THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

The University of Newcastle

Infrastructure and Facilities Services

Project Briefing Document

Engineering Services Design

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V2.1	June 2017	Deleted Electrical Services Preferred Equipment & Supplier List from Appendix B (now outlined in electrical specifications)	R. Eyre	Lynn Herd	L. Herd 12 June 2016

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Appendices

1. General

1.1 Purpose

The purpose of this document is to convey the extent of investigation and consideration relating to Engineering Services associated with new construction, major and minor alterations to buildings and utilities which are owned by or proposed to be sited on the campuses and satellite facilities of the University of Newcastle, NSW Australia.

The intent is to promote consistency of services engineering provided and including the early review and incorporation of all building services with a view to ensuring proposed works can be supported by the site infrastructure. This review will identify possible areas which will require attention, modification, rectification and installation which may be necessary to ensure the proposed works can function and operate in the most efficient and effective manner.

This document shall be used in conjunction with relevant technical specifications and standards as listed in Appendix A. The Designer shall ensure the latest documents have been received and are being applied in the design.

1.2 Application (Uniform to Project)

These guidelines are to be used and referred to in the early stages of project conceptual design with continued reference throughout design and development, to ensure all possible building services issues and constraints are considered and subsequently accommodated.

Specifically these guidelines shall be issued with, and read in conjunction with 'Request For Tender' (RFT) and/or 'Expression of Interest' (EOI) documentation issued by the University.

1.3 Goals and Priorities

These guidelines will require the formulation of a return brief for engineering design of building services, Energy/Water reduction and low operating costs etc, which may be necessary for the development of a new construction project.

In addition to the above, Quantity Surveys and/or Project Estimators must be engaged and involved on the project to work concurrently with the building services engineer during the early stages of design development to advise on budget implications of various design paths.

The designer shall maintain a high level of communication throughout the project with the University via the designated representative (Project Officer).

1.4 Standardisation, Supportability and Maintainability of Equipment

All specified services and equipment shall, as far as practicable, be standardised on a site basis and be provided in compliance with the Preferred Equipment and Suppliers List (Appendix B). Designers shall ensure that any existing standards are maintained as a minimum or exceeded wherever appropriate.

The designer shall ensure they are provided the latest versions of available University specifications or standards and requirements, from the project officer.

The designer shall assess the need for key or essential spares to meet the required availability and shall also include the requirement for the supplier to nominate essential recommended spares.

Building services installations and plant room layouts shall allow for appropriate and easy access for the purpose of operations, maintenance, repair, and replacement of major components. Where equipment and services are installed exterior to the building, provide a screened and secure enclosure.

The selection of equipment are to be from companies of long standing establishment where parts are accessible from numerous merchants where such items are not included in the preferred suppliers and equipment list.

Designers shall select, after comparing all design options available, the most long-term cost effective design solution that will meet the requirements of this brief and those specific to the establishment or facility. Designs shall be engineered to include equipment and materials complying with the appropriate standards. Generally, equipment and materials shall not be specified by make and model number but shall be selected on the basis of their performance, suitability, maintainability and cost effectiveness. Any proposal to specify equipment by make and model shall be formally documented for approval by the Project Officer Design Objectives shall include ESD principals and shall incorporate energy efficient design.

1.5 Existing Campus Services

All systems, services and equipment shall be fully integrated into existing campus-wide systems where applicable. These services include but are not limited to CCTV, BMS, Security and Access Control, Emergency Lighting Systems, Wet and Dry Fire systems and EWIS.

The designer shall investigate the University site's existing infrastructure capacities to determine if capacities for the new works are available. This may involve testing of water/fire mains, CCTV reports of sewer capacities and stormwater capacities, riparian zones, telecommunications, substation upgrades etc. and shall include the provision of written reports outlining upgrades and cost implications.

The designer shall ensure that a thorough investigation of the existing services infrastructure is undertaken to determine configuration and ownership which is specific to each University Campus. This would involve contacting the University Infrastructure & Facilities Services and the Utility supplier for each respective supply service.

All individual projects shall be considered in context of the impact and implications on existing campus services and identify solutions that may be beneficial to other buildings and services not immediately within the scope of the respective project.

1.6 Energy Efficiency

All designs shall incorporate energy efficient sustainable design practices in accordance with University policy and standards. Applicable energy rating schemes (over and above BCA requirements) will be considered on a project by project basis and will be incorporated in the briefing documents. Refer to separate Ecologically Sustainable Design Project Briefing document.

1.7 Site Safety and Work Permits

All works including site inspections shall be undertaken in strict conformance with the Universities Health, Safety and Environment requirements, including policies and procedures. The designer shall request the

latest versions of these policies for implementation during the design and incorporation within design documentation.

1.8 Safety in Design

Designers of Plant and Structures must comply with the requirements of the NSW WHS Act and WHS Regulation 2011. A safety in design risk assessment will be developed for the Project and proposed safety controls will be reviewed with the client at critical stages in the process.

In undertaking the Safety in Design process:

- Establish the context for the design.
- Identify the foreseeable uses of the design.
- Identify the hazards relevant to the Project as a whole and each phase of the Project.
- Undertake an assessment of risk based on the ALARP (As Low As Reasonably Practicable) model.
- Develop the Safety in Design Risk Assessment.
- Identify potential control measures and determine residual risk.
- Monitor and review the design process at critical stages.
- Communicate and consult with the Client regarding Safety in Design.

1.9 Design Life

A whole of life study, which would include life cycle costings for all building components, is required for this project. The design life selections for building components and systems located within a University structure will be expected to exceed standard industry practice for a typical commercial building.

1.10 General Advice

The consultant during the course of any stages being RFT or documentation stages will consider the following:

- Refer to all sections of this report.
- Report directly to the University's Project Director, Infrastructure & Facilities Services and or Lead Consultant which includes attendance, interface and liaison with all relevant stakeholders and other consultant disciplines.
- Provide advice in accordance with engineering best practice, energy efficiency and sustainability.
- Provide advice and assistance with the University's decision making through the provision of recommendations that comply to Regulations, Codes, Australian Standards, Local Authorities and Client requirements.
- Provide design, detail, documentation and certification of all the design elements.
- Provide inspection, certification including attendance at the commissioning stages of the installation at critical points during the construction period and also leading up to completion and final completion of the project.
- Coordinate, interface and design manage between other design disciplines to prevent abortive works,

improper planning and inconsistencies. Preference of coordination in 3D or 12D.

- Provide inspection, certification including attendance at the commissioning stages of the installation at critical points during the construction period and also leading up to completion and final completion of the project.
- Coordinate, interface and design manage between other design disciplines to prevent abortive works, improper planning and inconsistencies. Preference of coordination in 3D or 12D.
- Provide life-cycle cost assessments and value engineered solutions for all design options and at the request of the University.
- Provide cost estimates in excel format including working closely with the Quantity Surveyor to assess the cost of the works during all stages of the project.
- Ensure cost control and budget management in accordance with the agreed cost plan.
- Provide phase review reports during each design phase.
- Manage and coordinate all “own” sub-consultants.
- Provide infrastructure design and reports.
- Ensure the provision of maintenance schedules to indicate the life of the equipment, materials, (FF&E) which is to include the periodic and regular maintenance.
- Green star responsibilities are applicable for future certification.
- Ensure appropriate liaison and certification of the design by the relevant Authorities
- Investigate all incoming utility services capacities prior to commencement of detailed design.
- All data cabling, including cabling for Communication, BMS, EMS, Fire Systems and Security systems must be installed by trained and certified installers.
- Design and installation of the following must be compatible with, network with and be configured into existing University wide systems:
    - Building Management Systems x 2
    - Energy Monitoring System
    - Security Management System
    - Nexus Emergency Exit Lighting System
    - Door Hardware / Keying System
    - Fire Monitoring and EWIS System
    - IT Networks and Equipment
    - AV Equipment and Systems

2. General Design Principles

2.1 Electrical Services

2.1.1 General Requirements

Electrical installations shall comply with the requirements of the University of Newcastle's HV Safety and Operating Management Plan, AS/NZS 3000:2007, applicable Industry Regulator requirements and the Local Network Service Provider's (NSP) requirements such as the Service and Installation Rules or equivalent. In addition, electrical installations and equipment shall comply with all Australian standards that are appropriate and relevant for the type of installation or equipment to be used, irrespective of their status. Where Australian Standards are not available, recognised international or overseas national standards shall be used where they are relevant to the type of installation or equipment and to the installation conditions in Australia. The designer shall detail in the design report all standards and legislation adopted together with a clear indication of the extent and field of application.

The network is to be designed to minimise outages that would result from maintenance activities or in the event of a fault; by use of rings and redundancy.

Power factor correction shall be undertaken at the point of connection to achieve a power factor of at least 0.96.

All new designs shall consider how the new building fits into the overall campus electrical infrastructure including existing ring systems. The new design shall take into account the impact of the new project on the existing electrical infrastructure. When considering any reconfiguration of the system, the benefit to not only the new project but also other existing campus facilities should be considered.

2.2 Communications and Audio Visual

2.2.1 General Requirements

Communications on University campus sites differ from commercial installations in the level and standard of security applied and in the installation practices, which in some cases are University specific. Refer to Appendix A for the University of Newcastle Telecommunications and Data Cabling Technical Specifications.

All new University facilities need to cater for changes in "technology" and "security" and as such new cabling information systems and enclosures are to cater for this need, being cognisant of budget restraints and the user's current and future needs.

It is not the intent to specify or provide information specific to these systems, appropriately security qualified communication engineers/consultants will be expected to apply University specific standards/policies depending on the system requirements.

The large campus sites generally operate a fibre ring infrastructure between buildings supporting VOIP telephony. Copper cabling is utilised for emergency use and the interconnection of specific services.

Reference must be made to the University GFIS database for the area under consideration, or the University's preferred surveyor. The preferred surveyor and GFIS database hold services plans for all University sites. The position of services must be taken into account in design of new requirements or modifications to existing.

2.3 Security

2.3.1 General

Security works, combining both electronic and physical aspects shall be treated as a separate discipline and installed by specialist (and system certified) contractors. The University currently uses an organisation-wide card access control security system which is installed by preferred contractors and any new required security works shall conform to this system.

Detailed security design documentation and drawings shall be documented separately so as to be reviewed by the Manager of Security in order to ensure that it complies with the University security guidelines.

2.4 Mechanical and Building Management Systems (BMS) Services

2.4.1 Guiding Principles

- Facilities with cooling loads of >200kWr shall generally be CHW central plant, either dedicated or joined to existing nearby central plant.
- Small split units only to be used for on-off instances or hot spot cooling or network rooms.
- VRF systems only to be used in system up to 50kWr – multiple small circuits rather than large refrigeration circuit.
- Packaged DX units shall be avoided unless for spot cooling and provided with capacity control.
- All systems to incorporate economy cycles where possible.
- Central plants to have evaporative cooling towers.
- Multi-zone AHU's are preferred to multiple FCU's
- Large AHU's to have multi-zone VSD's with VAV box control (no reheat).
- Where full outside air is used incorporate air to air heat exchangers to reclaim exhaust energy.
- Outside air intakes shall not be taken from over roofs – preferable south eave intake.
- FCU's and AHU's shall be direct drive motors (no belts).
- Pumps to be close coupled 2900RPM motor pumps with VSD's.
- Cooling towers shall be roof mounted in preference to ground and include access ladders and walkways platforms. CT fans to be direct drive adjustable pitch low noise fans.
- Chillers shall be high-efficiency centrifugal with multiple refrigeration circuits where only one chiller is deployed.
- BMS controls shall be equal to the existing site wide existing systems and incorporate 'auto-off-manual' pots for all analogue outputs. Controllers shall be daisy chained together using dedicated

LAN with only a single Ethernet connection to head-end BMS.

- The system to be provided with an after-hours time clock to over-ride the BMS shut off
- The purge function is to be able to be controlled by inside and outside temperature parameters.
- Provide push-button timers for certain areas.
- Use of natural ventilation to supplement A/C systems.
- Where possible, make use of central steam plant for provision of steam to plant such as autoclaves in preference to local steam production.

2.4.2 General Requirements

This section describes the fundamental requirements of the mechanical services system and is intended to form a foundation for further design investigations associated with the next stages of the works – Concept Design Report, followed by Detailed Design. The contents of this section are listed below:

- Energy Efficient HVAC Systems.
- University Air conditioning Policy.
- Reticulated Fluids and Pipework Systems.
- Exhaust Systems.

The critical aspects of Mechanical Services are to address the following:

- Assess existing systems if to be retained.
- Goals.
- Thermal comfort.
- Energy efficiency.
- Code compliance.

2.5 Hydraulic Services

The following is considered to be a basis of guiding principles for all projects;

- All domestic hot water shall be provided by solar pre- heat gas boost with collectors only to be North orientated.
- Where feasible rainwater harvesting is to be used.
- Each facility and or building is to have separate pulse meters for all services.
- Hot water reticulating systems comprising of a flow and return pipework are to have control panels incorporating time clocks with 12/24 hour changeover.
- All tap-ware including PC items are to be water efficient and be WELLS rated.
- Hot water is to be only provided to amenities and toilet facilities incorporating showers.
- Where gas services are provided they are to be metered with pulse meters incorporating filters, pressure regulator and isolation valve.
- A separate fire supply is to commence at the main meter assembly prior to reticulating throughout the

building incorporating locked and tagged isolation valve.

