Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**
Building and Energy

General Inspection Report Three

Bush fire building requirements in Western Australia

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Building and Energy

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Contents

Glossary

The following is a summary of key terms frequently used in this document. The definitions listed apply unless otherwise indicated.

AS	Australian Standard
AS 3959	*Australian Standard 3959 – 2009* (Incorporating Amendments 1, 2 and 3) – *Construction of buildings in bushfire-prone areas*.
BAL	Bushfire Attack Level
BCA	Building Code of Australia.
Building Act	*Building Act 2011* (WA).
Building and Energy	Department of Mines, Industry Regulation and Safety – Building and Energy Division (merger of the former Building Commission and Energy Safety).
Building Confidence Report	A report by Professor Peter Shergold AC and Ms Bronwyn Weir titled 'Building Confidence: improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia' (February 2018)
building permit	A permit granted under section 20 of the Building Act that authorises the carrying out of building work.
Building Regulations	Building Regulations 2012 (WA).
building surveyor	A person registered under the *Building Services (Registration) Act 2012* (WA) to carry out building surveyor work.
CDC	Certificate for design compliance
local government	A local government established under the *Local Government Act 1995* (WA).
Method 1	A simplified procedure for determining a BAL using the steps provided in Section 2 of AS 3959.
Method 2	A detailed procedure for determining a BAL using the calculations provided in Appendix B of AS 3959.
NASH Standard	*National Association of Steel Housing Standard – Construction in Bushfire Areas* (2014, incorporating Amendment A).
permit authority(s)	Has the meaning given in section 6 of the Building Act. Generally the permit authority is the local government where the building or incidental structure is, or is proposed to be, located but may be the State in some circumstances.
WA	Western Australia

Foreword

In December 2015, significant bush fire planning and building reforms were introduced into WA to address recommendations made by Mr Mick Keelty AO APM in his report of the inquiry into the Perth Hills bush fire of February 2011 that destroyed 71 homes and damaged a further 39.

The state-wide designation of bush fire prone areas introduced as part of these reforms, increased the number of dwellings required to comply with the bush fire construction requirements of the Building Code of Australia (BCA). For some parts of WA's building and construction industry, this may have been the first time they had been exposed to the bush fire construction requirements.

During 2017 and 2018 Building and Energy monitored how well the bush fire building standards and regulatory requirements introduced as part the reforms were being applied. This report indicates that industry is responding to the introduction of these requirements, but that some improvements are necessary to increase confidence in bush fire building compliance.

The *Building Confidence Report* commissioned by the Building Ministers' Forum in 2018 found a number of compliance and enforcement problems within Australia's building and construction industry. The documentation and construction of buildings was identified as a key area of focus.

Building and Energy has recently released two Consultation Regulatory Impact Statements (CRISs) that explore ways to implement the Building Confidence Report recommendations in WA. Work to address these recommendations has also included consideration of the findings of this general inspection.

We continue to see the devastation and tragic consequences that bush fire brings to communities across Australia. The building and construction industry has an important role to play in ensuring the design and construction of dwellings in bush fire prone areas can, over time, help build the resilience of communities exposed to such events.

Saj Abdoolakhan
EXECUTIVE DIRECTOR, BUILDING AND ENERGY

Executive Summary

Introduction

The objective of this general inspection was to determine if new residential buildings (dwellings) in designated bush fire prone areas are adequately meeting the bush fire building requirements of WA. The two lines of inquiry were:

- Does the building approval documentation adequately demonstrate compliance?
- Does the constructed building adequately demonstrate compliance?

The general inspection selected 54 new dwellings located throughout WA to provide a snapshot of how buildings in bush fire prone areas are complying with the bush fire requirements of the Building Regulations and the BCA. The dwellings were spread across 14 different local governments and six different Bushfire Attack Levels (BALs). The sample of buildings included a variety of construction types including cavity masonry, brick veneer and metal and/or timber framing. All dwellings in the sample had been issued a building permit by the relevant permit authority and most buildings were under construction during 2017 and 2018.

Background

During the two year period of 2017 and 2018, it is estimated that 8,047 new dwellings were built in designated bush fire prone areas in WA, representing 23 percent of dwellings for the period[1]. These dwellings needed to comply with the bush fire requirements in the Building Regulations and the BCA.

The building approval process for WA is legislated under the Building Act and associated Building Regulations. This legislation controls the application of building standards for the design and construction of buildings and incidental structures and sets out when a building permit is needed for building work.

The Building Regulations adopt the BCA as the primary applicable building standard for all new buildings. The BCA contains bush fire performance requirements that apply to certain residential buildings[2] constructed in designated bush fire prone areas.

The BCA defines a designated bush fire prone area as land which has been designated under a power in legislation as being subject, or likely to be subject, to bush fire. In WA, the Fire and Emergency Services Commissioner has the power to

[1] Data produced by Data Analytics, Department of Planning, Lands and Heritage; Source data from Valuer General's Office, Landgate, 2019.

[2] Includes Class 1 buildings (such as dwellings, bed and breakfasts), Class 2 buildings (such as residential apartment buildings) and Class 3 buildings (such as hotels, motels and accommodation for the aged, children or people with a disability).

designate bush fire prone areas. These areas are shown on the Map of Bush Fire Prone Areas[3].

The purpose of the BCA bush fire performance requirement is to ensure that a building located in a designated bush fire prone area is designed and constructed to reduce the risk of ignition from a bushfire, having regard to burning embers, radiant heat and flame generated by a bushfire, and the intensity of bush fire attack on the building.

The BCA bush fire performance requirement can be met through the development of a suitable performance solution and/or by complying with one of the following published standards (as a deemed-to-satisfy solution):

- *Australian Standard (AS) 3959 – Construction of buildings in bushfire-prone areas* (AS 3959); or
- *National Association of Steel Housing (NASH) Standard – Steel Framed Construction in Bushfire Areas* (NASH Standard).

AS 3959 contains procedures for determining the intensity of bush fire attack on a building, known as a Bushfire Attack Level (BAL). The BAL takes into account the Fire Danger Index (FDI), the distance between the building and the vegetation type (for example, forest) and the slope of the land under the vegetation in relation to the building (a building on top of a hill is at a higher risk than a building on level ground).

A person with appropriate qualifications and experience, such as an accredited bush fire consultant or BAL assessor[4], is usually engaged to undertake an assessment of the site and determine the BAL.

