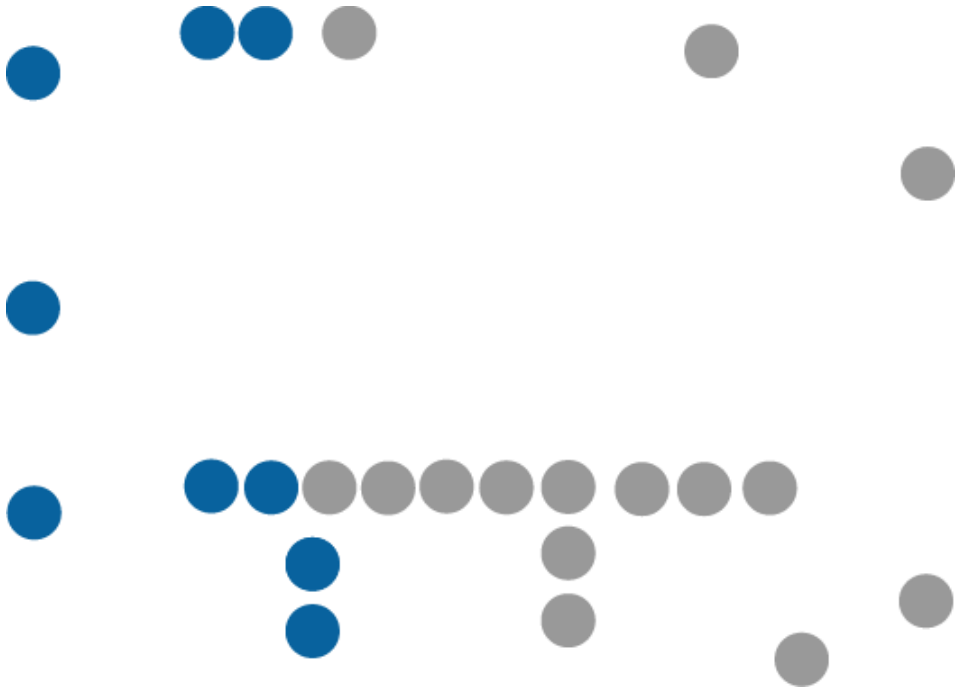
Cairns Entertainment Precinct

DA Report
Electrical Lighting and Vertical Transportation



STEENSEN VARMING

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1 Executive Summary

This Development Application report has been prepared to highlight the stage 1 and master-planning principles associated specifically with the lighting, vertical transport and electrical building services systems to service the proposed Cairns Entertainment Precinct (CEP).

Building services generally relate to human physiological needs, special environmental condition requirements and building functionality issues.

It is important to identify and state clearly that the overriding priority of the project is its function as a cultural precinct of international standard. All engineering systems have been developed with this as the primary goal with the following issues integral to the success of the project:

- Cost effectiveness – both in use and for construction
- Regional/ Climatic suitability – system/ equipment selection and specification
- ESD - Sustainability/ Energy
- Health and Safety
- Compliance
- Heritage interface
- Architectural Integrity

With these tenets in mind, a number of options have been assessed with the key ingredients to get right at the outset are cost, system selection and spatial requirements. The report provides this information for the following services:

- Power supply, protection and distribution
- Communications systems including NBN
- Lighting
- Electronic security
- Vertical transportation (lifts)

Control and monitoring systems will provide automatic control of systems as well as monitoring for energy analysis and the like.

The electrical services comprises of a new substation and new communications connections. Site diversions are necessary. Discussions are on with Ergon and Ports north regarding High Voltage and Substation arrangement. The electrical services also comprise of modern telecommunications and security systems which are also closely coordinated with the acoustic and performance theatre design requirements.

Lighting will support the architectural principles, relate to the openness and transparency of the building and reflect the geometry and core principles of the Architecture. Light is an integral element, tailored to suit the character of the building. Forming an integrated part of the building, light sources and lighting systems will be incorporated and concealed within the architecture.

Natural light of the foyers will inform the interior lighting which allow connection to the outside and balance the surfaces' brightness with the incoming daylight, mainly through uplighting and lighting of vertical surfaces.

2 Introduction

The Cairns Entertainment Precinct (CEP) will be developed in 3 stages. The first stage will contain :

A theatre comprising approximately 1100 seats, depending on the configuration of the orchestra pit; studio; rehearsal space; commercial kitchen; associated back of house; foyers; covered external public plaza; refurbishment of the heritage-listed White's Shed and car parking.

Stage 2 will see development of Cairns Regional Museum. Stage 3 will see development of a smaller 450 seat facility.

This report provides the outline description of the design solutions for the lighting, electrical and vertical transportation services that will serve the new development. The report discusses the various systems that will be required in the new development and the links required to the new buildings. The report also provides information on the existing services affected by the project.

Due to the early stage of the design a number of issues will need to be further addressed in more detail as progress takes place in order to guarantee appropriate and responsible implementation of solutions to meet the functional and environmental expectations of the project. The intent of this report is to provide a document that will be endorsed by Cairns Regional Council to enable the design team to progress into more detailed design stages using the principles defined here as a basis.

3 Design Principles

3.1 Project Priorities

It is important to identify and state clearly that the overriding priority of the project is its function as a cultural precinct of international standard. All engineering systems should be designed with this as the primary goal. Other considerations such as energy and budget, whilst extremely important must remain secondary to the project's purpose and its functional requirements. This principle has been and shall be used in all decision making processes and selection of options.

The building and engineering requirements described here aim to provide a well engineered project which is economical to build, operate and maintain, has the requisite quality for image and function and provides a practical level of adaptability for future changes and possible expansion. In particular a number of key design objectives shall be considered:

Safety	Installations which produce suitable conditions, particularly in terms of health, containment performance and occupational use
Environmental (external)	The achievement, or betterment, of environmental policy requirements for emissions from the building, including the provision of energy and water conservation features where practical and cost effective
Cost	A value for money approach over the total life of the project. The capital cost, operational costs, maintenance and support costs are all to be considered in the design development
Co-ordination	The design and layout of engineering services and passive elements shall be carried out in a manner that co-ordinates with and complements the building and structural design and satisfies operation requirements of the space
Maintenance	The production of specifications and system layouts/designs that will include features for safety, accessibility, reliability and ease of replacement
Flexibility	Decisions regarding designs will be taken in a manner which includes the need for future adaptability/flexibility where these are highlighted and cost parameters allow. All specified electrical systems will have spare capacity in accordance with best practice principals and to cater for minor alterations to the systems in the future.
Acoustic	Treatment and considerations play an important role in the electrical design solutions.

