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LIVING BUILDING SOLUTIONS

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DATE
Thursday, 29 July 2021

NCC 2019, VOLUME ONE SECTION J COMPLIANCE REPORT

PROJECT NAME
Sacred Heart Girls College Oakleigh

PROJECT ADDRESS
113 Warrigal Rd, Hughesdale VIC 3166

BUILDING CLASS
9b

REPORT COMMISSIONED BY
BRT Consulting

ON BEHALF OF
Sacred Heart Girls College Oakleigh

CLIENT REFERENCE NUMBER
2101

COMPLIANCE SUMMARY

The proposed development has been assessed using the prescribed *Verification Method:* JV3 'Verification using a reference building' to determine compliance with the *Performance Requirement* **JP1** in Section J of the NCC 2019 Volume One.

SPECIFICATION REQUIREMENTS

The proposed development must be constructed in accordance with the following specification to achieve compliance:

Surfmist coloured roof sheeting (SA=0.32)
Reflective sarking under roof cladding with reflective side facing downwards
R4.0 bulk insulation to all ceilings
R2.0 bulk insulation to all external walls
R2.0 bulk insulation to all external/suspended floors
All external glazing must meet or exceed the following performance: U ≤2.80, SHGC≤0.5
≥10kW Solar PV system (roof mounted) with ≥10kW inverter

ADDITIONAL REQUIREMENTS

The proposed development must also be constructed in accordance with the following provisions to be compliant with Section J (*See Appendix A)* :

(a) for general thermal construction, J1.2; and
(b) for floor edge insulation, J1.6(b) and J1.6(c); and
(c) for building sealing, JV4 or J3.1 to J3.7; and
(d) for air-conditioning and mechanical ventilation system control, J5.2 and J5.3; and
(e) for fan systems, J5.4; and
(f) for ductwork insulation and sealing, J5.5 and J5.6; and
(g) for pump systems, J5.7; and
(h) for pipework insulation, J5.8; and
(i) for space heating, J5.9; and
(j) for refrigerant chillers, J5.10; and
(k) for packaged air-conditioners less than 65kWr, MEPS; and
(l) for packaged air-conditioners equal to or greater than 65kWr, J5.11; and
(m) for cooling tower, closed circuit cooler or evaporative condenser, J5.12; and
(n) for interior/exterior artificial lighting and power control, J6.2 to J6.5; and
(o) for boiling water and chilled water storage unit control, Specification J6
(p) for lifts, escalators and moving walkways, J6.7 and J6.8; and
(q) for heated water supply, Part B2 of NCC Volume Three - Plumbing Code of Australia
(r) for swimming pool and spa pool plant, J7.3 and J7.4; and
(s) for facilities for energy monitoring, J8.3; and
(t) for thermal comfort a PMV of -1 to +1 across ≥95% of occupied floor area for ≥98% of annual hours of operation

NCC 2019, SECTION J ENERGY EFFICIENCY

Objective - JO1
The Objective of this Section is to reduce greenhouse gas (GHG) emissions.

Functional Statement - JF1
To reduce greenhouse gas emissions, to the degree necessary –

(a) a building, including its services, is to be capable of efficient using energy; and
(b) a building's services are to obtain their energy from –
  (i) a low greenhouse gas intensity source; or
  (ii) an on-site renewable energy source; or
  (iii) another process as reclaimed energy.

Performance Requirements - JP1 Energy Use
A building, including its services, must have features that facilitate the efficient use of energy appropriate to—

(a) the function and use of the building; and
(b) the level of human comfort required for the building use; and
(c) solar radiation being—
  (i) utilised for heating; and
  (ii) controlled to minimise energy for cooling; and
(d) the energy source of the services; and
(e) the sealing of the building envelope against air leakage; and
(f) for a conditioned space, achieving an hourly regulated energy consumption, averaged over the annual hours of operation, of not more than—
  (i) for a Class 6 building, 80 kJ/m2.hr; and
  (ii) for a Class 5, 7b, 8 or 9a building other than a ward area, or a Class 9b school, 43 kJ/m2.hr; and
  (iii) for all other building classifications, other than a sole-occupancy unit of a Class 2 building or a Class 4 part of a building, 15 kJ/m2.hr.

COMPLIANCE PATHWAY

Compliance with the Performance Requirement **JP1** in Section J of NCC 2019 Volume One can be achieved using either a *Performance Solution* , *Deemed-to-Satisfy Solution* or a combination of the two.

A *DtS Solution* uses the DtS Provisions and any referenced documents contained within the NCC. These provisions include prescriptive examples of materials, components, design factors, construction and installation methods, which if followed in full, are deemed to comply with the Performance Requirements of the NCC. The DtS Provisions for energy efficiency are contained in Section J, Parts J0 – J8 of NCC Volume One.

A *Performance Solution* is any solution that can meet the Performance Requirements, other than a *DtS Solution* . A *Performance Solution* may differ in whole or part from the DtS Provisions, but will still meet the Performance Requirements as long as it can be successfully demonstrated to the Appropriate Authority how this will be achieved.

A *Performance Solution* must use one or more of the following *Assessment Methods:*

(a) Evidence of Suitability,
(b) *Verifications Methods,*
(c) Expert Judgement
(d) Comparison with the DtS Provisions

JV3 - 'VERIFICATION USING A REFERENCE BUILDING'

JV3 is the Section J prescribed Verification Method used to demonstrate that a Performance Solution meets the Performance Requirements for JP1 in a Class 3, 5, 6, 7, 8 and 9 building.

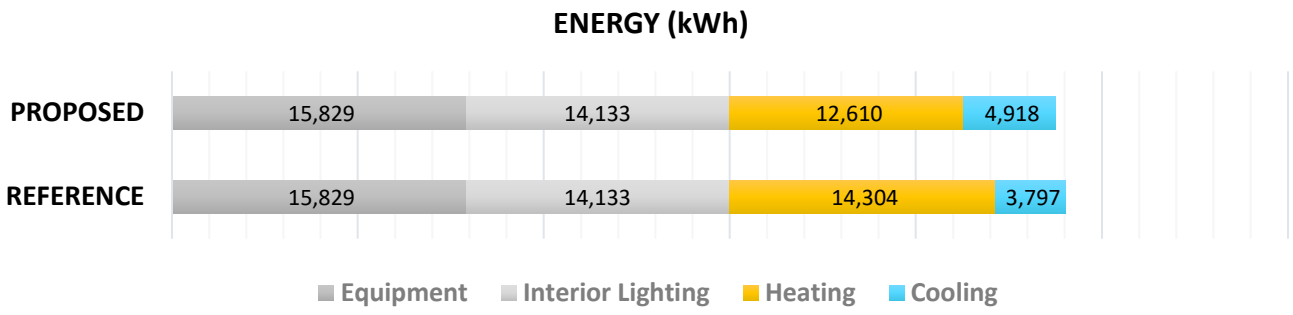
The JV3 methodology uses a reference building, which complies with the DtS Provisions, to determine the annual energy consumption. This quantifiable benchmark is the predetermined acceptance criteria that the proposed building design must meet. The annual energy consumption for the proposed building is then calculated using the same thermal calculation method. Compliance is demonstrated when the annual energy consumption of the proposed building does not exceed the reference building. The energy efficiency of services in the proposed building can not be used to offset poor building thermal performance when comparing to the reference building.

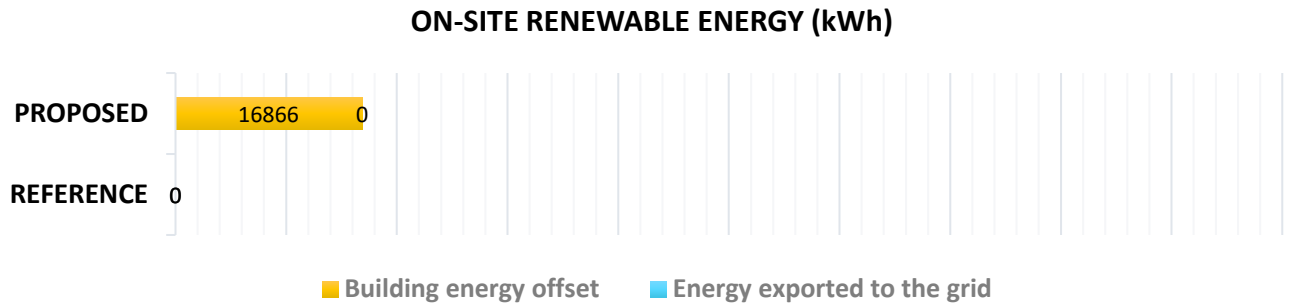
Calculation Method
The EnergyPlus thermal analysis software used to calculate the building annual energy consumption is deemed to comply with ANSI/ASHRAE Standard 140 2007 Evaluation of Building Energy Analysis Computer Programs as required by JV3(c).

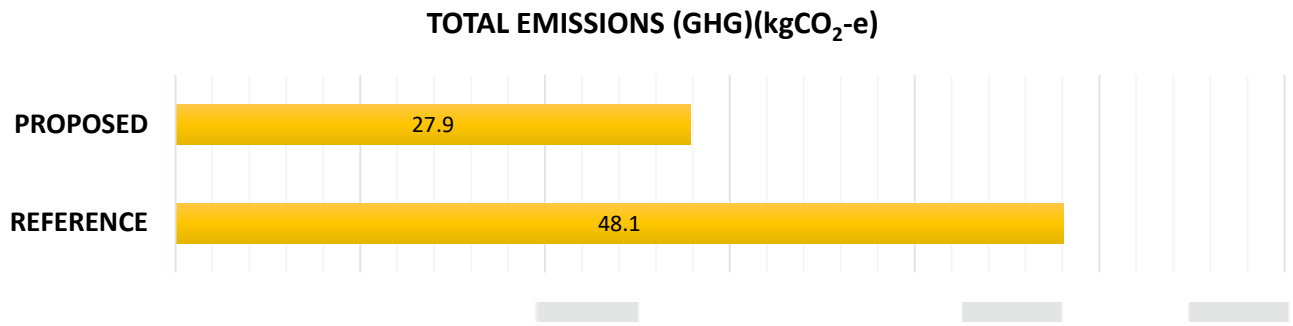
Fixed Modelling Parameters
The proposed and reference building annual energy consumptions have been calculated using the fixed parameters and profiles described in Specification JVb and JVc of Section J Energy Efficiency.

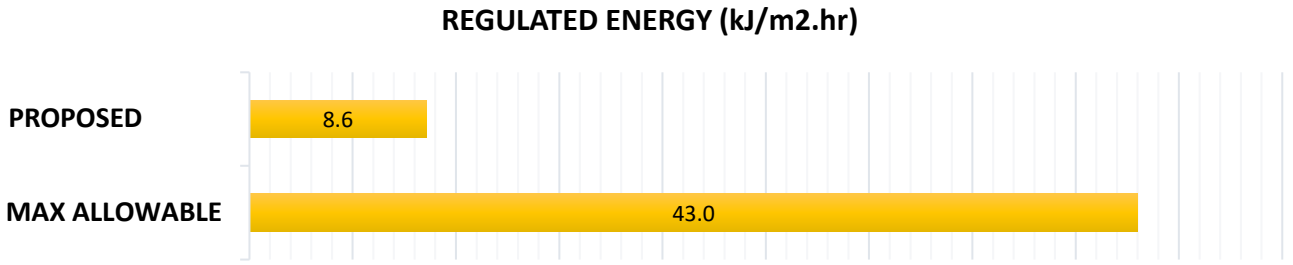
SIMULATION SUMMARY

Compliance is verified when the annual greenhouse gas emissions of the reference building are more than the proposed building and proposed building modelled with DtS services.









