

Fire Management Plan

Byford Central, Lots 9016 & 9017

E13036



Prepared for
Rivermoon Corporation Pty Ltd

May 2014

Contact Information

Cardno WA Pty Ltd
Trading as Cardno
ABN 77 009 119 000

11 Harvest Terrace, West Perth WA 6005

Telephone: 08 9273 3888
Facsimile: 08 9486 8664
International: +61 8 9273 3888

wa@cardno.com
www.cardno.com

Document Information

Prepared for	Rivermoon Corporation Pty Ltd
Project Name	Byford Central, Lots 9016 & 9017
File Reference	20141705-E13036-EV14045-R-FireManagementPlan-V3.1-MS-I.docx
Job Reference	E13036
Date	May 2014

Document Control

Version	Date	Description of Revision	Prepared By	Prepared (Signature)	Reviewed By	Reviewed (Signature)
V1	16/2/2014	First Draft	EV		MS	
V2	17/3/2014	Final Version	EV		MS	
V3	15/5/2014	Final Version	EV		MS	
V3.1	26/5/2014	Final Version	EV		MS	

Version	Reason for Issue	Approved Release By	for (Signature)	Approved Release Date
V1	First version issued to client	MS		19/2/2014
V2	Revised version of the FMP based on the Shire's comments	MS		17/3/2014
V3	Revised version of the FMP based on the Shire's comments	MS		15/5/2014
V3.1	Final version of the FMP based on the Shire's comments	MS		26/5/2014

© Cardno 2014. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person other than by agreement with Cardno.

This document is produced by Cardno solely for the benefit and use by the client in accordance with the terms of the engagement. Cardno does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

Executive Summary

This Fire Management Plan (FMP) has been prepared to satisfy the requirements of the Western Australian Planning Commission (WAPC) and to support the proposed subdivision of Lots 9016 and 9017 Thomas Road, Byford ('subject site').

The subject site is located within the Shire of Serpentine Jarrahdale (Shire), approximately 30 kilometres south east of the Perth central business district adjacent to Thomas Road. The subject site comprises approximately 12.5 hectares, the majority of which has been cleared of native vegetation to allow for residential development.

A vegetation class and bushfire hazard assessment was conducted for the subject site and adjacent areas for a minimum of 100 metres. Bushfire hazard on the site is low. Moderate bushfire hazard occurs along the western boundary of the subject site within the Public Recreation Reserve (PRR). Areas that are in close proximity to the moderate bushfire risk areas the siting of development must be designed to comply with the following:

- > Every building is sited a minimum of 100 m from the hazardous vegetation; or
- > If this is not possible, then increase the construction standard to align with the appropriate Bushfire Attack Level (BAL) for the location in accordance with the Standards Australia 2009, Construction of buildings in bushfire prone areas (AS3959-2009) and/or introduce other measure to mitigate risks in accordance with the Performance Criteria of the "Planning for Bushfire Protection Guidelines – Edition 2" (WAPC et al. 2010) (The Guideline).

This FMP has adopted a combination of the performance criteria and acceptable solutions approach as specifically provided for in the Guideline for the bushfire management and variety of design responses has been developed to address bushfire hazard issues.

In addition to the application of bushfire attack levels (BAL), bushfire risk is to be further mitigated through lot design and the siting of buildings, construction of firebreaks and road network, shielding structure, provision of adequate road access for firefighting/other emergency vehicles and safe evacuation and provision of an adequate and accessible water supply for firefighting purposes.

Based on the BAL assessment conducted as a part of this FMP, it is concluded that the proposed dwellings and lots will fall within the acceptable level of risk and will have construction standards increased to meet AS3959-2009 requirements.

Table of Contents

Executive Summary	ii
1 Introduction	1
1.1 Bushfire Management Plan Objectives	1
1.2 Guidelines, Specifications and Minimum Standards	1
2 Description of the Area	2
2.1 Site Details	2
2.2 Fire Climate	2
2.3 Topography	4
2.4 Bushfire Fuels	4
2.5 Land Use	4
2.6 Assets	4
2.7 Access	5
2.8 Water Supply	5
3 Fire Problem	6
3.1 Bushfire History	6
3.2 Bushfire Hazard Assessment	6
3.2.1 Vegetation Type and Structure	6
3.2.2 The Bushfire Hazard Level	7
4 Fire Mitigation Strategy	10
4.1 Location of the Site	10
4.2 Vehicular Access	10
4.3 Water Supplies	11
4.4 Lot Layout and Siting	11
4.4.1 Hazard Separation Zone	11
4.4.2 The Bushfire Attack Level	12
4.5 Design of development	12
4.6 Public Education and Community Awareness	12
4.7 Community Fire Refuges and Fire Safer Areas	13
4.8 Assessment of Fire Management Strategies	13
4.9 Implementation	13
4.9.1 The Developer	13
4.9.2 Owner/Occupier of the Lot	14
4.9.3 Shire of Serpentine Jarrahdale	14
4.9.4 Water Corporation	15
5 Conclusion	16
6 References	17
7 Abbreviations	18

Tables

Table 3-1 Bushfire Risk Assessment and Response Matrix	9
--	---

Figures

Figure 1	Site Location	19
Figure 2	Bushfire Management Plan	19
Figure 3	Road Network and Water Reticulation	19
Figure 4	Bushfire Risk Assessment	19
Figure 5	Shielding Structure Details	19

1 Introduction

Rivermoon Corporation is developing residential lots in Byford on 12.5 ha of land (subject site) situated within the Shire of Serpentine Jarrahdale (Shire). The subject site is located approximately 30 kilometres south east of the Perth central business district adjacent to Thomas Road.

This Fire Management Plan (FMP) has been developed to satisfy the requirements of the Western Australian Planning Commission (WAPC) and to support the proposed subdivision of Lots 9016 and 9017 Thomas Road, Byford. The aim is to reduce the occurrence, and minimise the impact of bushfires thereby reducing the threat to life, property and the environment, and to document fire prevention requirements where required.

The FMP is submitted pursuant to Condition No. 33 of the Subdivision Approval (WAPC 143440 issued on 21 March 2011) which proposes the subdivision of the subject site into 150 residential lots.

The FMP will be implemented by the developer of the subdivision in the first instance, with ongoing mitigation and management responsibilities passing to the individual lot owners and the Shire once the titles of the subdivision have been created. It is anticipated that the Shire will adopt and enforce this FMP under its Annual Firebreak Notice and Fuel Hazard Reduction Notice.

A checklist for the proposal against the provisions of the Guidelines is contained in Appendix A.

1.1 Bushfire Management Plan Objectives

This FMP has been commissioned by Rivermoon Corporation to meet the following objectives;

- > Fulfil the requirements of the WAPC to include a FMP as a part of the subdivision approval;
- > Detail the fire management methods and requirements that will be implemented within the subject site;
- > Reduce the threat to life, properties and for emergency response personnel in the event of a bushfire within or near the subject site either during staged development construction or once construction is complete; and
- > Provide responses to the performance criteria and acceptable solutions that fulfil intent of the bushfire management issues outlined in the “*Planning for Bushfire Protection Guidelines – Edition 2*” (WAPC *et al.* 2010) (The Guideline).

The FMP outlines the achievable and measurable management measures and sets out the roles and responsibilities of the developer, lot owners/occupiers, Shire and the Department of Fire and Emergency Services (DFES).

1.2 Guidelines, Specifications and Minimum Standards

Specifications or standards relevant to this FMP are derived from and consistent with:

- > The Guideline;
- > Australian Standards (AS3959-2009): *Construction of buildings in bushfire prone areas*;
- > The Shire’s Firebreak Notice and Fuel Hazard Reduction Notice 2013-2014 (FN&FHRN); and
- > *Visual Fuel Load Guide for the Scrub Vegetation of the Swan Coastal Plain and Darling Scarp including Geraldton Sandplains & Leeuwin Ridge Regions of Western Australia – Edition 2.* (DFES, 2012)

2 Description of the Area

2.1 Site Details

The subject site is contained within the approved Byford Structure Plan (2009) bounded by Thomas Road to the north, Hopkinson Road and the future Tonkin Highway to the west, Cardup Siding Road to the south and the Byford townsite and Darling Range foothills to the east. The subject site comprises approximately 12.5 hectares, the majority of which was a dairy farm and has since been cleared to allow development of the residential lots. Any remaining remnant native vegetation is restricted adjacent to the site perimeter in the west and isolated internal 1.5 ha Public Open Space (POS). Byford Structure Plan area and subject site are shown in Figure 1.

