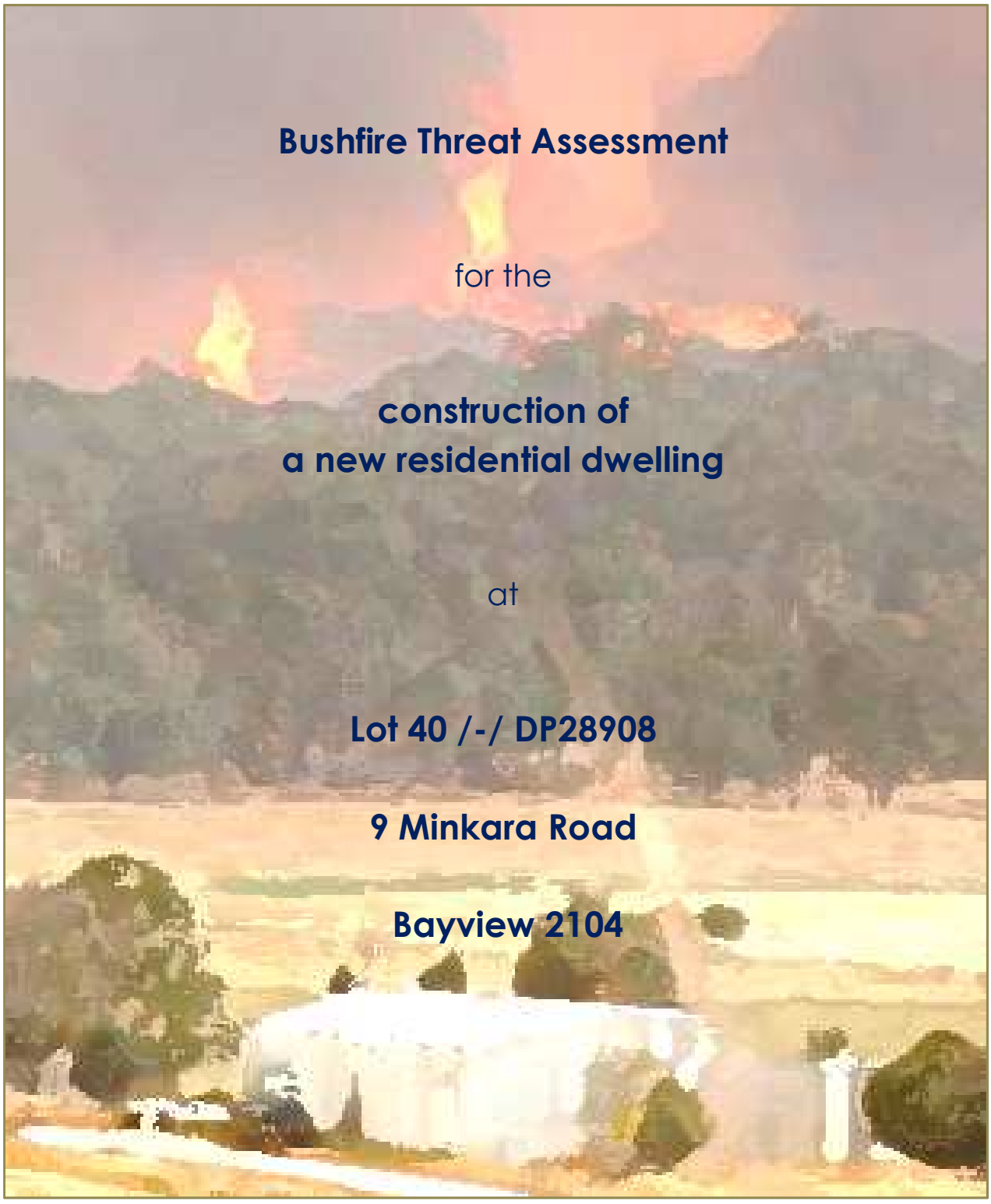
Australian Bushfire
Safety & Planning

Bushfire Protection Consultants



Bushfire Threat Assessment

for the

construction of
a new residential dwelling

at

Lot 40 /-/ DP28908

9 Minkara Road

Bayview 2104

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Australian Bushfire Safety and Planning ®
is the trading name of Jaydel Consulting Pty Ltd.

Project Number	Date	Assessment type	Prepared by	Reviewed	Authorised
BF – 00297	19 December 2018	Performance Solution	John Delany	JD	JD

BPAD CERTIFICATION

In accordance with the requirements of 4.14 of the EP&A Act No 203 Part (1) [b] this Assessment has been reviewed and Certified by: Ronald Coffey

BPAD – A, Level 3, Certified Practitioner

FPAA Cert. No: BPD-PA 09328

The following Bushfire Assessment Report prepared by Australian Bushfire Safety and Planning, report number BF-00297 9 Minkara Road Bayview, confirms that the proposal conforms to the specifications and requirements, that are relevant to the development, of the version (as prescribed by the regulations) of the document entitled Planning for Bushfire Protection prepared by the NSW Fire Service in co-operation with the NSW Department of Planning.

Ron Coffey – Bushfire Safety Engineer

19 December 2018

Grad I Fire E [Institute of Fire Engineers - 1973]
Grad Cert Fire Safety Eng [UWS - 2003]
Grad Dip Building in Bushfire Prone Areas [UWS – 2005]
Ass Prof Cert in Expert Evidence in the Land & Environment Court [UTS – 2005]
Member - Institute of Fire Engineers
Corporate Member - Fire Protection Association Australia

Planning for Bushfire Protection
Fire Protection Association of Australia
BPAD-A Certified Practitioner/Corporate Bronze Certified Business
Certification No BPD-PA09328
0408 220 443

EXECUTIVE SUMMARY

Australian Bushfire Safety and Planning [**ABSP**] has been engaged by the Mr Josh Dick to undertake a bushfire threat assessment for the proposed development at 9 Minkara Road, Bayview.

The site is identified as 'bush fire prone land' for the purposes of Section 146 of the *Environmental Planning and Assessment Act 1979* [**EP&A Act**] and the legislative requirements for building on bushfire prone lands are applicable. The proposed development is an infill development as defined within Chapter 4.3.5 of Planning for Bushfire Protection 2006 and this report has been prepared in accordance with the requirements of Section 4.14 of the Environment Planning and Assessment Act.

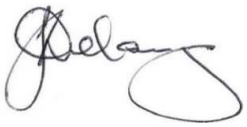
This assessment includes an analysis of the hazard, threat and subsequent risk to the development proposal and provides recommendations that satisfy the Objectives and Performance requirements of the National Construction Code [**NCC**], Planning for Bushfire Protection 2006 [**PBP**] and Australian Standard AS3959, 2009 [**AS3959**].

John Delany from ABSP inspected the site on 23 November 2018.

The proposal identifies the construction of a new Class 1A building. This report will further determine the category of bushfire attack and subsequent construction standard for the proposed new dwelling by applying performance solutions.

The proposed development site [**the site**] is currently vacant of any construction and is surrounded by large lot rural residential development with the development site being zoned RU2 – Rural Landscape.

This assessment examines the development proposal to construct a Class 1A residential dwelling which also complies with the requirements of the NCC, EP&A Act, AS3959 and Performance Criteria of PBP 2006 in addressing the bushfire hazard provided by vegetation located within and adjoining the development site.



John Delany *JP*

Grad. Dip. in Design for Bushfire Prone Areas [UWS – 2006]
Associate Professional Certificate - Expert Evidence for the Land & Environment Court [UTS – 2006]
Member - Fire Protection Association of Australia
Graduate Member – Institution of Fire Engineers

Managing Director
Australian Bushfire Safety & Planning

19 December 2018

List of Abbreviations:

ABSP	Australian Bushfire Safety & Planning
APZ	Asset Protection Zone
AS3959	Australian Standard 39592009 including Amendment 3
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BFRMP	Bushfire Risk management Plan
BFPLM	Bushfire Prone Land Map
BFSA	Bushfire Safety Authority
BFSP	Bushfire Survival Plan
BPM	Bushfire Protection Measures
CDC	Complying Development Certificate
DA	Development Application
DTS	Deemed To Satisfy
EEP	Emergency Evacuation Plan
EP&A Act	Environmental Planning and Assessment Act - 1979
FDF	Fully Developed Fire
FDI	Fire Danger Index
FROS	Forward Rate of Spread
IPA	Inner Protection Area
LGA	Local Government Area
NCC	National Construction Code - 2016
OPA	Outer Protection Area
PBP	Planning for Bushfire Protection - 2006
RF Act	Rural Fires Act 1997
RFS	Rural Fire Service
SEPP	State Environmental Planning Policy
SFPPD	Special Fire Protection Purpose Development
SFR	Short Fire Run
SWS	Static Water Supply
tph	tonnes per hectare

CONTENTS

1) Location.

Lot 40 /-/ DP28908, 9 Minkara Road Bayview is located on the eastern side of Minkara Road Bayview in the Northern Beaches Local Government Area (**LGA**).

Figure 1. Aerial view of the development site

2) Development Proposal and building classification.

The proposal identifies the construction of a new Class 1A building. This report will further determine the category of bushfire attack and subsequent construction standard for the proposed new dwelling. This assessment will discuss how the development can achieve compliance with the provisions of the EP&A, the NCC and AS3959.

The proposed development site [**the site**] is currently vacant of any construction and is surrounded by large lot rural residential development with the development site being zoned RU2 – Rural Landscape. The proposed dwelling footprint has already been cleared of vegetation.

The development site is impacted by the Northern Beaches Council Bushfire Prone Lands Map [**BFPLM**] and as such trigger's legislation under Section 100B (1(a)) of the Rural Fires Act.

Where reference has been made to vegetation located within surrounding properties, reference is made only to discuss and identify the true impact such as fire paths, vegetation formations and radiant heat associated with those features. The management of vegetation outside the proposed development site is not inferred.

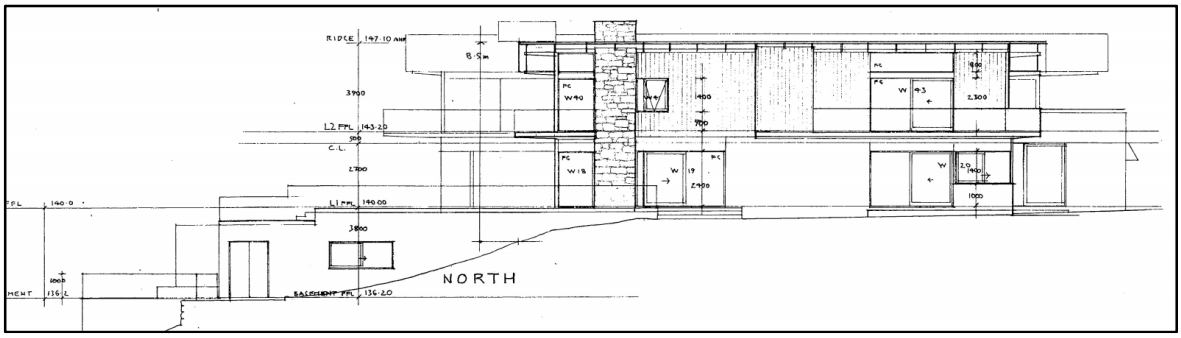


Figure 2. Architects perspective of the North elevation.

