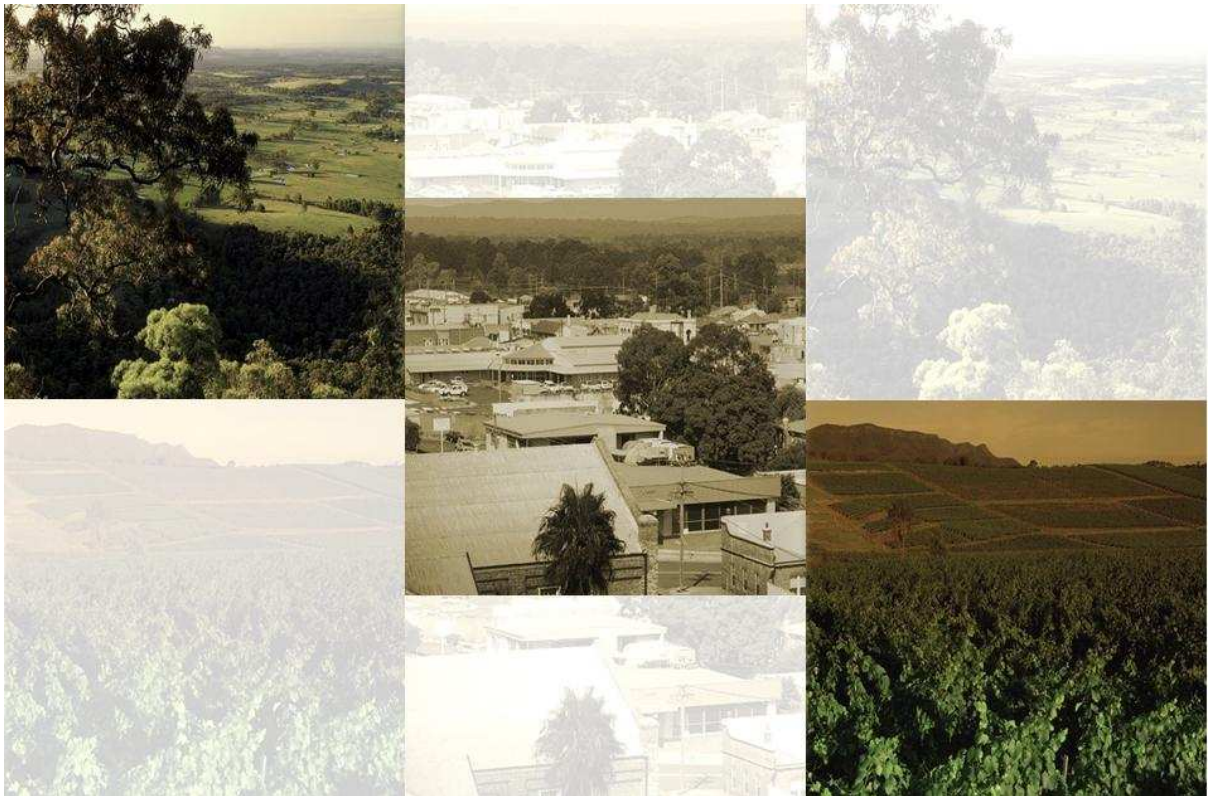




CESSNOCK
DEVELOPMENT CONTROL PLAN

PART E
SPECIFIC AREAS



E.10: Kitchener Residential Area

Amendment History

Version No.	Nature of Amendment	Date in force
1	Initial adoption by Council on 17 June 2009	28 May 2010
2	Consequential amendments as a result of Cessnock Local Environmental Plan	23 December 2011

TABLE OF CONTENTS

Chapter 10 KITCHENER RESIDENTIAL AREA

10.1 INTRODUCTION.....	2
10.1.1 Application.....	2
10.1.2 Purpose.....	2
10.1.3 Cessnock City Wide Settlement Strategy	2
10.1.4 Requirements of State Government Authorities.....	4
10.2 GENERAL DEVELOPMENT CONSIDERATIONS.....	5
10.2.1 Flora and Fauna.....	5
10.2.2 Designated Watercourses	5
10.2.3 Aboriginal Archaeology.....	7
10.2.4 Building, Siting and Design.....	7
10.2.5 Non-Indigenous Heritage Considerations	9
10.2.6 Soil and Water Management	9
10.2.7 Bushfire Hazard Control	11
10.2.8 Management of Domestic Sewage and Wastewater.....	12
10.2.9 Stormwater Management	12
10.2.10 Road Construction	13
10.2.11 Mine Subsidence	13
10.2.12 Kitchener Section 94 Contribution Plan.....	14

REFERENCES

LIST OF FIGURES

1	Subject site (Cessnock Local Environmental Plan 1989)	3
2	Rezoned subject site (Cessnock Local Environmental Plan 1989)	4
3	Kitchener Watercourses	6
4	Kitchener Concept Plan.....	15

APPENDICES

1	Flora and Fauna Assessment.....	16
2	Indigenous Cultural Heritage	17
3	Bushfire Hazard Assessment	18
4	Stormwater Management Strategy	19

E.10: KITCHENER RESIDENTIAL AREA

10.1 INTRODUCTION

The subject land is situated on the eastern side of the existing township of Kitchener, which comprises some 200 allotments and approximately 400 people. The area was probably cleared for agricultural pursuits in the mid 1800's when land grants were issued in and around Cessnock.

The town is named after Lord Kitchener, British Secretary for War from July 1914. The Khartoum Hotel was opened in 1926 and commemorates his victory at the Battle of Omdurman on 2 September 1898.

The village of Kitchener has an historical affiliation with the mining industry, as noted in the Heritage Park which contains the historic mine site, poppet head structure and interpretative information. A number of dwellings along Cessnock Street / Quorrobolong Road were originally occupied by mine management.

The subject land slopes gently from south to north and is bounded on the northern, eastern and southern sides by the Werakata National Park and the Aberdare State Forest. Significant areas of land have been cleared of native vegetation and used for grazing purposes on the majority of allotments.

10.1.1 Application

This Chapter applies to land at Kitchener, as shown edged heavy black in Figure 1. The land is located on the eastern side of Kitchener Village, approximately 4 kilometres south of Cessnock.

At the time of gazettal, the land comprised of the following allotments:

Lots 1 & 2, DP 862493, Lots 520, 521, 522 & 527, DP 755215, Lots 1 & 2, DP 815758, Lots 1 & 2, DP 1057609, Lots 3 & 4, DP 794444, Lot 2, DP 530297, Lots 9 to 16, Section 3, DP 758576, Lots 11 to 20, Section 13, DP 758576, Lot 1, Section 46, DP 758576 and Lot 1, DP 630297.

10.1.2 Purpose

This Chapter adds detail to those planning provisions contained in Cessnock Local Environmental Plan (CLEP) 1989. The Chapter provides detailed guidelines for those wishing to develop land within the area, for the purpose of the erection of dwelling houses or other buildings.

10.1.3 Cessnock City Wide Settlement Strategy

The City Wide Settlement Strategy (CWSS) was prepared by Council in response to an identified need to reconsider current planning policies and to embrace the principles of ecologically sustainable development. It aims to provide landuse recommendations on future directions for population growth, by defining limitations and identifying opportunities for development and conservation.

The CWSS examines the Cessnock Local Government Area (LGA), using defined growth management principles, identified key issues and objectives. Recommendations have been formulated for various areas of the LGA. The Kitchener Residential Area was added to the CWSS in October 2005.