3.2 Regional / Climatic Appropriateness

One main priority for the project is to ensure that the solutions provided are appropriate with regards to the local climate and the support (skills/ parts etc) available to maintain efficient and effective operation of the systems installed.

Whereas a number of options have been assessed and alternative/ more sophisticated solutions may be proposed, the concept design has been formulated to provide a robust, sustainable and appropriate outcome for many successful years of operation.

The concept design has taken into consideration local approaches to system selection, tried and tested componentry (albeit in some instances this has been configured in an innovative way), local weather considerations (moisture, temperature, diurnal ranges, solar intensity/ radiation, winds and the like) as well as material behaviours (with regard to weather and atmospheric properties.

All equipment shall be readily and adequately supported in the local region. Adequate spares for important equipment shall be available in Cairns/ Australia and all equipment shall be fully supported by the equipment manufacturers and suppliers. Installations and plantroom layouts shall allow for appropriate and easy access for the purpose of operations, maintenance, repair, and replacement of major components.

The building should also incorporate airlocks and vapour sealing to minimise corrosion/ energy/ condensation and internal environmental problems. It is suggested that the building also is placed under building pressurisation tests during construction to adhere to more stringent construction detailing and techniques to provide longevity in this regard.

The suggested systems are proposed as being elegant and intuitively suitable for the project.

3.3 Policies And Codes

The development shall generally be designed in accordance with Statutory Regulations, CEP specific recommendations, the recommendations of the Building Code of Australia (BCA) and Fire Engineering Consultants.

The current Building Code of Australia and amendments shall be applied to the building services systems.

Statutory requirements shall be acknowledged for all areas via published regulations such as Noise Control Act, and Occupational Health and Safety Act. Australian Standards and Fire Brigade requirements shall be acknowledge through the BCA and Fire Engineering Consultant.

3.4 Documented Reference Material

There are numerous publications and guidance documents, which cover the environmental conditions and specific design issues for cultural facilities. It is not intended within this briefing document to regurgitate the different recommendations or scientific research results, however, relevant publications that reflect a selection of appropriate guidance for an international standard facility which the engineering services design will reference have been utilised in the Concept Design.

The design of the facility will be developed taking into consideration the relevant code requirements and standards.

3.5 Heritage Considerations

Consideration shall be given in the design process to the heritage issues of the existing White's Shed. Understanding the physical characteristics of a historic building, studying its original environmental design, behaviour and performance and an incremental approach to improvements, including an appreciation of what is driving the improvements , will not only benefit the conservation of the building and be more cost-efficient, but it will also earn wider points for the historic environment.

There are many buildings that need to be retained purely for their historical significance where the integrity and conservation of their features are key issues, however, this project is required to function in a modern context and address the performance expectations of the cultural precinct. The apparent conflict between modern technology and historic buildings should not be seen as irreconcilable however, needs to be carried out sensitively.

3.6 Master plan Issues

The initial design of the buildings and the major supply infrastructure/ energy plant shall take into consideration system integration to initial, future expansion/ master planning issues where this is economically viable at this stage. An indicative services plan for future connection/ growth and use shall be developed in parallel with that of the site during developed design (i.e. consideration will be given to the Staging of works), this shall then be utilised to assess the impact on the major services supply infrastructure with a preference that allowances shall be made to cater for this expansion in the initial stage. It is not expected that all equipment will be provided initially, however, a plan shall be developed to allow for this expansion in a logical form.

The spare capacity for each of the relevant electrical services such as the substation, mains, switchboards and communication nodes shall be determined during the design phase.

4 Electrical

4.1 General

The development consists of the Performance Arts Building and the Museum building. The services detailed within this section are common to both buildings. The following provides an overview of the proposed systems and electrical services.

4.2 Design Principles

A number of essential design objectives have been set down by Steensen Varming to ensure the success of the Cairns Entertainment Precinct (CEP) project from an electrical point of view:

- safety and reliability
- properly designed and appropriately sized to allow the full and proper functioning of all equipment, plant and fittings
- facilitates the operational requirements of the specific equipment, materials, processes and functions in the building
- sized with adequate capacity for expansion
- arranged and routed in an organised and systematic manner and be accessible for operations and maintenance
- provided with necessary flexibility and versatility to allow isolation, shutdown and removal of equipment and systems as required for maintenance and extension
- compatibility with other services and systems in the facility
- labelled and colour coded for ease of identification and operation, to suit semi-skilled operation
- designed and installed to all relevant legislation, standards, codes and guidance that are appropriate and relevant to the type of electrical installation or equipment
- Acoustic Considerations
  Noise generated by electrical equipment and services can be of concern as they contain pure tones, to which the ears are very sensitive. Small control gear transformers, relays and ballasts can also generate noise that is annoying to performers and the audience members. These sounds may also be dedicated by sensitive recording equipment.

  While electronic gear appears to be less of a concern the final selection and design of systems needs to consider the acoustic requirements. The electric noise and the structural integrity of the fixtures are also important to avoid vibration.

  Openings within walls affect the integrity of acoustic ratings and thus outlets and cable penetrations must be carefully considered.

4.3 Codes & Standards

All works must be in accordance with this specification and the current Australian Standards and standards detailed within.

Electrical:
SAA Wiring Rule AS/NZS 3000:2007
Selection of Cables AS/NZS 3008:2009
Australian Communications Media Authority (ACMA) Installation Requirement for Customer Wiring
AS3080, AS3084, AS/NZS 3085, AS/NZS 3087
AS/ACIF S008 and AS/ACIF S009
Emergency and Exit Lighting AS/NZS2293
MEPS AS/NZS 4783.2 and AS/NZS 4782.2

4.4 Power Supply

GENERAL

The power supply for the entire development will be fed from new substations to be located with the site premises. The substation will be operated, owned and maintained by Ergon. Appendix D illustrates the substation solutions proposed for the facility.

MAXIMUM DEMAND

The initial calculated maximum demand for the development (including stages 2 & 3) is 2.9 MVA. The maximum demand breakdown for the different stages is as follows;

Stage 1 (including White's shed) –2.12 MVA
Stage 2 - 0.52 MVA
Stage 3 - 0.26 MVA

The Maximum Demand is the largest current that the will exist in the electrical infrastructure at any one time. The above maximum demand is calculated based on VA/m^2, maximum demand figures shall be calculated for each individual section of infrastructure. The calculations shall be completed in accordance with AS/NZS3000 Table C2. The initial figures shall be based on After Diversity Maximum Demand (ADMD) and then by detailed calculations once all the loads have been confirmed.