The DtS Provisions listed under 'ADDITIONAL REQUIREMENTS' (page 2) and detailed in Appendix A must be complied with in addition to the requirements listed under 'SPECIFICATION REQUIREMENTS' (page 2) for compliance with Section J to be achieved.

THERMAL COMFORT

In accordance with the requirements for a 2019 NCC JV3 modelling approach a thermal comfort model has been undertaken in accordance with ASHRAE 55 criteria using the Fanger Predicted Mean Vote (PMV) method. The intent of this model is to ensure that the space is comfortable for the occupants who use the space.

The NCC states that:

In the proposed building, a thermal comfort level of between a Predicted Mean Vote of -1 to +1 is achieved across not less than 95% of the floor area of all occupied zones for not less than 98% of the annual hours of operation of the building.

The PMV method uses a range of variables to calculate if the space is comfortable for occupants within the space.

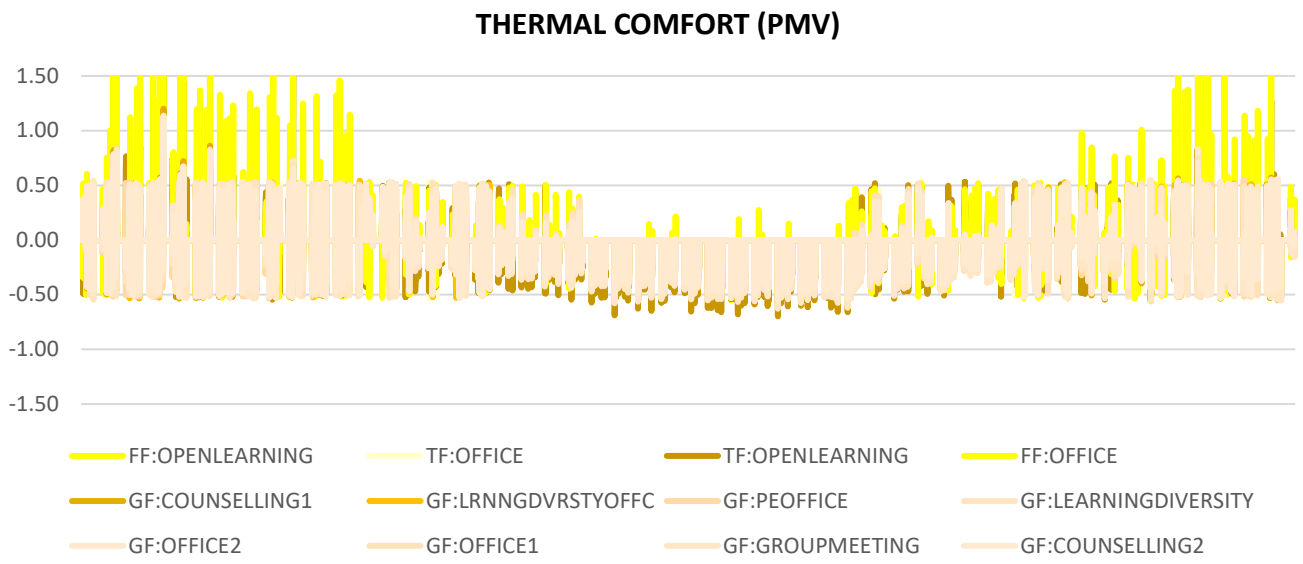
The following variable were fixed during the PMV calculation:

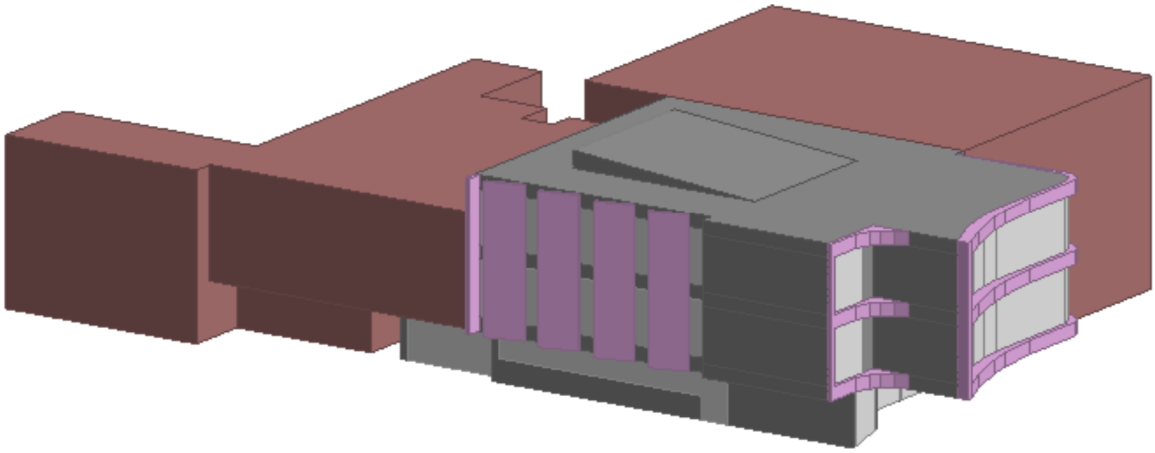
VARIABLE	INPUT	SOURCE
Air speed (m/s)	0.1	NCC 2019
Metabolic rate (W/person)	130	ASHRAE Standard 55
Metabolic factor	1	ASHRAE Standard 55
Summer clothing (clo)	0.36	ASHRAE Standard 55
Winter clothing (clo)	1.01	ASHRAE Standard 55

Air temperature, mean radiant temperature and relative humidity have all been calculated hourly using DesignBuilder and EnergyPlus.

Only occupied spaces in the building are required to meet the thermal comfort requirements for the building. Of these spaces a minimum of 95% of the floor area is required to meet the PMV of -1 to +1 for not less than 98% of the time.

Results showed 98% of the floor area is comfortable for not less that 98% of the time, confirming the building is compliant with the thermal comfort requirements of 2019 NCC JV3 methodology. Refer Thermal Comfort (PMV) graph below:





CALCULATION METHOD

The EnergyPlus thermal analysis software used to calculate the building annual energy consumption is deemed to comply with the ABCB Protocol for Building Energy Analysis Software and ANSI/ASHRAE Standard 140.

GENERAL INPUT DATA

	PROPOSED BUILDING	DTS BUILDING
Location file	Melbourne	Melbourne
Weather file	Melbourne Airport (IWEC 2)	Melbourne Airport (IWEC 2)
Geometry	As per attached drawings	As per attached drawings
Internal temperature set points	Specification JVb(c)	Specification JVb(c)
Infiltration	Specification JVb(d)	Specification JVb(d)
Occupancy profile	Specification JVc, Tables 2a-2k	Specification JVc, Tables 2a-2k
Internal heat gains from appliances and equipment	Specification JVc, Tables 2l	Specification JVc, Tables 2l
Internal heat gains from occupants and hot meals	Specification JVc, Tables 2n	Specification JVc, Tables 2n
Heated water supply consumption	Specification JVc, Tables 2m	Specification JVc, Tables 2m
Occupancy density	Table D1.13	Table D1.13
GHG emissions factor	1.16	1.16

SPECIFICATION

PART J1 INPUT DATA

J1.3 ROOF/CEILING CONSTRUCTION	PROPOSED BUILDING	DTS BUILDING
Lightweight Roof		
Product R-Value	R4.20	R1.89
Total R-Value	R5.29	R3.20
Bridged Total R-Value	R2.23	R3.20
Solar Absorptance	0.32	0.45
Thermal Break	N	Y

J1.4 ROOF LIGHTS	PROPOSED BUILDING	DTS BUILDING
Performance	N/A	N/A

J1.5 WALLS & GLAZING	PROPOSED BUILDING	DTS BUILDING
Walls		
Brick Veneer		
Product R-Value	R2.00	R0.85
Total R-Value	R2.55	R1.40
Bridged Total R-Value	R1.14	R1.40
Solar absorptance	0.60	0.60
Thermal Break	N	Y

Glazing

Orientation	U-Value	SHGC	U-Value	SHGC
North	2.80	0.50	7.00	0.90
East	2.80	0.50	7.00	0.90
South	2.80	0.50	2.43	0.17
West	2.80	0.50	3.65	0.30
Internal	N/A	N/A	N/A	N/A

J1.6 FLOORS		
CSOG		
Product R-Value	R0.00	R0.00
Total R-Value	R2.12	R2.12
Bridged Total R-Value	R2.12	R2.12
Slab Edge R-Value	N/A	N/A
Suspended Slab		
Product R-Value	R2.00	R1.71

Total R-Value	R2.29	R2.00
Bridged Total R-Value	R0.93	R2.00
Slab Edge R-Value	N/A	N/A

PART J5 INPUT DATA

J5.2 AIR-CONDITIONING SYSTEM	PROPOSED BUILDING	DTS BUILDING
Air-To-Air Heat Pump/Air Conditioner		
Ducted Split Systems 10kw - <19kw	MEPS – COP/EER 3.10	MEPS – COP/EER 3.10

PART J6 INPUT DATA

J6.2 ARTIFICIAL LIGHTING	PROPOSED BUILDING	DTS BUILDING
Wattage	Max. Allowable Table J6.2a	Max. Allowable Table J6.2a

APPENDIX A

J1.2 Thermal construction — general

(a) Where required, insulation must comply with AS/NZS 4859.1 and be installed so that it—

(i) abuts or overlaps adjoining insulation other than at supporting members such as studs, noggings, joists, furring channels and the like where the insulation must be against the member; and

(ii) forms a continuous barrier with ceilings, walls, bulkheads, floors or the like that inherently contribute to the thermal barrier; and

(iii) does not affect the safe or effective operation of a service or fitting.

(b) Where required, reflective insulation must be installed with—

(i) the necessary airspace to achieve the required R-Value between a reflective side of the reflective insulation and a building lining or cladding; and

(ii) the reflective insulation closely fitted against any penetration, door or window opening; and

(iii) the reflective insulation adequately supported by framing members; and

(iv) each adjoining sheet of roll membrane being—

(A) overlapped not less than 50 mm; or

(B) taped together

(c) Where required, bulk insulation must be installed so that—

(i) it maintains its position and thickness, other than where it is compressed between cladding and supporting members, water pipes, electrical cabling or the like; and

(ii) in a ceiling, where there is no bulk insulation or reflective insulation in the wall beneath, it overlaps the wall by not less than 50 mm.

(d) Roof, ceiling, wall and floor materials, and associated surfaces are deemed to have the thermal properties listed in Specification J1.2.

(e) The required Total R-Value and Total System U-Value, including allowance for thermal bridging, must be—

(i) calculated in accordance with AS/NZS 4859.2 for a roof or floor; or

(ii) determined in accordance with Specification J1.5a for wall-glazing construction; or

(iii) determined in accordance with Specification J1.6 or Section 3.5 of CIBSE Guide A for soil or sub-floor spaces.

J1.6 Floors

(a) A floor must achieve the Total R-Value specified in Table J1.6.

(b) A floor must be insulated around the vertical edge of its perimeter with insulation having an R-Value greater than or equal to 1.0 when the floor—

(i) is a concrete slab-on-ground in climate zone 8; or

(ii) has an in-slab or in-screed heating or cooling system, except where used solely in a bathroom, amenity area or the like.

(c) Insulation required by (b) for a concrete slab-on-ground must—

(i) be water resistant; and

(ii) be continuous from the adjacent finished ground level—

(A) to a depth not less than 300 mm; or

(B) for the full depth of the vertical edge of the concrete slab-on-ground.

J3.2 Chimneys and flues

The chimney or flue of an open solid-fuel burning appliance must be provided with a damper or flap that can be closed to seal the chimney or flue.