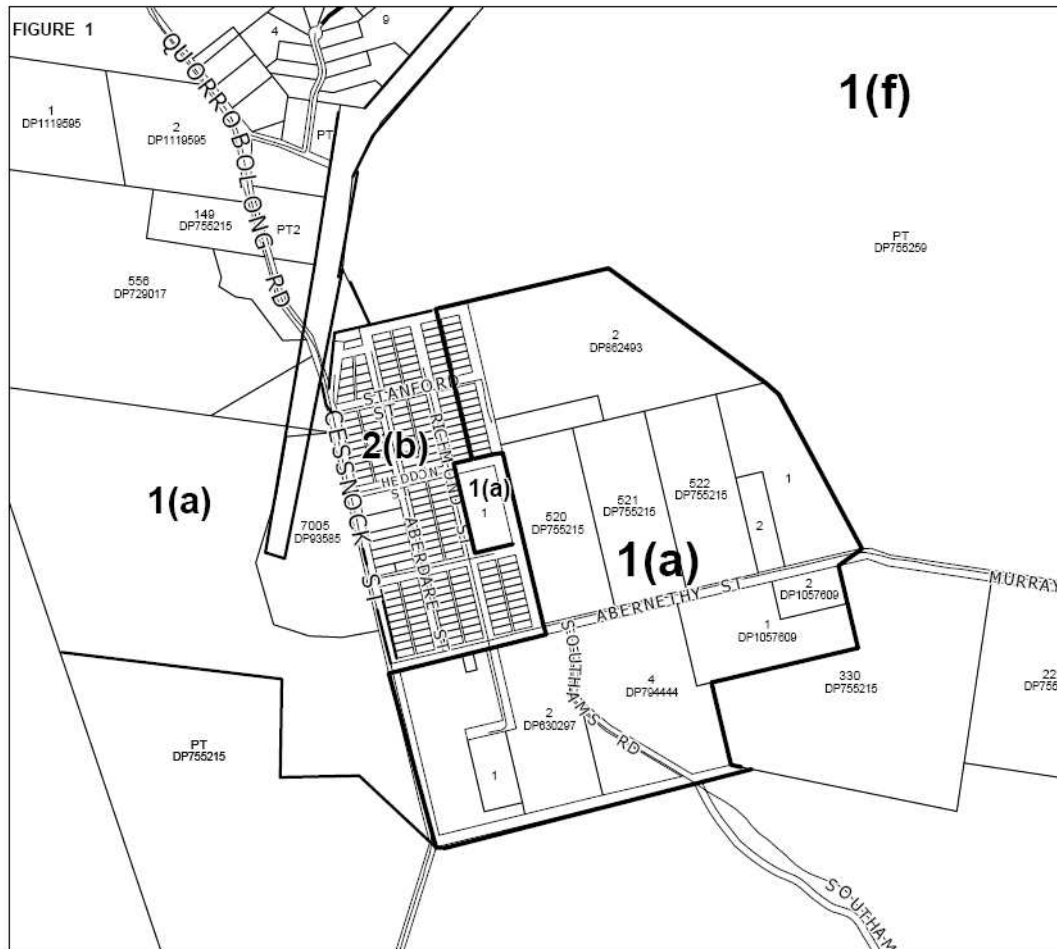


Figure 1: Subject site & existing zonings under CLEP 1989

- 1(a) – Rural “A” Zone**
- 1(f) – Rural (Forestry) Zone**
- 2(b) – Village Zone**

10.1.4 Requirements of State Government Authorities

All relevant State Government Authorities were consulted during the preparation of the rezoning. Any recommendations made have been considered and, where appropriate, incorporated into this Chapter.

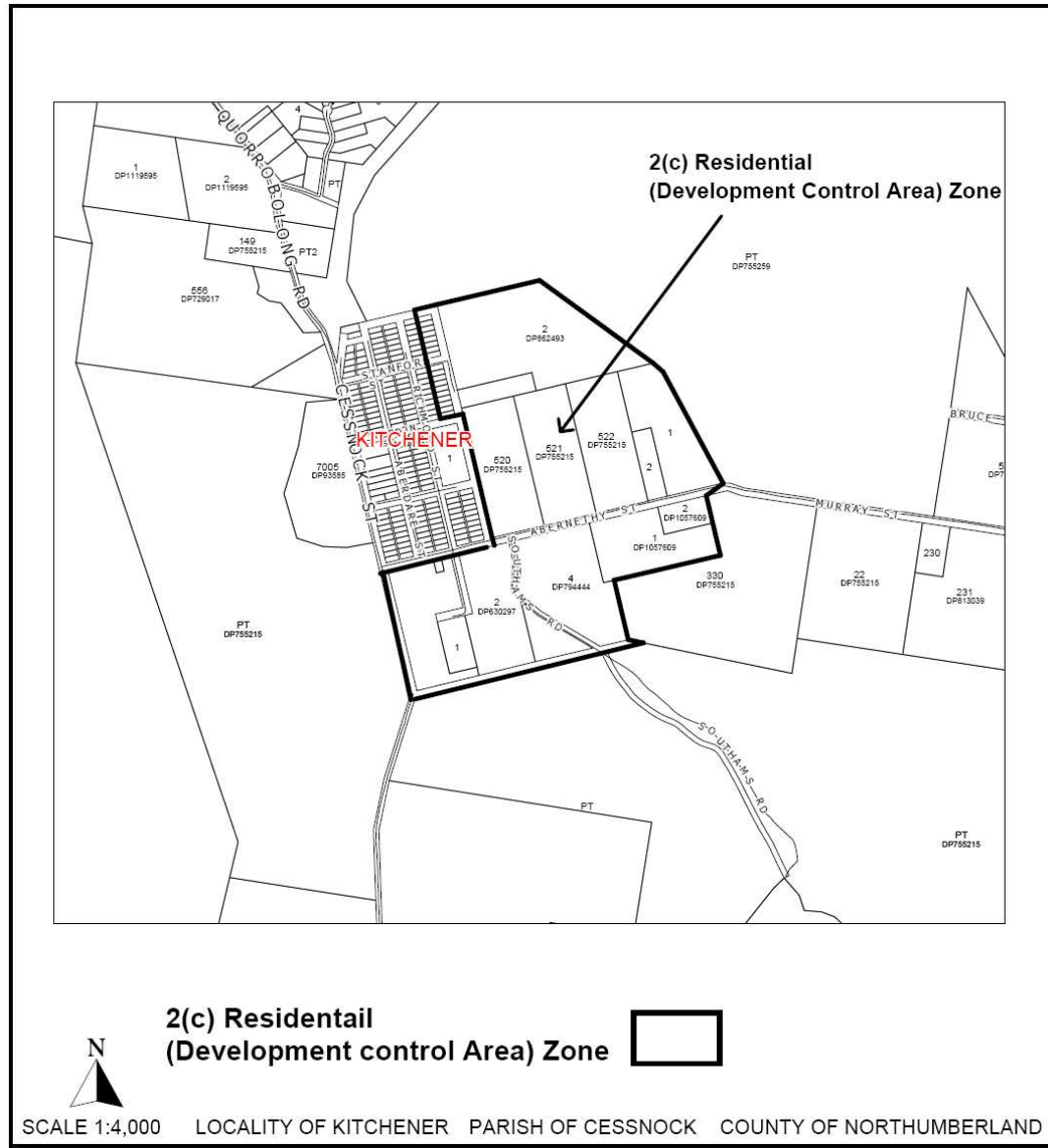


Figure 2: Subject site & proposed rezoning under CLEP 1989.

10.2 GENERAL DEVELOPMENT CONSIDERATIONS

The following development considerations apply to development within the Kitchener Residential Area.

10.2.1 Flora and Fauna

A Flora and Fauna Assessment dated April 2005 was prepared by Ecotone Ecological Consultants Pty., Ltd., (see Appendix 1). The report examines both the land to which this Chapter applies and the surrounding locality. Prospective applicants shall refer to this report during the preparation of development applications.

Objectives

- To ensure that development is carried out in a manner that minimises any adverse impact on threatened species, populations or ecological communities.
- To protect the ecology of the adjoining Werakata National Park and the Aberdare State Forest from potentially adverse impacts of development.

Requirements

- Subdivision design shall aim to retain adequate riparian vegetation along the designated watercourses (see Figure 3: Kitchener Watercourses). This will involve private allotments having restrictive covenants over a portion of the affected land to permit overland flows and retain riparian areas along the designated watercourses.
- The removal of any native vegetation at the subdivision stage will require the consent of the Department of Environment & Climate Change (DECC), with the two main options being subject to a 'Developer Agreement' or 'Bio-banking'.
- Scattered trees shall be provided within the asset protection zones (see Section 10.2.7 Bushfire Hazard Control), provided that the crowns are not touching. A spacing of 30 – 40 metres should be adequate for species to move through the landscape.

10.2.2 Designated Watercourses

The subject site is traversed by a number of designated watercourses. These watercourses range in stream order and flow regimes. These watercourses form an integral part of the local drainage system and feed into the district catchment.

Objectives

- The major watercourse in the south-western corner and the northern reaches of the central watercourse be retained to permit the flow of water and act as a detention basin (central watercourse). This will also protect the area from degradation or contamination by urban development.

The northern reaches of the central watercourse to the northern boundary of the site, shall be embellished to contain a permanent water feature, passive recreation and be regenerated with native vegetation.

- The other lower order streams shall be incorporated into the future stormwater drainage system, with some smaller passive parks operating as detention basins as per Figure 4: Kitchener Concept Plan.

Requirements

- The northern reaches of the central watercourse shall be designed to accept the flows from the existing watercourses (having being incorporated into the stormwater drainage system) and from overland flows.
- The open space area shall act as a detention basin and disperse water through the north-western section of the site to Black Creek, keeping flows and impacts to the current levels (undeveloped land).
- Appropriate gross pollutant traps shall be incorporated into this stormwater drainage system.
- The watercourses running through the south-western corner of the site are orders 2 & 3 and shall be maintained in their natural state. A 40 metre wide riparian corridor shall be provided to include the retention of significant vegetation, with provision made to revegetate 20 metres either side of the watercourse.