POWER SUPPLY OPTIONS

The power supply for the whole development will be fed from new Ergon substations to be located within the site. Different options were considered for the substations during discussions with Ergon. The most viable option is considered to be supply via 2 substations with 1 No. substation SS1 located on Lot 10 and second substation SS2 located on lot 9. Substation SS1 will house 3 x 1000 KVA transformers and substation SS2 will be a kiosk substation with 1 x 1000 KVA transformers.

The final solution will involve 1 Chamber substation which will house 3 x 1000 KVA transformers and 1 Kiosk substation which with 1 x 1000 KVA transformers. Since the project will be developed in different stages , the power supply arrangement will be modified during each stage and evolve towards the final solution. The following solution is proposed

Stage 1 (including White's Shed will be fed from substation-1 via 3 x 1000 KVA transformers)

Stage 2 – Possible Future New substation-2 via 1 x 1000 KVA transformer will be installed. Power supply to White's shed will be modified to fed from the new substation-2. Stage 2 will also be fed from substation-2.

Stage-3 – Stage 3 will be fed from substation-1.

The final solution will involve Stage 1 and 3 fed from substation-1 and Stage-2 and White's shed fed from substation -2.

The capital cost for the substation has been included in the report.

4.5 Generator

The facility will not be provided with a standby generator system.

4.6 Uninterruptible Power Supplies

An uninterruptable power supply unit will be provided. The UPS will be located in the UPS room in the lower plaza level.

Uninterruptible power supplies will be provided with 10 minutes battery autonomy and be adequately sized to accommodate the electrical capacity of the following:

- Computer Servers
- Electronic security system head end equipment.
- BMCS

The electrical reticulation associated with each UPS will be designed and installed to incorporate an external maintenance bypass to allow removal of the UPS (for maintenance if required) without compromising the integrity of the power supply to the items of equipment listed above.

The Emergency lighting will have separate integrated battery systems and will not be connected to the UPS system.

All UPSs will be sized to suit the load requirements of the equipment to be served and be equal to American Power Conversions type or similar and incorporate surge protection on both the line and load side of each UPS.

Uninterruptible power systems
AS 62040.1.1-2003 - Uninterruptible power systems (UPS) - - General and safety requirements for UPS used in operator access areas
AS 62040.1.2-2003 - Uninterruptible power systems (UPS) - - General and safety requirements for UPS used in restricted access locations
AS 62040.2-2008 - Uninterruptible power systems (UPS) - Electromagnetic compatibility (EMC) requirements

4.7 ESD

The ESD initiatives for Electrical services shall be as per ESD report.

4.8 Lightning Protection

A lightning protection risk assessment has been undertaken in accordance with AS 1768 2007. Based on the assessment, the new building will require a dedicated lightning protection system.

Thus a system incorporating traditional and/or a type Early Streamer Emission (ESE) system shall be provided in accordance with AS1768 (2007) and industry standards.

Lightning protection shall also consist of surge protection on the telecommunications systems, main switchboard and distribution boards which shall be provided throughout the installation in accordance with the relevant Australian Standards.

4.9 Metering

The main switchboard and the metering facilities shall be arranged to enable tariff selection changes without the need to modify the switchboard busbar system. The metering shall also be arranged to allow for authority meters for individual installations downstream of the main switchboard for possible cafe or restaurant.

Supply Authority meters shall be located in accordance with Local Supply Authority requirements. It is proposed that authority meters be located within the main switch room and these meters be digital with remote read facility.

Private metering consisting power monitors shall be positioned on the main supplies and on selected loads in compliance with current BCA standards. This will include separate metering of lighting & power and metering of major plant items. The microprocessor based 3 phase power monitors that shall communicate with BMCS / metering system and shall display and transmit selected data such as:

- voltage
- current (each phase)
- frequency
- kilowatts
- kVA maximum demand (15 min. cycle)
- kilowatt hours
- kVA
- power factor
- THD including the details on the neutral conductor

4.9.1 Security

It is understood that the buildings will not be occupied by Security Staff after hours.

The security for the building consists of physical and active systems. The active systems (Electronic Security Systems) which form part of this report will be closely coordinated with the physical systems as detailed by the architect.

An electronic security system shall be provided throughout the building to assist in providing a safe environment for all building users. Final details of the electronic security system shall be determined during detailed design, however, it is anticipated that the electronic security system shall incorporate the following system elements:

- Access Control
- Intercom System
- Intruder detection
- CCTV System

- Duress Alarms

The CCTV system shall be an IP based system. CCTV monitoring points shall be provided. CCTVs shall be provided in the following areas

- Car Park Entry and Exit
- Car Park Bay
- Loading Dock
- Studio
- Foyer Area
- Building Entry
- Corridors
- External Areas

4.9.2 Codes and Guidelines

Security and CCTV will be provided throughout the building in accordance with the following guidelines and standards.

- The Building Code of Australia
- Security Intruder Alarm System AS2201

4.9.3 Access control

The Access control system will incorporate sufficient door reader modules, electronic strikes (fail safe), electromagnetic locks (fail safe), proximity card readers and door release pushbuttons as required to serve the nominated locations. Typical locations may be the entry to the following areas:

- Car Park Entry
- Administration Offices and Back of House Areas
- Lifts
- Plant rooms
- Stores
- Communication room
- Security and Staff Entries
- Studio

All access control points to the facility will be secure, with the exception of the main entry which will be unsecured during normal opening hours. After hours entry to the building via the main entry will be secured by card access.

All external perimeter doors will be manually locked to prevent unauthorised access and complete with Reed Switches unless otherwise stated.

The access control system will be linked to the fire system.

4.9.4 Intruder Detection

An intruder detection and alarm system will be provided to monitor perimeter doors and incorporate zone expanders, door reed switches and passive infrared movement detectors to nominated locations as required.

All external doors will have reed switches and local sounders.

The intruder alarm system shall be controlled from a central security location. Duress alarms will also be linked to the intruder alarm system to utilise secure lines of transmissions.

The response to alarms will be dependent on the location of the area in alarm in relation to the location of, security staff. All alarms will report to the central security room and be automatically sent via the paging system to the security staff as a text message.

4.9.5 Intercoms

Audio intercoms will be used at selected areas such as car park, loading dock and main entry.

4.9.6 Closed circuit television

CCTV network and cameras shall be a full IP CCTV system with open protocols system such as LENEL allowing various manufacturers and camera types to be installed.

The system shall be used for

(a) Public awareness, crime watch (vulnerable areas monitored more actively to allay public concern about safety and enable a swift response to incidents).
(b) Improved staff and visitor safety.
(c) Reduction in theft and crime.

