SCENTRE GROUP

GENERAL SPECIFICATION

ELECTRICAL SERVICES

Owner and Operator of Westfield in Australia and New Zealand

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DOCUMENT INFORMATION

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PREFACE

This General Specification is intended as supplementary information to be read in conjunction with the Project Specification issued in the Contract Documents.

The Scope of Works relevant to the Contract is contained within the Project Specification(s) and this specification provides additional information as to requirements pertaining to that scope.

Items may be referenced within that are not within the Scope of Works.

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1 GENERAL REQUIREMENTS

1.1 GENERAL

General: This General Specification covers the general requirements of materials, workmanship, testing, maintenance and documentation for electrical services installations. Unless specified otherwise in other project specific document, these requirements will apply when they are relevant to the project.

1.2 STANDARDS

a) General:

I. Comply with the relevant Australian Standards including but not limiting to those referenced in this document.

II. If the Australian Standard referenced in this document is superseded or withdrawn, the superseding standard or other relevant standards shall apply.

III. Refer to the latest issue of the Australian Standard unless a particular issue is referenced in the BCA.

1.3 DESIGN AND COMPLIANCE WITH OHS

a) Services and equipment: Locate and arrange all services and equipment so that:

I. Failure of plant and equipment does not create a hazard for the building occupants.

II. Failure of plant and equipment causes minimum or no damage to the building, its finishes and contents.

III. Inspection and maintenance operations can be carried out with minimum inconvenience and disruption to building occupants or damage to the building structure or finishes.

IV. Services and equipment are readily accessible for inspection and maintenance and arranged so that inspection and maintenance can be carried out in a safe and efficient manner.

i. If parts of the plant require regular inspection and maintenance either locate plant so it is safely and readily accessible from floor level or provide permanent access platforms and ladders.

ii. Locate items of equipment that require inspection and maintenance above removable ceiling where possible. If this is not possible (for example above set plaster or other inaccessible ceilings) provide access panels. Arrange services and plant locations to reduce the number of access panels. Coordinate with other trades to use common access panels where feasible.

iii. Modify manufacturer's standard equipment when necessary to provide the plant access.

b) Fault level protection: To withstand the fault level of the incoming supply at the location of the equipment.

c) Energy efficiency: Equipment selection and design shall comply with Section J of the BCA .

d) Submission to authorities: If required, submit design and documentation to statutory authorities for approval. Provide evidence showing approval of the authorities.

1.4 MATERIALS AND WORMANSHIP

a) Materials: Provide new and high quality materials and components.

b) Workmanship: The standard of workmanship for all works shall conform to the industry best practice and shall be in accordance with the relevant standards, codes of practice.

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c) Consistency: For the whole quantity of each material or product, use the same manufacturer or source and provide consistent type, size, quality and appearance.

   I. Factory finish: To manufacturer's standard for factory fabricated equipment. All ferrous metallic work which is exposed to elements shall be hot dip galvanised. Any damage to the factory finish shall be repaired at completion.

d) Locking system: Provide 'Lockwood Twin System' for all locking applications.

1.5 INSTALLATION

a) General: Install equipment and services plumb, fix securely and organise reticulation neatly. Provide for movement in both structure and services.

b) Install equipment in accordance with manufacturer's recommendation, and in such a way that the performance of the equipment shall not be adversely affected.

c) Arrangement:: Arrange services so that services running together are parallel with each other and with adjacent building elements. Under suspended ground floors, keep services at least 150 mm clear above ground surface, additional to insulation, and ensure access is not impeded.

d) Minimum clear head height in Car Park 2200mm, Disabled car space (directly over) 2500mm.

e) Lifting: Provide permanent fixtures attached to the equipment for lifting heavy items of equipment as recommended by the manufacturer.

f) System integration: Interconnect system elements so that the installation performs the designed functions.

g) Fixing:

   I. General: If equipment or services are not suitable for fixing to non-structural building elements, fix directly to structure and trim around holes or penetrations in non-structural building elements.

   II. Fasteners: Use proprietary fasteners capable of transmitting the loads imposed, and sufficient to ensure the rigidity of the assembly.

   III. Explosive-powered tools: Do not use explosive-powered tools.

h) Mounting: (caution heavy items will require structural engineers approval prior to installation)

   I. Wall/ceiling mount: Provide galvanised steel support from building structure.

   II. Roof mount:

      i. Roof mount - Metal: Unless equipment platform is provided by the Builder, provide galvanised steel support from roof structure.

      ii. Concrete roof: Fix equipment on concrete plinth.

i) Services connections:

   I. Statutory Authorities requirements: If the authorities elect to perform or supply part of the works, make the necessary arrangements. Install equipment supplied, but not installed, by the authorities.

   II. Connections: Connect to statutory authorities services or service points. Excavate to locate and expose connection points. On completion reinstate the surfaces and facilities which have been disturbed.

j) Concrete plinth:

   I. General: Provide concrete plinth for floor mounted equipment. Contractor to confirm size and location on a builders work drawing for review and coordination.

   II. Construction:

      i. General: Provide galvanised steel surround at least 75 mm high and 1.6 mm thick, fixed to floor with masonry anchors, fill with concrete.

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ii. Reinforcement: Single layer of F62 fabric.

iii. Concrete: Grade N20.

iv. Finish: Steel float finish with the surround.

k) External application: Equipment and installation located outdoor shall be suitable for external application and shall be protected from the elements.

l) Cleaning: At completion, clean all cable tray, conduit, equipment and switchboards (internal and external). Remove all redundant material and rubbish from site.

1.6 BUILDING PENETRATIONS

a) General: Provide all necessary building penetrations details shop drawings including those formed in situ in concrete and block work structures to allow structural coordination. Seal all penetrations after installation of services in accordance with any applicable fire or acoustic rating.

b) Piping sleeves:

I. General: Provide metal sleeves formed from pipe sections for piping penetrations through building elements.

II. Sleeve diameter: Sufficient to provide an annular space around the pipe or pipe insulation of at least 12 mm.

III. Minimum sleeve thickness:

i. Metal: 1 mm.

ii. PVC: 3 mm.

IV. Sleeve terminations:

i. If cover plates are fitted: Flush with the building surface.

ii. If floor draining to floor waste: 50 mm above finished floor.

iii. In fire-rated and acoustic-rated building elements: 50 mm beyond finished building surface.

iv. Elsewhere: 5 mm beyond finished building surface.

V. Finish: Prime paint ferrous surfaces.

c) Cable sleeves: Provide UPVC sleeves formed from pipe sections, for penetration through ground floor slab and beams and external walls by cables not enclosed in conduit.

d) Penetrations:

I. Fire Resistance Level: Seal penetrations using a system to comply with BCA Spec A1.3, AS 1530.4 and AS 4072.1 to retain the design FRL of the building element.

II. Non-fire rated building elements: Seal penetrations around conduits and sleeves. Seal around cables within sleeves. If the building element is acoustic rated, maintain the rating.

III. Roof penetration: Provide leak-proof seal for roof penetration with under-flashing and over-flashing.

IV. Limitations: Do not penetrate or fix to the following without approval:

i. Structural building elements including external walls, fire walls, floor slabs and beams.

ii. Membrane elements including damp-proof course, waterproofing membranes and roof coverings.

V. Membranes: If approval is given to penetrate membranes, provide waterproof seal between the membrane and the penetrating component.

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1.7 VIBRATION SUPPRESSION

a) General: Minimise the transmission of vibration and noise from rotating or reciprocating equipment to other building elements.

b) Flexible connection: Provide flexible connections to rotating machinery and assemblies containing rotating machinery.

   I. Isolate ducts by flexible connections.

   II. Isolate pipes by incorporating sufficient flexibility into the pipework or by use of proprietary flexible pipe connections installed so that no stress is placed on pipes due to end reaction.

c) Vibration isolation mountings:

d) Equipment requiring vibration isolation mountings: Except for external equipment that is not connected to the structure of any building, support rotating or reciprocating equipment on mountings as follows:

   I. Type:

      i. For static deflections < 15 mm: Single or double deflection neoprene in-shear mountings incorporating steel top and base plates and a tapped hole for bolting to equipment.

      ii. For static deflections ≥ 15 mm: Spring mountings.

   II. Selection of vibration isolation mountings: Select mountings to achieve 95% isolation efficiency at the normal operating speeds of the equipment.

e) Spring mountings: Use freestanding laterally stable springs with at least 12 mm clearance between springs and other members such as bolts and housing. Provide the following:

   I. Ratio of mean coil diameter to compressed length at the designated minimum static deflection: > 0.8:1.

   II. Minimum travel to solid of at lease 150% of the designated minimum static defection.

   III. Levelling bolts and lock nuts.

   IV. Neoprene acoustic isolation pads between base plate and support.

   V. Vertical resilient limit stops: To prevent spring extension when unloaded, to serve as blocking during erection, and which remain out of contact during normal operation.

   VI. Snubbing: Snub the springs to prevent bounce at start-up.

f) Installation: Set and adjust vibration isolation mounting supports to give adequate clearance for free movement of the supports.

1.8 NOISE CONTROL

a) General: Control noise levels at site boundaries and in occupied spaces by proper system design, equipment selection, and acoustic treatment to plant rooms and noise sources.

b) Environmental noise:

   I. General: Comply with the noise limit requirements of the authorities.

   II. Background noise: If there is no specific authorities' noise limit requirements, classify the site as noise area category R3 in accordance with Australian Standards

   III. Noise level at boundary: If there is no specific authorities' noise limit requirements, ensure that when equipment operates under normal conditions it will not raise the ambient noise level at the nearest boundary of the site by more than 5 dB when measured on the unweighted 'A' scale, and will be free of any disturbing tone or harmonic sound, at any time of day and night, 7 days a week.

   IV. Building interior noise: Ensure that the sound levels of different areas of the building interior will not exceed the recommended 'satisfactory' levels in accordance with Australian Standards when all equipment is operating under normal conditions.

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1.9 SEISMIC RESTRAINT

a) General: Arrange all components, other than service items exempted in Australian Standards to resist seismic loads. Securely fix all plant and equipment to the building structure. Do not rely on gravity and/or friction to resist seismic forces.

b) Anti-vibration mounts: Use horizontally restrained type.

c) Components: Do not use components that will be damaged by earthquake conditions. Protect systems against the adverse effects of components such as mercury switches that, although not damaged by earthquake, may malfunction.

1.10 CABLE TRENCHES

a) Excavation

I. Existing surfaces: Before excavating trenches, saw-cut existing concrete and bituminous surfaces on each side of the trench to provide a straight even joint. Lift and store unit paving for later reinstatement.

II. General: If practicable, make trenches straight between pits, personnel access ways, junctions and changes in cable route, with vertical sides and uniform grades.

III. Spoil: If excavated material cannot be used for filling or backfilling, remove it from the site.

IV. Trench widths: Keep trench widths to the minimum consistent with the laying and bedding of services, and the construction of personnel access ways and pits.

V. Trench depths: If excavation is necessary below the level of adjacent footings, seek approval and provide necessary support for the footings.

VI. Obstructions: Clear trench of sharp projections. Cut back roots to at least 600 mm clear of services. Remove other obstructions including stumps and boulders, which interfere with services or bedding. If rock is encountered, give notice.

VII. Dewatering: Keep trenches free of water. Place bedding material, services and backfilling on firm ground free of surface water.

VIII. Excess excavation: If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or grade N20 concrete.

IX. Boring: If required by statutory authorities, provide under road boring carried out by a suitable qualified person in lieu of trenches. Ensure a tight fit to the service pipes. If voids are encountered, fill by pressure grouting.

b) Backfilling

I. General: Backfill trenches as soon as possible after approval of laid and bedded service. Place the backfill in layers < 150 mm thick and compact to the density which applies to the location of the trenches, to minimise settlement and so that pipes are buttressed by the trench walls.

II. Under roads and paved areas: Coarse sand, controlled low strength material, or fine crushed rock.

III. In topsoil areas: Complete the backfilling with topsoil for at least the top 50 mm.

IV. In reactive clay: In sites classified M, H or E to AS 2870 use an impervious material if trenches fall towards footings.

V. Elsewhere: Well graded, inorganic, non-perishable material, maximum size 75mm, plasticity index ≤ 5%. Do not place stones greater than 25 mm within 150 mm of services.

c) Reinstatement

I. Lawn areas: Provide 150 mm of loam and re-sow the lawn over the trench and other disturbed areas.

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II. Paving and roads: Reinstate to match adjacent work, paved surfaces and assets disturbed or removed during excavation of trenching.

III. Concrete surfaces: Reinstate concrete surfaces to the original level. If necessary, provide steel reinforcement keyed to the adjacent concrete and laid to prevent the reinstalled concrete from subsiding and cracking.

IV. Bituminous surfaces:

i. General: Provide crushed rock base and sub base to match the existing pavement. Prime coat the existing surfacing with bitumen. Lay and compact hot-mix asphalt so that the edges are flush and the centre is cambered 10 mm above the existing pavement. If hot pre-mix is not available, cold pre-mix may be accepted.

ii. Minimum asphalt thickness: 50 mm or the adjacent pavement thickness, whichever is thicker.

V. Unit paving: Provide sand bedding and, if necessary, compacted crushed rock base. Reinstate the paving units.

1.11 MARKING AND LABELLING

a) General: Mark services and equipment to provide a ready means of identification.

b) Piping: Identify throughout its length, including in concealed space.

c) Electrical:

I. Mark operable control devices, indicators, isolating switches to provide a ready means of identification.

II. Label cables. to indicate the origin and destination, cable number, cable cross sectional area and associated earth cable size.

d) Consistency: Label and mark equipment using a consistent scheme across all services elements of the project.

e) Text:: Provide marking and labelling text identical to the text and terminology used in Operating and Maintenance Manuals.

f) Labels and Notices:

Select from the following:

I. For indoor application: Engraved two-colour laminated plastic or proprietary pre-printed self-adhesive flexible plastic labels.

II. For outdoor application: Engraved and black filled lettering on stainless steel or brass, minimum thickness 1 mm.

g) Emergency functions: Code compliant Safety Signs required for operational environment

h) Colours: Generally in conformance with Australian Standards as appropriate, otherwise black lettering on white background except as follows:

I. Danger, warning labels: White lettering on red background.

II. Main switch and caution labels: Red lettering on white background.

i) Minimum lettering heights: Unless specified in the Australian Standard:

I. Equipment nameplates: 40 mm.

II. Warning notices: 7 mm.

III. Automatic controls and electrical equipment: 5 mm.

IV. Isolating switches: 5 mm.

V. Inside electrical enclosures: 3.5 mm.

VI. Other: 3 mm.

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j) Fault current limiters: In assembly sections containing fault current limiter fuses provide caution notices fixed next to the fault current limiters, stating that replacement fuse links are to match as-installed fuse link ratings, make and characteristics. Provide separate label stating fault current limiting fuse ratings.

k) Externally controlled equipment: To prevent accidental contact with live parts, provide warning notices for equipment on assemblies not isolated by main switch or local main switch.

l) Stand-by power: Provide warning notices stating that assemblies may be energised from the stand-by supply at any time.

m) Custom-built assemblies: For insulation or shrouding requiring removal during normal assembly maintenance, provide danger notices with appropriate wording for replacement of insulation shrouding before re-energising assemblies.

n) Location: Locate notices so that they can be readily seen, next to, if impracticable, on busbar chamber covers of functional units, and behind the front cover of functional units. Provide circuit identification labels in the cabling chamber of each functional unit, located next to external terminations.

o) Schedule cards: Provide schedule cards with written text showing the following as-installed information.

p) Submain designation, rating and short-circuit protective device.

q) Equipment item numbers and current ratings, cable sizes and types and areas supplied.

r) Mounting: Mount schedule cards in a holder fixed to the inside of the assembly or cupboard door, next to the distribution circuit switches. Protect with hard plastic transparent covers, or laminated.

s) Fixing: Use mechanical fixing.

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2 HIGH VOLTAGE INSTALLATION

2.1 GENERAL

a) General: Provide all equipment and materials necessary for the connection, transformation and distribution of High Voltage (HV) electricity supply.

b) Comply with the following:

I. AS/NZS 3000

II. AS 2067: Substation and high voltage installation exceeding 1kV a.c

III. AS/NZS 2344: Limit of electromagnetic interference from overhead a.c power lines and high voltage equipment installations in the frequency range of 0.15 to 1000 Mhz.

2.2 SWITCHGEAR ASSEMBLIES

2.2.1 GENERAL

a) Comply with the following:

I. AS 2650: Common specification for high voltage switchgear and control gear.

II. AS 6227: High voltage switchgear & control gear

b) Construction: Modular construction based on standard module width; fixed and non-withdrawable type.

c) Degree of protection: IP2XC for indoor use to AS 60529.

d) Insulation and breaking medium: SF_6. Provide separate breaking medium so as not to corrupt the integrity of the insulation medium.

e) Compatibility: All new equipment shall be fully compatible with the existing equipment.

f) Operating mechanism:

I. Centralised control: Centralise all control devices required for the unit operating mechanism on the front panel.

II. Operating mechanism: Independent-operation, opening or closing by spring charged lever.

g) Indication: Provide indications for the following:

I. Circuit close.

II. Circuit open.

III. Auto tripping.

h) Remote fault indication: Provide aux contacts for interface with BMS for remote fault indication.

i) Ring Main Units (RMU): Self-contained totally insulated single metal enclosure unit, complete with:

I. 630A network switch-disconnectors at incomings and outgoings.

II. 200A circuit breaker for tee-off with system powered protection unit.

j) Voltage indicator: Provide voltage indicator lamps on all circuit breakers and switch-disconnectors.

k) Cable testing bushings: Provide cable testing bushings. Access to the cable testing bushings shall be interlocked with the earthing switch.

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2.2.2 SPARES CABINET

a) General: Provide a spares cabinet with non-lockable door in each substation, sized for storing equipment, tools and spares necessary for the operation and maintenance of the installation.

b) Spare fuses: Provide 3 spare fuse links for each rating of fuse link on each switchgear assembly.

c) Accessories: Provide one set of raking tool for circuit breakers, and special tools.

d) Label: Label the cabinet 'SPARES CABINET'.

2.3 POWER TRANSFORMERS

2.3.1 GENERAL

a) Comply with the following:

   I. To AS 2374

b) Type: Oil filled sealed type or cast resin dry type as documented.

c) Sound level: To AS 2374, Table A2 'Specially Reduced Sound Levels'.

d) Type test: Carry out type tests to AS 2374 or certify that type tests have been carried out on a transformer of identical design.

e) Certificates: Provide manufacturer's type test certificates.

