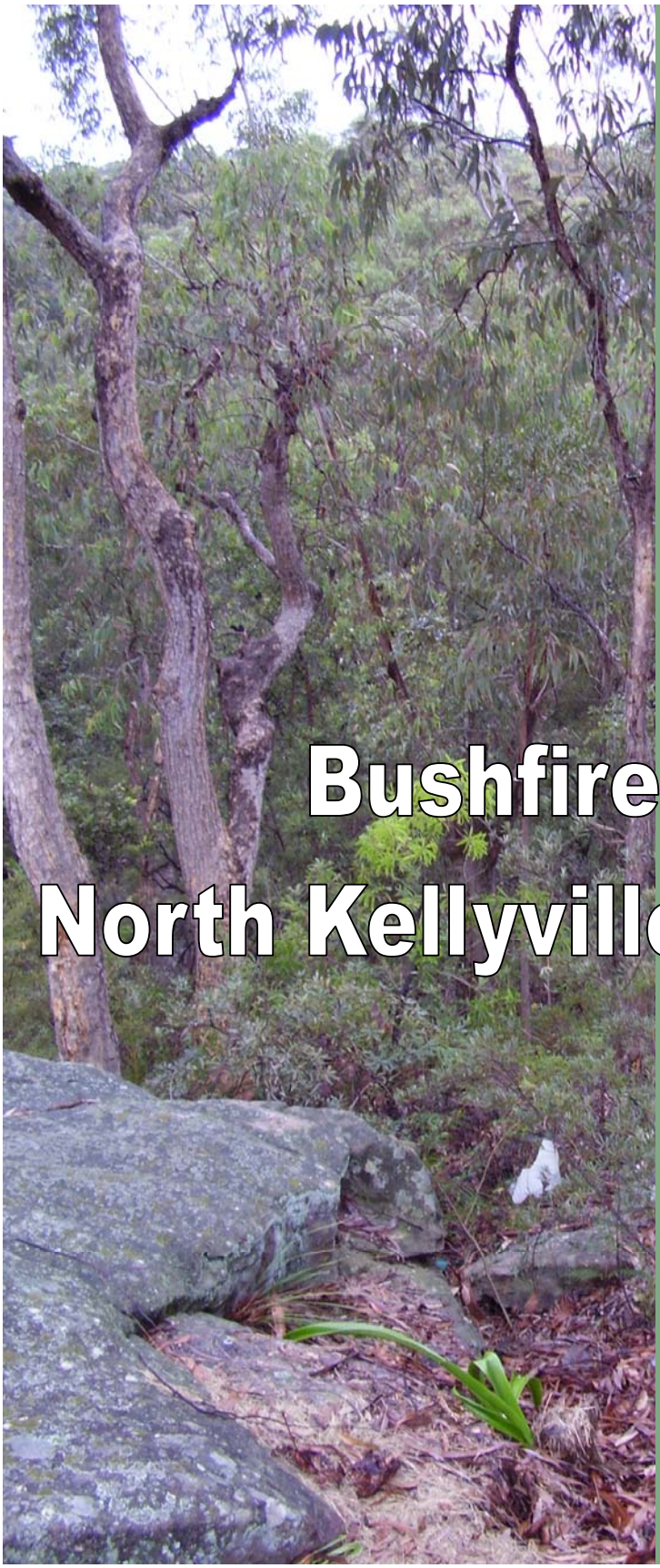

Travers environmental

Bushfire Planning
North Kellyville Precinct

Growth Centres Commission

FEBRUARY 2008

BUSHFIRE PLANNING
NORTH KELLYVILLE PRECINCT

FOR
GROWTH CENTRES COMMISSION

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EXECUTIVE SUMMARY

Bushfire planning has been undertaken by *Travers environmental Pty Ltd* on behalf of the Growth Centres Commission for the North Kellyville development precinct.

The North Kellyville precinct occupies an area of 706 hectares and is situated within the Baulkham Hills Local Government Area (LGA). Figure 1 provides an aerial appraisal of the site. North Kellyville forms part of the north-west Growth Centres land release area. The precinct has been identified as one of the future growth centres. This site has the potential to support approximately 4,500 to 5,000 dwellings. The site is also proposed to support 2 retail centres and 1 primary school.

Strategic planning has been required for this precinct due to the existence of approximately 230 separate rural / rural residential allotments and the need for a focused and strategic approach to land use planning.

Bushfire planning has considered the matters raised within the NSW Rural Fire Service planning document *Planning for Bushfire Protection, 2006 (PBP).* PBP provides planning controls for building in bushfire prone areas as well as guidance on effective bushfire protection measures.

The assessment has been prepared to contribute to the creation of a precinct plan and an indicative layout plan for North Kellyville. The Growth Centres Commission has taken the lead role in preparing the preliminary indicative layout plan. This report provides an assessment of the bushfire protection measures required for the development to guard against the potential impact of bushfires. Recommendations have been made in respect of fuel management, construction standards / building protection, access, bushfire education and land ownership responsibility.

Fuel management planning will be required for the proposed public conservation reserves. Similarly a coordinated approach to fuel management planning should occur for the two major creek environments so that biodiversity values can be maintained as complex ecosystems and not simplified through poor management practices. More difficult, but equally necessary, will be a need to ensure that hazard management practices are maintained for existing allotments should grazing animals be removed as development occurs over the ensuing years.

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BUSHFIRE PLANNING – NORTH KELLYVILLE PRECINCT

1 INTRODUCTION

Bushfire planning has been undertaken by *Travers environmental o*n behalf of the *Growth Centres Commission for an area of land known as the North Kellyville Precinct.*

A team of consultants lead by the *Growth Centre Commission* has prepared a Preliminary Indicative Layout Plan which summaries the potential development of the North Kellyville development precinct. An aerial appraisal of the precinct and surrounds is provided at Figure 1.

Bushfire planning requires consideration of the matters raised within the NSW Rural Fire Service planning document entitled *Planning for Bushfire Protection* published in 2006 *(PBP).* PBP provides planning controls for building in bushfire prone areas as well as guidance on effective bushfire protection measures.

A set of figures has been prepared to accompany this document:

Figure 1: Provides an aerial appraisal of the North Kellyville Precinct.
Figure 2: Provides the Indicative Layout Plan for the precinct.
Figure 3: Provides the proposed zoning for the precinct.
Figure 4: Depicts the vegetation communities as surveyed by Cumberland Ecology.
Figure 5: Depicts the vegetation to be retained within the precinct as well as the riparian stream classifications.
Figure 6: Provides a detailed slope analysis undertaken to determine the required asset protection zones for the precinct.
Figure 7: Depicts the proposed road network within the precinct.

In addition, a detailed set of bushfire plans has been prepared within this document. Due to the size of the precinct and the detailed bushfire planning required, the plans (schedules) have been divided into 6 separate zooms. These six zooms accompany Schedule 1 as

Schedule 1.1: Covering the area to the south west of Public Recreation Zone 2, extending to Smalls Creek on the Precincts western boundary. It includes the areas adjacent Hezlett Road, Withers Road, Curtis Road and Gum Nut Close and creek lines 1– 4.

Schedule 1.2: Covering Hillview Road and the northern end of Barry Road. Smalls Creek and Creek lines 4-10 are also included in this zoom.

Schedule 1.3: Covering the northern point of the Precinct including Ross Place, Stringer Road, Public Recreation Zone 3, Cattai Creek and creek lines 9-15.

Schedule 1.4: Covering the area to the north east of Barry Road, including Heath Road, Cattai Creek and creek lines 16-19.

Schedule 1.5: Covering the area to the north east of Public Recreation Zone 2, extending to Cattai Creek on the Precincts eastern boundary. The proposed school and creek lines 20-22 are also included in this zoom.

Schedule 1.6: Covering the area to the north east of Public Recreation Zone 1, extending to Cattai Creek. It includes Foxall Road, the proposed sporting fields and creek lines 22-24.

1.1 AIMS OF THE ASSESSMENT

The aim of this bushfire planning document is to:

- Undertake an assessment of the bushfire prone lands
- Determine the possible bushfire attack on those lands
- Provide advice on mitigation measures including the provision of asset protection zones and construction standards in accordance with *'Planning for Bushfire Protection, 2006'*
- Review the potential to carry out hazard management over the landscape
- Liaise with the NSW Rural Fire Service.

1.2 INFORMATION COLLATION

To achieve the aims of this report, a review of the information relevant to the study area y was undertaken prior to the initiation of field surveys. Information sources reviewed include the following:

- Preliminary Indicative Layout plans prepared by *Jackson Teece 17.12.07*
- Vegetation mapping by *Cumberland Ecology*
- Australian Standard 3959 '*Construction of Buildings in Bush Fire Prone Areas*'
- 1:25,000 Topographic Map
- DLWC 1:25,000 Aerial Photograph

An inspection of the precinct and surrounds was undertaken on several occasions in 2007 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bush fire protection measures and a visual appraisal of bush fire hazard and risk were also undertaken. Site inspections occurred in cooperation with Growth Centres Commission, Cumberland Ecology staff, Jackson Teece and other assisting consultants.