Note: Any works within 40 metres of the bank or watercourse will require a permit under the Water Management Act 2000. Bushfire hazard reduction zones should not be considered as part of a riparian buffer zone.

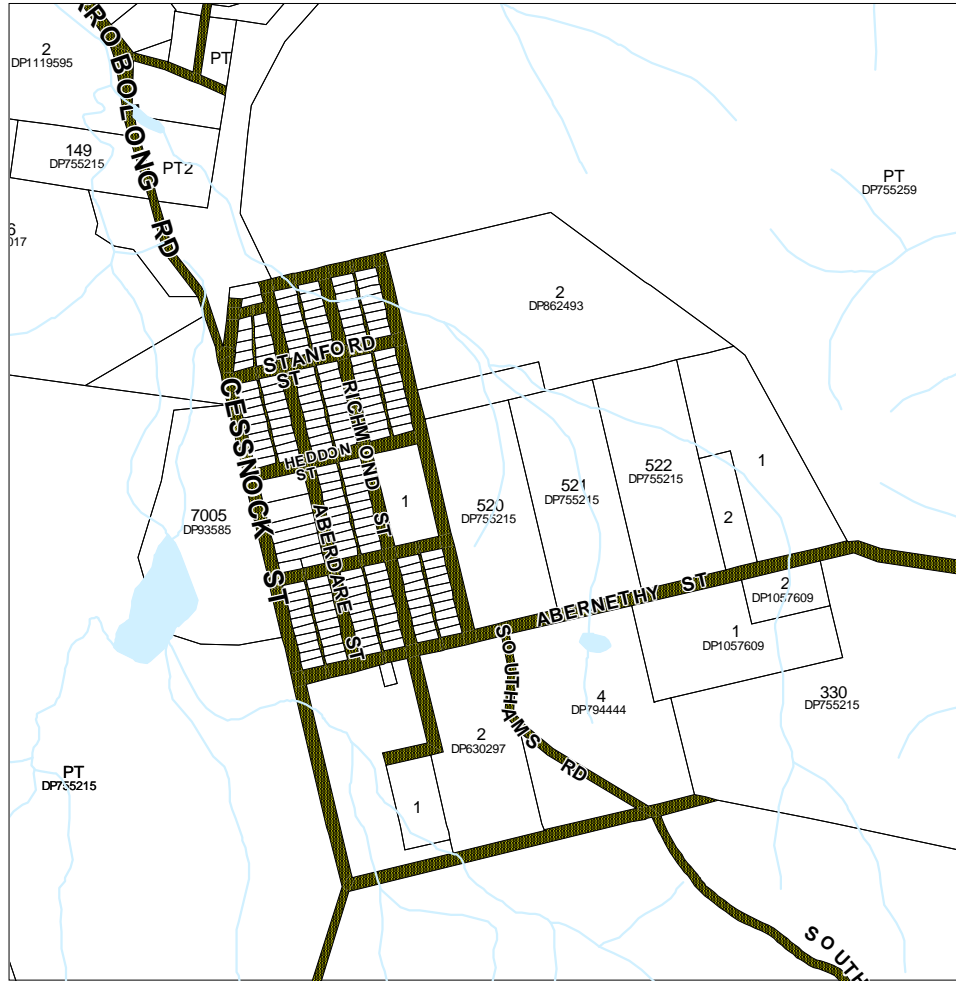


Figure 3: Kitchener Watercourses

10.2.3 Aboriginal Archaeology

An Indigenous Cultural Heritage report dated June 2006 was prepared by McCardle Cultural Heritage Pty., Ltd., (see Appendix 2). The Area is likely to contain evidence of past Aboriginal occupation, with the most likely sites being artefact scatters and isolated finds.

Objectives

- To ensure that development does not disturb or impact on Aboriginal archaeological heritage.
- To advise prospective developers of the natural and cultural values of Aboriginal occupation of the Kitchener area and to encourage appreciation and preservation of these values.

Requirements

- Initial subdivision applications shall undertake additional detailed assessment and survey, prior to any development work.

10.2.4 Building, Siting and Design

Residential Densities

Objectives

- To provide a mix a housing stock within the Kitchener Residential Area (identified within this Chapter), appropriate to geographical and natural features and restrictions.

Requirements

- Larger residential allotments shall be located along the interface (opposite) with the Werakata National Park and the Aberdare State Forest. These allotments shall be approximately 1500m², permitting appropriate Asset Protection Zones, building envelopes and private open space.
- More general forms of residential development shall be located away from the bushfire threat, utilising urban design philosophies and generally in accordance with Figure 4: Kitchener Concept Plan. These allotments shall be approximately 600 – 900m², depending on location and whether restrictive covenants regarding overland flows and on-site detention are required.
- Higher densities and commercial activities shall be located to the east of the primary school, within the designated medium density area, as per Figure 4: Kitchener Concept Plan. These allotments shall be approximately 450 – 600m².
- The south-west corner of the site contains watercourses with designated stream orders 2 & 3, which shall be maintained in their natural state. Given this natural feature in association with the existing natural vegetation, only large lot residential development will be permitted, as per Figure 4: Kitchener Concept Plan. These allotments shall be approximately 1500m², permitting appropriate riparian corridors on the watercourses, Asset Protection Zones, building envelopes and private open space.

Setbacks

Objectives

- To maximise the privacy and outlook enjoyed by adjoining and adjacent residents.
- To create a visually attractive streetscape.
- To ensure that setbacks are appropriate and maintained with regard to the bushfire threat from the adjoining Werakata National Park and the Aberdare State Forest.

Requirements

- The minimum setback of dwelling houses and other buildings from the adjoining Werakata National Park and the Aberdare State Forest is generally 30 – 40 metres, in accordance with the Bushfire Hazard Assessment dated May 2005 and prepared by Building Code & Bushfire Hazard Solutions (see Appendix 3). However, the Asset Protection Zone for each specific site shall be determined on an individual basis and an appropriate report submitted as part of each development application.
- Buildings on lots within 100 metres of the designated watercourses (as per Figure 3: Kitchener Watercourses) and with no road between, are to be sited as far from the designated watercourses as practicable.
- All other buildings shall comply with the requirements of Council's Building Line Policy B32.4 last updated 23 July 2004. Variations to the minimum building setbacks may be considered, where Council is satisfied that, the proposed location:
 - will minimise the need for cut and fill on the site; and / or
 - will not adversely impact on the privacy or outlook for adjoining or adjacent residents; and / or
 - will not disrupt established or desirable streetscape patterns; and / or
 - will increase the distance to the designated watercourse.

10.2.5 Non-Indigenous Heritage Considerations

Council will give consideration to the impact that a proposed development may have on identified items of non-indigenous heritage and on the cultural values of the landscape in which the proposal is set, as per standard clauses contained within CLEP 1989.

Kitchener contains the Khartoum Hotel (Lot 4, Sec 15, DP 758576), Kitchener Public School (Lot 1, Sec 17, DP 758576), Kitchener Poppet Head (Lot 7005, DP 93585) and the Aberdare Central Colliery company houses (Lots 390 & 391, DP 755215 and Lots 536 - 539, DP 257370), all in close proximity to the land to which this Chapter applies.

10.2.6 Soil and Water Management

The land to which this Chapter applies was found to have no appreciable erosion over the majority of the site.

Development of lots shall be carried out in a manner that restricts soil erosion and controls sediment, nutrients and other pollutants to adjoining lands and / or waterways.

Objectives

- To provide mechanisms for the protection of the environment through minimisation of erosion and sedimentation.
- To protect the quality of water in designated watercourses (as per Figure 3: Kitchener Watercourses).

Requirements

- All applications for the initial subdivision are to be accompanied by an Erosion and Sediment Control Plan and Soil and Water Management Plan.
- Soil and water management measures shall be designed for 1 in 5 year ARI storm event.
- Applications for the development of land (allotment boundary) within 40 metres of the banks of the designated watercourses shall be accompanied by a Stormwater Management Plan demonstrating that stormwater can be disposed of in a manner that minimises impact on the designated watercourses. This plan shall address quality control measures and the means to eliminate point discharges.
- Surface runoff from lots adjoining the designated watercourses is to be collected in a grassed swale or similarly approved diversion and directed to a gross pollutant trap, prior to discharge into the designated watercourses at approved locations.

Erosion and Sediment Control Plans and Soil and Water Management Plans shall be prepared according to the scale of the project.