2.3.2 DESIGN

a) Windings: Provide separate 3-phase HV and LV windings for connection to a 3-phase 50 Hz supply system.

b) Impedances: Normal impedances measured or converted to the values at 75°C:

   I. 1000 kVA: 5.5%.

   II. 1500 kVA: 6%.

   III. 2000 kVA: 6.5%.

c) Impulse levels: 11 kV windings: 95 kV BIL.

2.3.3 CONSTRUCTION

a) Oil filled transformers:

   I. Oil: High flashing point oil (270°C and over) ~~to AS 1767~~, 'Beta Oil' by ABB or equivalent.

   II. Oil tank construction: Construct the transformer tank to withstand, without damage, the mechanical stresses and internal pressures that may occur in service or during lifting and transport.

b) Dry type transformers:

   I. Thermal class: F.

   II. Cooling: Natural air cooling Type AN.

c) Metal enclosure: IP31 metal enclosure.

d) Lifting lugs: Capable of supporting the transformer and its filling oil.

e) Earthing lug: Welded to the outside of the tank.

f) External finish: Suitable for the installation location.

g) Tap changing: Provide an off-circuit tap changing switch operable from the outside of the tank, clearly marked to indicate each switch position, and a means of padlocking the switch in each position.

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h) Bushing: To relevant Australian Standards AS 1265 for voltage above 1000 V, and otherwise suitable for the insulation levels and the degree of atmospheric pollution.

i) Cable boxes: Provide cable boxes, sized to permit the cable cores to be manipulated and terminated within the box, of air insulated construction with removable front cover plate.

j) LV busbars connection: Provide LV bushings with terminal contact surfaces suitable for connection via flexible links to busbars. Fix a flanged surround to the transformer tank, suitable for the connection of a busbar trunking.

k) Indicators: Provide the following:

   I. Oil level indicator.

   II. Temperature indicator.

2.4 HV CABLING

a) General: Multi-stranded polymeric insulated copper conductor cables with equal size neutral, to AS 1429. Provide cable with steel armour for direct unground installation.

b) Rating: Apply manufacturers' data for compliance with fault level rupture capacity.

c) Location marking of underground cable: Comply with Clause 3.7 – Underground Services

Install cabling so as to achieve maximum EMF Field mitigation.

2.5 EARTHING

General: Provide a separate earthing system for the HV installation within the substation with removable link sized to carry the HV fault current.

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3 LOW VOLTAGE INSTALLATION

3.1 GENERAL

a) General: Provide a complete low voltage (LV) installation (including extra low voltage installation) for lighting and power, commencing at the LV terminals of transformer or the LV supply point.

b) Install all LV equipment an infrastructure so as to minimise the effects of EMF in surrounding occupied areas to a maximum of 10 milligauss at 1m above the floor and 1m from perimeter walls.

c) General standards: Comply with the following

I. AS/NZS 3000 Part 1 and Part 2: Electrical installations.

II. SAA/SNZ HB 301: Electrical installations – Designing to the Wiring rules.

III. AS/NZS 3013: Electrical installation – Classification of the fire and mechanical performance of wiring system elements.

IV. AS/NZS 3008.1.1: Electrical installations – Selection of cables.

V. AS/NZS 4961: Electric cables – Polymeric insulated.

3.2 CONSUMERS MAINS

a) General: Provide consumers mains between the transformer LV terminals and the main switchboard. Cables grouped so as to minimise the effects of EMF.

b) Types: Provide consumers mains selected from the following types:

I. Fire rated cables supported by cable ladder/tray rated to WS53 of relevant Australian Standards.

II. Fire rated cable in underground conduits.

III. Busbars in an appropriate fire-rated enclosure provided with suitable mechanical protection.

3.3 SWITCHBOARDS

3.3.1 GENERAL

a) General: Provide proprietary switchboard assemblies, or custom-built assemblies that are type tested.

b) Comply with the following:

I. AS 3439.1

3.3.2 DESIGN

a) Service conditions: Normal service conditions.

b) Short-circuit capacity: Rate main circuit supply and function units as follows:

I. Back-up protective device not provided: Rated short-circuit current for one second.

II. Back-up protective device provided: Rated short-circuit current for the maximum opening time of the associated protective device.

c) Tested levels: Do not use equipment at fault levels higher than tested levels, unless provided with current-limiting back-up protection.

d) Separation: As documented.

e) Degree of protection:

I. In plant rooms: IP 42.

II. Outdoor use: IP 56.

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f) Segregation: Segregate emergency equipment from non-emergency equipment by means of metal partitions designed to prevent the spread of a fault from non-emergency equipment to emergency equipment.

g) Spare capacity: Provide at least 25% spare capacity for load, and at least 25% spare capacity for space, unless it is documented otherwise.

h) Cable entry:

   I. Indoor cable entries: Top or bottom.

   II. Outdoor cable entries: Bottom.

i) Mounting:

   I. Floor mounted: Assemblies generally.

   II. Wall mounted: Front access assemblies with frontal area < 2 m^2.

3.3.3 CONSTRUCTION

a) General: Provide rigid, ventilated, insect-screened enclosures consisting of panels, doors giving the designated enclosure separation and degree of protection.

b) Compartments: Separate shipping sections, subsections, cable and busbar zones, functional unit modules and low voltage equipment compartments using vertical and horizontal steel partitions which suit the layout and form of separation.

c) Steel enclosures:

   I. General: Minimum 1.6 mm thick zinc-coated steel coating class Z200.

   II. Outdoor assemblies: Coating class Z450.

d) Insect proofing: Cover ventilation openings using non-combustible and non-corroding 1 mm mesh.

e) Equipment spacing: Provide sufficient thermal, mechanical and electrical clearance between equipment to ensure proper functioning.

f) Ventilation: Provide natural ventilation or mechanical ventilation if necessary, to maintain design operating temperatures at full load.

g) Earth continuity: Effectively bond equipment and assembly cabinet metal frame to the protective earth conductor

h) Cable entry: Provide cable entry facilities within assembly cable zones for incoming and outgoing power and control cabling. Provide sufficient clear space within each enclosure next to cable entries to allow incoming and outgoing cables and wiring to be neatly run and terminated, without undue bunching and sharp bends.

i) Cover plates and gland plates: 5 mm thick aluminium cover plate and gland plate to maintain the degree of protection.

j) Doors and covers:

   I. Maximum dimensions: 900 mm wide and 1.2 m^2 surface area.

   II. Adjacent door: Space adjacent doors to allow both open to 90° at the same time.

k) Floor-mounting: Provide mild steel channel plinth, galvanised to class Z600, with toe-out profile, nominal 75 mm (high) x 40 mm (wide) x 6 mm (thick), for mounting complete assemblies on site.

l) Lifting provisions: For assemblies with shipping dimensions exceeding 1800 mm high x 600 mm wide, provide fixings in the supporting structure and removable attachments for lifting.

m) Facilities for interface with BMS: Provide wiring terminals, relays, contactors and other accessories which are necessary for interface with the BMS for control and monitoring of electrical services equipment.

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3.3.4 FINISH

a) Extent: Apply protective coatings to internal and external metal surfaces of assembly cabinets including covers, except to stainless steel, galvanised, electroplated, or anodised surfaces and to ventilation mesh covers.

b) Finish coats: Full gloss enamel finishing coats.

c) Comply with the following:

   I. AS 2700

3.3.5 COLOURS:

a) Doors and covers:

   I. Essential services supply: Signal red, Ref. No. R13.

   II. House supply: Golden yellow, Ref. No. Y14.

   III. Tenants supply: Lilac, Ref. No. P23.

b) Plinth: Galvanise

c) Other external surfaces: Orange, Ref. No. X15.

d) Internal surfaces: White

3.3.6 BUSBARS

a) General: Provide main circuit supply busbars within assemblies, extending from incoming supply terminals to the line side of protective equipment for outgoing functional units and for future functional units.

b) Comply with the following:

   I. AS 3768

   II. AS 3865

   III. AS 4388

c) Material: Hard-drawn high-conductivity electrolytic tough pitched copper alloy bars, designation 110.

d) Temperature rise limits - active and neutral conductors: Maximum rated current temperature rise limits: 65 ± 1.5 °C by type test.

e) Maximum current density rating 1.55 A/sq mm

f) Maximum short-circuit withstand current temperature rise limits: 160 °C by calculation to AS 3865.

g) Busbars: rated to min 65kA. Neutral and phase busbars to be grouped in close proximity to minimse the effects of EMF

h) Phase sequence: For main busbars and connections to switching devices, setout phase sequence for phases A, B and C, from left-to-right, top-to-bottom and back-to-front when viewed from the front of the assembly.

i) Colour coding:

   I. General: Provide 25 mm minimum width colour bands permanently applied to busbars at 500 mm maximum intervals with at least 1 colour band for each busbar section within each compartment.

   II. Active busbars: Red, white and blue respectively for the A, B and C-phase.

   III. Neutral busbar: Black.

   IV. MEN link: Green-yellow and black.

   V. Protective earth busbar: Green-yellow.

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VI. Restrictions: Do not use adhesive type colour bands.

3.3.7 INTERNAL WIRING

a) Cable type: Provide 0.6/11 kV copper cables. Use V-90HT insulation where directly connected to active and neutral busbars.

b) Cable entries:

I. General: Neatly adapt one or more cable entry plates, if fitted, to accept incoming cable enclosure. Use the minimum number of entry plates to leave spare capacity for future cable entries. Do not run cables into the top of weatherproof assemblies.

II. Single core cables rated > ~~300~~ 100A. Pass separately through non-ferrous gland plates. Do not use metal saddles.

c) Cable Terminations:

I. Connection to circuits $\leq$ 6 mm^2: Provide DIN-type tunnel terminal blocks.

II. Connection to circuits > 6 mm^2: Provide stud type terminals $\geq$ 5 mm diameter, sized to continuously carry the load.

III. Tunnel terminals: Provide insulated sleeve ferrules to flexible cables terminated in tunnel terminals.

IV. Identification: Identify cables at both ends using neat ring-type ferrules.

V. Arrangement: Terminate internal wiring to one side of the terminal block, leaving the other side for outgoing circuits.

VI. Grouping: Provide separate terminal groups for final subcircuits and control wiring. Provide oversized barriers between each group of terminals having different voltages and terminal size.

d) Control and indication circuits: Minimum size: 1 mm^2 with 32/0.2 stranding.

e) Conrol and indication circuits: Cable colours: Colour code wiring as follows:

I. A phase: Red.

II. B phase: White.

III. C phase: Blue.

IV. Neutral: Black.

V. Earthing: Green-yellow.

3.4 SWITCHGEAR AND CONTROLGEAR

3.4.1 GENERAL

a) Comply with the following:

I. AS 3000

II. AS/NZS 60947.1

b) Rated making capacity (peak): $\geq$ 2.1 x fault level (r.m.s.) at assembly incoming terminals.

c) Utilisation category:

I. Circuits consisting of motors or other highly inductive loads: At least AC-23.

II. Other circuits: At least AC-22.

III. Fuses:

i. Distribution/general purpose: gG.

ii. Motors: gM.

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d) Coordination: Select and adjust protective devices to discriminate under over-current and earth faults.

3.4.2 SWITCHGEAR

a) Comply with the following:
   I. AS/NZS 60947 all parts
   II. AS 3947.3
   III. AS 60269

b) Operation: Independent manual operation including positive ON/OFF indicator

c) Operation: Independent manual operation including positive 'ON/OFF' indicator.

d) Locking: If specified, provide for padlocking in the 'OFF' position.

3.4.3 CONTROL AND TESTING SWITCHES

a) Comply with the following:
   I. AS 3947.5.1

b) Degree of protection: At least the degree of protection of the assembly.

c) Push buttons
   I. Type: Oil-tight, minimum 22 mm∅, or 22 mm x 22 mm.
   II. Rated operational current: At least 4A at 240 V a.c.
   III. Marking: Identify functions of each push-button. For latched 'STOP' or 'EMERGENCY STOP' push-buttons, state instructions for releasing latches.
   IV. Colour code: to AS 1431.2
   V. All illuminated push buttons shall be of the LED illumination type

d) Rotary switches:
   I. Type: Oil-tight, minimum 22 mm∅, or 22 mm x 22 mm.
   II. Rated operational current: At least 4A at 240 V a.c.
   III. Marking: Identify functions of each push-button. For latched 'STOP' or 'EMERGENCY STOP' push-buttons, state instructions for releasing latches.
   IV. Colour code: to AS 1431.2

3.4.4 MOTOR STARTERS

a) Comply with the following:
   I. AS/NZS 60947 all parts

b) Type:
   I. General: Direct-on-line starter.
   II. Power rating exceeding 75 kW: Electronic starter with soft starting.

c) Performance:
   I. Rated duty: Intermittent class 12.
   II. Utilisation category: AC-3.
   III. Mechanical durability: ≥ 3 million cycles
   IV. Electric durability: ≥ 1 million operations at AC-3

d) Motor protection: Provide:

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I. Over-current protection.

II. Single-phase protection.

III. Thermal protection.

3.5 INSTRUMENTS

3.5.1 POWER METERS

a) General: Provide a power meter for real-time local and remote (via BMS) monitoring.

b) Comply with the following:

I. AS 1284

II. AS 62052

c) Type: 3-phase communicating power meter complete with current transformers, local display and accessories.

d) Local display: Panel mounted anti-glare back-light LCD screen.

e) Energy parameters to be monitored: Minimum data output of:

I. kWh.

II. kW and max. kW.

III. kVA and max. kVA.

IV. Voltages.

V. Currents.

VI. Phase power factors.

VII. Frequency.

VIII. THD currents.

3.5.2 ELECTRICITY SUBMETERS

a) General: Provide electricity submeters for real-time local reading, and with output and facility for interface with the BMS for remote monitoring.

b) Comply with the following:

I. AS 1284

II. AS 62052

c) Type: 3-phase or single phase electricity meter complete with current transformers and accessories.

d) Local display: Panel mounted LCD screen.

e) Energy parameters to be monitored: Minimum data output of:

I. kWh.

II. kW.

f) Interface with BMS: Provide high level interface with BMS at the meter based on MODBUS protocol for remote meter reading.

3.5.3 EQUIPMENT SUPPLIED BY OTHERS

a) By services provider:

I. General: Install equipment supplied by the services providers, and provide wiring to complete the installation.

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II. Tariff meter compartment: Install the tariff meter equipment supplied by services providers in a separate sealed meter compartment or separate meter panel.

b) By other contractors: Install measurement accessories supplied by others such as BMS/Metering contractor, on to switchboards in accordance with the recommendation of the supplier.

3.5.4 MARKING

a) General: Provide labels including control and circuit equipment ratings, functional units, notices for operational and maintenance personnel, incoming and outgoing circuit rating, sizes and origin of supply and kW ratings of motor starters.

b) Labels on assembly exteriors:

I. Manufacturer's name: Required.

II. Assemblies: Label with essential markings.

III. Designation labels: For other than main assemblies, provide designation label stating source of electrical supply. Identify separate sections of enclosures.

c) Assembly controls: Label controls and fault current limiters, including the following:

I. Circuit designation for main switches, main controls and submains controls; and

II. Fuse link size.

d) Labels on assembly interiors: General: Provide labels for equipment within assemblies. Locate so that it is clear which equipment is referred to, and lettering is not obscured by equipment or wiring.

e) Danger, warning and caution notices:

I. Fault current limiters: In assembly sections containing fault current limiter fuses provide caution notices fixed next to the fault current limiters, stating that replacement fuse links are to match as-installed fuse link ratings, make and characteristics. Provide separate label stating fault current limiting fuse ratings.

II. Externally controlled equipment: To prevent accidental contact with live parts, provide warning notices for equipment on assemblies not isolated by main switch or local main switch.

III. Stand-by power: Provide warning notices stating that assemblies may be energised from the stand-by supply at any time.

IV. Custom-built assemblies: For insulation or shrouding requiring removal during normal assembly maintenance, provide danger notices with appropriate wording for replacement of insulation shrouding before re-energising assemblies.

V. Positioning: Locate notices so that they can be readily seen, next to, if impracticable, on busbar chamber covers of functional units, and behind the front cover of functional units. Provide circuit identification labels in the cabling chamber of each functional unit, located next to external terminations.

f) Schedule cards: Provide schedule cards with written text showing the following as-installed information.

I. Submain designation, rating and short-circuit protective device.

II. Equipment item numbers and current ratings, cable sizes and types and areas supplied.

III. Mounting: Mount schedule cards in a holder fixed to the inside of the assembly or cupboard door, next to the distribution circuit switches. Protect with hard plastic transparent covers, or laminated.

g) Single-line diagrams: Provide single-line diagrams in each main switch room showing the as-installed power distribution system.

I. Format: Non-fading print, at least A1 size.

II. Mounting: Enclose in a non-reflective glazed metal frame and wall mount.

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3.6 SPARE CABINET

a) General: Provide a spares cabinet with main name plate, labelled shelves and non-lockable door. Size the cabinet for storing racking handles, special tools, spare lamps, spare fuse links and other equipment necessary for satisfactory assembly operation.

b) Location: Wall mounted.

c) Finish: To match assembly.

d) Spare fuses: Provide 3 spare fuse links for each rating of fuse link on each assembly. Mount spares on clips.

e) Spare Indicator lamps: Provide 5 of each type of indicator lamps for the switchboards.

f) Label: Label the cabinet 'SPARES CABINET'.

g) Accessories: Provide one set of racking tools for circuit breakers, and special installation, operation and servicing tools.

3.7 POWER FACTOR CORRECTION SYSTEM

3.7.1 DESIGN CRITERIA

a) Power factor correction: To maintain the system power factor from 0.75 lagging to 0.99 under all load conditions. No leading power factor at any time

b) The power factor correction system shall include the following:

I. main isolation circuit breaker if required and busbar tags for the termination of incoming cabling;

II. DIN fuses for each step busbar mounted;

III. contactors rated for capacitor duty;

IV. 50,25 or 12.5 kvar capacitor steps;

V. each 50,25 or 12.5 kvar step with reactor, contactor and stage fuse to be mounted on a single modular tray to allow easy access and future system expandability;

VI. programmable power factor control relay with integral digital power factor indicator; and

VII. all necessary fuses, flexible wiring using tinned copper and associated equipment for correct functioning of power factor correction system.