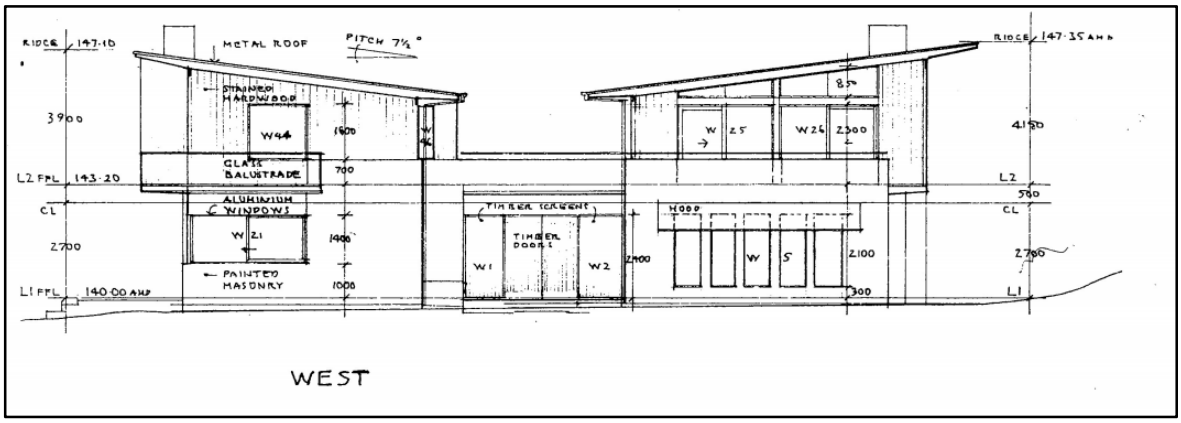


Figure 3. Architects perspective for the West elevation.

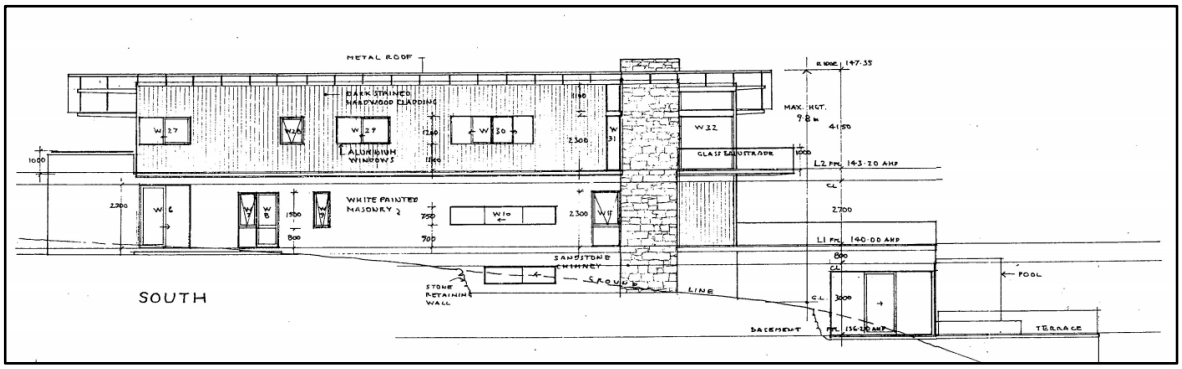


Figure 4. Architects perspective for the South elevation.

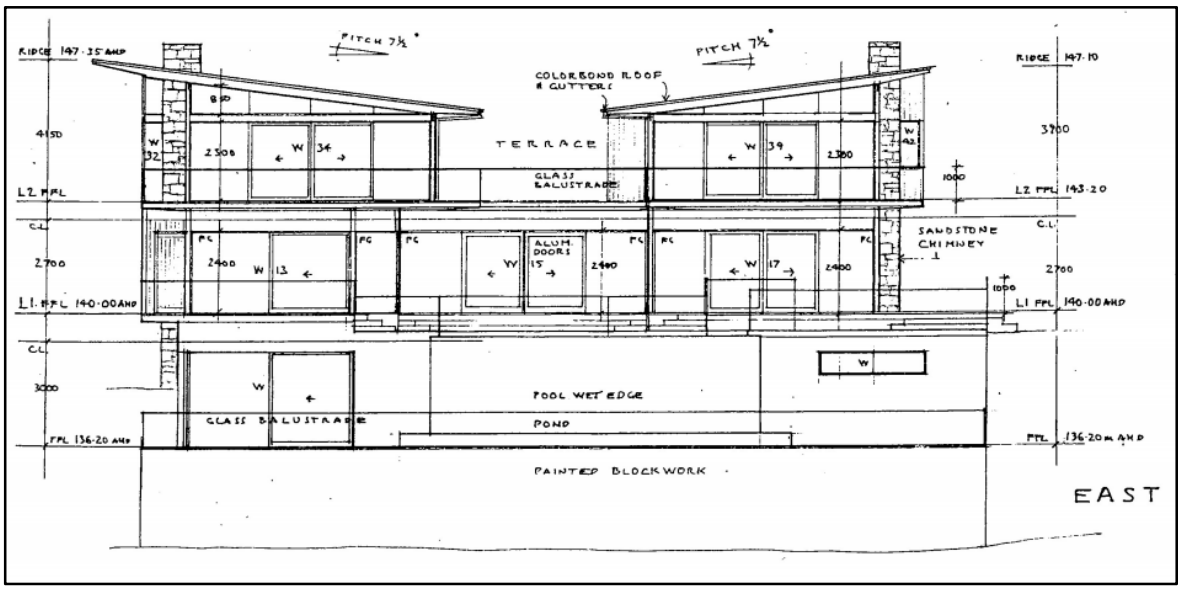


Figure 5. Architects perspective for the East elevation.

3) Description of the subject property

John Delany from ABSP inspected the development site on 23 November 2018 to access topography, slopes and vegetation classifications within and adjoining the development site. During the site inspection information was gathered to identify:

- Existing management practices;
- Vegetation classification and structure both within and external to the development site;
- Vegetation classification and structure to 140 metres of the proposed development;
- Determination as to the '*effective slope'* for each fire run;
- Determine the slope of the '*site slope'*; and
- Naturally occurring mitigating features.

The development site is zoned RU2, Rural Landscape under the Northern Beaches Local Environmental Plan. The development site is situated within an established rural residential area and surrounded by exist large lot rural development. Slopes on and surrounding the development site are slight to steep. Mains water and electrical services are located within the road reserve of Minkara Road and available to the development site.

The site is identified as 'bushfire prone land' for the purposes of Section 146 of the Environmental Planning and Assessment Act 1979 (**EPA Act**) and the legislative requirements for building on bushfire prone lands are applicable.

Bushfire prone land maps provide a trigger for the development assessment provisions and consideration of sites that are bushfire prone. Bushfire prone land (**BFPL**) is land that has been identified by council and the NSW RFS that are subject to some form of bushfire attack. BFPLM's are prepared for each council area jointly by local council and the NSW RFS. Each BFPLM is certified by the Commissioner of the NSW Rural Fire Service.

The development property at 9 Minkara Road Bayview supports Category 1 Vegetation.

Mapping Categories for bushfire prone land.

Category 1.

Vegetation category 1 is considered the highest risk for bushfire. It is represented as **red on the bushfire prone lands map** and is assigned a 100-metre buffer (yellow). This vegetation category is considered to have the highest combustibility and likelihood of supporting a fully developed fire resulting in heavy ember production.

Vegetation Category 1 consists of:

Areas of:

- Forest
- Woodlands
- heath (tall and Short)
- forested wetlands and
- timber plantations.

Category 2.

Vegetation 2 is considered a lower bushfire risk than Category 1 and Category 3 but higher than the excluded areas. It is represented by **light orange on a bushfire prone lands map** and has been assigned a 30-metre buffer (yellow).

Vegetation Category 2 consists of:

- Rainforest;
- Lower risk vegetation parcels
  - Remnant vegetation
  - Land with ongoing land management practices that actively reduces bushfire risk;

Category 3

Vegetation category 3 is considered a medium bushfire risk vegetation. It is higher in bushfire risk than category 2 (and the excluded areas) but lower than Category 1. It is represented as **dark orange on the bushfire prone lands map** and requires a 30-metre buffer (yellow).

- Vegetation Category 3 consists of:
- Grasslands
- Freshwater wetlands
- Semi-arid woodlands
- Alpine complex
- Arid shrublands

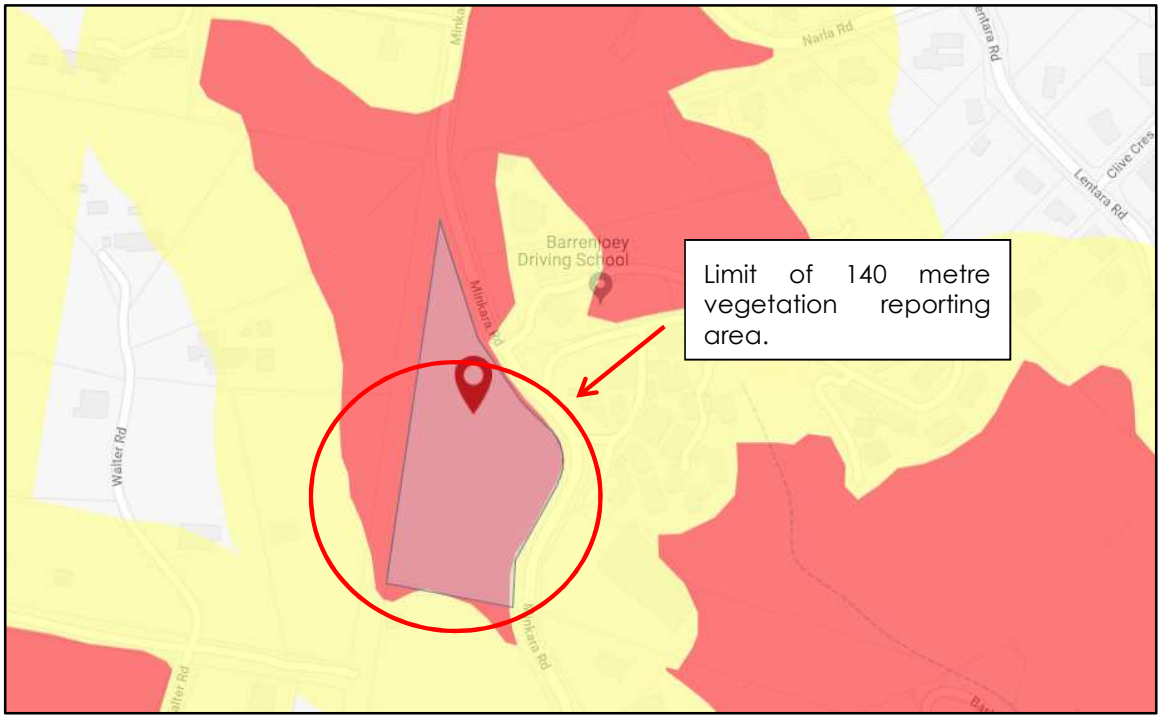


Figure 6. Impact of BFPLM on the development site.