The BAL is then used as part of the building design to inform what level of bush fire resistant construction is needed for the building. AS 3959 identifies six BALs (or BAL ratings) for setting the bush fire construction requirements. The higher the BAL, the more bush fire resistant construction is required for the building:

- BAL—Low - insufficient risk to warrant additional bush fire construction;
- BAL—12.5 - low risk, risk of ember attack;
- BAL—19 - moderate risk of ember attack and radiant heat;
- BAL—29 - high risk of ember attack and radiant heat;
- BAL—40 - very high risk of ember attack, radiant heat and flame exposure; and
- BAL—FZ - extremely high risk of ember attack, radiant heat and flame exposure.

The NASH Standard provides bush fire resistant construction solutions predominantly using steel framing and other non-combustible materials such as metal roof sheeting.

[3] The Map of Bush Fire Prone Areas can be viewed at www.dfes.wa.gov.au/bushfirepronеareas.

[4] The Fire Protection Association of Australia provides a register of people who are accredited to undertake bush fire assessments in WA (www.fpaa.com.au/bpad).

The NASH Standard includes specific references to AS 3959 for calculating the BAL for the building and for the construction of certain building elements such as windows and doors[5].

The Building Act generally requires a building permit for the construction of a new dwelling. As part of the process for getting a building permit, a building surveyor needs to sign a certificate of design compliance (CDC) stating that if the building is completed in accordance with the plans and specifications, the building will comply with each applicable building standard that applies to it. Before signing a CDC for certain residential buildings, the building surveyor must also make statements about bush fire and any related performance solutions.

The permit authority (usually the local government in whose district the dwelling will be built) can grant a building permit if satisfied that the application for a building permit addresses the requirements of the Building Act and Building Regulations. The permit authority can request further information to assist it in considering an application (if information is missing or incorrect) and impose conditions on the grant of a building permit if necessary.

The builder named on the building permit is responsible for ensuring that the building is constructed in accordance with the applicable building standards and the building permit (including any conditions). The Building Act gives the permit authority powers to monitor and inspect building work to ensure compliance with these requirements. The Building Act also provides permit authorities with the power to issue building orders to remedy or stop building work, and to prosecute builders and owners for non-compliance.

Building and Energy regulates, among other trades, builders, owner-builders and building surveyors through the registration of building service providers. Building and Energy has powers to investigate complaints about the work and conduct of builders and building surveyors and, where necessary, take disciplinary action. Building and Energy does not however have legislative powers to issue building orders to rectify building work; this is the responsibility of the permit authority.

The typical building approval process for a new dwelling in a designated bush fire prone area is summarised in Figure 1.

[5] Appendix A of the NASH Standard clarifies that it is not appropriate to adopt other requirements of AS 3959 when using the NASH Standard.

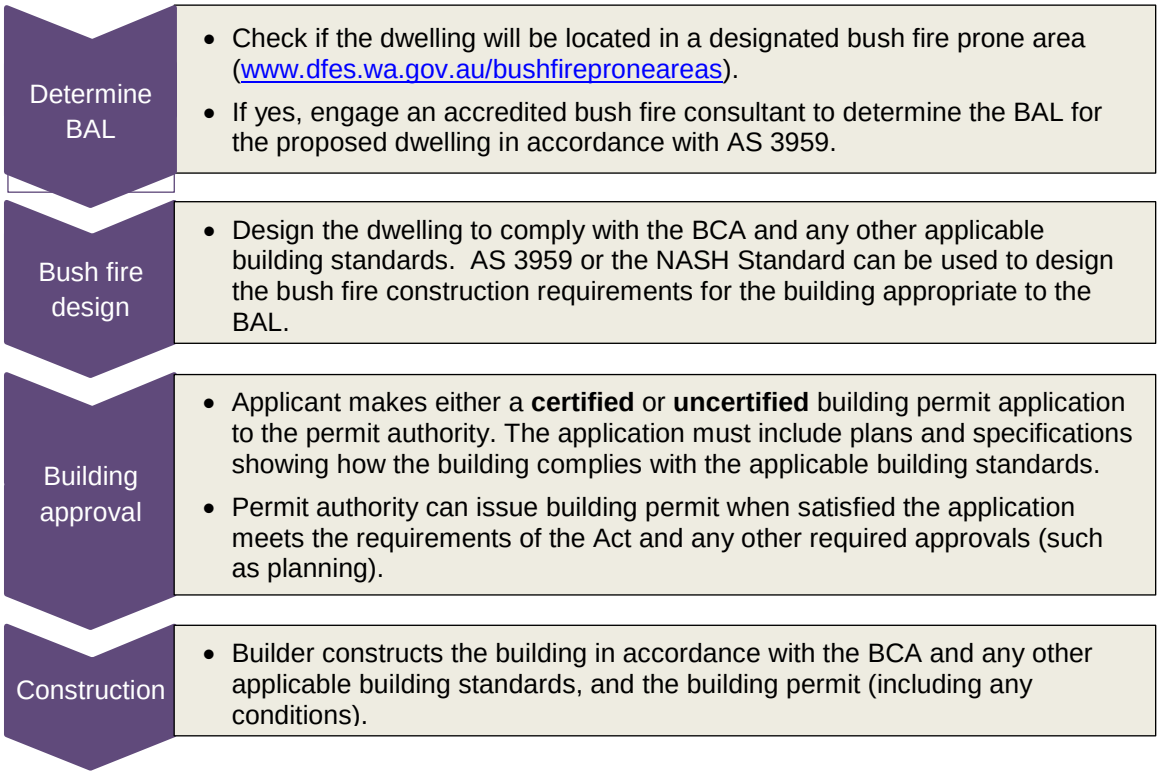

Figure 1: Typical building approval process for a new dwelling located in a designated bush fire prone area.

Conclusion

The general inspection found the 54 dwellings in the sample had considered the bush fire requirements of the Building Act, Building Regulations and applicable building standards.

Most plans and specifications were accompanied by a bush fire risk assessment. Most of these were in the form of a BAL assessment in accordance with AS 3959. All building surveyors had made statements about bush fire on the CDC when required to do so, but none had included a statement about the use of performance solutions.

No plans and specifications for any dwelling in the sample satisfactorily addressed all relevant inspection points for demonstrating how the building was complying with the bush fire requirements of the BCA.

The on-site inspections confirmed that the dwellings had included some level of bush fire resistant construction in the building. Construction to the NASH Standard generally had a higher satisfactory rate across the inspection points than the buildings constructed to AS 3959.

However, due to the small sample size of dwellings included in the general inspection, it is not possible to draw conclusions as to broader levels of compliance in the industry.