A surveillance system shall be designed to be a deterrent to illegal activity as well as providing the ability to review incidents after the event. It is not intended for the CCTV system to be monitored at all times as incidents will be recorded automatically.

5 Telecommunications

5.1 General

The new development will provided with a new communication services connection. The communications services for the new building will be linked via new lead in connections from Telstra. The development will be serviced from a single lead in from Telstra to the main communication room within the Main Auditorium building on the upper Mezzanine level. The remaining development shall be subsequently serviced from the Main Communication Cabinet. Discussions are on with Telstra on this basis.

The telecommunications systems for the building shall consist of following and will be carefully coordinated with the Performing Arts Brief and Scope.

- Intercom system(s)
- Structured Cabling System

- PABX
- Wireless network
- PA - Public Address system(s)
- PayTV/MATV signal distribution system(s).
- NBN

It is important to ensure that the overall ICT infrastructure supports both the short and long term requirements of a world class facility.

It is important that the core network infrastructure, equipment and the servers are identified at an early stage. Each of these may have a direct impact on the design of the building, including:

- Supply of suitable power to nominated areas (type and capacity)
- Inclusion of multiple paths for cabling infrastructure, to allow for sufficient cabling via diverse pathways
- Main Computer / Server room
- Telecommunication rooms and cupboards to be sized to accommodate racks for cabling and network equipment
- The number and location of voice and data outlets
- UPS and back-up power supply

The Network Infrastructure must consider:

- Management (fault and performance indicators)
- Network virtualisation (VLANs)
- High availability (path redundancy, device redundancy)
- Security (access control lists, wireless intrusion detection and prevention system)
- Scalability
- Wireless (convergence of wired/wireless infrastructure, VPNs/VLANS)
- Voice and multimedia (Power of Ethernet (PoE)

The Facility shall be cabled to provide real-time network technology for the integrated transport and routing of multi-channel 3G/HD/SD-SDI, video, multi-channel audio, Inter-communications, control and data.

Structured cabling pathways shall be provided throughout the precinct and within various venues to provide initial and future cabling requirements in accordance with the theatre performance brief requirements.

The installation shall comprise of both high speed optical fibre and copper cabling systems.

lT technical systems will use OS1 Single-mode Fibre and Multi Mode Fibre as the primary transport medium and venues will be connected via a redundant ring of multi-core and Single-mode Fibre.

Single-mode and Multi mode Fibre network will form the core cabling technology for the precinct.

As per the theatre consultant requirements ‘Zero Water Peak OS1 Single-mode Fibre’ shall be the standard used to maximise the useable spectrum (bandwidth) of the fibre.

While the precinct will be integrated to enable a “Connected Community” the designed cabling topology shall be implemented to help minimise no single point failures.

The adoption of Coarse Wavelength Division Multiplexing (CWDM) will increase channel capacity while keeping the number of fibre cables to a manageable level. Cabling within venues will comprise of OS1 Single-mode Fibre

and Category 6A Shielded copper cable thus ensuring high speed and wide bandwidth transport is maintained to every connection point.

Distributed Node Rooms will be established at strategic points throughout the precinct to service the venues. The Distributed Node Rooms will be built to telecommunication carrier standards i.e. redundant environmental control, power and security. A fundamental part of the distributed design will ensure that in the unlikely event of failure of one or more Node Rooms, catastrophic precinct failure will not occur.

Interface to outside communities will be achieved through the National Broadband Network (NBN) thus enabling all Australians with high-speed and wide bandwidth interaction to the Cairns Cultural Centre Precinct. Connection to the NBN will be via redundant links. This is considered essential and the venue is not only for the city of Cairns but also the benefit of the wider community.

5.2 Codes and Guidelines

Communication services will be provided in the new building in accordance with the following guidelines and standards.

- Room Data Sheets
- AN/NZS 3000 SAA Wiring Rules
- AS/NZS 3080 Telecommunications Installations – Integrated telecommunications cabling Systems for Commercial Premises
- AS/NZS 3084 Telecommunications Installations – Telecommunications Pathways and Spaces for commercial buildings
- AS/NZS 3085.1 Telecommunications Installations – Administration of communications cabling systems part 1 : Basic requirements
- AS/NZS 4703 Electrical wiring in furniture
- AS/NZS 61935.1Telecommunications Installations – Generic cabling systems – Specification for the testing of balanced communication cabling
- ISO 14763-3 Telecommunications Installations – Generic cabling systems – Specification for the testing of optical fibre communication cabling
- Cable Manufacturer Design and Installation Training Manuals
- ACIF S008
- ACIF S009
- ACA TCPR Communications Cabling Provider Rules
- ACA CRCPR Competency Requirements for Cabling Provider Rules
- ISO/IEC 11801 Telecommunications Installations – Integrated Telecommunications Cabling System for Commercial Premise

5.3 Communications

The provision of containment and cabling infrastructure shall be developed during the design development stage of the project.

The new communication systems will include a Cat 6A structured cabling system capable of handling voice and data systems throughout the building. Cabling to meet the requirements for extended warranty.

All telecommunication nodes shall be linked via multimode 12 core 50/125µm OM3 optical fibre as well as being linked back to building main communication room. Single Mode optical fibre cabling shall be utilised where it is deemed necessary. These links to the existing rooms shall be further established during detail design.

Final arrangement of the communications outlets shall be determined during the design stages of the project.

Generally the detailed brief of the telecommunications services shall be developed further in conjunction with the client and their requirements. The following should be considered by the stakeholders in providing the telecommunications for the building;

- Topology and system architecture
- Voice and data Requirements
- Functional requirements for voice and data
- Security
- Cable type and performance capacity
- Redundancy
- Spare Capacity
- Interfaces to other facilities

All labelling shall be in accordance with industry standards.

5.4 Optical Fibre Backbone Network

Optical fibre backbone cabling shall be a minimum of 12-core single mode OS1. Consideration shall be made to installation methods due to environmental factors.

Installation methods shall be such that compliance with IEC 60794-2 and IEC 60794-3 are achieved. Special consideration shall be given to ensure that subterranean cables are fit for purpose.

Multi-mode fibre may be installed only in facilities that require this and will generally be 12 core 62.5/125 micron multi-mode optical fibre.

Additional cores and cables shall be installed subject to a bandwidth analysis of the system.

Lengths of channels shall not exceed those as specified by AS/NZS 3080.

5.5 Horizontal Cabling – Cable Type

Fibre-optic horizontal cabling is to be is to be provided to outlets only to locations as required by the facility and equipment.

The horizontal wiring is the portion of the telecommunications wiring system that connects the voice and data outlets in the work area. These shall be Cat 6A specification.