4) Classification of the vegetation on and surrounding the Site.

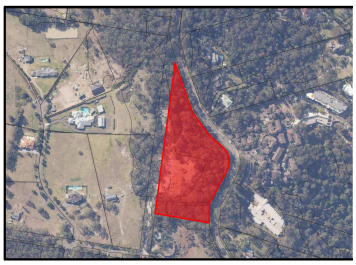
Appendix 3 – A3.4 'Site Assessment Methodology' in PBP 2006 requires vegetation forms to a distance of 140 metres from the asset to be assessed and reported on.

The site and adjoining development support two vegetation forms:

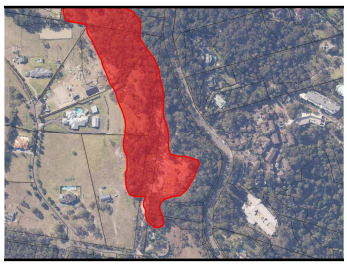
1. Coastal Sandstone Gully Forest [**CSGF**]; and
2. Sydney North Exposed Sandstone Woodland [**SNESW**].

Both are mapped on the Northern Beaches BFPLM. This vegetation has been identified as using information available from the Office of Environment & Heritage [**OEH**] vegetation mapping 'SydMetroVeg_v3 2016 E 4489' dataset which has an equivalent classification in '*Ocean Shores to Desert Dunes*' – 2004 [**Keith**] as:

Sydney Coastal Dry Sclerophyll Forests.
Sydney Coastal Dry Sclerophyll Forest has been used in calculations to determine bushfire impact at 9 Minkara Road Bayview.



Development Site.



Sydney Northern Exposed Sandstone Forest.

Coastal Sandstone Gully Forest.

Figures 7, 8 & 9. Clip from OEH SydMetroVeg_v3 2016 E 4489' dataset.

The following table provides advice on adjoining land use for the development site at 9 Minkara Road Bayview.

Aspect	Use or purpose
North	Existing rural residential development.
East	Minkara Road reserve & existing rural residential development.
South	Existing rural residential development.
West	Unnamed '*paper road reserve*' & existing rural residential development.

Table1. Adjoining land use or purpose.

5) Assessment of effective slope and Topography.

Topography at the development site is dominated by an area already cleared in preparation for the application of Asset Protection Zones and a residential dwelling.

The following table and Figure 10 provide an overall indication as to the topography and resultant fire runs from worst-case aspects as they develop from the cleared area of the proposed development site.

Aspect	Slope
North FDF1	Downslope for 23 metres then cross slope under an escarpment tending upslope for 158 metres. Effective slope as indicated and determined as 19 degrees.
North East SFR1	Downslope to Minkara Road. Effective slope as indicated and determined as 16.7 degrees.
East Southeast SFR2	Downslope to Minkara Road. Effective slope as indicated and determined as 15 degrees.
South	Downslope to drainage line then upslope to existing rural residential development. Effective slope as indicated and determined as 4.4 degrees.
West	Upslope -5 degrees to vegetated paper road reserve then level managed grazing paddocks.

Table 2. Description of topography.

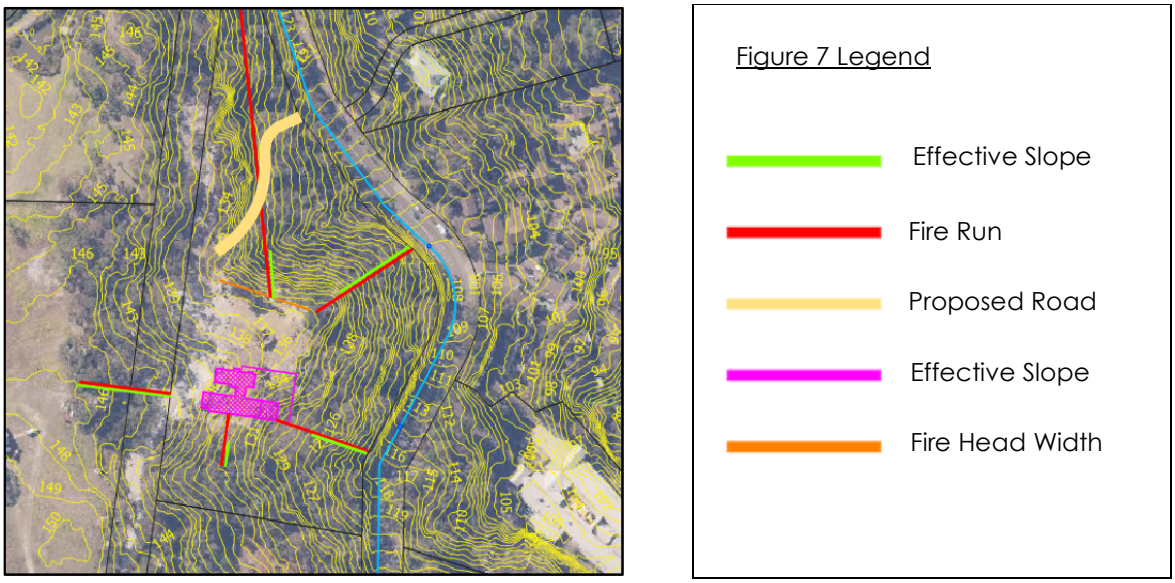


Figure 10. Lidar contour and proposed fire run information.

Figure 11. Development site already cleared.

Figure 12. New access road under construction.

The effective slope for each fire run has been identified and plotted. Figure 10 refers.

6) Access and Egress.

The proposed development site will have vehicular access direct from Minkara Road. A secondary access point and emergency evacuation path has been identified leading through the south boundary to a ROW providing access to private properties off Walter Road. Evacuation via this route will nominally be away from the bushfire threat.

7) Adequacy of water mains and emergency water supplies.

A 100 mm mains pressure water supply is available in Minkara Road below the development site. This supply exceeds the requirements for water and location of fire hydrants requirements of PBP. However, the water supply and extended distance to fire hydrants does not comply with the requirements of PBP. ABSP has identified those requirements to the proponent who proposes to run a new 100mm water supply line into the property to a location adjacent to the proposed dwelling rather than take up the options of a larger stored water supply [**SWS**], pump and fire hose reels. The extended water main will also provide for a fire hydrant at this location.

8) Environmental considerations.

The scope of this assessment has not been to provide an environmental assessment; however, the building envelope and the proposed APZ's are, in the majority cleared and it appears the proposed development will have no adverse environmental effect.

9) Details and location of Aboriginal relics or places.

There are no known sites of Aboriginal heritage or significance within the proposed development site.

10) Performance Assessment & Methodology

This bushfire threat assessment applies two methodologies, in combination, to more closely identify the full fire behaviour and resulting bushfire impact on the proposed development site.

The following is a detailed explanation of the above methodology as applied to:

FR1

FR1, in worst case, will have an ignition point in the northern most extent of the development property. The bushfire will develop as a low intensity fire running down the slope from north to south towards the proposed dwelling and split on two differing levels above and below an existing escarpment that runs parallel to the fire run. The fire running atop the upper escarpment will meet managed land and stall at this point. Fire running on the lower escarpment will meet the proposed new access road to Minkara Road. It is assumed that spot fires will ignite vegetation on the southern side of the proposed access road and continue until it meets an upslope then change direction to run directly up the slope the managed land and at the proposed dwelling.

The application of Method 2 AS3959 has been applied even though the fire will not, due to a restriction to the width of vegetation, exceed a head width of 100 metres. The maximum head width at this point has been determined at 48 metres where it meets the managed construction platform.

FR1	Length of fire run	Effective Slope	Maximum calculated Head Width	Required APZ	Calculated BAL
FDF	Approx. 180 metres	19 degrees	48 metres	43.0 metres	28.84kW/m^2

Table3.

FR2

The BAL for FR2 has been calculated by applying the Short Fire Run Methodology. Ignition in vegetation adjoining Minkara Road directly to the north east will burn up the slope to meet the construction platform. The following table and calculation sheet in Appendix B provide the relevant information for FR2. The modelled SFR will have a higher intensity than a fire extending cross-slope (Flank Fire) from FR1 originating in the north.

FR2	Length of fire run	Effective Slope	Required APZ	Calculated BAL
SFR	58 metres	16.7 degrees	23 metres	28.71kW/m^2

Table 4.

FR3

The BAL for FR3 has been calculated by applying the Short Fire Run Methodology. Ignition in vegetation adjoining Minkara Road directly to the east-southeast will burn up the slope to meet the construction platform. The following table and calculation sheet in Appendix B provide the relevant information for FR3. The modelled SFR will have a higher intensity than a fire extending cross-slope (Flank Fire) from FR1 originating in the north.

FR3	Length of fire run	Effective Slope	Required APZ	Calculated BAL
SFR	27 metres	15 degrees	19 metres	25.30kW/m^2

Table 5.

FR4

The BAL for FR4 has been calculated by applying the Short Fire Run Methodology. Ignition of a bushfire could occur within vegetation extending from the drainage reserve towards the proposed dwelling from the south. The aerial photograph in the report does not reflect accurately the cleared area of vegetation already undertaken to this aspect. The remainder of the vegetation further to the south is upslope away from the proposed dwelling and is mostly cleared by the adjoining property owner within his site. Fire burning on this slope will be of a lower intensity than the identified low risk fire burning towards the proposed dwelling.

FR4	Length of fire run	Effective Slope	Required APZ	Calculated BAL
SFR	26 metres	4.4 degrees	13 metres	26.57kW/m^2

Table 6.

FR5

The BAL for FR5 has been calculated by applying the Short Fire Run Methodology. Ignition in vegetation above the proposed dwelling will burn up the slope away from the proposed dwelling to meet managed rural properties to the west. The following table and calculation sheet in Appendix B provide the relevant information for FR5.

FR5	Length of fire run	Effective Slope	Required APZ	Calculated BAL
SFR	44 metres	-5 degrees	10 metres	28.85kW/m^2

Table 7.

11) Bushfire Risk Assessment

Assessment of the extent to which the construction conforms or deviates from Chapter 4 of 'Planning for Bushfire Protection 2006'

The worst-case bushfire attack identified for the development proposal at 9 Minkara Road is fire igniting in the far north of the property and burning on a minor cross slope parallel to an existing escarpment to a point where it will meet the proposed primary access road providing access to the development. It is unlikely that fire will run over the access road, but ember attack is expected. Ignition on the southern side of the access road will continue to burn down the slope, spreading quickly on the right flank as it starts a fire run up the slope toward the development site. This fire run [**FDF FR1**] will not achieve a quasi rate of spread and therefore will not achieve a full 100-metre-wide head width. This fire has been calculated as a fully developed fire having a maximum fire head width at the limit of vegetation where it meets the APZ of 48 metres.

