safety and occupational health: The requirements of the New South Wales Work Cover Authority and New South Wales Occupational Health and Safety Act;
- The NSW Health Engineering Services Guidelines TS11 2007;
- NSW Fire brigades.

8. Fire Services

8.1. Scope

The fire services design for this project comprises the following systems:

- Combined fire sprinkler / fire hydrant system.
- Fire hose reel system.
- Fire Control Centre.
- Smoke detection system.
- Sound System and Intercom System for Emergency Purposes.
- Portable Fire Extinguishers.
- Passive Fire Protection.

8.2. Combined Fire Sprinkler / Fire Hydrant System

A combined fire sprinkler / fire hydrant system will be installed throughout the building to BCA 2010 Part E1.3, E1.5, AS 2118.1 - 1999, AS 2419.1 - 2005 and AS 2118.6 - 1995 requirements. The system will incorporate the following:

- A Grade 1 water supply consisting of two separate water sources.
- A NSWFB booster assembly will be located at Ground Level adjacent to the Fire Control Centre and facing Salisbury Road.
- Fire hydrant pipework will be located within fire stairs with hydrant landing valves at each stair landing. Additional fire hydrants may be located elsewhere within the building to provide additional coverage if required.
- A sprinkler control valve assembly located in the fire stairs at each level.

8.3. Fire Hose Reel System

A fire hose reel system will be installed throughout the building to BCA 2010 Part E1.4 and AS 2441 - 2005 requirements. Fire hose reels will be located in cupboards within 4.0 m of the building exits. Additional fire hose reels may be located elsewhere within the building to provide additional coverage if required.

8.4. Fire Control Centre

A Fire Control Centre complying with BCA 2010 Specification E1.8 shall be located at Ground Floor Level. The room shall contain the Fire Indicator Panel, Video Smoke Detection Event Management Server and Remote Monitoring Station, Fire Fan Control Panel and Master Emergency Control Panel.

8.5. Smoke Detection System

A smoke detection system will be installed throughout the building (with the exception of the atrium void) to BCA 2010 Part E2.2, AS 1670.1 - 2004 and AS 1668.1 - 1998 requirements.

Video Smoke Detection (VSD) complying with NFPA 72 is proposed to protect the atrium void as conventional smoke detectors are unsuitable for such a space. The VSD utilises CCTV cameras to detect smoke or flame at the atrium floor level and initiate an alarm through the FIP. Although not compliant with the Australian Standard the VSD system will be subject to approval by the Fire Engineer, Building Certifier and the NSWFB.

8.6. Sound System and Intercom System for Emergency Purposes

A new Sound System and Intercom System for Emergency Purposes (previously called an EWIS) will be installed throughout building to BCA 2010 Part E4.9 and AS 1670.4 – 2004 requirements. The system will incorporate the following:

- A Master Emergency Control Panel (MECP) located in the Fire Control Centre on the Ground Floor.
- Cone type speakers located within ceilings, horn speakers within car parks & exposed areas, and strobe type visual indicators where required.

8.7. Portable Fire Extinguishers

New portable fire extinguishers will be selected and located throughout the building to BCA 2010 Part E1.6, E1.10 and AS 2441 – 2001 requirements.

8.8. Passive Fire Protection

All fire services passing through any walls, floors and ceilings required to have a Fire Resistance Level (FRL) rating will be sealed with approved passive fire protection systems to satisfy Part C3.15 and Specification C3.15 of the Building Code of Australia, having material complying with AS1530.4 & installed to AS 4072.1 and manufacturer's requirements.

8.9. Fire Safety Management, Disaster & Evacuation plan (Displan)

Lifehouse will develop an emergency management plan based on AS 3745 - 2002 and AS 4083 - 1997. The EWIS system operation will be incorporated into the emergency management plan requirements.

9. Lift Services

9.1. General

The proposed vertical transport is based on:

Dedicated Bed / Patient Lifts – One group of four (4) lifts shared with staff is proposed.

