National Construction Code (NCC) 2019 Section J – JV3 Assessment Report

Project:

The Boathouse, Palm Beach, NSW 2108

Prepared for:

London Lakes Land P/L

Job Number: 18117

Rev 1.3 – 18 February 2021

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SUSTAINABILITY.

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1. Executive Summary

EEG has been engaged to review the proposed Boathouse development at Palm Beach, NSW 2108 against the requirements for the National Construction Code 2019 provisions for energy efficiency under Section J (NCC 2019 Volume 1, Part J).

This report details the outcome of a National Construction Code (NCC) 2019 Section J assessment (JV3) to determine compliance requirements for the proposed development. Energy simulations were undertaken to provide an alternative method of verification (JV3) in relation to NCC Section J in order to allow for glazing and insulation variations within the development.

JV3 requires the comparison of a reference building (Case 1) to two proposed building models, one having the reference building (Case 2) and one having the same services as the proposed services (Case 3). The compression is based on the forecasted annual greenhouse gas emissions. Furthermore, in the proposed building (case 3), 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; and

The following table details the computer simulation results for the simulation cases undertaken in compliance with the JV3 Verification Method. The simulation process is detailed as part of this report.

	CASE 1 Reference Building [DTS Fabric and DTS services]	CASE 2 Proposed Building [Proposed Fabric and DTS services] *	CASE 3 Proposed Building [Proposed Fabric and Proposed services] *
Annual greenhouse gas emissions (normalised emissions)	64.6 kg/m2/annum	57.4 kg/m2/annum	57.4 kg/m2/annum

** The "proposed services" under the modelling case 3 have been conservatively set at the "DTS services" level. The results of modelling cases 2 and 3 are therefore the same (57.4 kg/m2/annum).*

The results show that the total annual energy consumption of the Proposed Building models is less than the annual energy consumption of the Reference Building. The glazing and insulation systems utilised within the proposed building are therefore compliant with the performance requirement of JP1 under JV3 method of verification.

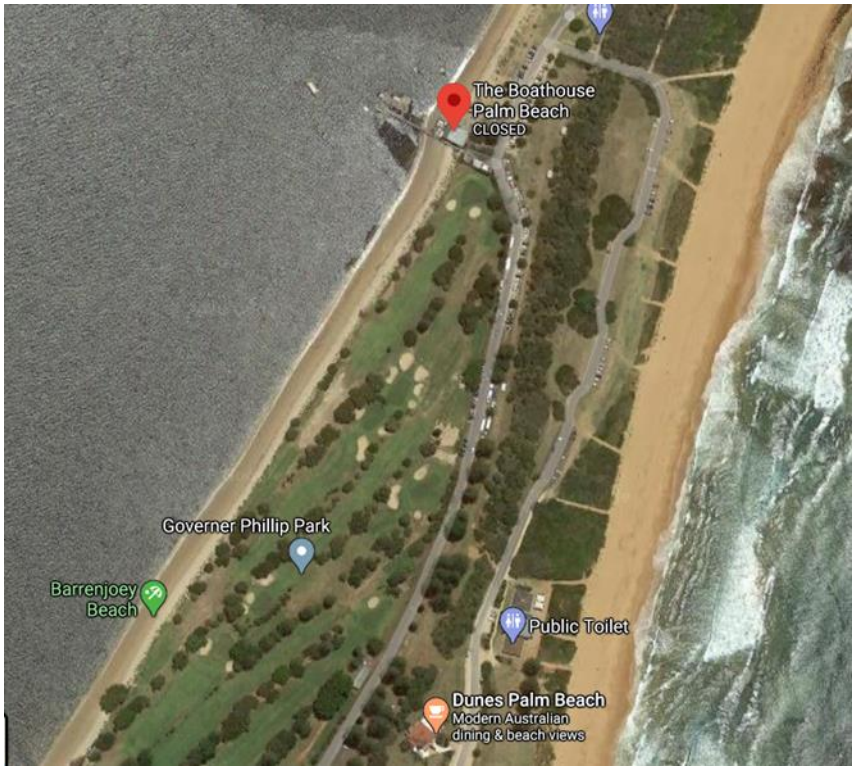
Areas addressed by JV3 assessment

The following table outlines the glazing and thermal insulation levels utilised in the Proposed Building simulations. Based on this assessment, systems with performance level of equal or better will achieve NCC Part J compliance under the JV3 method of verification.

Item	Minimum Insulation & Glazing Requirements
Roof / Ceiling	Total Insulation: R3.7 The solar absorptance of the upper surface of a roof must be not more than 0.45.
Walls	External Walls: minimum total R3.0 thermal insulation with thermal breaks. Internal walls separating conditioned and non-conditioned zones: minimum total R2.0
Glazing	Total system U-Value ≤ 4.3 Total system SHGC ≤ 0.53
Floors (addressed through JV3)	Suspended Floors: no added insulation (addressed via JV3)
Other	• Building services: minimum DTS performance or better. • Thermal comfort level of between a Predicted Mean Vote of -1 to +1 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.

A summary of the NCC Section J requirements is provided in section 7 of this report.

Subject to satisfaction of the provisions outlined in this report, this development will comply with the requirements of Section J of NCC 2019.



Location of the development – *The Boathouse Palm Beach, NSW 2108*– Source: Google Map

2. Introduction

EEG has been engaged to review the proposed Boathouse development at Palm Beach, NSW 2108 against the requirements for the National Construction Code 2019 provisions for energy efficiency under Section J (NCC 2019 Volume 1, Part J).

Energy simulation was undertaken to provide an alternative method of verification (JV3) in relation to NCC Section J in order to allow for glazing and thermal insulation variations within the development.

The assessment process under JV3 requires a comparison of simulated annual energy consumption of a reference building to the proposed building utilising the required assumptions and inputs for JV3. The reference building is based on the proposed building with the performance of all features set to the minimum performance in order to achieve DTS compliance with the provisions of Part J1 to J7.

The proposed building in this assessment also utilises DTS compliance performance of the provisions of Part J1 to J8 excluding those of Part J1 in relation to the glazing and insulation system performance as outlined in section 7 of this report.

On this basis, the outcome of this JV3 assessment demonstrates achievement of compliance for the proposed glazing and thermal insulation variations for the building (outlined in section 7). Compliance with the DTS provisions for all the other parts is therefore required by all the applicable design trades of the development.

A summary of the NCC Section J requirements for the development is provided in section 7 of this report.

Compliance with JP1 has been verified in accordance with JV3 requirements and utilising Carrier E20-II energy modelling software package that is ABCB protocol compliant.