3.7.2 ENCLOSURE

The power factor correction cabinet(s) shall be manufactured in modules of 600x600x 2175mm high and have the following features:

a) be manufactured from a minimum 2mm sheet steel for indoor cubicles and 2mm Zincseal for outdoor cubicles both being powder coated to a paint thickness of 70 micron;

b) outdoor cubicles to be manufactured to IP54 rating with galvanised base channels;

c) doors to have lift off type hinges and to be locked with quarter turn locks;

d) free standing, front access with top entry. 2 mm thick aluminium cable gland plates shall be provided;

e) have sufficient natural ventilation without forced cooling, unless detuning reactors fitted; Cubicle heat rise test must be available to prove there is no undue heat stress to the capacitors.

f) well ventilated and vermin proof.

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3.7.3 CAPACITORS

a) Comply with the following:
   I. IEC 60831-1
   II. IEC 60831.2
b) Type: Dry type with low loss and self healing attributes.
c) Automatic overpressure disconnection: Required.
d) Capacitance tolerance: Within -5% to +10%.
e) Continuous Over Current: 30%
f) Over Voltage:
   I. 10% for 8 hours
   II. 20% for 5 minutes
   III. 30% for 1 minute
g) Construction: Cylindrical with single capacitor unit per can.
h) Dielectric rating: ≥ 525V r.m.s. at 50 Hz selected to accommodate the series reactor voltage.
i) Discharge resistance: Required.
j) Loss: < 0.5 W/kVAr (low loss type).
k) Removal: Arranged to permit removal of faulty module while the remaining capacitors continue to function normally.
l) Surface temperature: Rated to achieve < 60°C.
m) Terminals: Tunnel or post type.
n) Connections between capacitors shall be designed to minimise the transfer of short circuit forces on the terminals
o) Have a design life of 15 years minimum

3.7.4 CONTACTORS

a) Type: Step-switching.
b) Utilisation category: for capacitor switching AC-6b (low loss, low inductance capacitance l
c) Rating: For capacitor switching duty at ≥ 1.5 times the capacitor step full load current.
d) Operations: Contactors shall be capable of minimum of 100,000 operations.

3.7.5 POWER FACTOR CONTROL RELAYS

a) The cubicle shall be fitted with an automatic power factor control relay. This relay shall include the following features:
   I. suitable for connection to 110-440V + 10%, 50Hz, 3 phase, 4 wire supply;
   II. suitable for connection to a/1A or -/5A, class 1 current transformer installed in the main switchboard;
   III. minimum 6 stage switching;
   IV. output contact max. rating 8A, AC11 minimum;
   V. adjustable power factor setting. Range 0.7 inductive to 0.7 capacitive;
   VI. adjustable sensitivity to prevent hunting,
   VII. automatic disconnection of all capacitors in case of power outages of longer than 20ms;
   VIII. variable time delay for switching between stages. Programmable from 1s to 18h.

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IX. variable time delay after restoration of power supply to switching in of first stage. Programmable from 1s to 120s or 1min and 120min;

X. capable of reliable operation in temperature range of -20°C to 70°C;

XI. selection of 'manual' or 'automatic' operation;

XII. the controller shall monitor and control a programmable ambient temperature in the enclosure by switching a cooling fan;

XIII. over-voltage, under-voltage, over-temperature and THD V protection trips;

XIV. flush mounted on door of switchgear compartment;

XV. indication for energisation of each capacitor stage;

XVI. all possible programmable switching sequences (eg. 1:1:1:1, 1:1:2:2, 1:2:2:2, 1:2:4:4, 1:1:2:4, 1:2:4:8, etc.or any other customer programmable sequence);

XVII. programmable switching modes (ie. linear, circular, progressive, direct, integral, normal);

XVIII. integral digital power factor display;

XIX. displayed system parameters to include Volts, Amps, THD A, THD V, kVA, kW kvar, PF and Temperature; plus % THD I, THD V and individual harmonics up to the 49th.

XX. monitoring of the above parameters with the capability of logging if pre-set minimum and maximum values are exceeded;

XXI. auto-adaptation to phase rotation, and a programmable angular setting to displace the current signal in case the CT is fitted to the incorrect phase.

XXII. Be insensitive to harmonics

XXIII. Accuracy of better than 1% of full scale.

b) The power factor control relay shall be capable of remote control or integration into a BMS system via an RS-232 serial port or RS-485 Modbus Adaptor.

3.7.6 REACTANCE

a) Reactors shall be designed in accordance with IEC 76/289 and VDE 0532. Type test certificates are to be available on request.

b) The reactors shall:

I. be rated for series connection in a detuning circuit tuned to 189Hz, for operation on a 415V, 50Hz supply;

II. be three phase, iron core type. To minimise vibration and noise, and to ensure long-life, the core laminations shall be secured with bolts which penetrate the core. The laminations shall not be held by a clamping arrangement;

III. be designed with multiple miniature air gaps to minimise straying fields and minimise losses;

IV. be designed with a ±3.0% tolerance;

V. be designed with suitable linearity to prevent saturation during switching such that L = 1.9xLn ;

VI. be designed with an allowance for fundamental over-voltage and harmonics over-voltages of V3 = 0.5%, V5 = 6.0% , V7 = 5.0%; V11=3.5% and V13=3%

VII. have a temperature class of T50/F;

VIII. be designed for application under an average ambient temperature of 50°C;

IX. be designed such that Ith is rated suitably higher than Irms ;

X. have fundamental losses of less than 125W;

XI. be impregnated in resin under vacuum and over-pressure conditions to temperature class H;

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XII. have coil windings of type, aluminium band to minimise losses;

XIII. have terminals of type, copper bars (DIN 46 206);

XIV. be tested in accordance with IEC 76/3 (ie. core to coil 3.0kV for 1 minute).

3.7.7 INSTALLATION

a) Current transformer: Provide a 5 A secondary, 10 VA class 1, PFC current sensing transformer installed in the relevant switchboard.

b) Protection: Provide protective devices to grade and discriminate with upstream devices. Individually protect each kVAR step.

c) Capacitors

I. Insulation: Insulate all live parts.

II. Layout: Arrange capacitors for easy removal and replacement.

III. Mount capacitors in separate cubicle compartment, segregated from inductors, fuses and switchgear. Cubicles shall have adequate strength to withstand an internal electrical fault. Fire retardant filling material shall be incorporated in the cubicles.

IV. Ventilation: Separate capacitors by > 25 mm of air space.

d) Inductors: Mount inductors in separate cubicle compartment, segregated from capacitors, fuses and switchgear.

e) Cubicle

I. Enclosure: Rigid sheet metal cubicle with front access, top and bottom cable entries, matching the enclosure of the main switchboard.

II. Degree of protection: IP 54.

III. Ventilation: Ventilate the PFC cabinet so internal temperature rise is < 5°C above ambient in each cabinet compartment. Provide mechanical ventilation with thermostatic control if necessary.

3.8 WIRING

3.8.1 GENERAL

a) Comply with the following:

I. General: To AS 3000.

II. Fire and smoke control: To AS 1668.1.

III. Fire or mechanical damage: Classifications to AS 3013.

IV. Suspended ceiling space: Thermoplastic insulated and sheathed cable fixed directly to the soffit.

V. Plant rooms: Unsheathed cable in heavy duty UPVC conduit, or in tray or in duct.

VI. Lift machine rooms: Unsheathed cable in metallic conduit.

VII. Plastered or rendered surface: Cable in UPVC conduit chased into wall.

VIII. Stud walls without bulk insulation: Thermoplastic insulated and sheathed cable.

IX. Underground: Thermoplastic insulated and sheathed cable in heavy duty UPVC conduit.

X. Other exposed areas: Cable in UPVC conduit.

b) Tagging: Identify multi-core cables and trefoil groups at each end using stamped non-ferrous tags clipped around each cable or trefoil group.

c) Marking: Identify the origin of all wiring using legible indelible marking.

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d) Cable termination: Terminate copper conductors to equipment using compression-type lugs of the correct size for the conductor. Compress using the correct tool or use soldering.

e) Redundant equipment and wiring: Remove redundant equipment and wiring, including that in accessible ceiling space, before commencing the installation of new wiring.

f) Handling cables: Avoid damage to cable insulation, serving or sheathing. Replace damaged cables.

g) Straight-through joints: Unless unavoidable because of length or difficult installation conditions, run cable without intermediate straight-through joints. Locate in accessible positions in junction boxes. Obtain approval from Project manager for all joints prior to the works, and if approved, must be identified on the Work-As-Executed drawings. The works must be carried out in accordance with the manufacturer's recommendations.

h) Excess cables: Allow 10 m excess cables on all submains to tenants for possible future relocation. Coil neatly and mechanically secure the cables in ceiling space above the distribution board.

3.8.2 POWER CABLES

a) General: Use multi-stranded copper cable.

b) Comply with the following:

I. AS/NZS 5000.1

II. AS/NZS 3008.1.1

III. AS 1746

c) Default insulation: V-90

d) Default sheathing: 4V-90

e) Minimum size:

I. Lighting sub-circuits: 2.5mm2.

II. Power sub-circuits: 2.5 mm^2.

III. Sub-mains: 6 mm^2.

f) Neutral conductor: Provide neutral conductor of same size as the live conductor.

g) Rating: Use AS 3008.1 for the determination of current ratings and voltage drops.

3.8.3 BUSDUCTS

a) General: Use proprietary type-tested systems made up of integral lengths and fittings containing solid copper busbar conductors and housings, assembled in sections to form complete fully enclosed and insulated low impedance power distribution systems.

b) Comply with the following:

I. AS 3439.2

c) Ratings: Select busduct to meet nominated current ratings and, if used as consumer's mains, to match the statutory authority's substation equipment.

d) Neutral conductor: The neutral conductor shall be of same size/rating as the live conductors.

e) Degree of protection: For complete assembly, at least the following:

I. Indoor use: IP40.

II. Weatherproof (partial exposure): IP54.

III. Outdoor use:IP65

f) Indoor system accessories

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I. For current ratings ≤ 400 A: Provide fuse, fuse switch or circuit breaker type plug-in connection boxes. Provide interlocks to enable plug-in boxes to be safely installed or removed on an energised system. Provide plug-in boxes whereby earthing to the busduct housing is achieved before connection of active conductors.

II. For current ratings > 400 A: Provide bolt on accessible T-off boxes.

III. Expansion joints: Provide expansion joints in vertical runs, to allow for expansion and contraction of the busduct system.

IV. End caps: Provide end caps or covers to fully enclose ends of busduct not connected to equipment.

g) Horizontal runs: Support Busduct at maximum intervals of 2 m, using adjustable hangers and steel angle supports. Provide runs that are straight and level. Install hangers at least 300 mm from joint centres. Secure Busduct to angle supports using proprietary clamps.

h) Vertical runs: Support Busduct using a combination of fixed and spring type hangers to allow for expansion and contraction of Busduct system.

i) Fittings: Use elbows, offsets and junctions for changes in direction. If necessary, provide weatherproof covers and gaskets.

j) Busduct system suspensions shall comply with the detailed manufacturers recommendations

3.8.4 EARTHING SYSTEM

a) General: Provide a complete earthing system for the installation.

b) Comply with the following:

I. AS 3000.

c) Type: A direct earthing system using driven electrodes.

d) Connections: Use clamps to AS 1882 for the connection of the main earthing conductor and interconnecting bonding.

e) Earth electrodes: Use copper rod type earth electrodes. Locate earth electrode within a pit having removable cover. Size the pit and cover to allow access for testing, and maintenance.

3.9 UNDERGROUND SERVICES

3.9.1 CABLES IN TRENCHES

a) Sand bed and surround: Provide clean sharp sand around cables and conduits installed underground.

b) Sealing ducts and conduits: Seal buried entries to ducts and conduits using waterproof seals. Seal spare ducts and conduits immediately after installation. Seal other ducts and conduits after cable installation.

3.9.2 CABLE PITS

a) Size: Sufficient size for draw-in of cables.

b) Construction: Construct walls and bottoms using rendered brickwork or 75 mm thick reinforced concrete. Incorporate a waterproofing agent in the render or concrete.

c) Pit covers:

I. General: Provide pit covers to suit expected loads. Fit flush with the top of the pit.

II. Comply with AS 3996

III. Maximum weight: 40 kg for any section of the cover.

IV. Lifting handles: Provide a lifting handle for each size of cover section.

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d) Drainage: Provide drainage from the bottom of cable pit, either to absorption trenches filled with rubble or to the stormwater drainage system.

3.9.3 UNDERGROUND CABLE ROUTES

a) Survey: Accurately record the routes and depth of underground cables before backfilling.

b) Location marking:

I. General: Accurately mark the location of underground cables using route markers consisting of a marking plate set flush in a concrete base.

II. Location: Place markers at each joint, route junction, change of direction, termination and building entry point and in straight runs at intervals of not more than 100 m.

III. Concrete bases: 200 mm diameter x 200 mm deep, minimum.

IV. Direction marking: Show the direction of the cable run using direction arrows on the marker plate. Indicate distance to the next marker.

c) Plates: Brass, minimum size 75 mm x 75 mm x 1 mm thick. Plate fixing: Waterproof adhesive and 4 brass or stainless steel countersunk screws.

d) Marker height: Set the marker plate flush with paved surfaces, and 25 mm above other surfaces.

e) Draw wire: Provide draw wire for spare conduits.

3.10 ACCESSORIES

3.10.1 GENERAL

a) Default mounting heights to centre of accessory plate:

I. Outlets: 300mm above finished floor.

II. Switches and controls: 1100mm above finished floor.

b) Flush mounting: Provide flush mounted accessories except in concrete or block work walls

c) Common face plates: Mount adjacent flush mounted accessories under a common faceplate.

d) Where the number of accessories, in particular switches, is large consider specifying a stainless steel plate as an alternative to plastic.

e) Surface mounting: Proprietary mounting blocks

3.10.2 SWITCHES

a) General: Provide switches for isolation and control.

I. Type: Single pole, flush rocker or time delay push button type; intermediate or 2-way as appropriate.

II. Plate: Moulded plastic flush plate of selected colour. Common plate for grouped switches and associated pilot lights.

b) Comply with the following:

I. Isolation switch: AS/NZS 3133.

II. Emergency stop switch: IEC 60947-5-5

3.10.3 SOCKET-OUTLETS

a) General: Provide socket-outlets for general purpose and for permanently connected equipment.

b) General purpose socket outlet:

I. General: To AS/NZS 3112.

II. Industrial socket-outlet: To AS/NZS 3123.

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III. Type: Switched twin outlets. Industrial type for outlets located in plant room, switch room, pump room, etc.

IV. Plate: Moulded plastic flush plate of selected colour. Stainless steel plate for outlets located in malls.

c) Three-phase outlets:

I. Type: 5-pin, switched, high-impact-resistant plastic, weatherproof type with flap lip on the outlet.

II. Plug: Provide a matching plug top for each outlet.

d) Circuit identification: Provide circuit identification on the inside of the cover plate.

3.10.4 LIGHTING MASTS

a) Design: Provide lighting masts of proven design, manufactured and tested by an approved specialist manufacturer, and suitable for installation in the specified environment and location.

b) Steel masts: Electro-welded ASTM-A500 Grade C tubing. Minimum yield strength (50,000 psi) after fabrication to AS 4792.

c) Bases: Mounting base shall be manufactured with ASTM-A36 hot rolled steel plate, of minimum yield strength (36,000 psi). Fix mounting base to reinforced concrete footing with hot dip galvanized anchor bolts supplied with two nuts and washers. Anchor bolts shall conform to ASTM-A36, of minimum yield strength 36,000 psi.

d) Hand hole: Located 300 mm above the base plate to the centre of the opening. Pole access plate shall be screw fixed with gasket. Poles higher than 6.7 m shall have a re-enforced aperture. House cable connectors (including an earthing lug) and a fuse board inside the hand hole. Provide fuse with enclosed fuse link for individual luminaire.

e) Luminaire mountings: Provide adjustable mountings to suit the specified luminaires, and with provision of rigidly clamping each luminaire in position once it is correctly aimed.

f) Luminaire lowering facility: For masts higher than 12 m, provide maintenance access to luminaires by a lowering facility with ensured safety to the operator during the raising and lowering operations.

g) Wiring: For connections to fuses and luminaires use PVC insulated and sheathed cables of 2.5 mm^2 minimum conductor size. For masts higher than 3 m, provide a catenary wire cable support system to AS 3000 for the wiring to luminaire.

h) Mast erection: Erect the mast on the footing using steel packers where necessary to install in plumb. After the mast is bolted down, neatly pack the space under the mounting base with sand-cement grout.

i) Circuit identification: Provide circuit identification with label of stainless steel plate, engraved with colour infill. Mechanically fix the label to the mast above the hand hole.

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4 LUMINAIRES

4.1 GENERAL

a) Provide proprietary luminaires complete with lamps, luminaire control equipment, lighting control equipment, and accessories as documented

b) Comply with the following:

I. AS/NZS 4783: Performance of electrical lighting equipment.

II. AS 60598: Luminaires.

III. AS 1158: Lighting for roads and public spaces.

IV. EMC compliance: To AS/NZS CISPR 15.

c) Ballasts

I. Provide ballasts for lighting systems selected to be compatible with the lamp and control method.

II. Comply with the following: AS/NZS 61558.1

d) Fluorescent lamp ballasts:

I. Type: High power factor and low loss electronic type.

II. Current total harmonic distortion: < 15%.

III. Number of ballasts: Provide separate ballasts for each lamp.

IV. Comply with the following: AS/NZS 61347.2.3 and AS/NZS 60929

e) Discharge lamp ballasts

I. Standard: High-pressure mercury vapour, low-pressure sodium vapour, high-pressure sodium vapour and metal halide type, to

II. Metal halide type:

i. ≤ 150 W: Electronic controlgear.

ii. 150 W and above: To the lamp manufacturer's recommendation.

III. Igniters: Provide igniters which cut out when lamp ignites and after pre-determined time period if lamp fails to ignite.

4.1.1 POWER FACTOR CORRECTION

a) General: Correct each luminaire to a minimum power factor of 0.9 lagging.

b) Capacitors: To:

I. AS 61048.

II. AS 61049.

c) Integral fuses: Provide integral fuses for high intensity discharge (HID) lamp ballasts.

4.1.2 LAMPS

a) Fluorescent lamp: T5 or T8 triphosphor lamps of documented colour temperature.

b) Neon/cold cathode:

I. Type: 15 mm or 18 mm tubes, colour as documented.

II. Joint: Butt joint, 2 mm space maximum.

III. Supports: Grab-on type, minimum 2 for any length with additional supports for curved sections.

IV. Cable termination: Protect high voltage cables by silicon sleeves.

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c) Incandescent lamp: Do not use incandescent lamps.

