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Innovation & expertise in building regulations

Fire Safety Assessment of Ausgrid Advice on Option 4

**2-10 Anderson Street, 47-55 Bunnerong Road,
Kingsford, NSW 2032**

DATE ► 7 September 2023

Reference ► F3709 FSA Rev 01

PREPARED FOR ► NSW Department of Family and Community Services

PREPARED BY ► AED Fire

FRNSW REFERENCE ► N/A



Fire



Document Control

This document has been prepared and reviewed by the following personnel at AED Fire and includes at least one C10 accredited fire safety engineer.

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REVISION STATUS				
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COMMERCIAL IN CONFIDENCE

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1 Discussion of radiant heat exposure

AED Fire has been commissioned by the Department of Family and Community Services to provide a preliminary assessment of the advice provided to the Department by Ausgrid in relation to the potential thermal radiation from a large transformer fire and the impact on the proposed concept design identified as Option 4.

The intent of the assessment is to determine the risks and hazards in relation to the substation and provide advice that may be incorporated into the concept design. This assessment is not a Performance Solution and is not intended to be submitted to FRNSW or to form part of any DA/CC/OC submissions and approvals.

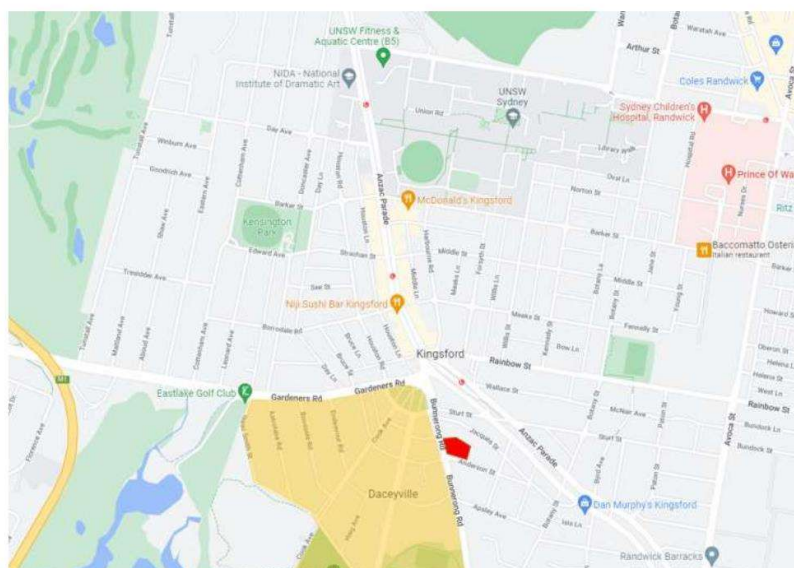
1.1 Bunnerong Road Option 4

The proposed development to be located at 2-10 Anderson Street and 47-55 Bunnerong Road, Kingsford, is a Class 2 residential development. There may be retail or commercial on the ground floor and residential parking in the basement.

The development has exposure on two elevations to a substantial existing Ausgrid sub-station containing oil filled transformers.

AED Fire have been provided with the following information;

2-10 Anderson St, 47-55 Bunnerong Rd, Kingsford (Mixed Tenure)



Site Background:

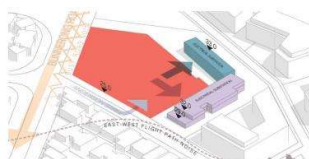
- The Site is part of the Daceyville Strategy and adjacent to the Daceyville estate.
- The Site is close to the Council's urban renewal strategy area (K2K Strategy) which influenced the proposed height of the site. The proposed height steps down from rezones of K2K to the site.
- The Site is part of strategic approach to deal with Randwick Council.

Site Area: Site Area:

6,093m²

Existing Social Housing:

- 8 blocks of 3 storeys 80 yo brick building,
- 60 Social apartments in total.



2-10 Anderson St, 47-55 Bunnerong Rd, Kingsford (Mixed Tenure)



Project History

Nov 2021 – LAHC became aware that Council had resolved to proceed with a comprehensive LEP PP that covers LAHC's site.

Mar 2022 – Final Urban Design Study submitted to Council before the exhibition of Council's PP.

May 2022 – The exhibition of the Council's PP commenced without considering LAHC's Urban Design study.

Jul 2022 – Exhibition of Council's PP closed. LAHC provided a submission requesting LAHC's site be deferred from the Council's PP.