1.3 PROJECT SYNOPSIS

The North Kellyville Concept Application seeks the approval of a precinct plan and a preliminary indicative layout plan (see Figure 3). This plan highlights the proposed land zoning within the Growth Centres landscape. These zonings include:

- A *neighbourhood and local centre* located at the junction of Samantha Riley Drive and Hezlett Road and also at the junction of Hezlett Road and Withers Road. These areas will incorporate high density residential development, service station, retail and medical centre, supermarkets and child care centre.

- *Medium density residential* zoning concentrated along the main arterial routes and adjacent to the ephemeral drainage lines of Smalls Creek.

- Low density residential is proposed within the majority of the land in the precinct.

- *Environmental Living* zoning adjoining Cattai Creek. This area incorporates large allotments to take into account the steep (>18^0) land, riparian corridors and

vegetation of high conservation value. This zoning provides sufficient area for the application of asset protection zones.

- *Public Recreation* Zones (Open Space) have been identified throughout the site. At least three of these zones will be set aside as bushland reserves for the protection of endangered ecological communities. The remaining zones will be managed as public open space for use as ovals and parks etc.

For the purposes of this report the development has been divided into four zones (see Schedule 1).

- Smalls Creek South is located within the south-western portion of the site and to the south of Withers Road. (Refer to Zoom 1, Table 2)

- Smalls Creek North is located in the north-western portion of the site and to the north of Withers Road. (Refer to Zoom 2, Table 3)

- Environmental Living is located in the eastern portion of the site (Refer to Zoom 3-6 and Table 4)

- Public Recreation Zones are located throughout the precinct. Three of these zones (marked red hatch in Schedule 1) will be set aside as bushland reserves for the conservation of Ecological Endangered Communities. (refer zoom 5, 6, 3 and Table 5)

- The remaining zones (marked purple in Schedule 1) will be managed as public open space for use as sporting ovals and parkland areas.

Cattai and Smalls Creek adjoin the boundaries of the North Kellyville precinct. There are also over 20 ephemeral water courses within the precinct which flow into Cattai and Smalls Creek. These areas will be regenerated and restored to maintain the natural forest vegetation structure in accordance with riparian buffer analysis.

As the North Kellyville landscape is currently developed as rural residential / rural there are many existing residences and other associated infrastructure such as roads and other services. These are not to be isolated from the current bushfire planning focus but are to be considered as part of the insitu landscape for future development options.

Current owners are not in any way affected by any statements within this document that may be considered to be ambiguous. It is fully recognised that they are central to the development options available.

It is the case that where any existing development such as dwelling houses exist within close proximity to bushfire prone lands then any further development applications may cause a review of the bushfire protection measures employed to date. That will be the role of the NSW Rural Fire Service.

1.4 CONSULTATION WITH THE NSW RURAL FIRE SERVICE

Consultation occurred with the NSW Rural Fire Service on 22nd November 2007 to discuss the future development of the North Kellyville site. The RFS were shown the *preliminary indicative layout plan* prepared by *Jackson Teece* and a series of plans prepared indicative of proposed asset protection zones as well as other plans undertaken by various consultants.

Explanations were provided to the RFS on likely hazard management options within the private lands relative to the provision of perimeter roads and or fire trails given the management of bushfire hazards across the precinct landscape will be in the main managed by private owners.

The RFS required that the DCP should generally comply with the *aims & objectives* of the *Planning for Bushfire Protection 2006.* In addition the RFS advised that any planning for either residential and or rural residential subdivision was required to be considered under the requirements of the Rural Fires Act Section 100B.

There was no legislative possibility to vary this assessment requirement and have the precinct formerly assessed by the RFS under the provision of the DCP. It is the case that the RFS is able to consider the DCP as an appropriate development control instrument and potentially agree to sign off subdivision planning. But as the North Kellyville planning has yet to exhibit a final preliminary indicative layout plan, that option was not available.

The RFS further advised that without detailed knowledge of subdivision intentions by individual owners, no such planning agreement of conference of a general bushfire safety authority was possible. Thus the RFS will require a review of any development planning by way of subdivisions that occur on the land in the future. This also includes any special fire protection purpose facilities such as aged care facilities, schools etc should they occur.

1.5 SITE DESCRIPTION

Landscape Context

The precinct (refer Figure 1) is situated on the northern side of Samantha Riley Drive between Smalls Creek and Cattai Creek.

The precinct occupies an area of 706 hectares and is situated within the Baulkham Hills Local Government Area (LGA).

The precinct is surrounded by Nelson and Box Hill to the north, Rouse Hill to the west, Kellyville to the south, Beaumont Hills to the south-west and Annangrove to the east.

Approximate Australian Map Grid (AMG) coordinates for the site are 310000E and 6271000N.

Currently there are approximately 230 narrow lots within the precinct. The majority of these lots are 2 hectares or above and are characterised by predominately rural residential, rural industry and agricultural uses such as nurseries, market gardens and chicken farms.

Natural Landscape Descriptions

Topography and Drainage

The precinct encompasses the northern end of a ridgeline and is naturally enclosed by Smalls Creek in the west and Cattai Creek in the east. These creek lines form a junction at the northern point of the precinct boundary and continue to flow in a northerly direction. Cattai and Smalls Creek have a generally continuous flow with permanent water. Over 20 smaller tributaries that flow into these creek lines are present throughout the site however these are mostly small ephemeral streams.

The topography across the central portion of the precinct is gently undulating with steep lands and gullies on the outskirts of the precinct boundary along the creek lines.

Gradients of the precinct range from steep (>18^{o}) along Cattai Creek in the east to moderate 5 – 10^{o} along Smalls Creek in the west to less than 5^{o} along the top of the ridge line.

The approximate elevation ranges from less than 10m AHD within the creek lines to 73 - 87m (AHD) on the ridge within the central section of the precinct. A slope analysis of the site has been undertaken and depicted on Figure 6.

1.6 LAND OWNERSHIP

Currently there are approximately 230 lots within the precinct which are privately owned by a variety of land holders. The majority of these lots are characterised predominately by rural residential, rural industry and agricultural uses.

Sydney Water is in ownership of the trunk drainage areas located adjacent to Smalls Creek. The local roads, drainage areas and open space are owned by Baulkham Hills Council.

Derubbin Local Aboriginal Land Council (DLALC) are in ownership of Portions 187 and 188, Parish Castle Hill, County of Cumberland (Claim no's 2669 and 2670) located off Heath Road, North Kellyville.

2.1 LEGISLATIVE RELATIONSHIPS

The Growth Centres landscape is located on land that is mapped by Baulkham Hills Council as being bushfire prone. This triggers assessment by Council in respect of the NSW Rural Fire Service policy document PBP 2006. This also requires the RFS to consider issuing a *Bushfire Safety Authority* for any subdivision of rural and or rural residential land or the development of special fire protection purpose developments such as aged care facilities, tourist facilities, child care centres and schools.

2.2 PLANNING POLICIES

PBP 2006 provides concepts for building in bushfire prone areas as well as guidance on the planning and development control processes in relation to bushfire protection measures.

PBP 2006 aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property from the threat of bush fire, while having due regard to development potential, onsite amenity and protection of the environment. More specifically, the objectives are to:

The *aims & objectives* as outlined with PBP 2006 are to;

1. Afford occupants of any building adequate protection from exposure to a bush fire

2. Provide for a defendable space to be located around buildings

3. Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition

4. Ensure that safe operational access and egress for emergency service personnel and residents is available

5. Provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ); and

In addition where there is potential for developments that require special protection considerations such as aged care facilities, schools and or child care centres etc, then further consideration must be attended to, such as;

6. Provide for the special characteristics and needs of occupants. Unlike residential subdivisions, which can be built to a construction standard to withstand the fire event, enabling occupants and fire fighters to provide property protection after the passage of fire, occupants of SFPP developments may not be able to assist in property

protection. They are more likely to be adversely affected by smoke or heat while being evacuated.

7. Provide for safe emergency evacuation procedures. SFPP Developments are highly dependent on suitable emergency evacuation arrangements, which require greater separation from bush fire threats. During emergencies, the risk to fire fighters and other emergency services personnel can be high through prolonged exposure, where door-to-door warnings are being given and exposure to the bush fire is imminent.

The RFS also advised that where there is no subdivision is proposed on an allotment then the *Infill Development* aims & objectives should be considered and applied.

8. Ensure that the bush fire risk to adjoining properties is not increased

9. Provide a minimum defendable space

10. Provide better bushfire protection on a redevelopment site than the existing situation. This should not result in new works being exposed to a greater risk than the existing building.

11. Ensure that the footprint of the proposed building does not extend towards the hazard beyond existing buildings lines on neighbouring land.

