Brookvale Oval Redevelopment

21st October 2019

Energy Performance Report

Revision D
Issued for DA Submission

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Revision Information

Project	Brookvale Oval Redevelopment
Title	Energy Performance Report
Client	Manly Warringah Sea Eagles
Prepared By	LCI (Australia) Pty Ltd Sydney Office Level 4, 73 Walker Street, North Sydney, 2060 T 02 9157 0570
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Revision Schedule

Revision	Date	Issue Name	Author	Authorised
A	01-Oct-19	DA Submission	PY	LEP
B	09-Oct-19	DA Submission	PY	LEP
C	10-Oct-19	DA Submission	PY	LEP
D	21-Oct-19	DA Submission	PY	LEP

Executive Summary

This report presents the minimum building fabric thermal performance requirements for the design of the Brookvale Oval Redevelopment located on Pittwater Road, Brookvale, NSW 2100, in accordance with the National Construction Code (NCC) 2019 Building Code of Australia (BCA) Section J *Part J1 Building Fabric* Deemed to Satisfy (DTS) requirements.

The assessment for building fabric (walls, roof, ceilings, floors and glazing systems) are presented in the marked-up drawings attached in the Appendices and summarised below in Table 1 and Table 2, respectively.

Table 1: DTS Thermal Insulation Requirements

Building Thermal Element	Minimum Total System R-value (m^2.K/W) Required
External Walls	R2.8
External Spandrel Walls	R1.0
Internal Walls	R1.4
Roof Construction	R3.7 (Solar Absorptance < 0.45)
Floor on Soil (Lower Ground Floor)	R1.5
Suspended Floor (Concourse Level Soffit)	R2.0

Table 2: DTS Glazing Performance Requirements

Orientation	Glazing Element	Total system U-value	Total system SHGC	Potential Glazing Type, or the like *(glass only specs)*
NORTH	Double-storey North Entrance Transparent Glazing (Grids 8-10)	3.4	0.32	Guardian Glass SN 70/35 DGU Low-E; Neutral Toned; VLT 69% U-value ~ 1.6 SHGC ~ 0.33
	Weighted Transparent Glazing (Grids 5-8 & 10-13)	3.4	0.22	Guardian Glass SN 40/23 DGU Low-E; VLT 40% U-value ~ 1.6 SHGC ~ 0.23
SOUTH	Concourse & Upper Level Glazing	3.4	0.32	Guardian Glass SN 70/35 DGU Low-E; Neutral Toned; VLT 69% U-value ~ 1.6 SHGC ~ 0.33
	High-level Louvred Glazing on Concourse Level	5.5	0.50	Monolithic Louvre

Notes:

- Thermal breaks must be installed to ensure a continuous thermal barrier; minimising thermal bridging effects
- Refer to '***Appendix A – NCC2019 DTS Thermal Insulation Mark-up***' for location & extent of thermal envelope
- Refer to '***Appendix B – NCC2019 Façade Calculator Glazing Mark-up***' for location & extent of the glazing used as assumptions for the calculation
- Refer to '***Appendix C – LCI NCC2019 Façade Calculator***' for calculation performed based on the latest architectural drawings
- Any alternative glazing selection must be DTS compliant and will require re-assessment using the DTS Façade Calculator or through Verification Method JV3 for confirmation of compliance

Contents

1. Introduction

The following report identifies the compliance requirements of the Brookvale Oval Redevelopment located on Pittwater Road, Brookvale, NSW 2100. The analysis has been conducted against the deemed-to-satisfy (DTS) provisions of the National Construction Code (NCC), Building Code of Australia (BCA) 2019 Section J *Part J1 Building Fabric*. The assessed areas of the development have been given an NCC classification of Class 9b.

This report is limited to identifying Section J Part J1 DTS requirements; Section J Parts J3, J5, J6 J7 and J8 DTS requirements will be addressed separately by the architect and building services consulting engineers.

1.1. Scope of Analysis for Part J1 and Part J2 Compliance

The scope of this report is based on:

1. The review & interpretation of the architectural drawing plans and elevations of the proposed development (dated 24/09/2019), to determine the Section J envelope and orientation of the building.
2. *Part J1 Building Fabric* compliance, including:
    - Review & interpretation of roof/ceiling, wall, and floor construction.
    - Identification of the DTS design compliance requirements of the building fabric according to Part J1 of the BCA 2019.
    - Review & interpretation of conditioned and non-conditioned space.
    - Establishment of glazed areas of building envelope.
    - Application of the BCA Facade Calculator spreadsheet to evaluate performance requirements.

The assessment within the report presents the DTS requirements of Section J Part J1, with respect to the documented architectural design of the development.

1.2. NCC BCA Section J

The NCC/BCA 2019 includes within Section J mandatory minimum energy efficiency performance requirements for buildings (Class 3, Class 5 to 9). 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 BCA, 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.

- *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, and floors. It also relates to the control of heat loss and heat gain within specified limits through vision glazing that forms part of the envelope.
- *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 Hot Water Supply and Swimming Pool & Spa Pool Plant* details requirements for hot water supply design.
- *Part J8 Facilities for Energy Monitoring* details requirements in relation to the monitoring of energy consumption.

The DTS provisions of Part J1 Building Fabric that form the scope of assessment within this report generally apply to building elements forming the “thermal envelope” of the building. The thermal envelope in Section J refers to

building fabric that separates a “conditioned space” or “habitable room” from the exterior of the building, or from a non-conditioned space. For this building, any space that is supplied with conditioned air, tempered air or is a space for the return air path to heating / air conditioning equipment would be subject to the envelope definition. **The extent of the thermal envelope applicable to the proposed development is illustrated in Appendix A.**

1.3. Climate Zone

The BCA 2019 climate zone for the location of the development is assumed to be Climate Zone 5, as shown in Figure 1.