Public Lifts – One group of three (3) lifts is proposed.

Specimen Hoist – One(1) hoist is proposed.

Sterile Hoist – One (1) hoist is proposed.

Used Hoist – One (1) hoist is proposed.

Staff/Patient Lift – One (1) is proposed at Radiation Oncology (Building No. 27)

All of the elevators shall comply with the Australian Lift Code AS1735.

9.2. Vertical Transportation

This section deals with vertical transportation services in the Lifehouse development.

9.2.1. Bed / Patient Lifts

It is proposed to install four bed / patient lifts to transport patients and staff to specific areas in Lifehouse.

A general description of the lift installation is as follows:

Number of Lifts	-	Four (4)
Type of Lift	-	Bed / patient.
Drive System	-	Geared variable frequency AC.
Control System	-	Microprocessor demand response.
Rate Load (kg/person)	-	2500kg / 33 person (nominal)
Rate Speed (m/s)	-	1.6 (nominal)
Levels served:	-	B3 to 07 (Stage B1 to 09)

Approx. travel (m)	-	52
Machine room location	-	N/A
Number of car entrances	-	One
Clear entrances size (m)	-	1.6 W x 2.1 H (door system 4 panel centre opening power operated)
Car size	-	1.95W x 2.65D x 2.4H clear, (nominal)
Car operating panel	-	Two (2) one located on the front wall and one located on the side wall complying with AS 1735 Part 12.
Communication	-	Emergency self dialling telephone connected to 24 hour manned Hospital central monitoring station.
Doorway protection	-	Three dimensional infra-red beams. Beams are not to be activated by ambient light.
Landing button	-	Illuminating call recorded buttons from Lift Sub-contractor's standard range. The height and type of buttons shall comply with AS 1735 Part 12.
Car door finishes	-	Satin finish, stainless steel.
Landing finishes	-	Satin finish, stainless steel.
Car Interior Finishes	-	PC Sum
Fireman's service	-	Lift to have key switch operation and recall key switch in the landing button unit on Ground Floor.
Priority Service	-	Provide card key access control to landing button units and lift cars.

The completed lift installation shall be designed and installed in accordance with the following Regulations:

- AS1735 – Part 1 Lift Code.
- Building Code of Australia (BCA).

9.2.2. Public Lifts

It is proposed to install one group of three lifts in this area for the purpose of transporting the public to all levels in Lifehouse.

A general description of the lift installation is as follows:

Number of Lifts	-	One group of three lifts operating independently of each other.
Type of Lift	-	Machineroomless passenger.
Drive System	-	Variable frequency AC.
Control System	-	Microprocessor demand response.
Rate Load (kg/person)	-	1350/18 (nominal).
Rate Speed (m/s)	-	1.6 (nominal)
Levels served:	-	B3 to 07 (Stage B1 to 09).
Machine room location	-	Not required.
Number of car entrances	-	One
Clear entrances size (m)	-	1.2 W x 2.10 H (door system 2 panel centre opening power operated)
Car operating panel	-	Two (2) one located on the front wall and one located on the side wall complying with AS 1735 Part 12.
Communication	-	Emergency self dialling telephone connected to 24 hour manned Hospital central monitoring station.
Doorway protection	-	Three dimensional infra-red beams. Beams are not to be activated by ambient light.
Landing button	-	Illuminating call recorded buttons from Lift Sub-contractor's standard range. The height and type of buttons shall comply with AS 1735 Part 12.
Car door finishes	-	Glass with satin finished, stainless steel fixtures.

Landing finishes	-	Glass with satin finished, stainless steel fixtures.
Car Interior Finishes	-	To be selected.
Fireman's service	-	Lifts to have key switch operation and recall key switch in the landing button unit on the Ground floor.