J3.3 Roof lights

(a) A roof light must be sealed, or capable of being sealed, when serving—

(i) a conditioned space; or

(ii) a habitable room in climate zones 4, 5, 6, 7 or 8.

(b) A roof light required by (a) to be sealed, or capable of being sealed, must be constructed with—

(i) an imperforate ceiling diffuser or the like installed at the ceiling or internal lining level; or

(ii) a weatherproof seal; or
(iii) a shutter system readily operated either manually, mechanically or electronically by the occupant.

J3.4 Windows and doors

(a) A door, openable window or the like must be sealed—
(i) when forming part of the envelope; or
(ii) in climate zones 4, 5, 6, 7 or 8.

(b) The requirements of (a) do not apply to—
(i) a window complying with AS 2047; or
(ii) a fire door or smoke door; or
(iii) a roller shutter door, roller shutter grille or other security door or device installed only for out-of-hours security.

(c) A seal to restrict air infiltration—
(i) for the bottom edge of a door, must be a draft protection device; and
(ii) for the other edges of a door or the edges of an openable window or other such opening, may be a foam or rubber compression strip, fibrous seal or the like.

(d) An entrance to a building, if leading to a conditioned space must have an airlock, self-closing door, rapid roller door, revolving door or the like, other than—
(i) where the conditioned space has a floor area of not more than 50 m2; or
(ii) where a café, restaurant, open front shop or the like has—
(A) a 3 m deep un-conditioned zone between the main entrance, including an open front, and the conditioned space; and
(B) at all other entrances to the café, restaurant, open front shop or the like, self-closing doors.

(e) A loading dock entrance, if leading to a conditioned space, must be fitted with a rapid roller door or the like.

J3.5 Exhaust fans

(a) An exhaust fan must be fitted with a sealing device such as a self-closing damper or the like when serving—
(i) a conditioned space; or
(ii) a habitable room in climate zones 4, 5, 6, 7 or 8.

J3.6 Construction of ceilings, walls and floors

(a) Ceilings, walls, floors and any opening such as a window frame, door frame, roof light frame or the like must be constructed to minimise air leakage in accordance with (b) when forming part of—
(i) the envelope; or
(ii) in climate zones 4, 5, 6, 7 or 8.

(b) Construction required by (a) must be—
(i) enclosed by internal lining systems that are close fitting at ceiling, wall and floor junctions; or
(ii) sealed at junctions and penetrations with—
(A) close fitting architrave, skirting or cornice; or
(B) expanding foam, rubber compressible strip, caulking or the like.

(c) The requirements of (a) do not apply to openings, grilles or the like required for smoke hazard management.

J3.7 Evaporative coolers

An evaporative cooler must be fitted with a self-closing damper or the like—
(a) when serving a heated space; or
(b) in climate zones 4, 5, 6, 7 or 8.

J5.2 Air-conditioning system control

(a) An air-conditioning system—
(i) must be capable of being deactivated when the building or part of a building served by that system is not occupied; and
(ii) when serving more than one air-conditioning zone or area with different heating or cooling needs, must—
(A) thermostatically control the temperature of each zone or area; and
(B) not control the temperature by mixing actively heated air and actively cooled air; and
(C) limit reheating to not more than—

(aa) for a fixed supply air rate, a 7.5 K rise in temperature; and

(bb) for a variable supply air rate, a 7.5 K rise in temperature at the nominal supply air rate but increased or decreased at the same rate that the supply air rate is respectively decreased or increased; and

(iii) which provides the required mechanical ventilation, other than in climate zone 1 or where dehumidification control is needed, must have an outdoor air economy cycle if the total air flow rate of any airside component of an air-conditioning system is greater than or equal to the figures in Table J5.2; and

(iv) which contains more than one water heater, chiller or coil, must be capable of stopping the flow of water to those not operating; and

(v) with an airflow of more than 1000 L/s, must have a variable speed fan when its supply air quantity is capable of being varied; and

(vi) when serving a sole-occupancy unit in a Class 3 building, must not operate when any external door of the sole-occupancy unit that opens to a balcony or the like, is open for more than one minute; and

(vii) must have the ability to use direct signals from the control components responsible for the delivery of comfort conditions in the building to regulate the operation of central plant; and

(viii) must have a control dead band of not less than 2°C, except where a smaller range is required for specialised applications; and

(ix) must be provided with balancing dampers and balancing valves that ensure the maximum design air or fluid flow is achieved but not exceeded by more than 15% above design at each—

(A) component; or

(B) group of components operating under a common control in a system containing multiple components, as required to meet the needs of the system at its maximum operating condition; and

(x) must ensure that each independently operating space of more than 1 000 m2 and every separate floor of the building has provision to terminate airflow independently of the remainder of the system sufficient to allow for different operating times; and

(xi) must have automatic variable temperature operation of heated water and chilled water circuits; and

(xii) when deactivated, must close any motorised outdoor air or return air damper that is not otherwise being actively controlled.

(b) When two or more air-conditioning systems serve the same space they must use control sequences that prevent the systems from operating in opposing heating and cooling modes.

(c) Time switches—

(i) A time switch must be provided to control—

(A) an air-conditioning system of more than 2 kWh; and

(B) a heater of more than 1 kW heating used for air-conditioning.

(ii) The time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days.

(iii) The requirements of (i) and (ii) do not apply to—

(A) an air-conditioning system that serves—

(aa) only one sole-occupancy unit in a Class 2, 3 or 9c building; or

(bb) a Class 4 part of a building; or

(B) a conditioned space where air-conditioning is needed for 24 hour continuous use.

J5.3 Mechanical ventilation system control

(a) General — A mechanical ventilation system, including one that is part of an air-conditioning system, except where the mechanical system serves only one sole-occupancy unit in a Class 2 building or serves only a Class 4 part of a building, must—

(i) be capable of being deactivated when the building or part of the building served by that system is not

(ii) when serving a conditioned space, except in periods when evaporative cooling is being used—

(A) where specified in Table J5.3, have—

(aa) an energy reclaiming system that preconditions outdoor air at a minimum sensible heat transfer effectiveness of 60%; or

(bb) demand control ventilation in accordance with AS 1668.2 if appropriate to the application; and

(B) not exceed the minimum outdoor air quantity required by Part F4 by more than 20%, except where—

(aa) additional unconditioned outdoor air is supplied for free cooling; or

(bb) additional mechanical ventilation is needed to balance the required exhaust or process

exhaust; or

(cc) an energy reclaiming system preconditions all the outdoor air; and

(iii) for an airflow of more than 1000 L/s, have a variable speed fan unless the downstream airflow is required by Part F4 to be constant.

(b) Exhaust systems — An exhaust system with an air flow rate of more than 1000 L/s must be capable of stopping the motor when the system is not needed, except for an exhaust system in a sole-occupancy unit in a Class 2, 3 or 9c building.

(c) Carpark exhaust systems — Carpark exhaust systems must have a control system in accordance with—

(i) 4.11.2 of AS 1668.2; or

(ii) 4.11.3 of AS 1668.2.

(d) Time switches—

(i) A time switch must be provided to a mechanical ventilation system with an air flow rate of more than 1000 L/s.

(ii) The time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days.

(iii) The requirements of (i) and (ii) do not apply to—

(A) a mechanical ventilation system that serves—

(aa) only one sole-occupancy unit in a Class 2, 3 or 9c building; or

(bb) a Class 4 part of a building; or

(B) a building where mechanical ventilation is needed for 24 hour occupancy.

J5.4 Fan systems

(a) Fans, ductwork and duct components that form part of an air-conditioning system or mechanical ventilation system must -

(i) separately comply with (b), (c), (d) and (e); or

(ii) achieve a fan motor input power per unit of flowrate lower than the fan motor input power per unit of flowrate achieved when applying (b), (c), (d) and (e) together.

(b) Fans—

(i) Fans in systems that have a static pressure of not more than 200 Pa must have an efficiency at the full load operating point not less than the efficiency calculated with the following formula:

$\eta min = 13 \times \ln(p) - 30$

where-

ηmin = the minimum required system static efficiency for installation type A or C or the minimum required system total efficiency for installation type B or D; and

p = the static pressure of the system (Pa).

(ii) Fans in systems that have a static pressure above 200 Pa must have an efficiency at the full load operating point not less than the efficiency calculated with the following formula:

$\eta min = 0.85 \times (a \times \ln(P) - b + N) / 100$

where—

ηmin = the minimum required system static efficiency for installation type A or C or the minimum required system total efficiency for installation type B or D; and

P = the motor input power of the fan (kW); and

N = the minimum performance grade obtained from Table J5.4a; and

a = regression coefficient a, obtained from Table J5.4b; and

b = regression coefficient b, obtained from Table J5.4c; and

ln = natural logarithm

(iii) The requirements of (i) and (ii) do not apply to fans that need to be explosion proof.

(c) Ductwork—

(i) The pressure drop in the index run across all straight sections of rigid ductwork and all sections of flexible ductwork must not exceed 1 Pa/m when averaged over the entire length of straight rigid duct and flexible duct. The pressure drop of flexible ductwork sections may be calculated as if the flexible ductwork is laid straight.

(ii) Flexible ductwork must not account for more than 6 m in length in any duct run.

(iii) The upstream connection to ductwork bends, elbows and tees in the index run must have an equivalent diameter to the connected duct.

(iv) Turning vanes must be included in all rigid ductwork elbows of 90° or more acute than 90° in the index run except where—

(A) the inclusion of turning vanes presents a fouling risk; or
(B) a long radius bend in accordance with AS 4254.2 is used.

(d) Ductwork components in the index run—
(i) The pressure drop across a coil must not exceed the value specified in Table J5.4d.
(ii) A high efficiency particulate arrestance (HEPA) air filter must not exceed the higher of—
(A) a pressure drop of 200 Pa when clean; or
(B) the filter design pressure drop when clean at an air velocity of 1.5 m/s.
(iii) Any other air filter must not exceed—
(A) the pressure drop specified in Table J5.4e when clean; or
(B) the filter design pressure drop when clean at an air velocity of 2.5 m/s.
(iv) The pressure drop across intake louvres must not exceed the higher of—
(A) for single stage louvres, 30 Pa; and
(B) for two stage louvres, 60 Pa; and
(C) for acoustic louvres, 50 Pa; and
(D) for other non-weatherproof louvres, 30 Pa.
(v) The pressure drop across a variable air volume box, with the damper in the fully open position, must not exceed -
(A) for units with electric reheat, 100 Pa; and
(B) for other units, 25 Pa not including coil pressure losses.
(vi) Rooftop cowls must not exceed a pressure drop of 30 Pa.
(vii) Attenuators must not exceed a pressure drop of 40 Pa.
(viii) Fire dampers must not exceed a pressure drop of 15 Pa when open.
(ix) Balancing and control dampers in the index run must not exceed a pressure drop of 25 Pa when in the fully open position.
(x) Supply air diffusers and grilles must not exceed a pressure drop of 40 Pa.
(xi) Exhaust grilles must not exceed a pressure drop of 30 Pa.
(xii) Transfer ducts must not exceed a pressure drop of 12 Pa.
(xiii) Door grilles must not exceed a pressure drop of 12 Pa.
(xiv) Active chilled beams must not exceed a pressure drop of 150 Pa.

(e) The requirements of (a), (b), (c) and (d) do not apply to—
(i) fans in unducted air-conditioning systems with a supply air capacity of less than 1000 L/s; and
(ii) smoke spill fans, except where also used for air-conditioning or ventilation; and
(iii) the power for process-related components; and
(iv) kitchen exhaust systems.

J5.5 Ductwork insulation

(a) Ductwork and fittings in an air-conditioning system must be provided with insulation—
(i) complying with AS/NZS 4859.1; and
(ii) having an insulation R-Value greater than or equal to—
(A) for flexible ductwork, 1.0; or
(B) for cushion boxes, that of the connecting ductwork; or
(C) that specified in Table J5.5.