Aug 2022 – Council determined that LAHC's site be deferred from its PP and be listed on the key Sites Map to enable LAHC to lodge a site-specific DCP and PP.

Dec 2022 – Consultant engaged to prepare PP.

Oct 2023 – Lodged PP with Council.



Council's Planning Proposal

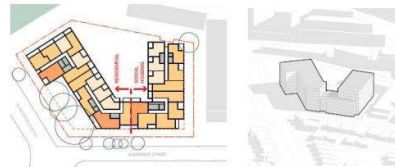
- R3 zone
- 5 Storeys (18.4m)
- 1.55:1 FSR

LAHC's Preferred Controls

- R3 zone
- 8 Storeys (28m)
- 4.47: 1 FSR

Timeframe

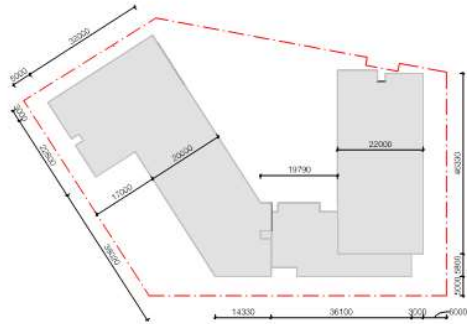
- Council Assessment + Gateway Recommendation – 12 months
- DPE Gateway Review + Determination – 3 months
- Exhibition – 1 month
- Post-Exhibition – Review of submissions & Finalisation by Council – 3 months
- DPE Finalisation Report + LEP Notification – 3 months