12. Not result in an increased bushfire management and maintenance responsibility on adjoining lands unless they have agreed to the development

13. Ensure building design and construction enhances the chances of occupant and building survival.

2.3 Construction and Development Standards

In the development of residential communities there are several Australian Standards that contribute to the effective planning, design and construction in bushfire prone areas. Specifically they relate to the construction of dwellings and other buildings, the supply of sufficient water through hydrants and other non integrated supply sources; and the planning framework for emergency evacuation.

2.3.1 Australian Standard AS 3959 Construction of Buildings in Bushfire Prone Areas

This standard sets out requirements for the construction of buildings in bushfire prone areas. These requirements are intended to improve the performance of buildings subjected primarily to bushfire attack.

2.3.2 Australian Standard AS 3745 Emergency control organization and procedures for buildings

This standard gives guidance on the establishment of an Emergency Control Organisation (ECO) and the preparation of emergency procedures for buildings or groups of buildings, for ensuring controlled movement of occupants including evacuation as necessary.

2.3.3 Australian Standard AS 2419 Fire Hydrant Installations

This standard specifies requirements for the installation of fire hydrants when connected to town water. It also specifies the requirements for hydrant system design and acceptable sources of water supply. The standard is, however, subordinate to the PBP in that PBP requires hydrant spacing to be no more than 70 metres in residential developments.

2.4 NORTH KELLYVILLE PRECINCT DCP 2008 (DRAFT) AND PRELIMINARY INDICATIVE LAYOUT PLAN (ILP)

Strategic planning has been required for this precinct due to the existence of 230 separate rural / rural residential allotments and the need for a focused and strategic approach to land use planning.

The Growth Centres Commission has taken the lead role in seeking the preparation of a Preliminary Indicative Layout Plan (PILP). The PILP is integrated within the proposed North Kellyville Precinct DCP 2008 (Draft). With the submission of the DCP, the Growth Centres Commission is seeking a global approval for the DCP to enable a rapid assessment of applications which are compliant with the DCP. Where an application is not compliant with the DCP, the Council are required to refer the application to the relevant authorities for assessment.

The PILP is a set of seven maps depicting a range of development outcomes including (1) the preliminary proposed layout (refer Figure 2), (2) building heights, (3) Vegetation of high conservation value, (4) land reservation acquisition, (5) minimum lot sizes, (6) retained native vegetation, and (7) the proposed zoning for the precinct.

These proposed zonings are described below and depicted on Figure 3.

- **B1 and B2**: A *neighbourhood* and *local centre* located at the junction of Samantha Riley Drive and Hezlett Road and also at the junction of Hezlett Road and Withers Road. These areas will incorporate high density residential development, service station, retail and medical centre, supermarkets and child care centre.

- **R1, R2 and R3**: *General, Low and Medium density residential* zonings concentrated along the main arterial routes and adjacent to the ephemeral drainage lines of Smalls Creek. The R2 Low density residential is proposed within the majority of the land in the subject site.

- **E3**: *Environmental Management* located adjacent Cattai Creek located centrally on the precincts eastern boundary

- **E4**: *Environmental Living* zoning adjoining the precincts eastern boundary adjacent Cattai Creek. This area incorporates large allotments to take into account the steep (>18^0) land, riparian corridors and vegetation of high conservation value. This zoning provides sufficient area for the application of asset protection zones.

- **RE1**: *Public Recreation* Zones (Open Space) have been identified throughout the site. At least three of these zones will be set aside as bushland reserves for the

protection of endangered ecological communities. The remaining zones will be managed as public open space for use as ovals and parks etc.

2.4.1 DESIGN PRINCIPLES

Design principles for the future land use of the North Kellyville development precinct have been identified within the DCP. Before granting development consent, the consent authority must be satisfied that the development is consistent with the following principles (in so far as they are, in its opinion, applicable to the development):

- Responsiveness to the natural environment and visual character of the land with respect to topography, vegetation and riparian corridors,

- Promotion of a road layout and design that:
  (a) accommodates integrated stormwater management and water sensitive design,
  (b) connects major activities and open spaces in a direct and appropriate manner, and
  (c) accommodates the needs of pedestrians, cyclists and vehicles,

- Provision of a street block orientation that:
  (a) responds to site and climate,
  (b) accommodates a range of uses and dwelling types,
  (c) maximises the provision of lots fronting open space and streets, and
  (d) emphasises amenity in terms of passive solar design, privacy and casual surveillance,

- Provision of an interconnected network of accessible, safe and well located open spaces, pedestrian paths and linkages that cater for a range of uses and activities and accommodates integrated stormwater management and water sensitive design,

- Promotion of a built form that responds appropriately to its site area, in terms of gross floor area, height, bulk and scale,

- Establishment of a built form that is of high architectural quality, minimised the impact on the privacy or solar access of neighbouring properties and maintains a reasonable sharing of views and outlook,

- Provision of access to private, usable and functional open space for all dwelling types,

- Provision of energy efficiency in design.

2.4.2 VEGETATION CONSERVATION AND RIPARIAN CONSTRAINTS ANALYSIS

Vegetation mapping has been undertaken by *Cumberland Ecology*. Eight (8) vegetation communities (see Figure 4) have been identified with varying levels of disturbance. The identification of high quality vegetation has led to areas being set aside for restoration and conservation in perpetuity (see Figure 5). The bushfire planning for the site has taken these areas into consideration when designing the asset protection zones required for the precinct.

In addition natural and disturbed native riparian open forest forms the northern, eastern and western boundaries of the property encompassing Smalls and Cattai Creek. There are also numerous ephemeral streams within the eastern and western boundaries of the site. These

creek lines and streams have been classified into Category 1, 2 and 3 and as such have varying vegetative buffers assigned to them in accordance with their classification.

Category 1 (Smalls and Cattai Creek) – 100m wide vegetated Buffer Zone
Category 2 – 55m wide vegetated buffer zone
Category 3 – 25m wide vegetated buffer zone

The stream classifications applied to the precinct are provided in Figure 5.

Native vegetation is present within Heathcote Reserve found in the central portion of the eastern boundary and along the edge of Cattai Creek. Native vegetation also extends external and adjacent to the western boundary along Smalls Creek.

The riparian vegetation found along the creek lines range from highly disturbed to that of high conservation value particularly within the steeper sections of Cattai and Smalls Creek. This is largely due to the fact that the steep slopes have prevented land clearing from taking place. It is proposed that the conservation area, including the riparian corridors, will be restored where necessary to form its natural vegetation type.

2.4.3 PUBLIC PARKS

Public Parks have been provided throughout the precinct. In accordance with the DCP, parks should be located and designed to accommodate remnant vegetation and where appropriate, should be linked to and integrated with riparian corridors.

Riparian corridors and conservation areas are to provide opportunities for pedestrian and cycleways, fitness trails and additional open space in a manner that maintains the environmental significance of these areas. A range of themed elements such as boardwalks, eco-pathways, and educational tracks should be utilised in appropriate locations (ie within the 10m riparian corridor buffer).

A landscape plan is required to accompany a subdivision DA creating any park and is to provide details on elements such as earthworks, plant species and sizes (with consideration for bush fire risks), hard and soft landscaping treatments, signage and waste facilities.

2.4.4 STREET NETWORK AND DESIGN

Various levels of street design have been provided throughout the precinct depending upon the level and type of traffic that they are designed to accommodate. These street types are provided within the DCP and depicted on Figure 7.

The main access throughout the precinct consists of Ross Place, Stringer Road, Barry Road, Withers Road and Foxall Road these roads are referred to as Collector roads within the DCP. The collector roads form a T-intersection with Samantha Riley Drive to the south of the development precinct.

The collector roads collect traffic from the local streets and carry the volume of traffic, linking neighbourhoods and centres and accommodating public transport routes. In accordance with the DCP, amenity and safety is to be maintained by restricting vehicle speeds through traffic calming measures and intersection design. Intermittent parking with landscaping is provided on both sides of the street.

In terms of fire fighting and evacuation, the provision of adequate road access has been considered within the development design for the precinct. For example:

- The two way movement of fire fighting vehicles requires the consideration of appropriate width, a 4m vertical clearance, and no severe dips / crests in the road alignment.

- Non perimeter single lane roads require a width of at least 4.5 meters.

- Construction standards of roads and any bridges which allow for the carrying of Category 1 Bushfire Tankers with a G.V.M of 15 tonnes.

- Roads should provide a 6m internal radii to corners and a turning radius of 12 metres to roundabouts/cul-de-sacs.

- Maximum grades do not generally exceed 15 degrees and an average grade of not more than 10 degrees.

- Clearly sign posted roads

- In situations where narrow access corridors are proposed (e.g. less than 15 meters in width) any dead-end roads in excess of 200 metres in length are to be avoided. The exception is where those roads are connected to a fire trial or emergency access point.