(b) Insulation must—
(i) be protected against the effects of weather and sunlight; and
(ii) be installed so that it—
(A) abuts adjoining insulation to form a continuous barrier; and
(B) maintains its position and thickness, other than at flanges and supports; and
(iii) when conveying cooled air—
(A) be protected by a vapour barrier on the outside of the insulation; and
(B) where the vapour barrier is a membrane, be installed so that adjoining sheets of the membrane—
(aa) overlap by at least 50 mm; and
(bb) are bonded or taped together.

(c) The requirements of (a) do not apply to—
(i) ductwork and fittings located within the only or last room served by the system; or
(ii) fittings that form part of the interface with the conditioned space; or

(iii) return air ductwork in, or passing through, a conditioned space; or
(iv) ductwork for outdoor air and exhaust air associated with an air-conditioning system; or
(v) the floor of an in-situ air-handling unit; or
(vi) packaged air conditioners, split systems, and variable refrigerant flow air-conditioning equipment complying with MEPS; or
(vii) flexible fan connections.

(d) For the purposes of (a), (b) and (c), fittings—
(i) include non-active components of a ductwork system such as cushion boxes; and
(ii) exclude active components such as air-handling unit components.

J5.6 Ductwork sealing

Ductwork in an air-conditioning system with a capacity of 3000 L/s or greater, not located within the only or last room served by the system, must be sealed against air loss in accordance with the duct sealing requirements of AS 4254.1 and AS 4254.2 for the static pressure in the system.

J5.7 Pump systems

(a) General — Pumps and pipework that form part of an air-conditioning system must either—
(i) separately comply with (b), (c) and (d); or
(ii) achieve a pump motor power per unit of flowrate lower than the pump motor power per unit of flowrate achieved when applying (b), (c) and (d) together

(b) Circulator pumps — A glandless impeller pump, with a rated hydraulic power output of less than 2.5 kW and that is used in closed loop systems must have an energy efficiency index (EEI) not more than 0.27 calculated in accordance with European Union Commission Regulation No. 622/2012.

(c) Other pumps — Pumps that are in accordance with Articles 1 and 2 of European Union Commission Regulation No. 547/2012 must have a minimum efficiency index (MEI) of 0.4 or more when calculated in accordance with European Union Commission Regulation No. 547/2012.

(d) Pipework — Straight segments of pipework along the index run, forming part of an air-conditioning system—
(i) in pipework systems that do not have branches and have the same flow rate throughout the entire pipe network, must achieve an average pressure drop of not more than—
(A) for constant speed systems, the values nominated in Table J5.7a; or
(B) for variable speed systems, the values nominated in Table J5.7b; or
(ii) in any other pipework system, must achieve an average pressure drop of not more than—
(A) for constant speed systems, the values nominated in Table J5.7c; or
(B) for variable speed systems, the values nominated in Table J5.7d.

(e) the requirements of (d) do not apply—
(i) to valves and fittings; or
(ii) where the smallest pipe size compliant with (d) results in a velocity of 0.7 m/s or less at design flow.

J5.8 Pipework insulation

(a) Piping, vessels, heat exchangers and tanks containing heating or cooling fluid, where the fluid is held at a heated or cooled temperature, that are part of an air-conditioning system, other than in appliances covered by MEPS, must be provided with insulation—
(i) complying with AS/NZS 4859.1; and
(ii) for piping of heating and cooling fluids, having an insulation R-Value in accordance with Table J5.8a; and
(iii) for vessels, heat exchangers or tanks, having an insulation R-Value in accordance with Table J5.8b; and
(iv) for refill or pressure relief piping, having an insulation R-Value equal to the required insulation R-Value of the connected pipe, vessel or tank within 500 mm of the connection.

(b) Insulation must—
(i) be protected against the effects of weather and sunlight; and
(ii) be able to withstand the temperatures within the piping, vessel, heat exchanger or tank.

(c) Insulation provided to piping, vessels, heat exchangers or tanks containing cooling fluid must be protected by a vapour barrier on the outside of the insulation.

(d) The requirements of (a) and (b) do not apply to piping, vessels or heat exchangers—
(i) located within the only or last room served by the system and downstream of the control device for the

regulation of heating or cooling service to that room; or

(ii) encased within a concrete slab or panel which is part of a heating or cooling system; or

(iii) supplied as an integral part of a chiller, boiler or unitary air-conditioner complying with the requirements of J5.9, J5.10 and J5.11; or

(iv) inside an air-handling unit, fan-coil unit, or the like.

(e) For the purposes of (a), (b), (c) and (d)—

(i) heating fluids include refrigerant, heated water, steam and condensate; and

(ii) cooling fluids include refrigerant, chilled water, brines and glycol mixtures, but do not include condenser cooling water.

J5.9 Space heating

(a) A heater used for air-conditioning or as part of an air-conditioning system must be—

(i) a solar heater; or

(ii) a gas heater; or

(iii) a heat pump heater; or

(iv) a heater using reclaimed heat from another process such as reject heat from a refrigeration plant; or

(v) an electric heater if—

(A) the heating capacity is not more than—

(aa) 10 W/m2 of the floor area of the conditioned space in climate zone 1; or

(bb) 40 W/m2 of the floor area of the conditioned space in climate zone 2; or

(cc) the value specified in Table J5.9 where reticulated gas is not available at the allotment boundary; or

(B) the annual energy consumption for heating is not more than 15 kWh/m2 of the floor area of the conditioned space in climate zones 1, 2, 3, 4 and 5; or

(C) the in-duct heater complies with J5.2(a)(ii)(C); or

(vi) any combination of (i) to (v).

(b) An electric heater may be used for heating a bathroom in a Class 2, 3, 9a or 9c building if the heating capacity is not more than 1.2 kW and the heater has a timer.

(c) A fixed heating or cooling appliance that moderates the temperature of an outdoor space must be configured to automatically shut down when—

(i) there are no occupants in the space served; or

(ii) a period of one hour has elapsed since the last activation of the heater; or

(iii) the space served has reached the design temperature.

(d) A gas water heater, that is used as part of an air-conditioning system, must—

(i) if rated to consume 500 MJ/hour of gas or less, achieve a minimum gross thermal efficiency of 86%; or

(ii) if rated to consume more than 500 MJ/hour of gas, achieve a minimum gross thermal efficiency of 90%.

J5.10 Refrigerant chillers

An air-conditioning system refrigerant chiller must comply with MEPS and the full load operation energy efficiency ratio and integrated part load energy efficiency ratio in Table J5.10a or Table J5.10b when determined in accordance with AHRI 551/591.

J5.11 Unitary air-conditioning equipment

Unitary air-conditioning equipment including packaged air-conditioners, split systems, and variable refrigerant flow systems must comply with MEPS and for a capacity greater than or equal to 65 kWr—

(a) where water cooled, have a minimum energy efficiency ratio of 4.0 Wr / W input power for cooling when tested in accordance with AS/NZS 3823.1.2 at test condition T1, where input power includes both compressor and fan input power; or

(b) where air cooled, have a minimum energy efficiency ratio of 2.9 Wr / W input power for cooling when tested in accordance with AS/NZS 3823.1.2 at test condition T1, where input power includes both compressor and fan input power.

J5.12 Heat rejection equipment

(a) The motor rated power of a fan in a cooling tower, closed circuit cooler or evaporative condenser must not exceed the allowances in Table J5.12.

(b) The fan in an air-cooled condenser must have a motor rated power of not more than 42 W for each kW of heat rejected from the refrigerant, when determined in accordance with AHRI 460 except for—

(i) a refrigerant chiller in an air-conditioning system that complies with the energy efficiency ratios in J5.10; or

(ii) packaged air-conditioners, split systems, and variable refrigerant flow air-conditioning equipment that complies with the energy efficiency ratios in J5.11.

J6.2 Artificial lighting

(a) In a sole-occupancy unit of a Class 2 building or a Class 4 part of a building—

(i) the lamp power density or illumination power density of artificial lighting must not exceed the allowance of—

(A) 5 W/m2 within a sole-occupancy unit; and

(B) 4 W/m2 on a verandah, balcony or the like attached to a sole-occupancy unit; and

(ii) the illumination power density allowance in (i) may be increased by dividing it by the illumination power density adjustment factor for a control device in Table J6.2b as applicable; and

(iii) when designing the lamp power density or illumination power density, the power of the proposed installation must be used rather than nominal allowances for exposed batten holders or luminaires; and

(iv) halogen lamps must be separately switched from fluorescent lamps.

(b) In a building other than a sole-occupancy unit of a Class 2 building or a Class 4 part of a building—

(i) for artificial lighting, the aggregate design illumination power load must not exceed the sum of the allowances obtained by multiplying the area of each space by the maximum illumination power density in Table J6.2a; and

(ii) the aggregate design illumination power load in (i) is the sum of the design illumination power loads in each of the spaces served; and

(iii) where there are multiple lighting systems serving the same space, the design illumination power load for (ii) is-

(A) the total illumination power load of all systems; or

(B) where a control system permits only one system to operate at a time—

(aa) based on the highest illumination power load; or

(bb) determined by the formula—

$[H \times T/2 + P \times (100 - T/2)] / 100$

where—

H = the highest illumination power load; and

T = the time for which the maximum illumination power load will occur, expressed as a percentage

P = the predominant illumination power load

(c) The requirements of (a) and (b) do not apply to the following:

(i) Emergency lighting provided in accordance with Part E4.

(ii) Signage, display lighting within cabinets and display cases that are fixed in place.

(iii) Lighting for accommodation within the residential part of a detention centre.

(iv) A heater where the heater also emits light, such as in bathrooms.

(v) Lighting of a specialist process nature such as in a surgical operating theatre, fume cupboard or clean workstation.

(vi) Lighting of performances such as theatrical or sporting.

(vii) Lighting for the permanent display and preservation of works of art or objects in a museum or gallery other than for retail sale, purchase or auction.

(viii) Lighting installed solely to provide photosynthetically active radiation for indoor plant growth on green walls and the like.

(d) For the purposes of Table J6.2b, the following control devices must comply with Specification J6:

(i) Lighting timers.

(ii) Motion detectors.

(iii) Daylight sensors and dynamic lighting control devices.

J6.3 Interior artificial lighting and power control

(a) All artificial lighting of a room or space must be individually operated by–

(i) a switch; or

(ii) other control device; or

(iii) a combination of (i) and (ii).

(b) An occupant activated device, such as a room security device, a motion detector in accordance with Specification J6, or the like, must be provided in the sole-occupancy unit of a Class 3 building, other than where providing accommodation for people with a

disability or the aged, to cut power to the artificial lighting, air-conditioner, local exhaust fans and bathroom heater when the sole-occupancy unit is unoccupied.

(c) An artificial lighting switch or other control device in (a) must—

(i) if an artificial lighting switch, be located in a visible and easily accessed position—

(A) in the room or space being switched; or

(B) in an adjacent room or space from where 90% of the lighting being switched is visible; and

(ii) for other than a single functional space such as an auditorium, theatre, swimming pool, sporting stadium or warehouse—

(A) not operate lighting for an area of more than 250 m2 if in a Class 5 building or a Class 8 laboratory; or

(B) not operate lighting for an area of more than—

(aa) 250 m2 for a space of not more than 2000 m2; or

(bb) 1000 m2 for a space of more than 2000 m2, if in a Class 3, 6, 7, 8 (other than a laboratory) or 9 building

(d) 95% of the light fittings in a building or storey of a building, other than a Class 2 or 3 building or a Class 4 part of a building, of more than 250 m2 must be controlled by—

(i) a time switch in accordance with Specification J6; or

(ii) an occupant sensing device such as—

(A) a security key card reader that registers a person entering and leaving the building; or

(B) a motion detector in accordance with Specification J6.