- Where toilet facilities are large halls or similar that have high usage rates a mains pressure flushing system is to be used.

2.5.1 General Requirements

The design and capacity of each existing and proposed system is to be reviewed by the designer. Establish the owner of the utilities whether it be existing internal or external to determine whom is the owner of the piping system reticulation. All systems incorporated into new, extended, and refurbished buildings shall considerer the impact of the new systems on the existing site infrastructure and individual systems. Potential system issues shall be reported and design solutions produced.

Designers shall select, after comparing all design options available, the most cost effective design solution that will meet the requirements of this brief and those specific to the establishment or facility. Designs shall be engineered to include equipment and materials complying with the appropriate standards. Design objectives shall include reference to preferred suppliers and equipment list, environmentally sustainable design and energy efficiency.

Designers shall investigate all services for compliance with current AS/NZS Standards, Plumbing Code of Australia, University Standards and Local Authority requirements. Advise in writing to the University the owner of the assets, current loads/flow rates, upgrades for the current project and future proofing.

2.6 Lifts

2.6.1 Guiding Principles

- Refer to UON Guidelines for the Design of Vertical Transportation Services.
- Lifts shall be suitable for passenger/disabled/goods access.
- Lifts to be of the counterweight type rope-belt high efficiency with UPS to allow open at the next lower floor after the event of a power failure.
- Lifts shall be motor-roomless type.
- Lifts shall be of the guiderail roller type.
- Lift car shall be chosen with orientation giving maximum door opening.
- Internal light shall be of the LED type.

2.6.2 General

All consideration must be given to a proposed development when considering the requirements of vertical transportation (lifts) and their effect on the other buildings.

The requirement of a lift for a proposed project must first consider the existing pathway network, orientation and disabled access points to and from the lift access point, whether it be ground entry or elevated entry.

The campus is connected by a large network of pathways, with some installations having building to building elevated walkways above natural ground level. Some upper levels of buildings are provided with ramp access in lieu of lifts. Consideration shall be given for the provision of lifts to satisfy disability access to multiple buildings from a single lift, eg ramps, elevated walkways and the like.

In addition to the above, nominated egress/exit points from the proposed development shall be incorporated when looking at the installation of a lift.

Lift design shall also follow the minimum requirements of the enhanced accessibility codes.

2.7 Wet and Dry Fire Systems

2.7.1 General

The fire protection/detection systems offered ie: EWIS, fire hydrant, fire sprinkler, fire extinguishers, fire suppression must be approved by Infrastructure & Facilities Services, early in the design stage.

A detailed risk analysis is to be carried out to ascertain the most appropriate means of protection of all mission critical areas. As a minimum, the risk analysis should include automatic sprinkler systems, including pre-action type, gaseous suppression systems, wet fire (hydrants, sprinklers, hose reels), VESDA and smoke hazard management.

2.7.2 Fire Indication Panels and EWIS

All new facilities shall be equipped with a Smoke Detection and Fire Occupancy Warning System (EWIS) regardless of the provision of same being a requirement of the Building Code of Australia (BCA). A local Fire Indication Panels (FIP) and EWIS panel shall be networked to the Site Main FIP and EWIS Central control and be fully integrated for centralised remote monitoring and EWIS alarms and announcements as part of the Campus wide emergency management system.

All systems including FIP/EWIS systems shall also comply with minimum requirements of AS1670.

3. Electrical Services

3.1 Standards and Codes

As a minimum, the following codes and standards define the design and installation requirements that are applicable:

- The current version of the Building Code of Australia (NCC) – National Construction Code.
- All local Supply Authority requirements.
- NSW Services and Installation Rules.
- AS/NZS 3000:2007 Wiring Rules.
- Relevant University Design Standards.
- University High Voltage Networking Strategy.

3.2 University of Newcastle Electrical Specifications

The Engineering Service Briefing documentation is to be used as an overall design guideline for electrical works, The University of Newcastle Electrical Specifications are to be followed in addition to these guidelines. The Electrical specifications include:

- UON-ESS-101 General Electrical Specification
- UON-ESS-102 Distribution Board Specification
- UON-ESS-103 External Lighting Spec
- UON-ESS-104 Emergency Escape Lighting and Illuminated Exit Signage
- UON-ESS-105 Preferred equipment list
- UON-ESS-106 Generators
- UON-ESS-111 Interior Lighting and Control
- UON-ESS-112 Main Switchboards Specification
- UON-ESS-100 Specification Index

If there is a discrepancy between the Engineering Services Briefing document and the UON Electrical Specifications, it is to be addressed with the UON representative.

3.3 Electrical Contractors Approval

All Electrical Contractor intending to work at Newcastle University need to be approved by the University of Newcastle Electrical Asset Engineer or Mechanical Asset Engineer. The contractor will be required to produce the following documentation:

- Safety Management Plan.
- Copy of a blank SWMS or Risk assessment used by the company.
- Copy of standard Safe Work Procedures.
- The Isolation or Lockout policy.
- Live work policy.
- Past work/project resume.
- Electrical Licences for all Electricians.
- Electrical Contractors license.

The Electrical Contractor should request and familiarise themselves to the University of Newcastle ISMP (Installation Safety management Plan). This document can be provided upon request.

3.4 Outline of Works

The scope of services to be designed to requirements include but may not be limited to the following:

- Power supply from University HV network.
- Any required Substations (Review existing power supply, provide site demand assessment and document any required supply augmentation upgrades plus any additional works).
- Main switchboard's (MSB) and metering.
- Internal and external lighting and emergency lighting systems (incorporated into the Campus wide emergency lighting strategy).
- Interior and exterior power reticulation, MSB, DB's and cabling etc.
- Data and communications cabling and equipment.
- Security and Access control systems.
- Electronic fire detection systems.
- Lightning protection systems.
- UPS systems for communication equipment as required.
- Back-up emergency generator (subject to project specific requirements).

Incorporating all electrical systems and services into the existing University infrastructure as required.

3.5 External Electrical Services

3.5.1 Existing 11kV System

The Designer shall confirm the owner of the site electrical supply assets. These may include both Authority and University owned assets (note that the 11kV reticulation system on the Callahan Campus is owned by the University).

The capacity of the existing Ausgrid 11kV feeders and existing loads are unknown. The designer is to review site requirements and consult with the supply authority to determine any required upgrade of these services.

3.5.2 Service Corridors and Easements

The designer shall ensure that the engineering services are developed in a manner that rationalises the need to cross roads, pathways, car-parks, and other paved surfaces.

Wherever possible, electrical services shall be located in the designated service corridors within road reserves as identified.

HV Cabling shall be installed in conduit or direct buried and HV rings and spurs shall be appropriately protected with translay and directional protection relays.

The designer shall ensure that all underground engineering services locations are Surveyed and recorded on As-Installed documentation in an accurate manner. Cables shall be run through cable pits located not more that 100m apart on straight runs and on changes of direction. If required, appropriate cable locating transponders will also be provided between cable pits at a maximum spacing of 20 – 30m.

No high voltage or trunk low voltage services to remain or be placed underneath buildings or in a position that could conflict with any other proposed building site. Such services, where conflicting with the proposed site shall be relocated clear of the site.

Generally, joints in existing cables should be minimised, with preference given to running the cable back to a substation.

3.5.3 Interface with Existing Services

Where new works are to interface with existing services the designer shall arrange for pre-design surveys of the existing services, where necessary, to ensure the accuracy of existing documentation and the coordination of design. The capacity of the existing services will also need to be determined by the designer.

Where the capacity of existing services is found to be insufficient and the increase in capacity is large enough, the Designer will need to consider alterations to the site High Voltage Networking Strategy.

3.6 Power Supply

The designer shall ensure that each new, refurbished or leased facility is provided with a suitable power supply in accordance with the requirements of Ausgrid, NSW Service and Installation Rules and AS/NZS 3000:2007. In determining the requirement to achieve this, the designer shall review the existing reticulation system and the feeders to provide an adequate capacity and also the impact to the current energy and network agreements. The designer, when determining if augmentation works are required to the reticulation system, needs to consider the owner of the reticulation and negotiate accordingly.

The designer will ensure that the new or additional load does not adversely impact on current or proposed electricity retail and network connection agreements/contracts.

Where part of the reticulation is owned by a third party, the designer shall liaise with the third party and incorporate any additional requirements. All such requirements shall be agreed to by the University prior to any formal agreement or undertaking being made with any third party.

Where University owned reticulation needs to be modified or augmented to cater for the new or additional load, the designer in consultation with the Project Officer needs to consider the paragraphs below to determine if a Project Electrical Development plan is required. This is to ensure the orderly development of the reticulation system minimising abortive work whilst catering for the future planned requirements of the establishment. They are normally to be undertaken as a preliminary study but are required where the proposed modifications are not simple and where there is insufficient guidance provided by other studies or existing documentation.

3.6.1 Network Service Provider Augmentations

Where the feeders to the University or establishment are or will be overloaded or where new feeders are required, the designer is to investigate and liaise with the Authority on the options and costs to provide the appropriate power supply. No undertaking should be given without prior formal agreement with the University.

Where it is necessary for Ausgrid to augment their reticulation system, the designer shall submit a report to the Project Officer detailing the negotiations with Ausgrid for consideration and agreement addressing the following:

- Deficiencies in the existing arrangement.
- Proposed power supply arrangement to cater for the establishment, addressing the master plan requirements, and for a suitable period of load growth (normally 15 years where possible). The Designer needs to detail the options considered, and how the recommended option was chosen and how this option represents the best option available.
- Ausgrid reticulation arrangement particularly identifying key redundancies or possible failure points in the reticulation system.
- Alternate feeder requirements, if applicable.
- Impact to existing electricity retail agreements/contracts and also network connection agreements or similar.
- Network charges for each option. Consideration should be given to the most suitable supply option on a through life basis (ie capital works costs and ongoing network charges). The most cost effective option based on a minimum five (to ten) year payback should be considered, even where this requires connection at a higher voltage or has higher capital works contribution.
- Augmentation costs identifying the contribution to Ausgrid and the basis of these costs. The designer should also identify if the works are contestable and whether it should go to the market to achieve value for money.
- Address any configuration changes required on the University reticulation system and the costs to implement these.
- NPV calculation and through life assessment of the respective costs of each option to assist consideration.

3.6.2 Reticulation Augmentations

When determining the requirements to provide a power supply for the facility, the designer is to review the existing reticulation including the high voltage system and nearest substations, for adequate capacity; and the High Voltage Networking Strategy.

Where it is found necessary to augment the distribution system the designer shall design the augmentation works in accordance with the Project Electrical Development Plan where available.

Where the required augmentation is only relatively simple in nature such as the addition of a single substation and the existing reticulation system has adequate capacity to cater for the new facility or load, the design report is to reflect the outcome of these investigations and detail the proposed works for approval by the University. The design report is to detail as a minimum, the facility assessed maximum demand, existing reticulation loads and capacities, suitability for load growth and the proposed augmentation works.

Alternatively where considerable high voltage system augmentations are required reasonable work to the reticulation system such as a number of substations, more than one hundred metres of high voltage cable or the ring does not have capacity, a project Electrical Development Plan shall be developed by the designer to confirm suitability of the proposed augmentation Development plan requirements are provided below.

3.6.3 Planning Considerations

Whenever a new substation is augmented or added to a reticulation system an assessment is required on the high voltage system to confirm adequate capacity exists on the feeders to the University and the high voltage rings on the University. If insufficient capacity exists in either, or the extent of work is considerable, a high voltage Project Electrical Development Plan is required to be prepared in accordance with the University High Voltage Networking Strategy. All augmentations and Electrical Development Plans shall be in accordance with this strategy.

In determining the required augmentation and the outcomes of the development plan, the designer shall assess the existing loads and capacities, estimate the load of the new facilities and master planned facilities and include sufficient capacity for natural load growth of three percent per annum. Where a current electrical master plan does not exist for the establishment, the development plan must fulfil the basic electrical master planning requirements to ensure that the development plan represents the progressive development of the reticulation to meet the master planned site requirements minimising abortive work in the future growth of the system.

The designer shall also consider all suitable options in determining the recommended system configuration that shall also include the outcomes of any negotiations with Ausgrid.

Other aspects the designer must consider include replacing switchgear that is unsupportable, beyond its economic life, or where the switchgear or equipment does not meet the required system performance or fault level.

All substations and equipment affected by the required works shall be replaced or upgraded, however, substations and equipment not directly affected need to be assessed on a case-by-case basis against the available funding for the project (eg possible requirement to upgrade upstream 11kV switchboards etc).

3.6.4 Investigation of Existing Infrastructure

The designer shall allow to review all relevant plans and reports concerning the university electrical reticulation system and report on the shortfall in information.

Where the electrical reticulation system is to be investigated, the designer shall consider the following and detail the outcome of his investigations in the design report or possibly as a separate report as part of the development plan:

- Additional load contribution from each facility.
- Capacity of each HV ring and feeder.
- Existing load on each HV ring and feeder.
- Any particular operating requirements or constraints (eg feeder cannot be operated in parallel continuously, small ring cable sections).
- Planned loads and natural load growth of at least 2% pa.
- Load flow analysis, protection coordination study and insulation coordination study. The load flow analysis shall confirm the voltage regulation of the high voltage system adequately meets the supply characteristics of AS/NZS 3000 for both normal and abnormal load flow conditions.
- Identify under capacity, outdated or unserviceable equipment effected by the works requiring replacement.