Tables 2 & 3 provide the extent to which the development is to provide for both DTS and performance-based setbacks, including Asset Protection Zones and minimum bushfire attack levels.

Reference to '*Planning for Bushfire Protection - 2006*' Table A2.3 minimum Specifications for Asset Protection Zones to achieve DTS and calculated APZ determined as an alternate solution.

the site and subsequent building standards.

Direction (Aspect)	Calculated distance of proposed APZ	Assessment of Effective Slope	Anticipated Radiant heat	Bushfire Attack Level (BAL)
North – **FDF FR1**	43m	19 degrees	28.84kW/m^2	BAL 29
Northeast – **SFR FR2**	23m	16.7 degrees	28.71kW/m^2	BAL 29
East-southeast – **SFR – FR3**	19m	15 degrees	25.30kW/m^2	BAL 29
South – **SFR – FR4**	13m	4.4 degrees	26.57kW/m^2	BAL 29
West – **SFR – FR5**	10m	-5 degrees	28.85kW/m^2	BAL 29

Table 8.

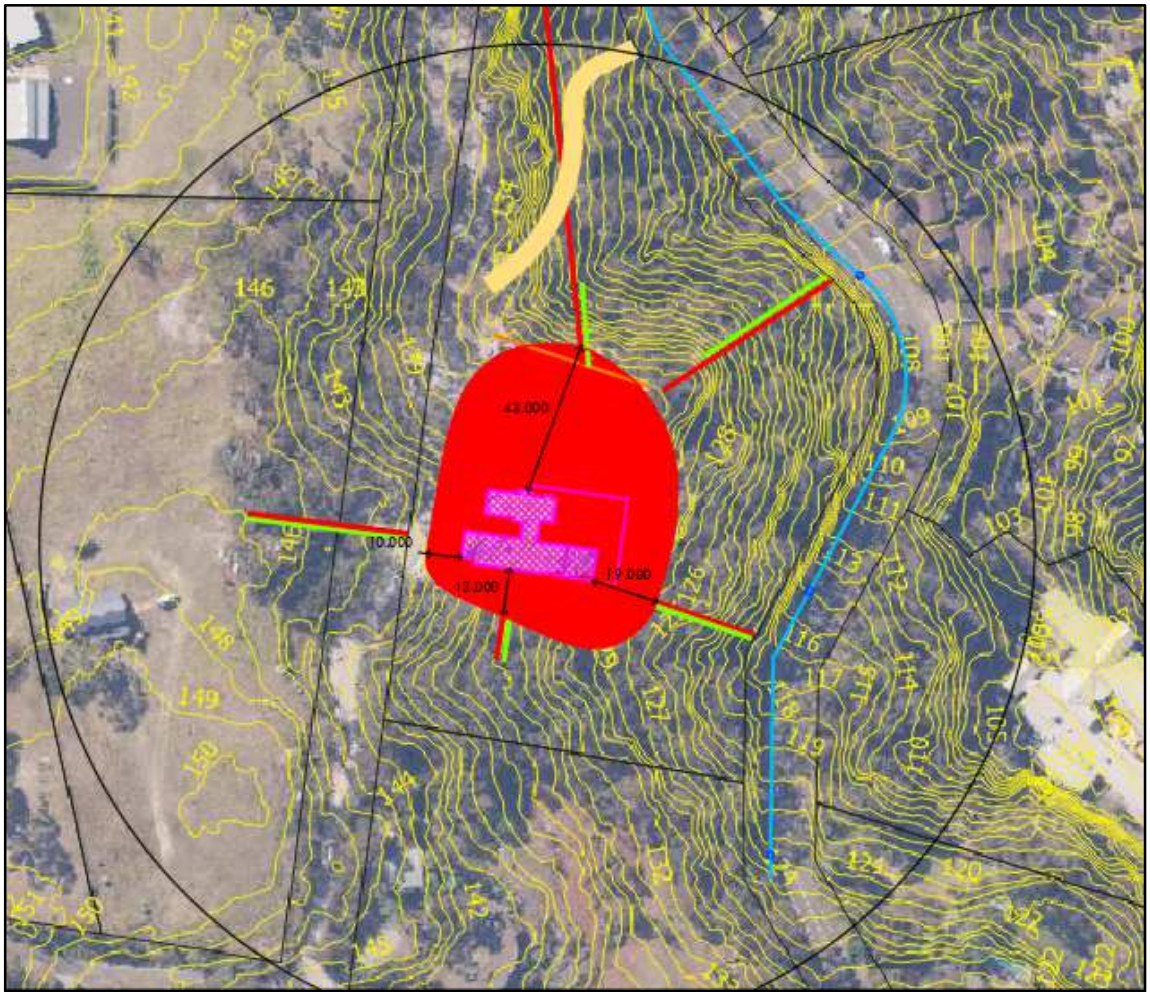


Figure 13. Asset Protection Zones as applied to the site.

Determination of Category of Bushfire Attack applying a combination of AS3959 Method 2 and performance solutions by applying the Short Fire Run Methodology for

Performance Criteria	Acceptable Solutions	Meets Performance Criteria
The intent may be achieved where:		
In relation to APZ's: - Defendable space is provided - An APZ is provided and maintained for the life of the building.	Defendable space is provided on all sides of the proposed building. Asset protection zones are provided on site and by adjoining development and public roads.	Yes

Performance Criteria	Acceptable Solutions	Meets Performance Criteria
In relation to siting and design: Buildings are sited and designed to minimise the risk of bushfire attack.	The buildings have been sited to minimise the risk of bushfire attack. [Buildings are designed and sited in accordance with the siting principles of chapter 4 of PBP]	Yes
In relation to construction standards: It is demonstrated that the proposed building can withstand bushfire attack in the form of wind, smoke, embers, radiant heat and flame contact.	Construction standards have been recommended in accordance with the requirements of PBP.	Yes
In relation to access requirements: Safe operational access is provided [and maintained] for emergency services personnel in suppressing a bushfire while residents are seeking to relocate, in advance of a bushfire.	The access and egress requirements have been designed to provide safe and effective evacuation from the subject site and appear to be adequate for fire brigade personnel and firefighting equipment.	Yes
In relation to water and utility services: - Adequate water and electricity services are provided for fire-fighting operations - gas and electricity services are located so as to not contribute to the risk to a building.	The nearest street hydrant is greater than 90m from the most distant point of the proposed development. This report will include recommendations that a water supply reserve dedicated to protection from bushfire attack shall be provided and permanently available. This report shall recommend compliance with PBP 4.1.3 for services including electricity and gas.	Yes
In relation to landscaping: It is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind driven embers to cause ignitions.	The development application shall include recommendations that the site is managed to minimise flame contact and radiant heat to the building.	Yes
In relation to Emergency and Evacuation Planning:	The need to formulate an emergency evacuation plan has been discussed and it is advised that the residents should complete a *Bush Fire Survival Plan* as formulated by the NSW Rural Fire Service. An emergency evacuation plan is not recommended as a condition of consent.	Yes

Table 9.

12) Fences and gates.

BAL 12.5 & BAL 19

1. Where a timber fence does not connect to a dwelling and has a minimum of 1 metre separation from the dwelling then a fence may be constructed from hardwood, or non-combustible material.
2. Where a fence connects directly to or has less than 1 metre separation from a dwelling it should be constructed from non-combustible materials only.
3. In all cases where timber fences are proposed, care should be taken in the selection, location and maintenance of landscaping adjoining the fence. Unmanaged landscaping could promote fire activity due to ember, radiant heat and direct flame contact and then further impact timber fencing.

The above is based on the premise that construction for level 1 & 2 dwellings is sufficiently removed from the main fire front and won't be subjected to direct flame contact or extreme levels of radiant heat that may cause ignition of combustible materials. However, dwellings could still be exposed to significant levels of ember attack and relatively high levels of radiated heat that may cause fences to ignite.

BAL 29, BAL 40 &/or Flame Zone

Dwellings assessed as requiring these construction levels shall have fencing constructed from non-combustible materials e.g. Sheet metal or masonry. This is due to the increased likelihood of direct flame contact causing ignition of combustible materials which may provide a fire path to the dwelling.

<table>
<tr>
<td>When creating, and maintaining vegetation or a garden that is part of an APZ you should:

▪ ensure that vegetation does not provide a continuous path to the house;
▪ remove all noxious and environmental weeds
▪ plant or thin vegetation into clumps rather than continuous rows
▪ ensure vegetation stratum (including canopy, shrub and ground layer) percentage cover thresholds fall within the thresholds permitted for the part of the APZ (e.g. IPA and OPA)
▪ prune low branches to a height of no less than two metres from the ground to prevent a ground fire from spreading into trees;
▪ locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission;
▪ a permanent, short ground cover should be established (for example, short native grass). This will provide an area that is easy to maintain and prevent soil erosion.If required plant and maintain short green grass or low herb layer (preferably using an indigenous species) around the buildings as this will slow the fire and reduce fire intensity. Alternatively, provide non-flammable (non-vegetated) pathways directly around the dwelling;
▪ ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non-flammable ground cover such as pebbles or crush tile;
▪ Native shrubs and trees should be retained in small clumps covering less than 20% of the total area
▪ The removal of significant native species including threatened species, ROTAP or notable habitat trees including hollow-bearing tree or significant nectar-bearing trees and should be avoided.</td>
<td>"An IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 metres from any part of the roofline of a dwelling. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 metres from an exposed window or door. Trees should have lower limbs removed up to a height of 2 metres above the ground."

"An OPA should provide a tree canopy cover of less than 30% and should have understorey managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season (usually September)."

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"An OPA should provide a tree canopy cover of less than 30% and should have understorey managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season (usually September)."</td>
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</table>

13) Site Photography.

The following photos depict vegetation located within and adjoining the proposed development site at 9 Minkara Road Bayview.

Looking west at proposed dwelling site.

Site Photo 1.

Looking north at the extent of clearing on the upper escarpment.

Site Photo 2.

Looking east over the proposed access road from atop the escarpment and further to Minkara Road.

Site Photo 3.

Looking east over Minkara Road from the eastern extent of clearing for the proposed dwelling.

Site Photo 4.

Looking east southeast over Minkara Road from the eastern extent of clearing for the proposed dwelling.

Site Photo 5.

Looking south into drainage line and then upslope vegetation to existing cleared area of an adjoining property.

Site Photo 6.

Looking west at disturbed vegetation within the paper road corridor and then cleared pasture in adjoining properties.

Site Photo 7.

Looking due south from edge of managed pasture in an adjoining property.

Site Photo 8.

Rough cut of proposed new access road from Minkara Road to the development site.

Site Photo 9.

Alternate exit to adjoining properties and Walter Road.

Site Photo 10.

14) Recommendations.

The following recommendations are made for the bushfire protection measures for the proposed residential development of a new Class 1A dwelling at 9 Minkara Road, Bayview and are based upon the relevant provisions of the NSW Rural Fire Service guideline entitled *Planning for Bushfire Protection 2006*.