4.1.3 TRANSFORMERS

a) ELV transformers

I. General: For extra-low voltage tungsten halogen lamps provide one transformer for each

II. Type: Electronic with in-built thermal cutout.

III. Transformer regulation: 5%.

IV. Output voltage: Not in excess of the nominal rated lamp voltage at a load of 75% of nominal transformer rating.

b) Neon and cold cathode transformers:

I. Type: 240 V single phase, double wound with centre tapping and balanced secondary.

II. Provision: 1 transformer for maximum 30 m tube.

III. Rating: 15 kV, 30 mA.

IV. Protection: Provide each transformer with open circuit monitor that opens the supply to the transformer in the case of secondary open circuit.

V. Provide local accessible isolation switch at each transformer for disconnection of power to the transformer.

4.2 INSTALLATION

a) General: Mount luminaires on proprietary supports using battens, trims, noggings, roses and packing material, as necessary.

b) Suspension:

I. Rods: Steel pipe suspension rods fitted with gimbal joints.

II. Chains: Electroplated welded link chain.

c) Levelling: Adjust the length of suspension rods or chains so that the lighting system is level and even.

d) Surface mounted luminaires:

I. General: Fit packing pieces to level luminaires and prevent distortion of luminaire bodies. Use packing strips to align end to end luminaires.

II. Fixing: Use 2 fixings at each end of fluorescent luminaires. A single fixing at each end in conjunction with 1.6mm backing plates may be used for narrow luminaires.

e) Recessed luminaires: Install recessed luminaries in trimmed openings in the suspended ceiling.

f) Lighting tracks: Locate associated low voltage transformers within 600 mm of the track.

g) Wiring:

I. General: Connect recessed luminaires to a plug socket outlet.

II. Flexible cords: Provide recessed luminaires with an external $\geq$ 1.5 m length of 0.75 mm^2 3-core V75 (minimum) PVC/PVC flexible cord, connected to a 10 A 3-pin moulded plug to AS/NZS 3112. Other fittings flexible cord cross sectional area: $\geq$ 1 mm^2.

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5 EMERGENCY ESCAPE LIGHTING AND EXIT SIGNS

5.1 GENERAL

a) Comply with the following:
   I. AS 2293
   II. AS 60598.2.22

b) Certification: Certify all luminaires by a NATA registered agent.

5.2 SINGLE-POINT SYSTEM

a) Emergency Luminaires : Energy efficient high power LED
   I. Visual indicator lights: Provide the following LED indicators:
      i. Battery charging.
      ii. Monitoring system in operation.

b) Flourescent Luminaires
   I. Visual indicator lights: Provide the following LED indicators:
      i. Battery charging.
      ii. Monitoring system in operation.

c) Inverter system: Provide protection of the inverter system against damage in the event of failure, removal or replacement of the lamp, while in normal operation.

d) Local test switches: Provide a momentary action test switch, accessible from below the ceiling, on each luminaire to temporarily disconnect the mains supply and connect the battery to the lamp.

e) Common test switches: Provide a common test switch on the local distribution board that disconnects main supply to the luminaires

5.2.1 POWER FAILURE DETECTION

Provide power failure detection modules to monitor local lighting circuits in each distribution board so as to initiate emergency lighting.

Benchmark: Clevertronics, NHP or Schneider

5.2.2 BATTERIES

a) General: Use nickel-cadmium batteries capable of operating each lamp at its rated output continuously at least 2 hours during acceptance tests and 1.5 hours during subsequent tests.

b) Battery life: At least 3 years when operating under normal conditions, ambient temperature and subjected to charging and discharging at 6-month intervals.

c) Marking: Indelibly mark each battery with its date of manufacture.

d) Battery charger: 2-rate or variable rate, constant current, constant voltage, and temperature compensated type, with automatic selection of boost and float charging rate.

5.2.3 EXIT SIGNS

a) Type: Standard internally illuminated with pictorial elements.

b) Light source: LED or cold cathode lamp.

c) Pictorial elements: Figure, and directional arrow when it is appropriate.

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d) For use in car parks, loading docks and for outdoor application: With robust, rustproof housing manufactured from high impact, self extinguishing, non-corrosive, glass filled polycarbonate material, IP65 protection rating.

5.3 MONITORING SYSTEM

a) Type of system: Power line carrier system or wireless system.

b) Comply with the following:

I. AS 2293.1

c) System functions: Provide the following minimum functions:

I. Perform testing procedures on luminaires; report on lamp status, battery status, and charge and discharge currents.

II. Display and initiate printing of test results.

III. Maintain a testing database.

IV. Generate logbook.

V. Continuous monitoring and diagnosis of communication network.

VI. Generate audible alarm in situation of fault.

VII. Automatic addressing of luminaires during installation and subsequent alteration.

VIII. Graphical display of individual luminaires and their address identification, use the AutoCAD architectural layouts for the graphic.

d) Luminaires: Addressable type, with 32-bit address, with communication status indicator.

e) Central controller: Provide the following minimum functions:

I. View system and luminaires status.

II. User friendly window compatible software.

III. Password protected operation.

f) Web browser: The system shall be of web based design and the system shall be connected to the Scentre Group Intranet.

5.4 INSTALLATION

a) Fixing:

I. Wall mounted: With or without bracket of steel tube powder coated white finish.

II. Ceiling mounted: With dual steel tubes of powder coated white finish.

III. Outdoor: Weather-proof luminaire mounted on hot dip galvanised steel pole for outdoor application.

b) Identification of luminaires: For addressable systems, label each luminaire to identify the address of the luminaire. The address must be the same as that shown on the as-installed drawings and on the graphic display of the central control unit.

c) Power supply to single-point system: Provide 240 V unswitched active supply to each luminaire and exit sign, connected to the nearest local lighting final sub-circuit.

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6 STANDBY POWER SUPPLY SYSTEM

6.1 GENERAL

a) General: Provide a standby power supply system comprising factory designed, assembled and tested generating set, fuel tanks and fuel transfer systems.

b) Comply with the following:

I. AS 3010.1

II. AS/NZS 4509

6.2 GENERATING SETS

a) General: Provide low noise, low emission and high efficiency generating sets comprising engine, alternator, control and indicating instrument.

6.2.1 GENERATOR:

a) Comply with the following:

I. AS 3010

b) Specification:

I. Electrical output: 230/400 V a.c. 50 Hz star connected with neutral terminal.

II. Excitation: Permanent magnet.

III. Number of poles: 4.

IV. Construction: Single bearing, close coupled.

V. Insulation: Class H.

VI. Voltage waveform: < ± 5%.

VII. Random frequency variation: < ± 0.25%.

VIII. Voltage regulation: < ± 0.5%).

IX. Harmonic distortion: < 5% no load to full linear load, < 3% for any single harmonic.

X. Temperature rise: 150^{o}C.

XI. Winding temperature detectors: Provide.

XII. Anti-condensation space heater: Provide.

XIII. Enclosure Classification: Drip proof IP22.

6.2.2 DIESEL ENGINE

a) Comply with the following:

I. AS 4594.1

b) Specification:

I. Engine type: 4-stroke, spark ignition.

II. Aspiration: Turbocharged and low temperature after-cooled.

III. Fuel type: Grade A1 or A2 distillate fuel.

IV. Fuel system: Direct injection.

V. Governor: ISO 8528 Part 1 Class G3.

VI. Cooling system:

i. Integral set-mounted radiator cooling/remote radiator cooling/heat exchanger cooling.

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ii. Rated ambient temperature: 40°C.

c) Accessories:

I. Fuel filter: Spin-on fuel filter with water separator.

II. Oil filter: Spin-on combination full flow and bypass filter.

III. Air cleaner: Dry disposable type.

6.2.3 GAS ENGINE

a) General: Low exhaust emission.

b) Specification:

I. Engine type: 4-stroke, spark ignition.

II. Aspiration: Turbocharged, low temperature after-cooled.

III. Fuel type: Low pressure natural gas.

IV. Governor: ISO 8528 Part 1 Class G3.

V. Oil filter: Full flow and bypass filters.

VI. Breather filter: Provide.

VII. Cooling system: Water cooled with remote radiator or heat exchanger.

6.2.4 CONTROL

a) General: Provide a microprocessor based control panel for simple and user friendly interface and navigation.

b) Operation: Provide automatic and manual modes to start and shut down generating sets in the selected sequence.

c) Emergency engine shutdown: Provide for the following conditions to register as audible and visible alarms and to cause each generating set main circuit breaker to open immediately and each generating set to immediately shutdown:

I. Emergency stop push-button: Pressed.

II. Generating set: Over voltage.

III. Generating set protection: Activated.

IV. Generating set: Over current.

V. Engine overspeed.

VI. Engine oil pressure: Low.

VII. Jacket water temperature: High.

d) Automatic load transfer: Upon mains power failure, the automatic transfer switches will transfer the loads from mains supply to the standby power supply in a pre-programmed sequence after the standby generator has reached its stable operation state; and vice versa after restoration of mains supply.

e) Generator controller to incorporate a PLC for load shedding control where necessary.

f) Generators connected in parallel:

I. Load sharing: Share the load in proportion to their rated kW and kVAR capacities.

II. Automatic synchronising: Provide synchronising modules that automatically synchronise each incoming alternator supply frequency and phase angle to the busbars.

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6.2.5 BATTERY AND CHARGERS

a) General: Provide the following:
   I. Starting motor(s).
   II. Floor standing batteries with rack with hold down.
   III. Battery chargers.
   IV. Charging alternator.

b) Comply with the following:
   I. AS 2149
   II. AS 4044

6.2.6 ENCLOSED SET

a) General: Self-contained generating set for outdoor installation, complete with:
   I. Factory integrated container with internal acoustic insulation.
   II. Acoustic baffles of air inlet and outlet.
   III. Access doors with stainless fittings.
   IV. 24 V lighting with timer control.
   V. Fuel tank.
   VI. Residential grade silencer.
   VII. Ventilation
      i. General: Provide ventilation to the enclosure so that:
      ii. With generating sets running at full rated output the enclosure temperature rise does not exceed 10°C.
      iii. Hazardous concentrations of toxic or explosive fumes and gases are prevented.
   VIII. Steel base with anti-vibration mounting.
   IX. Noise control shall be provided to ensure compliance with the EPA and any local council D.A conditions.

6.2.7 INSTALLATION

a) Mounting: Mount the engine and alternator units on a common structural steel frame to support the generating set assembly and the engine local control board.

b) Plinths: Provide reinforced concrete plinths for floor mounted equipment, sized to suit equipment footprints.

c) Resilient mounts: Provide resilient mounting blocks with a minimum vibration isolation efficiency of 95%.

d) Signs:
   I. Warning: Provide the following on each side of each generating set:
   II. 'WARNING: THIS SET MAY START AT ANY TIME WITHOUT NOTICE'.
   III. Lettering: 50 mm high, red on white background.

e) Drip trays: Provide removable drip trays under those parts of the assembly where fuel or lubricant leakage may occur. Provide overflow outlet pipes taken to a point where a receptacle can be fitted under the pipe outlet.

f) Emergency stop push-buttons
   I. Generating set < 2 m long: Provide one push-button mounted on the control panel.

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II. Other generating set: Provide 2 push-buttons per generating set including one on the control panel.

III. Type: 40 mm diameter red, palm operated type mounted in a metal wall box fixed to a free standing 'U' channel pedestal. Wire to disconnect the generator and immediately shut down the engine when the controls are in the automatic or manual mode.

g) Fuel connections: Provide stop valves on the fuel connection.

h) Cooling system: Provide a complete cooling system consisting of radiators / heat exchanger, fans and pumps. Provide ductwork for air intake and discharge of warm air to an outside location of the building.

i) Engine air intake:

I. Filters: Provide dry type air intake filters of sufficient capacity to permit continuous engine operation for 200 hours before filter servicing becomes necessary. Provide filter manometers.

II. Fans: Provide a supply air fan if necessary, selected for the installed system air pressure drop. Include power absorbed by the fan under site operating conditions when calculating generator output.

III. Duct work to comply with AS 4254

j) Exhaust system:

I. General: Provide exhaust piping from the engine complete with silencers, piping, ductwork, support and expansion devices.

II. Exhaust piping: Grade 321 stainless steel.

III. Diameter: Match engine exhaust manifold connection.

IV. Connection: Provide flanged connections to silencers and pipe interconnections.

V. Vibration isolation: Provide a stainless steel flexible connection to the engine.

VI. Weather-proofing: Provide weatherproof flashing, sleeves and acoustic seals where the exhaust system penetrates the roof or external walls.

VII. Exhaust drainage: Grade the exhaust line away from the engine to drainage pockets, or connect to a suitable drainage outlet.

VIII. Lagging: Lag externally exhaust piping and ductwork using 50 mm calcium silicate insulation, sheathed with zinc-coated steel sheet.

IX. Acoustic treatment: If necessary, provide acoustic treatment to the generator set and the generator room to meet the acoustic requirement of the EPA and any local council D.A conditions.

6.3 FUEL SYSTEM

a) Comply with the following:

I. AS 1692.

II. AS 1940.

6.3.1 DAILY SERVICE TANK

a) General: Provide a daily service tank with every generator.

b) Minimum capacity: Adequate for the generator to run continuously at full load for 8 hours.

c) Construction: Welded construction reinforced around the top edge. Provide a lid fabricated from zinc-coated steel 0.8 mm thick with rolled edge.

d) Tank stands: Provide a welded frame stand at least 900 mm high, fabricated from mild steel angle.

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e) Collection trays: Provide a collection tray fabricated from zinc-coated steel sheet 0.8 mm thick, with a 50 mm upturn and rolled edge.

f) Controls: Provide liquid level switches set to start the liquid transfer pump at low liquid level (half full), and cut the pump out at high level (full).

g) Provide low level alarm and initiate shutdown of generator to avoid engine stalling and required bleeding of diesel fuel.

6.3.2 MAIN FUEL TANK - GENERAL

a) Design: Design tanks to accommodate the static heads equal to the height of the vent pipe above the tank.

b) Fittings: Provide the following:

I. Personnel access.

II. Fill connection with internal pipe connection.

III. Dipstick indicating system.

IV. Suction connection, complete with internal pipe, check valve and anti-vortex device.

V. Return connection and internal pipe.

VI. Remote contents gauge connections.

VII. Drain connection for above ground tanks.

VIII. High and low level alarms.

c) Contents indicators:

I. Dipsticks: Form from brass section or anodised aluminium extrusion, with the bottom 100 mm coated with nylon or equivalent non-conducting coating. Stamp or engrave calibrations at intervals of not more than 5% of nominal tank capacity.

II. Contents gauges: Provide a remote-reading contents gauge and connect to a magnetic base balance chamber in the fuel tank, via a fuel-resistant plastic or neoprene pipe. Locate the gauge next to the filling point.

d) Tank supports: Locate supports close to the ends of the tank. Provide doubling plates (120° coverage) fixed to the underside of the tank, of the same material and thickness as the tank. Form box type stools from 6mm mild steel plate, and weld to the doubling plates. Make provision for tank expansion.

e) Finish: Preparation: Blast clean steel tanks and associated steel work, including holding-down bolts and strips, to Class 22, and apply coating systems within 4 hours of blast cleaning.

I. Finish coating:

Type	Coating System
Underground tank	Tar free high build polyamide cured epoxy. Minimum coating thickness: 200 mm
Above ground tank	Inorganic zinc silicate to GPC-C 29/8, following by polyurethane to GPC-C-29/11
Tank enclosed in chamber	Inorganic zinc silicate to GPC-C-29/8
Service tank	Inorganic zinc silicate to GPC-C-29/8

6.3.3 UNDERGROUND FUEL TANK

Installation of underground tanks shall be in accordance with the manufacturers recommendation, but in general shell be as follows:-

a) Excavation and backfilling: Keep excavations free of surface water. After placing the tank, backfill with sand.

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b) Sand backfilling:

I. General: Use chemically inert sand, free from foreign matter such as salt, organic matter and clay lumps, and graded.

II. Placing: Place sand backfilling in layers not more than 200 mm thick and compact to a minimum density index of 75% when tested to AS 1289.5.6.1.

c) Ballasting: If ballasting is necessary to prevent floatation, fill the tank with water before backfilling. Provide a concrete ballast collar at least equal to the weight of the full tank.

d) Trench cover: Provide covers for fuel pipe trenches in concrete floors, of 6mm thick mild steel chequer plate, cut to fit floor trench rebates, galvanised after fabrication.

6.3.4 CATHODIC PROTECTION

a) Comply with the following:

I. AS 2832.2

b) System: General: Provide a cathodic protection system for underground tanks, using an impressed current, designed and installed by a cathodic protection specialist.

c) Characteristics: Provide the following:

I. Monolithic insulating couplings in the suction, vent return and fill lines immediately next to the tank.

II. Power supply, anodes and interconnecting wiring, incorporating a facility for periodic testing.

III. Insulation to the return connection.

d) Power supply: Provide solid state regulated d.c. power supply with balanced outputs and ammeter.

6.3.5 PIPING

a) Pipes inside tank: Heavy steel pipe to AS 1074

b) Filling and service piping:

I. General: Galvanised medium steel pipe to AS 1074

II. Filling: ≥ DN 75.

c) Services: ≥ DN 25.

d) Joints for steel piping:

I. Joint sealing: Seal threads of permanent joints using litharge and glycerine. Make demountable joints using soft jointing compound.

II. Comply with AS 1722.1

e) Cleaning: Flush out piping with fuel, only when the system is complete.

f) Underground piping: Temporarily support the piping in the trench before backfilling. Provide at least 150 mm of backfilling all around piping.

g) Gradients: Lay piping to permit self-draining and avoid air locking, and to the following minimum gradients:

I. Fill pipe: 1: 50 down in the direction of flow.

II. Gravity return pipe: 1:100 down in the direction of flow.

h) Corrosion protection: Paint ends of pipes and joints with cold galvanise paint.

i) Valves and fittings:

I. Provide a check valve and a gate valve at the filling point, and a vertical check valve at the suction connection.

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II. Provide an automatic shut off valve located outside the generator room and connect to the remote controller at the Fire Control Room for automatic shut off of diesel supply in fire alarm situation.

j) Lock boxes:

I. General: Provide 300 mm diameter cast iron boxes with lockable cast iron cover flaps, to each filling and dip point and buried valves.