5.6 Wireless

Wireless Access Points (WAP) are to be incorporated in all services facilities to provide network access internally

and at nominated exterior locations including the public domain.

Consideration must be made to the location of the outlets to ensure coverage is provided to 100% of the interior of the facility excluding lifts and fire passageways. Bandwidth requirements shall be discussed with the facility to ensure that the minimum spacing of the WAPs are sufficient to provide this.

Discussions with the principal are to be undertaken to ascertain the IEEE 802.11standard equipment to be installed. Ensure minimum signal levels are achieved at all required locations to this standard.

Some equipment contained within the facility may be susceptible to electromagnetic interference (EMI). It is a requirement that the designer locates WAPs coordinated with this sensitive equipment to ensure interference is within the tolerance levels as specified by the equipment manufacturer. Areas that are not covered by wireless services due to this are to be discussed with the principal or their representative prior to complete design.

At this stage of the design it is understood that the WiFi and WAP will use Power over Ethernet (PoE).

5.7 MATV

The building shall be provided with an MATV system to receive free to air digital television. MATV outlet locations will be as nominated on the future room data sheets.

5.8 IT and PABX equipment

The IT computers, servers, switchers and the PABX equipment shall form part of the FFE budget.

The exact requirements for the new IT equipment and PABX shall be determined in the next stage of design.

The provision of PABX services is critical and consequently it is a requirement that the system is connected to the standby power supply.

The active equipment may utilise a traditional PABX or a VoIP system.

Active equipment such as telephone handsets, network switches, wireless access points etc to support the building, shall be provided. These devices shall be specified in close consultation with the principal. Handsets shall be provided in maintenance areas, including major plant rooms.

6 Vertical Transportation

6.1 General

The vertical transportation system will incorporate the following:

- Lifts must be safe and comply with all Queensland and national relevant codes and standards.
- Lifts must be easily maintained by multiple (other than the original manufacturer) lift maintenance contractors
- Lifts are to be as flexible and versatile in operation as possible
- Lifts must have a proven (10 year) local history of reliability
- Lifts must be environmentally friendly as well as being both economical to operate and maintain.

- Lifts must be energy efficient with minimal electrical power consumption to meet or exceed the building's ABGR rating and design intent.
- Lifts must meet the minimum requirements for use of persons with disabilities as defined by the lift code AS1735.12.
- Lifts must comply with the University of Wollongong Vertical Transportation Design standards.
- Any non-compliance or departure from the University of Wollongong Vertical Transportation Design standards must be clearly detailed and mad known to the Building and Grounds Manager.

Where vertical transportation system interconnects to other building services such as fire and security services, an interface will be provided that achieves optimum functionality, performance and reliability.

Low level interfaces shall comprise of a set of electrical contacts controlled via s signal from the lift control system, as listed below.

System to be Interfaced	Interface Type	Interface Responsibility
Fire	Low level	Fire
Access Control	Low Level	Security
BMCS	Low Level	Mechanical

6.2 Design Principles

The building is proposed to have several lifts at different locations as per the architectural plans.

6.3 Codes And Guidelines

The lifts shall be designed, manufactured, installed and tested in accordance with Australian and AS/NZ Standards or with other approved standards where the Australian Standards are not applicable.

All works must be in accordance with this specification and the current Australian Standards and codes detailed within.

BUILDING CODE OF AUTRALIA (BCA) 2011

AS 1735.1:2003	AUST. LIFT CODE - GENERAL REQUIREMENTS
AS 1735.2:2001	AUST. LIFT CODE - PASSENGER & GOODS LIFTS – ELECTRIC
AS 1735.3-2002	Lifts, escalators and moving walks - Passenger and goods lifts - Electrohydraulic
AS 1735.4:1986	AUST. LIFT CODE – SERVICE LIFTS – POWER OPERATED
AS 1735.5:2003	Lifts, Escalators and Moving walks
AS 1735.10:1998	LIFTS, ESCALATORS AND MOVING WALKS - TESTS
AS 1735.12:1999	AUST. LIFT CODE - FACILITIES FOR PERSONS WITH DISABILITIES
AS 1735.14-1998 :	Lifts, escalators and moving walks - Low-rise platforms for passengers
AS 1428.2:1992	DESIGN FOR ACCESS AND MOBILITY - ENHANCED AND ADDITIONAL REQUIREMENTS - BUILDINGS AND FACILITIES
AS/NZS 3000:2007	WIRING RULES
AS 1657:1992	STAIRWAYS, LADDERS AND PLATFORMS
AS 1170.4:2007	MINIMUM DESIGN LOADS ON STRUCTURES - EARTHQUAKE LOADS

AS/NZS 4431:1996 : GUIDELINES FOR SAFE WORKING ON NEW LIFT INSTALLATIONS IN NEW CONSTRUCTIONS

Workcover Authority

The Workcover Authority regulates the implementation of the Lift Code AS1735. The BCA also refers to AS 1735. This standard deals with the detail design of the lifts. The Authority will not inspect the installation however may audit the installation in the future or when there is an accident. The lifts however will need to be registered with Workcover by the Contractor.

Access Provisions - DDA

Disabled access is required to be provided to the retail sections of the building in accordance with the BCA and DDA. The code has requirements that refer to control panel heights, handrails, door sensing devices and minimum car sizes and openings.

E3.6 – when a passenger lift is provided in a building required to be accessible, it must be suitable for use by occupants with disabilities. (this relates to the lift complying with the requirements of AS1735.12).

The minimum car size is 1.1m x 1.4m deep, with 0.9m clear doors. Lift landings should have adequate space as detailed in Section D of the BCA.

AS1735.12 – Facilities for Persons with Disabilities

Compliance with this standard is most likely to be a condition in the DA. Compliance with the standard includes the need for appropriate Audio and Visual indication, higher light levels and minor alterations or restrictions of car finishes and panels. It also will have an effect on
the door closing times of the lifts.

AS1428.2 – Enhanced and Building Requirements

Usually an Access Consultant or Architect with consideration to the Disability Discrimination Act (DDA) would advise on the need to comply with this standard. Compliance with the standard in relation to Lifts includes the need for larger lift cars than stated in AS1735.12. ie. Minimum size for disabled access is 1.4m wide x 1.7m deep.

It is noted that the minimal car size in the pending draft BCA 2011 is 1400mm x 1600mm.

Stretcher Facility shall be provided where required by the BCA.

7 Lighting

7.1 General

Light has direct influence on the perception of the space and the visual performance and comfort of its users. There has been considerable research on lighting and its impact on the visual comfort, and health for people within the built environment.