The Reference and Proposed Building computer models were generated using an ABCB compliant energy simulation software and strictly in accordance with the following guidelines:

- NCC Section J Part JV3 Verification Using a Reference Building.

3. National Construction Code - Section J

The National Construction Code (NCC) 2019 includes mandatory minimum energy performance requirements for buildings (Class 3, Class 5 to 9) in Section J. The objective is to reduce building greenhouse gas emissions by efficiently using operational energy. Section J is focused on establishing minimum acceptable practice in the building industry.

To meet the performance requirements JP1 of Section J of the NCC, compliance of the design and function of the building can be demonstrated with the Deemed-To-Satisfy (DTS) provisions of Section J Parts J1 to J8. Alternatively, achievement of the performance requirements can be demonstrated through Verification Method JV3.

- Part J1 Building Fabric relates to the building fabric and minimum thermal performance for constructions according to climate zone for roofs, ceilings, roof lights, walls, glazing and floors.
- Part J3 Building Sealing details requirements in order to restrict unwanted infiltration into a building.
- Part J5 Air-Conditioning and Ventilation Systems details requirements to ensure these services are used and use energy in an efficient manner.
- Part J6 Artificial Lighting and Power details requirements for lighting and power to ensure energy is used efficiently by these systems.
- Part J7 Heated Water Supply and Swimming Pool & Spa Pool Plant details requirements for hot water supply design.
- Part J8 Facilities for Energy Monitoring.

3.1. NCC JV3 - Verification using a reference building

Compliance with JP1 is verified when:

A. it is determined that the annual greenhouse gas emissions of the proposed building are not more than the annual greenhouse gas emissions of a reference building when—
   a. the proposed building is modelled with the proposed services; and
   b. the proposed building is modelled with the same services as the reference building; and

B. 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; and

C. the building complies with the additional requirements in Specification JVa.

The annual greenhouse gas emissions of the proposed building may be offset by—

   i. renewable energy generated and used on site; and
   ii. another process such as reclaimed energy, used on site.

The calculation method used for (A) and (B) must comply with—

   i. ANSI/ASHRAE Standard 140; and
   ii. Specification JVb.

The following section summarises the process of performing the NCC Section J Performance Solution JV3 used in this study:

Modelling Case 1 (Reference Building): Calculated the theoretical annual greenhouse gas emissions by modelling a reference building. This was the DTS complying building based on the JV3 criteria provided in the following pages.

Modelling Case 2: Calculated the theoretical annual greenhouse gas emissions of the proposed Alternative Solution with the services modelled as if they were the same as those of the reference building.

Modelling Case 3: Calculated the theoretical annual greenhouse gas emissions of the proposed Alternative Solution (building and services).

The theoretical greenhouse gas emissions calculated in cases 2 and 3 were then compared to the annual greenhouse gas emissions calculated in case 1 to ensure that in both cases, the annual emissions of the reference building in case 1 is not exceeded by that in cases 2 and 3. The following tables outline the NCC requirements for the JV3 method of verification which were considered in all the modelling runs for the Reference Building.

(a) The reference building must— (i) comply with Deemed-to-Satisfy Provisions in Parts J1 to J7; and (ii) have the minimum amount of mechanical ventilation required by Part F4.
(b) The external walls must have a solar absorptance of 0.6.
(c) The air-conditioning must— (i) for 98% of the annual hours of operation, achieve temperatures between— (A) 18°CDB to 25°CDB for conditioned spaces with transitory occupancy; and (B) subject to (ii), 21°CDB to 24°CDB in all other conditioned spaces; and (ii) if the proposed building has no mechanically provided cooling or has mixed mode cooling, have the same method of control and control set points for non-mechanical cooling as the proposed building.
(d) The infiltration rate in each zone must be— (i) 0.7 air changes per hour throughout all zones when there is no mechanically supplied outdoor air; and (ii) 0.35 air changes per hour at all other times.
(e) The artificial lighting must achieve the required maximum Illumination power density in Part J6 without applying the control device adjustment factors.
(f) Minimum Energy Performance Standards must be applied to services not covered by Parts J5 to J7.

3.2. General Definitions

Envelope

In the NCC, this term is not limited to the building's outer shell, but also includes those continuous elements that separate a conditioned space from a non-conditioned space. For example, the floor between a plant room and an office space may be part of the envelope, rather than the outer shell. A non-conditioned space may be included within the envelope under certain circumstances.

Glazing

The glazing definition needs to be read in conjunction with the definition of a window and roof light. It can include a glazed door. For the purposes of Section J, the glazing provides an aperture by which light and energy can flow into or from the conditioned space. Glazing includes the glass and any frame system.

Annual energy consumption

This is the amount of energy calculated to be consumed under certain specific conditions in consideration of operating profiles, internal loads and plant efficiencies. It is used in Verification Method JV3 that compares the calculated energy consumption with that of a complying reference building. It should not be considered a prediction of the actual energy consumption of an actual building as there could be major differences in the conditions such as the internal loads of the building and the hours of operation. It differs from annual energy load because it is affected by the type of heating or cooling appliance used, for example, heating by a reverse cycle air-conditioner uses less than half the energy that a gas fired heater would use to meet the same annual energy load.