The subject site is adjoined by the established residential subdivision of Byford Central to the east, 7.5 ha Public Recreation Reserve (PRR) No. 37332 to the west which separates the site from a small special rural subdivision previously created from the subdivision of the original landholding. The subject site is separated from adjacent residential development to the north by Thomas Road and to the south by proposed Town Centre Distributor Road.

The Thomas Road and Larsen Road intersections are the main access points to the subject site. The proposed future Town Centre Distributor Road southwest to the subject site will provide additional access through Larsen Road. A network of subdivision roads connect to future Distributor Road and Caraway Avenue which serve as the primary emergency access route along the southern and eastern boundary of the subject site. The road network is detailed in Figure 2.

2.2 Fire Climate

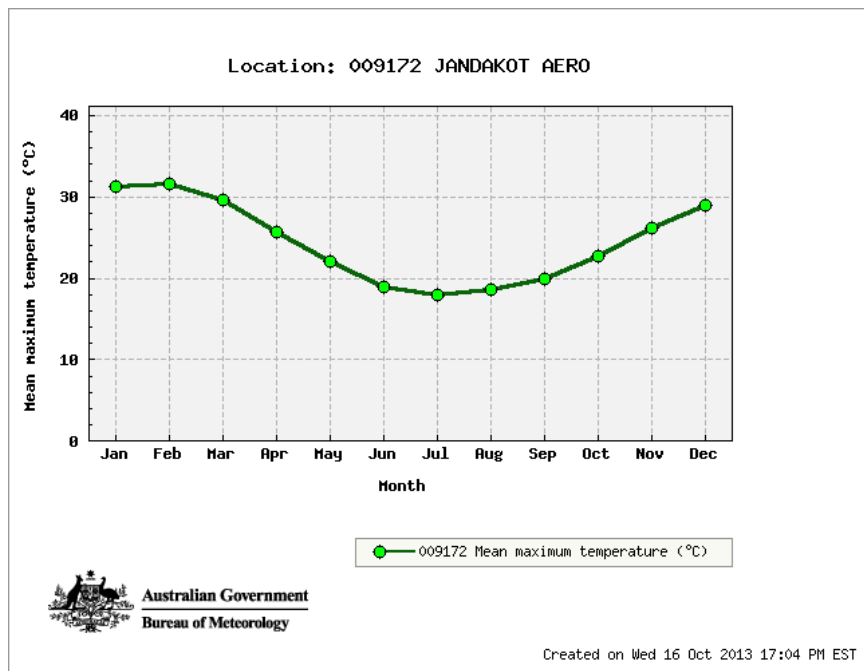
Bushfire behaviour in WA is significantly affected by weather conditions. Bushfires will burn with more aggression when a combination of high temperatures and low humidity occurs along with strong winds. In Perth, and the surrounding area, summer and autumn carry the greatest fire risk, when the moisture content in vegetation is low. The Bureau of Meteorology (BoM) website (BoM, 2014) states that extreme fire weather conditions in the Perth region typically occur with strong easterly or north easterly winds associated with a strong high pressure system to the south of the state and a trough offshore. Easterly winds represent about 60 % of extreme bushfire weather days (events) compared to less than five percent associated with southerly winds and about 15 % of events in a westerly flow following the passage of a trough.

Weather conditions which may result in a bushfire often follow a sequence of hot days and easterly winds that culminate when the trough deepens near the coast and moves inland. Winds can change from easterly to northerly and then to westerly during this sequence of climatic events.

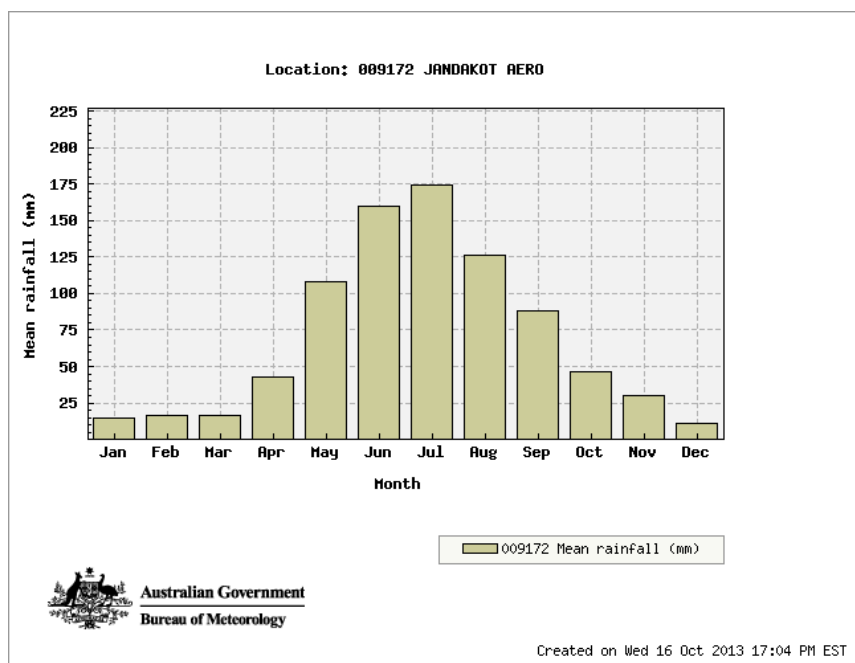
The subject site is located within the south west of Western Australia (WA), which experiences a Mediterranean climate of mild wet winters and hot dry summers. Climatic data obtained from the BoM provides average temperature and rainfall statistics. The closest weather station is located at Jandakot Airport (BoM Station 009172).

Graph 1 shows mean maximum daily temperatures vary from 31.6°C in February to 17.9°C in July, and Graph 2 confirms mean rainfall ranges from 174.3 mm in June to 14 mm in January.

Graph 1 Mean Temperature



Graph 2 Mean Rainfall

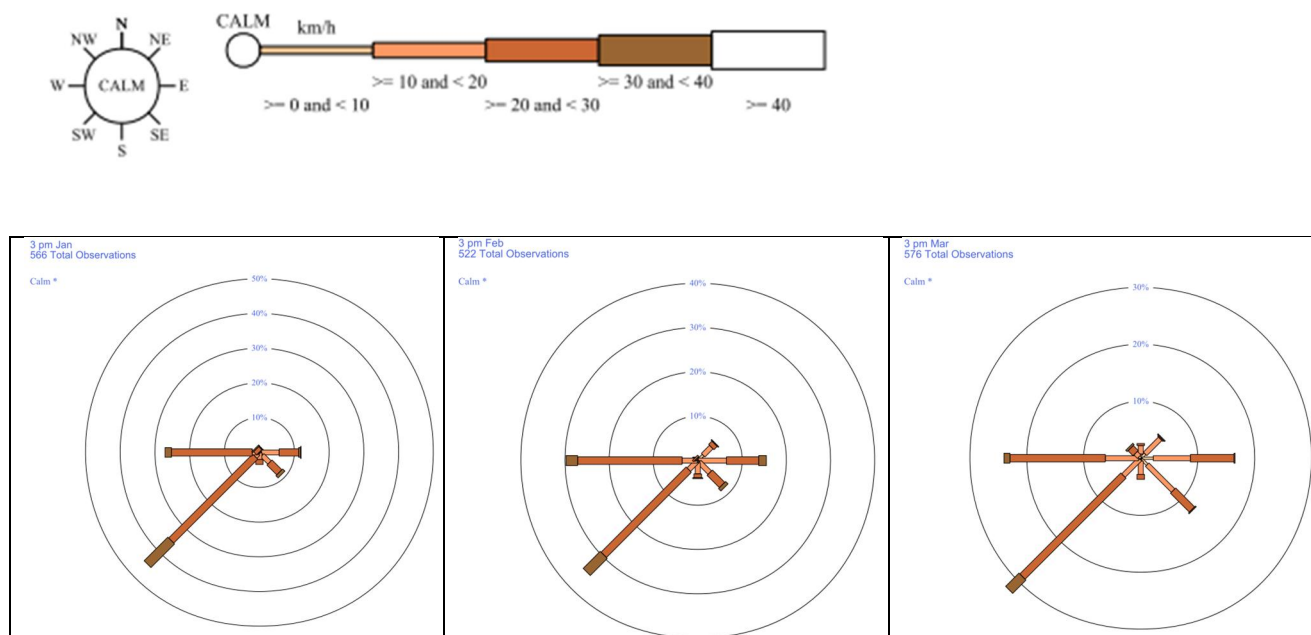


The subject site is located approximately 22 km from the coast and therefore sea breezes will have some influence, however, breeze generated from the surrounding land areas is likely to have a larger impact.