- Public roads, private roads and fire trails are to be constructed in accordance with *Planning for Bushfire Protection, 2006*.

2.4.5 SPECIAL PROTECTION PURPOSES – PROPOSED SCHOOL

The southern side of the Ridge Character Area will feature a primary school located adjacent to the North Kellyville Local Centre and Yalta House, a local heritage listed item. The school will be located around the northern and eastern boundary of Yalta House. One storey dwellings will be permitted around this property. The proposed school is considered a special fire protection purpose development and this has been taken into consideration during the design of the asset protection zones for these structures.

Planning for Bushfire Protection (2006) has identified *Special Fire Protection Purpose* developments as a category of land use that requires more stringent consideration of possible bush fire protection measures. Such developments have been defined generally as areas where people congregate such as tourist facilities and or aged care facilities and or schools.

2.4.6 TREE RETENTION

Trees to be retained within the post development landscape require protection from compaction and harm during the construction phase. The DCP has addressed tree retention within the development areas of the precinct stating that where it is likely that mature trees will be removed either through the creation of a residential lot or through its subsequent development Council will require:

- The lot area to be increased beyond the minimum 450m² so as to ensure mature tree(s) are retained; or

- The lot boundaries are to be rearranged to ensure mature tree(s) are retained.

3 BUSHFIRE PROTECTION ASSESSMENT

Developing in bushfire prone areas requires consideration of the overall threat upon a site and the way occupants of a site / dwelling(s) are potentially able to cope in the event of a bushfire. This allows an effective approach to designing appropriate bushfire protection measures for any possible development.

To assess the bushfire threat that is likely to occur and affect the proposed development property, and the eventual dwelling occupiers, a review of the elements that comprise the overall threat needs to be completed. These elements include the presence of hazardous fuels on site, the extent of the bushfire risk and the expected level of vulnerability of any proposed dwellings and other infrastructure to both occupants and or fire fighters. Through a process defined by the Rural Fire Service a bushfire attack model can be derived that provides a qualitative assessment of the level of potential bushfire risk.

3.1 HAZARDOUS VEGETATION

The bushfire hazard is defined as the potential severity of a fire and is measured by way of intensity i.e. *k/w* m^2 (Kilowatts per square metre of fire front). The factors that influence the bushfire hazard are primarily the nature of the vegetation (fuel) and the slope of the land where the hazardous vegetation is located. Factors such as wind and fuel dryness also contribute to the hazard achieving maximum intensity levels.

The precinct has been subjected to extensive clearing along the ridge top, with most of the natural vegetation within this area being removed apart from the two peripheral creeks. The central portion of the precinct consists of rural residential and agricultural land with scattered trees and fragmented areas of remnant vegetation. It is proposed that three of these isolated pockets of bushland vegetation will be retained and restored as Public Recreation Zones as shown in Schedule 1 (Zooms 3, 5 & 6).

Natural and disturbed native riparian open forest forms the eastern, western and northern boundaries of the property encompassing Smalls and Cattai Creek. There are also numerous ephemeral streams within the eastern and western boundaries of the site. These creek lines and streams have been classified into Category 1, 2 and 3 and as such have varying vegetative buffers assigned to them in accordance with their classification.

Category 1 (Smalls and Cattai Creek) – 100m wide vegetated Buffer Zone

Category 2 – 55m wide vegetated buffer zone

Category 3 – 25m wide vegetated buffer zone

Native vegetation is also present within Heathcote Reserve found in the central portion of the eastern boundary. Native vegetation also extends external and adjacent to the western boundary along Withers Road within the central portion of the precinct.

The riparian vegetation found along the creek lines range from highly disturbed to that of high conservation value particularly within the steeper sections of Cattai and Smalls Creek. This is largely due to the fact that the steep slopes have prevented land clearing from taking place. It is proposed that these riparian corridors will be regenerated and restored where necessary to form a forest vegetation type.

Photo 1 – Vegetation adjacent to Cattai Creek in the East

A draft Conservation Plan has been prepared which identifies the conservation of 37ha of high quality vegetation with most being within the 50 metre riparian zones of Cattai and Smalls Creek.

Eight (8) identified vegetation communities and one (1) vegetation community variant have been identified onsite with varying levels of disturbance. The communities include variations of Open Forest, Heathland and Grassland with Scattered Trees.

Table 1 below provides the diversity of vegetation communities and the RFS vegetation structure category. Vegetation 'structure' descriptions are provided by '*Planning for Bushfire Protection 2006*'. Those descriptions involve categorising vegetation according to either Group 1, 2 or 3 vegetation. For example Group 1 is forest, Group 2 is woodland and Group 3 is rainforest and or grassland. Figure 4 depicts the location and boundaries of this vegetation in relation to the creek lines.

Table 1 - Vegetation communities within the Precinct

Vegetation Community Title	**Probable Dominant Species**	**RFS Vegetation category**
Upper Georges River Sandstone Woodland	*Eucalyptus punctata, Corymbia gummifera*	Forest - Group 1
Alluvial Woodland (EEC under the *TSC Act* 1995)	*Eucalyptus ampifolia, Eucalyptus tereticornis, Casuarina glauca*	Forest - Group 1
Shale Sandstone Transition Forest (EEC under the *TSC Act* 1995)	*Eucalyptus tereticornis, Eucalyptus punctata, Eucalyptus fibrosa, Eucalyptus eugenioides*	Forest - Group 1
Sydney Sandstone Gully Forest	*Angophora costata, Corymbia gummifera, Eucalyptus piperita*	Forest - Group 1
Sydney Sandstone Gully Forest (rainforest understorey)	*Angophora costata, Corymbia gummifera, Eucalyptus piperita, Cerapetalum apetalum, Tristaniopsis*	Forest - Group 1
Sydney Sandstone Heath	*Eucalyptus sp. Cattai, Acacia bynoeana, Persoonia hirsuta*	Tall Heath - Group 2
Sydney Sandstone Ridgetop Woodland	*Angophora bakeri, Angophora costata, Corymbia gumifera, Eucalptus haemostoma*	Forest - Group 1

Table 1 - Vegetation communities within the Precinct (Cont.)

Vegetation Community Title	Probable Dominant Species	RFS Vegetation category
Turpentine Ironbark Forest (EEC under the *TSC Act* 1995)	*Syncarpia glomulifera, Angophora costata, Eucalyptus acmenoides, Eucalyptus aniculata*	Forest - Group 1
Cleared Lands (Grassland with scattered trees)	*Eucalyptus tereticornis, Eucalyptus punctata, Eucalyptus fibrosa, Eucalyptus eugenioides*	Grass - Group 3

The riparian corridors of Smalls Creek and Cattai Creek form a continuous link of vegetation along the eastern and western boundaries of the precinct. The forest vegetation found within these riparian corridors poses a potential bushfire threat to the proposed precinct development and will require defendable space in the form of asset protection zones to be provided for any future development.

The riparian corridors within and surrounding the Growth Centres landscape is intended to be revegetated and eventually restored to predominantly open forest vegetation. The steep land (>18 degrees) associated within the creek lines particularly in the east prevent the application of asset protection zones and development to an extent and these lands have been the catalyst for assigning a starting point for all asset protection zones.

Portions of the existing degraded remnant vegetation found along the ridgetop will be preserved as Open Space (refer Schedule 1) and therefore will also pose a risk from bushfire. This bushfire risk is less significant, due to the small and isolated nature of the vegetation.

Photos 2 and 3 – Examples of slopes found within the riparian corridors

It is possible that fires could occur within the surrounding bushland within the retained creek environments and other retained conservation zones resulting in potential impact in the form of radiant heat, flame impact and potentially ember attack. Therefore asset protection zones will also be required to provide defensible space between the bushfire threats and the development.

However with the application of appropriate asset protection zones any possible impact would be mitigated to acceptable levels. PBP 2006 provides suitable advice in respect of appropriate asset protection and the distances required to be provided between development and hazardous vegetation.

3.2 BUSHFIRE PROTECTION ASSESSMENT

PBP 2006 provides a methodology for assessing any possible bushfire attack upon a dwelling or other building. This process identifies the possible vulnerability of a structure and then allows the determination of a 'Construction Level' in accordance with AS3959 *'Construction of buildings in bushfire prone areas* to provide appropriate bushfire protection from radiant heat, ember attack or direct flame contact.

3.3 BUSHFIRE ATTACK ASSESSMENT

3.3.1 Smalls Creek South (South of Withers Road) Refer to Zoom 1.

Vegetation Description

Figure 4 indicates the vegetation that is proposed to be retained within the precinct. This vegetation is often degraded particularly adjacent to Smalls Creek. It is proposed that all vegetation within conservation boundary will be maintained and/or restored to its natural vegetative state.

West — A mixture of Sydney Sandstone Gully Forest and Shale Sandstone Transition Forest is found adjoining Smalls Creek.