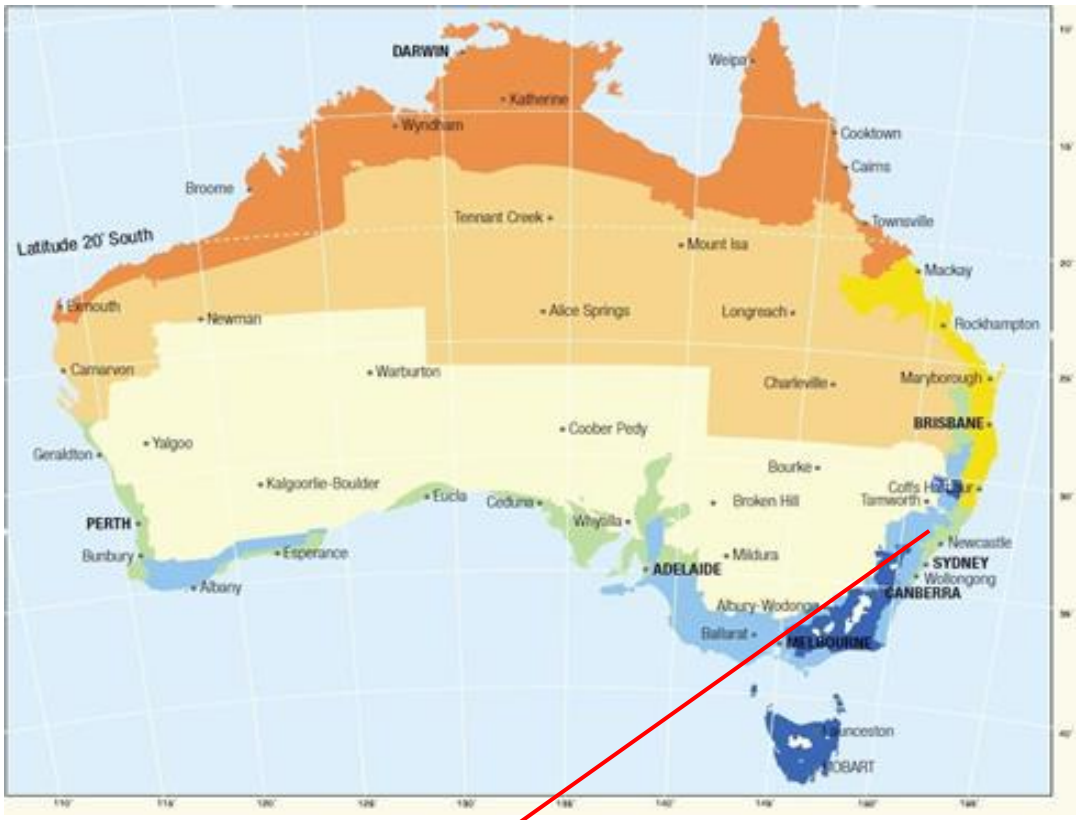
Conditioned space

A conditioned space is one likely to be air-conditioned rather than one that is air-conditioned. In some cases, chilled and hot water may be reticulated through duct risers as part of the building design to enable conditioning to be provided as part of a later fitout. A conditioned space may include a ceiling or under-floor space that is open to the conditioned space such as a space separated by only a perforated or grille ceiling or floor where the space is a supply air or return air plenum.

4. Building Description

4.1. NCC Climate Zone & Building Classification

The climate zone is defined by the NCC as 'an area for specific locations, having energy efficiency provisions based upon a range of similar climatic characteristics.
The development is located in Palm Beach NSW which is within the NCC climate zone 5 (warm temperate). The main building classification for the building is Class 6.



ZONE	DESCRIPTION
1	High humid summer, warm winter
2	Warm humid summer, mild winter
3	Hot dry summer, warm winter
4	Hot dry summer, cool winter
5	Warm temperate
6	Mild temperate
7	Cool temperate
8	Alpine

4.2. Scope of Analysis

The scope of this report is based on;

1. Review & interpretation of the architectural drawings to determine the Section J envelope and orientation of the building for assessment.
2. Parts J1 compliance (see sections 5 and 7 of the report)
    - Review and interpretation of façade and glazing dimensions based on the architectural drawings
    - Establish glazed areas of building envelope to conduct Part J1 DTS analysis (wall-glazing).
    - Input parameters (façade area, external shading devices and glazing dimensions) into the NCC 2019 - J1 Calculator (Facade) which is currently available in Beta version only.
3. JV3 compliance (see Section 6)
    - Conduct energy modelling for a reference building using the DTS results of the Parts J1 assessment and inputs reflecting achievement of minimum performance under the DTS provisions of Parts J3-J8. The energy modelling conducted is based on geometry development from the architectural and facade documentation.
    - Conduct energy modelling runs for the proposed building using glazing system thermal performances to reflect products in alignment with the architectural design intent.
    - Comparison of the annual energy consumption to determine JV3 compliance for the building with proposed level of glazing and wall insulation performance.

4.3. Information Used

The assessment within the report presents the requirements of Section J Part JV3 with respect to the documented design of the development. The assessment format generally follows the layout of Clauses within NCC Section J, to demonstrate the compliance requirements for Part J1. The assessment is based on the following architectural drawings prepared by Canvas Architecture & Design.

1602_200220_Pre DA_SD01_A2

1602_200220_Pre DA_SD02_A3

1602_200220_Pre DA_SD03_A3

1602_200220_Pre DA_SD04_A3

1602_200220_Pre DA_SD05_A3

1602_200220_Pre DA_SD06_A3

1602_200220_Pre DA_SD07_A3

4.4. General Assumptions for Glazing and JV3 Analysis

- Glazing areas defined as glazing in the building envelope (as per Section J) include the area of any associated framing.
- The glazing thermal performance properties are inclusive of frame effects (Total system: Glass + Frame).
- Relevant shading must comply with the requirements of the NCC 2019.
- With the exception of Part J1 (outlined in section 7.1 of this report), all other elements of the building design are required to achieve the DTS compliance provisions of NCC 2019 under Section J.

4.5. Architectural Drawings

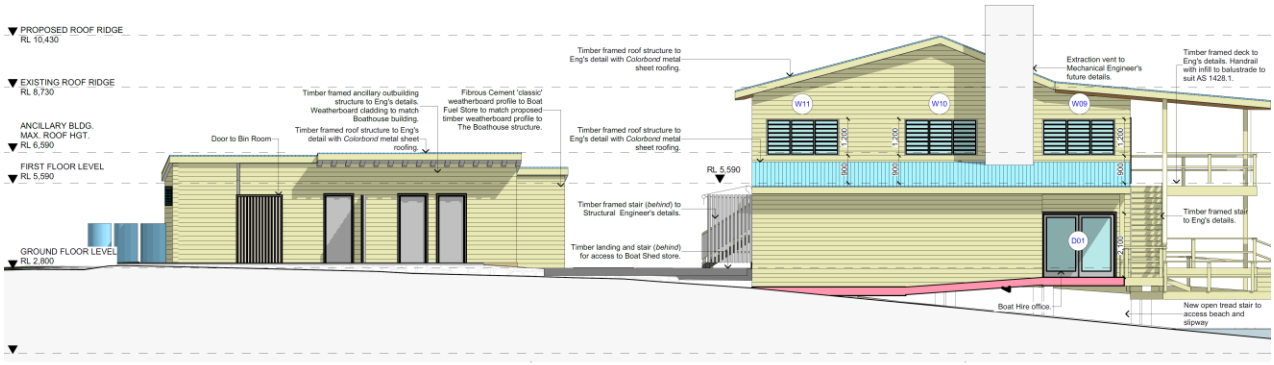
Selected architectural plans and elevations for the proposed development are provided below.