(e) In a Class 5, 6 or 8 building of more than 250 m2, artificial lighting in a natural lighting zone adjacent to windows must be separately controlled from artificial lighting not in a natural lighting zone in the same storey except where—

(i) the room containing the natural lighting zone is less than 20 m2; or

(ii) the room's natural lighting zone contains less than 4 luminaires; or

(iii) 70% or more of the luminaires in the room are in the natural lighting zone.

(f) Artificial lighting in a fire-isolated stairway, fire-isolated passageway or fire-isolated ramp, must be controlled by a motion detector in accordance with Specification J6.

(g) Artificial lighting in a foyer, corridor and other circulation spaces—

(i) of more than 250 W within a single zone; and

(ii) adjacent to windows,

must be controlled by a daylight sensor and dynamic lighting control device in accordance with Specification J6.

(h) Artificial lighting for daytime travel in the first 19 m of travel in a carpark entry zone must be controlled by a daylight sensor in accordance with Specification J6.

(i) The requirements of (a), (b), (c), (d), (e), (f), (g) and (h) do not apply to the following:

(i) Emergency lighting in accordance with Part E4.

(ii) Where artificial lighting is needed for 24 hour occupancy such as for a manufacturing process, parts of a hospital, an airport control tower or within a detention centre.

(j) The requirements of (d) do not apply to the following:

(i) Artificial lighting in a space where the sudden loss of artificial lighting would cause an unsafe situation such as—

(A) in a patient care area in a Class 9a building or in a Class 9c building; or

(B) a plant room or lift motor room; or

(C) a workshop where power tools are used.

(ii) A heater where the heater also emits light, such as in bathrooms.

J6.4 Interior decorative and display lighting

(a) Interior decorative and display lighting, such as for a foyer mural or art display, must be controlled—

(i) separately from other artificial lighting; and

(ii) by a manual switch for each area other than when the operating times of the displays are the same in a number of areas such as in a museum, art gallery or the like, in which case they may be combined; and

(iii) by a time switch in accordance with Specification J6 where the display lighting exceeds 1 kW.

(b) Window display lighting must be controlled separately from other display lighting.

J6.5 Exterior artificial lighting

(a) Exterior artificial lighting attached to or directed at the facade of a building, must—

(i) be controlled by—

(A) a daylight sensor; or

(B) a time switch that is capable of switching on and off electric power to the system at variable pre-programmed times and on variable pre-programmed days; and

(ii) when the total lighting load exceeds 100 W—

(A) use LED luminaires for 90% of the total lighting load; or

(B) be controlled by a motion detector in accordance with Specification J6; or

(C) when used for decorative purposes, such as façade lighting or signage lighting, have a separate time switch in accordance with Specification J6.

(b) The requirements of (a)(ii) do not apply to the following:

(i) Emergency lighting in accordance with Part E4.

(ii) Lighting around a detention centre.

J6.6 Boiling water and chilled water storage units

Power supply to a boiling water or chilled water storage unit must be controlled by a time switch in accordance with Specification J6.

J6.7 Lifts

Lifts must—

(a) be configured to ensure artificial lighting and ventilation in the car are turned off when it is unused for 15 minutes; and

(b) achieve the idle and standby energy performance level in Table 6.7a; and

(c) achieve—

(i) the energy efficiency class in Table 6.7b; or

(ii) if a dedicated goods lift, energy efficiency class D in accordance with ISO 25745-2.

J6.8 Escalators and moving walkways

Escalators and moving walkways must have the ability to slow to between 0.2 m/s and 0.05 m/s when unused for more than 15 minutes.

J7.3 Swimming pool heating and pumping

(a) Heating for a swimming pool must be by—

(i) a solar heater; or

(ii) a heater using reclaimed heat from another process such as reject heat from a refrigeration plant; or

(iii) a geothermal heater; or

(iv) a gas heater that—

(A) if rated to consume 500 MJ/hour or less, achieves a minimum gross thermal efficiency of 86%; or

(B) if rated to consume more than 500 MJ/hour, achieves a minimum gross thermal efficiency of 90%; or

(v) a heat pump; or

(vi) a combination of (i) to (v).

(b) Where some or all of the heating required by (a) is by a gas heater or a heat pump, the swimming pool must have—

(i) a cover with a minimum R-Value of 0.05; and

(ii) a time switch to control the operation of the heater

(c) A time switch must be provided to control the operation of a circulation pump for a swimming pool.

(d) Where required, a time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days.

(e) Pipework carrying heated or chilled water for a swimming pool must comply with the insulation requirements of J5.8.

(f) For the purpose of J7.3, a swimming pool does not include a spa pool.

J7.4 Spa pool heating and pumping

(a) Heating for a spa pool that shares a water recirculation system with a swimming pool must be by—

(i) a solar heater; or

(ii) a heater using reclaimed heat from another process such as reject heat from a refrigeration plant; or

(iii) a geothermal heater; or

(iv) a gas heater that—

(A) if rated to consume 500 MJ/hour or less, achieves a minimum gross thermal efficiency of 86%; or

(B) if rated to consume more than 500 MJ/hour, achieves a minimum gross thermal efficiency of 90%; or

(v) a heat pump; or

(vi) a combination of (i) to (v).

(b) Where some or all of the heating required by (a) is by a gas heater or a heat pump, the spa pool must have—

(i) a cover with a minimum R-Value of 0.05; and

(ii) a push button and a time switch to control the operation of the heater.

(c) A time switch must be provided to control the operation of a circulation pump for a spa pool having a capacity of 680L or more.

(d) Where required, a time switch must be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days.

(e) Pipework carrying heated or chilled water for a spa pool must comply with the insulation requirements of J5.8.

J8.3 Facilities for energy monitoring

(a) A building or sole-occupancy unit with a floor area of more than 500 m2 must have an energy meter configured to record the time-of-use consumption of gas and electricity.

(b) A building with a floor area of more than 2 500 m2 must have energy meters configured to enable individual time-of-use energy consumption data recording, in accordance with (c), of the energy consumption of—

(i) air-conditioning plant including, where appropriate, heating plant, cooling plant and air handling fans; and

(ii) artificial lighting; and

(iii) appliance power; and

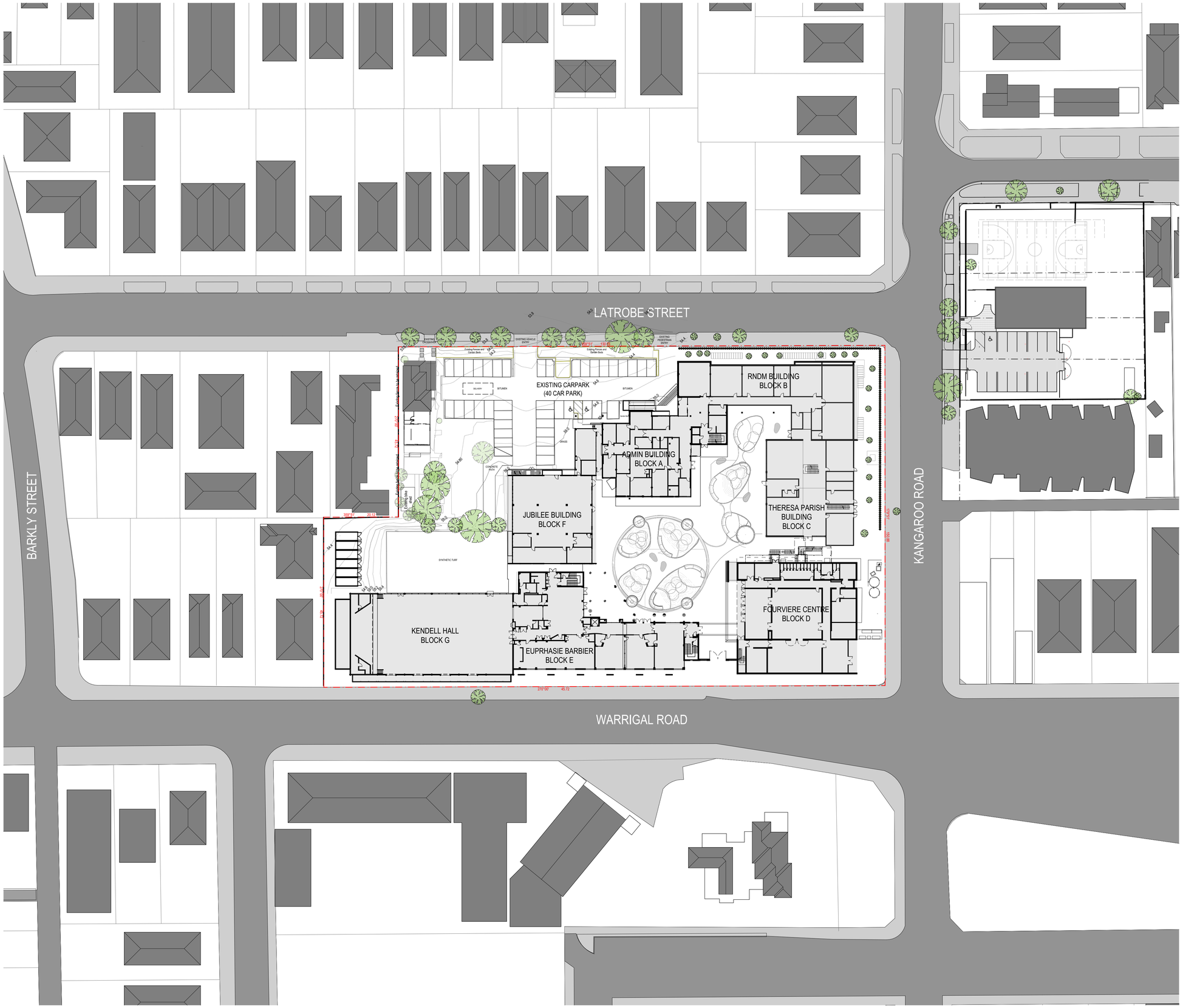
(iv) central hot water supply; and

(v) internal transport devices including lifts, escalators and moving walkways where there is more than one serving the building; and

(vi) other ancillary plant.

(c) Energy meters required by (b) must be interlinked by a communication system that collates the time-of-use energy consumption data to a single interface monitoring system where it can be stored, analysed and reviewed.

(d) The provisions of (b) do not apply to a Class 2 building with a floor area of more than 2 500 m2 where the total area of the common areas is less than 500 m2.



GENERAL NOTES

1. Refer existing Land Survey for contours & site features. Land Dimensions - Feature + Levels Survey.
2. Refer to Civil documentation for site works and setout of carpark.
3. Refer Landscape documentation for new contours, external surface finishes, planting, fencing, bollards and structures.
4. Refer Services documentation for extent of site services.
5. This plan describes the final site plan at completion of all works. Refer to Early Works documentation for works to be completed under a seperarate contract prior to this contract.

LEGEND

- Title Boundary
- Stage 3A Proposed building footprint.
- Existing trees. Refer Landscape Documentation for existing and new trees.
- Tree Protection Zone
  Refer to Landscape Documents and Arborist Report for requirements.
- Proposed trees. Refer Landscape Documentation for existing and new trees.
- Proposed total building footprint.