1) Construction Standard: The proposed development shall be constructed to a minimum standard of Section 3 [construction general] and Section 7 [BAL 29] of AS3959, 2009 '*Construction of Buildings in Bushfire Prone Areas*' and Section A3.7 of the NSW Rural Fire Service Addendum to Appendix 3 of '*Planning for Bushfire Protection 2006*'.

2) Construction Standard Class 10a Buildings: Class 10a buildings shall comply with the requirements of AS3959, 2009 Part 3.2. *Construction Requirements for Specific Structures*.

3) Construction Standard Class 10b: PBP 4.3.6 [f] At the planning stage, class 10b buildings in bushfire prone areas should be non-combustible. [Class 10b buildings include a retaining or free-standing wall, swimming pool or the like.]

4) Fences and Gates: All new fencing and gates shall be constructed in accordance with the NSW Rural Fire Service guideline: Fast Fact – *Fences or Gates in Bushfire Prone Areas*. [Refer Section 11 of this report]

5) Gutter Guards: Roofing shall be gutterless or have leafless guttering and valleys to prevent the build-up of flammable material. Any materials used shall have a flammability index no greater than 5.

6) Electricity and Gas Supplies: As far as practical, new electricity and gas supplies shall be installed in accordance with the requirements of 4.1.3 of PBP. Note: 4.1.3 of PBP requires that '*where practical, electrical transmission lines should be underground*' and '*the location of gas services will not lead to ignition of surrounding bushland or the fabric of the building*'.

7) Asset Protection Zones: At the commencement of building works and in perpetuity, the property shall be managed as an inner protection area as outlined within PBP and the NSW RFS document 'Standards for asset protection zones' for the distances specified in Section 10, Table 3 and Figure 12 of this assessment.

   The following points are a guide to Inner Protection area requirements.

   The Inner Protection Area should comprise of the following:
   - Minimal fine fuel on the ground;
   - Vegetation that does not provide a continuous path to the building for the transfer of fire;
   - Shrubs and trees that do not form a continuous canopy and vegetation is planted in clumps rather than continuous rows;
   - Species that retain dead material or deposit excessive quantities of ground fuel are avoided;
   - Shrubs and trees are pruned so that they do not touch or overhang the building; and
   - Vegetation is located far enough away from the building so that plants will not ignite the building by direct flame contact or radiant heat emission.

8) Emergency and Evacuation Planning: The need to formulate an emergency evacuation plan has been discussed and it is advised that the residents should complete a *Bush Fire Survival Plan* as formulated by the NSW Rural Fire Service. An emergency evacuation plan is not recommended as a condition of consent.

9) Water Supplies: Reticulated water supply is located on the adjoining road at regular intervals and is easily accessible. A 100mm mains water supply is proposed to be extended from the Sydney Water mains supply in Minkara Road. A fire hydrant point is also proposed to be installed adjacent to the proposed new dwelling. The proposed supply will need to satisfy the pressure requirements as determined by determined by Council and Sydney Water.

CONCLUSION

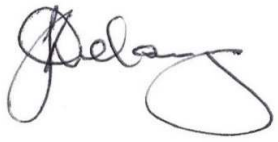
This bushfire threat assessment has been developed to support a development application to construct a new Class 1A dwelling at No 9 Minkara Road, Bayview.

The site is captured on the Northern Beaches Council Bushfire Prone Lands Map and as such addresses the infill proposal to construct a new Class 1A dwelling as defined within Chapter 4.3.5 of *Planning for Bushfire Protection 2006* and the requirements of Section 4.14 of the Environment Planning and Assessment Act – 1979 [**EP&A Act**].

This report concludes that the proposed development is on designated bushfire prone land and the legislative requirements for development in bushfire prone areas are applicable. The proposed development will be constructed to the minimum standards as determined by calculations developed from performance solutions developed for the development application.

This report has considered all the elements of bushfire attack and provided the proposed development is constructed in accordance with the recommendations included in Section 11 & 12 of this assessment.

Recommendations made within the assessment, when applied to the development, will provide a higher level of safety for occupants and emergency services should they respond to the site during an emergency event. Modelling outcomes provided in Tables 2, 3 and Appendix B demonstrate the expected radiant heat flux impact to the proposed development is below the 29kW/m^2 radiant heat flux limit as required by PBP.



John Delany *JP*

Grad. Dip. in Design for Bushfire Prone Areas [UWS – 2006]
Associate Professional Certificate - Expert Evidence for the Land & Environment Court [UTS – 2006]
Member Fire Protection Association of Australia
Graduate Member – Institution of Fire Engineers

Managing Director

Australian Bushfire Safety & Planning

REFERENCES

- NSW Rural Fire Service – *Planning for bushfire Protection 2006*;
- NSW Rural Fire Service – *Threatened Species Hazard Reduction List for the Bushfire Environment Code (2003)*;
- *Environmental Planning and Assessment Act -1979*;
- *Rural Fires Act – 1997*;
- *Rural Fires and Environmental Assessment Legislation Amendment Act 2002*;
- *Rural Fires Regulation 2013*;
- NSW Rural Fire Service – *Guideline for Bushfire Prone Land Mapping*;
- Threatened Species Conservation Act 1995;
- Native Vegetation Act;
- *Bushfire Environmental Assessment Code 2006*;
- Building Code of Australia;
- Australian Standard AS3959 - 2009 '*Construction of Buildings in Bushfire Prone Areas'*;
- '*Report 5 – Fuels Modelling Project - Final Report*'- Centre for Environmental Risk Management of Bushfires – University of Wollongong.
- *Pittwater Bushfire Prone Lands Map*;
- Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.
- NSW Rural Fire Service - '*SHORT FIRE RUN – Methodology for assessing bush fire risk for low risk vegetation'*.
- SydneyMetroArea_v3_2016_E_4489 overlay vegetation GIS Layer
- NSW Six Maps Portal
- BM Wotton, JS Gould, WL McCaw, NP Cheney, SW Taylor – '*Flame temperature and residence time of fires in dry eucalypt forest – 2012'*.
- ME Alexander – '*Calculating and interpreting forest fire intensities – 1982'*.
- AL Sullivan, JJ Sharples, S Matthews, MP Plucinski – '*A downslope fire spread correction factor based on landscape-scale fire behaviour'. (Kataburn Paper)*

APPENDIX A.

Performance Assessment Methodology

Modified Method 2 AS3959 – 2009. Fire Run 1.

This report has applied an amended Method 2 AS3959 '*Construction of buildings in bushfire-prone areas' to* more closely identify fire behaviour and resulting bushfire impact on the proposed development site. The only change to the methodology is that of a restricted head width has been applied to changes the view factor from a fully developed fire. This methodology is permitted by AS3959 B8 Step 7-Flame Width.

This methodology has been applied to Fire Run 1 (FR1) only.

ABSP has also calculated the BAL impacts utilising classification and specific fuel loads determined by the University of Wollongong to provide a more accurate indication of the bushfire impact at 9 Minkara Road Bayview.

Short Fire Run methodology. Fire Run 2 > 5.

Fire shape and head width.

The shape of the design fire is determined by firstly identifying the *first dimension* of the view factor (head width). To achieve this site-specific information is gathered from a site inspection for use in a mathematical calculation to determine the fire's length/breath ratio which in turn identifies the forward rate of spread and intensity. The shape and growth of the 'design fire' can then be determined mathematically and presented as an ellipse. The elliptical shape of the fire is a basic assumption of most fire spread models (Van Wagner 1969, Alexander 1981, Tolhurst 2007 and RFS Fire Behaviour Analysts FBA course). The basis for this assumption is that fuels are relatively uniform, the terrain is relatively flat and wind speed is constant and in the same direction. Professor Martin Alexander's paper, '*Estimating the length-to-breadth ratio of Elliptical Forest Fire Patterns'* identifies the calculation process and has been applied in this instance.

Flame height.

The *second dimension* of the view factor varies depending on the structure of the vegetation formation. For forest and woodland vegetation formations, findings from CSIRO Project Vesta were used to calculate the flame height using surface, near surface and elevated fuels only. There is no allowance for bark and canopy fuels as low risk fires are not expected to support a fully involved crown fire. Scorching and intermittent involvement of the canopy fuels is permitted, no sustained crown fire. Fuel loads are based on research undertaken by the University of Wollongong and recent scientific papers.

Modified wind speed.

The simplest fire pattern is that of a single ignition source, on flat terrain and under calm conditions, spreading out at an equal rate in all directions from its ignition point in a more or less circular fashion. The origin point of the bushfire in this instance is roughly in the centre of the burning area. With the introduction of wind, the circle shape deforms to resemble an ellipse with the flame advancing in the direction of the wind.

The higher the wind speed, the narrower and elongated the elliptic fire shape becomes.

As wind speed increases the expected head width *decreases*. Mathematically, the calculation of the reduced head width for a low risk fire is undertaken by using a slower wind speed. For a fully developed fire, other recognised scientific models apply a wind speed of 45 km/hr which provides the worst-case bush fire impact.

The calculation processes used for this assessment proposes a lower wind speed of 30 km/hr to provide a wider more conservative head width and to identify a worst-case scenario which would not otherwise be identified with the narrower head widths experienced as a result of higher wind speeds.

Assumptions.

The afore mentioned methodology relies on a number of assumptions to calculate the modified fire shape and flame height, these are:

- Wind direction and speed is constant in the direction of fire spread;
- Slope is considered relatively flat and uniform throughout the length of the fire run;
- Fuel load is distributed equally and is continuous for the entire fire run length;
- The shape of the fire is based on a uniform slope;
- The fire develops from a single ignition point and does not consider time of ignition or fire growth;
- Flaming is restricted to surface, near surface and elevated fuels;
- The fire does not become a crown fire (scorching and intermittent involvement of the canopy fuels is permitted, no sustained crown fire).
- Fire run is measured perpendicular to contours.

Limitations.