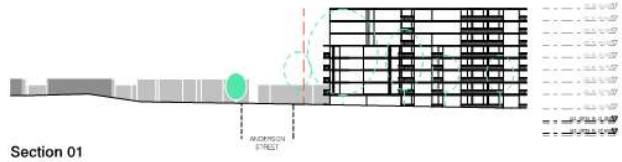


Option 04

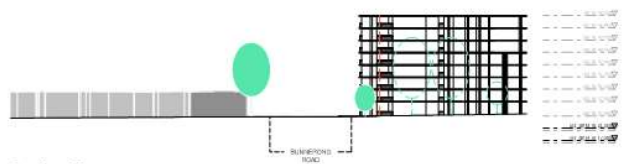
Building Dimension & Sections



Building Dimensioned Plan



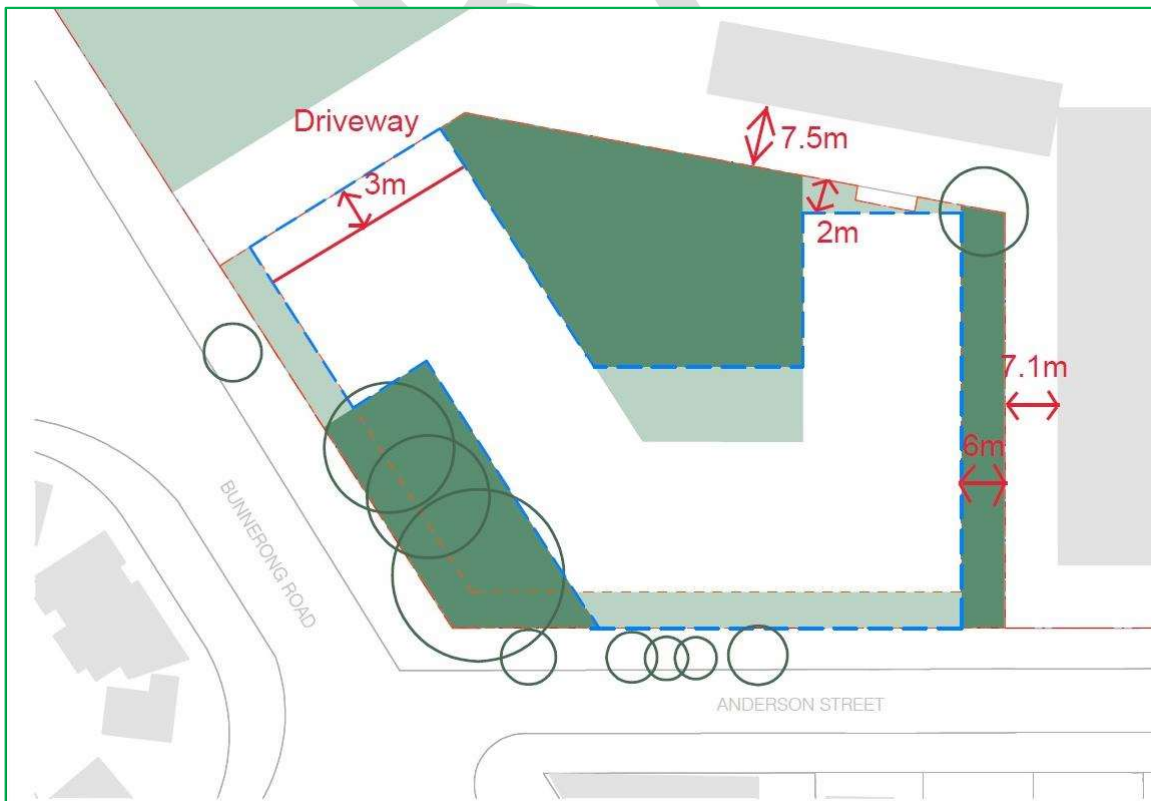
Section 01



Section 02



Stage 01 Report | 47-55 Bunnerong Road Kingsford | Prepared for LAHC | June 2023 | © 2023 PTW Architects PTW 80



1.2 Ausgrid Advice

Ausgrid provided the following advice in an email to the Department on the 7 August 2023.

'See below response from our engineering team in relation to fire risk. See below highlight – NSW LAHC will have to independently verify that risks associated from thermal radiation from a large transformer fire at the substation have been mitigated.

Drawings indicate that the back of the transformer bays are approximately 7.8m from the side boundary common with the Department of Housing property.

The fire separation walls are in the order of 8.8m high. A preliminary analysis of a plausible worst case scenario fire would suggest flames as high 12m for the current transformer configuration/footprint within the bays. The estimated thermal radiation incident at the boundary is not expected to exceed 10 kW/m². The peak thermal radiation would be around the height of the wall reduce to a negligible value near ground level.

The estimated incident thermal radiation level at the property boundary is below the threshold stipulated in the NSW Hazardous Industry Planning Advisory#4 Risk Criteria Land Use (HIPAP#4 – Table 6, see below) for significant risk of fatality for extended exposure, or piloted ignition of timber after long exposure.

At 3m beyond the boundary, the thermal radiation level will be significantly lower again.

The provision of the BCA/NCC is likely to provide sufficient controls to mitigate risks to the adjoining property associated from thermal radiation from a large transformer fire at the substation. This will need to be verified by NSW LHAC consultant's for the proposed development.'

Table 6: Consequences of Heat Radiation

Heat Radiation (kW/m ²)	Effect
1.2	Received from the sun at noon in summer
2.1	Minimum to cause pain after 1 minute
4.7	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur)
12.6	<ul style="list-style-type: none">Significant chance of fatality for extended exposure. High chance of injuryCauses the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposureThin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
23	<ul style="list-style-type: none">Likely fatality for extended exposure and chance of fatality for instantaneous exposureSpontaneous ignition of wood after long exposureUnprotected steel will reach thermal stress temperatures which can cause failurePressure vessel needs to be relieved or failure would occur
35	<ul style="list-style-type: none">Cellulosic material will pilot ignite within one minute's exposureSignificant chance of fatality for people exposed instantaneously

1.3 AED Fire's comments on the Ausgrid Advice

The Ausgrid advice that is relative to this assessment is summarised below with AED Fire's comments in red text;

The back of the transformer bays are approximately 7.8m from the side boundary common with the Department of Housing property.

To assess this we need the location of the transformer.

The fire separation walls are in the order of 8.8m high.



Does the wall survive and remain as a barrier.

A preliminary analysis of a plausible worst case scenario fire would suggest flames as high 12m for the current transformer configuration/footprint within the bays.

Noted – it is assumed that much of this is blocked by the 8.8m wall

The estimated thermal radiation incident at the boundary is not expected to exceed 10 kW/m². The peak thermal radiation would be around the height of the wall reduce to a negligible value near ground level.

Noted

The estimated incident thermal radiation level at the property boundary is below the threshold stipulated in the NSW Hazardous Industry Planning Advisory#4 Risk Criteria Land Use (HIPAP#4 – Table 6, see below) for significant risk of fatality for extended exposure, or piloted ignition of timber after long exposure.

At 3m beyond the boundary, the thermal radiation level will be significantly lower again.

Agreed.

1.4 Assessment

The following assessment compares the Ausgrid findings to the requirements of the NCC and provides an independent assessment of the radiant heat flux, based on assumptions, to verify the Ausgrid assessment.