In investigating this requirement, the designer must consider the high voltage system requirements below. Should any of the HV rings not have sufficient capacity to meet the required loads the designer shall investigate the options to establish sufficient capacity which shall include considering redistributing the load over other existing rings and the establishment of a new HV ring.

3.6.5 High Voltage System Requirements

In determining the required augmentation work the consultant shall consider the following basic requirements in coordination with the University High Voltage Networking Strategy:

- Each HV feeder is to be able to support the total campus load with the other feeder out of service, unless agreed that the alternate feeder provides only part alternate supply.
- High voltage rings must be able to support the entire ring load in either direction (ie open point at either end of the ring.
- Operational facilities and important facilities shall be connected on a ring main system that provides two sources for high voltage supply through switching to the substation supplying the facility.
- Sufficient load growth must be allowed in new high voltage rings. Normally rings should be designed with spare capacity up to around 50% based on master planned loads but no less than 25%.
- High voltage cables shall be separated appropriately to avoid single event failure condition and de-rating or 5m whichever is the greater. This clearance includes the return leg of any cabling to a substation or switching station.
- All establishments have standardised electrical equipment arrangements that needs to be accommodated and maintained as part of the design.
- Spares and redundancy requirements need to be addressed and catered for as part of the design.

3.6.6 Substations

New and refurbished substations shall be in accordance with the relevant Australian Standards and University requirements. As the most appropriate substation type will be project and campus specific, the designer shall confirm prior to generation of the project brief the preferred substation types which may include chamber or kiosk types.

Where substations are Authority owned, they will be provided in compliance with Authority Requirements.

Chamber Substations

Generally substations located on the Callaghan Campus shall be Chamber type substations. The substation shall have sufficient capacity to provide redundancy in the event of a fault. The station should be designed with two transformers, sized accordingly to allow its load to be supported by one transformer.

Critical buildings shall be designed with substations with dual supply and bus tie to allow for MSB reconfiguration on-load without the need to disconnect load to reconfigure switching.

Substation LV Distribution Boards shall be supplied to provide substation auxiliary services as well as common outdoor path, car parking and road lighting via PE cell and off/auto/man override switches. Substation LV distribution boards should also be designed to incorporate a manual generator change over switch; and external generator connection point in a location suitable to safely store the temporary generator.

A common substation alarm shall be provided consisting of Circuit Breaker trip alarms, faults, power factor alarms, transformer protection faults etc. The common alarm shall be connected to the University Critical Alarm System (not BMS).

Kiosk Substations

Where a kiosk substation is provided as the only practical option (with approval from IFS), it shall be fed from a HV Switch from the nearest chamber substation as a spur with HV protection at the main switch. The protection for the spur shall be graded and cascaded with upstream protection to prevent tripping of upstream protection should a fault occur on the HV spur.

Kiosk substations shall not be installed as part of a ring or daisy chained as part of the spur line.

General

All substations shall consist of dry type transformers and SF6 or Vacuum Circuit Breakers fitted with translay and differential protection.

The substation LV switchboard shall have the capacity to supply the proposed new facility or facilities with spare capacity for future expansion provided for the supply of additional buildings.

Buildings shall be provided with a dedicated Main Switchboard (located as near as possible to the building entry) with a single dedicated supply mains from the substation LV switchboard. The chamber LV switchboard shall not be utilised as a Building MSB. Should expansion of a building require an upgrade of the supply mains cabling, the cabling shall be replaced rather than installing a parallel supply.

All building mains shall be metered within the substation LV switchboard.

3.6.7 Earthing

Earthing for electrical cabling installations shall in accordance with AS/NZS 3000:2007 and Ausgrid requirements.

Separate earthing systems or earth reference points, where required in buildings, are to be bonded in accordance with AS/NZS 3000, AS/NZS 1020 and AS/NZS 1768. In meeting this requirement the designer is to ensure that the design does not compromise the engineering requirements of the earthing systems and that the potential for earth loops in the facility are eliminated.

3.6.8 Trenches and Cabling

All underground cabling shall be installed in accordance with Supply Authority requirements, NSW Open road requirements and AS/NZS 3000. Site specific requirements shall also be taken into account in the design.

High voltage cabling shall be installed in conduit or direct in ground and in a manner that does not attract de-rating, particularly due to grouping. Cable ratings shall be maintained and consideration shall be given to larger cable sizes to avoid significant de-rating due to soil conditions or the requirement to install in pipes in paved areas.

As a general rule, 120mm^2 Cu cable is the minimum acceptable high voltage cable size to cater for fault levels. The designer shall confirm the required design cable ratings for each ring.

High voltage tee joints or branch joints are not permitted in reticulation systems.

All new high voltage cabling shall wherever possible be installed in common trenches along with LV reticulation and communications and control cabling.

3.6.9 Surge Protection

Parallel surge diverter protection shall be provided for the distribution system and within all MSB's and Distribution Boards. The surge equipment shall not disconnect the power supplier when operated. Diverters shall be as per the preferred suppliers and equipment list and shall be installed strictly as per the manufacturer's recommendations. All surge diverters within a building shall be monitored as a common alarm monitored by the Campus Wide BMS systems all overhead and underground junctions shall be suitably surge protected. All surge diverters shall be installed in a way to allow indication flags to be visible without removing any panels or escutcheons. Surge diverters must be labelled accordingly.

3.7 Uninterruptible Power Supply (UPS)

Uninterruptible Power Supply (UPS) systems (if required) shall meet the UPS equipment specifications and requirements defined on a project by project basis. The designer shall confirm the UPS specification and project requirements with the Project Officer.

Where large UPS systems are required (eg data centres), they shall be fitted with internal and external maintenance bypass infrastructure to allow complete removal of a UPS if required while maintaining supply to critical equipment. Additional building services such as ventilation and air conditioning of the UPS rooms shall be considered.

Dependant on the criticality of the facility, additional redundancy of mains supply, generator backup or connection point etc. may need to be considered.

3.8 Building Electrical Services

3.8.1 Lighting

It is a requirement that a functionality statement confirming lighting control be provided. This is to include interface with the BMS system.

The minimum standard to be provided is that required by the relevant Australian Standard.

Interior: To AS1680 series.

Exterior: AS1158.3.1 and AS4282.

3.8.2 Lighting

Interior Lighting

All lighting systems shall comply with the recommendations of relevant Australian standards and the NCC Section J and applicable parts.

All light fittings shall be of high quality, designed for a minimum service life of 20 years and be designed to provide a high level of energy efficiency.

New lighting systems shall be based on the use of luminaires fitted with T5 lamps or LED lighting where applicable. Another minimum design option is the use of T8 lamps with low mercury and electronic control gear. The selection is to be based on current applications and suitability for the design.

Lighting control systems shall be designed to provide automatic control of lighting. Functions shall include Daylight Dimming, Occupancy Sensing, push button timer, automatic timer and Security/Access lighting control as a minimum.

Larger areas shall be configured to prevent the whole area being unexpectedly put into darkness. The lighting will be able to be turned back on by an occupant if required. Sensors shall be ultrasonic or types suited to longer detection ranges and multiple sensors shall be utilised in a single space if needed and be selected from the preferred suppliers and equipment list. Thought must be given to the use of sound and motion detecting sensors to prevent these issues.

In spaces where lighting is controlled by an automated system, a minimum 25% of lights are to remain on at any one time to provide transition lighting.

Plant rooms and maintenance spaces shall be fitted with dual circuits and timers, which are to be set to different time limits to allow an occupant time to react when one circuit times out.

All light fittings shall be provided with permanent labels with the notation "Replacement lamps must be daylight colour".

Lighting to toilets, cleaner's rooms, store rooms and the like, must be controlled by Passive Infra-Red motion detectors of a type acceptable to the University. Such detectors shall have adjustable light level sensitivity with reset after an adjustable time period of 10 seconds to 20 minutes.

Exterior Lighting

Exterior lighting shall generally have little upward component ("Dark Sky" compliant). Mercury Vapour and incandescent reflector lamps shall not be used. Preference is for LED lighting. The designer shall

select approved luminaires but shall consider aspects of the luminaire such as bird proofing, water ingress and heat sink configuration and vandal proofing.

All external light poles shall be identified by a unique number as approved by IFS.

External lighting shall be controlled by timers, photo cells or Passive Infra-Red motion detectors as appropriate.

External lighting mounted on a building or in direct vicinity of a building shall be controlled from within the building. Common exterior lighting such as car park lighting, walk way lighting and road way lighting etc shall be controlled from a dedicated lighting control panel within the nearest substation. All controlled lighting shall be fitted with Off/Auto/Manual switches and be controlled by PE Cell/Timer or BMS.

Emergency Lighting

Emergency lighting shall be provided as per the requirements of the BCA. All new emergency lighting installed in new buildings or refurbishment work shall be consistent with the site wide strategy allowing remote management and test facilities and be selected from the preferred suppliers and equipment list. Preference is for low wattage or LED types.

The installed system shall allow ease of addition of fittings, removal and replacement of existing fittings and reconfiguration.

The installing contractor must allow for all installation requirements set out by the manufacturer, and also engage the suitable contractor for commissioning.

3.9 Electromagnetic Interference, Radio frequency Interference, Disturbances and Harmonic Limitation

The designer shall prevent interference to equipment and services. Limit interference, disturbances and distortion in accordance with relevant codes and standards including the following standards:

AS/NZS 61000 Electromagnetic capability

AS/NZS CISPR Limits and method of measurements of radio Disturbance characteristics of electrical motor operated and thermal appliances for households and similar purposes, electrical tools and similar electrical apparatus.

Electromagnetic compatibility (EMC) is the ability of a device (an equipment or system) to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment (AS/NZS 61000.1.1). All devices supplied, including drives, variable speed drive (VSD), motors, appliances, wiring and the like, shall be compatible with the levels of radiated and conducted electromagnetic energy found in similar buildings and shall not be susceptible to disturbances present in the environment nor shall their emissions result in electromagnetic interference.

All devices shall comply with the mandated standards in the EMC framework issued by the Australian Communications Authority (ACA) or Australia Communications and Media Authority (ACMA), with the State Electricity Distribution Codes, the Statutory Regulations contained in the State Service and Installation Rules and with IEEE Standard 519 and AS/NZS 61000.3.

Where devices are likely to be incompatible with emission levels, power quality, etc., they shall be provided with suitable filtering and conditioning equipment to ensure correct operation in the environment encountered and compliance with the above standards.

All devices provided shall be designed to eliminate interference to other electrical and electronic devices either in the vicinity or likely to be affected by the device directly or from induced interference from cabling connected to or in proximity to the device.

All required devices used shall have a C-Tick label that has been registered with the ACA.

3.10 Voltage Drop

In accordance with AS/NZS 3000, the maximum permissible voltage range at any point in an electrical installation under normal service conditions, excluding voltage transients such as those due to system switching, shall be 400/230V +10% −11%. This is based on the nominal supply voltage of 400/230V +10% −6% and the maximum permissible voltage drop between the point of supply and any point of an electrical installation of 5%.

The designer must determine the supply system characteristics which shall be accounted for in the electrical distribution system design to ensure the voltage is maintained within the above voltage range.

In determining the voltage drop, a minimum 25 percent load growth allowance or suitable master planned load allowance, whichever the greater, shall be used in addition to the estimated maximum demand.

Transient voltage performance (where outside the above voltage range) needs to be checked against the facility or equipment requirements to ensure the correct operation of the installation and equipment. Where equipment is susceptible to voltage transients the designer must ensure that the electrical installation is designed to meet the equipment requirements.

In determining the voltage drop the designer shall consider:

- Use of the electrical installation.
- Any special equipment requirements.
- Location and distribution of the load. Location and arrangement of the loads dictate the requirement for additional distribution boards.
- Characteristics of the load such as the effect of motors and effect of fluorescent or discharge lighting. Adequate allowance is required to cater for transient performance. The effect of low power factor and switching transients and impact of high current draw need to be adequately catered for and may require dedicated submains and distribution boards.

3.11 Circuit Arrangements and Spare Capacity

The designer is to review all equipment and user requirements in determining the most appropriate and cost effective electrical distribution layout. Adequate spare capacity is required as follows:

◗ Switchboards	◗ 25% spare capacity. ◗ 25% space for additional switchgear.
◗ Consumers Mains and submains	◗ 25% spare capacity.
◗ Power circuits	◗ Maximum 8 double socket outlets per circuit with a minimum 30% spare capacity. ◗ Minimum 4mm^2 cabling.

- Lighting circuits
  - Maximum 66% utilisation (ie 33% spare capacity).
  - Minimum 2.5mm^2 cabling.
- Cable trays and ducts
  - 50% spare capacity.

Dedicated power circuits shall be provided for equipment loads. Where appropriate the designer shall consider the installation of distribution boards for the connection of the equipment. As a general rule dedicated circuits shall be provided for the following:

- Each communication equipment rack.
- Lighting.
- General power.
- Electrical equipment.
- HVAC/mechanical services.

Care shall be taken to limit the number of points on a circuit and to distribute the points with leakage current in order to avoid nuisance tripping.

Power requirements can be deduced from the respective room data schedules.

ELCBs shall be provided to all lighting and power circuits as required by the supply authority.

3.12 Selection of Equipment

All electrical equipment in an electrical installation (ie cables, accessories, appliances, switchgear, control gear and the like) shall be suitable for use which encompasses safety from shock, prevention of injury and prevention of any adverse effect in accordance with AS/NZS 3000.