Data from the Jandakot Airport weather station indicates that the predominant summer winds near the site are west to south westerly (Graph 3).

Wind speed versus direction plots summarise the occurrence of winds at a location, showing the strength, direction and frequency. The percentage of calm conditions is represented by the size of the centre circle. The bigger the circle, the higher is the frequency of calm conditions. Each brand of rose represents wind coming from that direction, with north at the top of the diagram. The branches are divided into segments of different thickness and colour, which represent wind speed ranges in that direction. Speed ranges of 10 km/h are used. The length of each segment within a branch is proportional to the frequency of winds blowing within that corresponding range of speeds from that direction (BoM, 2014).

Graph 3 Predominant Summer Wind (December, January and February) Direction at 3pm



2.3 Topography

The subject site falls gently from the south east at approximately RL38 m towards the northwest at approximately RL33 m. The difference in elevation between the highest and lowest parts of the subject site is approximately 5 m over an average distance of 550 m. Topography is therefore not a significant consideration for the purposes of bushfire planning.

2.4 Bushfire Fuels

The majority of the subject site is cleared land devoid of ground fuel and other vegetation. The POS located in the north eastern corner of the subject site has few remaining Marri trees and no understorey surrounding a proposed water basin.

The primary fire load is located outside the western boundary of the subject site within the PRR. This area is characterised by open woodland over introduced grassland.

Urban areas, north and south of the subject site, are characterised by predominantly cleared land with small pockets of remnant vegetation or maintained gardens with varying degrees of foliage cover.

2.5 Land Use

The subject site has historically been predominantly cleared and used as a dairy farm. Presently the majority of the site is cleared for any remaining trees to allow the development of residential lots.

The subject site is zoned 'Residential' under the Shire District Structure Plan and Byford Central Structure Plan. The balance of the surrounding land to the north, south and west is currently used for rural/special rural purposes.

2.6 Assets

When the subject site is fully developed it will consist of 150 new residential dwellings, all of which will be required to comply with the current endorsed version of AS3959-2009 based on an assessment of the vegetation conditions and implementation of this FMP at the particular location.

In addition to this, the subject site also has a POS designed for recreational purposes of the residents.

The subdivision will also result in the introduction of other assets to service the subdivision, including lot access roads, water supply, power and telecommunications infrastructure.

2.7 Access

Regional accessibility to the subject site is good with both north-south (South Western Highway) and east-west (Thomas Road) connections to the regional road structure. Primary access to the subject site is currently via Thomas Road and Larsen Road through to Plaistowe Boulevard which connect with subdivision roads. In the future additional access will be from the south via the Town Centre Distributor Road, linking to Caraway Avenue and further to smaller subdivision roads.

Thomas Road is proposed to be increased by 30 m to 50 m to accommodate widening of the existing carriageway and the construction of an open drainage swale along the southern side of the road reserve. The intersection has been constructed as a 'left in-left out' intersection. The proposed Town Centre Distributor Road will run adjacent to the southern border of the subject site and connect Thomas and Abernethy Roads. The width of the road reserve of the Town Centre Distributor Road and subdivision roads is proposed to be 30 m and 15 m, respectively. The proposed road network is illustrated in Figure 2.

2.8 Water Supply

Reticulated water is to be provided to the entire subdivision and for emergency purposes.

Existing water infrastructure servicing the subject site includes a 300 mm main which sits in the Larsen Road reserve. Shared fire hydrants are to be spaced to Water Corporation and DFES standards and provide emergency response personnel access to adequate water supply. Standard water supply provision requires that fire hydrants be installed at 200m intervals along the public road system and in a fashion readily accessible to emergency vehicles. The reach of hose and spray for fire suppression purposes from the hydrants in the context of the subdivision layout is such that the whole of the subject site is covered by the conventional installation with no special facilities required as shown in Figure 2.

3 Fire Problem

3.1 Bushfire History

Byford Volunteer Bush Fire Brigade attended 66 fire incidents within a three kilometre radius during the 2013/2014 fire season (incidents up to 1/5/2014).

At the date of this report there is no documented history of bushfire within or immediately adjacent to the site that was of a nature that threatened life or property.

3.2 Bushfire Hazard Assessment

The bushfire risk in the subject site is assessed as primarily arising from human activity in the RRS, POS and vegetated rural residential areas south of the subject site and to the north of Thomas Road. The fire risk will reduce incrementally with the gradual development of the subject site and surrounds and the associated introduction of reticulated water supplies and hazard reduction regimes. The inherent bushfire hazard on the subject site and in the general locality is the extent and proximity of remnant vegetation to places of human occupation and other property and infrastructure.

The Guideline is used to determine appropriate bushfire hazard classifications for different areas of the subject site and its immediate vicinity. In recognition of the scale at which bushfires operate, for the purpose of this assessment the area considered for assessment of bushfire hazard levels includes all of the subject site and adjacent areas for a minimum of 100 metres.

The Guideline identifies three features of the landscape that strongly contribute towards the behaviour of bushfires, these being:

- > vegetation type and structure;
- > distance of the site from classified vegetation; and
- > average land slope.

In order to accurately assess the levels of bushfire hazard associated with a given locality, the subject site is divided into a number of sub-units, based on variances in vegetation and existing urban development. The bushfire hazard level assessment for the subdivision and locality is detailed in the following sections.

3.2.1 Vegetation Type and Structure

Isolated POS within the subject site is designed to have water basin and wetland vegetation, and will be separated from the rest of the subdivision by 15 m subdivision roads. The POS has few remaining Marri trees with no understorey. Landscaping for the area proposes planting *Melaleuca*, *Corymbia*, *Kunzea* and *Eucalyptus* trees and tubestock plants around the basin.

The PRR in the direct interface with the subject site in the west is typified by open woodland with introduced grasses as an understorey; most dominant are Marri with canopy heights ranging between 10 and 20 m. No native understorey is present and foliage cover is relatively low. The PRR has multiple existing tracks traversing the area and has been used to dump rubbish. The Shire is planning on revegetating and rehabilitating the PRR to a fit for purpose standard of drainage, stabilisation, conservation and habitat. The species that will be selected are from the Guildford complex vegetation type and have been identified through the Perth Region Plant Biodiversity Project. As part of the rehabilitation, the grasses will be chemically controlled and replaced with strategically placed native vegetation which will include an understorey and mid storey to support the native trees that are present. The planting regime along the development boundary incorporates low flammability species to a maximum height of 600mm and assist in lowering the potential fire risk to the lots within the subdivision. Once complete, the majority of the PRR is typified as woodland, interface with the development being an exception.

Urban areas, north and south of the subject site are characterised by predominantly cleared land with small pockets of remnant vegetation or maintained gardens with varying degrees of foliage cover. These areas will

be located in excess of a 30 m setback from any bushfire risk area, by virtue of wide road reserves (>30 m) once the Town Centre Distributor Road is constructed.

The subject site is bordered to the east by established and fully serviced residential subdivisions.

Some representative photographs of the site conditions are provided below.

Plate 1 Examples of site conditions. (a) Open woodland over grassland in the PRR, (b) scattered Marri trees and the water basin within the proposed POS, (c) Thomas Road reserve and small pockets of remnant vegetation on the northern side of the road and (d) cleared development area.



(a)



(b)



(c)



(d)

3.2.2 The Bushfire Hazard Level

The respective bushfire hazard ratings based on the vegetation were determined using Appendix 1 of the Guideline.

The bushfire hazard on the subject site is low as the majority of the site is cleared. The POS and urban areas north and south of the subject site have limited native standing vegetation and no understorey to increase the risk of a bushfire and are therefore classified as low hazard areas. The POS will be landscaped to include water basin and associated wetland vegetation and maintained to manage any bushfire risk.

Moderate bushfire hazard occurs currently in the PRR. A 6 m wide bridle trail in accordance with the A2.6 of the Guideline will be constructed into and looping throughout the PRR. This trail provides a strategic firebreak between the hazardous vegetation and subdivision and access for firefighting purposes. To the west of the firebreak/bridle trail, the PRR will be replanted with species from the Guildford complex vegetation type to achieve fit for purpose standard. Once mature, the bushfire hazard within this area will

increase to extreme. The planting regime on the eastern side of the firebreak/ bridle trail will be adjusted to lower the bushfire hazard. It is proposed by the Shire that existing trees will remain and revegetation of this area will consist of low flammability species and ground cover or understory to a maximum height of 600mm. The existing bushfire hazard ratings for the site are illustrated in Figure 3. Table 3-1 details the bushfire risk assessment and response matrix for these areas.