Site plan

Ground Floor Plan

Floor Plans - Level 1

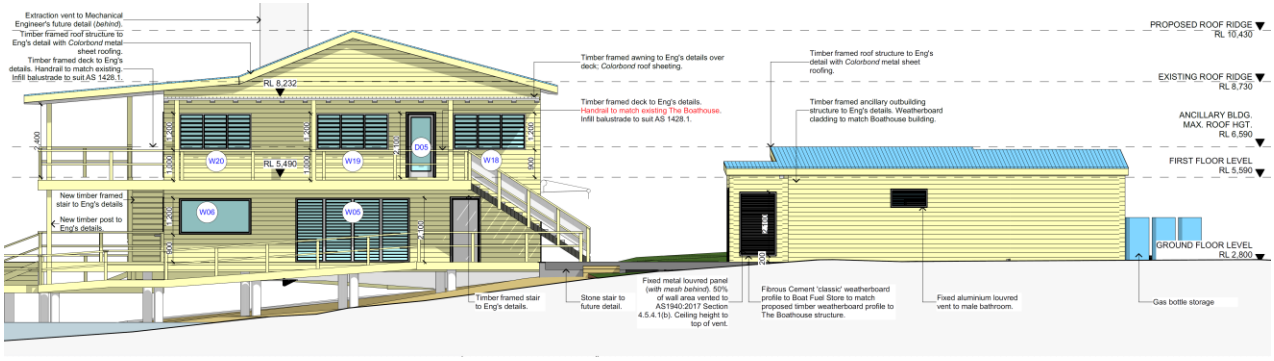
North & East Elevations



1 NORTH ELEVATION
1:100

2 EAST ELEVATION
1:100

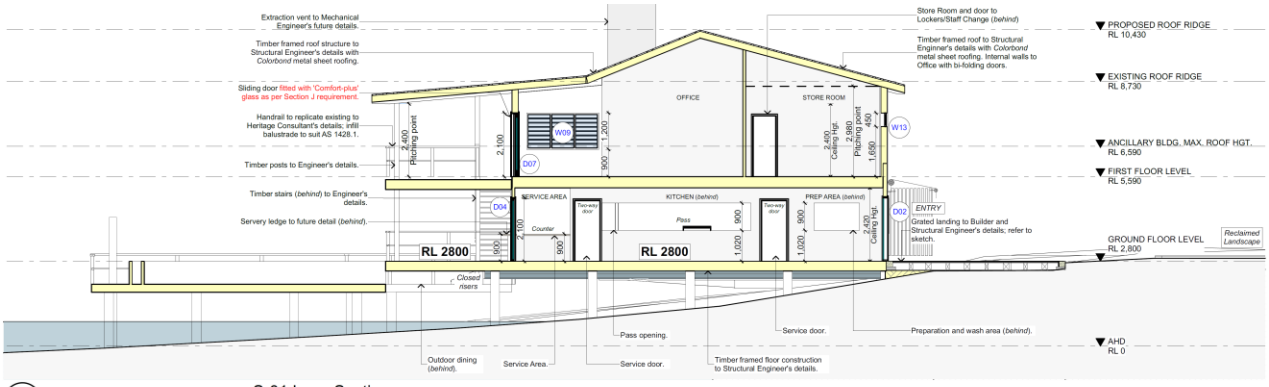
South & West Elevations



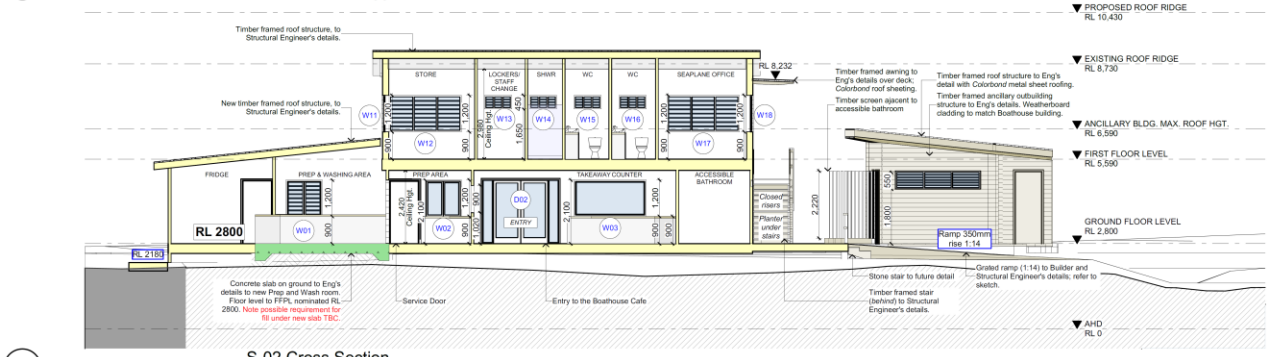
1 SOUTH ELEVATION
1:100

2 WEST ELEVATION
1:100

Sections



1 S-01 Long Section
1:100



2 S-02 Cross Section
1:100

5. Energy Modelling

5.1. Process

A Reference Building energy model was generated using the NCC compliant energy simulation software (Carrier E20-II). This model was based on the deemed to satisfy provisions (J1-8) and solar absorbance of 0.6 for external walls. This reference model provided the annual greenhouse gas emissions target for JP1 verification. This target was measured in kg/m2/annum.

The following two modelling cases were generated and compared with the reference building:

- The proposed building as modelled with the proposed design services.
- The proposed building as modelled with the same services used in modelling of the Reference Building.

The above process has been detailed in the following sections of the report.

5.1.1. Computer Simulation

Computer modelling was performed using the Carrier E-II software to predict the annual mechanical energy consumption requirements for the building. This program uses a dynamic simulation to assess the building envelope response as well as space and surface temperatures, internal loads and energy consumption.

To ensure appropriate results are derived from the software package, ABCB requires that the software conform to appropriate BESTEST validation test or be certified in accordance with ANSI/ASHRAE Standard 140-2001: “Standard Method of Test for Evaluation of Building Energy Analysis Computer Programs”. Carrier E-II satisfies this requirement

The Carrier E20-II program models the heat exchange between the air-conditioned space and the external environment to the space, hot or cold bodies in the space including people, lighting, and machines, and the air-conditioning system. The external environment includes the external ambient conditions and adjacent spaces.

The heat exchange analysis includes convection to and from surfaces, radiation exchange to and from the external environment, radiation exchange between the space internal surfaces, conduction through surfaces, and changes in humidity.

The software addressed all the main aspects of thermal modelling such as:

- Energy flow through the building’s envelope, including at adiabatic surfaces and also including thermal storage effects;
- Accurately modelling the performance of the air-conditioning and ventilation systems, including plant and equipment using their energy input ratios, coefficients of performance, or efficiency at full and part load;
- Control strategies, sequencing of plant and equipment, controlled settings and types of controls;
- Relative humidity range; and
- Use of different energy types.