3.13 Switchboards

All buildings shall be provided with a dedicated Main Switchboard with a single dedicated supply mains from the substation LV switchboard located within the substation.

Dedicated submains shall be provided to all individual distribution boards within the building. Rising mains feeding multiple DBs will not be acceptable.

The location of the main switchboard shall be readily accessible from the entry of the building. Main switchboards require special consideration since in an emergency situation such as a fire, the switchboard will need to be located and operated by persons unfamiliar with the installation and the disposition of the equipment on the switchboard. This requires the main switchboard for a building to be located within easy access to the entrance of a building with its location clearly indicated at the main entrance, by a sign if necessary, and at the fire indicator panel.

All switchboards shall comply with AS/NZS3000 and AS3439.

3.14 Residual Current Devices

Residual Current Devices shall be incorporated into the facilities in accordance with the requirements AS/NZS AS3000:2007.

3.15 Power Factor Correction

Power factor correction shall provided at the Authority connection point. This may be HV or LV power factor correction or the augmentation of existing power factor correction to maintain a minimum power factor of 0.96 lagging.

PFC Units shall have automatic control with suitable capacitive steps (minimum of 5) to provide stable control of the power factor. Duty cycle of the steps shall be controlled to prevent unequal duty of the small capacitor stages. The designer shall ensure any power factor correction is designed with capacitive steps suitable to the size of the load and has spare capacity for a minimum of 20% additional capacity.

3.16 Lightning Protection

The designer shall investigate the requirement for lightning protection. Lightning protection, where provided, shall be designed and installed in accordance with AS/NZS 1768. The following facilities shall be provided with lightning protection irrespective of the assessment:

- Where the facility type of construction allows lightning protection to be installed or incorporated at little cost (eg fully metallic construction).
- Alternate protection schemes shall be considered such as single point sphere or copper strap down conductors connected to a single earth (separated as far as possible form building systems and services). The preferred protection scheme shall be approved by IFS.

All computer accommodation and other sensitive equipment shall be provided suitable surge, inline filters and transient protection.

Surge protection shall be installed on the incoming supply within all Main Switchboards and distribution boards and selected from the approved suppliers list.

3.17 Metering

An intelligent meter shall also be provided for each new facility in addition to the requirements of Section J of the BCA. The preferred location for this metering is at the substation to minimise control cabling, however for large facilities with multiple meters install the meters at the facility. Where a substation supplies only one significant facility the additional meter for the facility can be omitted.

All intelligent meters shall be selected form the preferred suppliers and equipment list and shall be able to be interfaced to a site energy monitoring system and have the following minimum parameters:

Chamber substation and facility meter panels shall include all required ancillary equipment including Ethernet bridges, isolation switches for auxiliary supply, fuses, CTs and shorting links. Chamber substation metering panels shall allow for sufficient space for at least 7 meters.

Connection of gas and water metering to the energy monitoring system shall also be required.

Meters must be compatible with the existing energy monitoring system and set up so that they are added to and configured in the existing energy monitoring system.

3.18 Handover of New Works/Commissioning

The designer shall acquaint themselves with the university access and operating requirements and make all necessary allowances in the design. In particular the designer must ensure that appropriate requirements are included to address the following:

- Access permits, vicinity permits, dig permits, etc.
- Requirement for the contractor to have all necessary skills and training such as recipient training.
- Requirement for standard keying arrangements.
- Access to the high voltage systems including method of works and constraints in opening the high voltage system or any configuration changes effecting continuity of supply either directly or by subsequent fault.
- Required commissioning and acceptance procedures for new installations including the completion of all required tests and proving the system is safe to the requirements of the operating authority before connection.
- Requirements of Ausgrid.

The staging of the works shall ensure that where the high voltage system is opened, the duration of the outage is as short as practical. Under no circumstances shall the reticulation system be left with an open ring for greater than three days and all such works require prior approval from the Infrastructure & Facilities Services representative.

Before Infrastructure & Facilities Services can accept any new equipment for connection to the high voltage system and the designer must ensure that the following minimum requirements are documented as an obligation of the Contractor:

- All required tests have been undertaken and compliance certificates of Infrastructure & Facilities Services such as (but not limited to) earth mat resistance tests, high voltage withstand tests and polarity tests.
- All switchgear and equipment is correctly labelled and that the new labels for the existing reticulation are ready for change or changed as required by the Infrastructure & Facilities Services.
- All required safety equipment is provided, including all signs and barriers.
- Where new equipment is installed all appropriate operating and maintenance information is provided, including the requirement to train the operators where necessary in the operation of the new equipment prior to connection of the equipment.
- Revised documentation, acceptable to the Infrastructure & Facilities Services and reflecting the new system arrangement are provided.
- The new installation has been certified by the contractor as meeting the requirements of all appropriate legislation and standards and the requirements of the design brief.
- Before any testing commences, ensure that all equipment likely to be damaged by such testing has been removed from the circuit under test, or has been isolated and earthed. For example: dimmers, lighting controllers, electronic components and the like. All system voltages must be checked to confirm that their magnitude and type is compatible with the interconnected components. All testing and verification must be completed as required by AS3000, particularly Section 8.

Insulation resistance tests must be carried out on all LV main switch boards, LV distribution boards, LV cables and auxiliary equipment as follows:

- The test voltage shall be applied to each conductor and the resistance recorded.
- Voltage rating of insulation testers shall be 500V for LV equipment.
- Acceptable minimum resistance value is 1 MΩ.

On failure of a resistance level test, investigation and rectification works must be completed prior to energisation.

Check that all installed cable sizing complies with the requirements of AS3008.1, AS300 and the Service Rules of the Local Supply Authority.

The contractor must carry out the following:

- Check all relays, contactors, controllers, switches, and push buttons for operation, correct installation, adjustment, rating and labelling;
- Check all circuit breakers, fuses, type and rating and compare with specification and schematic diagrams;
- Primary Injection tests on all protection equipment
- Check tightness of cable terminations, and correct labelling of all cables, cores and termination strips where required;
- Energise lighting and general purpose outlet circuits one at a time. Check that each item is energised by the correct circuit in accordance with the electrical schematic. Check that lamps operate and replace as necessary. Check each power outlet for correct voltage and correct polarity of the device. Check all switches for correct operation;
- Complete a neatly typed schedule for each distribution panel and insert inside the panel in door storage provided;
- Carry out night test on external lighting to ensure correct lux levels and realign luminaries as necessary.

Complete all others tests as detailed in AS3017 “Electrical Installations – Testing and Inspection Guidelines.” Use the latest issue of the drawings during pre-commissioning. Mark any drawing changes up neatly using a red pen, and submit to drafter for modification. Provide all final, “as wired” drawings at commissioning.

Check continuity of static earthing throughout all steel work within the installation. All earth resistance testing must be completed using and an approved test instrument, and carried out in accordance with the requirements of AS/NZS 3000 Part 1 before and after the installation is bonded to the grid. Resistance readings shall be recorded and shall not exceed one ohm (1Ω) for the earthing system.

On completion of all checks and testing, ensure that all equipment that has been disconnected and/or removed to enable such checks and testing to be carried out has been replaced and/or reconnected. For example, verify that all links have been closed and tightened, all fuses replaced, all terminations made and tightened, components replaced and/or reconnected, and all covers and the like replaced.

The contractor must submit the Certificate of Compliance – Electrical Work (CCEW), covering all installation work, to the Local Electricity Distributor. As well as supplying the CCEW, the person who conducted all testing must submit test reports certifying the electrical installation.

All grading curves results must be submitted for circuit breakers and fuses.

After completing each test outlined in AS/NZS3000 Section 8, the contractor must provide a checklist confirming that each test has been undertaken and successfully completed. This must be signed by the certifying officer. All these documents must be included in the Operation and Maintenance manual (O&M), and submitted to the UoN project manager upon completion. The completed checklist should be supplied to the UoN project manager or Electrical Operations engineer at least 5 days before pre-commissioning where practicable.

4. Communications and Audio Visual

4.1 Communications

Communications installation shall, as a minimum, be designed in accordance the following:

- University IT Cabling Specification.
- AS3080 and other relevant standards.
- ACMA requirements.
- AS/ACIF Standards.

Note that Active equipment such as Switches etc shall be provided by the University. All other cabling and cabling infrastructure shall be part of the designed works.

4.1.1 Data Communications

Data Communications shall be provided to all buildings as follows:

- Refer to the UoN Telecommunications and Data Cabling Technical Specification for new buildings and installations within existing buildings.
- Copper cables horizontally terminated in RJ45 wall plates and RJ45 patch panels fitted to the floor/building telecommunication closets.
- All outlets within the buildings will be terminated in wall plates and FOBOT fitted to the floor/building telecommunication horizontal cabinets.
- All new fibre optic cabling must be single mode, for both internal and external use.
- Any existing LAN Network may require extension and upgrading to support new buildings including additions to the Central Switches.
- Planned augmentation of the LAN for Redevelopment shall cater for new buildings in capacity and access.
- All works associated with the Local Area Networks shall be to the approval of the University.
- The Site shall be provided (all new works) with a minimum 20 year Manufacturers' Certification of Cable Asset, covering the full installation, including all parts and labour.
- The data system serving the BMS shall be isolated from the building data system.
- Notification must be provided to University IT Services prior to the commencement of all communication cabling work at the University of Newcastle.

4.1.2 Site Critical Alarm System

The Critical Site Alarm System also utilises the existing structured cabling system (with the additional of test buttons at the wall outlet). Separate patch leads (Pink in colour) shall be utilised to connect the alarm system (located within the LAN room) to the structured cabling system for site wide integration.

4.1.3 New External Cabling

- New external cabling shall be provided as required to connect to the LAN for data and voice services. The external cabling shall also provide misc systems, which cannot be supported on the fibre LAN. The LAN will support Fire Alarms, Security, Access Control, Emergency Lighting Systems, CCTV, MATV and OH&S Systems.
- The new external cabling should be single mode fibre optic cables integrated into the LAN.
- New external copper cables shall be used to link minor building voice outlets to the nearest remote PABX node. The target should be to migrate all major links for voice on fibre.
- All external cables are to be tagged with identification in each pit.
- All data external cables shall be single mode fibre.

New external communications cables shall be located wherever possible within University Standard Combined Services Trenches/Layouts adjacent roadways.

No joints external to buildings should be installed as part of the new cabling below Ground Level.

All external communications pits and conduits shall be installed in accordance with Australian Standards. Polycrete pits are not acceptable. Where lightweight P8 pits are used, they are to be fitted with cable rests and concrete surround 200 mm wide to a depth of 500 mm. All conduits entries to pits shall have bell mouths.

4.1.4 Maintenance of Communications throughout Construction

It is expected that the following communication services may be disrupted:

- Voice Services.
- Data Services.
- Fire Alarms.
- BMS.
- Security Systems.
- Access Controls.

It is essential that maintenance of communications is co-ordinated with the local University IT representative. Interruptions can only occur with the acceptance of the Users and within the time period specified by the Users.

4.1.5 MATV Services

Provide an MATV distribution system including antenna, backbone cabling and outlets in accordance to the CCTV and TV Specification (included in Appendix B). Provide MATV outlets where identified on the room data sheets. The designer shall confirm any additional MATV system connections (eg Pay TV) with the Project Officer.

4.2 Audio Visual Services

Provide Audio Visual (AV) services including cabling and active equipment were identified on room data sheets. AV requirements will vary from project to project therefore the designer shall confirm all AV

functions, requirements and preferred suppliers/installers with the Project Officer and Teaching Spaces Support (TSS) during the design process.

The Association of Educational Technology Managers' (AETM), Audio Visual Design Guidelines for Tertiary Teaching Spaces, (currently Second Edition), is to be used to inform decisions in successfully integrating audio visual systems in teaching spaces. A copy of these Design Guidelines is available via the Project Officer from TSS.

The Design Guidelines do not define architectural, electrical, or acoustic standards, nor do they replace the use of applicable Australian and International standards and building codes.

Where CCTV is provided as part of these works, the designer shall refer to the CCTV and TV Specification (included in Appendix A).

5. Security and CCTV

5.1 Security Risk Analysis

The designer shall undertake a security risk analysis and safety evaluation with the Infrastructure & Facilities Services Manager of Security taking into account known security risk areas. This evaluation will include items such as security system functions, CCTV requirements, camera type and location, Security Help Points, lighting requirements, and may incorporate a Public Safety Evaluation undertaken by the project design team.

5.2 Security System

Refer to UON Project Briefing Document – Electronic Security Systems Design.

The establishment of all security stakeholders and definition of their roles and responsibilities at the earliest possible stage of project definition is essential for timely and successful delivery of the security component of the works. The designer shall coordinate with the Project Officer and respective stakeholders to confirm the requirements and function of the Security and Access Control Systems to be installed.

Electronic Security:

Security and access control systems provided where required by the University shall be in accordance with the Electronic Security Standard and be fully integrated into the existing University Critical Alarm Security System. The system shall be installed by accredited personnel involved in the detailed design, installation and commissioning.

The security system shall comprise of the following components as required:

- A Security Alarm System Panel.
- Balanced Magnetic Reed Switches to all external doors and windows (where required).
- Internal Passive Infra-Red Movement Detectors.
- Proximity card readers.
- Code keypads.
- Biometric (Fingerprint) readers.
- Monitoring of selected critical alarms such as Substation Common Alarms and fridge/freezer Alarms.
- Access control functionality.