An important issue that should be considered in designing lighting is the visual comfort of visitors and staff. Light should create a comfortable, varied, inviting and interesting atmosphere and support the intention and design of the architectural and exhibition design.

7.2 Design principles

The lighting system for the performing arts centre and gallery spaces seeks to address the following key issues:

- The provision of a lighting and lighting control system that provides operational and functional lighting to the auditorium.
- The creation of a humane and engaging interior that provides both comfort and "excitement". A warm colour temperature and good colour rendering are regarded as key requirements.
- Use of light to define qualities of surfaces (colour, form and texture).
- Lighting quality with respect to light distribution and illuminance levels.

Australian Standard AS/NZS 1680 should be used as guidance for illuminance levels. However, the lit atmosphere and surface brightness should be used as design parameters rather than solely illuminance levels.

- High quality lighting characteristics in terms of dimmability.
- High flexibility to cater for various seating/ stage arrangements.
- An approach that enhances and reinforces the Architect's vision and identity of the building and that is fully integrated into the architectural design.
- Designing lighting atmosphere (in terms of colour temperature, colour rendering properties, illumination intensity etc.) to suit best to the architectural context and the uses of the building.
- Provision of operational and functional lighting to the various spaces to fulfil visual task requirements without glare or discomfort.
- Lighting used to draw people to particular areas or down certain routes (orientation/ way finding).
- Energy efficient lamps, luminaries and control gear shall be used at all times, considering efficacy, light output ratio and suitable light distribution.
- Use of time controls, light sensors and occupancy sensors to control lighting when appropriate.
- The provision of an intelligent lighting control system and consideration of lighting control strategies to provide flexibility of operation and reduce energy consumption.
- The selection of light sources and control aims to minimise maintenance where possible. Lamp types will be standardised for ease of maintenance.
- All lighting fixtures and equipment need to be located to enable access and maintenance.
- Flexibility for the various usages, functions and future requirements as part of the design.
- Integration and coordination with other services and systems.
- Consideration of daylight in order to supplement and balance incoming daylight with electric lighting.
- Minimisation of energy consumption and environmentally sustainable initiatives as part of the design.
- As part of the energy efficiency measures, the design is required to comply with the Building Code of Australia Part J6, which restricts the power consumption of lighting in form of maximum illumination power densities. It is noted that the BCA part J assessment need to consider the entire building rather as a whole than individual areas.

7.3 Codes and Guidelines

Lighting will be provided in accordance with the following guidelines and standards.

Interior Lighting AS1680
Control of the Obtrusive Effects of Outdoor Lighting AS 4282:1997
Pedestrian Area Lighting AS/NZS 1158.3.1:2005

Emergency and Exit Lighting: to AS/NZS 2293.1-2005

Structural design requirements for utility services poles (for lighting poles) AS/NZS 4676:2000

Energy Consumption – BCA Part J6
Aisle Lighting – BCA Part H1.7

7.4 Light Quality

The appearance of colour, both in terms of chromaticity (Correlated Colour Temperature) and colour rendition (Colour Rendering Index) are important for the overall feeling, comfort and visual performance within the space:

- Colour rendering

The colour rendering index (CRI) describes the effect of a light source on the colour appearance of objects by comparison with their color appearance under a reference source.

Incandescent light sources have a continuous spectrum and attain a CRI value of 100.

It is recommended that the light sources applied in the foyer and auditorium spaces should have a minimum CRI of 80, whilst the colour rendering properties for light sources used in exhibition spaces should be rated above 90.

- Correlated colour temperature

Colour temperature is a characteristic of visible light that influences the perception and atmosphere of a space. The colour temperature of a light source is the temperature of a black-body radiator that radiates light of comparable hue to that light source. The black-body radiator gives a reference by which the whiteness of light sources is judged. The temperature is conventionally stated in units of temperature in Kelvin (K).

Higher colour temperatures (5,000 K or more) are perceived as cool, lower colour temperatures (2,700–3,000 K) as warm colours. Incandescent/ halogen lamps which are traditionally used in theatres, have warm white light output with a colour temperature of around 2700-3000K and become warmer when dimmed.

Generally, a neutral white colour will blend in with the natural light entering the spaces and contribute to balancing the incoming daylight.

A warm light colour is recommended for the auditorium space to create a warm and inviting atmosphere.

7.5 General Lighting Philosophy

Light is a powerful means for communication and plays an essential role in realizing and sharing the architectural vision of the project. For this communication to be “total”, lighting needs to embrace natural and artificial sources and their interaction with forms, surfaces and colours.

The concept will be developed to create a lighting atmosphere (in terms of colour temperature, colour rendering properties, illumination intensity etc.) to best suit to the architectural design and the use of the building.

Lighting will support the architectural principles of openness and transparency and reflect the geometry and core principles of the design.

Natural lighting plays a major part in the architectural design and as a key factor for the spatial quality as well as peoples’ alertness, comfort and well-being. Appropriate glazing, window treatments, light shelves and shading of glass will need to be part of the daylight design to limit glare and to ensure direct rays are

Architectural Concept image

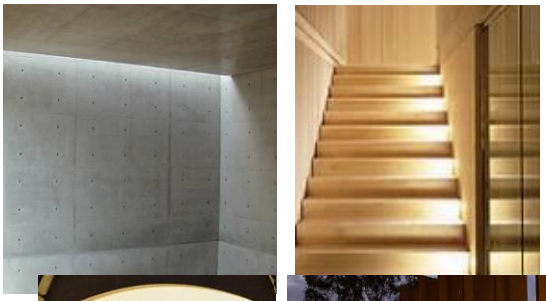
kept out of critical task spaces.

Natural light and the transparency during the daytime will inform the interior lighting. Internal lighting should be designed to allow connection and views to outside and to balance the surfaces' brightness with the incoming daylight, mainly through uplighting and lighting of vertical surfaces.

Concealed uplighting and lighting of vertical surfaces

Lighting underlines the architectural form and enhances the appreciation of height and openness. Through lighting, the vertical surfaces become illuminants, creating focal points, facilitating orientation and guiding movement. The main surface materials and their qualities will be enhanced through light.

Light is an integral element, tailored to suit the character of the building. Forming an integrated part of the building, light sources and lighting systems should be concealed within the architecture.



Lighting of materials and surface

The design involves illuminance variations in order to compliment the architecture and highlight features and focal points. Highlighting certain areas or surfaces draws people to particular areas or down certain routes.

At night, lighting treats the building as a sculpture enhancing its meaning within its surroundings and reflecting the layers and shapes of the roof/ canopies and the arrangements of internal spaces.