II. Installation: Set boxes with the top 25 mm above the adjacent finished pavement for ground surface. Surround and support the box with concrete, at least 150 mm thick. Provide gravel underlay to drain the box.

6.3.6 FUEL PUMPS

a) Type: Self-priming positive displacement internal gear type pumps with mechanical seal and direct driven by totally enclosed motor.

b) Mounting: Mount the motor and pump on a common base plate.

c) Material: Casing and rotor: Cast iron or cast steel.

d) Shaft: Hardened steel, or stainless steel.

e) Drip tray: Provide a 50 mm deep drip tray under each pump, of 1.6 mm thick copper with brazed joints.

f) Control: Provide:

I. Automatic control, and

II. Remote control at the Fire Control Room.

6.3.7 LABELS

Provide identification labels to fill and dip boxes, at least 150 mm x 50 mm overall, with lettering at least 25 mm high stating the intended function.

6.3.8 CHARGING

Fill tanks with fuel, and top up immediately before Completion.

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7 PUBLIC ADDRESS SYSTEMS & HEARING AUGMENTATION

7.1 GENERAL

a) Comply with the following:

I. DR 07014

II. AS 60118.4

7.2 PUBLIC ADDRESS

7.2.1 GENERAL

a) General: Provide a PA system public address and background music broadcasting purpose.

b) Performance: The system shall be capable of providing high quality background music and speech broadcast to the nominated areas in the shopping centre, suitable for the acoustical environment (high ambient noise level, low absorption coefficient) of the building. Sound distribution throughout the mall shall be uniform, sound intrusion into the shops and adjacent zones should be contained, and conversation among customers should not be unduly hampered by the broadcast.

c) System component: The system comprises the following integrated components:

I. A digital sound processor (DSP)/Matrix

II. A paging system comprising paging consoles and microphones

III. Amplifiers

IV. Loudspeakers

d) Sound level: Design the system to achieve a sound level of least 15 dBA above the ambient noise levels of the building, which can be taken as:

I. Mall: 60 dBA.

II. Food court and entertainment and leisure precinct (ELP): 70 dBA.

III. Amenities: 40 dBA.

7.2.2 DSP/MATRIX

a) General: The DSP/matrix shall have with built-in digital message player, amplifier monitoring, automatic switchover to backup amplifier and loudspeaker line monitoring. The DSP/matrix shall be compatible with off-the-shelf 100V amplifier and 100V loudspeakers.

b) Specification:

I. Automatic gain control for individual zones.

II. Individual control for each input and output level.

III. Parametric equalization.

IV. Remote control of racks from a master location.

V. Monitoring of incidents: All incidents shall be recorded into a data file which can be consulted on the PC of the BMS.

VI. Fault alarm: Any system fault detected shall be displayed on the BMS.

VII. 24V DC power supply with battery backup.

VIII. System setup: Provide configuration software for loading onto the BMS so that system setup can be executed on the BMS PC. Access to the system shall be password-protected.

c) Manufacturer: Ateïs Model SINAPS or equivalent.

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7.2.3 AMPLIFIERS

a) General: Provide amplifier(s) for individual zone.

b) Backup amplifier: Provide a backup amplifier for each amplifier rack, which has a power output rating equal to that of the highest rated duty amplifier.

c) Performance characteristic:

   I. Output: 100 V line output.

   II. Specification:

      i. Frequency response (1W): 80 Hz – 200 kHz (+/- 1dB)

      ii. Power bandwidth (- 3 dB): 85Hz – 20KHz.

      iii. THD @ 1 kHz, -3dB: ≤ 0.5%.

      iv. S/N ratio: ≥ 94 dB.

d) Rated power output: The rated power output of the amplifier must not be less than 150% of the total connected power (tapping) of the loudspeakers of the circuit.

e) Manufacturer: Australian Monitor Synergy Series or equivalent.

7.2.4 PAGING CONSOLES

a) Paging consoles shall have back-lit LCD touch screen for man-machine interface and information display, a high quality Omni directional microphone and a built-in loudspeaker for monitoring. The paging console shall perform the following minimum functions:

   I. Process and route calls including group calls and all calls functions

   II. Pre-call chime and digital messages

   III. Press-to-talk or ON/OFF buttons

   IV. Music ON/Off, route, select and control of level of music source.

   V. Fault alarm

b) Manufacturer: Ateïs Model PSSDT or equivalent.

7.2.5 LOUDSPEAKERS

a) General: Provide 100 V speakers with power taps as follows:

   I. Mall, offices, amenities and retail areas with suspended ceiling: Ceiling mounted loudspeaker with metal grill.

   II. Car parks: Surface mounted speaker with cone driver.

   III. Other areas: As documented.

b) Type:

   I. Type A: Flush mounted on suspended ceiling and bulkhead generally except where ceiling depth is insufficient.

      i. Type: Duo cone loudspeaker complete with ported and damped metal backbox.

      ii. Size: 165 mm diameter minimum, with metallic grille of powder coated finish and selected colour.

      iii. Rated output power: 30W minimum.

      iv. SPL 1W @ 1m: 89 dB.

      v. Frequency response: 75 Hz to 25 kHz or better.

      vi. Manufacturer: Redback Audio Model C2191 or equivalent.

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II. Type B: Used where Type A is not suitable due to limited ceiling depth.
    i. Type: Coaxial duo cone loudspeaker.
    ii. Size: 165 mm diameter minimum, with metallic grille of powder coated finish and selected colour.
    iii. Rated output power: 15 W minimum.
    iv. SPL 1W @ 1m: 88 dB.
    v. Frequency response: 55 Hz to 15 kHz or better.
    vi. Manufacturer: Redback Audio Model C2121 or equivalent.

III. Type C: Pendant speaker used in atria where flush mounted loudspeakers on surrounding bulkheads are not suitable.
    i. Type: Duo cone ball speaker. With Omni directional sound distribution.
    ii. Size: 100 mm diameter minimum, with white ABS plastic enclosure.
    iii. Rated output power: 15 W minimum.
    iv. SPL 1W @ 1m: 88 dB.
    v. Frequency response: 80 Hz to 20 kHz or better.

IV. Type D: Surface mounted loudspeaker for use in covered car park.
    i. Type: Surface mount 100mm dual cone driver. Direct mount on underside of concrete slab.
    ii. Casing: White industrial grade polypropylene with concealed internal fixing.
    iii. Rated power: 5 W minimum complete with variable taps.
    iv. SPL 1W @ 1m: 92 dB.
    v. Effective frequency range: 100 Hz to 20 kHz.
    vi. Manufacturer: Redback Model C0701 or equivalent.

V. Type E: Other loudspeaker as documented.

c) Design:
    I. General: Distribute loudspeakers evenly to avoid local areas of excessive output and 'blind spots'.
    II. Ceiling speaker:
        i. Space loudspeakers with medium overlap such that no spots are outside the -6 dB coverage pattern of the speakers. (In determining the coverage of speakers, use the Listening Plane coverage angle of speaker instead of Polar coverage angle).
        ii. Forming regular pattern on ceiling plan.
        iii. Maximum spacing: 6 m.
    III. Loudspeakers for car park: Minimise sound intrusion into the neighbour properties.
d) Individual volume control: Flush wall-mounted with stainless plate.

7.2.6 LINE LEVEL INPUT POINTS

a) General: Provide line level 3-pin XLR audio input points and connect to the SMS.
b) Finish: Provide stainless steel plate.

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7.2.7 EQUIPMENT RACKS

a) Central sound rack:

I. Provide a standard 19" professional lockable mounting rack cabinet to house the DSP/Matrix and music equipment. The cabinet shall be of metal construction with clear transparent front door and fan assisted ventilation. Allow storage space for music equipment, amplifier and accessories.

II. Locate the central rack in the Centre Management Office.

III. Label the equipment by engraving on the equipment case the words 'SCENTRE GROUP PROPERTY'.

b) Amplifiers which are not housed in the central sound rack shall be rack mounted and located inside fire rated and secured rooms. Provide a local monitoring loudspeaker shall be provided.

7.3 HEARING AUGMENTATION – LISTENING SYSTEM

a) General: Provide a listening system of audio frequency induction loop system (AFILS) for hearing impaired people. The system shall be an audio frequency induction loop system consisting of:

I. Loop amplifier.

II. Loop cable.

III. Test receiver.

IV. Other equipment as required.

b) Loop amplifier: Amplifier shall be of transconductance type, have:

I. Output current of 10 A continuous into 2 ohms.

II. Input compression of 30 dB input: 1 dB output.

III. Balanced microphone input with switchable phantom power.

IV. Balanced line input.

V. Output metering.

VI. Bar graph for output signal.

VII. Separate indication for 8 to 10 dB into compression.

VIII. Total harmonic distortion 0.5%.

IX. Frequency response 3 dB 100 Hz - 5 kHz.

X. Min. 6 dB per octave roll off from 6 kHz.

XI. Short circuit protection.

XII. Rack mounted.

XIII. Instruction adjacent to the amplifier detailing how the system works and the procedure of testing.

c) Loop cable: General: Loop cables shall be insulated Figure 8 cable with a continuous colour identification stripe along the entire length of the cable. The colour identification stripe shall be of a different colour to the colour of the insulation. The loop cable shall be matched to the loop amplifier.

d) Notices: Provide the international symbol for deafness in a prominent position at the nominated location to indicate that an assistive hearing system is installed. The symbol shall comply with the AS 1428.2. The size of the sign shall be a minimum of A4.

e) Test devices: Provide one test receiver.

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8 TRAFFIC COUNTER SYSTEM

8.1 GENERAL

General: Provide a traffic counter system to measure and record the number of people visiting the centre or any zone of the centre.

8.2 INFRA RED COUNTING DEVICES

a) General: The infra red counting device comprises IR transmitter, IR receiver and amplifier unit.

b) Transmitters and receivers:

   I. Type: Photoelectric type.

   II. Location: Opposite sides of each entrance.

   III. Mounting: Flush-mounted in wall-box complete with stainless steel cover plate, or flush-mounted in doorjambs at 1m above finished floor.

c) Amplifier units:

   I. Type: Solid state type.

   II. Location: Inside entrance door pelmet or in ceiling space above entrance door.

8.3 VIDEO COUNTING DEVICES

a) General: The video counting device comprises video sensor and microprocessor that detects and recognises human within the counting zone. The counter must distinguish the direction of movement, people from objects such as shopping trolleys and baby strollers. The system and the counting zone must be scalable. Data gathered must be time stamped to allow breakdown of data to any desired time increment. All data must be delivered in batches to the central monitoring unit and stored locally for on-site polling.

b) Mounting: Mounted overhead, flushed with the suspended ceiling, otherwise under the soffit.

c) Connection to central controller: Wire each counter directly back to the central controller with communication cable.

8.4 CENTRAL CONTROLLERS

a) General: Provide a central controller. The central controller will perform the following functions:

   I. Gathering data from sensing devices.

   II. Maintain a local database of historic data.

   III. Forward data to Scentre Group Head Office via the local LAN.

   IV. Automatic start after power failure.

8.5 WIRING

a) Wiring system: Enclose in conduits or support in cable trays. Fix cable trays and conduits to the soffit of slab or roof structure.

b) Cable routes: Use most direct route. Keep clear of other services, and avoid running cables above specialty shop ceiling unless it is unavoidable. Run cables parallel to building lines.

c) Continuity: Unless unavoidable due to length or difficult installation conditions, run cables without intermediate joints.

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9 MASTER ANTENNA TELEVISION SYSTEM

9.1 GENERAL

a) General: Provide a television system which is suitable for the reception and high quality distribution of multi-channel analogue and/or digital television, video and sound signals, comprising active and passive components, distribution networks and accessories.

b) Comply with the following:

   I. AS/NZS 1367: Coaxial cable and optical fibre systems for the RF distribution of analogue and digital television and sound signals in single and multiple dwelling installations. (Notwithstanding the specific building types inherent in clause 1.1.1 of AS/NZS 1367 the standard is deemed to apply to all building types.)

   II. Earthing and segregation: To AS/NZS 3000.

   III. Electromagnetic compatibility: To AS/NZS 1367 Section 3

c) Services: The system shall be designed to distribute the following services:

   I. Free-to-air Digital TV broadcast (DVB-T).

   II. FM radio broadcast.

   III. T-DAB radio.

   IV. In-house video/audio.

   V. Cable TV (Foxtel) if documented.

   VI. Satellite TV broadcast if documented.

d) Signal source:

   I. General: Provide service entry facilities to suit signal sources, head end equipment and distribution systems.

   II. Location:

      i. Free-to-air TV, FM radio, T-DAB radio and satellite TV: At the antenna.

      ii. Cable TV: At the Building Distributor Room (i.e. MDF Room).

      iii. In-house video/audio: At the Centre Management Office.

e) Distribution system:

   I. General: Provide a readily expandable distribution system with optic fibre backbone, coaxial/optic fibre connection between tap and outlets.

   II. Where satellite TV is documented, provide an integrated distribution system for FTA and satellite TV broadcasts.

   III. Where cable TV (Foxtel) is documented, provide a separate distribution system.

   IV. Performance: To AS 1367.

9.2 EQUIPMENT

9.2.1 FREE-TO-AIR ANTENNA

a) Standard: To AS 1417.

b) Material:

   I. Boom: Galvanized steel.

   II. Elements: Aluminium ≥ 12 mm.

c) Connection: F type to IEC 60169-24.

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d) Installation:

I. Location: Locate the antenna to obtain maximum signal level and minimise ghosting.

II. Fixing: Attach the antenna to a pipe support, fixed to the building and flashed where required.

III. Mounting hardware: Proprietary to suit antenna.

9.2.2 SATELLITE TV ANTENNA

General: Satellite TV antenna will be provided by the service provider. Install the antenna in accordance with the recommendation/instructions of the service provider.

9.2.3 ACTIVE EQUIPMENT

a) Head-end equipment: Provide headend equipment to suit signal sources, including modulators, frequency converters and amplifiers.

I. Location: In secured room as documented.

II. Mounting: In standard 19" professional rack.

9.2.4 PASSIVE EQUIPMENT

a) General: Provide all necessary passive equipment including multiswitches, taps, splitters, attenuators and wall plates.

b) Wallplates

I. UHF/VHF: Provide a single outlet wall plate for UHF/VHF signals.

II. Where satellite TV is documented, provide diplexed outlets for FTA and satellite TV reception.

III. Where cable TV is documented, provide a separate outlet for cable TV reception.

IV. Plate: Style, material and colour to match adjacent power and switch plates.

c) Outlets:

I. PAL (IEC 60169-2) type on the front and ‘F’ type on the rear for terrestrial FTA services and an ‘F’ type on the front and on the rear for satellite services.

II. ‘F’ type socket on the rear and on the front for cable services.

III. PAL (IEC 60169-2) type socket on the front for FM radio services.

9.3 WIRING

9.3.1 GENERAL

a) Wiring system: Enclose in conduits or support in cable trays. Fix cable trays and conduits to the soffit of slab or roof structure.

b) Cable routes: Use most direct route. Keep clear of other services, and avoid running cables above specialty shop ceiling unless it is unavoidable. Run cables parallel to building lines.

c) Continuity: Unless unavoidable due to length or difficult installation conditions, run cables without intermediate joints.

d) Tails: 1m at amplifiers and 150 mm at outlets, coiled above ceiling level.

9.3.2 COAXIAL CABLE

a) Comply with the following:

I. AS/NZS 1367

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b) Type:

I. General: Minimum RG6 ***Quad*** dual shield.

II. Underground: Flooded type.

III. Consider specifying coaxial cable identity labels to indicate functionality in the direction of main signal flow.

c) Connectors: F type to IEC 60169-24.

9.3.3 OPTIC FIBRE

a) General: Provide an optic fibre distribution system for RF transmission, comprising fibres, optical transmitters, receivers, amplifiers, splitters, couplers, isolators, multiplexors, connectors and splices.

b) Optic fibre: Optic fibre shall be of single mode, with core diameter/cladding diameter of 9µm/125 µm.

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10 LIGHTNING PROTECTION SYSTEM

10.1 GENERAL

a) Comply with the following:

   I. AS 1768

b) Alternative design: Lightning protection system other than the prescriptive requirement of AS 1768 can be accepted, provided that it is evidenced that the same or better protection than the AS 1768 system can be achieved.

10.2 INSTALLATION

a) Air termination: Provide horizontal air termination of copper tape.

b) Thermal expansion: Provide expansion loops in horizontal air terminations between fixing points.

c) Bonding: Bond to the foundation or footing reinforcement.

d) Electrode pits:

   I. General: Locate driven earth electrodes in dedicated pits.

   II. Marking: Mark pit covers with the words 'LIGHTNING PROTECTION EARTH'.

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11 CABLE MANAGEMENT SYSTEM

11.1 GENERAL

a) General: Provide cable management systems comprising cable enclosures (conduits, cable ducts, trunkings, trays and ladders) and cable supports for all electric wiring.

b) Comply with the following:

   I. AS 2053.1

   II. AS 4296

   III. AS 1939

c) Segregation: General: Segregate cables in accordance with the relevant Australian Standards.

d) Protection: Protect cables in accordance with AS 3000.

e) De-rating of cables: Cables shall be grouped and spaced on cable ladders and cable trays in such a way that the de-rating factor of cables will be the lowest.

11.2 CONDUITS

11.2.1 GENERAL

a) Type: Generally PVC conduits, minimum 25 mm. Use metallic conduits wherever exposed to mechanical damage.

b) Set out: If exposed to view, install conduits in parallel runs with right angle changes of direction.

c) Draw-in boxes: Provide draw-in boxes at intervals not exceeding 30 m in straight runs, and at changes of level or direction.

d) Flexible conduit: Use for equipment and plant subjected to vibration. If necessary, use for adjustment or ease of maintenance. Provide the minimum possible length.

e) Minimum sizes: Metallic and non-metallic conduits: 25 mm.

f) Rigid conduits: Provide straight long runs, smooth and free from rags, burrs and sharp edges. Set conduits to minimise the number of fittings.

g) Set out: If exposed to view, install conduits in parallel runs with right angle changes of direction.

h) Inspection fittings: Provide facilities for inspection. Locate inspection fittings in accessible positions.

i) Draw-in boxes:

   I. General: Provide draw-in boxes at intervals not exceeding 30 m in straight runs, and at changes of level or direction.

   II. Underground draw-in boxes: Provide covers and seal against moisture.

j) Draw wires: Provide galvanise steel drawing wires for all spare conduits.