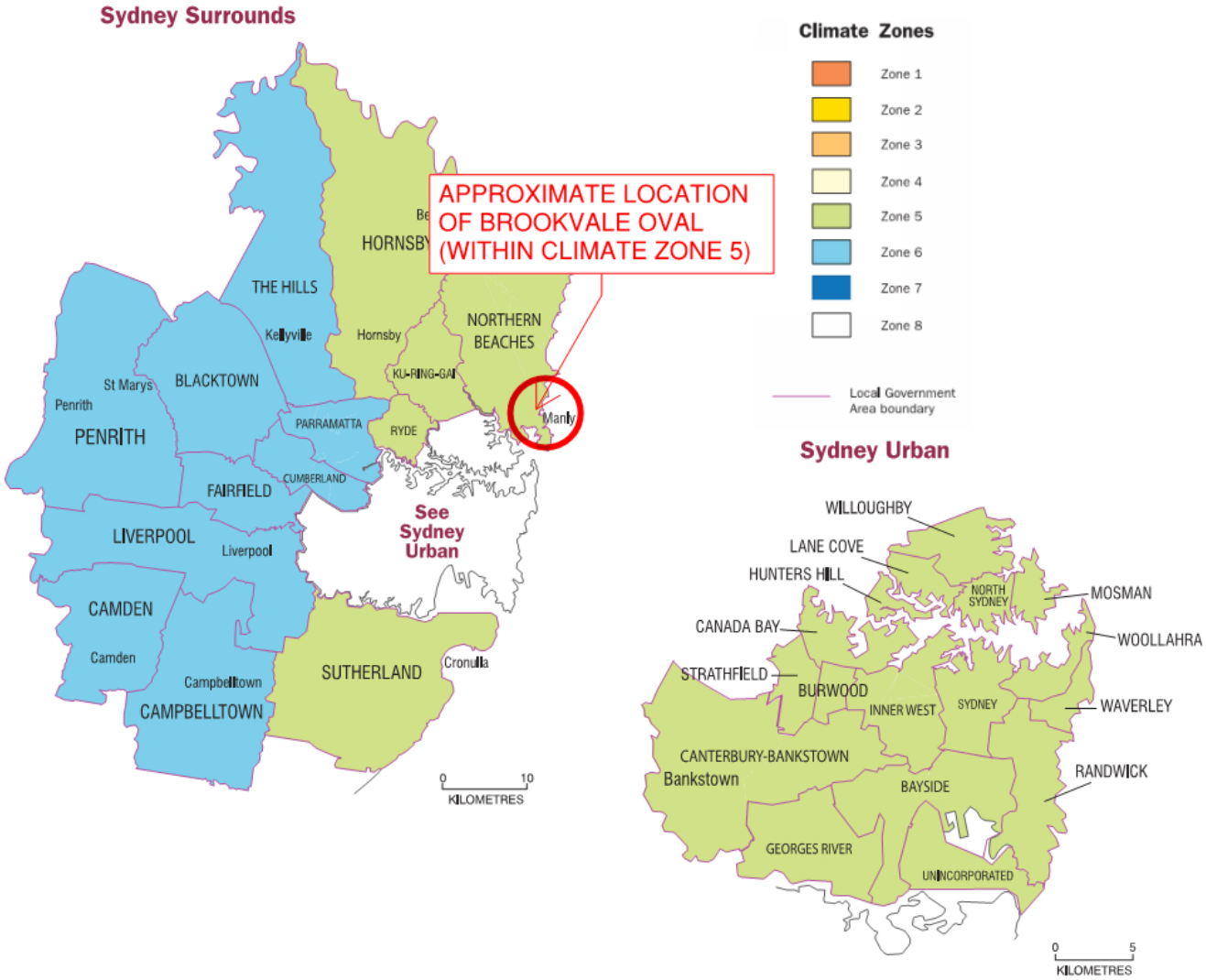

Figure 1: BCA Climate Zone Map

2. General Assumptions/Requirements for Part J1

- Where the BCA 2019 does not nominate specific thermal insulation requirements for a roof/ceiling/wall/floor outside of the envelope, it is assumed that no insulation is needed for that roof/ceiling/wall/floor for Section J compliance purposes.
- Additional thermal insulation may be required for reasons other than Section J compliance (e.g. thermal comfort, plant equipment performance, acoustics, etc.)
- In certain circumstances, the non-conditioned ceiling space will be included within the Section J envelope of the building (and will require J1 compliant insulation to the extended envelope)
- Any opaque spandrel/colour-backed glass/blanked-off panels present that form part of the external/internal envelope wall will require insulation behind to comply with the Part J1.5 requirements of BCA 2019 (to achieve a minimum Total System U-value or Total R-value).
- Envelope Wall thermal insulation as required by Part J1.5 must form a continuous thermal barrier from floor level to the underside of the slab above (or the underside of the roof above where relevant). This will require the installation of Part J1.5 compliant 'above ceiling' wall insulation to reduce heat transfer to/from the conditioned space via the ceiling space. Design & Construction co-ordination will be necessary with other services and other associated requirements.
- Ceiling/Roof/Floor insulation required is recommended from a Part J1 perspective to be fixed directly to the roof/slab soffit. Design & Construction co-ordination will be necessary with other services and other associated requirements.
- Assessment of glazing under Part J1 are applicable along the external envelope and internal envelope walls, as defined in Appendix A.
- External glazing areas defined as glazing in the external building envelope as per Section J are included in the assessment.
- The extent of glazing assumptions is as per the notes in the marked-up drawings.
- The glazing thermal performance entered into the facade calculator represents the combined thermal performance of both the glass and frame.

3. Part J1 Building Fabric Requirements

3.1. J1.1: Application of Part

The DTS requirements of this part apply to the Section J building envelope of the Development.

3.2. J1.2: Thermal Construction - General

a) Insulation is to comply with AS/NZS 4859.1 and is to be installed according to the requirements of J1.2 (a)(i), (ii) and (iii)

b) Reflective insulation (where required) is to be installed in accordance to J1.2 (b)(i), (ii), (iii) and (iv)

c) Bulk insulation is to be installed in accordance with J1.2 (c)(i) and (ii)

d) The thermal properties of the roof, ceiling, wall and floor materials are assumed 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 calculated in accordance with AS/NZS 4859.2 for a roof or floor; or determined in accordance with Specification J1.5a for wall-glazing construction; or determined in accordance with Specification J1.6 or Section 3.5 of CIBSE Guide A for soil or sub-floor spaces.

3.3. J1.3: Roof and Ceiling Construction

The roof/ceiling above the air-conditioned spaces of the development is deemed to be part of the Section J envelope and hence must satisfy the requirements of BCA 2019 J1.3 (a) and (b).

All non-air-conditioned spaces are generally excluded from Section J compliance; unless there is a specific non-Section J related requirement for thermal insulation (e.g. plant equipment performance/ thermal comfort /acoustic requirements). Where specified, the Total R-value achieved by the roof/ceiling construction over the air-conditioned areas is to be a minimum R3.7 for heat flow downwards (assuming a roof with an upper surface solar absorptance value of not more than 0.45).

The mark-ups in Appendix A are representative of the roof / ceiling elements of the conditioned space envelope and are based on LCI's interpretation of the listed drawings.

With reference to the mark-ups in Appendix A, the highlighted areas in the mark-up are conditioned spaces and, since the space above is exposed to the external conditions/non-conditioned spaces, the roof/ceiling construction in this area will need to achieve a minimum **Total R-Value of 3.7 downwards**.

The Total R-value required must be solely achieved through roof/ceiling construction and insulation, without relying on contribution from the ceiling/roof air space. In addition, it is recommended (from a Part J1 perspective) that the insulation be fixed to the underside of the roof, and not be laid directly lying above the ceiling. Design & Construction co-ordination will be necessary with other services and other associated requirements (e.g. acoustic requirements).

3.4. J1.4: Roof Lights

Not applicable as there are no roof lights.

3.5. J1.5: Walls and Glazing

In general, DTS thermal performance requirements of the walls & glazing that form part of the building's thermal envelope are dictated based on the below requirements and are implemented in the façade calculator to provide DTS compliant solutions.