Key findings

Building surveyors completed the bush fire statements on CDCs but did not complete statements about performance solutions

In every instance where a building surveyor was required by the Building Regulations to make a statement on the CDC about whether the building was in a bush fire prone area and the BAL or other measure for the building, this was completed satisfactorily.

No building surveyor had included a statement on the CDC about the use of a performance solution for complying with the BCA bush fire requirements. However Building and Energy identified 14 instances where a performance solution was being used to comply with the BCA bush fire requirements. In these instances, the building surveyor should have made the statement about the use of a performance solution before signing the CDC.

Most BAL assessments followed the processes in AS 3959, but some did not accurately reflect the bush fire risk found on-site

The sample of 54 dwellings included 49 BAL assessments in accordance with AS 3959. On paper, these BAL assessments generally reflected the requirements of AS 3959 and were assessed as having a satisfactory rate of 85 percent across the relevant inspection points.

BAL assessments almost always included site plans, photos and other supporting information that showed how the BAL for the building site was determined. The majority of BAL assessments (78 percent) were carried out by accredited bush fire consultants.

An on-site inspection was able to be undertaken for 40 building sites. Building and Energy identified 21 sites (52 percent) that were inconsistent with the information that had been provided in the BAL assessment. There were 12 sites (30 percent) where these inconsistencies had the potential to result in a higher BAL rating being applicable to the building. This finding was supported by the peer review process detailed on page 14 of this report.

The review of BAL assessments found 24 assessments (44 percent) that were satisfactory across all relevant inspection points for the documentation review. However only ten of these BAL assessments (42 percent) were consistent with the conditions found on-site.

Plans and specifications did not contain sufficient information about how the building was complying with the BCA bush fire requirements

Plans and specifications were assessed as having an overall satisfactory rate of 58 percent. The plans and specifications showing compliance with the AS 3959 had a higher satisfactory rate (61 percent) than those complying with the NASH Standard (50 percent).

There were two dwellings, assigned BAL—Low, that did not require bush fire construction information to be included in the plans and specifications for the building. The other 52 dwellings did require information in the plans and specifications that showed that the building would comply with the BCA bush fire requirements when completed.

All 52 dwellings (100 percent) had included some information about bush fire construction in the plans and specifications. However, the information provided to demonstrate how compliance would be achieved varied greatly.

Plans and specifications that included a standalone bush fire specification (or similar document) had a higher satisfactory rate of compliance with the BCA bush fire requirements (72 percent) than those that only included a catch-all statement (64 percent). There was no building that had plans and specifications that addressed all inspection points of the documentation review.

Building and Energy identified 14 instances where the plans and specifications did not comply with a BCA deemed-to-satisfy solution for bush fire. These instances had not been documented as a performance solution to the BCA bush fire requirements. Despite this, the building surveyors had issued CDCs with the statement that if the building was built in accordance with the plans and specifications it would comply with each applicable building standard.

Builders attempted to comply with the BCA bush fire construction requirements, but some areas need improving

There were 37 dwellings that were able to be inspected on-site to see if they were constructed in accordance with the BCA bush fire requirements as detailed in the plans and specifications. The satisfactory rate for the construction of these dwellings was 59 percent.

All of the buildings inspected on-site included some of the bush fire construction requirements of the BCA. Buildings being constructed to the NASH Standard had a higher satisfactory rate (75 percent) than those constructed to AS 3959 (53 percent). However there were only six buildings inspected to the NASH Standard compared to 31 buildings being constructed to AS 3959. A larger sample would be needed to see if this is a trend.

In general, satisfactory building work was most often found where the bush fire construction requirements largely followed common WA construction practices, such as using cavity masonry for external walls and a concrete floor slab. Unsatisfactory work was often found in situations where there was a departure from standard WA construction practice and additional detailing or consideration was required to enable the building meet the bush fire construction requirements.

Some of the dwellings inspected on-site included materials or methods of construction that were not in accordance with the deemed-to-satisfy provisions of the BCA, and had not been assessed or documented as performance solutions. Some dwellings also included materials or products that were suitable for use at lower BAL ratings or for compliance with one of the bush fire standards, but those materials or products did not meet the requirements of the standard that was being applied to that particular building.

Actions taken as a consequence of this general inspection

For buildings in this general inspection

Building and Energy sought to ensure that buildings in this general inspection complied with the applicable building standards for bush fire. Items assessed as unsatisfactory were brought to the attention of the person(s) undertaking the work (such as the building surveyor, bush fire consultant and/or builder). Copies of any peer review findings were also provided. The relevant person(s) was provided the opportunity to respond to the issue and explain how compliance with the bush fire building requirements was, or would be, achieved.

If an item was not able to be resolved through communication with the person who had undertaken the work, Building and Energy referred the matter to the relevant permit authority which has powers of enforcement to ensure buildings comply with the building standards. Communication between Building and Energy and the relevant parties was ongoing until August 2019.

Additionally, one building surveyor was referred to the Enforcement Branch of Building and Energy for a review of his/her conduct and an assessment as to whether further disciplinary action was warranted.

To improve plans and specifications, including the documentation of performance solutions

During the course of this general inspection, Building and Energy identified plans and specifications that did not contain sufficient information to demonstrate how buildings would comply with the BCA bush fire requirements.

In response, Building and Energy released *Industry Bulletin 104 - Bushfire construction details for housing* (2018)[6] to provide general guidance on the type of bush fire information that should be included within plans and specifications.

The industry bulletin also included a sample floor plan to assist industry to identify the level of bush fire construction information that may be required to show how a building complies with the BCA bush fire requirements.

[6] A copy of Industry Bulletin 104 is available at:
www.commerce.wa.gov.au/sites/default/files/atoms/files/ib_104_bushfire_construction_details_for_housing_0.pdf

To improve BAL assessments

Building and Energy has shared its draft findings from this general inspection with the main industry association for bush fire consultants to assist with training and professional development in WA. Building and Energy will identify additional opportunities to work with the bush fire consultant industry to improve the quality of BAL assessments used for the building approval purposes.

To improve bush fire building construction

Building and Energy has shared the draft findings of this general inspection with industry through stakeholder meetings, metropolitan and regional roadshows; individual presentations to building companies, direct advice to garage door installers and the publication of *Industry Bulletin 103 - Indicative BAL ratings in bushfire risk assessments* (2018)[7] and *Industry Bulletin 104 - Bushfire construction details for housing* (2018).

Building and Energy will identify additional opportunities to work with the building industry associations to provide further information, education and training based on the findings of this report. Industry associations have an important role to play in assisting their members understand BCA bush fire requirements.