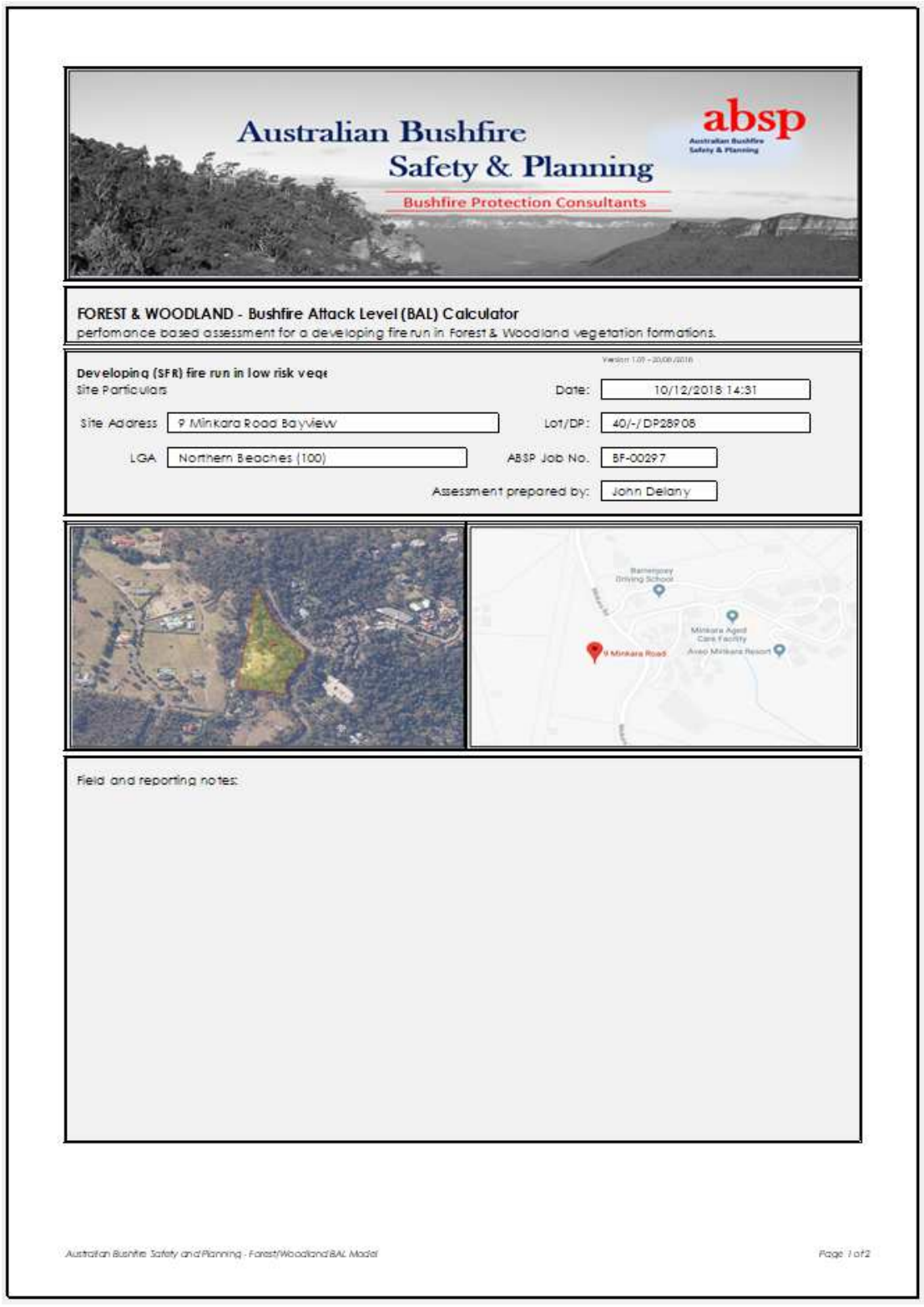
As in all mathematical models, operating parameters will degenerate as parameters exceed the design or purpose of the model. As such both the following limitations applied.

- Limited to 30 degrees for downslope inputs (Method 2 - AS3959);
- Limited to 20 degrees for the site slope due to fuel management issues (Method 2 - AS3959);
- Limited to 10 degrees for upslope (Kataburn Paper CSIRO);
- Limited to 150 metre fire run length, measured on the effective slope;

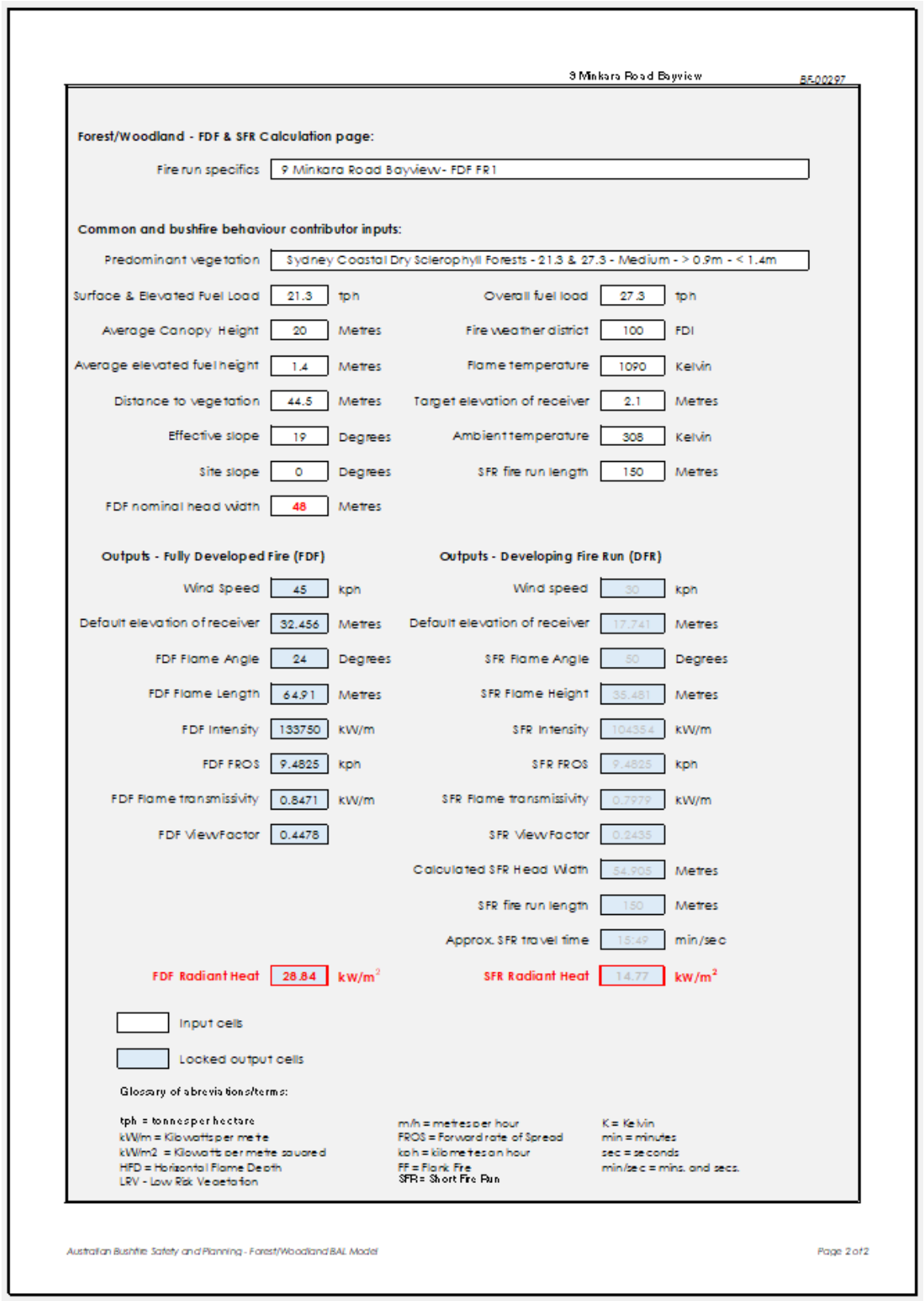
Limited to maximum input of 2 metres in height for elevated fuel (Project Vesta CSIRO), forest formations only.

APPENDIX B.

Site calculation sheets – Worst-case Fire Run FDF FR1.



FDF – **FR1**.



9 Minkara Road Bayview BF-00297

Forest/Woodland - FDF & SFR Calculation page:

Fire run specifics	9 Minkara Road Bayview- FDF FR1

Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
Surface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire weather district	100	FDI
Average elevated fuel height	1.4	Metres	Flame temperature	1090	Kelvin
Distance to vegetation	44.5	Metres	Target elevation of receiver	2.1	Metres
Effective slope	19	Degrees	Ambient temperature	308	Kelvin
Site slope	0	Degrees	SFR fire run length	150	Metres
FDF nominal head width	48	Metres			

Outputs - Fully Developed Fire (FDF)			**Outputs - Developing Fire Run (DFR)**		
Wind Speed	45	kph	Wind speed	30	kph
Default elevation of receiver	32.456	Metres	Default elevation of receiver	17.741	Metres
FDF Flame Angle	24	Degrees	SFR Flame Angle	50	Degrees
FDF Flame Length	64.91	Metres	SFR Flame Height	35.481	Metres
FDF Intensity	133750	kW/m	SFR Intensity	104354	kW/m
FDF FROS	9.4825	kph	SFR FROS	9.4825	kph
FDF Flame transmissivity	0.8471	kW/m	SFR Flame transmissivity	0.7979	kW/m
FDF ViewFactor	0.4478		SFR ViewFactor	0.2435	
			Calculated SFR Head Width	54.905	Metres
			SFR fire run length	150	Metres
			Approx. SFR travel time	15:49	min/sec
FDF Radiant Heat	28.84	kW/m^2	SFR Radiant Heat	14.77	kW/m^2

Input cells

Locked output cells

Glossary of abreviations/terms:

tph = tonnes per hectare
kW/m = Kilowatts per metre
kW/m2 = Kilowatts per metre squared
HFD = Horizontal Flame Depth
LRV - Low Risk Vegetation
m/h = metres per hour
FROS = Forward rate of Spread
kph = kilometres an hour
FF = Flank Fire
SFR= Short Fire Run
K = Kelvin
min = minutes
sec = seconds
min/sec = mins. and secs.