- The Total System U-Value of wall-glazing construction must not be greater than—
  - (i) for a Class 2 common area, a Class 5, 6, 7, 8 or 9b building or a Class 9a building other than a ward area, U2.0; and
  - (ii) for a Class 3 or 9c building or a Class 9a ward area—
    - (A) in climate zones 1, 3, 4, 6 or 7, U1.1; or
    - (B) in climate zones 2 or 5, U2.0; or
    - (C) in climate zone 8, U0.9.
- Wall components of a wall-glazing construction must achieve a minimum Total R-value of
  - (i) where the wall is less than 80% of the area of the wall-glazing construction, R1.0; or
  - (ii) where the wall is 80% or more of the area of the wall-glazing construction, the value specified in Table J1.5 a.
- The solar admittance of externally facing wall-glazing construction must not be greater than—
  - (i) for a Class 2 common area, a Class 5, 6, 7, 8 or 9b building or a Class 9a building other than a ward area, the values specified in Table J1.5b; and
  - (ii) (ii) for a Class 3 or 9c building or a Class 9a ward area, the values specified in Table J1.5c.
- The solar admittance of a wall-glazing construction must be calculated in accordance with Specification J1.5a.

Note that the insulation to external envelope walls must form a continuous thermal barrier to the underside of the slab above or the underside of the roof above where relevant. This includes any portions of external walls above the ceiling that may separate the exterior from a ceiling space that is considered air conditioned (or non-conditioned ceiling space that is included within the Section J building envelope) (refer to Figure 2). Design & Construction co-ordination will be necessary with other services and other associated requirements (e.g. acoustic requirements).

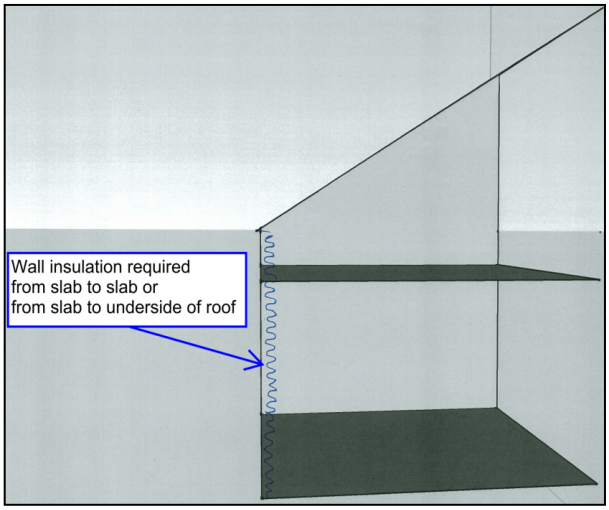

Figure 2: External Envelope Wall Insulation Requirement

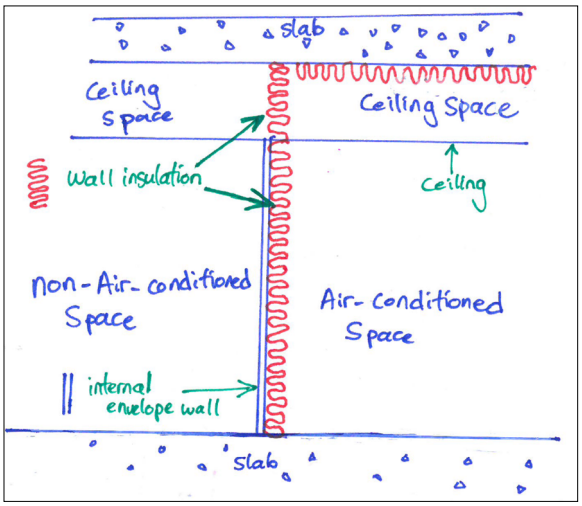

Figure 3: Internal Envelope Wall Insulation Requirement

The minimum Total R-value requirements of the internal walls forming the envelope are as noted in Appendix A. The insulation to these envelope walls must form a continuous thermal barrier to the underside of the slab above or the underside of the roof above where relevant. This will require the installation of Part J1.5 compliant 'above ceiling' wall insulation to reduce heat transfer to/from the conditioned space via the ceiling space (refer to Figure 3). Design & Construction co-ordination will be necessary with other services and other associated requirements (e.g. acoustic requirements).

3.6. J1.6: Floors

In general, a floor must achieve the Total R-Value specified in Table J1.6. This includes floors that are in direct contact with the soil on ground, suspended floors exposed to the external conditions and floors that form part of the thermal envelope separating conditioned spaces from non-conditioned spaces.

For this project, floor that forms part of the thermal envelope must achieve a minimum **Total R-value of 2.0**. However, Specification J1.6 allow use of R-values considered to be achieved by the soil for floors that are in direct contact with the ground by measuring the ratio of the floor area to floor perimeter and considering the thickness of the wall. This means that some floors may require less or no slab insulation as it can be considered to achieve a certain R-value. This has been considered in the DTS assessment and are reflected in **Appendix A**.

4. Wall-Glazing Construction Performance Requirements

The assessment for building wall-glazing construction (thermal insulation for walls, roof, ceilings, floors etc. & glass and frame Total Systems U-Values & Solar Heat Gain Coefficients (SHGC)) are presented in the marked-up drawings attached in the Appendices and summarised below in Table 3 and Table 4Table 2, respectively:

Table 3: DTS Thermal Insulation Requirements

Building Thermal Element	Minimum Total System R-value (m^2.K/W) Required
External Walls	R2.8
External Spandrel Walls	R1.0
Internal Walls	R1.4
Roof Construction	R3.7 (Solar Absorptance < 0.45)
Floor on Soil (Lower Ground Floor)	R1.5
Suspended Floor (Concourse Level Soffit)	R2.0

Table 4: DTS Glazing Performance Requirements

Orientation	Glazing Element	Total system U-value	Total system SHGC	Potential Glazing Type, or the like *(glass only specs)*
NORTH	Double-storey North Entrance Transparent Glazing (Grids 8-10)	3.4	0.32	Guardian Glass SN 70/35 DGU Low-E; Neutral Toned; VLT 69% U-value ~ 1.6 SHGC ~ 0.33
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	High-level Louvred Glazing on Concourse Level	5.5	0.50	Monolithic Louvre