1.4.1 Assumptions

As we do not have all of the details of the substation or Ausgrid's parameters, we have made the following conservative assumptions;

- It is assumed that the fire originates in a single transformer bay.
- It is assumed that the transformer is oil filled and the oil is contained within a bunded area around the transformer.
- It is assumed that the bunded area is 5m long parallel to the boundary.
- It is assumed that the walls are blast walls that survive the initial failure of the transformer oil containment.
- It is assumed that the fire results in a plume that extends above the walls and radiates onto the boundary.

1.4.2 NCC 2022

NCC 2022 contains a verification method, C1V1, to determine the acceptable levels of radiant heat flux incident on the boundary. Inherent in this verification method is an assumption that the subject building is located at least 3m away from the boundary. Additional radiant heat flux levels are provided for various distances within the lot e.g. at various distances from the boundary.

The verification method states that;

Compliance with C1P2(1)(c) to avoid the spread of fire between buildings on adjoining allotments is verified when it is calculated that –

- A building will not cause heat flux in excess of those set out in Column 2 of table C1V1 at the location on an adjoining property set out in column 1 of table C1V1; and*
- When located at the distances from the allotment boundary set out in Column 1 of table C1V1, a building is capable of withstanding the heat flux set out in Column 2 of table C1v1 without ignition.*

Table C1V1: Fire spread between buildings on adjoining allotments

Column 1 (location)	Column 2 (heat flux (kW/m ²))
On boundary	80
1m from boundary	40
3m from boundary	20
6m from boundary	10

The Ausgrid assessment calculates the radiant heat flux incident on the boundary to be no greater than 10kW/m². C1V1 requires that a building not radiate a heat flux that results in 80kW/m² at the boundary. On this basis the Ausgrid calculations shows that the location of the substation in relation to the proposed Option 4 building meets and complies with the NCC as assessed under verification method C1V1.

This is based on the Ausgrid nominated set back of 7.8m.





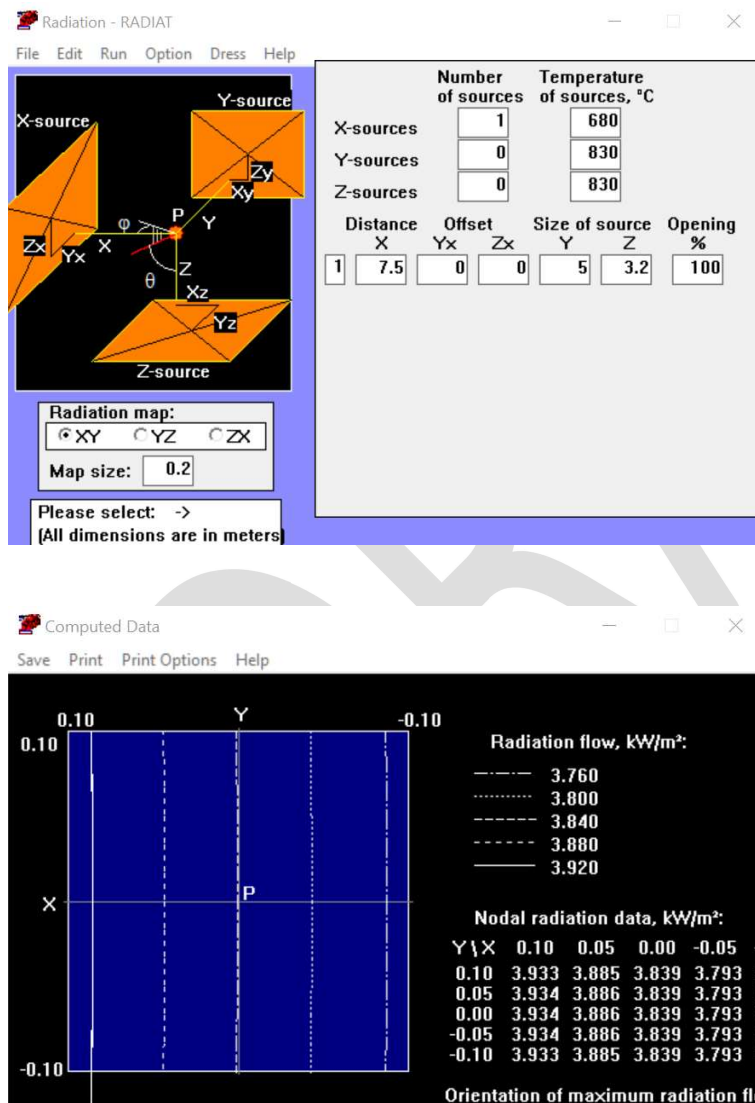
It is noted that the set backs provided to AED Fire by the department show set backs of 7.1m and 7.5m. It is uncertain how these relate to the actual transformer bays. It is also reasonable to assume that the Ausgrid set back includes the structure bounding the transformer bay.