The completed lift installation shall be designed and installed in accordance with the following Regulations:

- AS1735 – Part 1 Lift Code.
- AS1735 – Part 12 Lift Code – Facilities for Persons with Disabilities.
- Building Code of Australia (BCA).

9.2.3. Radiation Oncology Patient / Staff Lifts

It is proposed to install one new lift in this area to serve Level B1 to Level 1.

A general description of the lift installation is as follows:

Number of Lifts	-	One lift
Type of Lift	-	Bed Passenger
Drive System	-	Variable frequency AC.
Control System	-	Microprocessor demand response.
Rate Load (kg/person)	-	2500kg / 33 person (nominal)
Rate Speed (m/s)	-	1.0 (nominal)
Levels served:	-	B3 to 01
Machine room location	-	Not Applicable
Number of car entrances	-	One
Clear entrances size (m)	-	1.6 W x 2.1 H (door system 4 panel centre opening power operated)
Car operating panel	-	Two (2) one located on the front wall and one located on the side wall complying with AS 1735 Part 12.

Communication	-	Emergency self dialling telephone connected to 24 hour manned Hospital central monitoring station.
Doorway protection	-	Three dimensional infra-red beams. Beams are not to be activated by ambient light.
Landing button	-	Illuminating call recorded buttons from Lift Sub-contractor's standard range. The height and type of buttons shall comply with AS 1735 Part 12.
Car door finishes	-	Satin finished, stainless steel.
Landing finishes	-	Satin finished, stainless steel.
Car Interior Finishes	-	To be selected.
Fireman's service	-	Lifts to have key switch operation and recall key switch in the landing button unit on the Ground floor.
Priority Service	-	Priority service access key control to be in the landing button units and the lift cars for the three bed passenger lifts.

The completed lift installation shall be designed and installed in accordance with the following Regulations:

- AS1735 – Part 1 Lift Code.
- Building Code of Australia (BCA).

9.2.4. Specimen Hoist

Number of Lifts	-	One
Type of Lift	-	Service Hoist
Drive System	-	Traction
Control System	-	Call and Send
Rate Load (kg)	-	100
Rate Speed (m/s)	-	0.25

Levels served:	-	01-03
Machine room location	-	N/A
Number of car entrances	-	One
Clear entrances size (m)	-	1.0W x 1.2 H
Car operating panel	-	N/A
Communication	-	N/A
Doorway protection	-	N/A
Landing button	-	Call and send
Car door finishes	-	Stainless Steel
Landing finishes	-	Stainless steel
Car Interior Finishes	-	Stainless steel
Fireman's service	-	N/A
Priority Service	-	N/A

9.2.5. Sterile and Used Hoist

Number of Lifts	-	Two (2)
Type of Lift	-	Hoist
Drive System	-	Traction
Control System	-	Call and send
Rate Load (kg)	-	200
Rate Speed (m/s)	-	0.25
Levels served:	-	03-04
Machine room location	-	N/A

Number of car entrances	-	One
Clear entrances size (m)	-	1.2W x 1.2H
Car operating panel	-	N/A
Communication	-	N/A
Doorway protection	-	N/A
Landing button	-	Call and send
Car door finishes	-	Stainless steel
Landing finishes	-	Stainless steel
Car Interior Finishes	-	Stainless steel
Fireman's service	-	N/A
Priority Service	-	N/A

10. Security Systems

10.1. Introduction

This report has been prepared to discuss the conceptual recommendations, systems and components that enhance the security operations and comprise the proposed security management system for Lifehouse.

The overall objective of the security strategy for the Lifehouse is to create and maintain a welcoming environment for all patients, staff, and visitors within the facility while protecting critical assets. As well as robust security operating policies and procedures, a mix of electronic and physical security measures have been employed in view of achieving the overall security objective.

The planning and layout of the site and building will contribute significantly in providing a physically secure facility and surrounding area. Factors such as site perimeter protection, lighting, entry and exit points, pedestrian traffic patterns and flows, locking hardware, and the location of staff stations, reception points, visitor services and loading docks will all assist to provide layers of security for the building perimeter.