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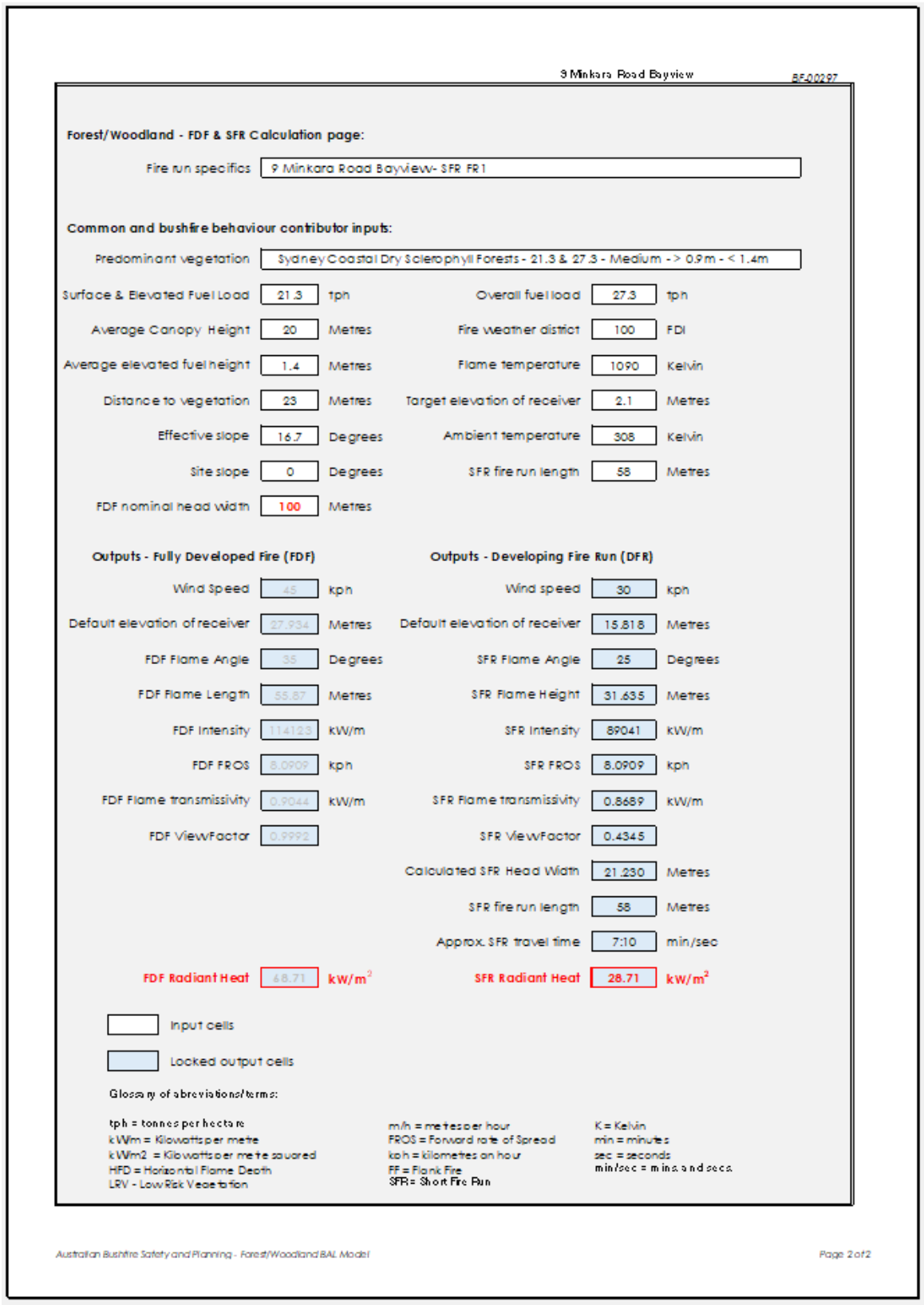
Fire Run SFR - **FR2**.



9 Minkara Road Bayview BF-00297

Forest/Woodland - FDF & SFR Calculation page:

Fire run specifics: 9 Minkara Road Bayview- SFR FR1

Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
Surface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire weather district	100	FDI
Average elevated fuel height	1.4	Metres	Flame temperature	1090	Kelvin
Distance to vegetation	23	Metres	Target elevation of receiver	2.1	Metres
Effective slope	16.7	Degrees	Ambient temperature	308	Kelvin
Site slope	0	Degrees	SFR fire run length	58	Metres
FDF nominal head width	100	Metres			

Outputs - Fully Developed Fire (FDF)			Outputs - Developing Fire Run (DFR)		
Wind Speed	45	kph	Wind speed	30	kph
Default elevation of receiver	27.934	Metres	Default elevation of receiver	15.818	Metres
FDF Flame Angle	35	Degrees	SFR Flame Angle	25	Degrees
FDF Flame Length	55.87	Metres	SFR Flame Height	31.635	Metres
FDF Intensity	114123	kW/m	SFR Intensity	89041	kW/m
FDF FROS	8.0909	kph	SFR FROS	8.0909	kph
FDF Flame transmissivity	0.9044	kW/m	SFR Flame transmissivity	0.8689	kW/m
FDF ViewFactor	0.9992		SFR ViewFactor	0.4345	
			Calculated SFR Head Width	21.230	Metres
			SFR fire run length	58	Metres
			Approx. SFR travel time	7:10	min/sec
FDF Radiant Heat	68.71	kW/m^2	SFR Radiant Heat	28.71	kW/m^2

Input cells

Locked output cells

Glossary of abreviations/terms:

tph = tonnes per hectare
kWm = Kilowatts per metre
kWm2 = Kilowatts per metre squared
HFD = Horizontal Flame Depth
LRV - Low Risk Vegetation
m/h = metres per hour
FROS = Forward rate of Spread
kph = kilometres an hour
FF = Flank Fire
SFR= Short Fire Run
K = Kelvin
min = minutes
sec = seconds
min/sec = mins and secs

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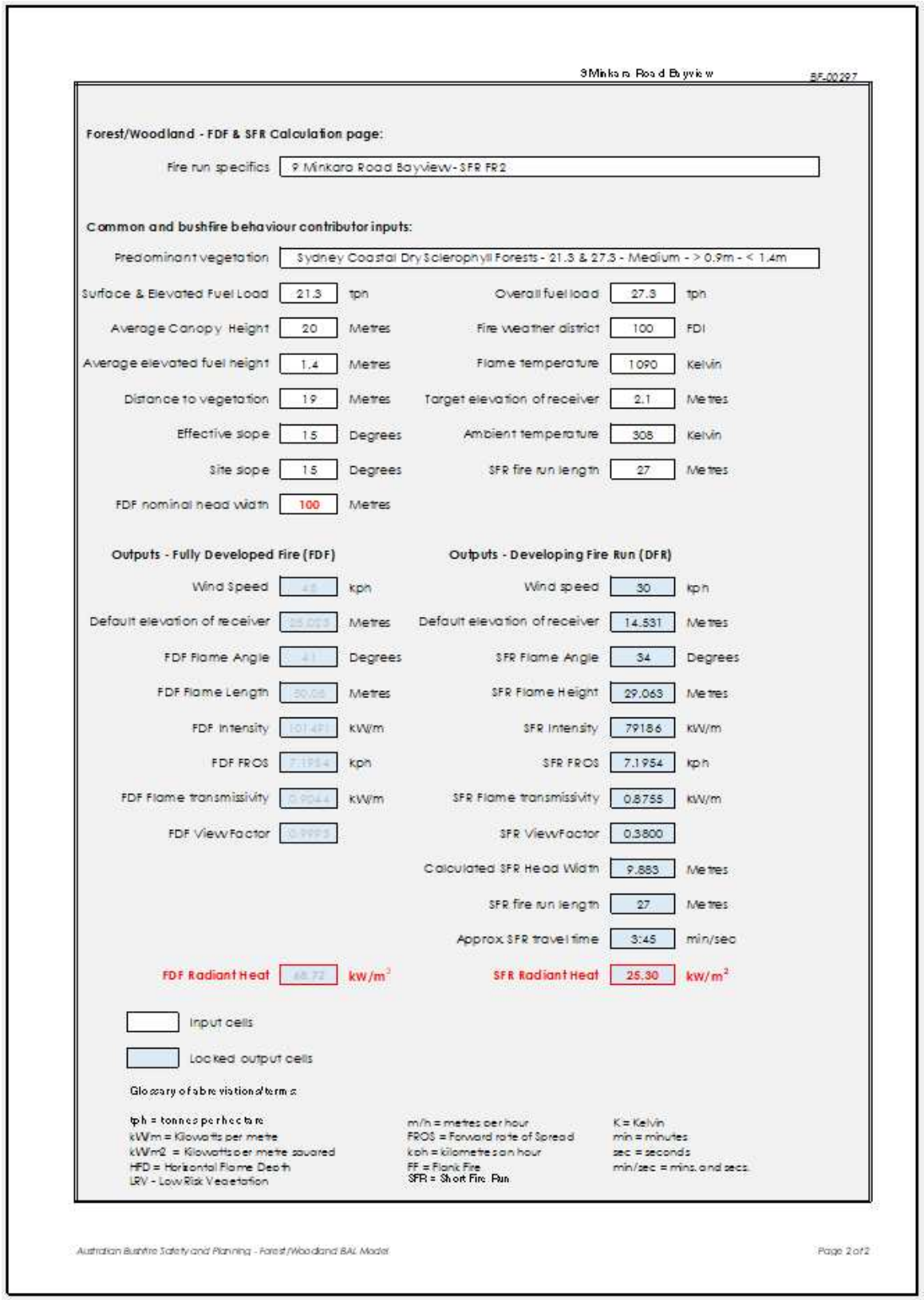
Fire Run SFR – **FR3.**



9 Minkara Road Bayview BF-00297

Forest/Woodland - FDF & SFR Calculation page:

Fire run specifics	9 Minkara Road Bayview - SFR FR2

Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
Surface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire weather district	100	FDI
Average elevated fuel height	1.4	Metres	Flame temperature	1090	Kelvin
Distance to vegetation	19	Metres	Target elevation of receiver	2.1	Metres
Effective slope	15	Degrees	Ambient temperature	308	Kelvin
Site slope	15	Degrees	SFR fire run length	27	Metres
FDF nominal head width	100	Metres			

Outputs - Fully Developed Fire (FDF)			Outputs - Developing Fire Run (DFR)		
Wind Speed	[illegible]	kph	Wind speed	30	kph
Default elevation of receiver	[illegible]	Metres	Default elevation of receiver	14.531	Metres
FDF Flame Angle	[illegible]	Degrees	SFR Flame Angle	34	Degrees
FDF Flame Length	[illegible]	Metres	SFR Flame Height	29.063	Metres
FDF Intensity	[illegible]	kW/m	SFR Intensity	79186	kW/m
FDF FROS	[illegible]	kph	SFR FROS	7.1954	kph
FDF Flame transmissivity	[illegible]	kW/m	SFR Flame transmissivity	0.8755	kW/m
FDF View Factor	[illegible]		SFR View Factor	0.3800	
			Calculated SFR Head Width	9.883	Metres
			SFR fire run length	27	Metres
			Approx SFR travel time	3:45	min/sec
FDF Radiant Heat	[illegible]	kW/m^2	SFR Radiant Heat	25.30	kW/m^2

Input cells

Locked output cells

Glossary of abreviations/terms:

tph = tonnes per hectare
kWm = Kilowatts per metre
kWm2 = Kilowatts per metre squared
HFD = Horizontal Flame Depth
LRV = Low Risk Vegetation
m/h = metres per hour
FROS = Forward rate of Spread
kph = kilometres an hour
FF = Flank Fire
SFR = Short Fire Run
K = Kelvin
min = minutes
sec = seconds
min/sec = mins. and secs.