Building and Energy is currently considering regulatory reforms to the building approval process to implement the recommendations from the Building Confidence Report. Building and Energy has ensured that the draft findings from this general inspection were included in the development of the options for reform presented in recent CRISs.

A key focus of the proposed reforms is to improve how buildings comply with the applicable building standards.

[7] A copy of Industry Bulletin 103 is available at: https://www.commerce.wa.gov.au/sites/default/files/atoms/files/ib_103_indicative_bal_ratings_in_bushfire_risk_assessments.pdf

General inspection objective and scope

This general inspection was conducted under section 65 of the *Building Services (Complaint Resolution and Administration) Act 2011* and in accordance with Building and Energy's compliance and enforcement policy[8].

The objective of this general inspection was to carry out a limited inspection of new dwellings in designated bush fire prone areas to assess how well industry was responding to the bush fire building requirements of WA. The two lines of inquiry were:

- Does the building approval documentation adequately demonstrate compliance?
- Does the constructed building adequately demonstrate compliance?

The general inspection considered a sample of 54 dwellings that were located in bush fire prone areas throughout WA. The dwellings were spread across 14 different local governments and six different BALs. The sample of buildings included a variety of construction types including cavity masonry, brick veneer and metal and/or timber framing. All dwellings in the sample had been issued a building permit by the relevant permit authority and most buildings were under construction during 2017 and 2018.

The building permit and relevant supporting information was obtained for each of the 54 dwellings. A documentation review was undertaken for the CDC, the plans and specifications and the accompanying bush fire risk assessment to assess them for compliance with the bush fire requirements of the Regulations and the BCA.

Where practical, the documentation review was followed by an inspection of the site. This was usually timed to occur at the point where the building work had been completed, but prior to the builder's handover to the owner. The on-site inspection focused on two key areas:

- Was bush fire risk found on-site consistent with what was detailed in the bush fire risk assessment?
- Was the building being constructed to the bush fire requirements detailed in the plans and specifications and the applicable building standards?

For on-site inspections undertaken before completion of the building work, buildings were assessed for the stage of construction the building work had reached. Where building work was only at a very early stage and no meaningful assessment could be made for building compliance, these buildings were omitted from the on-site construction statistics and related reporting outcomes.

[8] A copy of Building and Energy's compliance and enforcement policy is available at: https://www.commerce.wa.gov.au/sites/default/files/atoms/files/compliance_and_enforcement_policy_2015.pdf

Additionally, the compliance statistics do not include items that were unable to be inspected due to a site or safety constraint or where the particular inspection point was not applicable to the particular building.

Data for this general inspection was collected by a single authorised officer from Building and Energy to reduce possible variances in recording. The authorised officer had appropriate qualifications and experience to undertake the assessment of bush fire requirements.

Independent third party peer reviews of BAL assessments were also undertaken as part of the general inspection where it was considered necessary or appropriate for a particular matter. The peer reviews were undertaken by accredited bush fire consultants with appropriate qualifications and experience. Identifying information about the BAL assessor, building certifier, builder and/or owner were removed from the BAL assessments prior to being referred to the peer reviewer.

The requirements of 2016 edition of the BCA was used for the purposes of this general inspection as it was the edition of the BCA that each building was required to comply with. This edition of the BCA in-turn adopts the 2009 edition of AS 3959 (incorporating Amendment No. 1, 2 and 3), and the 2014 edition of the NASH Standard (incorporating Amendment A).

Findings

Building surveyors completed the bush fire statements on CDCs but did not complete statements about performance solutions

Statements about bush fire were completed

Since 8 April 2016, a CDC for certain residential buildings has required building surveyors to make statements about 'bush fire'. These statements include:

- whether the building is in a bush fire prone area; and
- if it is in a bush fire prone area, the BAL for the building site or other measure used to assess compliance with a bush fire performance requirement.

A review of CDCs was undertaken as part of the documentation review to find out if building surveyors had adequately completed these statements for bush fire.

The review identified that 29 different building surveyors had provided the 54 CDCs in the sample. There were 14 building surveyors who signed two or more CDCs; with one building surveyors having signed eight CDCs.

Of the 54 CDCs in the sample, there were 53 CDCs that required statements to be made by the building surveyor about bush fire. One CDC was signed prior to 8 April 2016 and was not required to have these statements.

Building and Energy found that all 53 CDCs (100 percent) included a statement indicating that the building was in a bush fire prone area, and in every case a BAL for the building site was included in the CDC.

In five cases (9 percent), two different BALs were included in the CDC for the same building. This most often occurred where the building surveyor identified the BAL for the building site and then included a lower BAL based on using the shielding provision of AS 3959 or that might be achievable for the building if vegetation modification was undertaken to the site.

Listing additional BALs on the CDC is unnecessary as the Building Regulations only require the BAL for the building site. Building site is defined to mean 'that part of a lot on which the building or incidental structure stands or is to be constructed'[9]. Where a building proposes to use a solution(s) with a lower BAL than that determined for the building site, then this solution should be adequately detailed in the plans and specifications to demonstrate how the building will achieve compliance with the BCA bush fire requirements.

[9] Building Regulation 2012 (WA), regulation 3, term used 'building site'.

Statements about bush fire performance solutions were not completed

For certain residential buildings, the CDC must include statements about each performance solution to a BCA bush fire performance requirement that is proposed to be used for the building. Details of the assessment methods used to establish compliance with that performance requirement are also required. The documentation review considered whether the building surveyor had adequately completed these statements on the CDC.

There were 52 buildings with plans and specifications that detailed bush fire resistant construction in the building (two buildings had BAL—Low and did not require bush fire resistant construction). All 52 buildings (100 percent) indicated that compliance with the applicable building standards would be achieved by using a BCA deemed-to-satisfy solution. No CDC, or the accompanying plans and specifications, indicated that a performance solution was being used to demonstrate compliance with the BCA performance requirement for bush fire.

However, Building and Energy identified 14 instances (26 percent) where a statement about a performance solution for bush fire should have been included in the CDC. These included:

- bush fire risk assessments that were developed in a manner outside of the methods provided in AS 3959;
- plans and specifications for the building that used a combination of referenced bush fire standards in a way that was not consistent with either of the BCA bush fire deemed-to-satisfy solutions; and
- buildings that contained materials or methods of construction that were not consistent with either of the BCA bush fire deemed-to-satisfy solutions.

Most BAL assessments followed the processes in AS 3959, but some did not accurately reflect the bush fire risk found on-site

Different types of bush fire risk assessments were used to provide the BALs for the buildings.