The design should include:

- Installation of the Panel to a secure area location.
- Dual path communications links to the site wide system. The dual paths shall be provided by the copper telephone cabling as well as the fibre ring.
- Incorporate at least 12 hour minimum standby power capacity.
- Be monitored (high level) by the University central monitoring station for alarm annunciation to enable a response.

- Integration into a Security Alarm System that covers other existing areas at the site where applicable including software augmentation and upgrading, alterations or additions to GUI etc.
- Have equipment and wiring which is protected against tampering. Any attempt to interfere with the equipment shall be registered on tamper alarms at the alarm panel and monitoring station.
- Ensure that all detectors and sensors are positioned so as not to cause or be prone to false alarms or nuisance alarms.

Access Control:

Buildings requiring access control as determined by the University should be provided with a local system fully integrated into the campus wide security system and should fulfil the requirements of the campus security assessment.

The access control system shall be integral to the security system and include automatic doors, lifts etc.

Monitoring and Control:

The main server 'head-end' data gathering point is located in the 'Pam Collins Data Centre', with a mimic panel located in the Security Services Office located in the McMullin Building. All new systems shall be fully integrated into the head end monitoring system including any additional hardware, software and graphics required.

5.2.1 Security Help Points

The designer shall include provision of security telephone help points as required by the safety evaluation review. Locations and function of the help points will be confirmed by the designer.

5.2.2 Security Lighting

The type, function and illumination levels of the security lighting shall be confirmed by the designer as part of the safety evaluation.

5.3 CCTV Systems

Refer to UON Project Specification for University of Newcastle CCTV System

The Designer shall incorporate CCTV systems as per the requirements of the University Design Standards and the safety evaluation review. As a minimum the designer shall provide for the following:

- Open platform system.
- Video Management Software (compatible with existing).
- Camera types, enclosures and location.
- Local camera image storage and retrieval system.
- Any CCTV installation shall have the capacity to interface with Security Services computer-aided dispatch management software system.

6. Mechanical / BMS Systems

6.1 Standards and Codes

Mechanical services are to be energy efficient and environmentally friendly and comply with Building Code of Australia and referenced Australian Standards as applicable for the works, including the latest or equivalent version of:

- Local government Act and Regulations there under.
- All requirements of Authorities having jurisdiction.
- Requirements of the Insurance Council of Australia.
- State Codes/Guidelines for Control of Legionnaires' Disease.
- Requirements of Occupational Health and Safety.
- Building Code of Australia (NCC) – National Construction Code.
- Workplace Health and Safety Regulation.
- Local Council Ventilation Code.
- AS 4254 Ductwork for Air Handling Systems in Buildings.
- AS 1324 Air filters for use in general ventilation and air-conditioning and HEPA filters for clean areas and laboratories.
- AS/NZ 2243.8 Safety in laboratories - Fume Cupboards.
- AS/NZ 1668:1991/2002 Mechanical Ventilation and Air Conditioning Code:
  - Part 1 Fire precautions in buildings with air-handling systems.
  - Part 2 Ventilation requirements.
- AS 1851 Maintenance of fire protection equipment:
  - Part 6 Management procedures for maintaining the fire precaution features of air handling systems
- AS/NZ 3102 Approval and test specification of electric duct heaters.
- AS/NZ 3666.1-3 Air handling and water systems of buildings - Microbial control.
- AS 1530 Early fire hazard tests.
- AS 1682 Fire Dampers:
  - Part 1 Specification.
  - Part 2 Installations.
- AS/NZ 2107 Acoustics - Recommended design sound levels and reverberation times for building interiors.
- AS/NZ 3000: 2007 Wiring Rules.
- AS/NS 3439 Low-voltage switchgear and control gear assemblies
- AS/NZ 1677.1-2 Refrigeration Systems.

6.2 Heating, Ventilation and Air Conditioning (HVAC) Systems

The selection of any HVAC systems shall be applicable and suitable to the type of building/structure/size/orientation proposed. Due consideration of suitable systems shall be investigated to ensure maximum energy efficiency and integration with the building design.

All existing campus/building HVAC infrastructure shall be investigated and considered in relation to the proposed development/alteration. The existing site infrastructure may consist of

- Chilled water, heating hot water, condenser water loops and its location relative to others underground ring mains to be capped for future use.
- Direct Expansion refrigeration reticulation.
- Existing nearby plant and equipment which may have spare capacity. Consideration and review shall be given to existing infrastructure impact and capacity.

In addition to the above, types of systems which must be considered early in the planning stage are:

- Centralised plant.
- Direct Expansion packaged and split systems.
- Passive ventilation systems.
- Earth pipe ducting systems for outside air intakes or intake labyrinths
- Geothermal heat rejection and reclaim.
- In-slab radiant heating and cooling (where practical).
- Passive and active radiant heating/cooling (where practical).
- Displacement ventilation.
- Adsorption and Absorption Chillers.
- Co-generation and Tri-generation systems.
- Natural ventilation.
- Mixed mode ventilation.
- Mechanically assist natural ventilation.
- Energy reclaim system.

Both the building structures and the associated building services must be:

- Robust in design and construction.
- Energy efficient in design as service life of building.
- Readily accessible and maintainable to maximise the capital investment in services infrastructure over the service life of the building.
- Easily adaptable to suit the varying demands likely to be imposed on building assets by staff.
- Conference rooms, meeting rooms, classrooms and the like are subject to variable or intermittent occupancy.

The HVAC system design should consider;

- Dedicated HVAC system where practical to large conference / lecture rooms or rooms with high occupancy and consideration to existing central plant.
- Energy efficient system design without compromise on occupant thermal comfort and space condition requirements.
- Dehumidification systems.
- Life cycle costing analysis (LCC) of various HVAC systems, advantages/disadvantages, maintenance costs and payback duration.
- Outdoor air quantities in accordance with ventilation code under variable occupancy conditions.
- Where practicable, air filtration of high efficiency should be utilised to minimise outdoor air quantities within the limits of ventilation code.
- Occupancy detection control which is to be fitted to the HVAC system (s) (The control logic should include 'Manual start', 'Auto off' and time limited manual override controls).
- CO_2 demand control ventilation in spaces of transient and high population density where practical.
- Purging after-hours operation of large individual areas, having large thermal mass (where feasible). Due to the low temperature of the ambient conditions during the winter months, purging is to be used for summer mode only. The timing of purging shall be defined by the scheduling of the BMS.
- New HVAC technologies emerge from time-to-time and whilst many may offer advantages over current alternatives, the premature application of unproven solutions is only to be considered and adopted with comprehensive investigation, concise explanation of the benefits and risks, and informed consent of the Principal.
- Simplicity, robustness and energy efficiency of HVAC systems are to be key outcomes of design.

6.3 Ecologically Sustainable Design (ESD) Principles – (refer ESD guidelines)

The design of all mechanical services systems are to accord with the ESD initiatives described in this document and in the Ecologically Sustainable Design Project Briefing Document. Particular initiatives for this site will include:

- Adherence to Greenhouse Rating targets, including provision for necessary instrumentation to monitor energy consumption.
- The use of refrigerants having zero ozone depleting potential (ODP).
- Whole of life cycle assessments of design options as required to allow Principal (and other stakeholders) review and direction.
- Minimise HVAC usage where possible and appropriate.

Materials used in construction that minimise energy consumption in construction and maximize the potential residual value at the end of its service life shall be considered.

Investigations of the following based on ESD principles and whole of life cycle assessment:

- Can the building design accommodate thermal comfort and ventilation rates without the need for full HVAC installation?
- Economy Cycle - where possible outside air is to be utilised for 'free' cooling, whenever available, in

air conditioning systems.

- Night purging and economy after hour cycle.
- Chilled beam technology (active and passive).
- Radiant panel/beam heating/cooling.
- Displacement ventilation.
- Variable air volume systems.
- Variable speed drives on pumps and fans.
- High-efficiency chillers.
- High-efficiency pumps, fans, motors and boilers.
- Heat recovery (air side and water side).

6.4 University Air Conditioning Policy

The University has an 'Air conditioning policy' in place to which all requests for air conditioning must comply. Any proposed development shall consider the requirements set out in the policy and be read in conjunction with the requirements of these guidelines.

For more information on the University Air conditioning policy follow this link:

www.newcastle.edu.au/policy/000528.html, or follow the links to the 'University Policy Library'.

6.5 Ventilated Spaces - Design Principles

Ventilation of non-air-conditioned spaces utilizing passive building design is encouraged where possible and practical. However, it shall be combined with the use of mechanical ventilation systems where necessary. All designs must take account of climatic conditions, the nature of the facility and the anticipated usage characteristics.

Ventilation to non-work areas such as stores and the like shall be to statutory code requirements.

Ventilation to work areas should generally be substantially higher than minimum code requirements where air can be drawn directly from outside, whilst maximizing satisfactory comfort conditions.

Passive ventilation strategies shall include automated louvre controls with 'weather' control sensors to close louvres and manual override.

Strategies to consider the lowest and highest entry/exit points of a space to ensure thermal buoyancy is maximised with prevailing wind direction reviewed for best effect.

Examples of such areas include:

- Storage Areas.
- Laundries.
- Workshops.
- Shower and toilet facilities.

Where exhaust air is drawn from air conditioned spaces, any increase above code minimum requirements shall not be at the expense of treating additional outside air to provide make up air.

Investigate the potential for heat recovery of exhausted air through uses of heat exchange devices.

6.6 Toilet and General Exhaust Systems

Provide mechanical exhaust systems in accordance with ventilation code and local regulations to ensure good cross ventilation of toilet compartments.

Provide grilles or undercut doors to suit exhaust quantities.

Provide control strategies and operation including PIR timers on fan control with 30min overrun after last detected movement.

6.7 Sundry Ventilation Systems

Supply air quantities are to meet the following criteria:

The air conditioning air distribution system(s) shall accommodate the peak cooling and heating loads without causing draughts or temperature fluctuations within the space.

Minimum supply air rates shall not be less than 3.5 L/s/m^2 for variable volume systems and 7 L/s/m^2 for constant volume systems.

Ventilation supply and exhaust systems shall be provided as required.

Ventilation shall be provided, but not limited to, sub-stations, switch rooms, pump rooms, specific workshop processes and the like.

Ventilation systems to server rooms and data centres.

6.8 Pumps and Piping Systems

Pipework shall be designed in a neat, workmanlike manner with acceptable support, alignment and grade and in accordance with code for chilled water and heating hot water systems.

The use of pre-insulated copper pipework shall be used where underground chiller water/heating hot water systems are required to reticulate water from building to building.

Consider use of HDPE and ABS pipe materials, however copper shall be predominantly used as the carrier pipe.

Underground heating water pipework shall have special treatment for expansion with pits at 20m centres and nylon cord reinforced rubber flex expansion joints.

Pipework shall be designed so that it is free to expand and contract without causing damage to itself or other works with due allowances for concrete shrinkage and deflection.

All pipework design and designed shall ensure that no “dead legs” within any system are present.

Pipework connections to equipment shall be arranged to allow easy access to all valves and fittings and shall not interfere with access to the equipment to which it connects.

Pipework for each service within a building shall be of the one material.

All piping systems including pumps, fittings, valves bends, control valves, condensate lines and components conveying fluids associated with heat transfer shall be adequately insulated. Where surfaces are likely to be below the dew point temperature of the surrounding air, provide a complete vapour seal on the outside of the insulating material.

All pumps shall be close-coupled with mechanical seals and TEFC motors selected at 2900RPM with high efficiency motors.

All insulated pipework run external to the building, in plant rooms, or exposed to normal view shall be sheathed. Sheathing shall be brushed aluminium and installed in plant areas only.

CHW pipework shall be foil backed foam with wooden blocks at support locations with vapour barrier seals continuous across support brackets.

Support brackets to be hot-dipped galvanised

Heating water pipes shall be supported on separate brackets to that of chilled/cooling water.

6.9 Mechanical Switchboards and Associated Electrical Energy Sub-metering

The power supply for all mechanical plant equipment shall be connected to and controlled by a Mechanical Services Switchboard (MSSB).

Where switchboards are required these shall comply with codes and standards.

Control switches, indicating lamps, meters and test buttons, on a top hinged door set, out in a logical manner in functional unit groups. Shield all door mounted equipment to prevent contact with live terminals and wiring.

Provide for kWh and kVA metering on all MSSB's which serve multiple systems. Small packaged air conditioning units provide for kWh metering only. Sub-MSSBs shall be fed from the main MSSB and not from the normal electrical distribution system.

All MSSB fire trips shall be auto reset on reset of fault on FIP.

In harsh environments consideration shall be given to using marine grade aluminium or stainless steel enclosures. All switchboards shall be provided with locks and all switchboards shall be dead front type and provided with doors. Lift off escutcheon panels is permitted.

The enclosure, doors, covers, finishes and painting shall be equal to or better than AS 3439.

Switchboards shall be labelled in accordance with the Australian Standards for Low Voltage Distribution and Switchboards Labelling and Numbering.

All cabling in switchboards shall be provided with suitable identifying labels. Mains and sub mains shall have engraved two colour laminated traffolyte or similar suitably fixed on the cable showing the cable size and type as well as the origin/destination of the cable. All other cabling shall be identified by slip on ferrules or other suitable means.

Variable speed drives (VSD's) shall be provided for all pumps and major fan systems with pressure volume capacity to control energy consumption.