1.4.3 Radiant Heat Assessment from Transformer to the Boundary

The worst case set back supplied to AED Fire is a 7.5m setback of the substation to the building with zero set back of the building from the boundary.

Assuming a wall 8.8m high and a plume 12m high, the boundary and hence the building is exposed to 3.2m high flame front 5m wide.

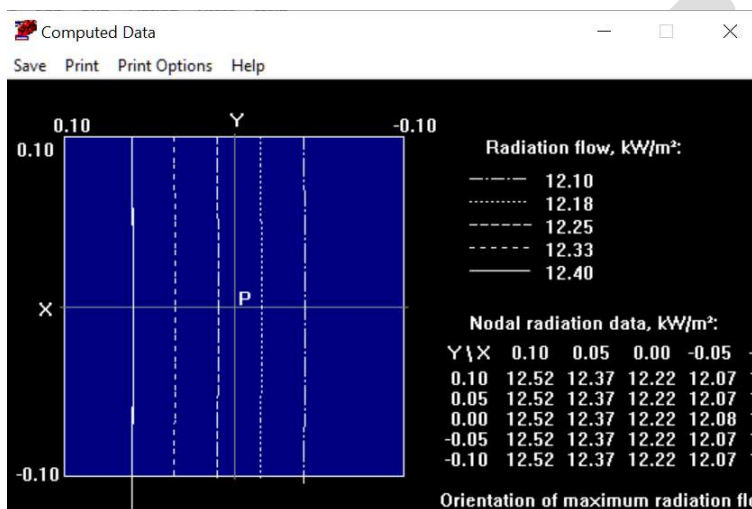
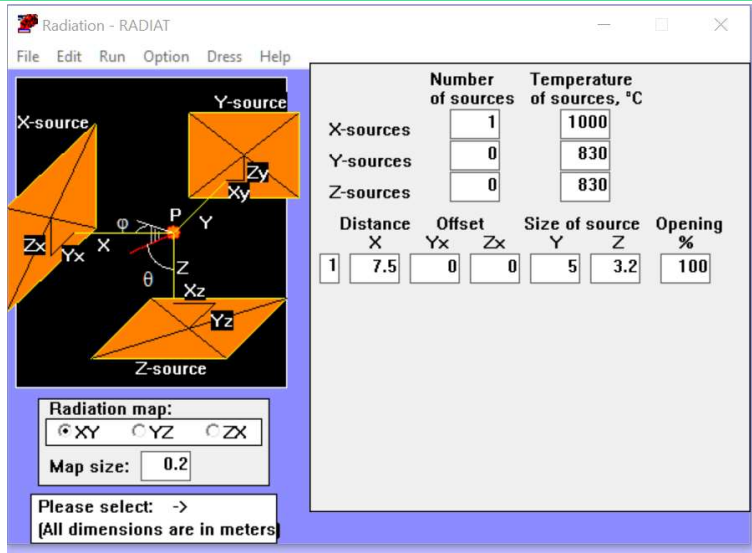
If the flame temperature is 680°C¹, the following calculation suggest that the radiant heat flux on the boundary is in the order of 3.8kW/m².



As a check calculation, a conservative assessment based on a flame temperature of 1000°C gives a heat flux of 12.22kW/m².

¹ Government of Western Australia, DFES GL-15 Fire Safety Engineered Performance Solutions, Section 7.6 Radiant heat flux calculations dated July 2021.





The calculation shows that the radiant heat flux incident on the boundary to be no greater than 12.22kW/m² and most likely to be 3.8kW/m². As C1V1 requires that a building not radiate a heat flux that results in 80kW/m² at the boundary the calculations show that the location of the substation in relation to the proposed Option 4 building meets and complies with the NCC as assessed under verification method C1V1.

1.4.3.1 Worst case assessment

In the worst case that the wall bounding the transformer fails, the building would be exposed to a flame 12m high. The calculation shows that this would result in a radiant heat flux in the range of 10.85kW/m² (flame temperature of 680°C) to 34.54kW/m² (flame temperature of 1000°C). Radiant heat flux in excess of 20kW/m² is sufficient to ignite easily ignitable materials such as cotton curtains.