Plans shall clearly indicate the following:

- location of site boundaries and adjoining roads;
- existing site contours at 500mm intervals, with approximate grades and direction of fall;
- location of trees and other vegetation, showing items for removal or retention;
- location of site access, proposed roads and other impervious areas;
- existing and proposed drainage patterns with proposed storm water discharge points; and
- north point and scale.

The following matters may need to be addressed in the preparation of Erosion and Sediment Control Plans and Soil and Water Management Plans. All listed matters may not apply in respect to each development proposal:

- timing of proposed works;
- locations of land where a protective groundcover will, as far as practicable, be maintained;
- access protection measures;
- nature and extent of earthworks, including the amount of any cut and fill;
- the diversion of runoff from upslope lands around the disturbed area;
- location of all soil and other material stockpiles including topsoil storage, protection and reuse methodology;
- location and type of proposed erosion and sediment control measures;
- site rehabilitation proposals, including schedules;
- frequency and nature of any maintenance program; and
- other site-specific soil or water conservation structures.

10.2.7 Bushfire Hazard Control

The land to which this Chapter applies, has been identified as being bushfire prone. The initial subdivisions shall take into account the Bushfire Hazard Assessment prepared by Building Code & Bushfire Hazard Solutions Pty., Ltd., dated May 2005 (see Appendix 3) and *Planning for Bushfire Protection 2006*.

Applicants shall consult with Council to ascertain the bushfire category applying to their lot, alternatively information can also be found on Council's website www.cessnock.nsw.gov.au.

Objectives

- To ensure that all new dwelling houses and future improvements have measures sufficient to minimise impacts of bushfires.
- To minimise the impact of fire protection measures on vegetation, fauna, views, watercourses, soil erosion, amenity and access.
- To identify potential bushfire threats to individual sites.

General Requirements

- A bushfire threat assessment shall form part of all development applications for new buildings (including dwelling houses) and for alterations / additions of existing dwelling houses in a Bushfire Prone Area.
- Assessment of threat from bushfire shall examine impacts of the proposal within and external to the site, including dwelling construction materials and existing road networks that accommodate traffic in emergency situations.
- Preparation of Assessment of bushfire threat shall include reference to:
 - NSW Rural Fire Service: *Planning for Bushfire Protection 2006*;
 - NSW Rural Fire Service: Single Dwelling Application Kit;
 - AS 3959 – 1999: Construction of Buildings in Bushfire Prone Areas; and
 - Consultation with Council and the Rural Fire Service.
- Fire protection measures shall be capable of being maintained by owners and users.
- Asset protection zones (APZs) shall be contained wholly within the subject site, but may incorporate fire trails, cleared road verges and fixed building lines.
- In instances where the balance between bushfire protection and environmental and social impacts cannot be achieved, the proposal may not be supported.

Specific Requirements for Dwelling Houses

- Appropriate APZs shall be provided around all dwelling houses (refer to *Planning for Bushfire Protection 2006* for APZ information).
- Large water storage tanks specifically for fire fighting purposes may be required for each lot prior to dwelling house occupation. This does not include swimming pools or dams.
- The provision of appropriate APZs for future dwelling houses shall be assessed with each development application.

- The provision of appropriate construction level material is to be in accordance with AS 3959-1999 and shall be assessed with each development application.

10.2.8 Management of Domestic Sewage and Wastewater

All lots to which this Chapter applies are to be serviced by a reticulated sewerage system.

10.2.9 Stormwater Management

All lots to which this Chapter applies are to be subject to the Stormwater Management Strategy dated October 2006 and prepared by Peter Sullivan & Associates Pty., Ltd., (see Appendix 4).

Objectives

- To ensure that Water Sensitive Urban Design (WSUD) is adopted to service the proposal, in order to achieve environmentally sustainability.
- WSUD will:
 - reduce flood risk;
 - improve water quality;
 - reduce the demand for reticulated water by increasing the reuse or by recycling runoff;
 - reduce erosion in waterways;
 - result in the more efficient use of water resources; and
 - protect riparian ecosystems and habitat.

Requirements

- Initial subdivision applications shall manage the runoff from roadways, which comprise the road carriageway (impervious surface), verge areas (mainly pervious, grassed or landscaped) and partly pervious (footpaths and driveways).

These applications shall also collect the flows from the minor drainage lines shown in Figure 3: Kitchener Watercourses. If necessary, provision shall be made for overland flows and on-site detention, remaining in private ownership, via larger allotments with restrictive covenants.

- Individual lot (generally residential) applications shall manage the runoff from their pervious structures and development. BASIX requirements will assist in the adoption of a number of measures, including: rainwater tanks; porous paving, infiltration devices and landscaping measures.
- Additional measures to implement WSUD include:
 - reuse of roofwater for hot water, laundry use, toilet flushing or irrigation;
 - reuse of surface runoff for irrigation purposes; and
 - use of landscaping for cleansing runoff and conserving water.

10.2.10 Road Construction

The basic road layout indicated in Figure 4: Kitchener Concept Plan shall be followed.

Objectives

- To identify and establish an efficient road network providing adequate access to all proposed building sites.
- To ensure that road construction standards satisfy Council's requirements.
- To ensure that runoff from roads does not adversely impact on the quality of water in the adjoining watercourses.
- To ensure that the road layout defines the northern, eastern and southern boundaries of the proposal, providing a permanent Asset Protection Zone against the bushfire threat and a means of accessing or evacuating any areas in an emergency situation.
- To ensure that the road layout provides a scenic outlook for those residences opposite the Werakata National Park and the Aberdare State Forest, while also providing passive surveillance.

Requirements

- All road and drainage works within the site are to be carried out in accordance with Council's 'Engineering Requirements for Development'. Full design plans are to be submitted prior to issue of a Construction Certificate for the subdivision works.
- Stormwater runoff from roads and other areas is to be collected and discharged at approved locations. A gross pollutant trap is to be provided at each final discharge point in accordance with the Stormwater Management Strategy dated October 2006, prepared by Peter Sullivan & Associates Pty., Ltd., (see Appendix 4).
- An Erosion and Sediment Control Plan is to be submitted prior to issue of a Construction Certificate for the works.
- The road layout shall be such that no residential allotment has a boundary directly adjoining the Werakata National Park or Aberdare State Forest.

10.2.11 Mine Subsidence

The purpose of building guidelines is to prevent or minimise damage through surface development controls that take account of the risk of damage by subsidence from old, current and future mining.

Requirements

- Improvements shall be erected on reinforced concrete footings and / or slabs that comply with AS 2870. The following improvements are limited to a maximum length of 30 metres.
 1. Single or two storey timber or steel framed improvements clad with weatherboards or similar materials.

2. Single or two storey brick veneer improvements.
3. Full masonry and other types of improvements will be considered for this area under the Board's 'Graduated Guidelines for Residential Construction'. The improvements would be subject to length restriction and may require engineering design.

10.2.12 Kitchener Section 94 Contribution Plan

The Section 94 Contribution Plan sets out Council's position in relation to the levying of contributions for the provision of public amenities and services for the area.

The Plan covers the development of the Kitchener Residential Area, assuming the creation of 1000 allotments over the next 15 to 20 years.

The Plan seeks contributions towards the provision of local public facilities and amenities that are required as a direct result of development within the Kitchener Residential Area, providing for the following local public services and amenities:

- two local parks and one local sportsground;
- neighbourhood centre;
- transport interchange;
- various roadworks, drainage and rail level crossing works.

The works identified in the Plan are reflected in this Chapter and strategic planning for the release area which has been identified through a local environmental study and the subsequent rezoning process.

The provision of public amenities and services will be provided over the period of the development. The development of the site will be subject mainly, to the availability of infrastructure to the locality and the resolution of drainage and native vegetation issues.

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Soil Conservation Service of NSW, 1982, *Land Resources Study of City of Greater Cessnock*, Soil Conservation Service of NSW, unpublished.

APPENDIX 1

**FLORA AND FAUNA ASSESSMENT
dated April 2005**

+ Addendum dated November 2006

Ecotone Ecological Consultants Pty., Ltd.

APPENDIX 2

**INDIGENOUS CULTURAL HERITAGE report
dated June 2006**

McCardle Cultural Heritage Pty., Ltd.

APPENDIX 3

**BUSHFIRE HAZARD ASSESSMENT report
dated May 2005**

Building Code & Bushfire Hazard Solutions Pty., Ltd.