Creek line 1, 2 & 3 — Disturbed Shale Sandstone Gully Forest will be restored to form a riparian corridor of 25m in width along the Category 3 creek lines. This vegetation is less than 20m in width on either side of the creek and is considered a low hazard and is therefore reduced to a rainforest vegetation class thus allowing APZ setbacks to be reduced considerably.

Table 2 – Smalls Creek South

Aspect	Vegetation within 140m of Development	Effective Slope of Land	APZ Provided (distance (m) metres)	Level of Bushfire Attack	Minimum Construction Standard
West (adjacent to Smalls Creek)	Forest	0-5° D	25 - < 36 36 - < 49 49 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		5-10° D	35 - < 45 45 - < 59 59 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		10 -15° D	50 - < 55 55 - <71 71 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
Creek line 1, 2 & 3	Rainforest	0 - 5° D	10 - < 16 16 - < 24 24 - < 50	Extreme High Medium	Level 3 Level 2 Level 1
		Level	10 - < 13 13 - < 19 19 - < 50	Extreme High Medium	Level 3 Level 2 Level 1

3.3.2 Smalls Creek North (north of Withers Road to Creek line 10) Refer to Zoom 2

Vegetation Description

West — A mixture of Sydney Sandstone Gully Forest and Upper Georges River Sandstone Woodland is found adjoining Smalls Creek.

Creek lines 4, 5 & 7 — These creek lines form part of a larger protected bushland reserve consisting of Upper Georges River Sandstone Woodland.

Creek lines 6, 8, 9 & 10 — Disturbed and natural Shale Sandstone Gully Forest, Upper Georges River Sandstone Woodland and a small section of Sydney Sandstone Heath (creek line 6) will be restored to form a riparian corridor of 25m in width along the Category 3 creek lines. This vegetation is less than 20m in width on either side of the creek and is considered a low hazard and is therefore reduced to a rainforest vegetation class thus allowing APZ setbacks to be reduced considerably.

Table 3 – Smalls Creek North

Aspect	Vegetation within 140m of Development	Effective Slope of Land	APZ Provided (distance (m) metres)	Level of Bushfire Attack	Minimum Construction Standard
West (adjacent to Smalls Creek)	Forest	0-5° D	25 - < 36 36 - < 49 49 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		5-10° D	35 - < 45 45 - < 59 59 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		10 -15° D	50 - < 55 55 - <71 71 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
Creek line 4, 5 & part of 7	Forest	0 - 5° D	25 - < 36 36 - < 49 49 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		5-10° D	35 - < 45 45 - < 59 59 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		10 -15° D	50 - < 55 55 - <71 71 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
Creek line 6, 7, 8, 9 & 10	Rainforest	Level	10 - < 13 13 - < 19 19 - < 50	Extreme High Medium	Level 3 Level 2 Level 1

		0 - 5° D	10 - < 16 16 - < 24 24 - < 50	Extreme High Medium	Level 3 Level 2 Level 1
		5 -10° D	15 - < 21 21 - <31 31 - <50	Extreme High Medium	Level 3 Level 2 Level 1

3.3.3 Environmental Living (North of Creek line 10 to encompass the northern tip and the eastern boundary of the property) Refer Zoom 3, 4, 5 & 6

Vegetation Description

The vegetation adjoining the northern and eastern boundaries of the precinct is associated with steep land (>18 degrees). This vegetation has a high conservation value and development within this area is restricted to low density classified as environmental living. The lots adjoining this vegetation within this steep land will in effect have a larger area to account for the larger Asset Protection Zones required in this area.

West — The vegetation adjoining Smalls Creek to the west consists of Shale Sandstone Transition Forest and Sydney Sandstone Gully Forest. Creek lines 11 and 12 form part of a larger protected bushland reserve adjoining Smalls Creek

North and east — The vegetation adjoining Cattai Creek in the east consists of Sydney Sandstone Gully Forest along the creek line with Shale Sandstone Transition Forest abutting this vegetation. Heath land vegetation is situated between creek lines 18 and 19 as shown on Zoom 4. All creek lines form part of a larger protected bushland reserve adjoining Cattai Creek

Table 4 – Environmental Living

Aspect	Vegetation within 140m of Development	Effective Slope of Land	APZ Provided (distance (m) metres)	Level of Bushfire Attack	Minimum Construction Standard
West (adjacent to Smalls Creek)	Forest	0-5° D	25 - < 36 36 - < 49 49 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		5-10° D	35 - < 45 45 - < 59 59 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
		10 -15° D	50 - < 55 55 - <71 71 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
East (adjoining Cattai Creek)	Forest	0 - 5° D	10 - < 16 16 - < 24 24 - < 50	Extreme High Medium	Level 3 Level 2 Level 1
		5-10° D	35 - < 45 45 - < 59 59 - < 100	Extreme High Medium	Level 3 Level 2 Level 1

		10 -15° D	50 - < 55 55 - <71 71 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
	Heath	5-10° D	17 - < 24 24 - < 35 35 - < 100	Extreme High Medium	Level 3 Level 2 Level 1

Bushfire Attack Assessment – Public Recreation Zones

Vegetation Description for the Public Recreation Zones (PRZ)

Purple zones The Public Recreation Zones marked purple on Schedule 1 are proposed for managed open space. The use of these areas will include parks and ovals with any vegetation to be managed to Asset Protection Zone standard.

PRZ 1 The vegetation within this open space area will be retained. Shale Sandstone Transition Forest is predominant within this zone. This is an endangered ecological community.

PRZ 2 The vegetation within this open space area will be retained. Turpentine Ironbark Forest is predominant within this zone. This is a critically endangered ecological community. The red hatched colour on Zoom 5 indicates the total area of the zone. The proposed APZ will encroach within this zone therefore impacting on the retained vegetation.

PRZ 3 The vegetation within this open space area will be retained The Shale Sandstone Transition Forest within this Public Recreation Zone is less than 1 hectare (ha) in size however offers a fire run of more than 50 meters. It is therefore considered to have a bushfire threat of equal to that of a forest vegetation structure.

Table 5 – Public Recreation Zones

Public Recreation Zones	Aspect	Vegetation within Zones	Effective Slope of Land	APZ Required	Level of Bushfire Attack	Construction Standard
Purple		Managed Open Space	Various	Not Required	Low	No requirement
Public Recreation Zone 1 (marked red hatch on Zoom 6)	North and West	Forest	0-5° D	25 - < 36 36 - < 49 49 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
	South and East		0 -5 ° U	20 - < 29 29 - < 40 40 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
Public Recreation Zone 2 (marked red hatch on Zoom 5)	East (School) *	Forest	0-5° C	70 metres	Medium	Level 1
	West		0-5° D C	36 - < 49 49 - < 100	High Medium	Level 2 Level 1

	North, South	Rainforest (fire run <50 metres)	0-5° D C	16 - < 24 24 - < 50	High Medium	Level 2 Level 1
Public Recreation Zone 3 (marked red hatch on Zoom 3)	North, South and North-east	Forest	0-5° D, C	25 - < 36 36 - < 49 49 - < 100	Extreme High Medium	Level 3 Level 2 Level 1
			0 -5 ° U	20 - < 29 29 - < 40 40 - < 100	Extreme High Medium	Level 3 Level 2 Level 1

- *Building construction levels for school are always predetermined to be Level 1 due to their RFS categorisation as a special fire protection purpose as determined by Section 100B of the Rural Fires Act.*

Photo 4 – Vegetation located adjacent to Smalls Creek in the west

Photo 5 – Tall heath vegetation located within Heathcote Reserve

The bushfire protection measures available to be used in the North Kellyville Precinct comprise asset protection zones, effective access, adequate water supplies, appropriate construction design and construction as well as adequate fire fighting infrastructure. In addition, the public recreation zones (see Figure 3 and Schedule 1) have been designed so that Council can have sole responsibility for their management, as opposed to the individual land owners.

4.1 BUILDING PROTECTION

The extent of fire behaviour likely to affect the precinct requires the implementation of the Australian Standard AS 3959, *'Construction of Buildings in Bush Fire Prone Areas'.* AS3959 classifies the level of construction affecting buildings in bushfire prone areas. This standard applies the requirements of Part 2.3.4 of the *Building Code of Australia* regarding building in bushfire prone areas.

The implementation of AS3959 is made more complex in NSW because the RFS require that the maximum level of bushfire attack upon a habitable building must not exceed 29 *K/w* m^2 of radiant heat flux for residential development; and 10 *K/w* m^2 for *special fire protection purpose* developments.

Habitable buildings that are proposed to be located within the specified distances for Extreme bushfire attack as outlined with PBP are required to be built to Level 3 type construction standard. Similarly buildings located within the specified distances for High bushfire attack require Level 2 type construction whilst Level 1 construction standards should apply if the proposed building is located within the specified distances for Medium bushfire attack.