In WA, bush fire risk assessments used to determine the intensity of bush fire attack on a building generally take the form of either a BAL assessment in accordance with AS 3959, a BAL contour map[10] or a bush fire management plan (BMP)[11]. Across the sample of 54 buildings considered by the general inspection, Building and Energy found:

- 47 buildings (87 percent) had a BAL assessment stating it was in accordance with Method 1 (simplified procedure) of AS 3959.
- Two buildings (4 percent) had a BAL assessment stating it was in accordance with Method 2 (detailed procedure) of AS 3959.
- One building (2 percent) had a BAL contour map stating the BALs achievable for the proposed subdivision were consistent with the principles of AS 3959. No supporting evidence was provided to confirm the BAL for the building site complied with AS 3959 on completion of the subdivision works.
- Two buildings (4 percent) had a BMP stating the BALs achievable if a subdivision was designed in a certain way. The BMP indicated the BALs were consistent with the principles of AS 3959 (no edition of the standard was nominated). No supporting evidence was provided to confirm the BAL for the building site complied with AS 3959 on completion of the subdivision works.
- Two buildings (4 percent) in the sample did not have any information about how the BAL for the building had been determined. One building had used a BAL that had been nominated in a single page subdivision plan. The other building had just indicated a BAL on the plans and specifications.

The 49 BAL assessments done in accordance with AS 3959 were considered deemed-to-satisfy solutions under the BCA. The other five assessments should have been assessed as performance solutions.

[10] A BAL contour map is a scaled map of a site illustrating the potential radiant heat impacts and associated indicative BAL ratings in reference to any vegetation remaining within 100 metres of the assessment area after subdivision works are complete. It is also possible to prepare BAL contour maps that illustrate the BAL ratings for an existing site. The processes for developing a BAL contour map are set out in the *Guidelines for Planning in Bushfire Prone Areas* (WAPC, 2017) and its associated factsheets.

[11] A BMP is a document, prepared for planning purposes, that sets out the short, medium and long-term risk management strategies for the life of a development. Newer BMP usually include a BAL assessment to AS 3959 or a BAL contour map. Some older style BMPs (prepared prior to December 2015) only provide an indication of the BALs that might be achievable across the site if a development or subdivision was laid out in a certain way or if site works were undertaken on the site (usually this involves modifying the vegetation).

BAL assessments generally followed the processes of AS 3959.

The documentation review considered whether BAL assessments had been completed in accordance with AS 3959. Building and Energy identified 47 BAL assessments that had used Method 1 (the simplified procedure), and two BAL assessments that had used Method 2 (detailed procedure). There were 38 assessments (78 percent) prepared by accredited bush fire consultants and 11 assessments (22 percent) prepared by non-accredited bush fire consultants.

Building and Energy found the BAL assessments had a satisfactory rate of 85 percent across the relevant inspection points for the documentation review. The results across the inspection points for BAL assessments can be seen in **Appendix A**.

While BAL assessments varied in the quality of information provided, they almost always included site plans, photos (including aerial photos and photos taken on-site) and other supporting information about how the BAL for the building site was determined.

All the BAL assessments had used the correct FDI for WA. All BAL assessments included some level of information about vegetation type, the distance to vegetation and the slope under the vegetation. However, vegetation in one Method 2 BAL assessment was assessed as unsatisfactory as the vegetation was not classified in accordance with AS 3959 for a Method 2 procedure.

Building and Energy found 24 BAL assessments (49 percent) had included the use of an AS 3959 exclusion provision. The use of the exclusion provisions was assessed as satisfactory for 17 BAL assessments (71 percent). There were seven BAL assessments (29 percent) that had incorrectly used the exclusion clause. Incorrect use most often occurred where vegetation was:

- incorrectly identified as being vegetation that could be excluded;
- not identified at all in the BAL assessment and therefore excluded from consideration when determining the BAL; or
- identified and excluded in the BAL assessment, but no details were provided to justify how the vegetation met the exclusion provision.

Building and Energy found 14 BAL assessments (28 percent) had included information about the use of the AS 3959 shielding provision. Only three (21 percent) of these assessments appropriately applied the shielding provision to the building in accordance with AS 3959.

The 11 instances (78 percent) assessed as unsatisfactory generally occurred because the BAL assessment indicated an elevation was only exposed to a source of bush fire attack from a single direction, when it was actually exposed to attack from multiple directions.

Building and Energy found 36 BAL assessments (73 percent) were assessed as satisfactory as they did not use any future vegetation modification (or management) in order to achieve the BAL stated in the bush fire risk assessment. The future vegetation modification included in the other 13 BAL assessments (26 percent) typically fitted into one of the following categories:

- **Fire break notice**[12]**:** the bush fire consultant indicated that the vegetation would be managed at a future time under a fire break notice issued by the local government.
- **Asset Protection Zone**[13] (APZ): the bush fire consultant indicated that an APZ would need to be installed between the building and the classifiable vegetation.

Of the 13 BAL assessments with future vegetation modification, two assessments (15 percent) did not make it clear that vegetation modification was necessary in order to be able to achieve the stated BAL. Three assessments (23 percent) indicated that future vegetation modification was necessary on the neighbouring property in order to achieve the stated BAL.

Across the 49 BAL assessments, Building and Energy found two errors (4 percent). The first occurred where the bush fire consultant had read from the wrong column of an AS 3959 table when determining the BAL.

The second occurred where the BAL assessment contained two different values for the same measurement of distance from the building to the classified vegetation.

Some BAL assessment did not accurately reflect the bush fire risk found on-site

An on-site inspection was able to be undertaken for 40 building sites to see if the bush fire risk found on-site was consistent with what was detailed in the bush fire risk assessment. All 40 sites had a BAL assessment stating it was in accordance with AS 3959.

Building and Energy found 19 sites (48 percent) that were consistent with the information provided in the bush fire risk assessment.

The other 21 sites (52 percent) had inconsistencies between what was recorded in the BAL assessment and the vegetation type, distance to vegetation or the slope under vegetation that was found on-site. For 12 of these sites, the inconsistencies had the potential to result in a higher BAL being applicable to the building.

[12] A notice issued by a local government under section 33 of the *Bush Fires Act 1954* that requires an owner or occupier of land to install and maintain fire-breaks around their property to help prevent the outbreak or spread of a bush fire.

[13] The *Guidelines for planning in bushfire prone areas* (WAPC, 2017) describes an APZ as a low fuel area immediately surrounding a building.