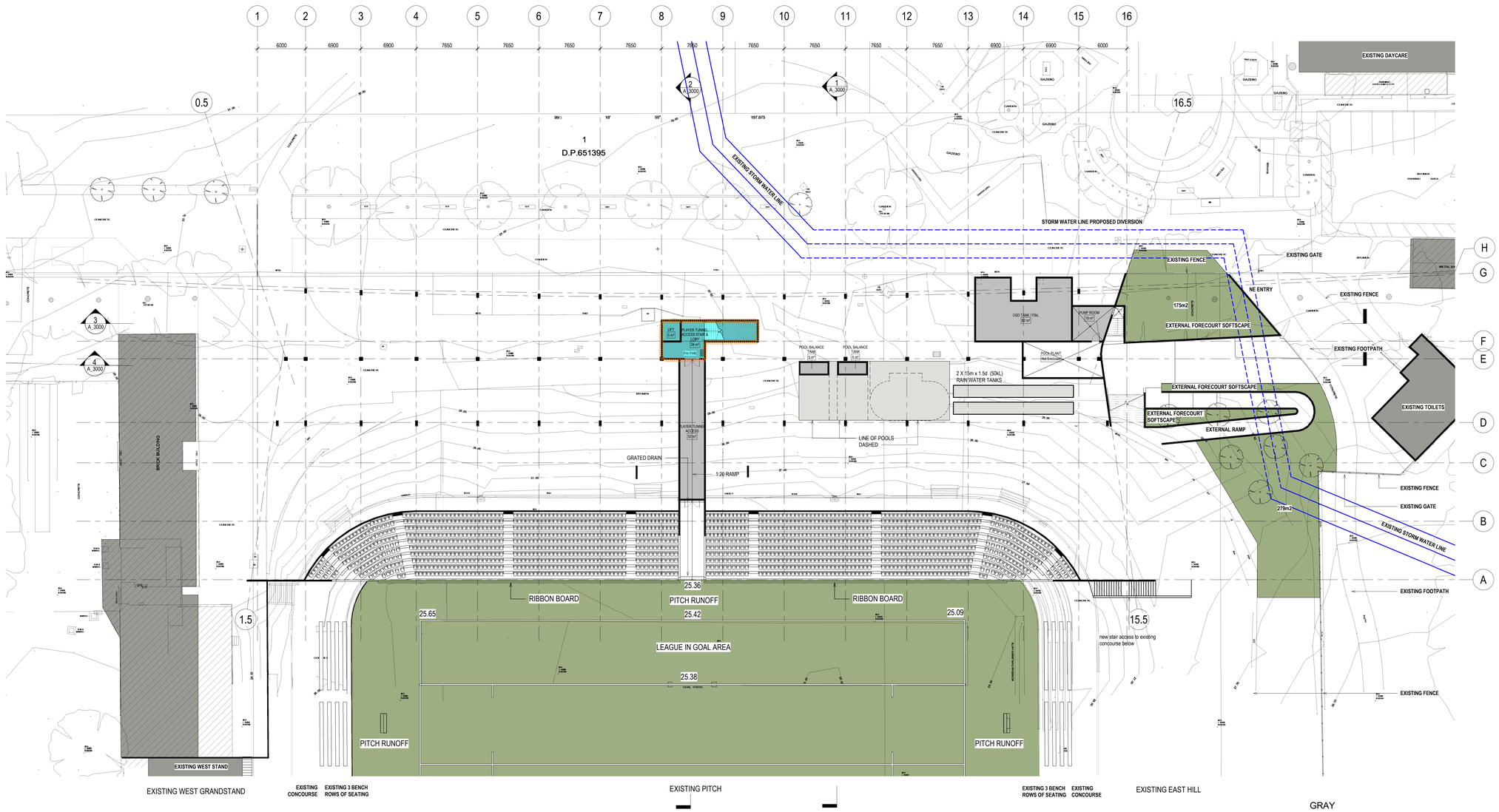
Notes:

- Thermal breaks must be installed to ensure a continuous thermal barrier, minimising thermal bridging effects.
- Refer to '***Appendix A – NCC2019 DTS Thermal Insulation Mark-up***' for location & extent of thermal envelope.
- Refer to '***Appendix B – NCC2019 Façade Calculator Glazing Mark-up***' for location & extent of the glazing used as assumptions for the calculation.
- Refer to '***Appendix C – LCI NCC2019 Façade Calculator***' for calculation performed based on the latest architectural drawings.
- Any alternative glazing selection must be DTS compliant and will require re-assessment using the DTS Façade calculator or through the JV3 Verification Method (Alternative Solution) for confirmation of compliance.
- Inputs into the façade calculator require the Total System U-Values and Solar Heat Gain Coefficient (SHGC) values to Australian Fenestration Rating Council (AFRC) standards, to represent the combined performance of the glass and frame. Values shown in the glazing calculators and the performance tables are Total System values (glass and frame).

- The performance of each type of glazing system (glass and frame) must be demonstrated under AFRC conditions for compliance with Part J1, demonstrated using the tested AFRC values. The results of the glazing analysis above demonstrate the performance requirements with which the selected AFRC tested glazing (glass and frame) must comply. Note that Glazed Doors that are part of the Section J Building Envelope also must comply with the Part J1 glazing component requirements identified.
- The glazing system tenderers must include confirmation of the Total System U-Values and SHGC (to AFRC guidelines) for the proposed glazing system (glass and frame), to ensure the selected system meets the DTS performance requirements.
- It is noted that the final minimum glazing performance requirements will need to be co-ordinated with the architectural, mechanical and acoustic requirements.

5. Appendices

APPENDIX A - BROOKVALE OVAL - NCC2019 DTS THERMAL INSULATION MARK-UP



GRAY
- Less than 20 m²
- 20 m² or more

KEY

- Total R-value of the External Wall Construction (Min R2.8) & Total R-value of the Spandrels Construction (Min R1.0)
- Total R-value of the Internal Wall Construction (Min R1.4)
- Floor Construction Total Thermal Performance (Min Total R-value 2.0)
- Floor Construction Total Thermal Performance (Min Total R-value 1.5)
- Roof Construction Total Thermal Performance (Min Total R-value 3.7; Solar Absorptance <0.45)

Note: The above construction are only to be applied to the **non-glazed portions of the envelope**; glazing must be installed as per the architectural layouts with its thermal performances pursuant to the respective glazing specifications stated in Section J report (Total Systems U-Value, and Total Systems SHGC value).

General Notes:

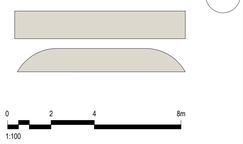
- Wall thermal insulation shall be applied for the full wall height (EXCLUDING any non-glazed openings in envelope wall such as doors/vents/ penetrations/shutters etc., glazing, earth retaining wall or earth berm)
- Insulation is also required to any opaque spandrel panels and around the external facing columns
- The insulation to external/internal envelope walls should generally form a continuous thermal barrier to the underside of the slab or roof. This includes insulating any portions of external/internal building envelope walls above the ceiling line (directly above the envelope wall).
- **Thermal breaks must be provided to prevent thermal bridging effects on the insulated envelopes.**

LCI DOCUMENT

DATE	21 Oct 2019
PROJECT NO.	19092
PROJECT NAME	Brookvale Oval
DRAWING NO.	
DRAWING TITLE	BROOKVALE OVAL - NCC2019 DTS THERMAL INSULATION MARK-UP

FOR INFORMATION ONLY, NOT FOR CONSTRUCTION

REFERENCE MAP



NOTES

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REV	DESCRIPTION	DATE
G	For Development Application	17.10.2019
F	Draft DA Issue	30.09.2019
E	Draft DA Issue	27.09.2019
D	For Quantity Surveyor	26.09.2019
C	For Information	24.09.2019
B	For Information	19.09.2019
A	For Information	17.09.2019

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Nominated Architects NSW: Tony Grist 5350 Glenn Scott 6842 Ross de la Motte 7356

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Mckenzie Group
Level 6
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Sydney NSW 2000

Town Planner
URBIS
Level 4
73 Walker Street
North Sydney NSW 2060

Aquatics
GNAF
68-70 Crown Street
Woolloomooloo NSW 2011

Acoustics
Pulse Acoustics
Level 4
73 Walker Street
North Sydney NSW 2060

Branding
Brand Culture
202 / 19a Boundary Street
Rushcutters Bay NSW 2011

Cost Planner
RLB
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North Sydney NSW 2060