In accordance with PBP 2006 the bushfire attack assessment has found the dwellings within the development are subject to variable levels of bushfire attack ranging from low (no specific construction requirements) through to extreme (Level 3 construction). The level of construction required for a particular dwelling is determined depending on the type of vegetation, slope and the separation distance between the building and the vegetation. For example;

- No construction standards should apply to the building if it is generally located more than 100m from a bushfire hazard (forest vegetation) or 50m from a bushfire hazard (rainforest threat).

- Level 1 construction standards of AS3959 Construction of buildings in bushfire prone areas are subject to Medium level of bushfire attack.

- A level 2 construction standard of AS3959 Construction of buildings in bushfire prone areas applies to areas subject to High level of bushfire attack.

- A Level 3 construction standard of AS3959 Construction of buildings in bushfire prone areas applies to areas subject to Extreme bushfire attack.

- Flame Zone is where deemed to satisfy construction can not occur as the APZ is not commensurate with AS3959. In this case there may be some scope for a performance based Alternative Solution to be applied for development within the outer edges of the flame zone. However the cost to apply the building materials may inhibit the practical application for a normal residential subdivision.

The bushfire attack assessment has determined the level of bushfire attack and the construction standards required for the proposed dwellings. The results are shown in Tables 2 - 5 and depicted in Schedule 1.

A *Special Fire Purpose Protection* building (School) is proposed in the adjoining lot to the east of a Public Recreation Zones 2 as shown in Schedules 1 and 1.5. Building construction levels for schools are predetermined to be Level 1 and therefore an APZ of no less than 70 meters must be provided within the adjoining open space area to the west of the proposed school.

4.2 ASSET PROTECTION ZONES

In the subdivision of land for the purpose of residential construction PBP 2006 requires that Class 1 & 2 structures as defined by the *Building Code of Australia* be provided with asset protection zones. This provides the required level of *defendable space* to protect a structure from bush fire attack.

Photo 6 – Residential dwellings sited amongst a bush land environment

The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire. These fuel reduced areas or asset protection zones have been planned to occur between hazardous vegetation and other future development.

Thus asset protection zones are provided adjoining the external boundaries of the development and the riparian corridors within the North Kellyville landscape as depicted in Schedule 1 and outlined within Tables 2 - 5 of this report. Existing approved buildings were approved prior to the introduction of *'Planning for Bushfire Protection 2006'* and are therefore generally not affected by this plan.

Tables 2-5 and the attached Schedule 1 can be used as a guide in determining the appropriate asset protection zones and construction levels required for the precinct. A step

by step example of the process involved in determining the appropriate APZ's and construction levels required are provided below. The following example in Diagram 1 below has been provided and is based on the presence of forest vegetation located on slopes of between 5 -10 degrees.

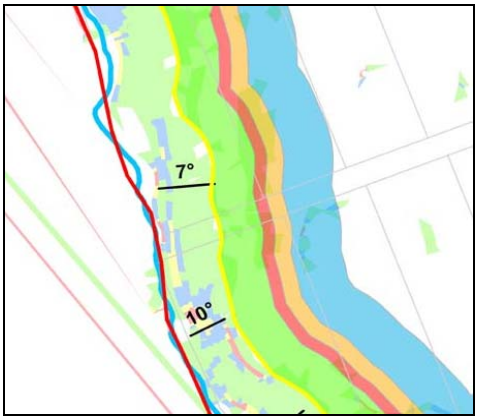


Diagram 1: Extract from Schedule 1 (Zoom 1)

The Flame Zone (Primary APZ) coloured green in Diagram 1 above is the minimum asset protection zone width for that site on that slope. No habitable dwellings are allowable in that colour zone.

The red zone indicates that Level 3 construction will be required when constructing a dwelling. The orange zone requires Level 2 construction and the Blue Zone requires Level 1 construction. In the above example residential development may occur within the red, orange and blue zones. No such development may occur within the green zone.

A more 'distanced based' explanation is provided, for example;

- If the minimum APZ of 34 metres is adopted as the asset protection zone then Level 3 construction standards will apply to dwellings located between 34 – 45 metres from the hazardous vegetation.

- If an APZ of at least 45 metres is adopted then Level 2 construction standards will apply.

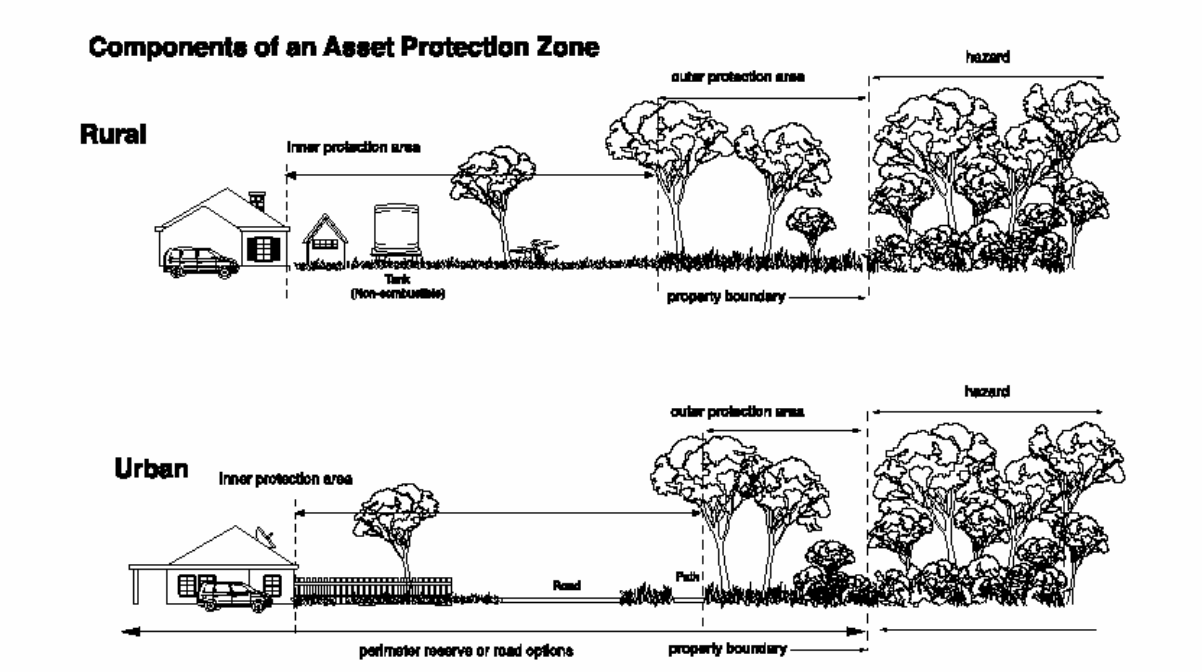
- If however an APZ of at least 59 metres is provided then Level 1 construction standards will apply. Note: A slope analysis has been undertaken for the North Kellyville site, the results of which are depicted on Figure 6.

- Three (3) parks with retained native bushland have been proposed throughout the development area. Each of these zones has been classified on Schedule 1 as a Flame Zone, and therefore a Primary APZ. The lots surrounding these parks have been classified as requiring levels 1, 2 or 3 construction depending on the distance from each park and proposed land use of each particular lot.

- A *Special Fire Purpose Protection* building (School) is proposed in the adjoining lot to the east of Park 2 as shown in Schedules 1 and 1.5. Building construction levels for schools are predetermined to be Level 1 and therefore an APZ of 70 meters must be provided within the north-western portion of the proposed school lot.

- Every Lot adjacent Smalls Creek (and any other watercourses on site) has been provided with a Primary APZ which is to be managed in perpetuity by Council. Each of these lots has also been classified as requiring level 1, 2 or 3 construction.

A typical APZ and therefore defendable space is graphically represented as follows;



4.3 HAZARD MANAGEMENT

There is a legal requirement under *Section 63 of the Rural Fires Act* to manage hazardous fuels. This requires that practical steps to be taken to stop fire either entering or leaving an allotment. This refers the responsibility to either the landowner or the land occupier.

The RFS provide practical advice in this regard via a document entitled *Standards for Asset Protection Zones.* This outlines specifications for managing asset protection zones. The RFS also provide practical assistance through community brigades either in advice or assistance with burning operations. The volunteer brigades are community based and sourced from local people.

The proposal to maintain native bushland on the North Kellyville perimeter within the creeks highlights the necessity for a coordinated approach to bushfire management planning. However the responsibility for fuel management will initially be with each individual land owner apart from the proposed conservation zones which will defer to Baulkham Hills Shire Council and the individual land owners.

A bushfire fuel management plan will need to be prepared for all public lands. This will require preparation prior to Council gaining control of the lands. A similar plan should be considered for the private lands by way of a cooperative approach. The Rural Fire Service would be a source of funding for such a plan.

4.4 EGRESS AND EVACUATION SAFETY

Evacuation safety is a basic tenant of effective bushfire planning for all type of developments.