The peer review process supported the finding that some BAL assessments did not accurately reflect the bush fire risk found on-site

BAL assessments were referred for independent third-party peer review where it was considered necessary or appropriate for a particular matter. Reasons a BAL assessment was referred for peer review included:

- inconsistencies between the information in the BAL assessment and what was found on-site having the potential to result in a higher BAL being applicable to the building;
- the BAL assessment appearing to use an exclusion clause incorrectly; or
- the BAL for the building being determined using the AS 3959 Method 2 procedure.

There were 15 BAL assessments in the general inspection that were referred for third party peer review; with 13 BAL assessments having used Method 1 and two BAL assessments having used Method 2. Where practicable, peer reviews included an inspection of the site by the peer reviewer. Only one BAL assessment did not have this site inspection. For that BAL assessment, the peer reviewer used photographs and distances taken by the authorised person, digital mapping, the original BAL assessment and previous experience in the area to undertaken the peer review.

The third party peer reviews supported the finding that some BAL assessments had inconsistencies between what was found on site and what was detailed in the BAL assessment. These differences mainly related to slope under the vegetation, distances between the building and the vegetation, and the classification of vegetation (including the type of vegetation and the use of AS 3959 exclusion clauses).

The peer reviews indicated that a higher BAL may have been applicable for 14 of the BAL assessments. These findings were referred for follow-up action by the builder, building surveyor, and if appropriate, the permit authority.

Plans and specifications did not contain sufficient information about how the building was complying with the BCA bush fire requirements

Plans and specifications not adequately documenting BCA bush fire requirements

There were 52 buildings with plans and specifications that detailed bush fire resistant construction in the building (two building had BAL—Low and did not require bush fire resistant construction). There were 44 buildings (85 percent) that indicated compliance with AS 3959 and eight buildings (15 percent) that appeared to indicate compliance with the NASH Standard.

Building and Energy found that plans and specifications had a satisfactory rate of 58 percent across the relevant inspection points for documenting compliance with the BCA bush fire requirements. Plans and specifications detailing requirements with AS 3959 had a higher satisfactory rate (61 percent) than those detailing compliance with the NASH Standard (50 percent). The results across the inspection points for plans and specifications can be seen in **Appendix B** for AS 3959 and **Appendix C** for the NASH Standard.

Some level of bush fire information was included in the plans and specifications for each of the 52 buildings. A standalone bush fire specification (or similar document) that detailed how the building would comply with the requirements of either AS 3959 or the NASH Standard was provided for 31 buildings (60 percent). There were 15 buildings (29 percent) with plans and specifications that only included a catch-all statement about how the building would comply, such as “this building is to be constructed to AS 3959”. Plans and specifications that included a standalone bush fire specification had a higher satisfactory rate (72 percent) of compliance with the BCA bush fire requirements than those that only included a catch-all statement (64 percent). There were five buildings (9 percent) that had attached a manufacturer’s specifications to the plans and specifications about a particular product.

However, only three of these had provided guidance about which provisions in the manufacturers’ specification applied to the particular building.

It is noted that AS 3959 and the NASH Standard often provide multiple options for how each building element can comply with a requirement of the standard. Generic statements on plans and specifications, such as “external door to comply with AS 3959”, fail to provide sufficient information about which option has been chosen for demonstrating how the building complies with the applicable building standards.

The plans and specification for the eight buildings intending to comply with the NASH Standard did not provide details about how the building would comply with each of the requirements of that standard. These plans and specifications only included a generic

statement saying the roof would comply with the NASH Standard (with no further details about how the building elements within the roof would meet the requirements of the NASH Standard). This approach is not consistent with the BCA deemed-to-satisfy solution for bush fire.

Building and Energy identified 10 instances where buildings were not designed to a BCA deemed-to-satisfy solution for bush fire. In each instance no details were provided in the plans and specifications about how compliance with the BCA performance requirements for bush fire would be achieved.

There were no plans and specification that satisfactorily documented all aspects of the BCA bush fire requirements. Despite this, building surveyors had signed CDCs stating that if the building was completed in accordance with the plans and specifications, the building would comply with each applicable building standard that applies to it.

Bush fire information was not consistent in plans and specifications

There were 52 buildings with plans and specifications that detailed bush fire resistant construction in the building. However only three buildings (6 percent) had plans and specifications that provided consistent information about how the bush fire construction requirements applied to the building.

The plans and specifications for the other 49 buildings (94 percent) contained conflicting details about how the building would comply with the bush fire requirements. This included window details for BAL—12.5 that were included in the bush fire specification for a BAL—FZ building. In another example, details provided in the plans and specifications about the installation of external wall cladding for BAL—FZ did not match the installation requirements set out in the accompanying test certificate for that cladding.

Another commonly repeated inconsistency was information that stated that sarking to the roof would extend into gutters and valleys. However detailed drawings within the plans and specifications often contradicted this statement by showing the sarking finishing within the roof space (and not extending into the gutters and valleys).

Clearer information needed about the use of products in bush fire prone areas

During the process of undertaking this general inspection Building and Energy sought information about the use of certain building products in designated bush fire prone areas. Some manufacturers provided a comprehensive suite of information about the suitability, use and installation of products in designated bush fire prone areas.

However, Building and Energy also found numerous instances where information about the use of products in bush fire prone areas was unclear, failed to mention the

limitations around the use of the products, or did not provide details of testing that may be necessary for demonstrating that the product met the BCA bush fire requirements.

Detailing how buildings comply with the applicable building standards is a key element of the building approval process. Designers, building surveyors, builders and permit authorities need to be provided with the appropriate information to know if the products being installed in buildings are suitable to achieve compliance with the applicable building standards.

Builders attempted to comply with the BCA bush fire requirements but some areas need improving

An on-site inspection to assess bush fire construction was able to be undertaken for 37 dwellings; with 31 buildings (84 percent) inspected for compliance with AS 3959 and six inspected (16 percent) for compliance with the NASH Standard. The buildings were spread across 12 different permit authorities and a range of three different BALs (being BAL—12.5, BAL—19 and BAL—29).

The overall satisfactory rate for the construction of these dwellings was 59 percent. Buildings constructed to the NASH Standard had a satisfactory rate of 75 percent. Building constructed to AS 3959 had a satisfactory rate of 53 percent. The results across the inspection points for construction can be seen in **Appendix B** for AS 3959 and **Appendix C** for the NASH Standard.

Building and Energy observed that all 37 buildings inspected included some level of bush fire resistant construction. However only one building in a BAL—12.5 location met all the requirements of AS 3959 for the particular stage of construction.

The following is an overview of the findings from the on-site inspection of construction.