11.2.2 CONDUITS IN CONCRETE SLABS

a) Route: Do not run in concrete toppings. Do not run within pre-tensioning cable zones; cross pre-tensioning cable zones at right angles. Route to avoid crossovers and minimise the number of conduits in any location. Space parallel conduits at least 50 mm apart.

b) Minimum cover: Conduit diameter or 20 mm.

c) Conduit size: 40 mm maximum diameter.

d) Fixing: Fix directly to top of the bottom layer of reinforcing where the conduits pass above a single layer of reinforcing.

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e) Attendance at pours: Ensure that conduits are not displaced, broken or damaged during concrete pours.

f) Prohibited floor slabs: Do not run conduits in the floor slabs of boiler rooms, plant rooms and tank rooms.

g) Hollow-block floors: Locate conduits in the core-filled sections of pre-cast hollow-block type floors.

11.2.3 CONDUITS IN COLUMNS

a) General: Do not place more than four 25 mm (maximum) diameter conduits centrally in each column.

b) Bends: Enter columns via bends with minimum radius of 150 mm.

c) Chasing: Do not chase columns.

11.3 CABLE DUCT/TRUNKING

a) Cable ducts:

I. Material: Metal.

II. Material finish: Metallic-coated to AS 1397 Grade G2, Coating Class Z275.

III. Construction: Solid.

IV. Accessories: Purpose-made to match the duct system.

V. Covers: Screw-fixed or clip-on type removable only with the use of tools.

VI. Cable support: Except for horizontal runs where the covers are on top, support wiring with retaining clips at intervals of not more than 1000 mm.

b) Proprietary trunking systems:

I. General: Provide proprietary, skirting duct, wall duct, floor duct and service column systems, incorporating segregation where used for multiple services. Provide rigid supports. Round off sharp edges and provide bushed or proprietary cable entries into metallic trunking.

II. Accessories: Provide proprietary fixings and mountings facilities for accessories and outlets.

11.4 CABLE TRAY / LADDER SUPPORT SYSTEMS

a) General: Provide a complete cable ladder system, complete with brackets, fixings and accessories. Fabricate brackets, racks and hangers using structural steel sections or other materials in sections of equivalent strength. Run cables < 13 mm diameter on cable trays or in ducts.

b) Standard: NEMA VE-1.

c) Construction:

I. General: Use 2 folded steel side rails with cable support rungs between the rails.

II. Material: Galvanised, heavy-duty steel.

III. Rung spacing: 300 mm maximum.

IV. Minimum width:

i. For power cable: 450 mm

ii. For communications cable: 150 mm.

V. Bend radius: Provide bends with a minimum inside radius of 12 times the outside diameter of the largest diameter cable carried.

VI. Covers: Provide ventilated flat covers to cable trays/ladders installed in accessible locations.

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VII. Fixing to building structure:

i. General: Fix supports to the building structure or fabric using direct fixing, hangers or brackets.

ii. Supports: Galvanised or zinc plated.

iii. Spacing: Space supports at maximum intervals of 1.5 m.

iv. Rods: 10 mm minimum diameter.

v. Access: Provide a minimum of 150 mm free space above and 600 mm free space on one side of trays and ladders.

d) Spare capacity: ≥ 50%.

e) Cable fixing:

- Provide slats or rails suitable for fixing cable ties, strapping or saddles.
- Cable protection: Provide rounded support surfaces under cables where they leave trays or ladders.

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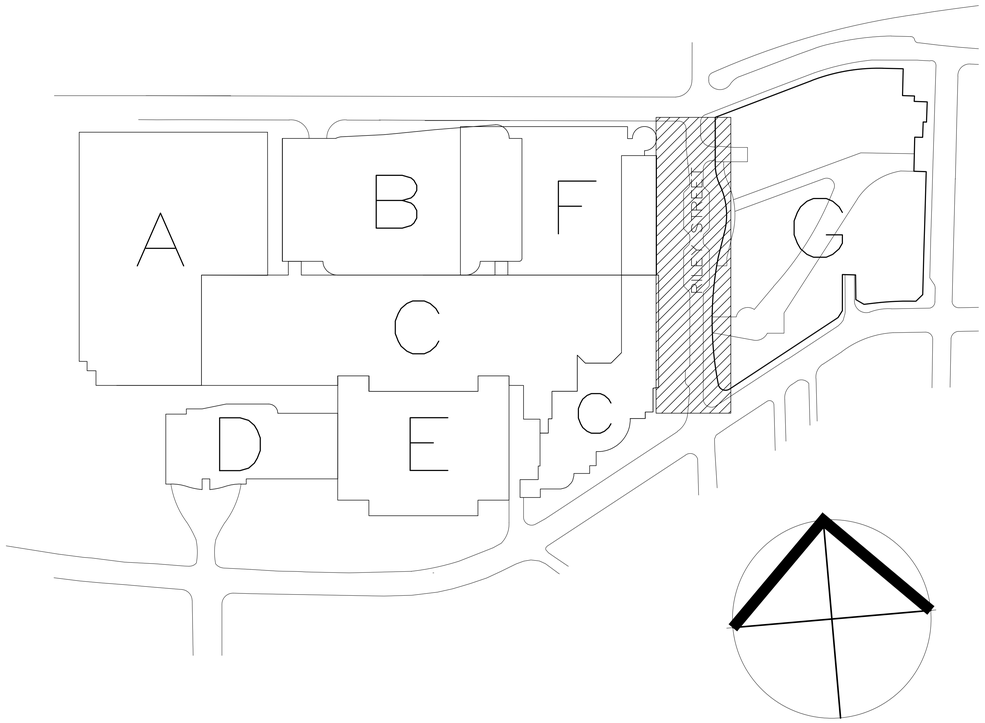
DRAWING SCHEDULE

Drawing No.	Rev.	Drawing Title	CAD file	Scale
E00.0000	3	ELECTRICAL SERVICES COVER SHEET AND DRAWING SCHEDULE	SGD-E000000_CAD	N.T.S.
E00.0001	3	ELECTRICAL SERVICES LIGHTING SYMBOLS STANDARD	SGD-E000001_CAD	N.T.S.
E10.0001	3	ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - FLOOR PLAN - SOUTH	SGD-E100001_CAD	1:100
E14.0001	3	ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - REFLECTED CEILING PLAN - SOUTH	SGD-E140001_CAD	1:100
E14.0002	3	ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - REFLECTED CEILING PLAN - NORTH	SGD-E140002_CAD	1:100
E71.0001	3	ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - PLANTERS A & B - PLAN & SECTIONS	SGD-E710001_CAD	AS SHOWN
E71.0003	3	ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE PLANTERS C & D - PLAN & SECTIONS	SGD-E710003_CAD	AS SHOWN
E71.0006	3	ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE SEATING A - PLAN, SECTION & ELEVATION	SGD-E710006_CAD	AS SHOWN
	3			



KEY PLAN N.T.S.

TENDER

SCENTRE GROUP

Owner and Operator of Westfield in Australia and New Zealand

Scentre Group Design and Construction Pty. Ltd.

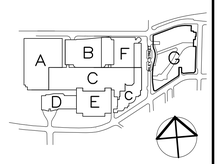
PENRITH -
ELECTRICAL SERVICES
C57490 RILEY ST. COLLONADE UPGRADE

Revision No. : 3
Issued : 01.07.2016

TENDER

Rev	Date	By	Chk	Description
3	01.07.2016	LT	HL	REVISED ISSUE FOR TENDER
2	24.06.2016	LT	HL	REVISED ISSUE FOR TENDER
1	18.12.2015	LT	HL	ISSUED FOR TENDER
A	16.12.2015	LT	HL	ISSUED FOR COSTING

Key Plan



General Note

ALL DIMENSIONS TO BE CHECKED ON SITE. WRITTEN DIMENSIONS ONLY TO BE USED. REFER TO ALL DETAIL DRAWINGS AND SPECIFICATIONS. ANY DISCREPANCIES TO BE REPORTED BEFORE COMMENCING WORK. REFER ANY DISCREPANCIES TO THE ARCHITECT. DO NOT SCALE FROM DRAWINGS.
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SCENTRE GROUP

Owner and Operator of Westfield in Australia and New Zealand

PENRITH

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85 Castlereagh Street, Sydney NSW 2000
Phone (02) 9358 7000 Fax (02) 9228 8500
GPO Box 4004 Sydney NSW 2001
ACN 000 287 246

Title

ELECTRICAL SERVICES COVER SHEET AND DRAWING SCHEDULE

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.

Drawing Scale	CAD File	Plot Date
N.T.S.	SGD-E00.0000_CAD.dwg	1/07/2016

Project No	Drawing No.	Revision
C57490	**E00.0000**	3

SGD-E00.0000[3]

Drawing to scale at A0

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Document Set ID: 7639794
Version: 1, Version Date: 05/05/2017

LIGHTING SCHEDULE

~~LA~~

~~RECESSED LINEAR IP68 RATED LED EXTRUSION MOUNTED TO THE UNDERSIDE OF SEATING COMPLETE WITH REMOTE IP67 RATED REMOTE DRIVER.~~

~~MAKE: XLUX-XL-NEON-22-WW, 2700K 10.5W/m OPAL DIFFUSER. LENGTH TO MATCH SEATING DIMENSIONS AND RECESS ALLOWANCES AS SHOWN ON ARCHITECTURAL DRAWINGS. TO BE SUPPLIED COMPLETE WITH MOUNTING CLIPS AT 300mm INTERVALS. CLIPS TO BE OF A TYPE THAT DOES NOT INTERFERE WITH THE LUMINOUS OPENING OF THE LED STRIP AND WILL NOT CREATE SHADOWS.~~

~~SUPPLIER: LIGHTPROJECT~~

3

~~LB~~

~~RECESSED LINEAR IP68 RATED LED EXTRUSION MOUNTED VERTICALLY INSIDE FEATURE SEATING RECESS, COMPLETE WITH REMOTE IP67 RATED REMOTE DRIVER. LED STRIP TO BE SUPPLIED WITH CUSTOM ALUMINIUM RECESS CHANNEL TO HOUSE LED.~~

~~MAKE: NS-XLUX-CHANNEL-XL-NEON-22-WW, 2700K 10.5W/m OPAL DIFFUSER. LENGTH TO MATCH HEIGHT OF SEATING/PLANTER DIMENSIONS AND RECESS ALLOWANCES AS SHOWN ON ARCHITECTURAL DRAWINGS.~~

~~SUPPLIER: LIGHTPROJECT~~

DA

SURFACE MOUNTED DIMMABLE IP54 RATED SQUARE LED DOWNLIGHT TO BE RECESSED BETWEEN FEATURE TIMBER PANEL CEILING.

MAKE: MODULAR SMART CAKE 82 IP54, 50DEG 3000K BLACK FINISH, NS12412432-DALI-SURFACE SQUARE BOX.

SUPPLIER: JSB LIGHTING

DB

RECESSED DIMMABLE IP54 RATED LED DOWNLIGHT TO BE RECESSED IN TIMBER CEILING.

MAKE: MODULAR SMART CAKE 82 IP54, 50DEG 3000K WHITE FINISH, 12412409-DALI

SUPPLIER: JSB LIGHTING

WA

SURFACE WALL MOUNTED IP55 RATED CIRCULAR DIRECT/INDIRECT LUMINAIRE.

MAKE: MODULAR NUDE UP/DOWN IN BLACK FINISH, 11W 2700K 40DEG LED – 10922332

SUPPLIER: JSB LIGHTING

~~FA~~

~~FEATURE IP68 RATED DECORATIVE LED GLOBE STRAND RGBW (DMX) STRAND, TREE MOUNTED "FAIRY" LIGHTING.~~

3

~~MAKE: MAXLED GLOBE SERIES RGBW. ALLOW FOR 60M OF LIGHTING STRING PER TREE, GLOBE SPACING 150MM. TO BE SUPPLIE DCOMPLETE WITH TREE TIES AND TREE CABLE TIES AS REQUIRED. COMPLETE WITH IP67 RATED REMOTE DRIVER. LIGHTING SUPPLIER TO PROVIDE DMX LIGHTING CONTROLS AND ALLOWANCE FOR A PRE PROGRAMMED SCENE SETTING SELECTION OF 6 DIFFERENT SCENES.~~

~~SUPPLIER: LIGHTPROJECT~~

UA

IP67 FACTORY SEALED INGROUND UPLIGHT C/W DEEP RECESSED LED LAMP, HOOD SAFETY LENS, INTEGRAL DRIVER, CONCRETE INSTALLATION BLOCKOUT\AND SEALABLE JUNCTION BOX. 12W 120EG 1656LUMENS RA90 3000K LED.

SUPPLIER: LIGHT CULTURE

MAKE: WE-EF

PRODUCT CODE: ESC330-FS 185-7489 LED-12W/830

POWER LEGEND

IP56

10A 240V SINGLE SOCKET OUTLET CLIPSAL IP56 PROTECTED.

J 10A 240V JUNCTION BOX INCLUDING EARTH AND NEUTRAL CONNECTORS CLIPSAL 56 SERIES OR EQUIVALENT.

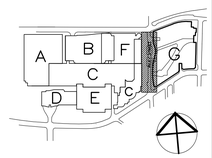
GENERAL NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE GENERAL SPECIFICATION OF ELECTRICAL SERVICES, THE ARCHITECTURAL DRAWINGS AND ALL OTHER RELEVANT SERVICES DRAWINGS.
2. REFER TO THE LEGEND AND LIGHT FITTING SCHEDULE.
3. FINAL POSITION OF ALL EQUIPMENT TO BE DETERMINED ON SITE PRIOR TO INSTALLATION. REFER TO THE ARCHITECTURAL LAYOUT DRAWINGS.
4. ALL LIGHTING AND POWER SUB-CIRCUITS SHALL BE RCD PROTECTED IN ACCORDANCE WITH AS3000:2007
5. ALL WORKS ARE TO BE INSTALLED IN ACCORDANCE WITH THE AUSTRALIAN STANDARDS IN PARTICULAR AS3000 "WIRING RULES", ALL ASSOCIATED MANDATORY STANDARDS, THE BUILDING CODE OF AUSTRALIA AND ALL REGULATORY AUTHORITY REQUIREMENTS.
6. THE EXTENT OF THE WORKS INDICATED ON THE DRAWINGS CALL FOR THE PROVISION OF SYSTEMS COMPLETE IN EVERY RESPECT, FIT AND READY FOR CONTINUOUS SAFE EFFICIENT OPERATION. THE ELECTRICAL CONTRACTOR SHALL SUPPLY, DELIVER, INSTALL, TEST, COMMISSION AND SET TO WORK THE SYSTEMS INDICATED ON THE DRAWINGS. THE FINISHED INSTALLATION SHALL BE COMPLETED WITH ALL NECESSARY ANCILLARY AND MINOR ITEMS, WHETHER EXPRESSLY INDICATED ON THE DRAWINGS OR NOT.
7. LOCATIONS OF EXISTING SERVICES SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE EXACT LOCATIONS AND EXTENT OF EXISTING EQUIPMENT SHALL BE VERIFIED ON SITE BY THE ELECTRICAL CONTRACTOR PRIOR TO WORK COMMENCING.
8. REFER TO THE ARCHITECTURAL STRUCTURAL AND CONSTRUCTION DRAWINGS IN DETAIL TO ENSURE THAT CABLING ACCESS TO THE LIGHT FITTINGS AND EQUIPMENT IS ACHIEVED.
9. ALL PENETRATIONS OF FIRE RATED WALLS, SLABS AND CEILINGS OR THE INSTALLATION OF ELECTRICAL SERVICES SHALL BE CONSTRUCTED AND SEALED BY THE ELECTRICAL CONTRACTOR AFTER INSTALLATION OF CABLES OR EQUIPMENT IN ACCORDANCE WITH THE BUILDING CODE OF AUSTRALIA TO PRESERVE THE INTEGRITY OF THEIR FIRE RATING.
10. LOCATIONS OF ALL NEW OUTLETS, LUMINAIRES, SWITCHES ETC SHOWN ON THE ELECTRICAL DRAWINGS ARE INDICATIVE. THE EXACT LOCATIONS, MOUNTING HEIGHTS ETC SHALL BE DETERMINED FROM THE ARCHITECTS DIMENSIONED PLANS, SECTIONS, ELEVATIONS AND DETAILS.
11. THE ELECTRICAL WORKS SHALL INCLUDE MODIFICATIONS TO THE EXISTING ELECTRICAL SYSTEMS INCLUDING MODIFICATIONS TO EXISTING LIGHTING SUBCIRCUIT WIRING, MODIFICATIONS TO EXISTING DISTRIBUTION BOARDS, PROVISION OF NEW CABLE SUPPORT AND CONTAINMENT SYSTEMS. ALL NEW FITTINGS SHALL MATCH THE EXISTING LIGHTING CONTROL SYSTEM.
12. THE PROVISION OF NEW CABLE SUPPORT SYSTEMS AND MODIFICATIONS TO EXISTING CABLE SUPPORT SYSTEMS SHALL BE UNDERTAKEN BY THE ELECTRICAL CONTRACTOR AS PART OF THESE WORKS.
13. ALL LUMINAIRES SHALL BE CLEANED PRIOR TO PRACTICAL COMPLETION.
14. ALL NEW WIRING SHALL BE CONCEALED FROM VIEW. WHERE THIS IS NOT POSSIBLE, WIRING SHALL BE ENCLOSED IN SURFACE RUN RIGID PVC CONDUIT. ALL SURFACE CONDUIT RUNS SHALL BE AGREED WITH THE ARCHITECT BEFORE INSTALLATION OCCURS. ALLOW TO PAINT ALL SURFACE CONDUITS AND ACCESSORIES TO MATCH COLOUR OF THE WALL/CEILING.
15. PROVIDE 12 MONTHS DEFECTS LIABILITY FOR THE WORKS FROM THE DATE OF PRACTICAL COMPLETION.
16. THE ELECTRICAL CONTRACTOR SHALL SEEK THE PERMISSION OF THE STRUCTURAL ENGINEER PRIOR TO THE COMMENCEMENT OF ANY SLAB PENETRATIONS/CHASING WORKS.
17. ALL POWER OUTLETS SHALL BE LOCATED CLEAR OF WET ZONES AS INDICATED IN AS3000:2700.