Refer to LBS report:
2101_Plans Combined_stamped
for compliance requirements

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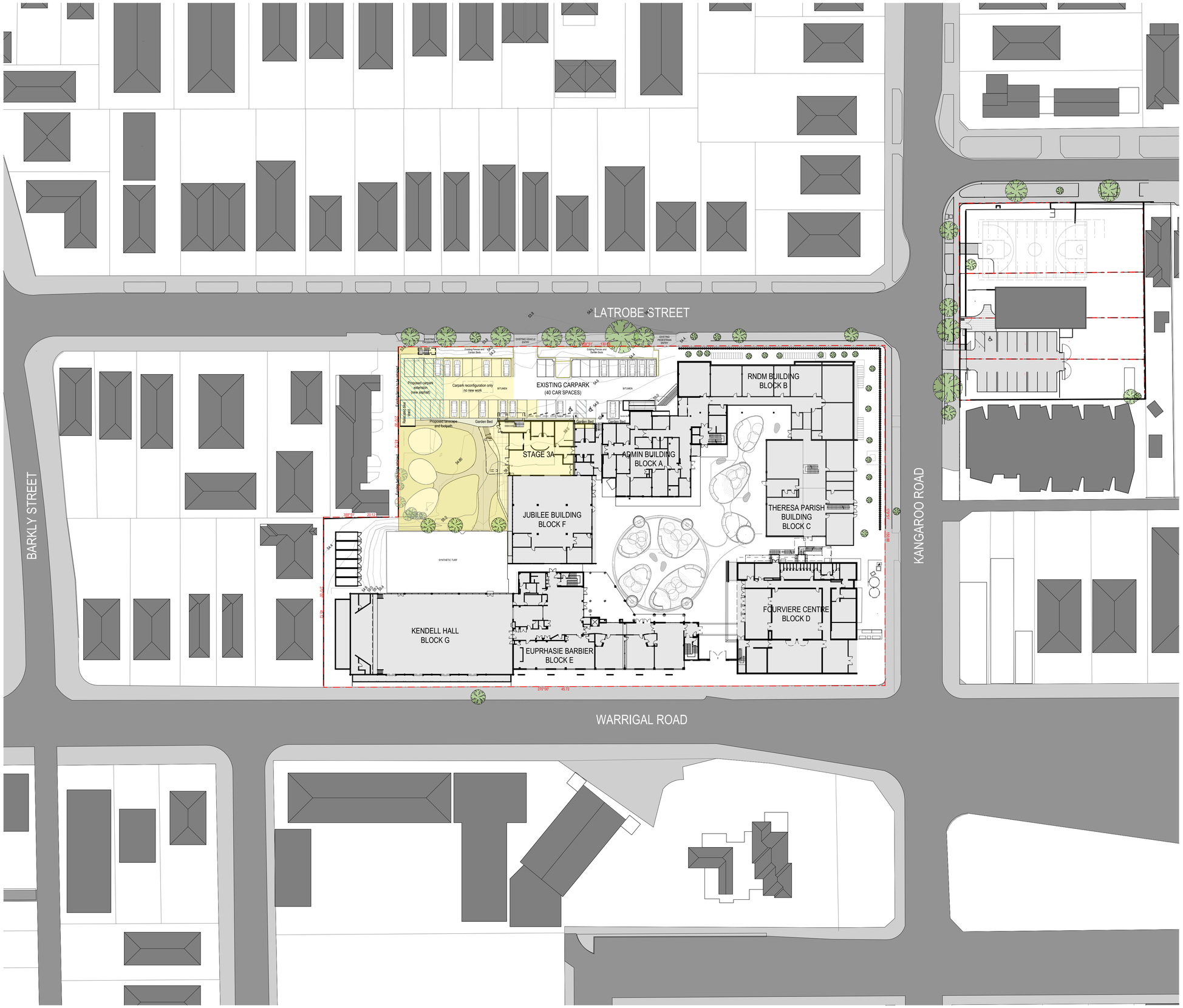
Stage 3A Latrobe Street Wing

Existing Site Plan

2021
1:500 @ A1
2101
SD01



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- Proposed total building footprint.
- Proposed new asphalt to car park extension

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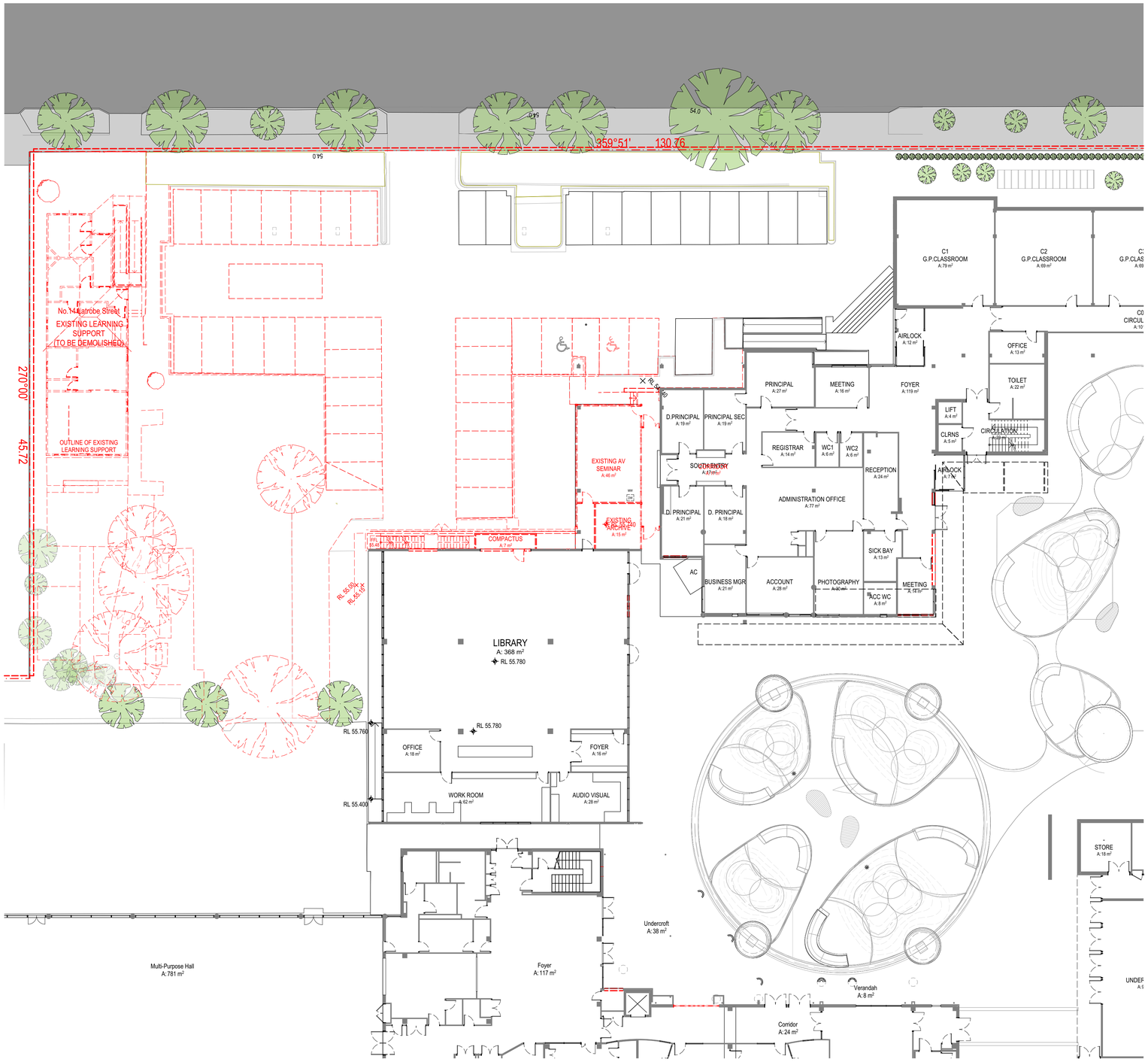
Stage 3A Latrobe Street Wing

Proposed Site Plan

2021
1:500, 1:1 @ A1
2101
SD02



Demolition Level 1 Plan
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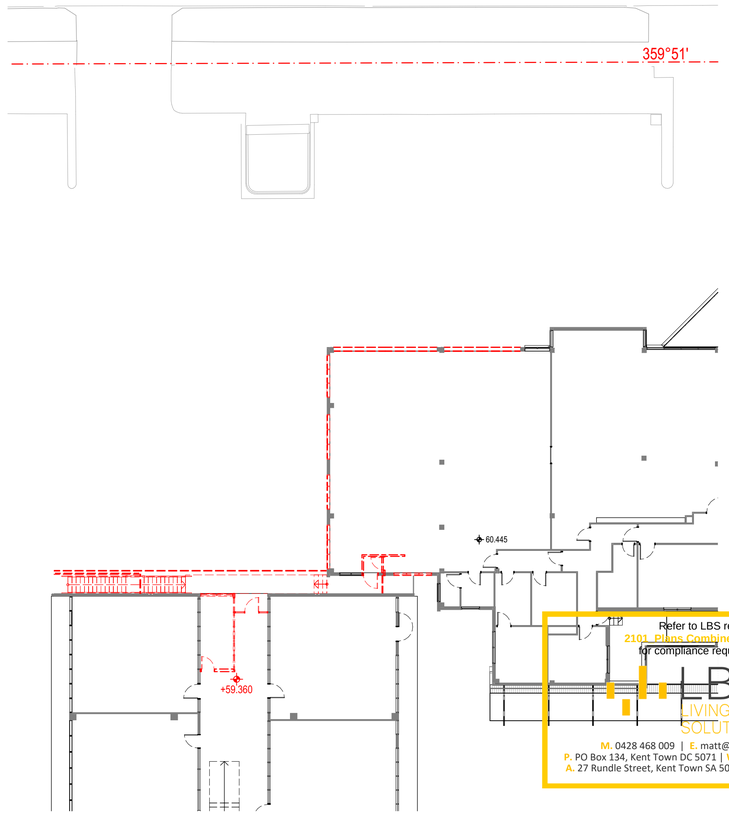

Refer to LBS report:
2101_Plans Combined_stamped
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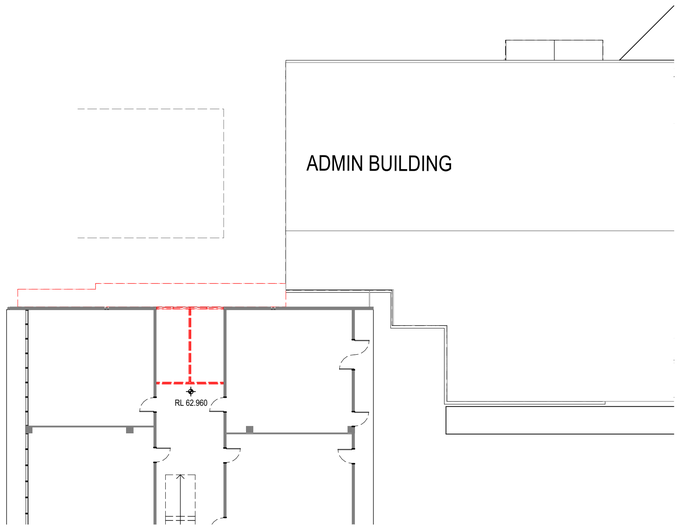
Demolition Level 2 Plan
1:200