Floors

AS 3959

Concrete slab on ground floors were able to be inspected for 29 buildings. All 29 floors were assessed as satisfactory. Four buildings included elevated floors for the whole or part of the building. The subfloor supports were satisfactory to three of the buildings. One building was unsatisfactory as it had used incorrect timber for the construction of the subfloor. All four buildings met the requirements that applied to the flooring.

NASH Standard

Concrete slab on ground floors were able to be inspected for six buildings. All six floors were assessed as satisfactory with the requirements of the NASH Standard.

External walls

AS 3959

External walls constructed of masonry were able to be inspected for 20 buildings. All were assessed as satisfactory with the requirements of AS 3959 for external walls.

External wall cladding was able to be inspected for 20 buildings. The external wall cladding for 10 buildings were assessed as satisfactory with the requirements of AS 3959. The other ten buildings were found to have external wall cladding that did

not meet the requirements of AS 3959. This included some external walls that had been clad with an incorrect timber species, and the use of suitably tested wall systems that were not installed in accordance with the manufacturer's instructions.

One building had used a composite wall system that did not have the appropriate testing to show how it complied with AS 3959. While another building had used copper wall cladding without any supporting information about how this complied with AS 3959.

NASH Standard

Masonry external walls were able to be inspected for six buildings. These walls were assessed as satisfactory with the requirements of the NASH Standard.

Windows

There were 28 buildings that had windows installed at the time of inspection. The windows to 21 buildings were satisfactory. The main area where windows were assessed as unsatisfactory was where windows incorporated hardware that was not metal. For example, some louvered window assemblies used plastic louvre clips to support the glazing.

There were 12 buildings where screens to windows were required in order for a window(s) to comply. The screens for seven buildings were assessed as satisfactory. Screens were assessed as unsatisfactory where there appeared to be no provision made for installing screens to the window assembly or its surrounds at the time of the inspection.

Doors

There were 22 buildings that had side hung doors installed at the time of inspection. Side hung doors to 11 buildings were assessed as satisfactory. Examples that were found to be unsatisfactory included:

- doors that did not have the required thickness of glazing, decorative routing that reduced the thickness of the door;
- doors that were not tight fitting to the frame (and failed to include a suitable seal); and
- doors that had frames made of an incorrect timber species.

Sliding doors were installed in 31 buildings. Sliding doors to 27 buildings were assessed as satisfactory. Sliding doors were most commonly assessed as unsatisfactory where glazing used in the door did not achieve the required thickness for the BAL.

Vehicle access doors were found in ten buildings. None of these vehicle access doors were assessed as satisfactory. While the vehicle access doors did meet the

requirements of AS 3959 to be made from non-combustible material, to include suitable seals to the bottom of the garage doors and to not have any ventilation slots in the door, no vehicle access door had been installed or sealed to prevent gaps greater than 3 mm.

Roofs

AS 3959

The roofs to 26 buildings were able to be assessed with the AS 3959 requirements for the roof to have non-combustible tiles or roof sheets and for general gaps greater than 3 mm to be adequately sealed or screened around the roof.

There were 25 buildings with sheet metal roofs and one building that had a tiled roof. The roofs to eight buildings were assessed as satisfactory. One building assessed as unsatisfactory had used polycarbonate roof sheeting for a portion of the roof (this is not permitted under AS 3959, unless the product has been suitably tested). Another building had installed a composite roof system that had not been suitably tested.

The sarking of roofs and the sealing of roof/wall junctions to prevent gaps greater than 3 mm was able to be inspected for 27 buildings. The sarking and roof/wall junctions to four buildings was satisfactory. Roofs assessed as unsatisfactory generally had sarking that was not installed to prevent gaps greater than 3 mm. Gaps greater than 3 mm also tended to be found around barge cappings and flashings, and at changes to eaves/gutter levels.

The fitting of ember screens/guards to roof penetration was able to be inspected on 12 buildings. Two buildings were assessed as satisfactory. Unsatisfactory work often occurred where flumes to bathroom extraction fans and sanitary plumbing vent pipes did not have suitable screens to the flume or cowl.

The sealing or screening of roof penetrations to prevent gaps greater than 3 mm at the roof surface was able to be inspected for ten buildings. Six buildings were assessed as satisfactory. Unsatisfactory work included penetrations that contained large gaps, using non-tested materials or products to seal gaps, and roof seals being used at higher BALs when testing information said they were only suitable for lower BALs. Additionally there were three vent pipes that were required to be non-combustible. None of these vent pipes met the requirements of AS 3959.

Eaves lining, fascia and gables were able to be inspected on 19 buildings. Seven buildings were assessed as satisfactory. Some buildings used timber and/or other types of fascias and barge boards that were not suitable options for the particular BAL. In some buildings, eaves or carport ceilings were lined with materials that were not included as a suitable option for eaves lining in AS 3959.

Verandah, carport and awning roofs were able inspected on ten buildings. Nine were assessed as satisfactory. One building had used an unsuitable timber species for the verandah posts.

NASH Standard

The roofs to five buildings were able to be assessed with the NASH Standard requirement to have steel roof cladding, steel roof frames and steel battens. The roofs to four buildings were assessed as satisfactory. One building was assessed as unsatisfactory because the valleys of the roof sheets in one area of the roof had not been turned up. The ridges and hips to two buildings was assessed as satisfactory with the requirements of the NASH Standard to have a minimum 150 mm overlap of the roof sheeting.

The sealing or screening of ember paths from gaps outside to internal rooms of the building was able to be assessed for four buildings. None of the buildings were assessed as having satisfactorily sealed or screened the ember paths. Instances of unsatisfactory work included internal ceiling vents that appeared to be screened with combustible materials in circumstances where the screening material was required to be non-combustible.

An inspection of the fascia and barge was able to be undertaken for all six buildings. The fascia and barge for four of the buildings was assessed as satisfactory. While the majority of buildings had installed metal fascias in line with the requirements of the NASH Standard, two buildings were assessed as unsatisfactory due to compressed fibre cement products having been used as barge boards.

The vent pipes to three buildings were able to be inspected against the requirements of the NASH Standard to be non-combustible or be covered by a non-combustible material. The vent pipes to one building were satisfactory. The two buildings assessed as unsatisfactory had exposed PVC vent pipes passing through the roof space.

The downlights and service ducting in the roof space of one building was able to be assessed at the time of inspection. The service ducting was assessed as being unsatisfactory as air-conditioning ducting in the roof space appeared to be made of combustible material. The NASH Standard requires the ducting to be either a non-combustible material or wrapped with insulation that is non-combustible glass wool or mineral wool. The downlights did not meet the requirements of the NASH Standard to be screened.