SGD-E00.0000[3]

Rev	Date	By	Chk	Description
3	01.07.2016	LT	HL	REVISED ISSUE FOR TENDER
2	24.06.2016	LT	HL	REVISED ISSUE FOR TENDER
1	18.12.2015	LT	HL	ISSUED FOR TENDER
A	16.12.2015	LT	HL	ISSUED FOR COSTING

Key Plan



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SCENTRE GROUP

Owner and Operator of Westfield in Australia and New Zealand

PENRITH

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Phone (02) 9358 7000 Fax (02) 9028 8500
GPO Box 4004 Sydney NSW 2001
ACN 000 257 295

Title

ELECTRICAL SERVICES LIGHTING SYMBOLS STANDARD

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.
Drawing Scale	**CAD File**	**Plot Date**
N.T.S.	SGD-E00.0001_CAD.dwg	1/07/2016
Project No	**Drawing No.**	**Revision**
C57490	**E00.0001**	3

TENDER

Drawing to scale at A0

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Document Set ID: 7639794
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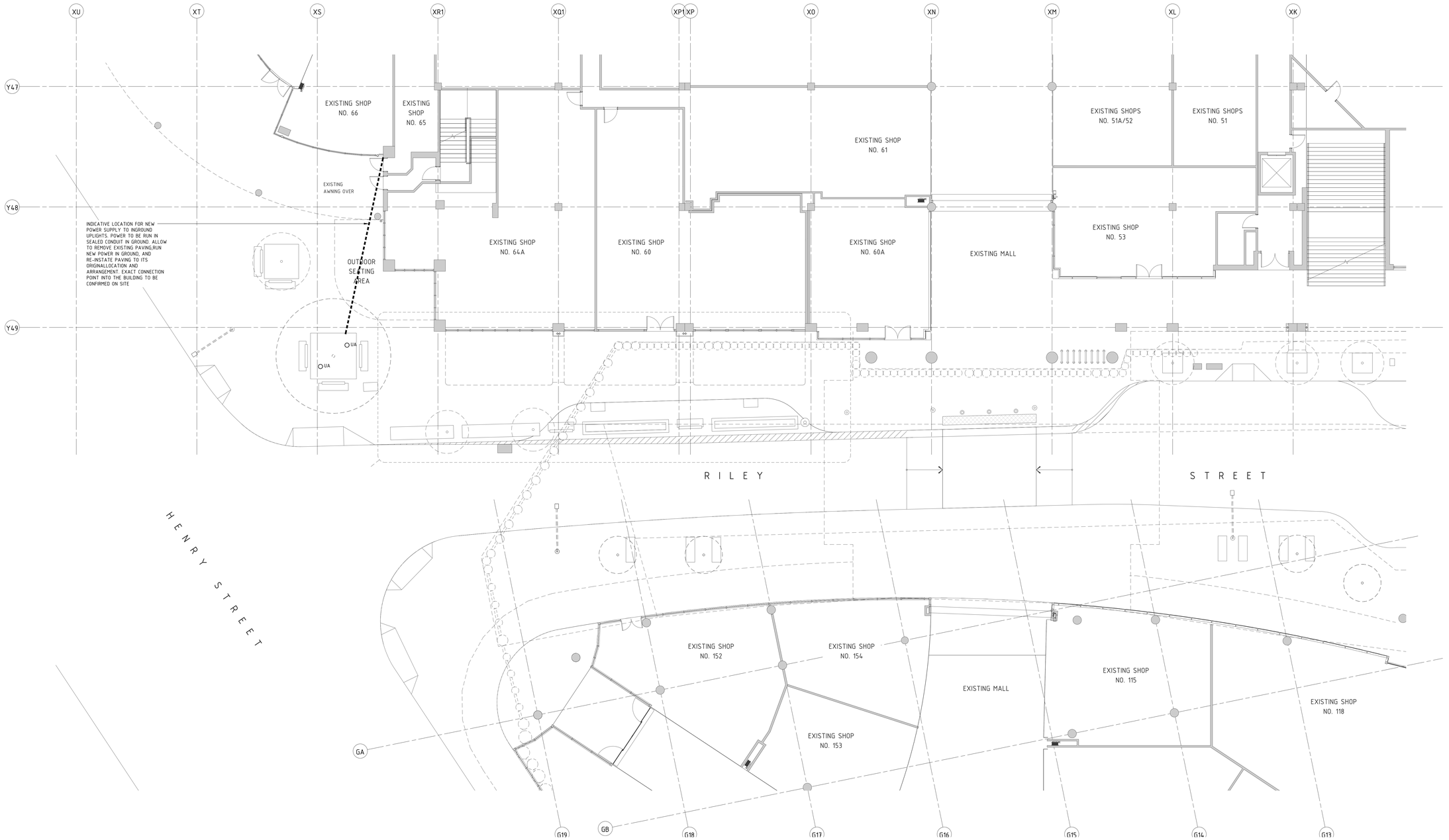
GENERAL NOTES

1. CONTRACTOR TO CONDUCT SITE INSPECTION AND DILAPIDATION REPORT INCLUDING LOAD TESTING AS REQUIRED AND COORDINATE DESIGN WITH OTHER SERVICES AND STRUCTURE.
2. CONTRACTOR TO ALLOW CONNECTION OF LIGHTING TO THE NEAREST ELECTRICAL SERVICES HOUSE LIGHTING BOARD. ALLOW TO EXPAND/MODIFY EXISTING BOARD AS REQUIRED TO CATER FOR CONNECTION OF NEW LIGHTING AS INDICATED.
3. CONTRACTOR TO ALLOW TO PROVIDE AND INSTALL LIGHTING CONTROLS AS REQUIRED FOR THE FUNCTIONALITY OF THE LIGHTING AS INDICATED.
4. WORK SHALL COMPLY WITH THE NECESSARY REGULATORY REQUIREMENTS INCLUDING BUT NOT LIMITED TO: AUSTRALIAN STANDARDS, BCA, FER AND SCENTRE GROUP SPECIFICATIONS.
5. EXACT LOCATION OF INGROUND UPLIGHT TO BE CO-ORDINATED ON SITE WITH EXISTING TREE. LOCATION TO BE SUCH THAT IT DOES NOT DAMAGE THE EXISTING TREE, OR ROOT SYSTEM.



01 FLOOR PLAN - SOUTH

SCALE 1:100

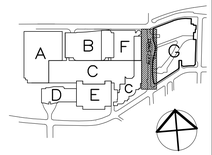
CAD REF.:

0 1m 2m 3m 5m 10m

SCALE = 1:100

Rev	Date	By	Chk	Description
4	27.04.2017	LT	HL	REVISED ISSUE FOR TENDER
3	01.07.2016	LT	HL	REVISED ISSUE FOR TENDER
2	24.06.2016	LT	HL	REVISED ISSUE FOR TENDER
1	18.12.2015	LT	HL	ISSUED FOR TENDER
A	16.12.2015	LT	HL	ISSUED FOR COSTING

Key Plan



General Note

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Phone (02) 9358 7000 Fax (02) 9028 8500
GPO Box 4004 Sydney NSW 2001
ACN 000 287 395

Title

ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - FLOOR PLAN - SOUTH

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.

Drawing Scale	CAD File	Plot Date
1:100	SGD-E10.0001_CAD.dwg	27/04/2017

Project No	Drawing No.	Revision
C57490	E10.0001	4

TENDER

SGD-E10.000114]

Drawing to scale at A0

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Document Set ID: 7639794
Version: 1, Version Date: 05/05/2017

GENERAL NOTES

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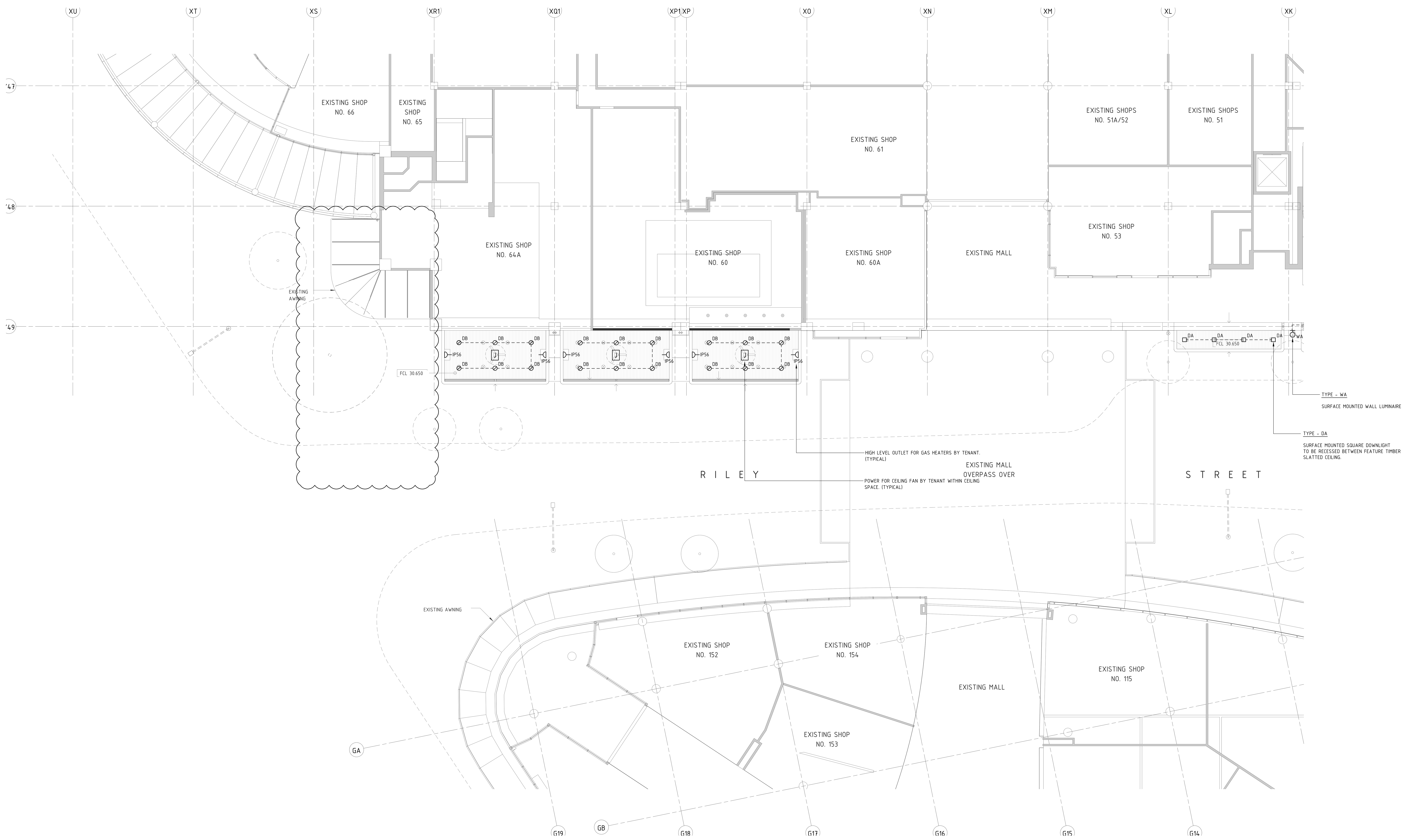
6. DOWNLIGHTS TO BE SPACED AT 1800MM CENTRES. MAXIMUM ALLOWABLE FUTURE FAN SPAN TO BE 1500MM TO ELIMINATE THE POSSIBILITY OF STROBING EFFECT

3



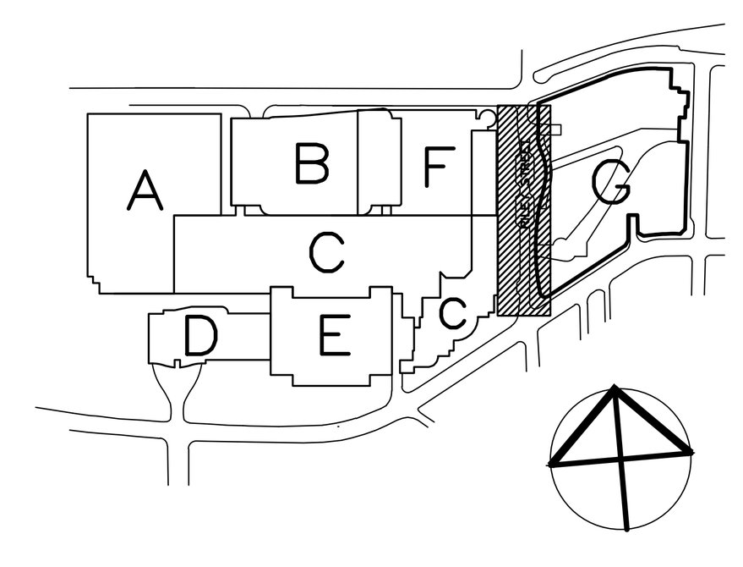
01 REFLECTED CEILING PLAN - SOUTH
SCALE 1:100
CAD REF.:

0 1m 2m 3m 5m 10m
SCALE = 1:100

TENDER

Rev	Date	By	Chk	Description
3	01.07.2016	LT	HL	REVISED ISSUE FOR TENDER
2	24.06.2016	LT	HL	REVISED ISSUE FOR TENDER
1	18.12.2015	LT	HL	ISSUED FOR TENDER
A	16.12.2015	LT	HL	ISSUED FOR COSTING

Key Plan



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GPO Box 4004 Sydney NSW 2001
ACN 000 267 265

Title
ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - REFLECTED CEILING PLAN - SOUTH

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.

Drawing Scale	CAD File	Plot Date
1:100	SGD-E14.0001_CAD.dwg	1/07/2016

Project No	Drawing No.	Revision
C57490	E14.0001	3

Drawing to scale at A0

SGD-E14.0001[3]

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Document Set ID: 7639794
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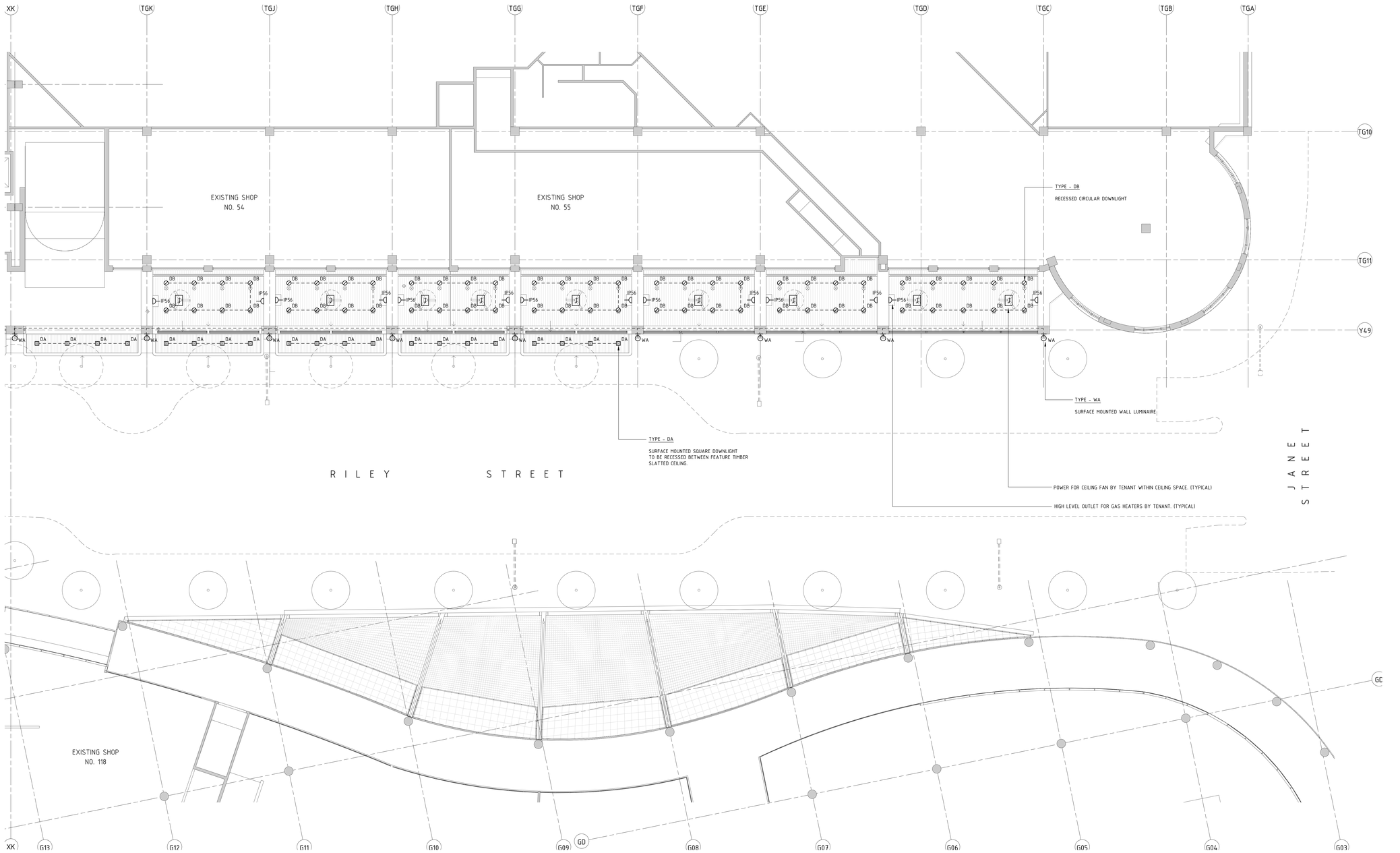

01 REFLECTED CEILING PLAN - NORTH

SCALE 1:100

CAD REF.:

0 1m 2m 3m 5m 10m

SCALE = 1:100

SERVICES DESIGN DOCUMENT QA REVIEW

Project Engineer -comments in Black	Construction Services -comments in Blue
Project Design Manager -comments in Green	Project Manager -comments in Red

By signing this document you agree that the documents are suitable for Costing purposes, subject to the incorporation of comments as noted on the drawings.