Demolition Level 3 Plan
1:200

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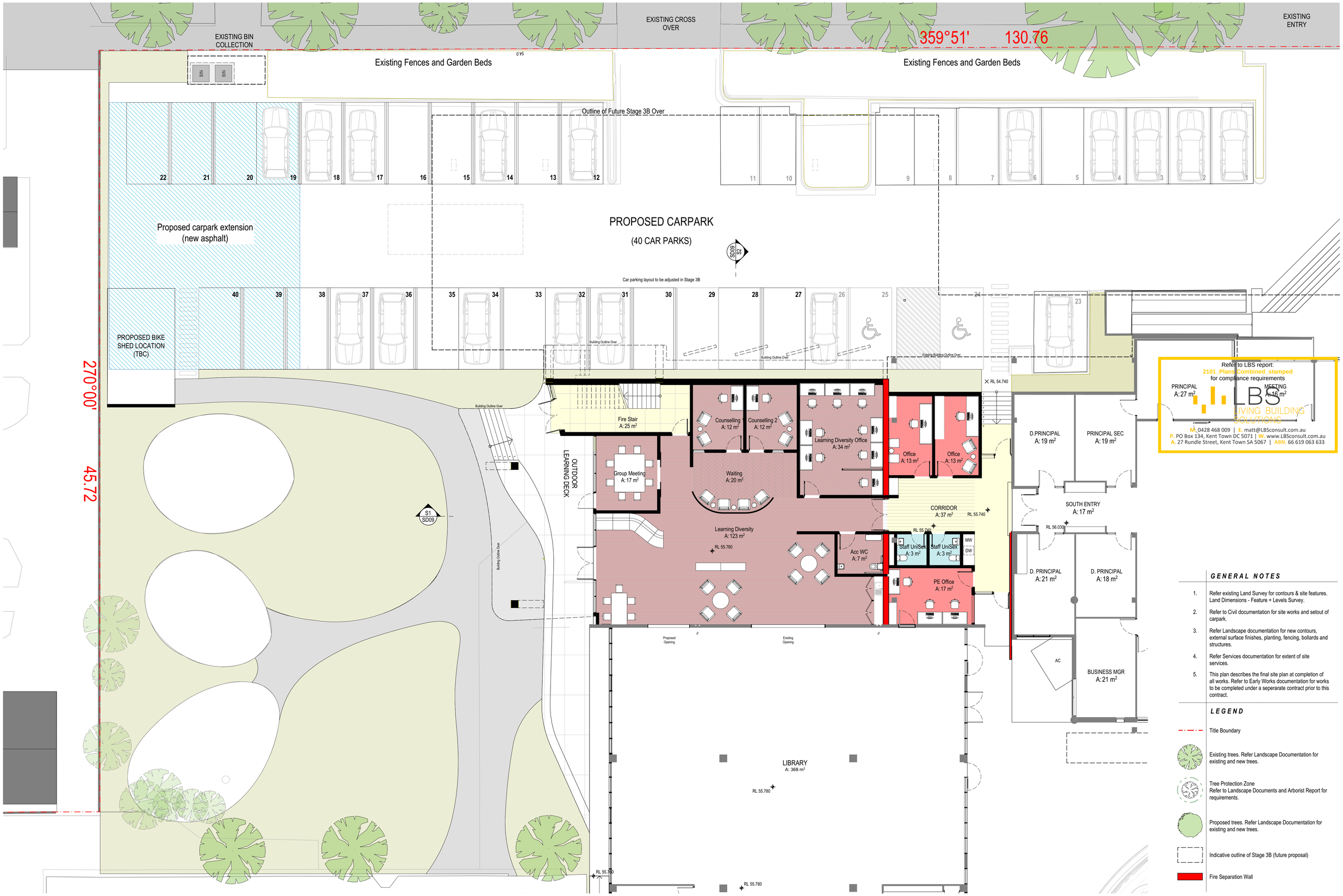
Stage 3A Latrobe Street Wing

Demolition Plans

2021
1:200 @ A1
2101
SD03



GENERAL NOTES

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LEGEND

- Title Boundary
- Existing trees. Refer Landscape Documentation for existing and new trees.
- Tree Protection Zone. Refer to Landscape Documents and Arborist Report for requirements.
- Proposed trees. Refer Landscape Documentation for existing and new trees.
- Indicative outline of Stage 3B (future proposal)
- Fire Separation Wall

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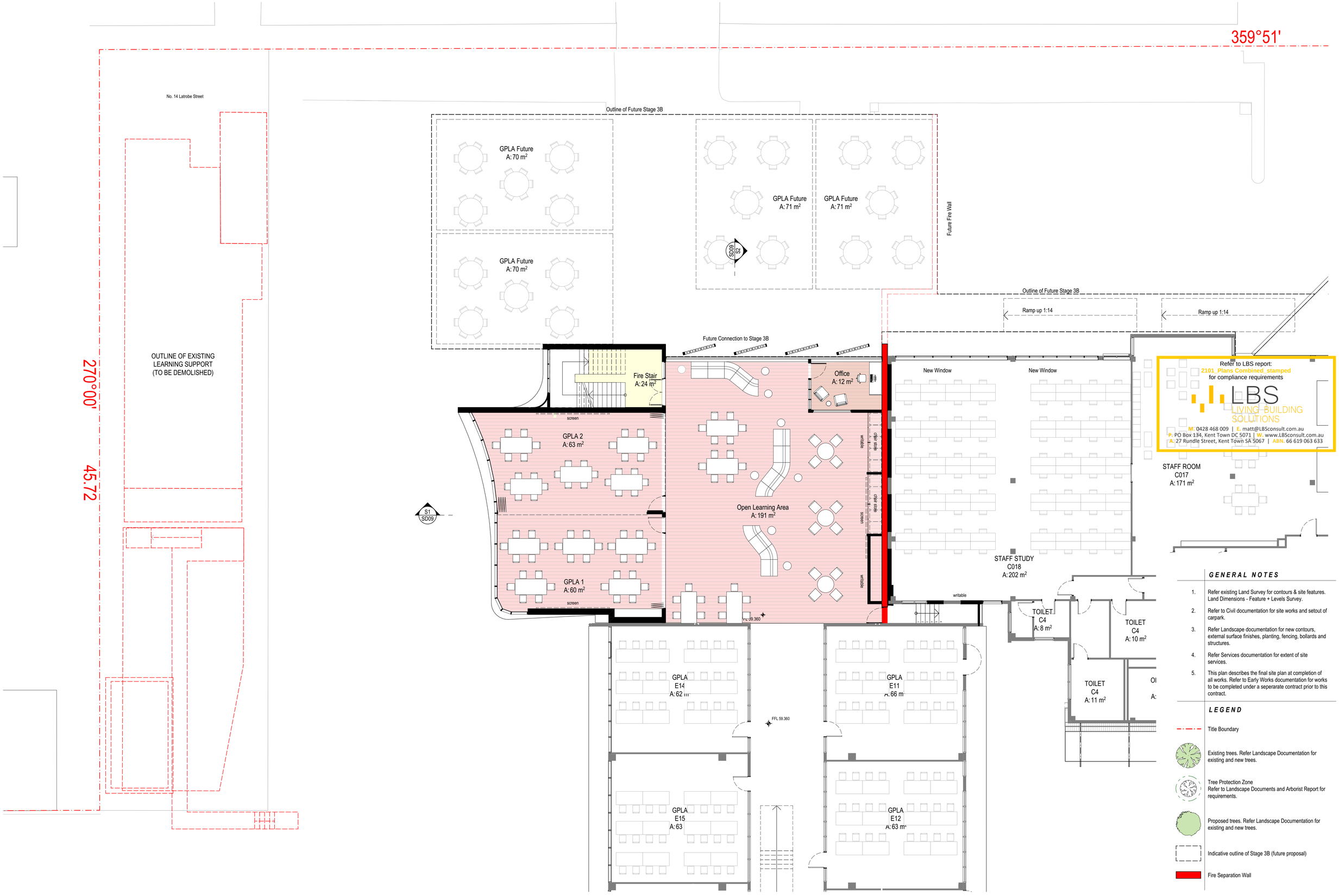
Stage 3A Latrobe Street Wing

Proposed L1 Floor Plan

2021
1:100, 1:1 @ A1
2101
SD04



GENERAL NOTES

1. Refer existing Land Survey for contours & site features. Land Dimensions - Feature + Levels Survey.
2. Refer to Civil documentation for site works and setout of carpark.
3. Refer Landscape documentation for new contours, external surface finishes, planting, fencing, bollards and structures.
4. Refer Services documentation for extent of site services.
5. This plan describes the final site plan at completion of all works. Refer to Early Works documentation for works to be completed under a seperarate contract prior to this contract.

LEGEND

- Title Boundary
- Existing trees. Refer Landscape Documentation for existing and new trees.
- Tree Protection Zone
  Refer to Landscape Documents and Arborist Report for requirements.
- Proposed trees. Refer Landscape Documentation for existing and new trees.
- Indicative outline of Stage 3B (future proposal)
- Fire Separation Wall

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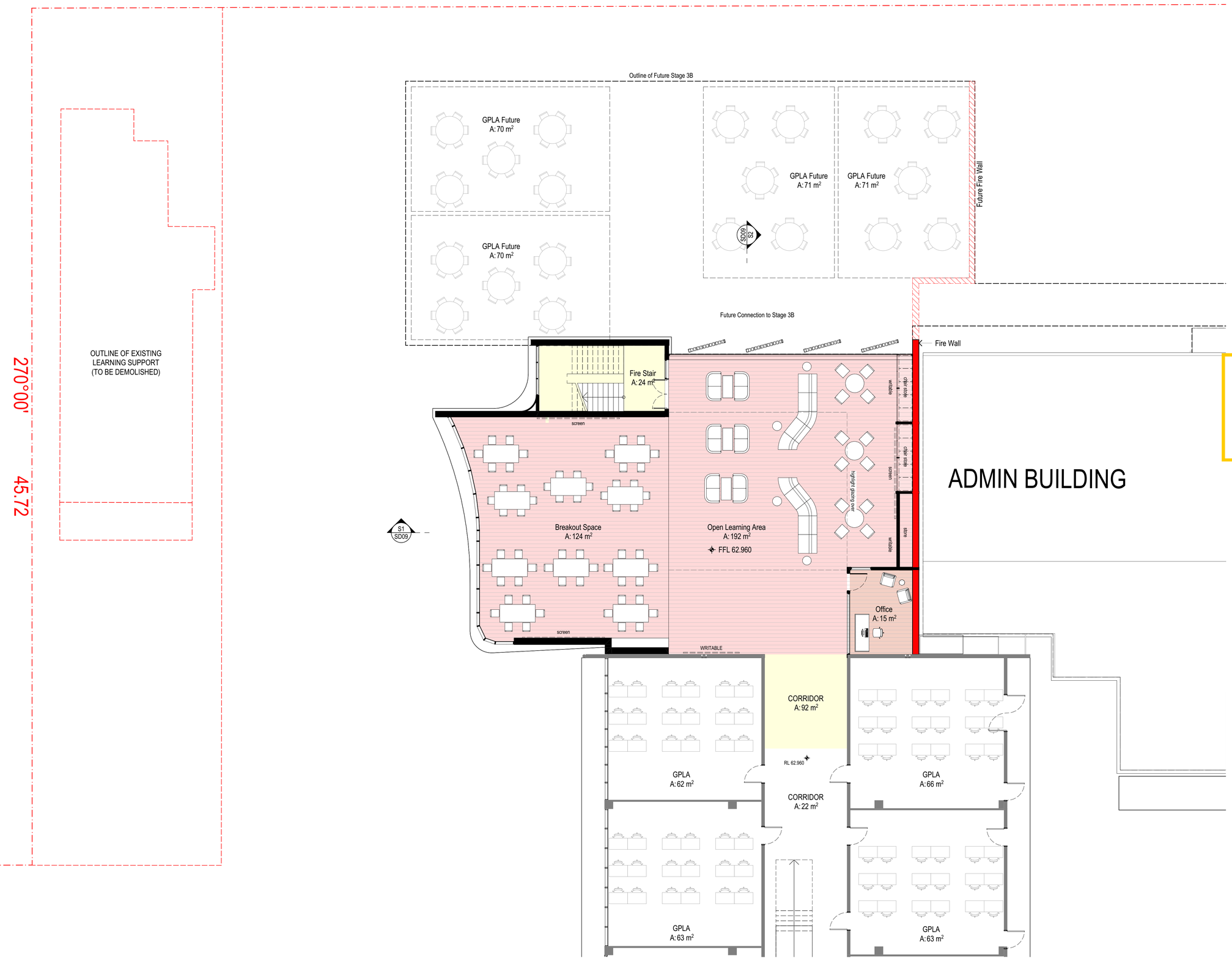
Stage 3A Latrobe Street Wing