10.2. Standards and Guidelines

The security systems design for the new Lifehouse development shall comply wherever possible with the following standards and guidelines:

- AS/NZS 2201 Intruder Alarm Systems
- AS/NZS 4806 Closed Circuit Television (CCTV)
- AS/NZS 4485 Security for Health Care Facilities
- AS/NZS HB3 Drawing Standards
- AS/NZS 1049 Telecommunication Cable – Insulation and Sheath - Polyethylene
- AS/NZS 1099 Tests for Electronic Equipment
- AS/NZS 1100 Technical Drawings
- AS/NZS 1101 Graphical Symbols for General Engineering
- AS/NZS 1102 Graphical Symbols for Electrotechnology
- AS/NZS 1104 Informative Symbols for use on Electrical and Electronic Equipment
- AS/NZS 1345 Identification of the Contents of Pipes, Conduits and Ducts
- AS/NZS 1768 Lightning Protection
- AS/NZS 1882 Earth and Bonding Clamps
- AS/NZS 2052 Metallic Conduits and Fittings

- AS/NZS 2053 Non Metallic conduits and Fittings
- AS/NZS 2279 Disturbances in Mains Supply Networks
- AS/NZS 2546 Printed Circuit Boards
- AS/NZS 3000 S.A.A. Wiring Rules
- AS/NZS 3901 Quality Assurance Standards
- AS/NZS 3905.2 Quality Systems Guidelines
- AS/NZS 4251.1 Electromagnetic Compatibility – Generic Emission Standards
- AS/ACIF S008:2006 Requirements for Customer Cabling Products
- AS/ACIF S009:2006 Installation Requirements for Customer Cabling (Wiring Rules)
- HB228:2001 Guidelines for Managing Risks in the Healthcare Sector
- IEC 297 Dimensions of Mechanical Structures of the 482.6 mm (19) series.
- ISO 9001 Quality Systems Guidelines
- ISO 9003 Quality Systems
- NSW Health: Engineering Services and Sustainability Development Guidelines, Technical Services TS11 dated December 2007
- Protecting People & Property: NSW Health Policy & Guidelines for Security Risk Management in Health Facilities dated December 2003
- Australasian Health Facility Guidelines dated May 2009.

10.3. Design Philosophy

The Lifehouse security systems will have the ability to be monitored from the Security Control Room (located on the Ground Floor, adjacent to the Main Entrance and Patient Services area).

10.4. Scope of Work

The scope of work shall comprise the supply, installation, programming, interfacing, testing and commissioning of the various systems, as specified, that form the project works. This shall include, but is not limited to: -

- Electronic Access Control System
- Intrusion detection system
- Fixed duress system
- Video Intercom System
- Closed Circuit Television System
- Equipment cabinets and racks

- Programming and systems engineering
- Termination panels
- Security services cabling for ACID equipment and power supplies for cameras
- Lightning protection of security services equipment (including earth bonding)
- Making good
- Documentation
- Training
- Defects liability
- Testing and commissioning
- Participation in acceptance testing and commissioning.

10.4.1. Electronic Access Control System (EACS)

A new electronic access control system (EACS) shall be provided to accommodate the movement of authorised staff through staff only areas while preventing access to unauthorised people. This shall be achieved by providing proximity based card readers at designated locations including staff entry and after-hours access points to allow access control to authorised personnel only.

Electronic keypads or keypad/card readers will be provided as a secondary security measure for selected high security areas (e.g. Drug Stores, Pharmacy, etc).

Access card credentials (PIN number/employee ID number/card ID number) will be provided for all authorised staff members using proximity card technology. The access card will also have the ability to be used as a Photo ID badge, with colour coded finished for individual departments and staff types.

The design intention is for Lifehouse EACS and access cards to be compatible with the existing RPA EACS.