APPENDIX 4

STORMWATER MANAGEMENT STRATEGY dated October 2006

Peter Sullivan & Associates Pty., Ltd.,

**FLORA AND FAUNA ASSESSMENT
OF THE KITCHENER TOWNSHIP PRECINCT,
CESSNOCK LGA.**

FINAL REPORT

Prepared for
PETER MAKEIG



ECOTONE ECOLOGICAL CONSULTANTS Pty Ltd

39 Platt Street, Waratah NSW 2298

phone: (02) 4968 4901 fax: (02) 4968 4960

www.ecotoneconsultants.com.au

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TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Background.....	1
1.2 General Description of the Study Locality.....	1
1.3 Description of the Study Area (Kitchener Township Precinct).....	2
2.0 DETERMINATION OF POTENTIAL THREATENED SPECIES OCCURRING WITHIN THE KITCHENER PRECINCT	5
2.1 Threatened Species Previously Recorded from the Study Locality	5
2.1.1 Flora.....	5
2.1.2 Fauna.....	6
2.2 EPBC Act Protected Matters Report.....	8
2.3 Description of available habitats.....	10
2.4 Threatened Species most likely to occur within the Kitchener Precinct.	11
3.0 ASSESSMENT OF PROPERTIES IDENTIFIED WITHIN THE PRECINCT STUDY AREA	13
3.1 Property Descriptions.....	13
3.2 Corridors and Habitat Links.....	17
3.3 Riparian Habitat	17
3.4 Development Options	19
4.0 CONCLUSIONS	21
5.0 REFERENCES	22
6.0 APPENDICES.....	23
Appendix 1. Flora Species Recorded in the Study Area	23
Appendix 2. Fauna recorded within the Study Area	27
Appendix 3. Summary of Habitat Attributes and Ranked Importance as Habitat.....	31

LIST OF TABLES

Table 1. Threatened Flora previously recorded within the Study Locality.....	5
Table 2. Threatened Fauna previously recorded within the Study Locality	7
Table 3. Characteristics of the dominant vegetation community.....	10
Table A3.1. Summary of Habitat Attributes of Individual Properties	31
Table A3.2. Ranking of Importance of Individual Properties.....	32

LIST OF FIGURES

Figure 1. Study Locality	3
Figure 2. Study Area.....	4
Figure 3. Wildlife corridors and creek buffers.....	18

1.0 INTRODUCTION

1.1 Background

This Flora and Fauna Assessment has been prepared at the request of Cessnock City Council as part of a rezoning application for Lot 2 DP 862493 and Lot 521 DP 755215, Kitchener being prepared by Peter Makeig of Otama Sands Project Development Consultants, on behalf of the property owners. Cessnock City Council is in the process of preparing a Local Environment Plan for the Kitchener Township Precinct and have requested that the flora and fauna assessment for the above properties be expanded to include the whole of the precinct.

A detailed flora and fauna study has been completed for the lots subject of the rezoning application and the results of this survey have been used to extrapolate the occurrence of these and other potential species across the whole precinct. The presence of threatened species listed under the NSW *Threatened Species Conservation Act (TSC Act)* and Commonwealth *Environment Protection and Biodiversity Protection Act (EPBC Act)* were particularly targeted. A habitat assessment of the precinct has been carried out by 'over the fence' observations and a study of air photos only.

The general aims of this assessment are to:

- describe the existing biological environment of the study area in relation to flora and fauna;
- discuss the potential impacts of any proposal within the study area on any threatened species that occur or could be likely to occur;
- provide discussion on measures to mitigate any identified impacts.

For this report,

- the *study area* consists of the whole of the Kitchener Township precinct; and
- the *study locality* is the area of land within a ten (10) kilometre radius of the centre of the precinct.

1.2 General Description of the Study Locality

The study locality is situated in the Lower Hunter Region of NSW, with the city of Cessnock being the major town. Several smaller satellite towns, including Kitchener, Paxton, Ellalong, Millfield, Aberdare, Bellbird, Abernethy, Abermain, Weston and Kurri, occur within close proximity to Cessnock. These are primarily former coal mining towns servicing the many collieries in the region. Most of these underground collieries have now closed and the main industries are now agricultural, particularly the production of wine.

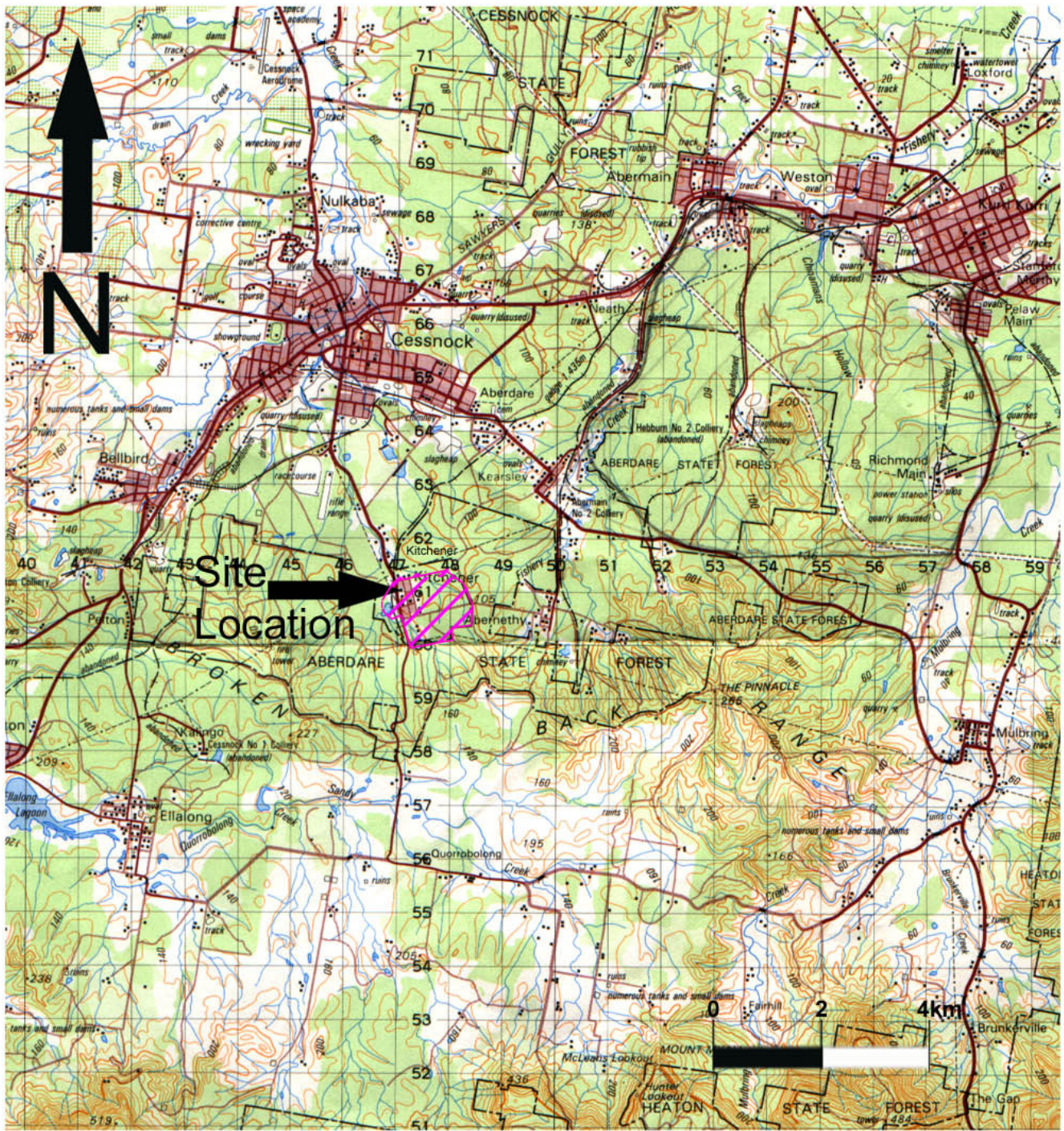
Much of the study locality is situated on the floodplains of the Hunter River and adjacent low rolling hills rising to a height of 200m. The west and south, escarpments of the Broken Back and Myall Ranges rise sharply to >400m. These form extensive areas of forest, comprising Watagan National Park and Pokolbin, Corrabare, Watagan and Heaton State Forests. Forested land closer to Cessnock, largely consist of the Cessnock and Aberdare State Forests and Werakata National Park (formerly parts of Cessnock and Aberdare State Forests).


The main creeks of the locality are Black Creek, Congewai Creek and Wollombi Brook, which all eventually drain into the Hunter River to the north.

The study locality and subject site location is illustrated in **Figure 1**.