Proposed L2 Floor Plans

2021
1:100, 1:1 @ A1
2101
SD05



Refer to LBS report:
2101_Plans Combined_stamped
for compliance requirements

LBS
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P. PO Box 134, Kent Town DC 5071 | W. www.LBSconsult.com.au
A. 27 Rundle Street, Kent Town SA 5067 | ABN. 66 619 063 633

GENERAL NOTES

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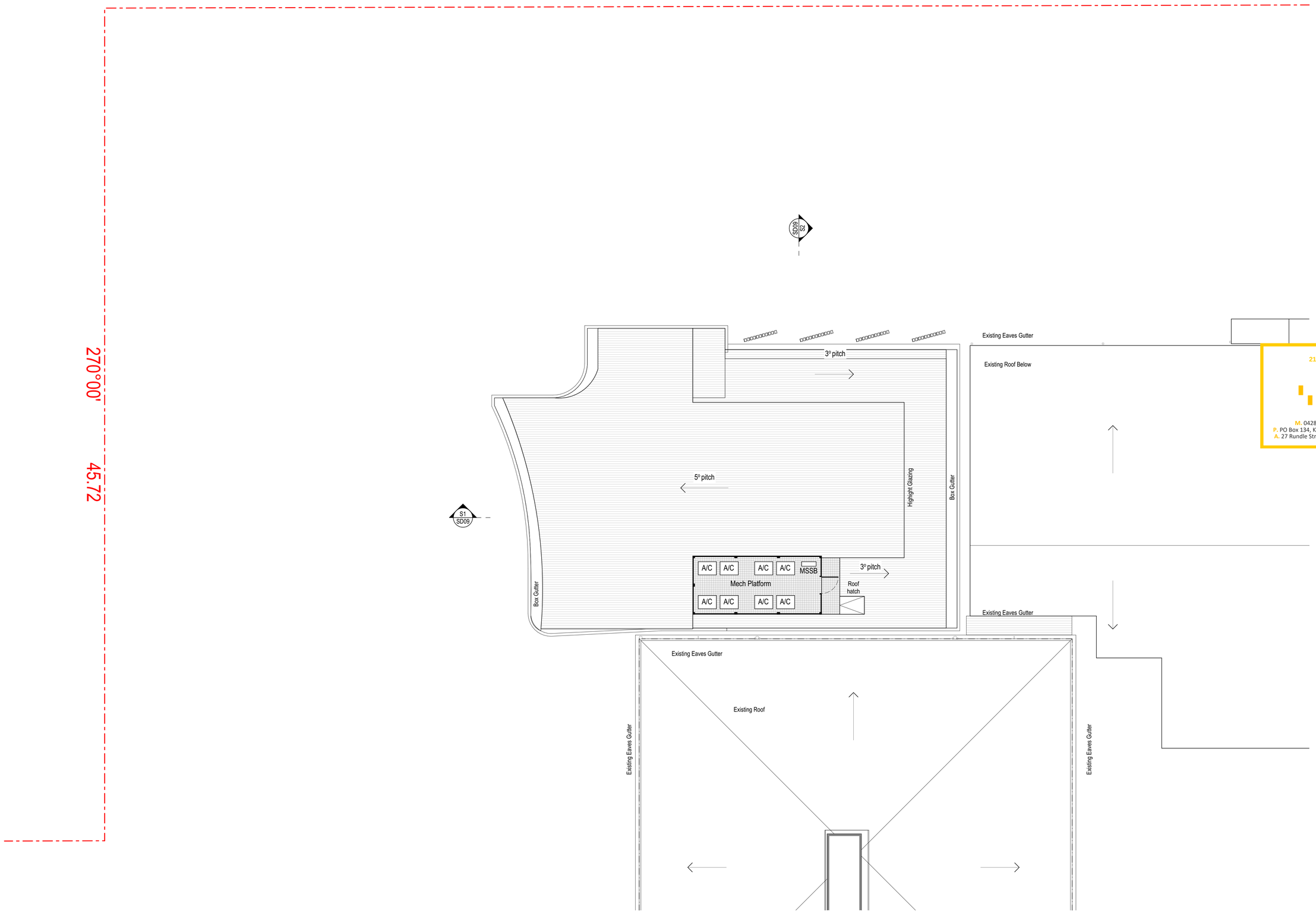
Stage 3A Latrobe Street Wing

Proposed L3 Floor Plans

2021
1:100, 1:1 @ A1
2101
SD06



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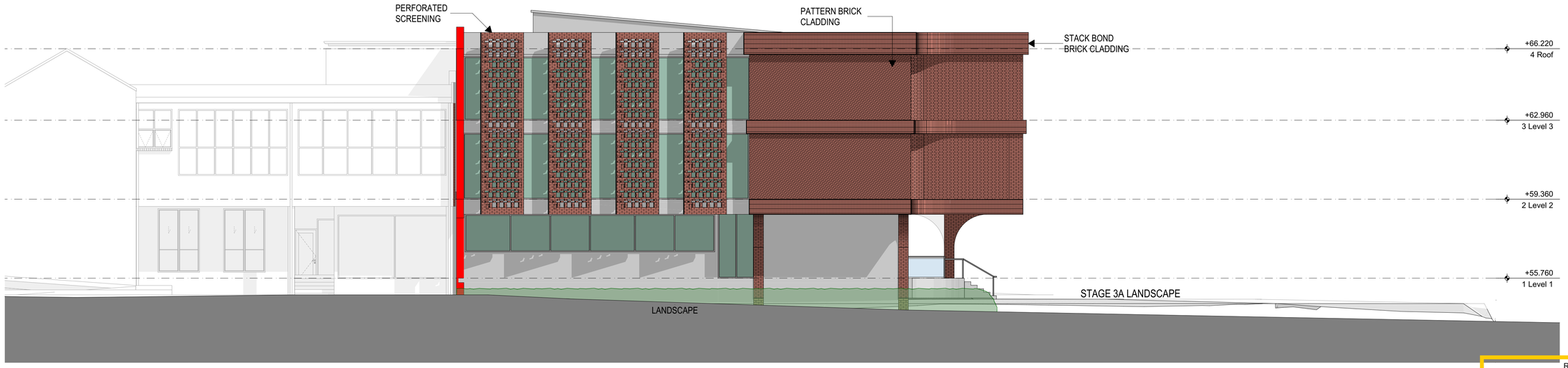
Stage 3A Latrobe Street Wing

Proposed Roof Plan

2021
1:100 @ A1
2101
SD07



W — West Elevation

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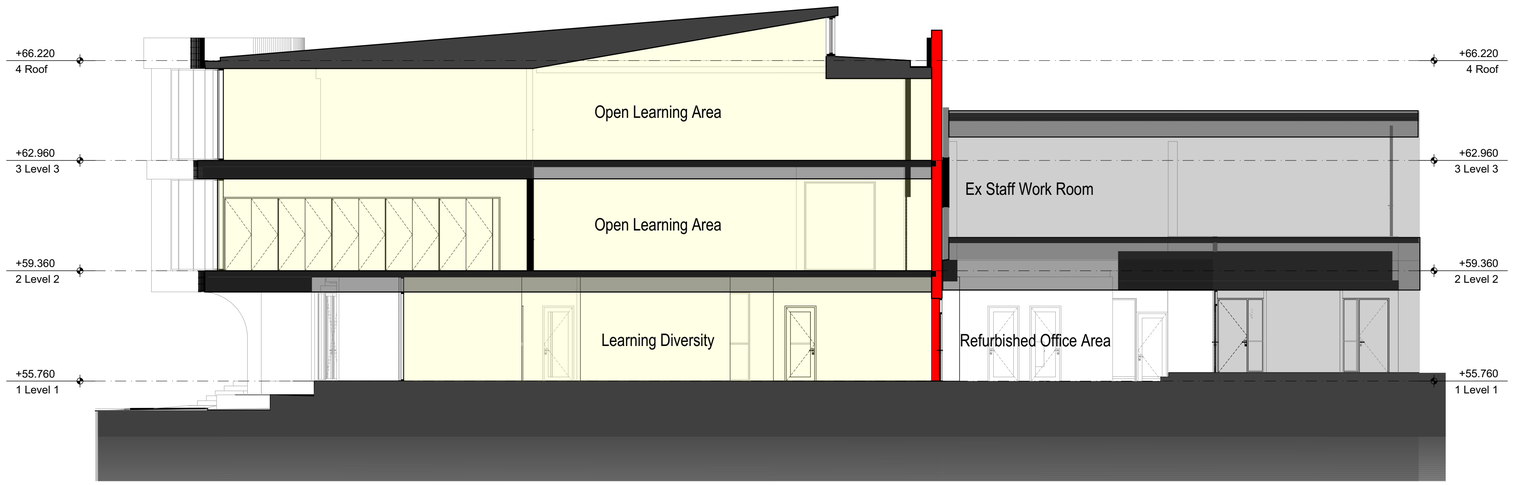
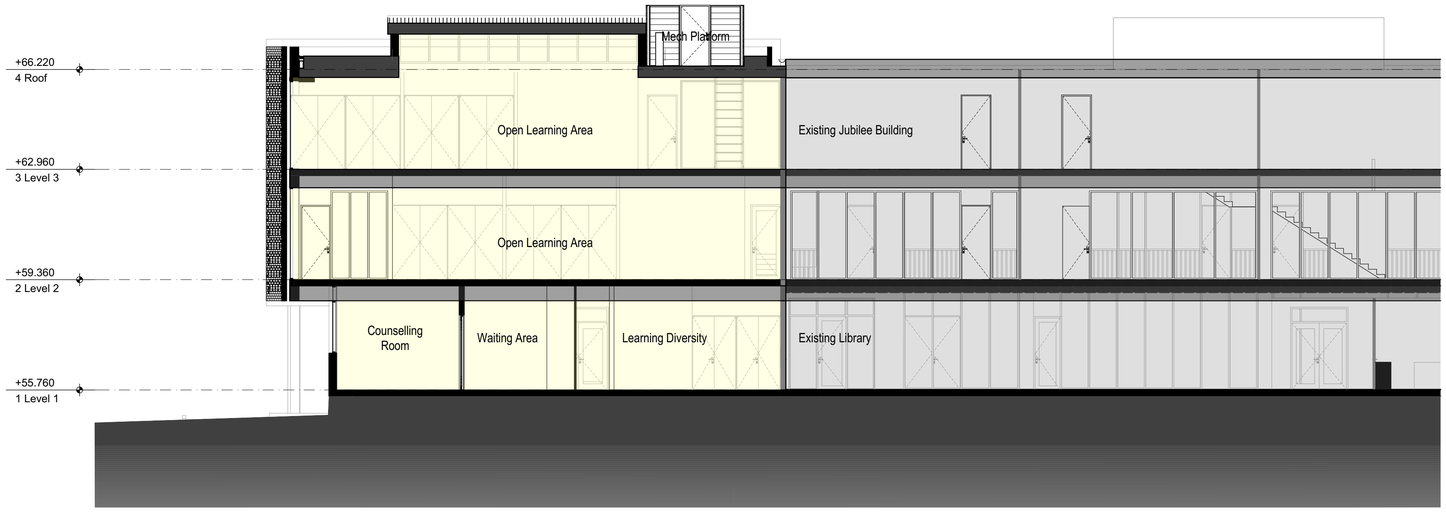
S — South Elevation



S1 Section



S2 Section

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Stage 3A Latrobe Street Wing

Sections

2021
1:100 @ A1
2101
SD09