The energy consumption outputs from the program were used as inputs to this assessment.

5.2. Modelling Input Data - General

In accordance with Verification Method JV3, the following input data were used to calculate the annual energy consumption for the reference building.

5.2.1. Weather Data

Historical hourly local weather data, in the form of twelve months' data, was used to represent the building external ambient data at the building location and to accurately model the dynamic nature of building thermal response. The weather data contains hourly records of radiation, temperature, humidity, sunshine duration and wind speed and direction for a typical meteorological year.

5.2.2. Area

The building geometry is based on the latest architectural drawing prepared by Canvas Architects.

5.2.3. Air Conditioning, Zoning and Simulation

The HVAC systems used in both the Proposed Building and Reference Building models were predefined in Carrier E20-II HAP. In compliance with NCC JV3, the following temperature bands were adopted for 98% of the plant operation time.

- 18°CDB to 25°CDB for conditioned spaces with transitory occupancy; and
- 21°CDB to 24°CDB in all other conditioned spaces

The mechanical systems for both the Proposed Building and Reference Building models were simulated with the input parameters in accordance with the DTS Requirements of NCC Part J5.

Infiltration Rates

The infiltration has been included in both the "reference" and proposed" models as Section JVb.

5.2.4. Internal Loads & NCC Default Values

In compliance with NCC Section J requirements, there are parameters that must be the same in all modelling runs (i.e. the reference building as well as the proposed building). This is to avoid using energy efficiency criteria or calculations that could result in a more generous allowance using the reference building and then criteria or calculations that result in lower annual energy consumption values for the proposed building.

In compliance with NCC Section J, the following parameters remained unchanged in all the simulation runs:
(a) General— (i) annual greenhouse gas emissions calculation method; and (ii) greenhouse gas emissions factors (based on Table 3a); or (iii) location, being either— (A) the location where the building is to be constructed if appropriate climatic data is available; or (B) the nearest location with similar climatic conditions, for which climatic data is available; and (iv) adjacent structures and features; and (v) orientation; and (vi) building form, including— (A) the roof geometry; and (B) the floor plan; and (C) the number of storeys; and

(D) the ground to lowest floor arrangements; and

(E) the size and location of glazing; and

(F) external doors; and

(vii) testing standards including for insulation, glazing, water heater and unitary air-conditioning equipment; and

(b) Fabric and glazing—

(i) quality of insulation installation; and

(ii) thermal resistance of air films including any adjustment factors, moisture content of materials and the like; and

(iii) dimensions of external, internal and separating walls; and

(iv) internal shading devices, their colour and their criteria for operation; and

(c) Services—

(i) range and type of services and energy sources, other than renewable energy generated on site; and

(ii) assumptions and means of calculating the temperature difference across air-conditioning zone boundaries; and

(iii) floor coverings and furniture and fittings density; and

(iv) internal artificial lighting illumination levels; and

(v) internal heat gains including people, lighting, appliances, meals and other electric power loads; and

(vi) air-conditioning system configuration and zones; and

(vii) profiles for occupancy, air-conditioning, lighting and internal heat gains from people, hot meals, appliances, equipment and heated water supply systems based on—

(A) Specification JVc; or

(B) NABERS Energy for Offices simulation requirements; or

(C) Green Star simulation requirements; or

(D) the actual building if—

(aa) the operating hours per year are not less than 2,500; or

(bb) the daily operating profiles are not listed in Specification JVc; and

(viii) supply heated water temperature and rate of use; and

(ix) infiltration values, unless the following have been specified—

(A) additional sealing provisions to those required by Part J3; and

(B) an intended building leakage of less than 10 m3 /hr.m2 at 50Pa; and

(C) pressure testing to verify achievement of the intended building leakage,

in which case the intended building leakage at 50Pa may be converted into a whole building infiltration value for the proposed building infiltration using Tables 4.16 to 4.24 of CIBSE Guide A; and

(x) sequencing for water heaters, refrigeration chillers and heat rejection equipment such as cooling towers; and

(xi) representation of clothing and metabolic rate of the occupants; and

(xii) control of air-conditioning except—

(A) the reference building must have variable temperature control for chilled and heated water that modulates the chilled water and heated water temperatures as required to maximise the efficiency of the chiller or boiler operation during periods of low load; and

(B) if the controls for the proposed building are not adequately specified or cannot be simulated, the sample control specifications in Appendix B of AIRAH-DA28 must be used; and

(xiii) environmental conditions such as ground reflectivity, sky and ground form factors, temperature of external bounding surfaces, air velocities across external surfaces and the like; and (xiv) number, sizes, floors and traffic served by lifts and escalators.
For the modelling of services for the purposes of calculating annual greenhouse gas emissions, for both proposed and reference building:
(a) system demand and response for all items of plant must be calculated on a not less frequent than hourly basis; and (b) energy usage of all items of plant must be calculated with allowances for— (i) part load performance; and (ii) staging to meet system demand; and (c) energy usage of cooling plant must be calculated with allowances for— (i) the impact of chilled water temperature on chiller efficiency; and (ii) the impact of condenser water temperature on water-cooled plant efficiency; and (iii) the impact of ambient temperature on air-cooled plant efficiency; and (iv) the energy use of primary pumps serving individual chillers; and (v) the energy use of auxiliary equipment, including controls and oil heating for chillers; and (vi) thermal losses in the chilled water system; and (vii) the impact of chilled water temperature on thermal losses in the chilled water system; and (d) energy usage of water heating systems for space heating must be calculated with allowances for— (i) the impact of water temperature on water heater efficiency; and (ii) the energy use of primary or feedwater pumps serving individual water heaters; and (iii) thermal losses in water heating systems; and (iv) the thermal mass of water heating systems, accounting for thermal losses during periods when the system is not operating; and (e) energy usage of fan and pump systems must be calculated with allowances for— (i) the method of capacity regulation; and (ii) the use of either fixed or variable pressure control; and (f) energy usage of pump systems must be calculated with allowances for the system fixed static pressure head; and (g) energy usage of auxiliary equipment associated with co-generation and tri-generation systems, including pumps, cooling towers and jacket heaters, must be calculated; and (h) where the energy usage of the heated water supply for food preparation and sanitary purposes or the energy usage of lifts and escalators is the same in the proposed building and the reference building, they may be omitted from the calculation of both the proposed building and the reference building; and (i) energy use of a lift in a building with more than one classification may be apportioned according to the number of storeys of the part for which the annual greenhouse gas emissions and thermal comfort level are being calculated.