The cleared residential landscape and the extensive internal road network proposed for the Growth Centres landscape provides for multiple safe egress routes such as Hezlett and Foxall Roads onto Samantha Riley Drive (South). Hezlett and Foxall Road run north to south within the southern portion of the precinct to provide connections to Kellyville in the south via Samantha Riley Drive. Withers Road provides a connection to Rouse Hill in the west across Smalls Creek.

Safe evacuation can also be sort via Withers Road into the adjoining land to the west of the precinct. These traffic routes to the south of the precinct are unlikely to be impacted directly by fire due to the existing residential development already established near the township of Kellyville and Beaumont Hills.

There is limited access provided to the north or east of the precinct due to the creek lines, tributaries and the vegetated steep lands found in these areas. Three (3) bridges cross the two main creeks within the precinct and allow for effective access/egress within the precinct. These entry points are adequately separated and are unlikely to be impacted by bushfire.

Barry, Hillview and Stringer Road run north to south within the northern portion of the precinct, however no access is provided into the adjoining residential lands to the north. It is recommended that an additional access road should be provided as a through link to the north. This will allow additional access and egress options and will reduce the potential for bottlenecks within the existing road network during bushfire events.

Planning for Bushfire Protection (2006) recommends perimeter roads as the preferred option to separate bushland from urban areas. The proposed road layout within the Kellyville development provides for a perimeter road around the existing vegetation adjoining Smalls Creek in the west.

Due to very steep slopes adjoining the boundaries of the site particularly in the east, perimeter roads are not an appropriate outcome in all circumstances. The alternative includes the creation of larger lots (Environmental Living) which are capable of supporting increased asset protection separation and potentially private fire trails. Access to these allotments will be provided from the internal road network to these areas of increased defendable space.

The road network within the North Kellyville precinct plan will require construction and upgrading in line with the public road specifications within PBP 2006. This requires the minimum widths for the internal road system (public roads) for a single lane as ranging between 3.5m and 4.5m. The minimum width of a two way road ranges from 6.5 to 8m.

The *Acceptable Solutions* to the RFS include:

- Roads should be two-wheel drive, sealed, all-weather roads
- Urban perimeter roads are provided with at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb) and shoulders on each side, allowing traffic to pass in opposite directions
- The perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas.

- Roads are through roads. Dead end roads are not more than 200 metres in length from a through road, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end

- Traffic management devices are constructed to facilitate access by emergency services vehicles

- A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches, is provided

- Curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress

- The minimum distance between inner and outer curves is six metres

- Maximum grades do not exceed 15 degrees and average grades are not more than 10 degrees

- Public roads have a cross-fall of the pavement is not more than 3 degrees.

- Roads do not traverse through a wetland or other land potentially subject to periodic inundation (other than flood or storm surge)

- Roads are clearly sign-posted and bridges clearly indicate load ratings

- The internal road surfaces and bridges have a capacity to carry fully-loaded fire-fighting vehicles (15 tonnes)

Access requirements in relation to *Special Fire Protection Purpose* Area's must provide for the special characteristics and needs of the occupants. Unlike residential subdivisions, which can be built to a construction standard to withstand the fire event, enabling occupants and fire fighters to provide property protection after the passage of fire, occupants of SFPP developments may not be able to assist in property protection. They are more likely to be adversely affected by smoke or heat while being evacuated.

SFPP Developments are highly dependent on suitable emergency evacuation arrangements, which require greater separation from bush fire threats. During emergencies, the risk to fire fighters and other emergency services personnel can be high through prolonged exposure, where door-to-door warnings are being given and exposure to the bush fire is imminent.

4.5 AVAILABILITY OF FIRE FIGHTING SERVICES

There is a Rural Fire Service station located at Kellyville approximately less than 1 kilometre (by road) from the property in an easterly direction. The Rural Fire Brigade would have a response time of approximately 15-20 minutes to service the Precinct if they are not assisting elsewhere.

There is a NSW Fire Brigade station also located at Kellyville less than 2 kilometres (by road) from the property in a south westerly direction. The NSW Rural Fire Service station would have a response time of approximately 5-10 minutes to service the Precinct if they are not assisting elsewhere.

The North Kellyville Precinct proposes a substantial increase in dwellings to approximately 4,500 to 5,000. Due to this increase in population a review will need to be undertaken to assess the location and availability of fires brigade standards of cover. As a result, additional fire fighting services may need to be provided, particularly in the northern portion of the precinct to meet this need. The NSW Rural Fire service and the NSW Fire Brigades will be required to provide appropriate services.

4.6 WATER SUPPLIES

Water hydrants should be installed in accordance with Australian Standard AS2419-1 (1994). This standard recommends spacing of no greater than 120 metres (Source AS 2419.1 2005 Appendix B, B2) for residential development and 90 metres for commercial development (Appendix B, B3). However the RFS require that hydrants be spaced no greater than 90 metres.

In addition all hydrant locations may be required by Council to be marked with a blue 'cats eye' in the centre of the road.

4.7 COMMUNICATIONS

Telephone communications will be provided for this development to aid in communications during a bushfire incident.

4.8 ECOLOGICAL SENSITIVITY

In respect of the biodiversity of the retained native vegetation ecological research into fire-prone landscapes has established some general principles in relation to the fire regimes.

Groups of flora and fauna species respond similarly to fire according to identifiable characteristics of their life history. Therefore, it is not necessary to individually specify fire regimes for the conservation of every species. Requirements for most plant species can be summarised on the basis of a small number of groups. The knowledge of requirements for groups of animals is less advanced.

A diversity of fire regimes are required in order to maintain diversity of plant and animal species. This means that, over time, there may be a need to implement fires of high, moderate and low intensity, frequency and size throughout the landscape. A reduction in species numbers may be likely if fire regimes of relatively fixed intensity, frequency and extent prevail without interruption.

In terms of fauna management of the available knowledge on the way fire effects native animal species is currently insufficient to accurately formulate comprehensive fire regime thresholds. The major long-term impact that fire has on fauna is the reduction of population size through changes in vegetation structure and floristics (habitat). The key characteristics of fire regimes which impact on animals are therefore frequency, season and extent / patchiness (NPWS, 1999).

The frequency of fires will determine the complexity and therefore the habitat value of the understorey, with frequent fires increasing exposure to predation and climatic influences, and promoting the potential loss of food and shelter resources.

Fires occurring during the breeding season could potentially adversely affect some species by killing offspring or preventing breeding. Reduction of vegetation density may increase the exposure of the young of some species to predation. Burns which are limited or patchy will

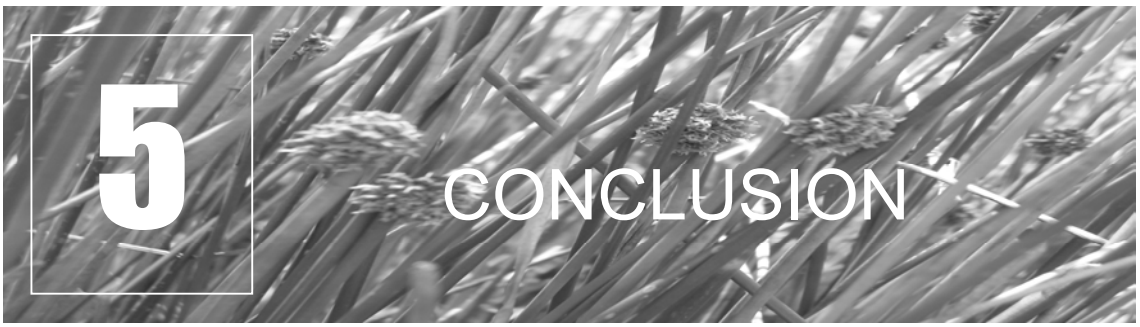
provide a range of ages of vegetation which will provide a greater variety of food and shelter sources, enabling utilisation of an area by a greater number of animal species. Areas not burnt also act as important refuges for wildlife to congregate in, providing shelter and food sources for survivors, from which recolonisation of the burnt areas can occur (NPWS, 2000).

Intense fires can initiate the creation of hollows in trees that, in turn, provides habitat for hollow-dependant fauna e.g. owls, gliders and bats. Exclusion of such hollow-forming processes can cause significant impact upon such species particularly threatened species over time. The guidelines within this plan intended for the management of animal species will be subject to the *TSC Act* (1995). This Act provides the framework to protect and encourage the recovery of threatened species, populations and ecological communities.

The development of 'Recovery Plans' is a requirement under the Act to ensure the appropriate management and planning for the conservation of threatened species. As these Recovery Plans are developed there may be a need to adjust the fire management guidelines provided in this plan.

However, research has given valuable insight into management practices that allow a high degree of confidence in application of fire regimes that minimise impact. The basic management regime for all fauna species is to ensure the maintenance of vegetative cover and structure (habitat).