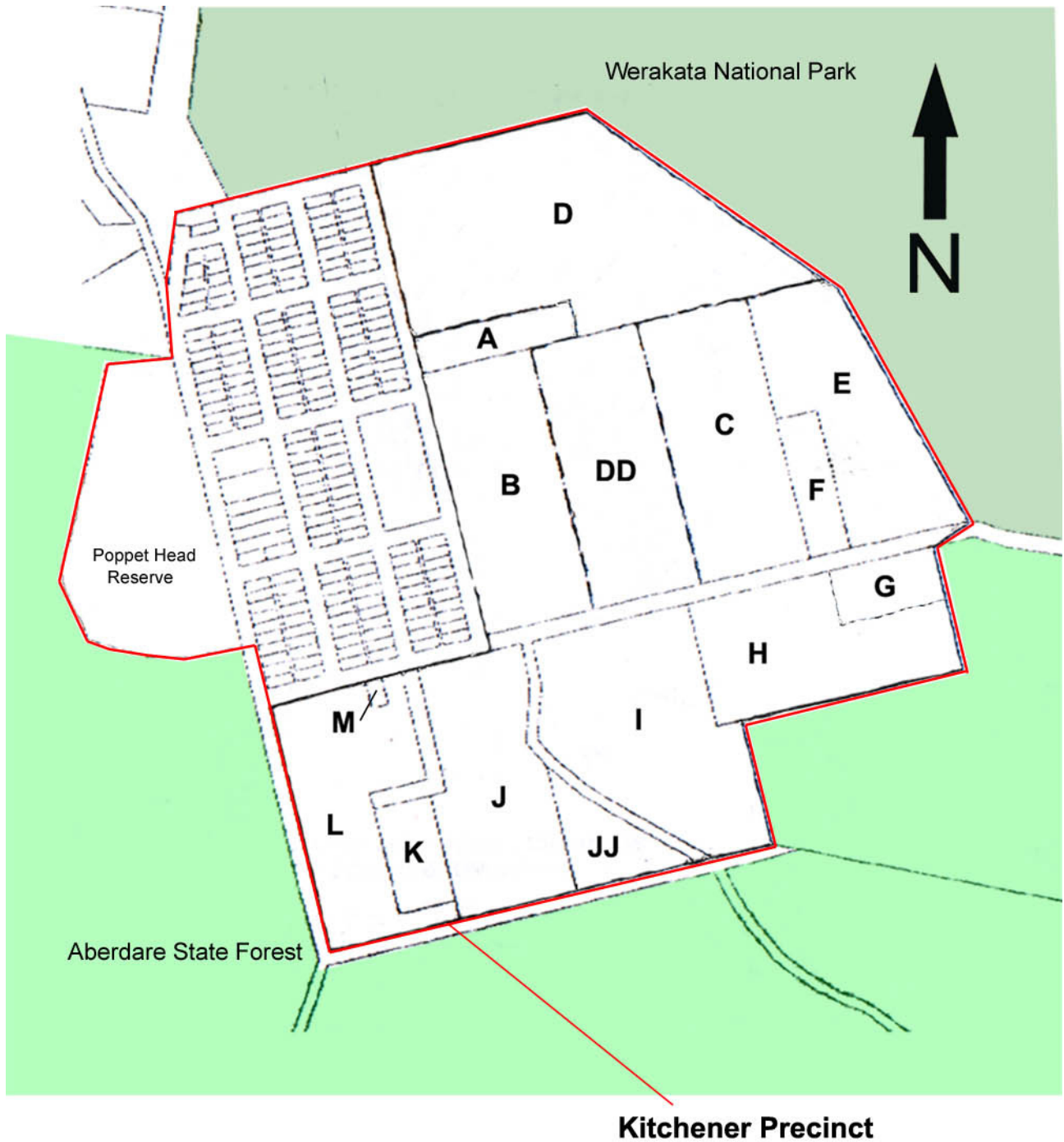
1.3 Description of the Study Area (Kitchener Township Precinct)

Kitchener township is situated approximately 3km south of Cessnock on Quorrobolong Road and as mentioned above, is an old coal mining village. The historic Poppethead Reserve occurs on the western edge of the Kitchener precinct and consists of the old mine poppethead and other mining artifacts as well as a picnic area, playground and walking tracks around a large lake. The precinct consists of the urban part of town, including a public primary school. Rural/residential properties of various sizes occur to the east and south of the town area. The rural lots consist of a mosaic of naturally vegetated areas and cleared pastureland. Apart from the Quorrobolong Road corridor to Cessnock and associated private properties, the precinct is surrounded by Werakata National Park to the north and east and Aberdare State Forest to the west and south, (see Figure 2). These forests, as well as the rural properties, have been heavily logged in the past for mine pit props and therefore, much of the surrounding forest is regenerating and hollow bearing old growth trees appear to be limited.




 <p><i>Ecotone Ecological Consultants Pty Ltd</i></p>	Figure 1: Site Location	
	Kitchener Precinct Flora and Fauna Assessment Report	April 2005

Map Source: Royal Australian Survey Corps (1982) Map 9132 Cessnock 1:100 000



Kitchener Precinct

 <p><i>Ecotone Ecological Consultants Pty Ltd</i></p>	Figure 2: Kitchener Investigation Zone	
	Kitchener Precinct Flora and Fauna Assessment Report	April 2005

2.0 DETERMINATION OF POTENTIAL THREATENED SPECIES OCCURRING WITHIN THE KITCHENER PRECINCT

A review of the documented records of the locations of threatened flora and fauna species within the study locality has been undertaken. Threatened species records were accessed from the NPWS Atlas of NSW Wildlife Database for the Cessnock 9132 1: 100, 000 map sheet, (updated to the January 2005). A protected matters report for the area under the *EPBC Act*, Ecotone records and other relevant reports were also reviewed. The results of flora and fauna surveys undertaken for Sites D and DD within the Kitchener precinct as part of a rezoning proposal have also been used to assist in determining subject species.

2.1 Threatened Species Previously Recorded from the Study Locality

2.1.1 Flora

From the review, a total of five (5) threatened flora species are known to occur within the study locality. These are listed in **Table 1** below. One (1) of these species (*Acacia bynoeana*) is classified as Endangered on Schedule 1, Part 1 and the remaining four (4) species are classified as Vulnerable on Schedule 2 of the *TSC Act*. In terms of national listings, four (4) of the species are listed as Vulnerable by the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*. Four of the species are also listed under the national database known as ROTAP *Rare or Threatened Australian Plants* (Briggs & Leigh 1996).

Endangered Populations of Plants

No listed endangered populations of plant occur within the study locality.

Endangered Ecological Communities in Cessnock LGA

Hunter Lowland Redgum Forest
 Quorrobolong Scribbly Gum Woodland
 River-flat Eucalypt Forest on Coastal Floodplain
 Swamp Oak Floodplain Forest
 Kurri Sand Swamp Woodland
 Lower Hunter Spotted Gum/Ironbark Forest

Table 1. Threatened Flora previously recorded within the Study Locality

Scientific Name	Status (TSC)	Status (EPBC)	ROTAP Risk Code	Earliest/latest record	Number of records within 10km of site	Number of records within 2.5km of site
<i>Acacia bynoeana</i>	E1	V	3VC	2003	6	0
<i>Callistemon linearifolius</i>	V	-	2RCi	2001-2003	19	0
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	V	V	2V	1999-2003	34	4
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V	V	-	2000-2004	69	31
<i>Rutidosis heterogama</i>	V	V	2VCa	2003-2004	33	3

Notes:

347000E & 6361000N are the closest co-ordinates to the centre of the study area.

Nomenclature follows Harden (1990, 1992, 1993, 2002) and Harden & Murray (2000).

Notes of Table 1. continued

Status (TSC): refers to the NSW *Threatened Species Conservation Act 1995* (TSC)

E1 – Schedule 1, Part 1: Endangered Species E2- Schedule 1, Part 2: Endangered Population
 E4 – Schedule 1, Part 4: Species Presumed Extinct V – Schedule 2: Vulnerable Species
 P13- Protected Native Plants U – Unprotected Flora and Fauna

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC)

E - Endangered Species V - Vulnerable Species

ROTAP coding (Briggs and Leigh 1996)

2 Geographic range in Australia less than 100km
 3 Geographic range in Australia greater than 100km
 V Vulnerable Species: not presently endangered, but possibly at risk in future due to continuing depletion or land-use change
 R Rare Species: rare in Australia, but currently without any identifiable threat
 C Reserved: indicates taxon has at least one population within a national park, or other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora
 a indicates that 1000 plants or more are known to occur within a conservation reserve(s)
 i indicates that less than 1000 plants are known to occur within a conservation reserve(s)

Please note: These records are based on information supplied by the National Parks and Wildlife Service and other sources, and may contain errors or omissions. Locations given are only accurate to within at least 0.5 kilometre in any direction.