CLIENT
MANLY WARRINGAH SEA EAGLES

PROJECT
BROOKVALE OVAL REDEVELOPMENT CENTRE OF EXCELLENCE AND GRANDSTAND

DRAWING TITLE
GA PLAN - LOWER GROUND B00

STATUS
DEVELOPMENT APPLICATION

SCALE @ A0	DRAWN	REVIEWED	APPROVED
1 : 200	RP	FG	GS

PROJECT NUMBER	DRAWING NUMBER	REV
014340	A_1000	G

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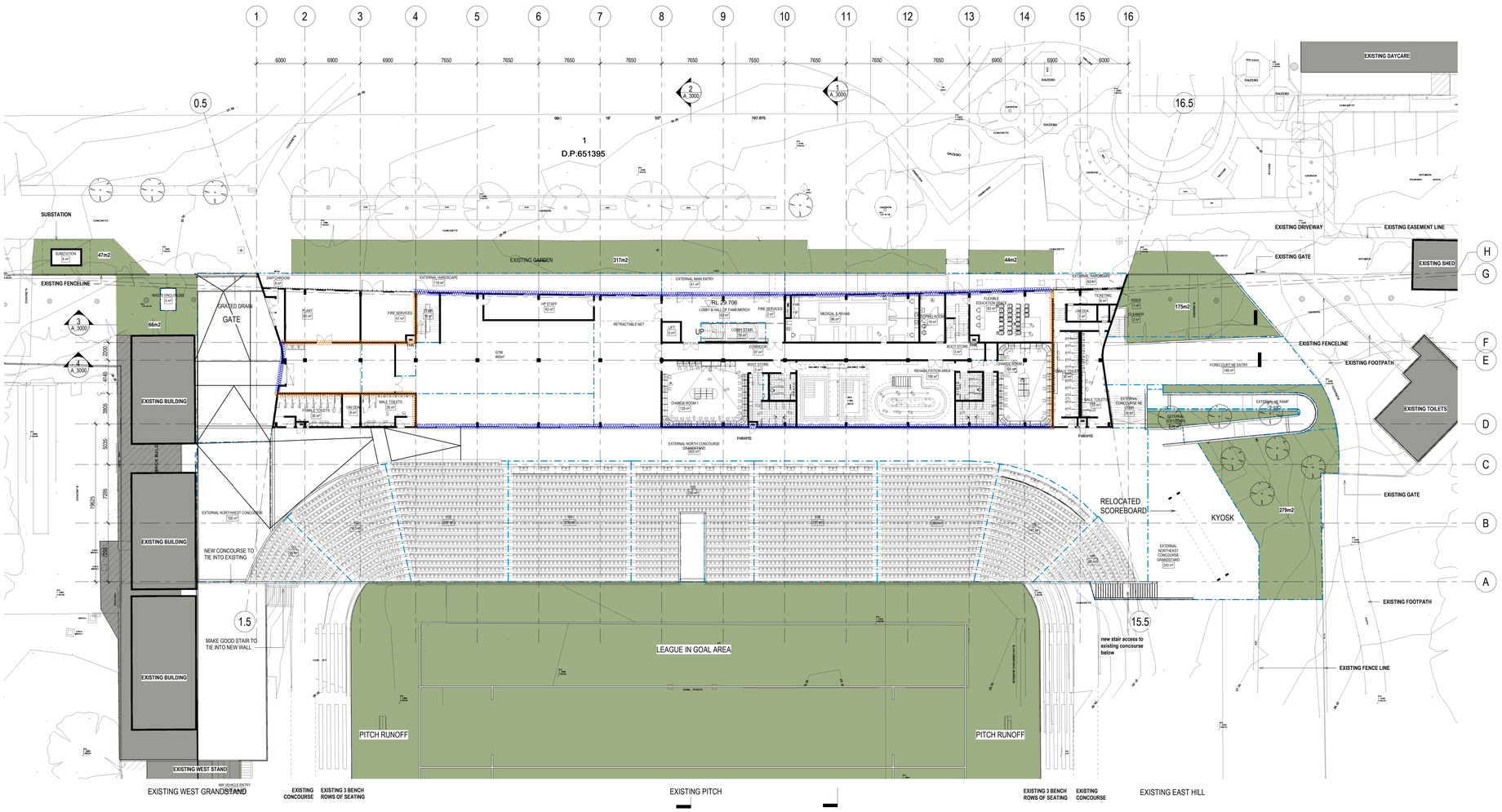

1 CONCOURSE LEVEL 00
1 : 200

KEY

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- The insulation to external/internal envelope walls should generally form a continuous thermal barrier to the underside of the slab or roof. This includes insulating any portions of external/internal building envelope walls above the ceiling line (directly above the envelope wall).

- Thermal breaks must be provided to prevent thermal bridging effects on the insulated envelopes.

Seatcount Schedule		
Seating Bay	Count	Comments
101	111	GA
102	290	GA
103	451	GA
104	465	GA
105	393	GA
106	465	GA
107	434	GA
108	242	GA
109	111	GA
PRUA	38	GA
TOTAL SEATS	3000	

Premium Product Seatcount Schedule		
Seating Bay	Count	Comments
201	135	BOX
TOTAL SEATS	135	

SUMMARY

TOTAL GA 3000
TOTAL VIP 135
TOTAL 3135

REFERENCE MAP

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A	For Information - Pre-Design & FTB	14.08.2019

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CLIENT
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PROJECT
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DRAWING TITLE
GA PLAN - CONCOURSE LEVEL 00

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1 : 200	RP	FG	GS

PROJECT NUMBER	DRAWING NUMBER	REV
014340	A_1001	L

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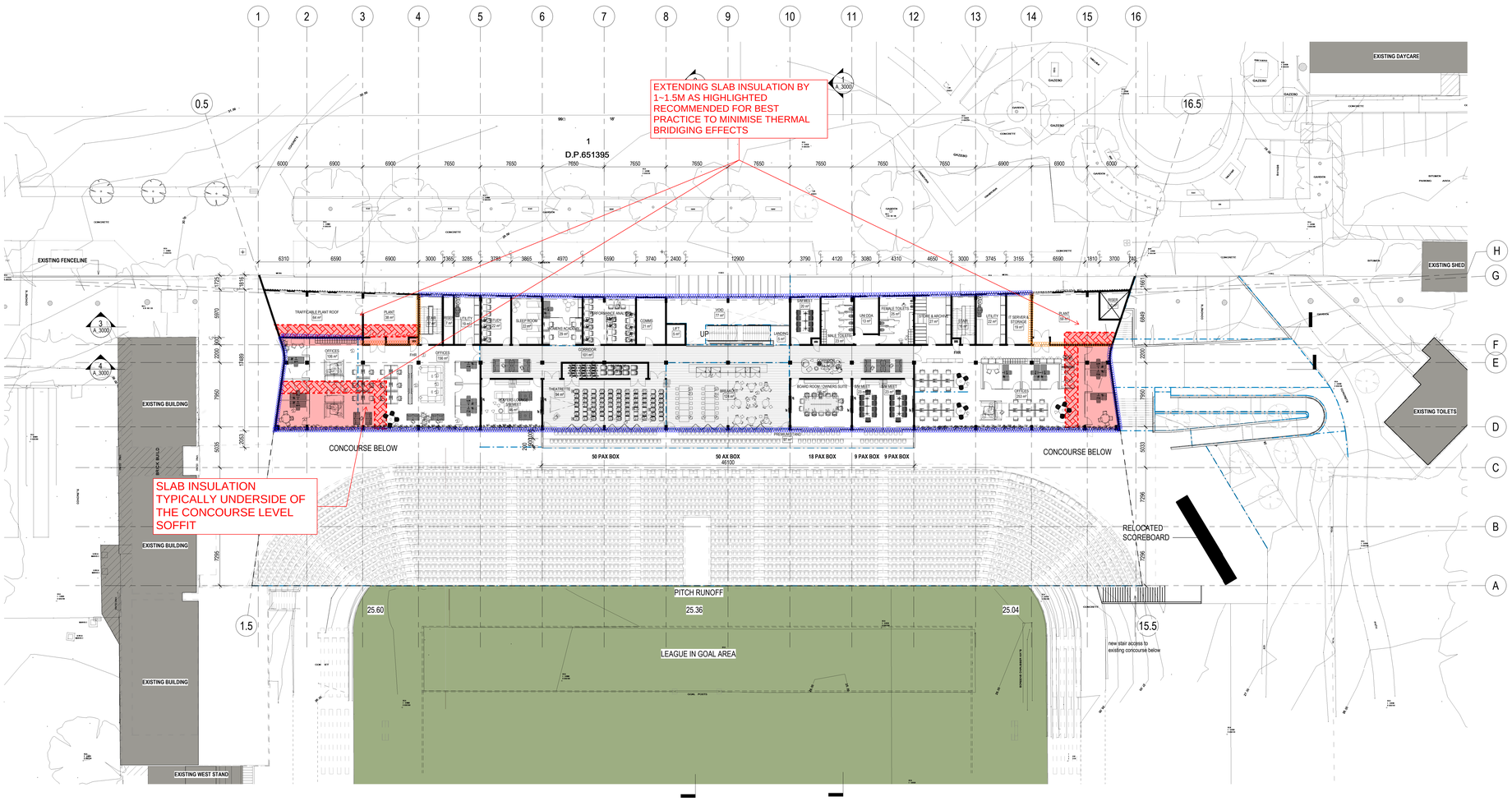