Lift access to staff only areas will be controlled via card readers in both interior doors and the lift cars. This shall be coordinated with the Lift Services Design.

Vehicle access to the basement car park will be controlled by the EACS.

EAC shall be provided to secure plant rooms, electrical switchrooms and communications rooms in keeping with their criticality to the ongoing operation of the site.

The EACS shall restrict general use of the fire stairs and access to roof areas.

Controlled access to restricted medical, administration and services areas, as well as security sensitive areas such as Pharmacies, Research Areas and Plasma Banks will be achieved through the use of card readers and electronic keypads as required.

10.4.2. Intrusion Detection System (IDS)

An Intrusion Detection System comprising alarm input devices such as reed switches, infrared motion detectors and the like will be provided in the building. This will allow the monitoring of these locations to detect unauthorised intrusions and allow an appropriate response to be coordinated from the Security Services department.

Alarm points will be provided to all EACS doors and other nominated doors on the perimeter of the building.

Motion detection devices (Passive Infra Red Detectors, both directional and 360 degree) shall be provided for nominated high-risk areas at the site, including the Pharmacy and other nominated Drug Store areas.

10.4.3. Closed Circuit Television (CCTV) System

An IP CCTV system is proposed for Lifehouse to provide video surveillance monitoring of key areas around the site. The CCTV system shall include Fixed IP cameras, Pan, tilt and zoom (PTZ) IP cameras, Network Video Storage and have the ability to use Video Analytics.

The CCTV system shall have the ability to interface with the EACS, IDS and Video Intercom System for event/alarm recording.

The provision of CCTV cameras shall include, but not be limited to providing surveillance of the following areas:

- High frequency public corridors
- Pedestrian concourses
- Stair cases
- Floor lift lobbies
- Waiting rooms
- Vehicle Entry points
- Building Entry points
- Main Reception areas
- After hours external access points
- Vending/Ticketing machines

- Car park areas
- Loading Dock
- Main pedestrian access thoroughfares
- Restricted staff only entrances

The CCTV system shall be monitored at the Security Control Room and have storage capacity for 28 days of video footage for all site cameras.

10.4.4. Video Intercom System

A new Video Intercom system shall be provided to allow visitors to access staff only areas or to allow after-hours access.

The system will include vandal-proof, weather resistant field video intercom stations for visitors/assistance and after-hours access. Designated Master Stations will be provided at Staff Reception Points/Security Control Room for call answering with call escalation ability.

The video intercom system shall control access to the departments – where video intercom stations at entry points to departments will allow staff to identify visitors/patients prior to admitting entry.

Door intercom stations will be provided at all after-hours entry points where authorised visitors/staff/contractors may require access.

Access to the basement car park after hours will be achieved with video intercom access to allow security personnel to identify legitimate visitors.

10.4.5. Duress Alarm System

A fixed duress alarm system will be provided for all nominated staff areas as per TS11 requirements.

For internal areas where staff are considered at risk (selected Reception Areas, Staff Stations, Patient Wards, etc) a wireless duress system shall be provided. This shall be inclusive of hand-held wireless devices with a duress button using the new WiFi network being provided by the ICT services as part of this scope. Lifehouse at RPA shall be responsible for providing the WiFi phones allowing dual communication mediums for the wireless duress alarm system (to provide RFD location tracking of staff members).

For internal areas (Pharmacies, Staff Stations, etc) and external areas (Car parks, etc) at the site where staff are considered at risk, a hard wired duress alarm system shall be provided.

10.4.6. Security Lighting

Security lighting shall be provided to deter undesirable behaviour at key locations and improve effectiveness of natural and video surveillance.

Security lighting should be provided to exteriors building entry points, loading dock areas, emergency exit points and other nominated high-risk areas.

White, metal halide lighting is preferred for increased colour rendition and quality for CCTV images.

Security lighting lux levels shall meet requirements provided in AS4485.1.