The threat that does exist is also mitigated for the subject site and the locality by the introduction of reticulated emergency water supplies and the connected network of public roads, fireproof fencing and easements associated with the proposed subdivision. The threat applies primarily to new dwellings and their occupants.

Table 3-1 **Bushfire Risk Assessment and Response Matrix**

Area	Predominant vegetation type	Distance between development and classified vegetation	Topography	Fuel loads	Current Bushfire Hazard Rating	Other factors	Design response
1	Open Woodland	0 m	Development is slightly upslope/level with vegetation. Generally flat terrain.	< 6 t/ha	Moderate	PRR remains as recreational area and will be partly rehabilitated to a fit for purpose standard (western side of the bridle trail) and partly with low flammability species to reduce fire risk (eastern side of the bridle trail). Classified currently as open woodland.	Current conditions result of BAL-FZ to BAL- 40 rating for lots immediately abutting the PRR and BAL-40 to BAL-29 for those adjacent to the Sarsparilla Ramble. Installation of bridle trail/ firebreak and shielding structure and modification of the vegetation within the eastern side of the firebreak as detailed in Figure 4 will result in BAL-12.5 rating to lots immediately behind the shielding structure. See Section 4.4.2 and Figure 4 for further information.
2	Cleared land / suburban area	N/A	Generally flat	N/A	Low	Only isolated pockets of vegetation remaining. Vegetation and development is separated by substantial firebreak.	Current conditions reflect BAL LOW rating. Construction of the Town Centre Distributor Road will provide strategic fire break (> 30 m) to surrounding area. A bridle trail/firebreak will be installed along the southern edge of the subject site as detailed in Figure 4 to ensure sufficient separation during the construction of the subject site.
3	Managed POS	20 m	Generally flat	< 2 t/ha	Low	Negligible ground fuel in managed POS.	Current conditions reflect BAL LOW rating. Jasmine Promenade will provide strategic fire break from vegetated area.
4	Cleared land / suburban area	N/A	Generally flat	N/A	Low	Vegetation and development is separated by substantial firebreak.	Current conditions reflect BAL LOW rating. Widening of Thomas Road will provide strategic fire break (>50 m) to surrounding area.

4 Fire Mitigation Strategy

The aim of the FMP is to reduce the occurrence, and minimise the impact, of bushfires to the development. The Guideline sets out the specific outcomes that should be achieved for development to be compatible with the nature of the bushfire hazard. These adopt a performance-based system of control for each of the five bushfire hazard management issues:

1. location;
2. vehicular access;
3. water;
4. siting of development; and
5. design of development.

The FMP adopts a conservative approach to the standards to be applied and measures to be introduced by the developer, erring on the side of caution if discretion has been available in the options available.

The FMP imposes requirements for vegetation and fuel management within for every dwelling in the subdivision area and in the PRR abutting to the west (in accordance with the Shire's Annual FN&FHRN). The requirements are based on contemporary standards for the nature of the land use and the assessed fire hazard, including compliance with the current endorsed version of *AS3959-2009* for each dwelling based on individual assessments at building licence stage. It is also proposed that the boundary fencing that is required to be constructed along the PRR interface to the property be built to standards for it to act as a shielding structure under the Guideline.

The shielding structure will allow development in the planned location pursuant to Performance Criteria P5 and Acceptable Standard A4.5 of the Guideline with a BAL-12.5 rating applying to lots immediately behind the wall. Mitigation strategies of the FMP are detailed in Figure 4.

4.1 Location of the Site

The Byford Structure Plan has been designed in accordance with the objectives of the Guideline as it relates to the location of the subject site and is in compliance with the performance criteria. During subdivision planning the following should be applied:

- > Avoid areas of extreme and moderate bushfire hazard; or
- > If development in these areas is necessary, mitigate the risk through:
 1. lot design and the siting of buildings;
 2. inclusion of firebreaks that provide adequate:
 - setbacks between buildings/structures and hazardous vegetation; and
 - access for firefighting/other emergency vehicles.
 3. providing adequate road access for firefighting/other emergency vehicles and safe evacuation; and
 4. providing an adequate and accessible water supply for firefighting purposes.

The site must be provided with adequate road access for firefighting/other emergency vehicles and safe evacuation and accessible water supply for firefighting purposes. These aspects are further discussed in the following sections.

4.2 Vehicular Access

The ability of both landholders and firefighters to access all areas of a property can be a vital factor in determining whether a fire can be fought successfully. Secure access also allows for safe performance of management actions and safe exit should evacuation be required.

The subject site is surrounded by two main regional roads; Thomas Road and Larsen Road. Access to the subject site is currently provided via these roads and the proposed Town Centre Distributor Road will provide further entrance points in the future. A comprehensive network of access roads is depicted on Figure 2, with the road network constructed to comply with Appendix 2, Element 2 – Vehicular Access of the Guideline by the developer prior to the creation of titles and maintained thereafter by the Shire. This ensures that:

- > two access routes are provided to surrounding regional roads at every stage of the development; and
- > the road design complies with the minimum standards of the Guideline as follows:
 - Total horizontal clearance of Thomas Road and the Town Centre Distributor Road will be 50 m and 30 m, respectively, to accommodate road drainage swales; and
 - All subdivision road reserves are between 14-16 m wide.

4.3 Water Supplies

To comply with the performance criteria, the development shall be provided with a reticulated water supply, together with fire hydrants in accordance with the specifications of the Water Corporation and DFES. Standard water supply provision requires that fire hydrants be installed at 200 m intervals along the public road system and in a fashion readily accessible to emergency vehicles. Locations of the fire hydrants are shown in Figure 2.

4.4 Lot Layout and Siting

A physical separation between bushfire hazard areas is required to protect buildings from burning debris, radiant heat and direct flame contact. Building protection zones (BPZ) can be classified as the low fuel area immediately surrounding a building and is designed to minimise the likelihood of flame contact with buildings. Features such as driveways, parking areas, roads and road reserves, footpaths and landscaped areas form parts of a BPZ. The Guideline states that the BPZ must be a minimum of 20 m wide on flat land, increasing as the slope increases.

For the majority of the subject site the minimum BPZ of 20 m will be ensured through widening the road reserves to a minimum of 30 m. A 6 m wide all-weather bridle trail/fire break in accordance with A2.6 of the Guidelines will be constructed along the western perimeter of the site and looping within the PRR, effectively breaking the PRR into 3 areas of vegetation. Eastern side of the trail will be rehabilitated to reduce the bushfire hazard arising from the PRR.

4.4.1 Hazard Separation Zone

A hazard separation zone (HSZ) is generally required on the perimeter of the development.

The western perimeter of the subject site currently adjoins bushfire risk areas classified as low and moderate. Within this area the siting of development must be designed to comply with the following:

- > Every building is sited a minimum of 100 m from designated moderate to extreme areas; or
- > If this is not possible, then increase the construction standard to align with the appropriate BAL for the location in accordance with the *AS3959-2009* and/or introduce other measure to mitigate risk to achieve the Performance Criteria of the Guideline.

Buildings within low bushfire hazard areas shall be sited a minimum of 20 m from any vegetation classified as grassland with accordance of the Guideline.

The HSZ in the perimeter of the subject site will be largely established by upgrading the existing road network. Where dwellings are proposed adjacent to hazardous vegetation within the western perimeter of the subject site, the combination of standard building setbacks from lot boundaries (4 to 6 m) and proposed road reserves will not in all instances provide sufficient setbacks between dwellings and hazardous vegetation. In these instances the design and construction of the dwelling must be done in accordance with the specifications of *AS3959-2009* that reflect the BAL to which an individual dwelling (or other urban structure) would be exposed. The BAL assessment for the proposed building envelope has been determined using the methodology outlined in the Guideline and documented below.

4.4.2 The Bushfire Attack Level

The BAL for the dwellings within the western perimeter of the subject site has been derived based on consideration of the individual hazard scores attributable to the vegetation type and structure, distance of the site from classified vegetation and average land slope.

Currently the unmodified vegetation along the western boundary of the site is located within the HSZ resulting in a rating of BAL-FZ to BAL-40 rating for adjoining lots immediately abutting the PRR development and BAL-40 to BAL-29 for those adjacent to the Sarsparilla Ramble. Bridle trail/firebreak and an access road in accordance with A2.6 of the Guideline will be constructed and area modified to reduce the bushfire hazard as detailed in Figure 4. It is also proposed that the boundary fencing that is required to be constructed along the reserve interface to the property be built to standards for it to act as a shielding structure under the Guideline.