2.1.2 Fauna

A total of twenty-eight (28) threatened terrestrial fauna species have previously been recorded within the study locality, including twenty-three (16) bird, twelve (9) mammal and three (3) amphibian species. Of these, six species are currently regarded as endangered on Schedule 1, Part 1 of the *TSC Act 1995* (Swift Parrot, Regent Honeyeater, Red Goshawk, Green and Golden Bell Frog, Giant Barred Frog and Brush-tailed Rock-wallaby) and the remainder as Vulnerable on Schedule 2 of the Act. The Regent Honeyeater is also listed as Endangered and Migratory and the Swift Parrot and Giant Barred Frog as endangered by the Commonwealth *EPBC Act, 1999* and a further four species are listed as vulnerable. The local threatened fauna species are listed below in **Table 2**.

Endangered Fauna Populations

No Endangered Populations occurs within the study locality.

Table 2. Threatened Fauna previously recorded within the Study Locality

Scientific Name	Common Name	Status (TSC)	Status (EPBC)	Earliest/latest record	Number of records within 10km of site	Number of records within 2.5km of site
BIRDS						
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-	1992-2003	14	0
<i>Climacteris picumnus</i>	Brown Treecreeper	V	-	1990-2003	17	1
<i>Erythrotriorchis radiatus</i>	Red Goshawk	E1	V	1987	1	0
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	V	-	1998-1999	3	0
<i>Lathamus discolor</i>	Swift Parrot	E1	E	1985-2000	32	3
<i>Melanodryas cucullata</i>	Hooded Robin	V	-	1997	1	0
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subsp.)	V	-	1996-2003	35	0
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	1992-2000	7	0
<i>Ninox connivens</i>	Barking Owl	V	-	1998	1	0
<i>Ninox strenua</i>	Powerful Owl	V	-	1996-2003	5	0
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subsp.)	V	-	1970-2003	17	0
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	V	-	1970-2000	2	0
<i>Stictonetta naevosa</i>	Freckled Duck	V	-	1983	1	0
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	2004	1	1
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	1996-2000	3	0
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	1993-2000	3	0
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E1	E, Mi	1979-2000	11	0
AMPHIBIANS						
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	V	1993	1	0
<i>Litoria brevipalmata</i>	Green-thighed Frog	V	-	2002	2	0
<i>Mixophyes iteratus</i>	Giant Barred Frog	E1	E	1999	3	0
MAMMALS						
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V	-	2000-2004	5	1
<i>Miniopterus australis</i>	Little Bent-wing Bat	V	-	2004	1	1
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	1998	2	0
<i>Myotis macropus</i>	Southern Myotis	V	-	2004	1	0
<i>Mormopterus norfolkensis</i>	East-coast Freetail-bat	V	-	2002-2004	4	1
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	2004	1	1
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	1994-2003	18	0
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	1992-2004	9	2
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1	V	1996-1998	3	0
<i>Phascolarctos cinereus</i>	Koala	V	-	1997-2000	4	0
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	1990-2003	2	0

Notes:

347000E & 6361000N are the closest co-ordinates to the centre of the Kitchener precinct.

Status (TSC): refers to the NSW *Threatened Species Conservation Act 1995* (TSC)

E1 – Schedule 1, Part 1: Endangered Species

E2 – Schedule 1, Part 2: Endangered Population

V – Schedule 2: Vulnerable Species

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC)

E - Endangered Species; V - Vulnerable Species

Please note: These records are based on information supplied by the National Parks and Wildlife Service and other sources, and may contain errors or omissions.

2.2 EPBC Act Protected Matters Report

A review of the Protected Matters under the Commonwealth EPBC Act for the study locality has yielded a report listing the following matters that could potentially be relevant to the EPBC Act for activities within the study area.

Matters of NES (National Environmental Significance)

World Heritage Properties: None

National Heritage Places: None

Wetlands of International Significance (Ramsar Sites): 1 – Hunter Estuary Wetlands.

The study locality is within the same catchment as this Ramsar site. Black Creek, the headwaters of which occur in State Forest near the current Kitchener township and also within the precinct study area, flows into the Hunter River. However, this Ramsar site occurs more than 30 kilometres to the east of the subject site, and any effects on the Ramsar wetland due to any development in the precinct are thus likely to be negligible, and further consideration of Ramsar sites is considered unnecessary.

Threatened Ecological Communities: None

Threatened Species: Plants – 5 species

A number of flora species (5) have been identified in the Protected Matters Report as “species or species habitat likely to occur in the area” (i.e, the study locality). Two of these species, (*Acacia bynoeana* and *Eucalyptus parramattensis* subsp. *parramattensis*), already appear as NPWS records in Table 1 above, including two additional species, (*Grevillea parviflora* subsp. *parviflora* and *Rutidosis heterogama*), that did not show up in the Protected Matters report. Three species, *Cryptostylis hunteriana*, *Angophora inopina* and *Eucalyptus glaucina*, additional to those already listed in Table 1 above are listed as species that are likely or may occur in the study locality.

Threatened Species: Fauna – 13 species

From the EPBC Act Protected Matters Report the following fauna species are listed but were not recorded in the NSW NPWS Wildlife Atlas search (Table 2) for the locality. Species that may occur, as potential habitat is available in the local area, are shown in bold:

Australian Painted Snipe *Rostratula australis* - vulnerable

Giant Burrowing Frog *Heleioporus australiacus* - vulnerable

Stuttering Frog *Mixophyes balbus* – vulnerable

Large-eared Pied Bat *Chalinolobus dwyeri* - vulnerable

Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland pop.) - endangered

Hastings River Mouse *Pseudomys oralis* - endangered

Broad-headed Snake *Hoplocephalus bungaroides* - vulnerable

Terrestrial Migratory Species

White-bellied Sea-Eagle *Haliaeetus leucogaster*

White-throated Needletail *Hirundapus caudacutus*

Black-faced Monarch *Monarcha melanopsis*

Satin Flycatcher *Myiagra cyanoleuca*

Rufous Fantail *Rhipidura rufifrons*

Regent Honeyeater *Xanthomyza phrygia*

Species that may occur, as potential habitat is available in the local area, are shown in bold:

Migratory Wetland Species: not relevant in the case of this proposal

Other Matters Protected by the EPBC Act

Listed Marine Species:

Fork-tailed Swift *Apus pacificus* – fly over only

Great or White Egret *Ardea alba* – occasional foraging

Cattle Egret *Ardea ibis* – likely foraging

Latham's or Japanese Snipe *Gallinago hardwickii* – no habitat

White-bellied Sea-Eagle *Haliaeetus leucogaster* - fly over only

White-throated Needletail *Hirundapus caudacutus* - fly over only

Swift Parrot *Lathamus discolor* – known to forage in the area

Rainbow Bee-eater *Merops ornatus* – may forage and/or breed on site

Black-faced Monarch *Monarcha melanopsis* – may forage and/or breed on site

Satin Flycatcher *Myiagra cyanoleuca* – may forage and/or breed on site

Rufous Fantail *Rhipidura rufifrons* – may forage and/or breed on site

Painted Snipe *Rostratula benghalensis* – no habitat

Species that may occur, as potential habitat is available in the local area, are shown in bold:

Critical Habitats: None

Commonwealth Lands: None of the land owned by these Commonwealth statutory authorities is within the immediate vicinity of the study area, and would therefore not be affected by the proposal. Telstra cabling may pass through or near the study area, but not within land owned by the Commonwealth.

Places on the Register of the National Estate:

Historic: None

Natural: 1 site – Bow Wow Creek Gorge

This place is not in the vicinity of the study area, and would not be affected by any proposed developments in the Kitchener Precinct

Extra Information

State and Territory Reserves: 2 – Watagans National Park and Werakata National Park

Werakata National Park adjoins the north and north-eastern boundaries of the precinct and therefore, there is some potential for impacts to occur as a result of development within the precinct.

2.3 Description of available habitats

The vegetation of the study area shows considerable variation in structure, maturity and species composition, but the dominant community type covering the entire site is that of Spotted Gum – Ironbark Forest, or transitional forms of that community with other vegetation communities in the area. The vegetation varies widely in the level of clearing, tree removal, grazing and underscrubbing. The vegetation types range from relatively intact forest or woodland to fully cleared open pasture with or without scattered remnant trees. Large areas of cleared open pasture occur, particularly at the northern end of the precinct area.

The characteristics of the “typical” form of the community (i.e., represented by those areas that are relatively undisturbed and where the vegetation remains relatively intact) are shown in Table 3 below. The nature of variant and intergrade forms of the community is described briefly.

Dams within the study area provide some aquatic and semi-aquatic habitat, with aquatic or fringing species such as *Ottelia ovalifolia*, *Eleocharis spahcelata*, *Typha orientalis*, *Ludwigia peploides* and *Persicaria decipiens* growing in or by the water.