The land managers for the retained vegetation are to be Baulkham Hills Council and the individual land holders. Both Baulkham Hills Shire Council and the individual land owners have responsibility for fuel management works on their lands under the common responsibilities of the Rural Fires Act. Given this knowledge, ecological fire management within conservation reserves can still occur without compromising ecological systems or denuding scenic values if managed in an expert manner. Therefore planning strategies can accommodate effective fire management of the landscape to achieve the desired balance of species and habitats.



5.1 CONCLUSION

The bushfire planning of the North Kellyville development precinct has been undertaken in accordance with the requirements of the NSW Rural Fire Service planning policy entitled *Planning for Bushfire Protection 2006.*

Fuel management planning will be required for the proposed public conservation reserves.

Similarly a coordinated approach to fuel management planning should occur for the two major creek environments so that biodiversity values can be maintained as complex ecosystems and not simplified through poor management practices.

More difficult, but equally necessary, will be a need to ensure that hazard management practices are maintained for existing allotments should grazing animals be removed as development occurs over the ensuing years.

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FIGURES

SCHEDULE 1
Plan of Bushfire Protection Measures

Schedule 1 Zooms 1.1-1.6

APPENDICES

A3 OPTIONS FOR FUEL MANAGEMENT TREATMENTS

PRESCRIBED BURNING
(SOURCE: NPWS 2003)

Source: ACT Rural Fire Service

Description: The planned application of fire, either by ground or from the air, under prescribed weather conditions and within defined boundaries to modify fuel characteristics including fuel load, continuity and arrangement.

How It Works: By modifying fuel characteristics, including fuel load, continuity and arrangement, bush fire rate of spread, flame height, intensity and spotting distance is reduced. This enables bush fires to be suppressed under a wider range of weather conditions than would otherwise be possible.

Effectiveness: The effectiveness of a prescribed burn depends on how successful the burn was in the first place, the time since the burn, the environmental conditions since the burn was conducted and the vegetation type in which the burn was conducted.
The effect of prescribed burning on subsequent fire behaviour lasts longer in forest and woodland (typically 2 - 7 yrs) than heathland (typically 2 - 4 years) and grassland (typically <1 – 2 years).
Prescribed burning is the only practical means of modifying fuels over large areas.

Limitations: Does not prevent bush fires or ensure all bush fires can be controlled or contained.
Can only be conducted under a narrow range of weather conditions.
Has only a very short-term effect on subsequent fire behaviour in some vegetation types, particularly grasslands and heath.
In some vegetation types may actually increase fire behaviour in the longer term by encouraging the replacement of moist understorey species, which are rarely dry enough to burn, with drier and more flammable understorey species. This particularly applies to damper vegetation types including wet sclerophyll forest and rainforest.
The frequency of burning required to maintain a high level of protection often exceeds biodiversity fire regime thresholds.
Disturbance caused by prescribed burning may provide opportunities for weed invasion and erosion.
Smoke produced by prescribed burns may pollute the air and present a traffic hazard.
There is a chance of prescribed burns escaping the planned boundaries of the burn and damaging natural, cultural or capital assets.

Application: *Management* may stipulate the use of prescribed burning in any fire management zone.

Management will normally only prescribe the use of high frequency prescribed burning in small areas within asset protection zones to protect life and property or cultural heritage sites.

Management may stipulate the use of prescribed burning over broader areas but at a lower frequency in strategic fire management zones to strengthen existing fire control advantages or to reduce the intensity and spotting distance of subsequent bush fires to assist in their control.

As well as being used to manage fuels, *The Association* may stipulate the use of prescribed burning over broad areas within heritage management zones to maintain fire regimes within biodiversity fire regime thresholds.

PILE BURNING
(SOURCE: *CONACHER TRAVERS*)

Description: The planned application of pile burning under appropriate weather conditions and within defined boundaries to reduce fuel load.

How It Works: By reducing fuel load the bush fire rate of spread, flame height, intensity and spotting distance is reduced. This enables bush fires to be suppressed under a wider range of weather conditions than would otherwise be possible.

Effectiveness: Pile burning is effective to reduce fuel load without the need to take excess fuels of site.

Limitations: Does not prevent bush fires or ensure all bush fires can be controlled or contained.

Can only be conducted under a narrow range of weather conditions.

Smoke produced by pile burns could possibly, but unlikely, pollute the air and present a traffic hazard and or a health hazard to neighbours with respiratory issues.

There is a chance of pile burns escaping the planned boundaries of the burn and damaging natural, cultural or capital assets

Must be undertaken by skilled persons.

Application: *Management* may prescribe the use of pile burning in an asset protection zone in an effort to reduce fuel loads.

UNDER SCRUBBING
(SOURCE: NPWS 2003)
(AS AMENDED BY *CONACHER TRAVERS*, 2004)

Description:

The use of mechanical scrub mulchers, slashers or brush cutters to cut the understorey in forests which reduces the height and increases the compaction of the understorey. The debris resulting from cutting the understorey may either be mulched on site or removed. While some smaller trees may be removed, larger overstorey trees are not disturbed.

How It Works:

By reducing understorey height and increasing compaction, rate of combustion and therefore fire behaviour is reduced (aerial fuels can have up to five times the effect on fire behaviour as the same amount of fuel on the ground). This enables bush fires to be suppressed under a wider range of weather conditions than would otherwise be possible.

Under scrubbing also increases the rate of fuel decomposition which reduces fuel loads and subsequent fire behaviour.

Creates a vertical fuel discontinuity which makes it more difficult for fires to climb from surface and near surface fuels into tree canopies (i.e.: become a crown fire).

Effectiveness:

Because under scrubbing does not remove all fuel, bush fires can still cross treat areas by burning across them, by direct flame contact or by spotting. Crown fires can still develop within areas that have been under scrubbed. Under scrubbing simply reduces fire behaviour in the treated area so that fires can be controlled under a wider range of weather conditions.

The effectiveness of under scrubbing largely depends on the height to which the understorey was cut, the height of the surrounding untreated understorey, the width of the treated area, the time since under scrubbing was conducted, the environmental conditions since under scrubbing was conducted and the fuel load remaining in the treated area.

The understorey often regenerates once it has been cut and hence frequent maintenance is usually required to maintain an adequate level of protection.

As well as reducing fire behaviour, under scrubbing may also increase vehicular access which makes it possible to suppress higher intensity fires.

Limitations:

Does not prevent bush fires or ensure all bush fires can be controlled or contained.

Use is limited to areas with good access. Cannot be used in areas which have steep slopes, rocky ground or a high density of trees (unless done by brush cutter).

Is of limited benefit in forests due to the very large width that needs to be slashed to have a significant effect on subsequent fire behaviour.

Is only applicable to treating relatively small areas, particularly if slashing is to be done by brush cutters.

Sparks caused by slashers hitting rocks may start fires, particularly in grasslands, if slashing is conducted when fuels are dry.

Slashing when the vegetation is green and damp may actually increase fire behaviour in the short term because the cut vegetation will dry out and immediately become flammable. It is better to delay slashing until after the vegetation has begun drying out. Thus, timing is a critical issue

with slashing.
Rocks dislodged by slashers become projectiles which may damage people and property.
Under scrubbing usually results in some soil disturbance which may provide opportunities for weed invasion and damage cultural heritage sites.

Application: *Management* may prescribe the use of under scrubbing in asset protection zones to protect life and property or cultural sites.
Management may prescribe the use of under scrubbing in other fire management zones to strengthen other fire control advantages such as along tracks and trails.

COMPLETE FUEL REMOVAL
(Source: NPWS 2003)

Description: The complete removal of all flammable material by ploughing, grading, bulldozing or through the use of herbicides.

How It Works: All flammable fuel is removed and hence subsequent bush fires cannot burn across the treated area.
Provide a control line that may be used for lighting back burns off.

Effectiveness: Effectiveness largely depends on the width of the treated area and the fuel characteristics adjacent to it. Effectiveness is significantly reduced by the presence of trees close to the treated area (because bush fires can climb the trees and spot across the treated area).
Very effective at containing low intensity bush fires with no spotting because the treated area is inflammable.
Very effective at containing grassfires because grassfires usually have a low flame height and produce only short distance spotting. Considerably less effective in forest because of the greater flame heights and spotting distances in forests.
Fuel removal increases vehicular access which makes it possible to suppress higher intensity fires.

Limitations: Bush fires may still cross treat areas by direct flame contact or by spotting across them. Use is limited to areas with reasonably good access. Cannot be used in areas where steep slopes or rocky ground prevents the use of ploughs, graders or bulldozers.
Results in soil disturbance which may provide opportunities for weed invasion and erosion and damage cultural heritage sites.
Areas treated with fuel removal techniques require regular maintenance to keep them in a fuel free state.
If herbicides are used, may kill surrounding, non-target, vegetation species.

Application: Complete fuel removal techniques may only be used in small areas within asset protection zones to protect life and property or cultural sites.