6.10 Weather Resistance

Special attention shall be given to the design details, construction methods and workmanship to ensure weather tightness of all HVAC components, with special emphasis placed on the serviceability of joint seals and penetrations under the design exposure conditions.

6.11 Provisions for Maintenance

All mechanical services plant shall be designed to allow adequate maintenance of the item and its various components, and shall be addressed as a matter of priority when consideration location of equipment.

Ensure that sufficient isolating valves and demountable joints are supplied on reticulated water systems to isolate and remove individual items of plant whilst retaining operation of the remainder of the system.

Ensure adequate valving and isolation points on all pipework. Adequate isolation points will allow future outages to the piping system to be minimised.

Generally plant requiring ongoing maintenance shall not be installed in ceilings. Items normally installed in ceiling spaces such as variable air volume terminals, fan coil units and fans shall be positioned where access is available to all sides and access panels shall be provided. They shall be installed outside the boundaries of offices, laboratories and the like and above tiled ceilings. Where access is through ceiling linings, it shall be in compliance with the WorkCover Safety Authority recommendations for the use of ladders.

All appropriate OH&S issues shall be considered when designing locations of systems

All air balancing devices shall be accessible both for initial air balance and for future adjustments.

Plant rooms shall be laid out to provide adequate working spaces for servicing operations.

No equipment should be placed such as to require refrigerant containers, vacuum pumps etc to be lifted onto roofs via ladders. Where small condensing units are elevated on the outside of buildings, the maximum height shall be 2.5m to the top from ground level. In addition to the requirements specifically detailed, design and layout plant spaces to provide safe and reasonable working conditions for all normal servicing operations.

Where practicable, exhaust fans shall be mounted in plant rooms or in accessible locations within the building rather than above roofs.

6.12 Seismic Restraints

All plant, equipment and supports shall be fixed to the building structure in accordance with the requirements of AS 1170.4. Applicable parameters for each structure are to be determined in conjunction with the structural design process.

6.13 Hours of Operation

The air conditioning system is to be designed to provide economical ‘push-button’ operation for operational areas running year round. Provide for the ability to close down non-essential areas after hours and when not occupied.

Essentially provide 2 hr (adjustable) push button timers to areas such as:

- Meeting rooms
- Interview rooms
- Other areas which have transient occupancy

PIRs and motion detectors connecting to A/C system are to be provided in infrequently occupied areas such as lecture theatres.

6.14 Noise

All areas shall be designed in accordance with code and authority requirements. The mechanical systems will be designed to ensure that the noise levels attributable to the mechanical services do not contribute to exceeding the combined sound levels described in this standard.

Maximum External Noise Levels:

- Background noise levels to be taken from AS 1055.2 for noise area category.
- Type of facility and adjacent buildings

6.15 Building Management Systems

The University building services' systems on campus are fitted with Building Management Control Systems throughout. They generally control and monitor infrastructure including; air conditioning, lighting, water supply and monitor power consumption through metering devices.

The University of Newcastle has a number of analogue and digital BMS on campus:

- Siemens.
- Delta.
- Circutor Energy Monitoring System

Each of these BMS systems controls numerous Building Services components throughout the Callaghan and off-site campuses. The head end control system is located within the maintenance section of the Services Building at the Callaghan campus.

All proposed new BMS shall be University preferred as described in Appendix 'B'.

The BMS shall be provided where assessed as cost effective to optimize the control of HVAC systems and minimize the energy consumption within the building.

All BMS preferred equipment shall be fully compliant with BACnet protocols and specifications.

Investigation shall be made with respect to the campus communications infrastructure to support BMS including:

- Cable Pits and pathways.
- Investigate use of optic fibre communications.
- Centralised data centres/ server rooms.

Building specific BMS systems are to be configured to allow full integration into the existing campus wide area networked (WAN) centralised BMS to provide control of:

- The management and monitoring of HVAC system operation and printing of reports.
- Interface and allow access to all BMS functions and data incorporating screen based graphics showing building specific dynamic system operation.
- Monitoring of Electrical Infrastructure.
- BMS shall be configured with a main controller connected to the WAN and internal building controllers being connected together via dedicated BMS LAN so as to reduce IT managed connections and so that control of plant is not reliant on IT network – only monitoring connection is via IT network.
- BMS graphics shall include, as a minimum; building elevation, floor plans for each level showing ductwork runs and room temperature sensors and after hours push buttons, time clocks, HVAC unit pages with all analogue and digital inputs/outputs shown, central plant with all inputs/outputs.
- Heat and cool calls from remote plants shall be hard wired (not via LAN or IT network) to inputs/outputs.
- Safety interlocks and 'start signals' to be hard wired.
- Static BMS connections using RS485 connections from controllers to field devices.
- BMS data cabling is to be installed by trained and certified installers.

6.16 Monitoring Systems

All monitoring systems must be installed and configured to connect to existing University systems. Critical Alarms shall be connected to the Electronic Security System, with local test button.

- Oxygen depletion monitoring
- Gas monitoring

7. Hydraulic Services

7.1 Generally

The consultant during the course of any stages being RFT or documentation stages will consider the following:

- Provide documentation supporting connections to BMS, FIP, Fire detection alarms and security systems.
- Provide fire safety engineering advice as required.
- Submission of water pressure flow enquiries, Development applications (ie section 50, 73) with the relevant water and sewer Authorities.
- Investigate and test all incoming utility services capacities prior to commencement of detailed design.
- Design, documentation, certification of all relevant hydraulic services including but not limited to supply service cold/hot/tempered/warm water, stormwater connections and drainage, sanitary services and drainage, rainwater services, non-potable water and waste services for laboratories , trade waste services for grease traps and laboratories, fire services being not limited to internal or external of the project, and backflow prevention.
- Design of building pumps as required for boosting of drenches, fire sprinkler, fire hydrant, fire hose reel, grey/black water, water reticulation, recycled water, non-potable water, solar, hot water and sanitary drainage, trade waste etc.
- Design of backflow prevention complaint to AS/NZS 3500, Local Authority and University requirements.
- Selection of hydraulic equipment including PC items and tap-ware.

7.2 Documentation

The consultant must manage the project documents creation, issue revision, transmittals and sign off at design completion.

This section of the brief details the requirements of the work to be included in the Hydraulic Services, but is not limited to, the following:

- Potable cold water.
  - Drinking water.
  - Showers for ablution and emergency.
  - Basins.
  - Sinks being for kitchen, tea, bar, pot or utility, cleaners and laboratory.
  - Autopsy tables.
  - Urinals.
  - Laundry, trough, washing machine and dryer.
  - Sterilizers.
  - Toilets, slop hoppers or the alike.

- Irrigation.
- Hot water generation equipment.
- Mechanical equipment.

- Non- potable water.
  - Sinks being for laboratory and research purposes.
  - Autopsy tables.
- Rainwater re-use.
  - Urinals.
  - Laundry - washing machine.
  - Toilets, slop hoppers or the alike.
  - Irrigation.
  - Fountains or ponds.
  - Mechanical equipment ie cooling towers.
  - Wash down for paths, windows etc.
- Grey water and black water re-use.
  - Urinals.
  - Laundry - washing machine.
  - Toilets, slop hoppers or the alike.
  - Irrigation.
  - Fountains or ponds.
  - Wash down for paths, windows etc.
- Pure water ie reverse osmosis/demineralised.
  - Laboratories and testing facilities.
- Hot water, warm water and tempered.
  - Thermostatic mixing valves for water temperature control – refer to APPENDIX B for preferred equipment and supplier list.
- Sanitary Drainage and Plumbing.
  - Showers for ablution and emergency.
  - Basins.
  - Sinks being for kitchen, tea, bar, pot or utility, cleaners and laboratory.
  - Autopsy tables.
  - Urinals.
  - Laundry, trough, washing machine and dryer.
  - Sterilizers.
  - Toilets, slop hoppers or the alike.
  - Irrigation.
  - Hot water generation equipment.

- Mechanical equipment – condensate drains etc.

- Box Gutters, Eaves gutters, sumps and overflow devices.
  - Building.
  - Awnings.
  - Walkways or similar.
- Natural & LPG gas supply.
  - Mechanical equipment.
  - Cooking equipment.
  - Hot water generation equipment.
- Laboratory gases – by a specialist contractor.
- Fire hydrant services.
  - Boosters Assemblies and their locations.
  - External and internal locations.
  - Pumps and their locations.
  - Test water recycling.
- Fire sprinkler.
  - Boosters Assemblies and their locations.
  - External and internal locations.
  - Pumps and their locations.
  - Window drenchers.
  - Test water recycling.
- Fire hose reel services.
  - External and internal locations (preference in a cupboard).
  - Pumps and their locations.
  - Test water recycling.
- Trade waste – including specialist contractor eg labs and anatomy areas.
  - Laboratories.
  - Cafes, Kitchen facilities.
  - Mechanical equipment
  - Dilution pits.
  - Oil separators.
  - Grease arrestors.
  - Car, truck or parts wash areas.
- Safety eye wash and shower systems – as required.
  - Laboratories and testing facilities.
  - Cafes, Kitchen facilities.
  - Mechanical equipment.

- Civil – stormwater management.
  - Retention or Detention to authority requirements.
  - Stormwater (rainwater) harvest.
  - Sub soil drainage.
  - Downpipes external or internal.
  - Sedimentation control.
  - Gross pollutant traps or equivalent.
- Control Panels – as required.
  - In accessible locations.
  - Protected by a cage where installed externally.
  - Installed at a serviceable height.
  - Verify connection back to BMS

7.3 Standards and Codes

The hydraulic systems proposed will be designed in accordance with the following codes and standards or the more recent versions where applicable:

- University Design Guidelines.
- Statutory Authorities.
- National Construction Code of Australia (BCA).
- Disability Code of Australia.
- Occupational Health and Safety Act and Standards.
- NSW Code of Practice for Plumbing and Drainage – 2006.
- NSWFR Design Guidelines
- AS 2441 Fire Hose Reels.
- AS 2419 Fire Hydrants.
- AS 2444 Extinguishers.
- AS 3500.1 – 2003 Water.
- AS 3500.2 – 2003 Sanitary.
- AS 3500.3 – 2003 Stormwater.
- AS 3500.4 – 2003 Hot Water.
- AS 3500.1 – 2003 Backflow Prevention.
- AS 5601 Gas.
- Local Water Authority Requirements for Trade Waste.
- AS 2118.1, 2, 3, 5, 6 Fire Sprinklers.
- AS 2941 - 2008 Fire pump set systems.

7.4 Site Considerations

7.4.1 Service Corridors and Easements

The designer shall ensure that the engineering services are developed in a manner that rationalises the need to cross roads, pathways, carparks, and other paved surfaces including where the pipeline reticulation installation depth is protected against mechanical damage and deformation.

Wherever possible, hydraulic services shall be located in designated service corridors within road reserves. Coordinate the design with other service disciplines to minimise trenching with a separation between services to be complying with the relevant Australian Standard.

No main water services shall be placed underneath buildings or in a position that could conflict with any proposed building site except at high level in undercroft areas as not to impede access. Such services, where conflicting with the proposed site shall be relocated clear of the footprint.

7.4.2 Interface with Existing Services

Where new works are to interface with existing services the designer shall arrange for pre-design surveys of the existing services if not provided, where necessary, to ensure the accuracy of existing documentation and the coordination of design. Perform calculations to determine the capacity and or flows of the existing services infrastructure and confirm in writing the new works can be connected or advise of upgrades to accommodate new and future projects.

7.4.3 Water, Gas and Sewer Supply

The designer shall ensure that each new, refurbished or leased facility is provided with a suitable water, gas and sewer supply. In determining the requirement to achieve this, the designer shall review the existing reticulation systems including the capacity to provide for the proposed works. Make contact with owner of the infrastructure asset to confirm size, flow and capacity. The designer needs to ensure that the new or additional services do not adversely impact on current building footprint or proposed future works.

7.4.4 Investigation of Existing Infrastructure

The designer shall allow to review all relevant plans and reports concerning the universities hydraulic reticulation system and report on the shortfall in information prior to any design development.

Where the hydraulic reticulation system is to be investigated, the designer shall consider the following and detail the outcome of his investigations in a design report or possibly as a separate report as part of the development plan:

- Additional water, gas, sewer and stormwater load contribution from proposed new facilities.
- Capacity of each existing service.
- Any particular operating requirements or constraints.

7.5 Ecologically Sustainable Design Principles

Refer to separate Ecologically Sustainable Design Project Briefing document. As a minimum, the following initiatives shall be considered to assist in the ecologically sustainable design of the Hydraulic Services:

- Flow and return systems for hot water lines.
- Rain water harvesting for reuse and irrigation.
- Grey water or black water reuse.
- Water metering including sub-metering of any reuse water systems.
- Reduction of uPVC products.
- Solar /gas hot water technology generated hot water preferred.
- Insulation of hot, warm and tempered water pipework.
- Water efficient fixtures and tap ware to WELLS standard.
- Integrated water management on a site basis.

7.5.1 Rainwater Harvesting

Rainwater harvesting reuse water shall be considered for all new buildings to reduce the water demand from the new development and the campus overall. As a minimum, rainwater reuse shall be used for toilet flushing, landscape irrigation and any mechanical water demand such as cooling towers.

The designer is to provide supporting calculations and a life cycle cost analysis of the size of the rainwater harvest tank, in excel format.