Uplighting and lighting of facade elements at night-time

Lighting to internal and external landscape elements such as trees and plants strengthens the architectural concept of creating a strong connection to the nature and enhances the appreciation and enjoyment of the external environment.

Landscape lighting within the foyer/ plaza improves the aesthetical quality of the environment at night time, emphasizing feature elements and creating a harmonious balance between light and shade, void and solid. Tree and leaf shadows, usually perceived as a natural effect from sunlight, can be considered to bring natural elements into the spaces and to strengthen the building's connection to the landscape. The lit night-time environment will include lighting of trees and landscape features as well as lighting of facade elements and the roof canopies, creating an inviting and welcoming environment and night.

Lighting of trees and landscape elements

7.6 Performing Arts Space Lighting

7.6.1 Principles

In the performing art spaces, Lighting has to fulfill task and functional requirements, integrate into the architectural design and contribute to the creation of an environment that enhances the theatregoer's senses in

preparation for the performance to come.

The lighting design concept will follow the architectural concept and will be based on seamless integration of the lighting into the architecture. Through lighting the architectural geometry and surfaces, the concept will aim to maximise the experience and comfort within the space.

The proposed solution should address the hierarchy of seeing: The gathering audience is considered the priority and the architectural envelope the next within the visual hierarchy.

Dimming holds a key position within performing arts spaces; it informs the viewers to settle down, end conversations and direct the attention towards the performance area.

The lamps used for auditorium lighting need to smoothly dimmable from 0% to 100% and require instant start and re-strike.

It is noted that lighting for maintenance and cleaning does not require dimming and instant start/ re-strike capabilities.

7.6.2 Illuminance Guidelines

Australian and International standards have been used to form the basis of the illuminance advice.

The following recommendations from various standards refer to auditorium house lighting:

- AS/ NZS 1680.2.3 – 2008 refers to educational and training facilities and recommends 160 lux for an auditorium when used as assembly hall and 80 lux for social activity.
- As part of the recommendations for Public and Educational Buildings, AS1680.2.0 – 1990 recommends an average illuminance of 80 - 160 lux for foyers and auditoriums of Assembly and Concert Halls.
- The AS1680.2.0 – 1990 recommendation for cinemas is for 80 lux for foyers and 40 lux for Auditoriums during intermissions.

Lighting will be designed to achieve an overall illuminance of 80 lux average at the seating area for pre- and post-entertainment sessions and intermissions. The lighting system will be dimmable to vary light levels, depending on the task requirements.

For safety and orientation, the steps must be seen clearly:

AS/ NZS 1680.2.3 – 2008 recommends to install aisle lighting if floors are sloped at greater than 1 in 12, or are stepped and that each step should be defined by producing contrast between the step and its riser.

To make the steps evident is considered a matter of contrast. A combination of appropriate illumination as well as the material selection will enhance the discrimination of steps and provide safe circulation.

7.7 Exterior Lighting

Exterior, façade, and plaza lighting will be provided throughout the complex in accordance with the following guidelines and standards.

- AS/NZS 1158 Lighting for Roads and Public Spaces
- AS/NZS 4282 Control of Obtrusive Effects of Outdoor Lighting

Detailed calculations shall be done during the detail design stage to address issues related to any light spills on neighbouring properties.

7.8 ESD Considerations

Energy efficiency and sustainability form part of the lighting design philosophy and will be considered throughout the design process.

The solutions implemented in the lighting design need to take into account environmental impacts by means of balancing a number of issues. Lighting encompasses display, architectural, ambient, access, task and security lighting, therefore needing to address several key issues one of which is the associated environmental impact.

The first priority is to be given to the creation of the required visual environment and compatibility with the architectural philosophy, performance and exhibition design requirements. Visual performance, visual comfort and an enjoyable atmosphere for visitors and staff are to be achieved by reflecting and enhancing architectural design intentions. In some cases, the solution may not have energy efficiency as the primary driver, but it will be balanced out in other areas and other modes in order to achieve an excellent overall energy efficiency, economy and environmental responsibility.

ESD objectives associated with the lighting design take into account the following issues:

- Where spaces are designed to embrace natural lighting, they promote a natural and comfortable visual environment and enable a connection to the outer environment. Maximization of daylight reduces the need for electric lighting.
- The design of the room surfaces has a considerable influence on the quality of the lighting including light distribution, general lighting levels, the degree of glare and space/ object perception. Light coloured and non-glossy surfaces improve the light distribution by multiple reflections and contribute to achieving required light levels (eventually less luminaires/ lamp wattage required) while limiting contrast glare.
- An appropriate and flexible lighting control system is a key requirement for a sustainable lighting installation. Time switches, occupancy sensors and photo sensors are suggested to be used to control lighting when and where appropriate.
- Appropriate luminaire types and light sources will be chosen to minimize energy consumption, maximize efficiency and obtain low maintenance expenses.

  However, the quality of the light is considered being the first priority and lamps will be chosen with consideration to the nature of the exhibited objects, the health and well-being of the occupants and to their qualitative spectral properties.

  LED sources will be considered as the limited ultraviolet and infrared radiation is in accordance with conservation requirements and recommended guidelines without the need for applying filters.

7.9 Lighting Control

Lighting comprises of auditorium house lighting, display lighting, architectural lighting and lighting for orientation and way finding; all of which functions need to have the ability to be separate controlled.

Lighting needs to be changeable and support multiple uses within the performing arts space and the galleries:

- Different settings before, during and after performance
- Different lighting atmospheres and configurations for different performances
- Adaptability and flexibility for future changes and requirements

- Various exhibition layouts and types of displayed objects

Flexible control groups, programmable control and dimmability are key requirement for the lighting operation, especially as the space will house a variety of events, shows, displays and changing exhibitions. The control system needs to allow for adaptability to cater for various uses and exhibition layouts.

Pre-programmed scenes shall be recalled to create a different atmosphere and to cater for the various requirements. The settings can be changed for different types of events and usages, e.g. allowing for functions within the foyer spaces.

7.10 Exit and Emergency Lighting

Emergency and Exit lighting will be provided throughout the building in accordance with the following guidelines and standards.