1.5 Conclusion

If the blast wall survives the initial fire, and the set back is 7.5m or greater, the radiant will be within the requirements of C1V1 and the building may be assessed as complying with the NCC.

The loss of the wall is likely to expose the building to higher temperatures at the base of the flame plume and the radiant heat flux will exceed that required by C1V1 and may cause the ignition of easily ignitable materials.

In order to finalise this assessment, the following information is necessary;

- The location of the transformers,
- the width of the bunded area,
- the set back from the boundary and to the building at that point, and
- an indication from Ausgrid of the construction of the wall and the likelihood of it remaining in place.





1.5.1 Potential Mitigating Measures

It is noted that the issue relates to openings in the external wall (e.g. windows). The openings may be protected if the radiant heat assessment is deemed to fail. The following options are proposed;

1. The opening can be protected in accordance with Building Code of Australia clause C4D5 which includes the following options;
 - a. An automatically closing or permanently closed fire window, or
 - b. An automatically closing fire shutter, or
 - c. Windows that are permanently fixed closed and provided with internal and external wall wetting sprinklers,
2. Alternatively, subject to a Performance Solution, the openings may be protected by;
 - d. A radiant heat screen protected internally and externally by wall wetting sprinklers.

1.6 Limitations of the Report

This report does not provide a Performance Solution, as defined by the Building Code of Australia, to permit departures to the Deemed-to-Satisfy (DTS) provisions of the BCA. The report identifies whether such a Performance Solution is considered appropriate for the proposed building design. Ultimately a Performance Solution Report containing the detailed assessments will be required to verify that the relevant Building Code of Australia provisions have been addressed before the issue of a construction Certificate.

This report is based on the following limitations –

- This report does not determine full compliance with the Building Code of Australia, other than the matters identified in the executive summary of this report;
- This report does not address any matters that are outside the scope or limitations of the Building Code of Australia;
- This report is based on interpretations and assumptions in common practice at the time of the report and future changes in interpretations and assumptions cannot be retrospectively applied to this analysis and recommendations without re-assessment.
- The design measures required by this report do not replace the fire safety measures required by the Deemed to Satisfy provisions of the Building Code of Australia unless specifically stated.
- Amendments to the Performance Solution due to design changes or incapacity to comply with the Design Requirements shall be assessed by a Fire Engineer;
- This report is not a Part 4A compliance certificate under the Environmental Planning & Assessment Act 1979 or Regulation 2000;
- This report does not provide any consideration of any fire services operations (including hydraulic, electrical or other systems);
- This report does not provide any consideration of any structural elements or geotechnical matters relating to the building, including any structural or other assessment of the existing fire resistance levels of the building;
- This report does not provide concessions for any Performance Solution or exemptions from the requirements of the BCA, other than that identified in the Executive Summary of this report;
- This report does not determine compliance with the Disability Discrimination Act 1992 or Part D3 of the BCA;
- This report does not include reporting on hazardous materials, OH&S matters or site contamination;
- This report does not consider heritage issues or any energy efficiency assessment.
- This report does not consider reimbursement of losses caused by business interruption.
- This report does not consider protection of property (other than directly adjoining property).
- This report does not consider fires caused by arson (other than as a potential source of fire initiation) or terrorist attacks.
- This report does not consider Bushfire
- This report does not consider multiple ignition sources for fire initiation.
- This report does not include operational checks of the fire safety equipment unless specified in this report.

1.7 Assumptions of the Report

This report provides a Performance Solution for departures from the Deemed-to-Satisfy provisions as identified in the table in the Executive Summary. The remainder of the building is assumed to comply with the Deemed-to-Satisfy Provisions of the BCA for the purpose of this report.

The report is provided on the basis that:





- The Performance Solution only applies to property detailed in the executive summary.
- The Performance Solution is applicable to the design documentation provided for assessment and as listed in section **Error! Reference source not found.** Any future alteration, enlargement or addition will require re-assessment to determine the application of this solution to those changes.
- The Buildings will generally comply with the Deemed-to-Satisfy Provisions of the BCA, except where modified specifically by this report.
- It is assumed that the buildings will be subject to ongoing annual maintenance and the fire safety measures required by this report and the BCA will be maintained to a standard not less than their installation standard.

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