Rainwater storage systems and ancillaries to be designed with minimum components:

- First flush diverter for primary filtration prior to water entering the storage tank.
- Vermin proof overflow connecting to the stormwater system.
- Post filtration for water reticulation from the storage tank to fixtures.
- Post filtration shall include automatic backwash filters and bag filtration incorporated into the system.
- All charged/flooded systems shall incorporate HDPE pipework with electro fusion joints. (uPVC pipework shall not be accepted on charged/flooded systems).
- Dual pressure pump system fit for purpose.
- Control panel with alarms, alternating and manual switch over including connection to the BMS.
- Structural support for tank and equipment.
- Signage to comply with AS/NZS3500.
- Liaison and compliance with Local Authority.

All proposed rainwater harvesting systems shall be submitted for University review in the Design Development Stage prior to Tender Documentation.

Metering of rainwater recovery is required, with connection to and configuration with the energy monitoring system (EMS)

7.5.2 Grey / Black Water Reuse

Grey/Black water reuse shall be considered when there is a significant water demand for proposed new buildings, and a rainwater reuse system is not capable of meeting the required demand.

The designer is to provide supporting calculations and a life cycle cost analysis of the size of the grey water system in excel format.

Grey Water systems and ancillaries to be to be designed with minimum components:

- System complaint with Australian Standards, Local Authority and State Government Health regulations
- A+ Grade water supply.
- Primary collection tank and dual pump system
- Filtration for water reticulation from the storage tank to fixtures.
- Post filtration shall include automatic backwash filters and bag filtration incorporated into the system.
- Dual pressure pump system fit for purpose.
- Control panels with alarms, alternating and manual switch over including connection to the BMS.
- Structural support for tanks and equipment.
- Signage to comply with AS/NZS3500.
- Liaison and compliance with Local Authority.

All proposed grey/black water systems shall be submitted for University review in the Design Development Stage prior to Tender Documentation.

7.5.3 Water Metering

All buildings shall be provided with a main water meter on the incoming water supply. Sub meters shall be provided on all major water usage in the building such as the following:

- Mechanical equipment i.e. cooling tower, evaporative coolers.
- Irrigation and wash down systems.
- Recycled water systems.
- Rainwater harvesting systems.
- Domestic Hot Water.
- Domestic Cold water.
- Individual wet areas in Student Accommodation.
- Gas supply.
- Fire services.

- Non Potable water systems.
- All meters shall be capable of being connected to and configured with the energy monitoring system (EMS).

7.6 Wet Fire

7.6.1 Fire Hose Reels

Where Fire hose reels are required in accordance with the National Construction Code of Australia to the deemed to satisfy requirements of Parts E1.3 and 1.4 the system is to be designed in accordance with AS/NZS 2444.1. It is University preference for the fire hose reels to be installed in a cupboard whether it is internal or external.

The fire hose reel system servicing the development shall be supplied by the Potable water supply from either the University reticulation system or direct from the Local Authority water main.

Make application to the Authority or engage the services of the current UoN Fire Services Maintenance Contractor to determine if there are adequate flows and pressure in the potable water reticulation system or Authority water main. Perform the necessary calculations on the final designed piping system for the project to ensure adequate flow and pressure meets code requirements. Pumps shall be incorporated into the system as required to ensure adequate flow and pressure to meet code requirements. Pumps shall be housed in a pump room with access in accordance with the NSW fire brigade requirements and AS/NZS 2419.1 and AS/NZS 2941.

Provide for in the design backflow prevention to comply with AS/NZS and Local Authority requirements.

7.6.2 Fire Hydrants

Where a Fire hydrants is required in accordance with the National Construction Code of Australia to the deemed to satisfy requirements of Parts E1.3 and 1.4, the system is to be designed in accordance with AS/NZS 2419.1.

The fire hydrant system servicing the development shall be supplied by the Potable water supply from either the Uon reticulation system or direct from the Local Authority water main. Assess the requirement for augmentation. A separate booster assembly may be required for each building in a location compliant with AS/NZS2419.1. Confirm final location with UoN during Design Development Stage.

Make application to the Authority or engage the services of the current UoN Fire Services Maintenance Contractor to determine if there are adequate flows and pressure in the potable water reticulation system or Authority water main. Perform the necessary calculations on the final designed piping system for the project to ensure adequate flow and pressure meets code requirements. Pumps shall be incorporated into the system as required to ensure adequate flow and pressure to meet code requirements. Pumps shall be housed in a pump room with access in accordance with the NSW fire brigade requirements and AS/NZS 2419.1 and AS/NZS 2941. Where a fire pump is installed consider an operational control panel to detect low flows with alarm system connected to the BMS.

Provide for in the design backflow prevention to comply with AS/NZS and Local Authority requirements.

7.6.3 Fire Sprinkler

Where a Fire sprinkler is required in accordance with the National Construction Code of Australia to the deemed to satisfy requirements of Parts E1.3 and 1.4, the system is to be designed in accordance with AS/NZS 2118.1 - 6.

The fire sprinkler system servicing the development shall be supplied by the Potable water supply from either the University reticulation system or direct from the Local Authority water main. A separate booster assembly is to be provided for each building in a location compliant with AS/NZS2419.1. Confirm final location with University during Design Development Stage.

Make application to the Authority or engage the services of the current UoN Fire Services Maintenance Contractor to determine if there are adequate flows and pressure in the potable water reticulation system or Authority water main. Perform the necessary calculations on the final designed piping system for the project to ensure adequate flow and pressure meets code requirements. Pumps shall be incorporated into the system as required to ensure adequate flow and pressure to meet code requirements. Pumps shall be housed in a pump room with access in accordance with the NSW fire brigade requirements and AS/NZS 2118.1-6 and AS/NZS 2941. Where a fire pump is installed consider an operational control panel to detect low flows with alarm system connected to the BMS.

Provide for in the design backflow prevention to comply with AS/NZS and Local Authority requirements.

7.6.4 Extinguishers

Portable fire extinguishers shall be provided throughout all areas in accordance with AS/NZS 2444 and the National Building Code of Australia.

7.7 Building Hydraulic Services

7.7.1 Cold Water

In general, buildings shall be supplied from a reticulated mains pressure. Separate metering and backflow protection for site containment, zone protection and individual protection shall be considered for all buildings and shall be in accordance with AS/NZS 3500.1.

7.7.2 Non Potable water

- Laboratories - connection to specialised work areas to be a system providing demineralised reverse osmosis system or equivalent. The system is to be approved in the design Development stage by the University.
- The hot water service to laboratories shall be separate from all other hot water requirements to the remainder of the building to provide adequate backflow protection (refer also below for further hot water design requirements).
- The non-potable water connection is to be via a Reduced Pressure Zone Device or break tank and booster pumps. Provide a baffle within the tank or float valve which eliminates any wave action in the tank.
- Requirements for individual backflow prevention to specialised equipment is to be investigated during briefing and design.

- Specific backflow prevention requirements and provision of non-potable water to animal holding facilities should be reviewed with University Animal Services personnel during design of animal facilities.

7.7.3 Domestic Hot Water

- Hot water services shall be minimum of 20mm. N.B. Short branches up to 1.5m may be 15mm N.B., if serving only one outlet. Dead legs should be restricted to 8m maximum.
- Hot water should be centralised using a number of mains pressure HWS in parallel with insulated flow and return lines incorporating a circulating pump plus stand-by pump. Individual, local electric units are acceptable under some conditions where the number of outlets is small. The circulation pumps are to incorporate a time clock and connected to the BMS.
- All hot water pipes shall be insulated with preformed sectionalised fibreglass insulation wrapped with sisalation with a minimum thickness of 25mm.
- Where exposed to mechanical damage or to the weather, the pipe work and insulation shall be metal sheathed with powder coated aluminium sheathing, edges swaged and overlapped.
- The minimum insulation thickness to hot water piping shall be 25mm for pipes less than 50mm nominal bore and 38mm for pipes of 50mm and above.
- Hot water lines should not be encased in walls; however, where this in unavoidable, wall thickness shall be increased to allow for the insulation as specified to be installed.
- Hot water systems temperatures are to be monitored and shall be connected to the BMS.
- Solar / gas installations or solar pre-heat preferred.

7.7.4 Pumps

- General
  - All pumps shall be designed with isolating valves, non-return valves and strainers, all adequately supported to manufacturer's specifications.
  - Pumps shall be connected to and controllable from the BMS, and shall show stop/start and status on the operator station graphic, nylon cord reinforced rubber flexible connections, isolation valves, pressure gauges on inlet and outlet including close coupled motor pumps to have mechanical seals with high efficiency TEFC motors.
  - Provide in the design pumps at a minimum requirement as follows:
- Cold Water Booster Pumps including Fire hose reel.
  - Dual variable cold water pumps with pump fault back to the BMS.
  - One pump shall be capable of providing the flow and pressures required. Similarly the other pump shall act as standby and alternate daily.
  - Facilities shall exist for manual changeover for duty and standby pumps.
  - Pressure gauges with a nominal 75mm diameter face of the bourdon-tube type complete with an isolation cock shall be provided on each side of the pumps.
  - Pumps shall be activated by a drop in system pressure. The system shall be automatically controlled by means of a pressure tank sized to suit the system.

- Domestic Hot Water Pumps.
  - Hot water circulating pumps shall be provided in hot water loops to minimise dead legs, where a central system is installed.
  - The domestic hot water circulating pump shall be installed in the return water loop.
  - Care shall be taken to ensure that pressure in the hot water circuit is not greater than the pressure in the cold water main.
  - Pumps shall be of the 'in line' type with totally enclosed single phase motor.
  - Pump casings shall be bronze with bronze impellers and mechanical seals. Open motors are not acceptable.
  - Hot water circulating pumps shall be controlled by the BMS for hours of operation.
  - 240v contactors shall be provided on the pump control panel for the purpose.
  - Isolation valves shall be installed to either side of the pump to enable removal of the pump for maintenance.
- Rainwater harvest pumps.
  - Dual rainwater water pumps (submersible type).
  - One pump shall be capable of providing the flow and pressures required. The other pump shall act as standby to be automatically switched into service on alternate days. Switching shall allow both manual selection and automatic changeover.
  - Facilities shall exist for manual changeover for duty and standby pumps.
  - Pressure gauges with a nominal 75mm diameter face of the bourdon-tube type complete with an isolation cock shall be provided on each side of the pumps.
- Stormwater pumps.
- Dual rainwater water pumps (submersible type).
- One pump shall be capable of providing the flow and pressures required. The other pump shall act as standby to be automatically switched into service on alternate days. Switching shall allow both manual selection and automatic changeover.
- Facilities shall exist for manual changeover for duty and standby pumps.
- Pressure gauges with a nominal 75mm diameter face of the bourdon-tube type complete with an isolation cock shall be provided on each side of the pumps.
- Fire Hydrant and Fire Sprinkler pumps
- Pump either electric or diesel to be code compliance
- Where electric specified confirm adequate power supply with electrical engineer.
- Control panel to comply with AS/NZS 2419 and AS/NZS 2941.

7.7.5 Services Isolation

- Services shall be isolated at each duct riser within buildings. Branch lines shall be isolated at the duct riser on each level and further where servicing an outlet or group of outlets in a laboratory or on a bench. In all cases, isolation valves shall be readily accessible and clearly marked by means of an

engraved identification plate screw fixed or pop riveted to the inspection access/door.

- In cases of water supply, gas, ring main distribution pipes should be used wherever possible.
- All fittings shall comply with the requirements of SAA MP52-1993 and shall have AS markings and manufacturers Licence No. stamped into the fitting.
- Individual fixtures are to be isolated at the fixture with mini ball valve type isolation.
- Brackets for all pipe supports shall be “Unistrut” with threaded rod hangers and appropriate saddles or stand-off “Abbey” clips. In all cases, the pipe work is to be separated from the hanging bracket by the use of “Uni-cush” tape or approved equal.

7.7.6 Materials

- Pipe work Reticulation within buildings shall be in copper tube to AS 1432
- Mains buried in the ground shall have:
  - Type B copper with appropriate protection.
- PVC for mains 100mm diameter or above. Buried mains less than 100mm diameter shall be copper with appropriate protection or ABS.
- UPVC pipework shall be used for deionised and distilled water only.
- Where mains pass through walls and floors they shall be sleeved and fire-rated.
- Fittings.
  - Silver soldered Capillary fittings, screwed fittings, barrel unions and flanged connections only shall be used. Compression fittings shall not be used under any circumstances.
  - Silver solder shall contain 15% silver in all instances.
- Valves.
  - Isolation valves shall be Norcast resilient seat gate valves where service exceeds 80mm diameter.
  - Ball valves or butterfly valves shall be used on services less than 80mm diameter.
  - Balance valves shall be globe valves.
  - Stat valves shall be used for hot water balance valves.
  - All screwed valves shall have unions for easy removal without cutting pipe work.
  - Valves in the ground shall be provided with valve pits adequately sized for easy removal and servicing of valves.
  - Wherever possible, non return and building isolation valves shall be located within the building readily accessible from outside.
  - All bolts, nuts, washers and the like located in the ground or in pits shall be Grade 316 stainless-steel.
  - Any brackets located in pits shall be hot dipped galvanised.
- Meters.
  - Where possible all meters shall be located in an accessible location outside the building such that they are easily found, for ease of identification and accessibility for maintenance.

7.7.7 Trade Waste - Grease Traps

- Investigate the Design Brief, considering all potential activities in the building to determine the number and location of Trade Waste grease traps.
- Grease traps are to be fully accessible to cleaning trucks, with easily accessible lids for testing.