Internal heat loads, lighting loads and occupancy density

The internal heath loads applied to both the “reference” and “proposed” models are provided in the following table. The occupancy, lighting and equipment loads have been uniformly distributed throughout the building.

Item	Details
People Load	80 W sensible heat gain and 80 W latent heat gain. An average adjusted metabolic rate from Table 45 of AIRAH-DA09. A heat emission rate from Table 6.3 of CIBSE Guide A
Hourly Profile	The schedule is provided in section 5.2.4 – based on NCC Specification Table 2f.
Hot water consumption	As per Table 2m
Internal heat gains for appliances and equipment	5 W/m2

Shading

All external shading has been incorporated in the model based on the provided architectural drawings.

Schedules of Usage

The internal load schedules used in the model are as per the Specification JVc Modelling profiles provided in NCC Section J. Details of the schedules used are contained in the following tables;

> (a) The air-conditioning, must be modelled on the basis of—
>
> (i) the daily occupancy and operation profiles in Tables 2a to 2k (see the schedules provided in the following table); and
>
> (ii) the internal heat gains in a building—
>
> (A) from occupants and hot meals, in accordance with one of the options in Table 2n; and
>
> (B) from appliances and equipment, in accordance with Table 2l; and
>
> (C) from artificial lighting, determined in accordance with (b).
>
> (b) The artificial lighting must be modelled on the basis of the proposed level of artificial lighting in the building with the daily profile in Tables 2a to 2k.
>
> (c) The heated water supply, must be modelled on the basis of the consumption rates of Table 2m.

Occupancy and operation profiles

The following table provides the occupancy and operation profiles used for modelling runs in accordance with Table 2f Occupancy and operation profiles of a Class 6 restaurant or café

Time period	Occupancy	Artificial lighting	Appliances and equipment	Air-conditioning
	(Monday to Saturday)	(Monday to Saturday)	(Monday to Saturday)	(Monday to Saturday)
12:00am to 1:00am	0%	5%	15%	Off
1:00am to 2:00am	0%	5%	15%	Off
2:00am to 3:00am	0%	5%	15%	Off
3:00am to 4:00am	0%	5%	15%	Off
4:00am to 5:00am	0%	5%	15%	Off
5:00am to 6:00am	0%	5%	15%	Off
6:00am to 7:00am	5%	40%	40%	Off
7:00am to 8:00am	5%	40%	40%	On
8:00am to 9:00am	5%	60%	60%	On
9:00am to 10:00am	5%	60%	60%	On
10:00am to 11:00am	20%	90%	90%	On
11:00am to 12:00pm	50%	90%	90%	On
12:00pm to 1:00pm	80%	90%	90%	On
1:00pm to 2:00pm	70%	90%	90%	On
2:00pm to 3:00pm	40%	90%	90%	On
3:00pm to 4:00pm	20%	90%	90%	On
4:00pm to 5:00pm	25%	90%	90%	On
5:00pm to 6:00pm	50%	90%	90%	On
6:00pm to 7:00pm	80%	90%	90%	On
7:00pm to 8:00pm	80%	90%	90%	On
8:00pm to 9:00pm	80%	90%	90%	On
9:00pm to 10:00pm	50%	90%	90%	On

10:00pm to 11:00pm	35%	50%	50%	On
11:00pm to 12:00am	20%	30%	30%	On

Note:

1. The occupancy profile is expressed as a percentage of the maximum number of people that can be accommodated in the building. The artificial lighting profile is expressed as a percentage of the maximum Illumination power density permitted under Part J6. The appliances and equipment profile are expressed as a percentage of the maximum internal heat gain in Table 2l. The air-conditioning profile is expressed as the plant status.
2. Sunday profile is 5% continuous artificial lighting and 5% continuous appliances and equipment. There is no occupancy and the air-conditioning are “off”.

Greenhouse gas emissions factors

The annual greenhouse gas emissions for the proposed building and the reference building have been calculated using the following greenhouse gas emissions factors (kg CO2-e/GJ).

Energy Source	GHG emissions factors (kgCO2-e/GJ)
Electricity	256
Natural Gas	51.53

Onsite Energy Generation

JV3 allows the renewable energy generated on-site or the “free” energy derived from another process (e.g. heat from cogeneration) to be deducted from the annual energy consumption of the proposed building. This means that the “annual energy consumption” is the sum of the energy drawn annually from the electrical grid, the gas network or fuel brought in by road transport and not the total of the energy consumed by the services that use energy. We understand that a 100 kW Solar PV system may be considered for the facility at later stage.

5.3. Modelling Case 1 - Reference Building with DTS Services

5.3.1. Inputs

Building Fabric: The building fabric was modelled based on the minimum Deemed to Satisfy (DTS) provisions outlined in the NCC Part J1 for building fabric (summarised in the following table).

Building Services: Based on the minimum NCC part J Deemed to Satisfy provisions.

The following table further outlines the DTS building fabric thermal performance and services used within the simulation model 1 (reference case).

Items (where separating conditioned and non-conditioned zones)		Reference Building Case (Model 1)
J1 (DTS)	Roof / Ceiling	Total R-Value: R3.7 The solar absorptance of the upper surface of a roof must be not more than 0.45.
	Roof lights	N.A
	Walls &Glazing	• Total System U-Value of wall-glazing construction < U2.0 • Total System R-Value of wall components of the wall-glazing construction >R1.0. • Maximum wall-glazing construction solar admittance 0.13 Process: As expected, the “proposed” glazing and insulation did not meet the NCC part J1 ‘deemed to satisfy’ calculators. Specification of the DTS external glazing and insulation were refined to be as close as possible to 100% to ensure the highest possible energy consumption figure was achieved for the reference building.
	Floors	Suspended Floors: Total R-Value > R2.0
J3-8 (DTS)	Building Services	Set at the minimum NCC 2019 DTS requirements.
Other	Solar Absorptance:	Solar absorptance of 0.6 for external walls and 0.7 for roofs, in accordance with JV3.

5.3.2 Results

The outcome for the Reference Building with DTS services was 64.1 kg/m2.annum.

5.4. Modelling Case 2 - Proposed Building with DTS Services

5.4.1 Inputs

Building Fabric: The building was modelled based on the proposed fabric which is the same as the NCC part J deemed to satisfy provisions with the following exceptions:

- J1 – Building Fabric: modelling is based on the proposed glazing and insulation performance specification (provided in the following table and summarised in section 7.1 of the report);

Building Services: Based on the minimum NCC part J Deemed to Satisfy provisions.