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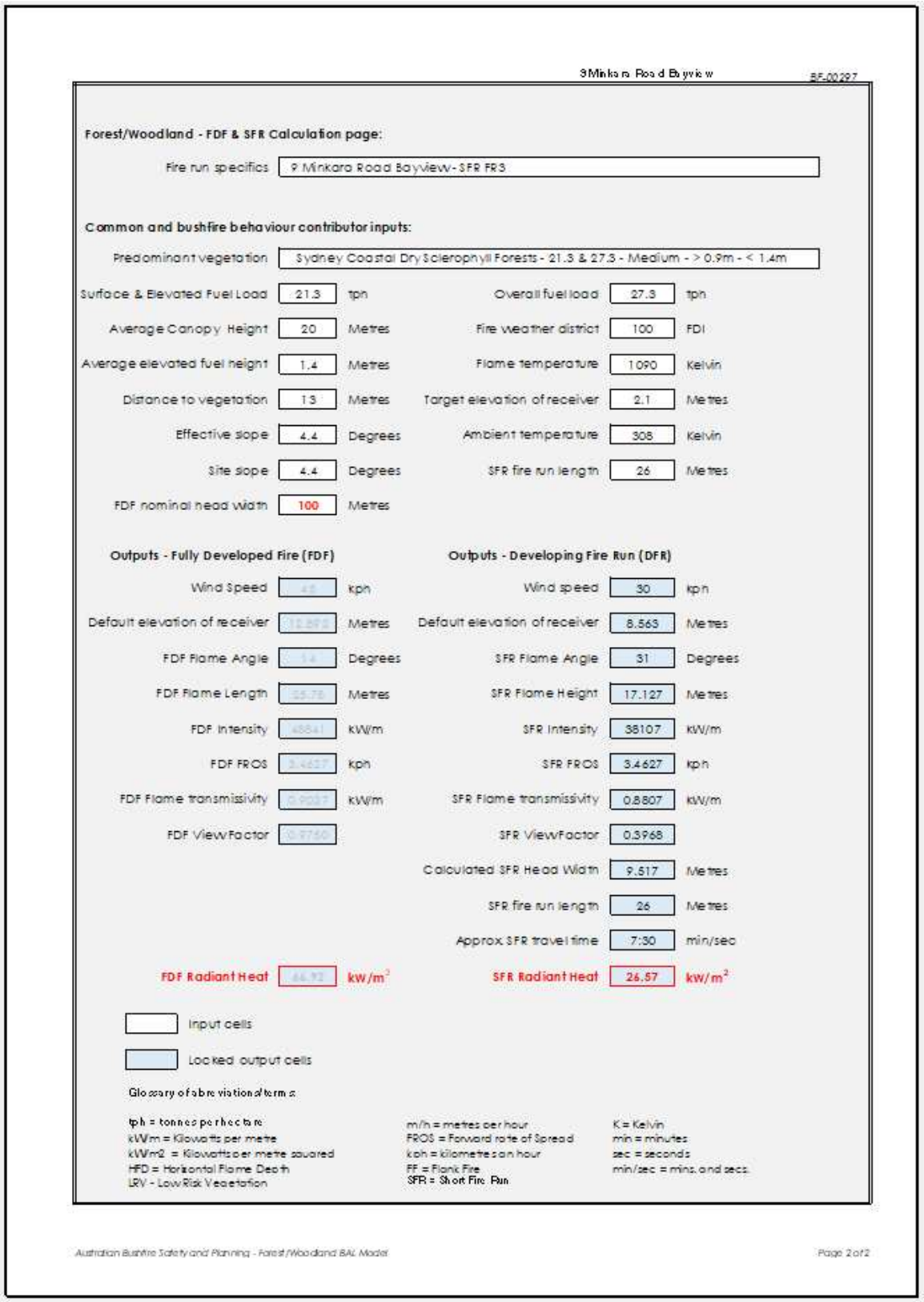
Fire Run SFR - **FR4**.



9 Minkara Road Bayview BF-00297

Forest/Woodland - FDF & SFR Calculation page:

Fire run specifics: 9 Minkara Road Bayview - SFR FR3

Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
Surface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire weather district	100	FDI
Average elevated fuel height	1.4	Metres	Flame temperature	1090	Kelvin
Distance to vegetation	13	Metres	Target elevation of receiver	2.1	Metres
Effective slope	4.4	Degrees	Ambient temperature	308	Kelvin
Site slope	4.4	Degrees	SFR fire run length	26	Metres
FDF nominal head width	100	Metres			

Outputs - Fully Developed Fire (FDF)			Outputs - Developing Fire Run (DFR)		
Wind Speed	[illegible]	kph	Wind speed	30	kph
Default elevation of receiver	[illegible]	Metres	Default elevation of receiver	8.563	Metres
FDF Flame Angle	[illegible]	Degrees	SFR Flame Angle	31	Degrees
FDF Flame Length	[illegible]	Metres	SFR Flame Height	17.127	Metres
FDF Intensity	[illegible]	kW/m	SFR Intensity	38107	kW/m
FDF FROS	[illegible]	kph	SFR FROS	3.4627	kph
FDF Flame transmissivity	[illegible]	kW/m	SFR Flame transmissivity	0.8807	kW/m
FDF View Factor	[illegible]		SFR View Factor	0.3968	
			Calculated SFR Head Width	9.517	Metres
			SFR fire run length	26	Metres
			Approx SFR travel time	7:30	min/sec
FDF Radiant Heat	[illegible]	kW/m^2	SFR Radiant Heat	26.57	kW/m^2

Input cells

Locked output cells

Glossary of abreviations/terms:

tph = tonnes per hectare
kWm = Kilowatts per metre
kWm2 = Kilowatts per metre squared
HFD = Horizontal Flame Depth
LRV = Low Risk Vegetation

m/h = metres per hour
FROS = Forward rate of Spread
kph = kilometres an hour
FF = Flank Fire
SFR = Short Fire Run

K = Kelvin
min = minutes
sec = seconds
min/sec = mins. and secs.

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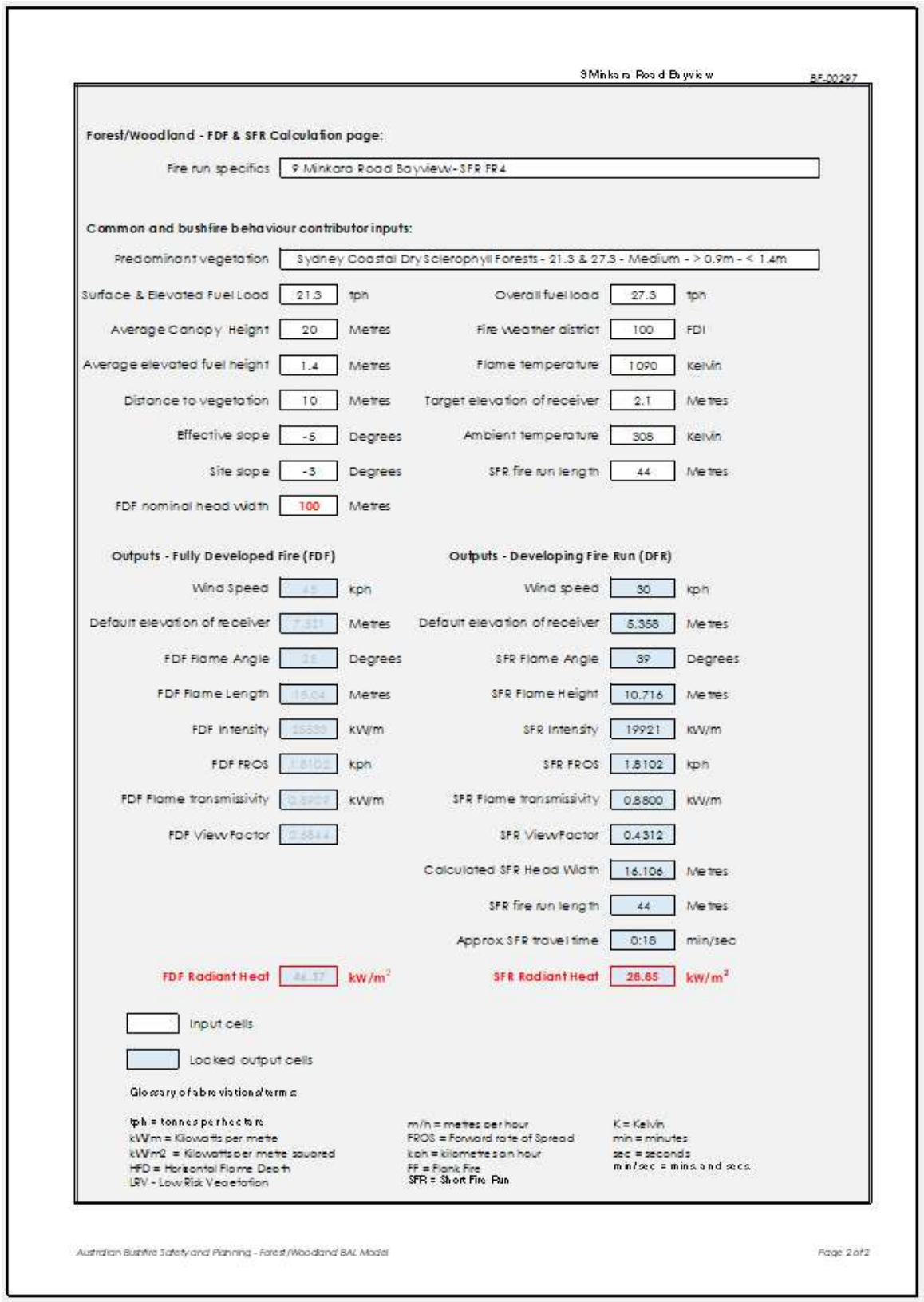
Fire Run SFR – **FR5**.



9 Minkara Road Bayview BF-00297

Forest/Woodland - FDF & SFR Calculation page:

Fire run specifics: 9 Minkara Road Bayview - SFR FR4

Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
Surface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire Weather district	100	FDI
Average elevated fuel height	1.4	Metres	Flame temperature	1090	Kelvin
Distance to vegetation	10	Metres	Target elevation of receiver	2.1	Metres
Effective slope	-5	Degrees	Ambient temperature	308	Kelvin
Site slope	-3	Degrees	SFR fire run length	44	Metres
FDF nominal head width	100	Metres			

Outputs - Fully Developed Fire (FDF)			Outputs - Developing Fire Run (DFR)		
Wind Speed	[illegible]	kph	Wind speed	50	kph
Default elevation of receiver	[illegible]	Metres	Default elevation of receiver	5.358	Metres
FDF Flame Angle	[illegible]	Degrees	SFR Flame Angle	39	Degrees
FDF Flame Length	[illegible]	Metres	SFR Flame Height	10.716	Metres
FDF Intensity	[illegible]	kW/m	SFR Intensity	19921	kW/m
FDF FROS	[illegible]	kph	SFR FROS	1.8102	kph
FDF Flame transmissivity	[illegible]	kW/m	SFR Flame transmissivity	0.8800	kW/m
FDF ViewFactor	[illegible]		SFR ViewFactor	0.4312	
			Calculated SFR Head Width	16.106	Metres
			SFR fire run length	44	Metres
			Approx SFR travel time	0:18	min/sec
FDF Radiant Heat	[illegible]	kW/m²	SFR Radiant Heat	28.85	kW/m²

Input cells

Locked output cells

Glossary of abreviations/terms

tph = tonnes per hectare
kWm = Kilowatts per metre
kWm2 = Kilowatts per metre squared
HFD = Horizontal Flame Depth
LRV = Low Risk Vegetation
m/h = metres per hour
FROS = Forward rate of Spread
kph = kilometres on hour
FF = Flank Fire
SFR = Short Fire Run
K = Kelvin
min = minutes
sec = seconds
min/sec = mins and secs

Australian Bushfire Safety and Planning - Forest/Woodland BAL Model

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