SGD-E14.0002[3]

Rev	Date	By	Chk	Description
3	01.07.2016	LT	HL	REVISED ISSUE FOR TENDER
2	24.06.2016	LT	HL	REVISED ISSUE FOR TENDER
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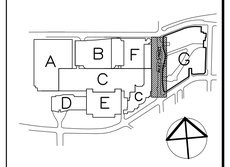
A	16.12.2015	LT	HL	ISSUED FOR COSTING

Key Plan



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ACN 080 641 266

Title

ELECTRICAL SERVICES RILEY ST UPGRADE - REFLECTED CEILING PLAN - NORTH

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.
Drawing Scale	CAD File	Plot Date
1:100	SGD-E14.0002_CAD.dwg	1/07/2016
Project No	Drawing No.	Revision
C57490	E14.0002	3

TENDER

Drawing to scale at A0

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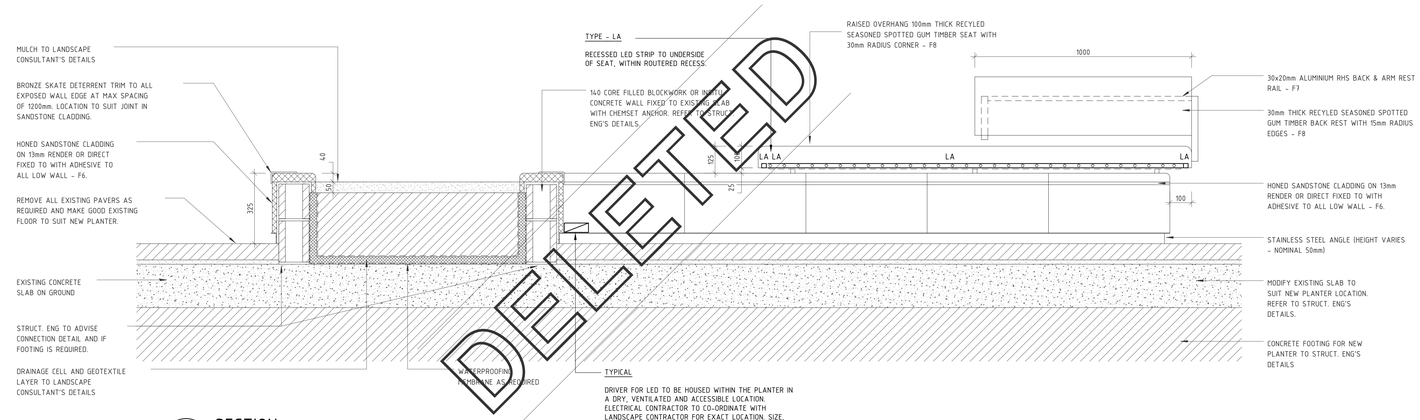
Document Set ID: 7639794
Version: 1, Version Date: 05/05/2017



B SECTION
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CAD REF.:

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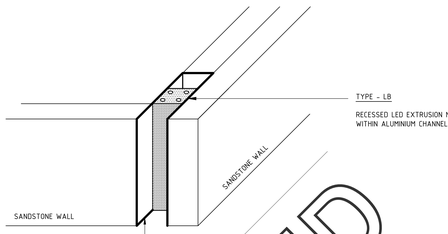

E DETAIL
SCALE : NTS
CAD REF.:

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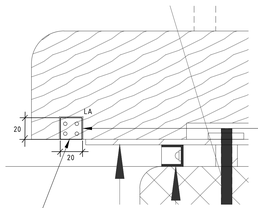
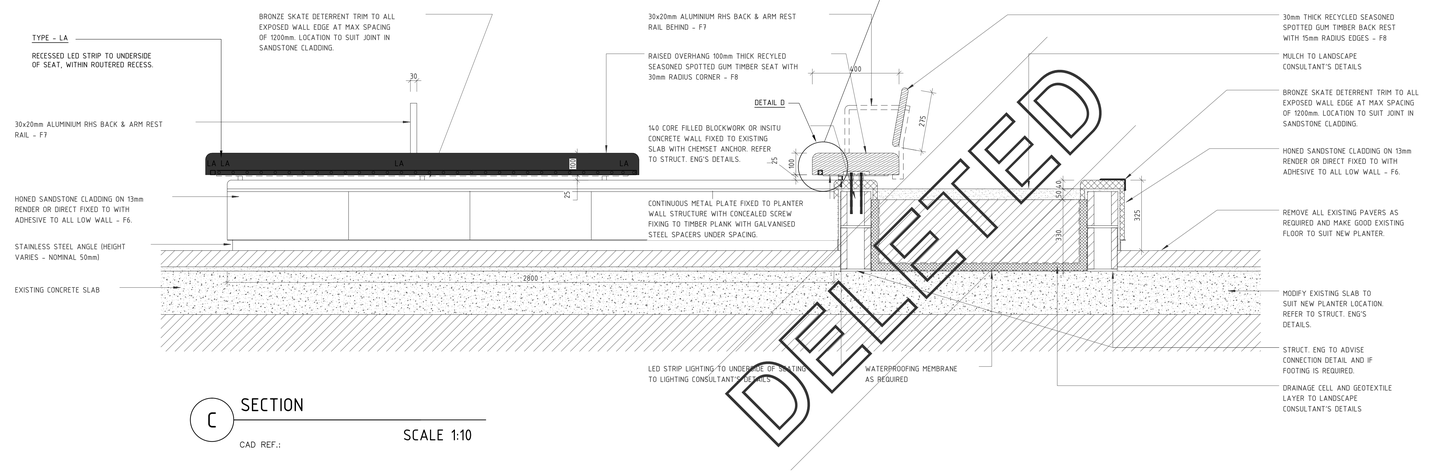
D DETAIL
SCALE 1:2
CAD REF.:





C SECTION
SCALE 1:10
CAD REF.:

DELETED

Rev	Date	By	Chk	Description
3	01.07.2016	LT	HL	REVISED ISSUE FOR TENDER
2	24.06.2016	LT	HL	REVISED ISSUE FOR TENDER
1	18.12.2015	LT	HL	ISSUED FOR TENDER
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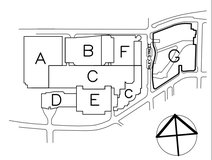
Key Plan



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ACN 090 849 288

Title

ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - PLANTERS A & B PLAN & SECTIONS

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.

Drawing Scale	CAD File	Plot Date
AS SHOWN	SGD-E71.0001_CAD.dwg	1/07/2016

Project No	Drawing No.	Revision
C57490	E71.0001	3

TENDER

Drawing to scale at A0

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Document Set ID: 7639794
Version: 1, Version Date: 05/05/2017

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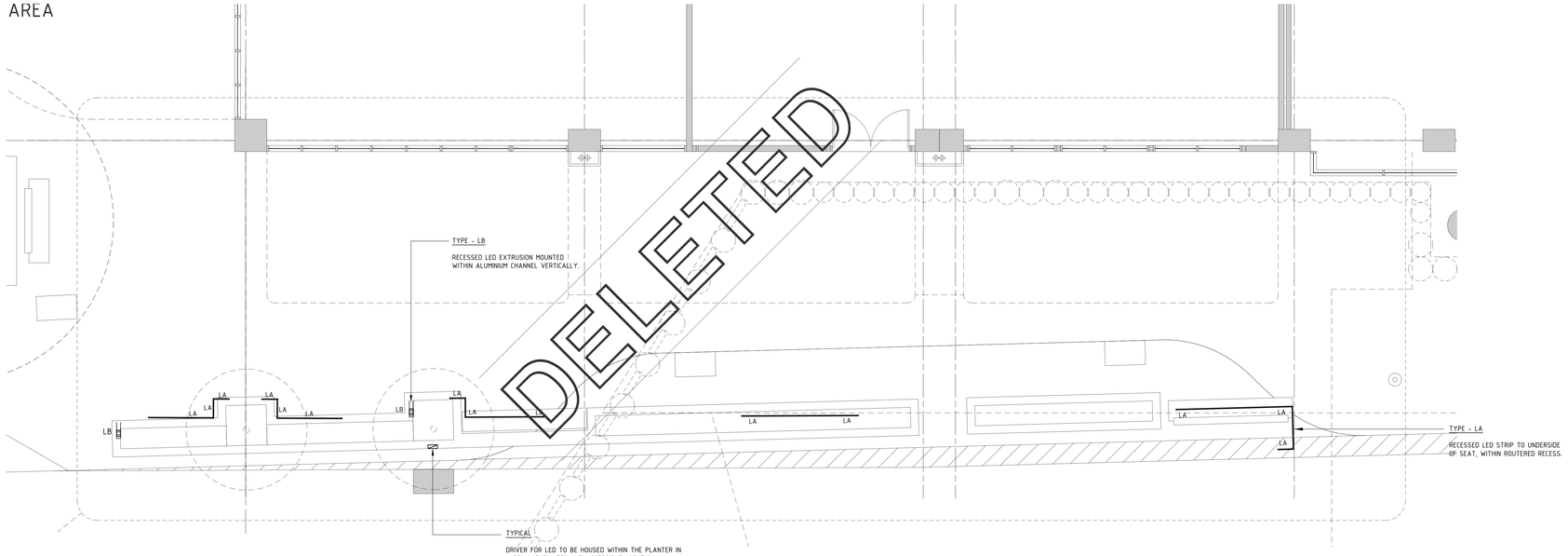

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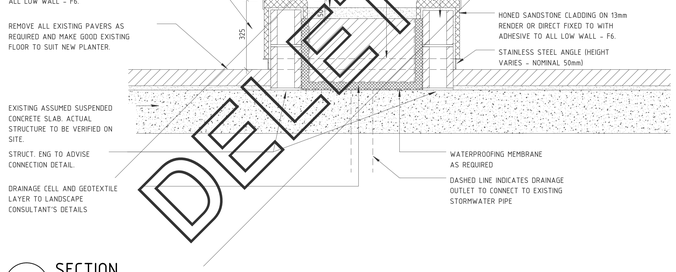
1 FLOOR PLAN - PLANTERS C & D

SCALE 1:50

CAD REF.:



A SECTION

SCALE 1:10

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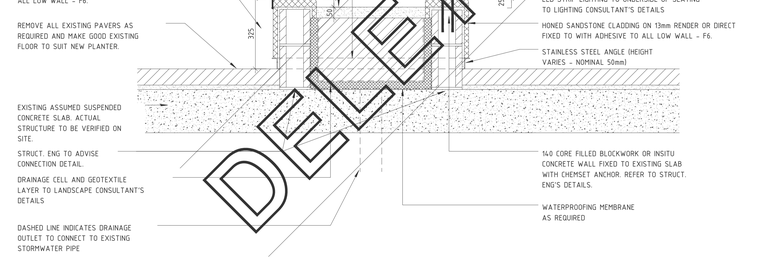
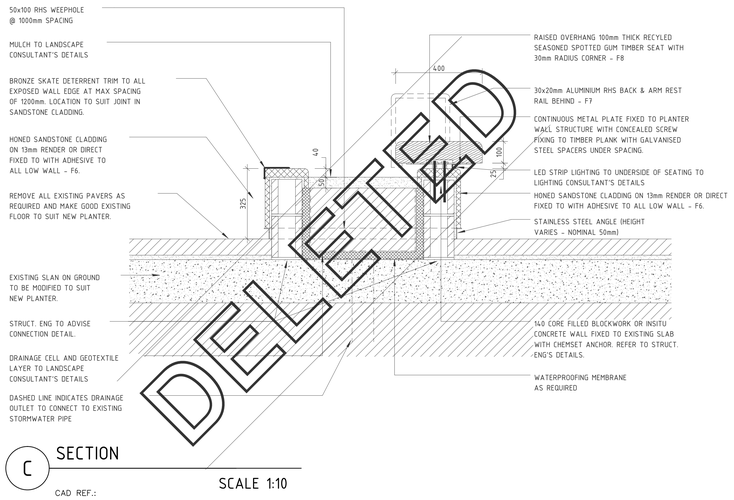


B SECTION

SCALE 1:10

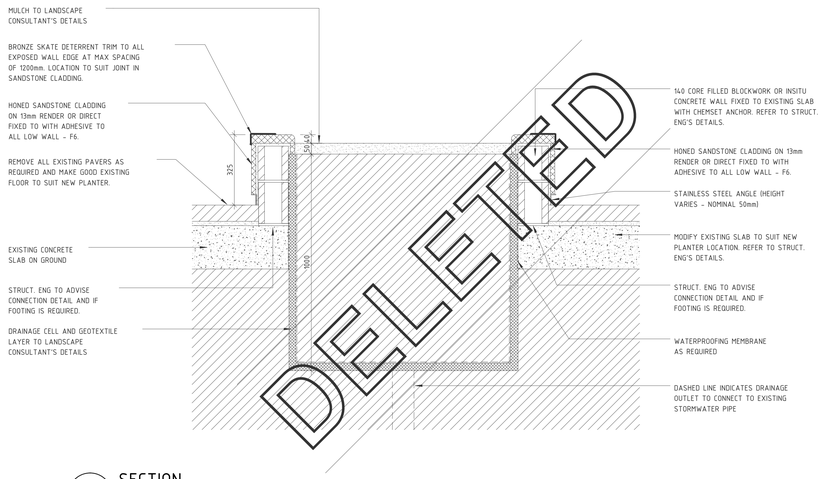
CAD REF.:



C SECTION

SCALE 1:10

CAD REF.:



D SECTION

SCALE 1:10

CAD REF.:

DELETED

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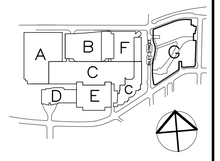
Key Plan



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Title

ELECTRICAL SERVICES RILEY ST COLLONADE UPGRADE - PLANTERS C & D PLAN & SECTIONS

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.

Drawing Scale	CAD File	Plot Date
AS SHOWN	SGD-E71.0003_CAD.dwg	1/07/2016

Project No	Drawing No.	Revision
C57490	E71.0003	3

TENDER

Drawing to scale at A0

SGD-E71.0003[3]

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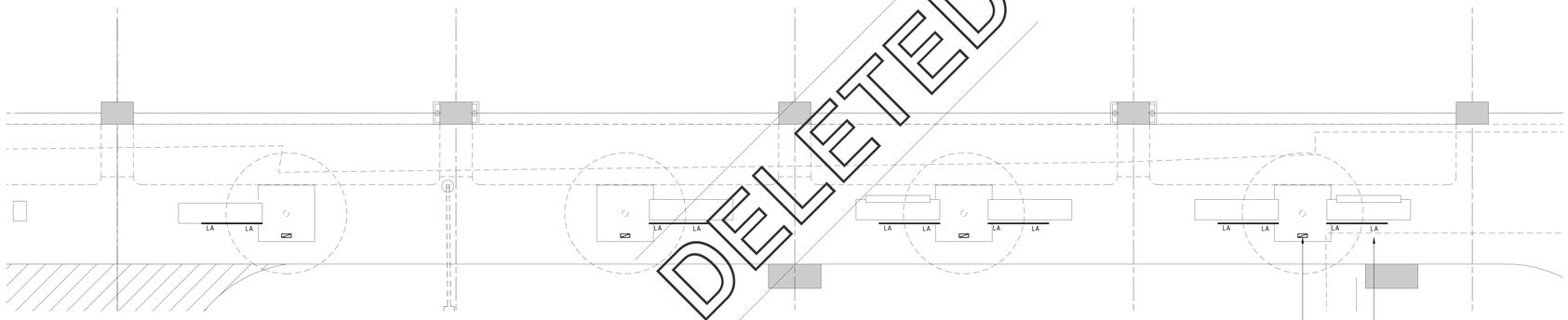
Document Set ID: 7639794
Version: 1, Version Date: 05/05/2017



SGD-E71.0006[3]

DELETED

01 FLOOR PLAN - SEATING

CAD REF.:

SCALE 1:50

TYPE - LA

RECESSED LED STRIP TO UNDERSIDE
OF SEAT, WITHIN ROUTERED RECESS.

TYPICAL

DRIVER FOR LED TO BE HOUSED WITHIN THE PLANTER IN A DRY, VENTILATED AND ACCESSIBLE LOCATION. ELECTRICAL CONTRACTOR TO CO-ORDINATE WITH LANDSCAPE CONTRACTOR FOR EXACT LOCATION. SIZE, TYPE, QUANTITY AND MAXIMUM DISTANCES OF DRIVERS TO BE CO-ORDINATED BETWEEN ELECTRICAL CONTRACTOR AND LIGHTING SUPPLIER.

30mm THICK RECYCLED SEASONED SPOTTED GUM TIMBER BACK REST WITH 15mm RADIUS EDGES - F8

RAISED OVERHANG 100mm THICK RECYLED SEASONED SPOTTED GUM TIMBER SEAT WITH 30mm RADIUS CORNER - F8

30x20mm ALUMINIUM RHS BACK & ARM REST RAIL BEHIND - F7

CONTINUOUS METAL PLATE FIXED TO PLANTER WALL STRUCTURE WITH CONCEALED SCREW FIXING TO TIMBER PLANK WITH GALVANISED STEEL SPACERS UNDER SPACING.

LED STRIP LIGHTING TO UNDERSIDE OF SEATING TO LIGHTING CONSULTANT'S DETAILS

HONED SANDSTONE CLADDING ON 13mm RENDER OR DIRECT FIXED TO WITH ADHESIVE TO ALL LOW WALL - F6.

STAINLESS STEEL ANGLE (HEIGHT VARIES - NOMINAL 50mm)

BRONZE SKATE DETERRENT TRIM TO ALL EXPOSED WALL EDGE AT MAX SPACING OF 1200mm. LOCATION TO SUIT JOINT IN SANDSTONE CLADDING.

HONED SANDSTONE CLADDING ON 13mm RENDER OR DIRECT FIXED TO WITH ADHESIVE TO ALL LOW WALL - F6.

REMOVE ALL EXISTING PAVERS AS REQUIRED AND MAKE GOOD EXISTING FLOOR TO SUIT NEW PLANTER.

EXISTING ASSUMED SUSPENDED CONCRETE SLAB. ACTUAL STRUCTURE TO BE VERIFIED ON SITE.

STRUCT. ENG TO ADVISE CONNECTION DETAIL.

140 CORE FILLED BLOCKWORK OR INSITU CONCRETE WALL FIXED TO EXISTING SLAB WITH CHEMSET ANCHOR. REFER TO STRUCT. ENG'S DETAILS.

TYPE - LA

RECESSED LED STRIP TO UNDERSIDE
OF SEAT, WITHIN ROUTERED RECESS.

A SECTION

CAD REF.:

SCALE 1:10

DELETED

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Key Plan

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Title

**ELECTRICAL SERVICES
RILEY ST COLLONADE
UPGRADE SEATING A - PLAN
SECTION & ELEVATION**

Drawn By	Design By	Checked By
S.A.	L.T.	H.L.

Drawing Scale	CAD File	Plot Date
AS SHOWN	SGD-E71.0006_CAD.dwg	1/07/2016

Project No	Drawing No.	Revision
C57490	E71.0006	3

TENDER

Drawing to scale at A0