The following table further outlines the performance inputs applied to the simulation model 2 (proposed building with DTS services):

Items (where separating conditioned and non-conditioned zones)		Proposed Building Case (Model 2)
J1 (Proposed)	Roof / Ceiling	Total Insulation: R3.7 The solar absorptance of the upper surface of a roof must be not more than 0.45.
	Roof lights	N.A
	Walls	External Walls: minimum total R3.0 thermal insulation with thermal breaks. Internal walls separating conditioned and non-conditioned zones: minimum total R2.0
	Glazing	• Total system U-Value $\leq$ 4.3 • Total system SHGC $\leq$ 0.53
	Floors (Addressed through JV3 assessment)	Suspended Floors: no added thermal insulation
J3-8 (DTS)	Building Services	As required by NCC JV3 method: Set at the minimum of NCC 2019 DTS requirements (Similar to Case 1- Reference Building)
Other requirements		• Building services: minimum DTS performance or better • Thermal comfort level of between a Predicted Mean Vote of -1 to +1 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.

5.4.2 Results

The outcome for the Proposed Building with DTS services was 57.4 kg/m2.annum.

5.5. Modelling Case 3 - Proposed Building with Proposed Services

5.5.1. Inputs

Building Fabric: The building was modelled based on the proposed fabric which is the same as the NCC part J deemed to satisfy provisions with the following exceptions:

- J1 – Building Fabric: modelling is based on the proposed glazing and insulation performance specification (provided in the following table and summarised in section 7.1 of the report);

Building Services: Based on the proposed building services. The "proposed services" under the modelling case 3 have been conservatively set at the "DTS services" level. The results of modelling cases 2 and 3 are therefore identical.

The following table outlines the performance inputs applied to the simulation model 2 (proposed building with proposed services):

Items (where separating conditioned and non-conditioned zones)		Proposed Building Case (Model 2)
J1 (Proposed)	Roof / Ceiling	Total Insulation: R3.7 The solar absorptance of the upper surface of a roof must be not more than 0.45.
	Roof lights	N.A
	Walls	External Walls: minimum total R3.0 thermal insulation with thermal breaks. Internal walls separating conditioned and non-conditioned zones: minimum total R2.0
	Glazing	• Total system U-Value ≤ 4.3 • Total system SHGC ≤ 0.53
	Floors (Addressed through JV3 assessment)	Suspended Floors: no added thermal insulation
J3-8 (Proposed)	Building Services	The "proposed services" under the modelling case 3 have been conservatively set at the "DTS services" level. The results of modelling cases 2 and 3 are therefore the same.
Other requirements		• Building services: minimum DTS performance or better. • Thermal comfort level of between a Predicted Mean Vote of -1 to +1 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.

5.5.2. Results

The outcome for the Proposed Building with proposed services was 57.4 kg/m2.annum per annum.

Note: The "proposed services" under the modelling case 3 have been conservatively set at the "DTS services" level. The results of modelling cases 2 and 3 are therefore the same (58.8 kg/m2.annum).

6. Summary of the Simulation Results and Conclusion

The following table summarises the total annual energy consumption for the simulation cases of the development.

	CASE 1 Reference Building [DTS Fabric and DTS services]	CASE 2 Proposed Building [Proposed Fabric and DTS services] *	CASE 3 Proposed Building [Proposed Fabric and Proposed services] *
Annual greenhouse gas emissions (normalised emissions)	64.1 kg/m2/annum	57.4 kg/m2/annum	57.4 kg/m2/annum

** The "proposed services" under the modelling case 3 have been conservatively set at the "DTS services" level. The results of modelling cases 2 and 3 are therefore the same (57.4 kg/m2/annum).*

A reference building was modelled having minimum DTS envelope characteristics as well as minimum DTS services. The annual energy consumption of the reference building and services was estimated to be 64.1 kg/m2.annum.

The annual energy consumption of the proposed building with the

DTS services (modelling case 2) is calculated at 57.4 kg/m2/annum. The services under the 3rd modelling case have been conservatively set at the "DTS services" level. The results of modelling cases 2 and 3 are therefore the same (57.4 kg/m2.annum).

The Proposed Building therefore meets the criteria of JV3 (a) (i) & (ii), for Verification Method JV3 as 57.4 kg/m2 annum is less than the 64.1 kg/m2.annum estimated for the Reference Case.

The proposed insulation and glazing system as outlined within the report (see section 7) are therefore compliant with the performance requirement of NCC Section J 2019.

7. Summary of the Section J Requirements

7.1. part J 1 – Building Fabric Requirements

7.1.1. Overview

Section J part J1 outlines the minimum requirements of building envelope. The envelope is defined by the NCC as parts of a building's fabric that separate a conditioned space or habitable room from the exterior of the building or a non-conditioned space.

The required thermal insulation requirements are as provided below:

Item	Minimum Insulation & Glazing Requirements
Roof / Ceiling	Total Insulation: R3.7 The solar absorptance of the upper surface of a roof must be not more than 0.45.
Roof lights	N.A
Walls	External Walls: minimum total R3.0 thermal insulation with thermal breaks. Internal walls separating conditioned and non-conditioned zones: minimum total R2.0
Glazing	• Total system U-Value $\leq$ 4.3 • Total system SHGC $\leq$ 0.53

7.1.2. Part J1.1 – Application

The Deemed-to-Satisfy Provisions of this Part apply to building elements forming the envelope of a Class 2 to 9 building other than J1.2(e), J1.3, J1.4, J1.5 and J1.6(a) which do not apply to a Class 2 sole-occupancy unit or a Class 4 part of a building. Part J1 is therefore applicable to the upgrade works.

7.1.3. 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.

Note:

The thermal insulation performance requirements outlined in this report nominate the Section J compliance requirements only. The specified performance values therefore do not consider requirements for any other disciplines such as Acoustics, Fire or Safety compliance. Where required, the development shall comply with any additional requirements related to other disciplines in addition to the Section J compliance requirements detailed in this report. All works need to comply with the minimum Section J1 requirements, Thermal bridging must be accounted for in accordance with J1.2 (e) and is the responsibility of the builder or the architect to obtain a construction build-up calculation from their insulation supplier.

7.1.4. J1.3 Roof and Ceiling Construction

For roof and ceiling constructions that form part of the building envelope of the conditioned space, NCC Section J Compliance shall be achieved with minimum total R3.7 insulation.
If the loss of insulation from penetrations such as recessed downlights, exhaust fans, etc. exceeds 0.5% of the ceiling area, additional insulation will be required according to Table J1.3b of the code.
The min. insulation value required is applicable for all upper solar absorbance values.