- AS/NZS 2293 Emergency escape lighting and exit signs for buildings
- Building Code Of Australia

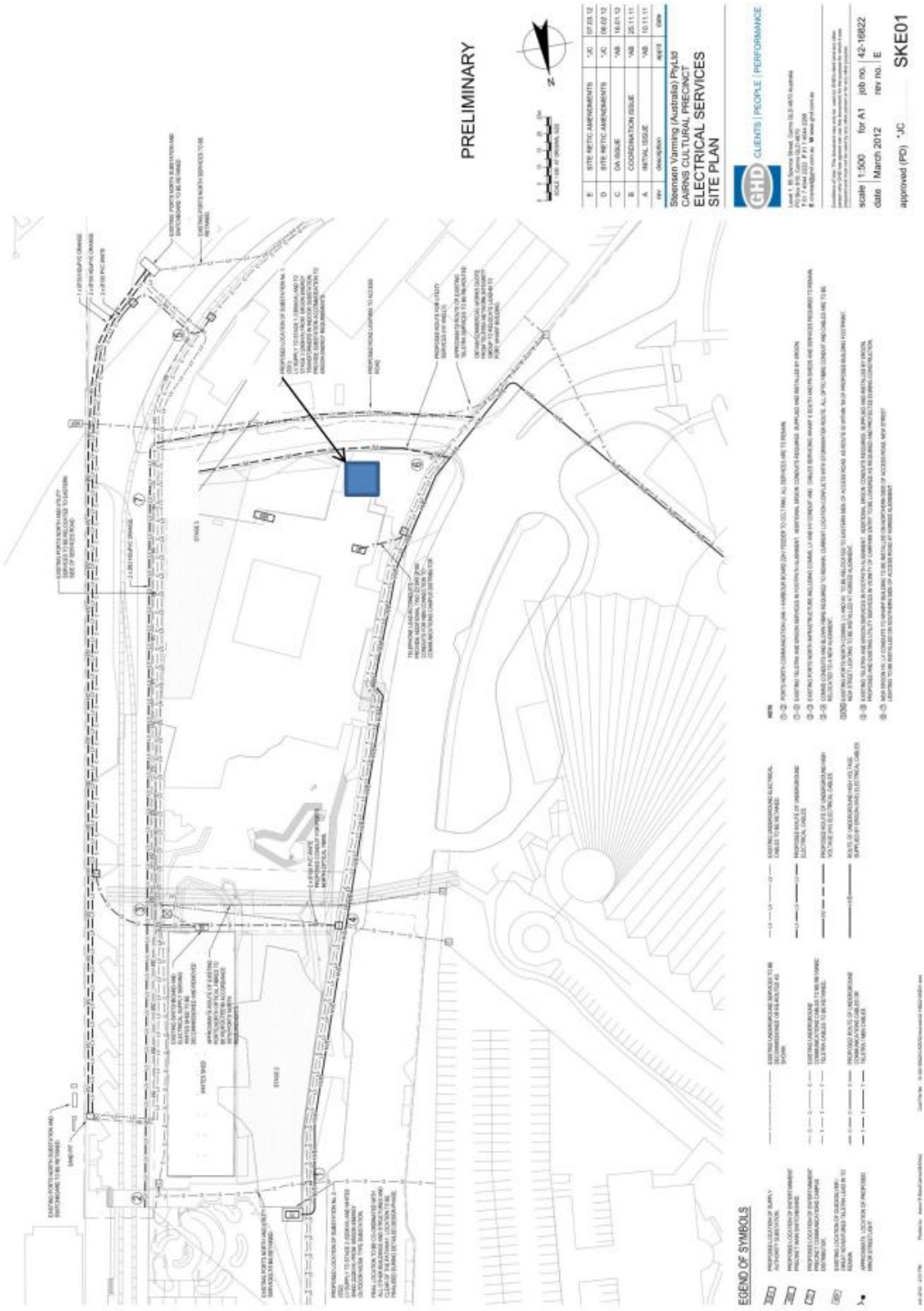
Emergency lighting and emergency exit lighting is an essential part of the building lighting. The system should consist of luminaries and exit signs that identify an escape route.

A computer monitored emergency lighting and emergency exit lighting system will be provided in accordance with the Building Code of Australia, AS/NZS 2293 and comprise of self contained emergency exit and emergency luminaries.

The fittings require regularly scheduled maintenance testing in accordance with the requirements of AS/NZS 2293. The maintenance testing of the emergency lighting system shall have the capacity for automatic testing, generate test reports, colour graphic display and be capable of remote monitoring (testing, report generation).

The style and type of emergency fittings will be selected to suit the area in which it is located and to match the particular requirements for each area. Generally, the emergency lighting equipment will be an integral part of the design and mainly concealed or unobtrusive. In line with this principle, emergency lighting will be integrated within general luminaries where possible or provided through dedicated recessed LED emergency fittings complete with self-contained battery and charger.

8 Appendix A – Site Diversions Layout



9 Appendix B – Correspondence with Ergon, Telstra and NBN

Ergon

Discussions are on with Ergon regarding provision of new substations to service the development. Based on previous meeting and discussions the following correspondence sent to Ergon and their written approval to is awaited.

1. The general location and orientation of the substation shown on sketch 42-16822-SKE01 (Appendix C) is acceptable to Ergon.
2. Based on the maximum loading supplied a 3 x 1000KVA substation arranged to Ergon standard detail is Acceptable to supply Stage 1 works consisting of Performance arts facility and White's shed. During development of stage 2 (Museum), stage 2 and white's shed may be fed from a future separate 1 x 1000 KVA transformer. The White's shed supply will be re-arranged at this stage. Stage 3 will be fed from the 3 x1000 KVA transformer substation. The spare capacity created by re-arranging of White's shed will be used to feed stage3.
3. A 2m x 4m pit located adjacent the substation with a cable tunnel connection into the rear of the substation trench is acceptable to Ergon.
4. The HV and LV conduits from Wharf Street to the above pit will be located within the access road footpaths and a 3m non-exclusive use easement in favour to Ergon will be established over the conduits.
5. An exclusive use volumetric easement in favour of Ergon will be established over the entire substation building.
6. The HV RMU will be located on the southern wall of the substation and the LV switchboard will be located on the northern wall of the substation.
7. White's Shed will be feed via a separate 1000KVA pad mount transformer located to the North of the precinct and shown on the attached drawing 42-16822-SKE01(Appendix C) . The White's Shed initially will be fed from Substation-1 (3 x 1000 KVA transformers). Only in stage 2 the supply to White's shed will be diverted from substation-1 to Pad mount 1000 KVA transformer.

Telstra

The development will be serviced from a single lead in from Telstra to the main communication room within the Main Auditorium building on the upper Mezzanine level. The remaining development shall be subsequently serviced from the Main Communication Cabinet. Discussions are on with Telstra on this basis. An application has been submitted to Tesltra in November 2011. The reference number for the application is **12055014.** Attached is correspondence from Telstra application.

A separate application will be submitted for NBN lead in.

10 Appendix C – Substation Solution