Installation of bridle trail/ firebreak and shielding structure and modification of the vegetation within the eastern side of the firebreak will allow development in the planned location pursuant to Performance Criteria P5 and Acceptable Standard A4.5 of the Guidelines with a BAL-12.5 rating applying to lots immediately behind the shielding structure under the AS3959-2009.

4.5 Design of development

Appropriate design of the subject site will greatly assist in bushfire prevention. Figure 4 prescribes the location, layout and management of future development to reduce fire threat. The specifications include:

- > Restricting new development to lower fire threat areas (i.e. cleared land) and the specification of minimum standards for access;
- > Requirements for low fuel areas and fire breaks, water supply and building standards for development in bushfire prone areas;
- > Construction of 2.2 m high shielding structure to the western boundary of the subject site as detailed in Figure 5;
- > Locating roads on the perimeter of the subject site in most areas and construction of internal roads that provides separation between dwellings;
- > Construction standards of buildings are to be in accordance with the BAL rating specified for the particular building location on the Figure 4 and to otherwise accord with AS3959-2009;
- > Construction of bridle trail/firebreak in the adjacent PRR;
- > New planting eastern side of the bridle trail to utilise low flammability species; and
- > Landscape Management Plan for the POS will need to be consistent with the bushfire protection requirements of this FMP in addition to environmental considerations. The POS shall be actively managed to reduce risk to adjacent buildings.

The Shire will be responsible for annual inspection of all dwellings to ensure ongoing compliance with this FMP under its Annual FN&FHRN. The developer will contribute to the implementation of other fire mitigation measures beyond the subject land and to the equipment needs of local bush fire brigades via a cash contribution made to the Shire at subdivision clearance stage. Each lot owner will also contribute annually via the DFES levy.

4.6 Public Education and Community Awareness

Broader public education and community awareness is at the discretion of the Shire and DFES. This might include school-based education, fire awareness campaigns such as open days, field days and seminars, electronic media or signage visible from major access roads or other suitable location. Also, the Shire's Annual FN&FHRN is issued to every landowner in the Shire with rates notices every year and is publicised in the local press.

4.7 Community Fire Refuges and Fire Safer Areas

There are no designated Community Fire Refuges in the Shire. However, at the time of an emergency, the relevant authorities can select an evacuation centre and DFES, the Shire and Police will provide this information to residents. A predetermined centre cannot be nominated because there are no purpose built structures (such as bunkers) designed to withstand the impacts of a bushfire. This means the location of an evacuation centre is not determined until the position of the fire and the characteristics of a specific event are considered by authorities. The preferred option for residents is to designate a destination that is not in a bushfire-prone area and will be safe to travel to before a bushfire attack.

4.8 Assessment of Fire Management Strategies

Assessment of the FMP and associated strategies will occur in three stages:

- > Assessment and approval of the FMP (for implementation) by the Shire pursuant to conditions of the subdivision approval;
- > Approval and acceptance of the works and measures to be implemented by the developer under the FMP prior to the clearance of conditions of the subdivision to facilitate the issue of titles for the new lots to be created; and
- > A future broader assessment of this FMP and the Shire's FN&FHRN and bushfire management practices by the Shire and DFES as part of a program of continual improvement to fire mitigation and management regimes.

4.9 Implementation

The design of the subdivision area and dwellings constructed at the time of the development are such that with implementation of this FMP, the bushfire threat to person and property within the subject site is significantly reduced.

4.9.1 The Developer

The developer is required to carry out a number of tasks to maintain a reduced level of risk from bushfires including:

- > Install subdivision roads to standards outlined in this FMP;
- > Ensure two way access to the subject site during the staging of the development;
- > Present all lots in a manner consistent with a BPZ at clearance of titles;
- > Install reticulated water supply and hydrants to Water Corporation, DFES and Shire standards;
- > Installation of any internal lot and strategic firebreaks as shown on the FMP;
- > The installation of section of the 6 m wide all-weather 2-wheel drive access road in accordance with A2.6 of the Guidelines as shown on the FMP (Figure 4);
- > Installation of shielding structure to the lots abutting the PRR as shown on the Figure 4 and detailed in Figure 5;
- > Comply with the Shire's FN&DHRN as published (Appendix A), on all vacant land;
- > Identify lots that are subject to more detailed BAL assessment during the building licence application stage;
- > Lodge a section 70A Notification on each Certificate of Title proposed by this subdivision. The Notification shall alert purchasers of land and successors in Title of the responsibilities of the FMP and bushfire building construction requirements in accordance with the AS3959-2009 construction standards; and
- > Supply a copy of this FMP and The Homeowner's Bushfire Survival Manual to each lot owner/occupier.

4.9.2 Owner/Occupier of the Lot

To maintain the reduced level of risk and threat of fire, the owners/occupiers of lots will be responsible for undertaking, complying and implementing measures protecting their own assets from the threat and risk of bushfire. The owners/occupiers will be responsible for:

- > Ensuring lots and dwellings comply with the Shire's FN&DHRN and the Home Owners Bush Fire Survival Manual Guidelines;
- > Maintaining the property in good order to minimise bushfire fuels and in accordance with BPZ requirements as follows:
 - Maintain grasses below 25 mm throughout the period 30 November to 31 May every year;
 - Maintain low fuel zones adjacent to all buildings and outbuildings;
 - Trim back all overhanging trees from buildings, driveways and access ways to all buildings; and
 - Have the entire land cleared of all flammable material except substantive trees and bushes by mowing and slashing or other means.
- > Ensuring where fire hydrants are located, they are not obstructed and remain visible at all times;
- > At the time of construction the proposed buildings are to be re-assessed for BAL with the results submitted to the Shire;
- > Buildings are constructed and any renovation conducted in accordance with the AS3959-2009 construction standards; and
- > Contribute toward the provision of local fire management via the DFES Levy applied in conjunction with Local Government rates.

4.9.3 Shire of Serpentine Jarrahdale

The responsibility for compliance with the law rests with individual property owners and occupiers and the following conditions are not intended to unnecessarily transfer some of the responsibilities to the Shire.

The Shire shall be responsible for:

- > Reviewing and certifying compliance with this FMP prior to the clearance of conditions of subdivision approval to facilitate the issue of titles for new lots;
- > Installation of the remainder of the 6 m wide bridle trail/firebreak in accordance with A2.6 of the Guideline as shown on the FMP (Figure 4);
- > Maintaining the bridle trail/firebreak to appropriate standards and ensuring compliance with the Shire's FN&DHRN;
- > Modification of eastern side of the bridle trail to reduce fire hazard;
- > New planting eastern side of the bridle trail to utilise low flammability species;
- > Endorsing a Section 70A Notification on each Certificate of Title affected by this FMP;
- > Periodic checking of hydrants for operation and reporting any faults discovered to the Water Corporation;
- > Maintaining public roads to appropriate standards and ensuring compliance with the Shire's FN&DHRN;
- > Reviewing the FMP as necessary;
- > Monitoring bushfire fuel loads in road reserve sites, eastern side of the bridle trail and remnant vegetation areas and liaising with relevant stakeholders to maintain fuel loads at safe levels;
- > Ensuring buildings are constructed to AS3959-2009 where applicable;
- > Periodic review of the FMP and broader fire policies and practices to assess their effectiveness; and
- > Enforcement of the Annual Firebreaks Notice.

4.9.4 Water Corporation

- > Developing and maintaining the fire water supply and infrastructure in good condition.

5 Conclusion

The subdivision plan of the subject site will place most of the dwellings in areas where exposure to any discernible threats in the event of a bushfire occurring in the subject site locality are unlikely and as such satisfies the objective of the Guideline to avoid areas of extreme and moderate bushfire hazard.

Notwithstanding this, a number of lots will be placed along the western perimeter of the site which is currently located next to the PRR classified as moderate bushfire hazard area.

In respect to this area the FMP makes appropriate provision for the mitigating the risk through:

- > inclusion of bridle trail/firebreaks that provide adequate:
 - setbacks between buildings/structures and hazardous vegetation;
 - separation between copses of trees adjacent to the development boundary, and
 - access for firefighting/other emergency vehicles.
- > Installation of shielding structure;
- > modification of the eastern side of the bridle trail to reduce fire hazard by removal of grasses and replacement with low-flamability species;
- > providing adequate road access for firefighting/other emergency vehicles and safe evacuation; and
- > providing an adequate and accessible water supply for firefighting purposes.

The design and construction of dwellings in areas adjacent to the western boundary will also need to satisfy the relevant requirements of *AS3959-2009*. Based on the mitigation measures incorporated into the design of the subject site the relevant *AS3959-2009* design level would generally correspond to a BAL of 12.5 applying to lots immediately behind the shielding structure.