1 UPPER LEVEL 01
1 : 200

KEY

Total R-value of the External Wall Construction (Min R2.8) &
Total R-value of the Spandrels Construction (Min R1.0)

Total R-value of the Internal Wall Construction (Min R1.4)

Floor Construction Total Thermal Performance
(Min Total R-value 2.0)

Floor Construction Total Thermal Performance
(Min Total R-value 1.5)

Roof Construction Total Thermal Performance
(Min Total R-value 3.7; Solar Absorptance <0.45)

Note: The above construction are only to be applied to the **non-glazed portions of the envelope**; glazing must be installed as per the architectural layouts with its thermal performances pursuant to the respective glazing specifications stated in Section J report (Total Systems U-Value, and Total Systems SHGC value).

General Notes:

- Wall thermal insulation shall be applied for the full wall height (EXCLUDING any non-glazed openings in envelope wall such as doors/vents/ penetrations/shutters etc., glazing, earth retaining wall or earth berm)
- Insulation is also required to any opaque spandrel panels and around the external facing columns
- The insulation to external/internal envelope walls should generally form a continuous thermal barrier to the underside of the slab or roof. This includes insulating any portions of external/internal building envelope walls above the ceiling line (directly above the envelope wall).

- Thermal breaks must be provided to prevent thermal bridging effects on the insulated envelopes.

REFERENCE MAP

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L	For Development Application	17.10.2019
K	Draft DA Issue	30.09.2019
J	Draft DA Issue	27.09.2019
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C	For Information	09.09.2019
B	For Information	29.08.2019
A	For Information - Pre-Design & FTB	14.08.2019

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MANLY WARRINGAH SEA EAGLES

PROJECT
BROOKVALE OVAL REDEVELOPMENT
CENTRE OF EXCELLENCE AND GRANDSTAND

DRAWING TITLE
GA PLAN - UPPER LEVEL 01

STATUS
DEVELOPMENT APPLICATION

SCALE @ A0	DRAWN	REVIEWED	APPROVED
1 : 200	RP	FG	GS

PROJECT NUMBER	DRAWING NUMBER	REV
014340	A_1002	L

Original Sheet Size A0 - 841 x 1189mm

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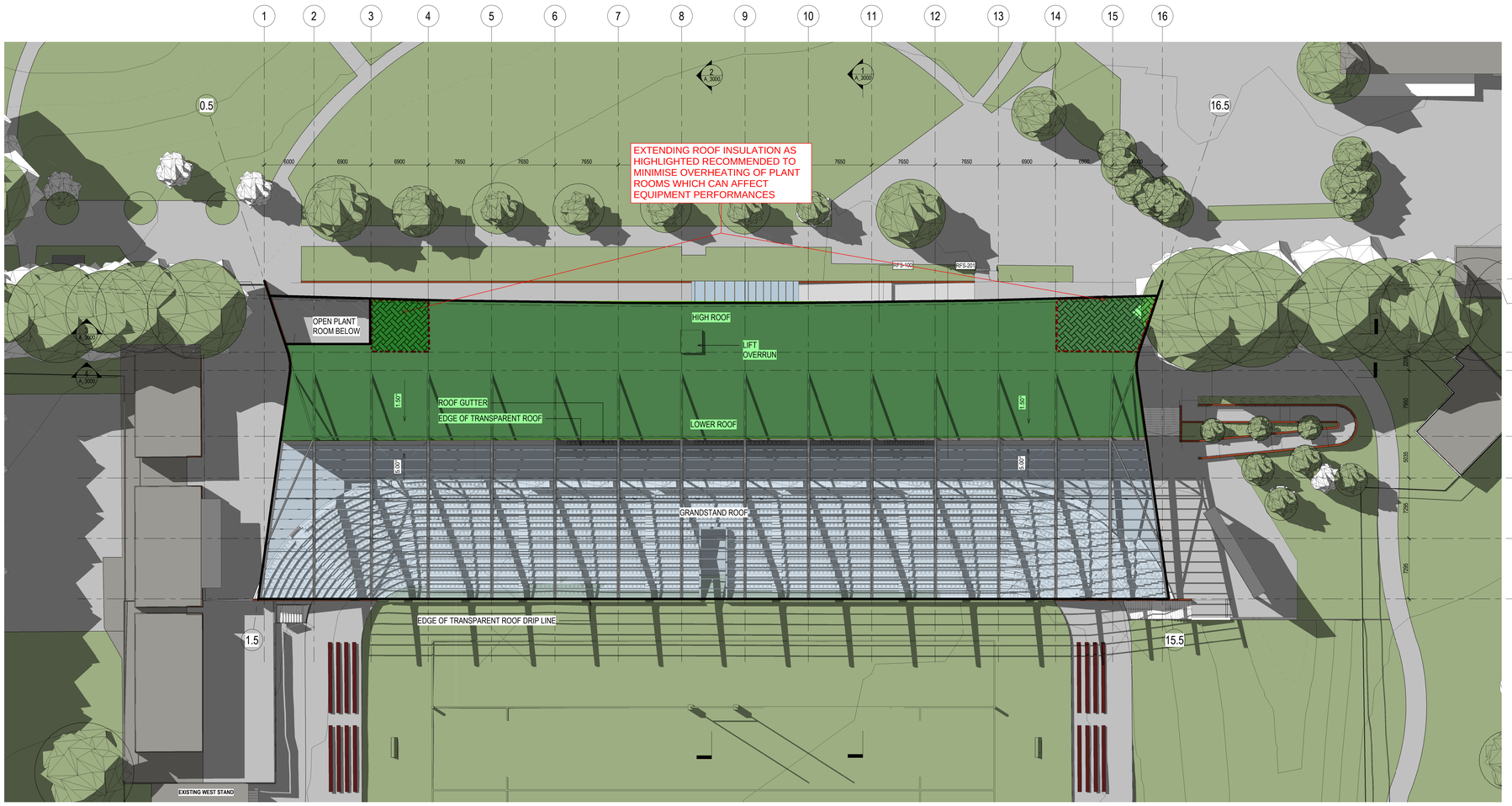