Additionally, gaps were visible where the downlight was fitted to the ceiling lining, which had the potential to create an ember path into the internal room below.

Verandahs, decks, steps, ramps and landings

The verandahs, decks, steps, ramps and landings were able to be inspected for five buildings that were complying with AS 3959. Two of these buildings were assessed as satisfactory. Unsatisfactory work generally occurred where the deck had used unsuitable timber species.

Water and gas supply pipes

AS 3959

There were 16 buildings able to be inspected with the AS 3959 requirement to use metal for above-ground exposed water and gas pipes. Of these, 15 buildings were assessed as satisfactory. One building was assessed as unsatisfactory as externally located plastic gas and water pipes that were exposed at the time of the inspection.

NASH Standard

There were five buildings able to be inspected with the NASH Standard requirement to use metal for externally exposed water and gas supply pipes. All five buildings were assessed as satisfactory.

Appendix A – BAL assessment statistics

Table A1: Summary of documentation review findings for BAL assessments.

Criteria	Number assessed	Number Satisfactory	Percentage Satisfactory
Fire Danger Index (FDI)	49	49	100%
Vegetation	49	48	98%
Exclusion provision – Low threat and non-vegetated areas	24	17	71%
Vegetation modification	49	36	73%
Errors	49	47	96%
Shielding	14	3	21%
TOTAL	**234**	**200**	**85%**

Appendix B – AS 3959 statistics

Table B1: Summary of findings for AS 3959.

	Plans and specifications			Construction		
Building element	**Number assessed**	**Number satisfactory**	**Percentage satisfactory**	**Number assessed**	**Number satisfactory**	**Percentage satisfactory**
General construction						
Attached structures	41*	N/A	N/A	29*	N/A	N/A
Attached structures below subject building	1*	N/A	N/A	1*	N/A	N/A
Adjacent structures (not including openings)	14	4	29%	8	3	38%
Shielding	4	0	0%	2	0	0%
Vents, weepholes, gaps	41	23	56%	26	2	8%
Floors						
Concrete slab on ground	41	41	100%	29	29	100%
Subfloor supports	7	6	86%	4	3	75%
Elevated floors	6	6	100%	4	4	100%
External wall						
Masonry walls	29	29	100%	20	20	100%
Cladding other wall system	31	21	68%	20	10	50%
Windows						
Window general	42	25	60%	22	16	73%
Screens to window	37	24	65%	9	4	44%
Bushfire shutter	0	N/A	N/A	0	N/A	NA
Doors						
Side hung doors	44	25	57%	19	8	42%
Sliding doors	42	22	52%	25	21	84%
Vehicle access doors	35	21	60%	8	0	0%
Roofs						
General	44	32	73%	26	8	31%
Roof-wall junction	43	29	67%	27	4	15%
Roof ventilation openings	42	22	52%	12	2	17%
Pipes non-combustible	19	2	11%	3	0	0%
Evaporative coolers	8	3	38%	1*	Unable to determine	N/A
Sealing roof penetrations	44	24	55%	10	6	60%
Eaves lining, fascia, gables	25	9	36%	19	7	37%
Verandahs, carports, awnings roofs	29	18	62%	10	9	90%
Verandahs, decks, steps, ramps and landings						
General	N/A	N/A	N/A	N/A	N/A	N/A
Enclosed	6	5	83%	1	1	100%
Unenclosed	10	6	60%	4	1	25%
Water and gas pipes	40	22	55%	16	15	94%
TOTAL	**683**	**419**	**61%**	**324**	**173**	**53%**

Note: * Building element excluded from calculation of 'total number assessed' as this was only a count of when this occurred. Attached structures were assessed as part of the assessment of the main dwelling due to fire separation not being included between main dwelling and the structure.

Appendix C – NASH Standard statistics

Table C1: Summary of findings for the NASH Standard.

	Plans and specifications			Construction		
Building element	**Number assessed**	**Number satisfactory**	**Percentage satisfactory**	**Number assessed**	**Number satisfactory**	**Percentage satisfactory**
General construction						
Non-combustible materials	8	7	88%	6	6	100%
Ember paths	8	6	75%	4	0	0%
Reflective insulation	4	1	25%	1	1	100%
Bulk insulation	8	0	0%	3	3	100%
Utility services	8	0	0%	5	5	100%
Attached and adjacent structures	8	8	100%	6	6	100%
Existing structures	2	2	100%	2	2	100%
Roof and ceiling system						
Roof battens	8	2	25%	0	N/A	N/A
Framing	8	6	75%	0	N/A	N/A
Cladding	8	7	88%	5	4	80%
Ridge and capping	8	1	13%	5	2	40%
Gables	3	1	33%	1	0	0%
Fascia and barge	8	4	50%	6	4	67%
Eaves lining	8	3	38%	6	4	67%
Penetrations	8	1	13%	3	1	33%
Valley support	8	1	13%	6	2	100%
Valley gutter	8	1	13%	4	4	100%
Gutter and gutter guard	8	6	75%	5	5	100%
Exhaust fan	8	1	13%	3	0	0%
Roof mounted equipment and services	1	0	0%	0	N/A	N/A
Vent pipes	8	1	13%	3	1	33%
Ventilators	6	1	17%	4	4	100%
Ceiling battens	8	1	13%	0	N/A	N/A
Ceiling lining	8	8	100%	2	2	100%
Access holes	8	1	13%	4	4	100%
Services ducting	3	1	33%	1	0	0%
Downlights	2	1	50%	1	0	0%
External walls						
Masonry walls (including brick veneer)	8	8	100%	6	6	100%
Cladding or other wall system	0	N/A	N/A	0	N/A	N/A
Windows						
Window general	8	8	100%	6	5	83%
Screens to window	8	8	100%	3	3	100%
Bushfire shutter	0	N/A	N/A	0	N/A	N/A
Doors						
Side hung doors	7	5	71%	3	3	100%
Sliding doors	8	7	88%	6	6	100%
Vehicle access doors	8	2	25%	2	0	0%

Table C1 (continued)

Building element	Plans and specifications			Construction		
	Number assessed	**Number satisfactory**	**Percentage satisfactory**	**Number assessed**	**Number satisfactory**	**Percentage satisfactory**
Floors						
Concrete slab on ground	8	8	100%	6	6	100%
Elevated floors	0	N/A	N/A	0	N/A	N/A
Carports, pergolas, verandahs and decks *	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**236**	**118**	**50%**	**118**	**89**	**75%**

Note: * No data recorded as this particular building element was considered as part of the assessment of building element items for attached and adjacent structures.

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