It is also noted that a potential reduction in the BAL requirements for dwellings may be permitted when a more detailed analysis is carried out in the building licence application phase.

Based on the BAL assessment conducted as a part of this FMP, it is concluded that the proposed dwellings and lots will fall within the acceptable level of risk and, if required, will have construction standards increased to meet *AS3959-2009* requirements.

6 References

Australian Standards (AS3959-2009): Construction of buildings in bushfire prone areas.

Building Code of Australia 2011

Bureau of Meteorology (BoM) (2014). Climate data for Jandakot Airport weather station. www.bom.gov.au, accessed 10th of February 2014.

Bushfires Act (1954)

Byford Structure Plan (2009)

Gray & Lewis (2004). Local Structure Plan Lots 1, 2 and 63 Thomas Road/Larsen Road, Byford

Shire of Serpentine Jarrahdale (2013). Firebreak Notice and Fuel Hazard Reduction Notice 2013-2014

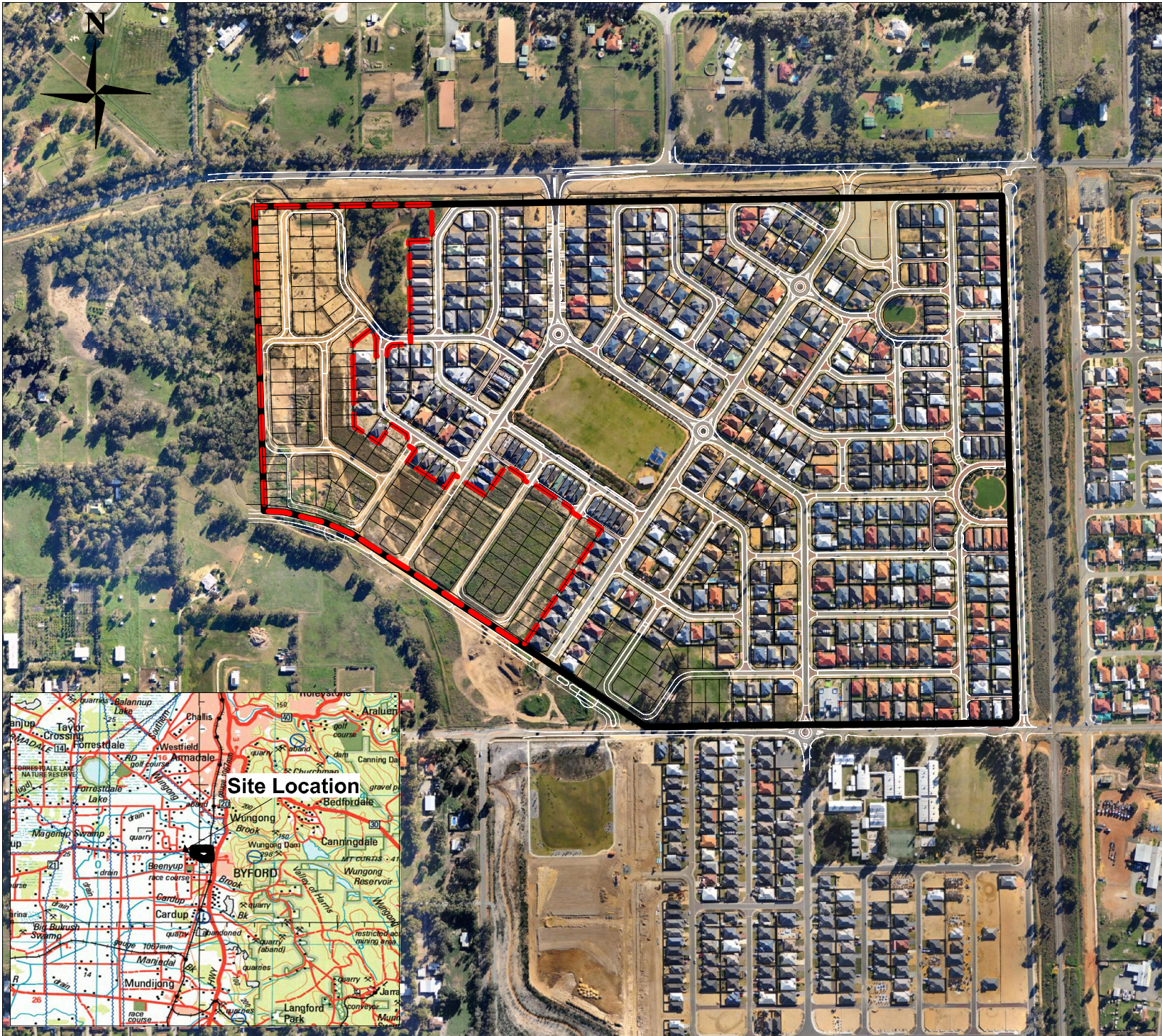
Western Australian Planning commission (WAPC), FESA and Departments of Planning and Infrastructure (2010) Planning for Bushfire Protection – Edition 2. Western Australian Planning Commission, Perth.

7 Abbreviations

B	
BAL	Bushfire Attack Level
BPZ	Building Protection Zone
D	
DFES	Department of Fire and Emergency Services
F	
FN&FHRN	Firebreak Notice and Fuel Hazard Reduction Notice
FMP	Fire Management Plan
G	
Guideline	<i>Planning for Bushfire Protection Guidelines – Edition 2</i> (WAPC et al. 2010)
H	
HSZ	Hazard Separation Zone
P	
POS	Public Open Space
PRR	Public Recreation Reserve
S	
Shire	Shire of Serpentine Jarrahdale
W	
WA	Western Australia
WAPC	Western Australian Planning Commission

FIGURES




- Figure 1 Site Location**
- Figure 2 Bushfire Management Plan**
- Figure 3 Road Network and Water Reticulation**
- Figure 4 Bushfire Risk Assessment**
- Figure 5 Shielding Structure Details**