1 ROOF LEVEL
1 : 200

KEY

Total R-value of the External Wall Construction (Min R2.8) &
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Total R-value of the Internal Wall Construction (Min R1.4)

Floor Construction Total Thermal Performance
(Min Total R-value 2.0)

Floor Construction Total Thermal Performance
(Min Total R-value 1.5)

Roof Construction Total Thermal Performance
(Min Total R-value 3.7; Solar Absorptance <0.45)

Note: The above construction are only to be applied to the **non-glazed portions of the envelope**; glazing must be installed as per the architectural layouts with its thermal performances pursuant to the respective glazing specifications stated in Section J report (Total Systems U-Value, and Total Systems SHGC value).

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PROJECT
BROOKVALE OVAL REDEVELOPMENT
CENTRE OF EXCELLENCE AND
GRANDSTAND

DRAWING TITLE
GA PLAN - ROOF PLAN

STATUS
DEVELOPMENT APPLICATION

SCALE @ A0	DRAWN	REVIEWED	APPROVED
1 : 200	RP	FG	GS

PROJECT NUMBER	DRAWING NUMBER	REV
014340	A_1003	L

Original Sheet Size A0 - 841 x 1189mm

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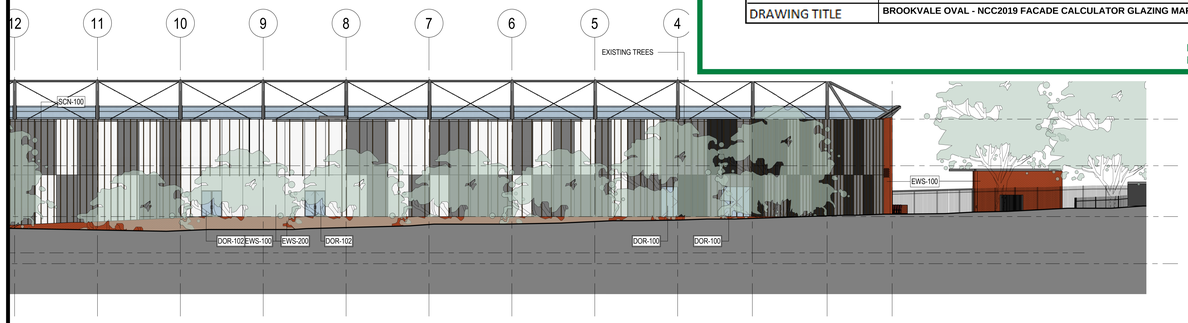
APPENDIX B - BROOKVALE OVAL - NCC2019 FACADE CALCULATOR GLAZING MARK-UP

KEY

South Glazing - Height 3.7m (GF) - Floor to Ceiling 2.7m (L1)	Total Systems U-value ~ 3.4 W/m²K Total Systems SHGC ~ 0.32 VLT 69%
Typical Transparent North Glazing - Floor to Ceiling 7.4m (Double Storey)	Total Systems U-value ~ 3.4 W/m²K Total Systems SHGC ~ 0.32 VLT 69%
Typical Weighted Transparent North Glazing - Floor to Ceiling 3.5m (GF) - Floor to Ceiling 2.7m (L1)	Total Systems U-value ~ 3.4 W/m²K Total Systems SHGC ~ 0.22 VLT ~40%
High-Level Louvred South Monolithic Glazing - Height 1.0m (GF)	Total Systems U-value ~ 5.5 W/m²K Total Systems SHGC ~ 0.50



LCI

LCI DOCUMENT

DATE	21 Oct 2019
PROJECT NO.	19092
PROJECT NAME	Brookvale Oval
DRAWING NO.	
DRAWING TITLE	BROOKVALE OVAL - NCC2019 FACADE CALCULATOR GLAZING MARKUP

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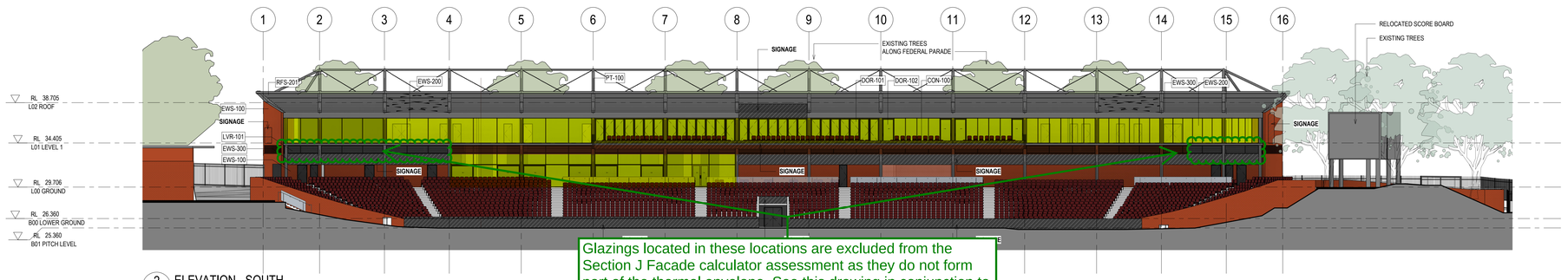
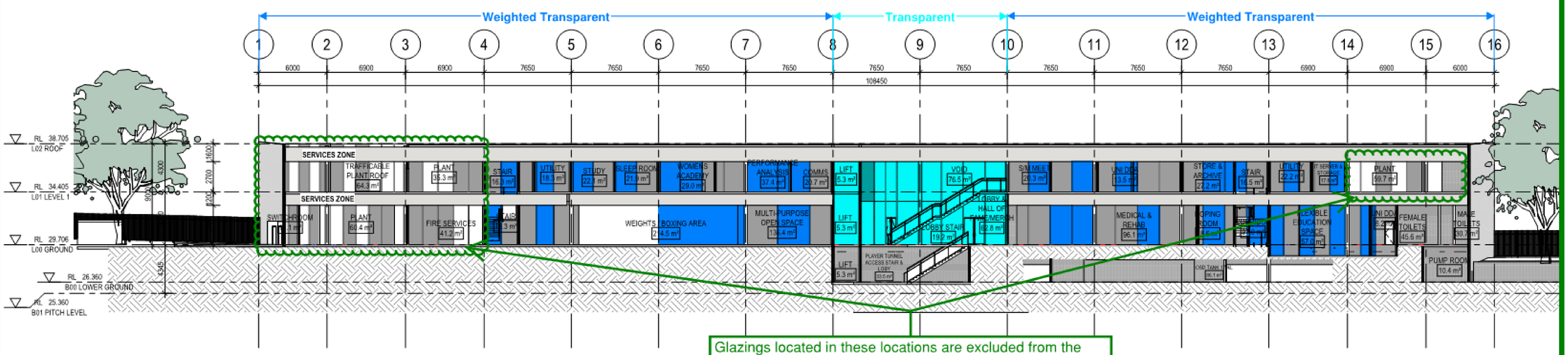
SOUTH GLAZING (Elevation Drawing)



2 ELEVATION - SOUTH
A_1100 1 : 200

Glazings located in these locations are excluded from the Section J Facade calculator assessment as they do not form part of the thermal envelope. See this drawing in conjunction to the DTS Thermal Insulation mark-up drawing provided.