7.1.5. J1.4 Roof Lights

Based on the architectural drawings no roof lights are proposed for the development, Part J1.4 is therefore not applicable to this development.
Under any other design conditions, the roof light must meet the following criteria (Table J1.4 Roof Lights – Thermal Performance of transparent and translucent elements).

Roof light shaft index	Total area of roof lights up to 3.5% of the floor area of the room or space	Total area of roof lights more than 3.5% and up to 5% of the floor area of the room or space
< 1.0	≤ 0.45	≤ 0.29
≥ 1.0 to < 2.5	≤ 0.51	≤ 0.33
≥ 2.5	≤ 0.76	≤ 0.49

Notes:

1. 1 The total area of a roof light serving the space as a percentage of the floor area of the space must not exceed 5%.
2. Roof lights must have—
   a. a total area of not more than 5% of the floor area of the room or space served; and
   b. transparent and translucent elements, including any imperforate ceiling diffuser, with a combined performance of—
      i. for Total system SHGC, in accordance with Table J1.4; and
      ii. for Total system U-Value, not more than U3.9.

3. The roof light shaft index is determined by measuring the distance from the centre of the shaft at the roof to the centre of the shaft at the ceiling level and dividing it by the average internal dimension of the shaft opening at the ceiling level (or the diameter for a circular shaft) in the same units of measurement.
4. The area of a roof light is the area of the roof opening that allows light to enter the building. The total area of roof lights is the combined area for all roof lights serving the room or space.
5. The performance requirements of the total glazing system (glass + frame) must be demonstrated under NFRC100-2001 conditions and based on AFRC requirements and in compliance with the NCC

7.1.6. J1.5 Walls and Glazing

For wall and glazing constructions that form part of the building envelope of the conditioned space, NCC Section J Compliance shall be achieved as follows:

Walls	**External Walls:** minimum total R3.0 thermal insulation with thermal breaks. **Internal walls separating conditioned and non-conditioned zones:** minimum total R2.0
Glazing	• Total system U-Value $\leq$ 4.3 • Total system SHGC $\leq$ 0.53

7.1.7. J1.6 Floors (Addressed as part of JV3)

Compliance has been achieved through JV3 assessment and no added thermal insulation will be required to the suspended floors.

7.2. Part J3 – Building Sealing

Part J3 of the NCC 2019 contains the requirements of the Deemed-to-Satisfy compliance for building sealing. The purpose of this subsection is to ensure that additional heating and cooling loads will not be introduced through building leakage.

Part J3 is applicable to the development.

Clause J3.2 refers to 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. Clause J3.3 refers to roof lights.

Clause J3.4 outlines that a seal to restrict air infiltration must be fitted to each edge of doors, openable windows or the like that separate conditioned spaces from non-conditioned spaces or external areas. This provision is not required for windows complying with Australian Standard AS2047, a fire door or smoke door; or a roller shutter door, roller shutter grille or other security door or device installed only for out-of-hours security.

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.

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 m 2; 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.

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

Clause J3.5is related to exhaust fans. 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.

Clause J3.6is related to 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.

Clause J3.7 is related to 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.

7.3. Part J4

Part J4 of the NCC 2019 is blank and therefore not applicable to this development

7.4. Part J5 – Air Conditioning and Ventilation Systems

Part J5 of the NCC outlines the performance requirements for air conditioning and ventilation systems to ensure these services operate in an efficient manner.

Furthermore, in compliance with the JV3 method, the proposed building is required to achieve a thermal comfort level of between a Predicted Mean Vote of -1 to +1 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.

All services consultants and contractors shall design the air conditioning and ventilation systems to ensure compliance with the PMV requirements noted above, Part J5 of the NCC Section J and all subsections associated therein.

Part J6 – Artificial Lighting and Power Part J5 of the NCC outlines the performance requirements for air conditioning and ventilation systems to ensure these services operate in an efficient manner.

All services consultants and contractors shall design the air conditioning and ventilation systems to ensure compliance with Part J5 of the NCC Section J and all subsections associated therein.

7.5. Part J6 – Artificial Lighting and Power

Part J6 of the NCC outlines the performance requirements for illumination power density and the efficient use of lighting power and controls.

All services consultants and contractors shall design the artificial lighting systems to ensure compliance with Part J6 of the NCC Section J and all subsections associated therein with regards to power.

7.6. Part J7 – Hot Water Supply

Part J7 of the NCC outlines the provisions for the energy efficient use of hot water supply systems.

Clause J7.2 of Part J7 states that a hot water supply system for food preparation or sanitary purposes must be designed and installed in accordance with Section 8 of AS/NZS 3500.4.

All services consultants and contractors shall design the Hot Water supply systems to ensure compliance with Part J7 of the NCC Section J and all subsections associated therein.

7.7. Part J8 – Facilities for Energy Monitoring

Part J8 of the NCC outlines the provisions of facilities for energy monitoring. Facilities for energy monitoring shall be provided in accordance to Part J8 of the NCC.
A building or sole-occupancy unit with a floor area of more than 500 m2 must have the facility to record the consumption of gas and electricity.

A building with a floor area of more than 2,500m2 must have the facility to record individually the energy consumption of the following services. Energy meters required by 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.

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 travelators where there is more than one serving the building; and
vi. other ancillary plant.

All services consultants and contractors shall design for access for maintenance and facilities for monitoring to ensure compliance with Part J8 of the NCC Section J and all subsections associated therein.

8. Disclaimer

This report is prepared using the information described above and inputs from other consultants. Whilst EEG has endeavoured to ensure the information used is accurate, no responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact EEG for detailed advice which will take into account that party's particular requirements.

Computer performance assessment provides an estimate of building performance. This estimate is based on a necessarily simplified and idealised version of the building that does not and cannot fully represent all the intricacies of the building once built. As a result, simulation results only represent an interpretation of the potential performance of the building. No guarantee or warrantee of building performance in practice can be based on simulation results alone. EEG and its employees and agents shall not be liable for any loss arising because of, any person using or relying on the Report and whether caused by reason or error, negligent act or omission in the report. The draft assessment has been prepared based on the preliminary building services and architectural design with the view to conduct a detailed assessment once the design is further developed.

Performance of the completed building may be significantly affected by the quality of construction; the quality of commissioning, ongoing management of the building, and the way the building is operated, monitored and maintained. Building fabric inputs require verifiable manufacturer data to confirm thermal properties.

This report is intended as a guide to assist with the application of NCC Section J. It should be read in conjunction with the NCC 2019, specific applications may vary during the design development of the project.