7.7.8 Trade Waste - Dilution Pits

- Investigate the Design Brief, considering all potential activities in the building to determine the number and location of Trade Waste dilution pits.
- Dilution pits are to be fully accessible to pump-out trucks, with easily accessible lids for testing.

7.7.9 Radiation Liquid Waste

- Ensure that consultation occurs with University Radiation Safety Advisor and Hunter Water Corporation to understand requirements for collection or monitoring of Liquid waste from areas in which radioisotopes may be used.

7.7.10 Sewer Pump Stations

- Ensure that Sewer pump station and associated infrastructure:
  - Has a minimum emergency storage capacity in accordance with Hunter Water Corporation design requirements;
  - Runs effectively with minimal pump failures.
  - Has the capacity to function during 1:100 year flood levels.
  - Can be easily maintained.
- Scope of works to include but not be limited to:
  - Packaged pump station
    - Wet well;
    - Twin pumps; and
    - Discharge pipe work.
  - Emergency storage.
  - Connection to the existing sewerage system.
  - Civil and roadworks.
  - Electrical service and Switchboard.
  - Stormwater management.
  - Retaining walls.
  - BMS monitoring.

7.7.11 Water Filtration Domestic

- Determine requirements for filtered drinking water both internal to the building and external hydro stations.
- Such filtration to incorporate
  - Industry available, changeable filter cartridges in accessible locations for ease of service.
  - Filter service isolation valves.
  - External stations shall be of stainless steel construction or constructed from anti-corrosive materials.

8. Lifts

8.1 Standards and Codes

- AS 1735 - Lifts, escalators and moving walks – General requirements.
- AS 1428.2 – Design of access and mobility, Enhanced and Additional requirements, Buildings and Facilities.
- Building Code of Australia (NCC) – National Construction Code.
- AS 1670 Fire Protection and detection.

8.2 Lift Type

All lifts which are proposed shall be of the latest technology, energy efficient and be of the counterweight, machine-roomless type, and shall be fitted with VSD systems.

Early consideration and review must also be given to the location of the lift shaft, and incorporation into the proposed building structure along with consideration of the following:

- Number of Lifts to be installed in the building.
- Personnel capacity.
- Weight/load carrying capacity.
- Uses, ie public, goods only or both.

Hydraulic lifts and caisson style lifts shall not be used

Any new lift installation must comply with the latest version of AS1735 and all relevant volumes and appendices.

The lift consultant shall demonstrate the most appropriate lift type and configuration specific to the project. They shall also consult with the building designers to advise on:

- Spatial requirements.
- Structural requirements of the lift car and lift shaft.
- Lift pit depth and landing levels.

8.3 Security

As the university is a public place and operates after dark, there will be requirements to access lifts where applicable.

Liaison with the Security Contractor and Infrastructure & Facilities Services shall be conducted to ensure all requirements of security have been considered and implemented.

8.4 Specification

Refer to Appendix A for the University of Newcastle Guidelines for the Design of Vertical Transportation Services.

9. Fire Services

9.1 Standards and Codes

New and existing fire detection and suppression systems, shall, as a minimum, be in accordance with the requirements of the Building Code of Australia. Depending on the function of individual facilities, a higher level of detection/suppression may be required by University as set out in the Building Code of Australia and Australian Standards.

Detection/suppression systems installed are to be connected to the area alarm panel located and terminated at the main Fire Indication Panel and responding State fire brigade. Extension of existing facilities shall include extending any installed fire detection/suppression systems. This includes the requirements for recommissioning installed systems and upgrading of Block Plans.

Table 9-1 details the primary codes to be used in the design of the fire detection and protection systems.

Table 9-1 Fire Detection and Protection Codes

Code	Title
AS 1670.1 - 2004	Fire detection, warning, control and intercom systems—System design, installation and commissioning: Fire.
AS 1670.2 - 2004	Fire detection, warning, control and intercom systems—System design, installation and commissioning: Fire alarm monitoring.
AS 1670.3 - 2004	Fire detection, warning, control and intercom systems—System design, installation and commissioning: Sound systems and intercom systems for emergency purposes.
AS 1851 - 2005	Maintenance of Fire Protection Systems and Equipment.
AS 1940 - 2004	The storage and handling of flammable and combustible liquids.
AS 2665 - 2001	Smoke/heat venting systems—Design, installation and commissioning.
AS 2941 - 2002	Fixed fire protection installations - Pumpset systems.
AS 3786.1, 2, 3 and 4 - 1993	Smoke Alarms.
AS 4428.1 - 1998	Fire detection, warning, control and intercom systems—Control and indicating equipment: Fire.
AS 4428.4 - 2004	Fire detection, warning, control and intercom systems—Control and indicating equipment: Intercommunication systems for emergency purposes.
AS 60849 - 2004	Sound systems for emergency purposes (IEC 60849:1998 MOD).
AS 4214 - 2002	Gaseous fire extinguishing systems.

Code	Title
AS/NZS 2293.1 - 1998	Emergency evacuation lighting in buildings: System design, installation and operation.
AS/NZS 3000 - 2000	Electrical Installations – Australian and New Zealand Wiring Rules.

9.2 Existing Suppression Systems

Any new connections or alterations to the water service needs to be planned so that the site is not left unprotected by hydraulic fire services during the alterations.

The designer is required to review and confirm the adequacy of the supply of fire-water and the impact placed on the existing system from the new load so not to deplete existing requirements. This review shall include testing of all hydrants on site and confirmation of the reliability, pressure and flow of water supply, all in accordance with AS 2419.1. The design for any required work raised by this review shall be included in the work.

9.3 Integrated Design

Where systems are interfaced, the designs will take into account fire protection systems that interface with other systems to permit fire protection systems to function as intended at the time of commissioning. Sufficient information will be provided for the contractor to produce systems interface diagrams for displayed in the fire control room or centre, or at locations adjacent to block plans.

9.4 Passive Fire Protection

Where passive fire protection devices are installed, provision will be made to allow for access to the devices so that annual inspection in accordance with AS 1851:2005 can be undertaken.

9.5 Automatic Electronic Fire Detection

The designer shall provide for an Automatic Electronic Fire Detection and Occupant Warning system in accordance with the relevant council, AS 1670 Fire Detection and OWS series and the UoN specific requirements.

All new facilities shall be equipped with a Smoke Detection and Fire Occupancy Warning System (EWIS) – even if not specifically required by the Relevant Local Council. A local Fire Indication Panel (FIP) and EWIS panel shall be networked to the Site Main FIP and EWIS Central control and be fully integrated for centralised remote monitoring and EWIS alarms and announcements as part of the Campus wide emergency management system. Panels are to be installed with a University of Newcastle network data point for connection to the centralised control. All site documentation and notification systems to be updated with information of new systems added to the network.

- Consultant shall investigate network architecture to advise the design and use of ASE devices, integrating with existing University infrastructure.

If the proposed building is NOT located on either Callaghan or Ourimbah Campus the system shall be connected to the NSWFB via an ASE device and all UoN documentation altered to add the new systems.

The automatic fire detection system shall incorporate the following as a minimum:

- Detectors shall be the addressable type allowing identification of individual detectors in fault or alarm.
- Detectors in labs, plant rooms and other hostile environments shall be thermal detectors.
- Detectors prone to moisture shall be water proof to prevent false alarms.
- Integration and fire trip functions into mechanical systems.
- The FIP shall clearly display zone/detector identification for alarm, fault and isolation in include a facility layout which clearly indicates zone coverage, electrical MSB location and substation location, booster assembly location, fire pump location, gas and water supply locations.
- Compliance with all relevant Australian Standards.

This report was prepared for the University of Newcastle by GHD. It has been prepared in accordance with the Terms of Engagement for the commission and on the basis of specific instructions and information provided by the client. The contents and conclusion of this report cannot be relied upon by any third party.

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Appendix A

University Technical Specification and Standards List

1. University of Newcastle Electronic Security System Version 3.0 August 2016
2. University of Newcastle CCTV Specification version G June 2016
3. University of Newcastle Telecommunications' and Data Cabling Technical Specification 2009 (Revised April 2016)
4. University of Newcastle Guidelines for the Design of Vertical Transportation Services April 2016
5. University of Newcastle (HV) Installation Safety Management Plan Issue No. 9 July 2016
6. University of Newcastle Audio Visual Systems Standards and Specification – DRAFT.
7. University of Newcastle Diagram of 11kV Distribution Network
8. Infrastructure and Facilities Services Standard Specification Clause for Operations and Maintenance Manuals
9. Infrastructure and Facilities Services Safe Work Procedure – Standard Requirements for Installation of Split Air Conditioner, SWP No. AC1 August 2012
10. Infrastructure and Facilities Services Safe Work Procedure – Altering of Existing Automatic and Passive Fire Systems, SWP No. FIRE2 July 2012
11. Site services drawings (GFIS) – water / gas schematics.
12. UON-ESS-101 General Electrical Specification
13. UON-ESS-102 Distribution Board Specification
14. UON-ESS-103 External Lighting Spec
15. UON-ESS-104 Emergency Escape Lighting and Illuminated Exit Signage
16. UON-ESS-105 Electrical Preferred equipment list
17. UON-ESS-106 Generators and Emergency Power Supplies
18. UON-ESS-111 Interior Lighting and Control
19. UON-ESS-112 Main Switchboard Specification
20. UON-ESS-100 Electrical Specification Index

Appendix B

Preferred Equipment and Suppliers Lists

1. Electronic Fire Detection

University of Newcastle FM Fire System Component Standard Specification for Components 2010:

1.1.	Fire Indicator Panel	-	Wormald MX4428	Part# FP0821*
1.2.	Photo Heat Detectors	-	Minerva 814PH	Part# 516.800.510
1.3.	Carbon Monoxide Detectors	-	Minerva 814CH	Part# 516.800.511
1.4.	Heat Detectors	-	Minerva 814H	Part# 516.800.513
1.5.	Manual Call Points	-	CP820	Part# 515.001.025
1.6.	EWIS	-	QE90	Part# QS1000*

* Part numbers change dependent on panel sizes and internal equipment fitted.

2. Hydraulics Services

2.1. Enware thermostatic mixing valves (preferred) for water temperature control.

2.2. Gas meters – Elster / Krom Schroeder / Email / FMG – other as approved.

2.3. Water meters – Elster / Davies Kent – other as approved.

2.4. Rinnai / Rheem hot water systems.

2.5. Grundfos multistage pumps,

3. Security Services

3.1. Avgilon CCTV cameras

4. Mechanical Services

4.1. Smardt Turbocor fluid chillers, multiple refrigeration circuits where multiple compressors, stainless steel tube sheets for condenser water boxes, monitoring of chiller amps and compressor speeds & interface of other suction/discharge pressures to BMS, Carel control system. Carrier air cooled chillers with corrosion treated condenser for small capacity installations >250 kWr.

4.2. Southern Cross close coupled motor pumps with galvanised spring mount base, cast iron casing, bronze impellor, stainless steel shaft, mechanical seal, and 2900rpm high efficiency motor.

4.3. Danfoss variable speed electric motor drives, interface to BMS, shielded cable between VSD and motor.

4.4. Daikin/Mitsubishi Electric (Split systems & VRV),

4.5. Temperzone/Actron package AC equipment.

4.6. Carrier/Air Design/Temperzone/Fan Coil Industries/Dunn/Walker fan coil units and AHU's. (AHU fans >5,000 l/s shall be double width double inlet backward curved aerofoil blade fans preferably direct drive motor, FCU's shall be direct drive)

4.7. Grundfos close coupled multi stage motor pumps.

4.8. Sime/Dedietrich/Feroli/Simons cast iron section water heaters.

4.9. Siemens & Delta BMS control, all analogue outputs shall have adjustable 0-100% position manual override pot, actuators shall be Siemens, damper actuators shall be maximum 1x actuator per 1m2 of damper and use of GIB131 for small dampers and GIB161 for larger damper.

4.10. Circutor Energy Monitoring System, Schneider Electric PM5350 digital power meters and Schneider Electric TSX-ETG100 RS485 to ethernet communications routers,

4.11. AirChange air to air heat exchangers,

4.12. Evapco-BAC cooling towers including direct drive low noise fans and galvanised work platform, where direct drive low noise is not available, direct drive shall be used where noise can be tolerated, otherwise belt drive low speed are to be used.

4.13. Feed & expansion shall be via open tank with ball float unless impractical (pressure pump systems are to be avoided),

4.14. Chemical dose pots shall be 10ltr stainless steel with integral funnel/drain & valves,

4.15. Alfa Laval plate heat exchangers,

4.16. Motorised dampers shall be aluminium frame/aluminium blade stainless steel/gal shaft, bronze/nylon bush, external side shaft driven linkages maximum 1x actuator per 1m2 of damper hex shaft,

4.17. Filters shall be standard sizes of 600mmx600mm / 600mm x 300mm / 300mm x 300mm - 50/100mm thick pleated panel disposable with Magnahelic/Sailsor differential pressure gauge mounted across filter,

4.18. Non return valves shall be Keystone or equal single swing check, ball valves with bronze body stainless steel (ball/extended shaft/handles), butterfly valves shall be lugged buna N seal bronze disc cast handle stainless steel quadrant, flexible couplings shall be nylon cord reinforced rubber, pipework shall be copper with brushed aluminium sheathing, CHW systems greater than 200kWr shall also include a 1000-10000Ltr storage tank depending on system size to minimise short cycling of chillers during low load.