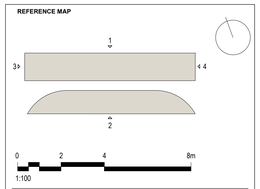
NORTH GLAZING (Section Drawing Extract)



3 LONG SECTION 01
A_1000 1 : 200

Glazings located in these locations are excluded from the Section J Facade calculator assessment as they do not form part of the thermal envelope. See this drawing in conjunction to the DTS Thermal Insulation mark-up drawing provided.

REFERENCE MAP



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PROJECT
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CENTRE OF EXCELLENCE AND
GRANDSTAND

DRAWING TITLE
GA ELEVATIONS

STATUS
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SCALE @ A0	DRAWN	REVIEWED	APPROVED
1 : 200	RP	FG	GS

PROJECT NUMBER	DRAWING NUMBER	REV
014340	A_2000	G

Original Sheet Size A0 - 841 x 1189mm

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APPENDIX C - FACADE CALCULATOR

NCC2019 SECTION J FAÇADE CALCULATOR

PROJECT	BROOKVALE OVAL
BUILDING STATE	NSW
BUILDING CLASSIFICATION	CLASS 9B - SPORTS VENUES OR THE LIKE
CLIMATE ZONE	ZONE 5

	METHOD 1				METHOD 2	
	North	East	South	West		
DTS Wall-Glazing U-value (W/m2.K)	2.00	2.00	2.00	2.00	2.00	**TOTAL ENVELOPE AREA**
PRO Wall-Glazing U-value (W/m2.K)	1.84	0.36	2.43	0.36	2.00	1669.96
DTS Solar Admittance	0.130	0.130	0.130	0.130		
PRO Solar Admittance	0.100		0.196			
DTS AC Energy Value					327	
PRO AC Energy Value					327	

NORTH

	Glazing Ref	H (m)	W (m)	Glazing Area (m2)	Total Systems U-Value (W/m2.K)	Total Systems SHGC	P	G	H	P/H	G/H	Shading Multiplier	Wall Ref	Wall Area (m2)	Total R-Value (m2.K/W)	Total Area
1	North GF Weighted Opaque Grid 1 - 5	3.5	3.00	10.50	3.40	0.22						1	EXT-GFSPL-N1	210.47	1.00	220.97
2	North L1 Weighted Opaque Grid 1 - 5	2.7	3.10	8.37	3.40	0.22						1	EXT-L1SPL-N1	207.99	1.00	216.36
3	North GF Weighted Transparent Grids 5 - 8	3.5	10.10	35.35	3.40	0.22						1				35.35
4	North L1 Weighted Transparent Grids 5 - 8	2.7	12.90	34.83	3.40	0.22						1	EXT-L1W-N1	44.94	2.80	79.77
5	North Entrance Transparent Grid 8 - 10	7.4	15.3	113.22	3.40	0.32						1				113.22
6	North GF Weighted Transparent Grids 10 -13	3.5	9.80	34.30	3.40	0.22						1				34.30
7	North L1 Weighted Transparent Grids 10 -13	2.7	9.60	25.92	3.40	0.22						1				25.92
8	North GF Weighted Opaque Grid 13 - 16	4.5	5.50	24.75	3.40	0.22						1				24.75
9	North L1 Weighted Opaque Grid 13 - 16	2.7	2.72	7.34	3.40	0.22						1				7.34

	Result	Target				
Wall-Glazing U-value (W/m2.K)	1.84	2.00	**Glazing Area (m2)**	294.58	**Average Glazing U-Value (W/m2.K)**	3.40
Solar Admittance	0.100	0.13	**Wall Area (m2)**	463.40	**Average Glazing SHGC**	0.26
			Total (m2)	757.98	**Average Wall R-Value (m2.K/W)**	1.17
			WWR (%)	39%		

EAST

	Glazing Ref	H	W	Glazing Area	Total Systems U-Value (W/m2.K)	Total Systems SHGC	P	G	H	P/H	G/H	Shading Multiplier	Wall Ref	Wall Area	Total R-Value	Total Area
1				0								1	EXT-GFW-E1	46.35	2.80	46.35
2				0								1				0
3				0								1				0
4				0								1				0
5				0								1				0

	Result	Target				
Wall-Glazing U-value (W/m2.K)	0.36	2.00	**Glazing Area (m2)**	0	**Average Glazing U-Value (W/m2.K)**	#DIV/0!
Solar Admittance	0.000	0.13	**Wall Area (m2)**	46.354	**Average Glazing SHGC**	#DIV/0!
			Total (m2)	46.354	**Average Wall R-Value (m2.K/W)**	2.80
			WWR (%)	0%		

SOUTH

	Glazing Ref	H	W	Glazing Area	Total Systems U-Value (W/m2.K)	Total Systems SHGC	P	G	H	P/H	G/H	Shading Multiplier	Wall Ref	Wall Area	Total R-Value	Total Area
1	South GF DGU GYM Shaded	3.7	13.3	49.21	3.40	0.32	2.0	0.0	4.7	0.43	0	0.77	EXT-GFW-S1	180.56	2.80	229.77
2	South GF DGU GYM	3.7	17.2	63.64	3.40	0.32						1				63.64
3	South L1 DGU	2.7	104.4	281.88	3.40	0.32						1	EXT-L1W-S1	167.04	2.80	448.92
4	South GF High Level Louvres Shaded	1.0	41.9	41.9	5.50	0.50	2	0	1	2	0	0.58				41.9
5	South GF High Level Louvres	1.0	37.31	37.31	5.50	0.50						1				37.31

	Result	Target				
Wall-Glazing U-value	2.43	2.00	**Overall Glazing Area**	436.63	**Average Glazing U-Value**	4.07
Solar Admittance	0.196	0.13	**Overall Wall Area**	347.60	**Average Glazing SHGC**	0.38
			Total	784.23	**Average Wall R-Value**	2.80
			WWR	56%		

WEST

	Glazing Ref	H	W	Glazing Area	Total Systems U-Value (W/m2.K)	Total Systems SHGC	P	G	H	P/H	G/H	Shading Multiplier	Wall Ref	Wall Area	Total R-Value	Total Area
1				0								1	EXT-GFW-W1	81.396	2.80	81.396
2				0								1				0
3				0								1				0
4				0								1				0
5				0								1				0

	Result	Target				
Wall-Glazing U-value	0.36	2.00	**Overall Glazing Area**	0	**Average Glazing U-Value**	#DIV/0!
Solar Admittance	0.000	0.13	**Overall Wall Area**	81.396	**Average Glazing SHGC**	#DIV/0!
			Total	81.396	**Average Wall R-Value**	2.80
			WWR	0%		