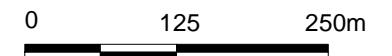
Byford Fire Management Plan

Figure 1 Site Location

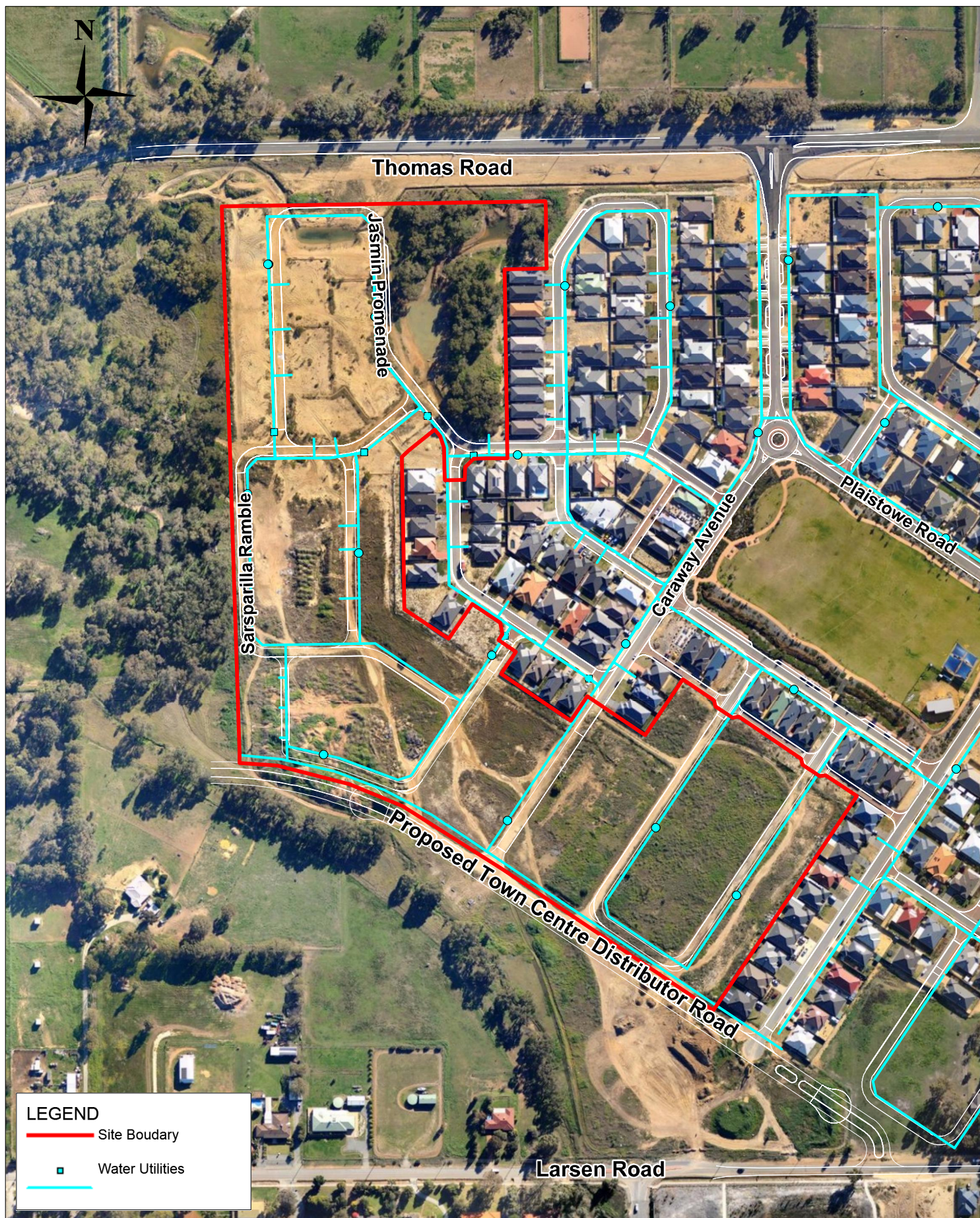
LEGEND

-  Byford Structure Plan Boundary
-  Site Boundary
-  Lot Boundaries

Scale 1:10,000 Scale at A4



Map Produced by Cardno WA Pty Ltd
 Date: 17 February 2014
 Coordinate System: Zone 50 MGA/GDA 94
 GIS MAP REF:
 <E13036>_<FMP>_<Figure 1 Site Location.wor>01



Byford Fire Management Plan

Figure 2 Water Supply and Road Network

Scale 1:5,000 Scale at A4

0 50 100m



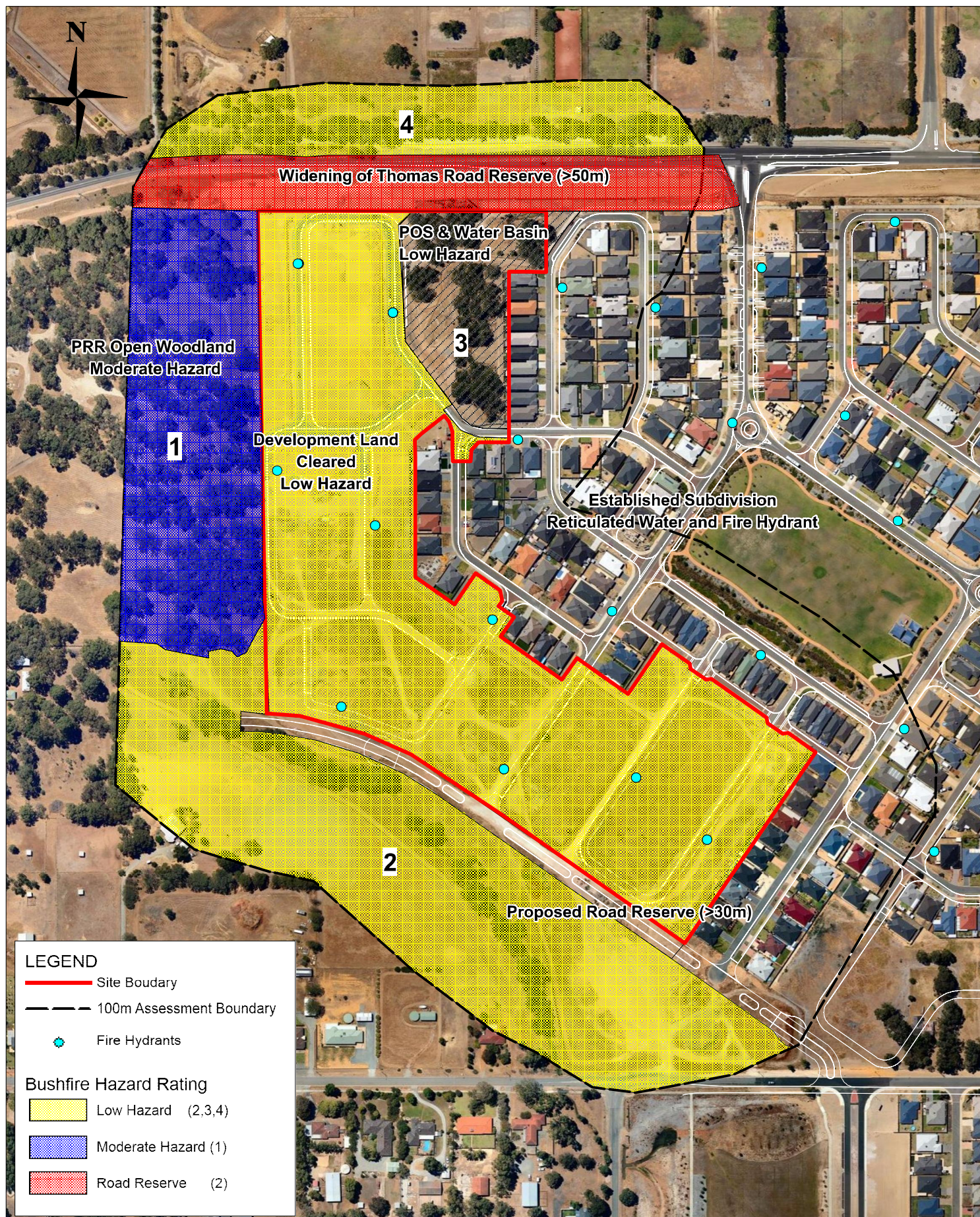
Map Produced by Cardno WA Pty Ltd

Date: 14 February 2012

Coordinate System: Zone 50 MGA/GDA 94

GIS MAP REF:

<E13036>_<FMP>_<Figure 2. Water Supply .wor> 01



Byford Fire Management Plan

Figure 3 Bushfire Risk Assessment

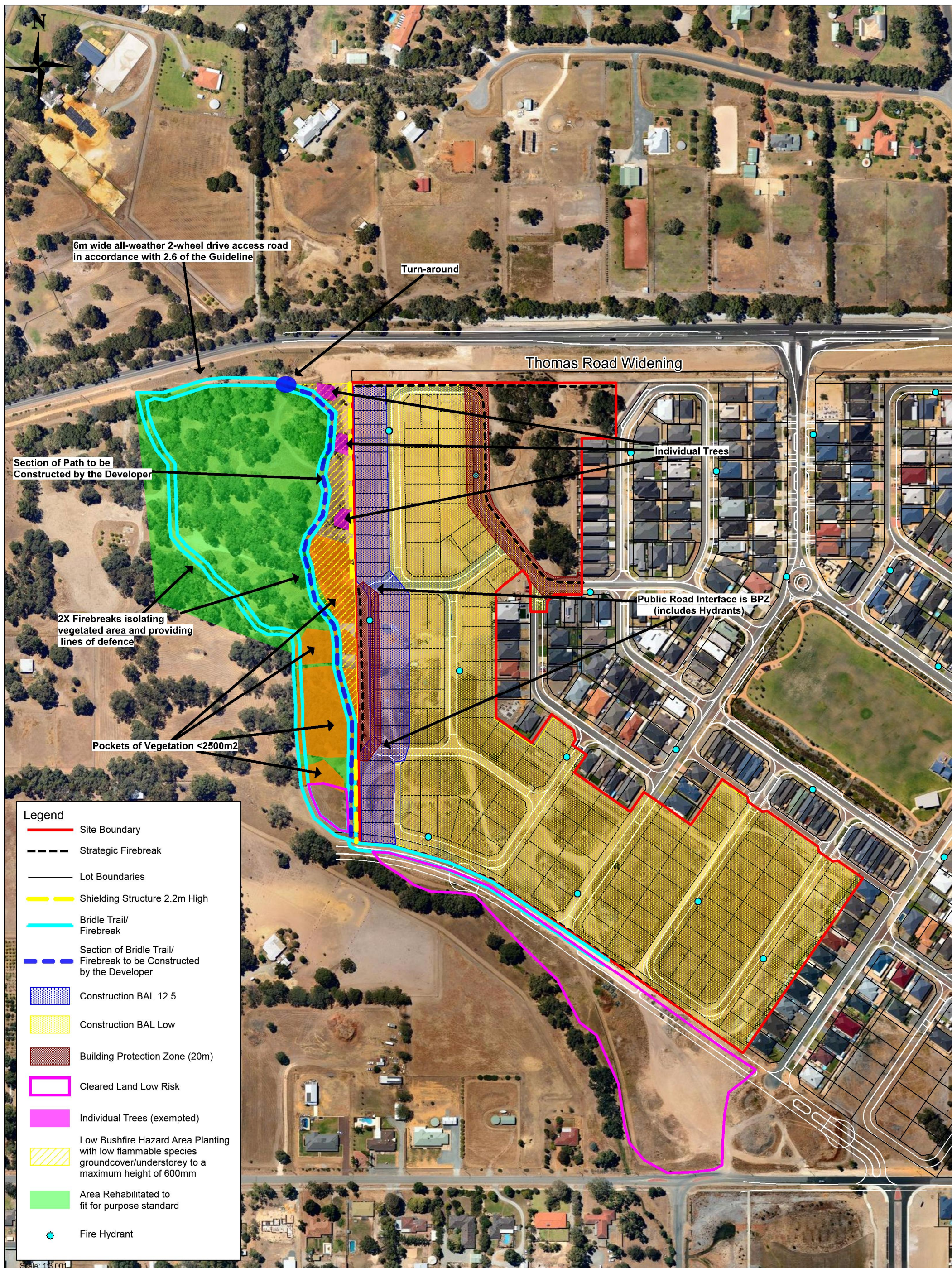
Scale 1:4,000 Scale at A4

0 50 100
metres



Map Produced by Cardno WA Pty Ltd
Date: 14 February 2012
Coordinate System: Zone 50 MGA/GDA 94

GIS MAP REF:
<E13036>_<FMP>_<Figure 3. Bushfire Risk.wor> 01



Scale 1:3,000 Scale at A3

0 50 100
metres

Byford Fire Management Plan

Figure 4 Bushfire Management Plan



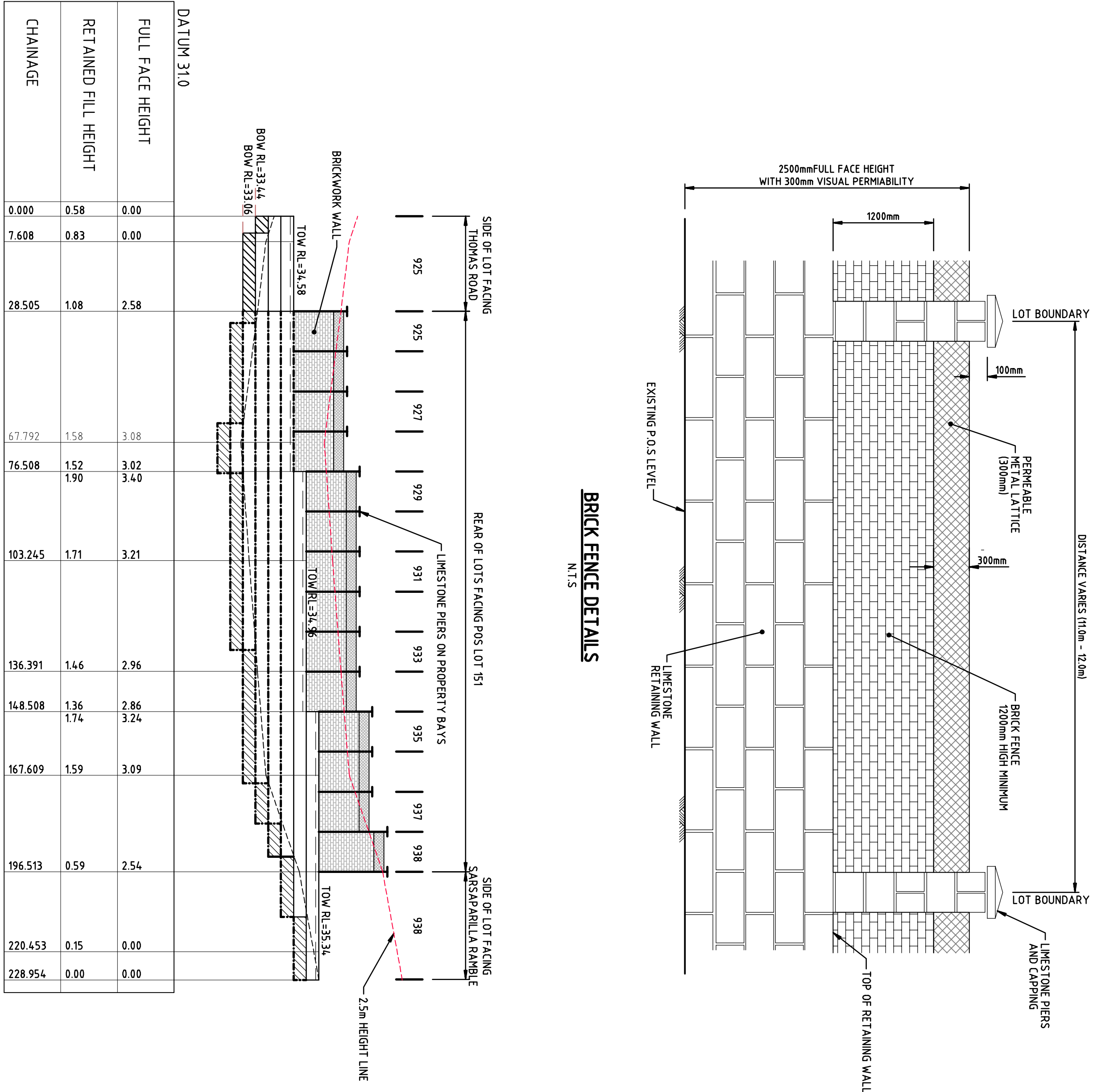
Map Produced by Cardno WA Pty Ltd
Date: 14 February 2012
Coordinate System: Zone 50 MGA/GDA 94
GIS MAP REF:
<E13036>_<FMP>_<Figure 4. Bushfire Mgt.wor>

[illegible]

© Cardno Limited All Rights Reserved.



Cardno (WA) Pty Ltd
11 Harvest Terrace, P.O. Box 44, West Perth Western Australia 6872
Phone (08) 9273 3888 Fax (08) 9486 8664
South West Regional Office
Unit 2, 89 Duncanson Street, Busselton Western Australia 6280
Phone (08) 9781 1444 Fax (08) 9752 2471

[illegible]

BRICK FENCE DETAILS

N.T.S

Byford Central, Lots 9016 & 9017

APPENDIX A

FIRE MANAGEMENT
PLAN COMPLIANCE
CHECKLIST

FIRE MANAGEMENT PLAN

Byford Central, Lots 9016 & 9017

Compliance checklist for performance criteria and acceptable solutions

Element	Yes/No
Element 1: Location	
Does the proposal comply with the performance criteria by applying acceptable solution A1.1?	Yes
Element 2: Vehicular access	
Does the proposal comply with the performance criteria by applying acceptable solution A2.1?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.2?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.3?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.4?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.5?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.6?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.7?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.8?	N/A
Does the proposal comply with the performance criteria by applying acceptable solution A2.9?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A2.10?	Yes
Element 3: Water	
Does the proposal comply with the performance criteria by applying acceptable solution A3.1?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A3.2?	N/A
Does the proposal comply with the performance criteria by applying acceptable solution A3.3?	N/A
Element 4: Siting of development	
Does the proposal comply with the performance criteria by applying acceptable solution A4.1?	No
The FMP complies with the performance criteria by means other than applying acceptable solution A4.1, as follows:	
<ul style="list-style-type: none"> ▪ The vegetated area between the bridle trail and development boundary will be modified to reduce bushfire risk; ▪ Reserves of the Thomas Road and proposed Town Centre Distributor Road provide a strategic firebreak between the areas north and south and future development; and ▪ The development of the subject land include introduction of a reticulated emergency water supply and fire hydrants at 200m intervals throughout the subdivision, thus providing appropriate means of sufficient fire suppression at the boundaries of the FMP area. 	
Does the proposal comply with the performance criteria by applying acceptable solution A4.2?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A4.3?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A4.4?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A4.5?	Yes
Element 5: Design of development	
Does the proposal comply with the performance criteria by applying acceptable solution A5.1?	Yes
Does the proposal comply with the performance criteria by applying acceptable solution A5.2?	Yes

Applicant Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Full name: Michael Swift (Cardno WA) on behalf of Rivermoon Corporation.

Applicant signature:



Michael Swift

for Cardno

Date: 19 May 2014

About Cardno

Cardno is an ASX200 professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company, listed on the Australian Securities Exchange [ASX: CDD].

Contact

Perth

11 Harvest Terrace
West Perth WA 6005

PO Box 447
West Perth WA 6872

Phone +61 8 9273 3888

Fax +61 8 9486 8664

wa@cardno.com
www.cardno.com