Table 3. Characteristics of the dominant vegetation community

Stratum	Height	% cover*	Dominant species	Comments
OPEN FOREST – Spotted Gum / Ironbark / Grey Gum				
Tree layer	20 - 25 m	30 - 40	<i>Corymbia maculata</i> <i>Eucalyptus fibrosa</i> <i>E. canaliculata</i> <i>E. punctata</i> <i>E. resinifera</i> <i>E. globoidea</i>	Variants of this community represent practically the entire natural vegetation cover of the study area. In its “typical” form, the community is dominated by Spotted Gums, Ironbarks and Grey Gums of reasonable maturity and height, with a sparse to moderate understorey. The precinct area is practically surrounded by uncleared vegetation, based on the Spotted Gum-Ironbark Community. To the north and north-west, the vegetation is lower and more scrubby, and tends towards the Kurri Sand Swamp Woodland Community. The uncleared lot in the centre of the site contains some Forest Red Gums, and tends towards the Hunter Lowland Redgum Forest Community. Other variants of the community within the site include remnants with Turpentines, Stringybarks and Smooth-barked Apples, (e.g., paddock areas to the west) but due to the extent of clearing, it was difficult to determine the original composition of these remnants. Parts of the community were characterised by low thickets of Ball Honeymyrtle.
Sub-canopy layer	2 – 8 m	0 - 30	<i>Melaleuca nodosa</i> <i>Melaleuca styphelioides</i> <i>Leptospermum trinervium</i>	
Shrub layer	1 - 2 m	0 - 30	<i>Acacia lunata</i> <i>A. longifolia</i> <i>A. parvipinnula</i> <i>A. falcata</i> <i>A. elongata</i> <i>A. ulicifolia</i> <i>Maytenus silvestris</i> <i>Callistemon rigidus</i> <i>Melaleuca sieberi</i> <i>Dodonaea triquetra</i> <i>Hakea sericea</i> <i>Breynia oblongifolia</i> <i>Jacksonia scoparia</i> <i>Pimelea linifolia</i> <i>Banksia spinulosa</i> <i>Daviesia ulicifolia</i> <i>Monotoca scoparia</i> <i>Persoonia linearis</i> <i>Leptospermum polygalifolium</i>	

Stratum	Height	% cover*	Dominant species	Comments
OPEN FOREST – Spotted Gum / Ironbark / Grey Gum - continued				
Ground layer	To 1 m	5 - 40	<i>Glycine clandestina</i> <i>Melaleuca thymifolia</i> <i>Grevillea montana</i> <i>Aristida vagans</i> <i>Cheilanthes sieberi</i> <i>Lomandra filiformis</i> <i>Epaltes australis</i> <i>Pomax umbellata</i> <i>Platysace ericoides</i> <i>Echinopogon caespitosus</i> <i>Billardiera scandens</i> <i>Phyllanthus hirtellus</i> <i>Macrozamia communis</i> <i>Goodenia hederacea</i> <i>Hardenbergia violacea</i> <i>Wahlenbergia communis</i> <i>Chorizema parvifolium</i> <i>Haemodorum planifolium</i> <i>Pratia purpurascens</i> <i>Themeda australis</i> <i>Viola hederacea</i> <i>Dichelachne crinita</i> <i>Austrodanthonia</i> sp. <i>Chrysocephalum apiculatum</i>	

2.4 Threatened Species most likely to occur within the Kitchener Precinct.

Based on the assessment above and the field work conducted on properties D and DD, the following species and endangered ecological communities are regarded as being known or the most potential species to occur within the Kitchener precinct.

Flora

No threatened flora species listed under the *TSC Act* or *EPBC Act* were found during field surveys within the precinct, however, one species *Grevillea montana* listed as a ROTAP species was found in Property D. The Parramatta Red Gum *Eucalyptus parramattensis* subsp. *decadens* is known to occur just north of the Kitchener Precinct adjacent to Quorrobolong Road, however, suitable habitat does not appear to occur within the precinct.

Endangered Ecological Communities

The Lower Hunter Spotted Gum/Ironbark Forest has recently been listed, therefore, a large part of the precinct would be considered to contain remnants of this endangered ecological community. Small pockets of Hunter Lowland Redgum Forest may occur, particularly along the creek flats of property L. Other remnants of this community occur in Poppethead Reserve and State Forest fronting the junction of Abernethy Street and Cessnock Street.

Fauna

Several threatened fauna species are known or have most potential to occur within or near the precinct boundary. These can be grouped as follows:

Woodland Birds

*Diamond Firetail *Stagonopleura guttata* – known to occur in the precinct.

Grey-crowned Babbler *Pomatostomus temporalis temporalis* – known to occur in the locality and potential habitat occurs.

Speckled Warbler *Pyrrholaemus sagittatus* – known to occur in the locality and potential habitat occurs.

Hooded Robin *Melanodryas cucullata* – known to occur in the locality and potential habitat occurs.

Brown Treecreeper *Climacteris picumnus* – known to occur within 2km and potential habitat occurs.

Turquoise Parrot *Neophema pulchella* – known to occur in the locality and potential habitat occurs.

Nomadic Predominantly Winter Visitors

Swift Parrot *Lathamus discolor* – known to occur in the precinct.

Regent Honeyeater *Xanthomyza phrygia* – known to occur in the locality and potential habitat occurs.

Black-chinned Honeyeater *Melithreptus gularis gularis* – known to occur in the locality and potential habitat occurs.

Forest Owls

Masked Owl *Tyto novaehollandiae* – known to occur in the locality and potential habitat occurs

Barking Owl *Ninox connivens* – known to occur in the locality and potential habitat occurs

Bats

*Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis* – known to occur in the precinct

*Little Bent-wing Bat *Miniopterus australis* – known to occur in the precinct

Southern Myotis *Myotis macropus* – known to occur in the locality and foraging habitat available

*Greater Broad-nosed Bat *Scoteanax rueppellii* – probably recorded by call within the precinct

*East-coast Freetail-bat *Mormopterus norfolkensis* – probably recorded by call within the precinct

*Grey-headed Flying-fox *Pteropus poliocephalus* – known to occur in the precinct

Arboreal Mammals

*Squirrel Glider *Petaurus norfolcensis* – known to occur in the precinct

Koala *Phascolarctos cinereus* – known to occur in the locality and potential habitat occurs

* indicates that this species was recorded during the surveys carried out on properties D and DD.

General Fauna

The fauna surveys conducted for Properties D and DD recorded 83 species, comprising 61 bird, 14 mammal, 7 frog and one reptile species. An additional 6 bat species were probably or possibly recorded, however, positive identification could not be achieved by call analysis alone. A list of the fauna recorded is appended. This represents only part of the overall fauna species diversity expected within the precinct and seasonal surveys would certainly increase the number of at least bird and reptile species.

Additional species recorded at the Poppethead Reserve during the current precinct assessment are as follows: Muscovy Duck (introduced), Azure Kingfisher, Coot, Black Swan, Superb Fairy-wren and Eastern Long-necked Tortoise.

3.0 ASSESSMENT OF PROPERTIES IDENTIFIED WITHIN THE PRECINCT STUDY AREA

The boundary of the Kitchener Township Precinct is shown in Figure 2. The lot boundaries within the precinct to be assessed are also shown in Figure 2. Each individual lot has been given an identifying letter, (A – M). Each lot was visually assessed from the boundary fence, except in the case of D and DD, where a full flora and fauna survey was conducted. The full results of these surveys will be the subject of a rezoning application for these properties and only an extract of the results will be used in this report. A brief description of available habitats and the potential for the occurrence of threatened flora and fauna species and endangered ecological communities is given.

3.1 Property Descriptions

Property A

Predominantly cleared with a dwelling, sheds and a trotting training track.

Potential Threatened Species and Endangered Ecological Communities

Flora – nil

Fauna – foraging insectivorous bats

Property B

Spotted Gum/Ironbark forest in southern end with Grey Gum and Forest Red Gum more common in the northern part. A reasonably intact shrub and ground cover occurs with no recent evidence of fire.

Potential Threatened Species and Endangered Ecological Communities

Flora – Lower Hunter Spotted Gum/Ironbark forest, particularly in south and Hunter Lowland Red Gum Forest remnants in the northern part of the property.

Fauna- Squirrel Glider – known to occur
 Woodland Birds – known to occur in the locality
 Nomadic Winter Visitors – known to occur in the locality, foraging only
 Forest Owls – mainly foraging, few nesting opportunities noted
 Bats- foraging and roosting (tree roosting species only)

Property C

Well vegetated with one dwelling and sheds. Spotted Gum/Ironbark forest adjacent to Abernethy Street with more dominance by Stringybarks at the rear of the lot. The whole property has been burnt within the last two years and the trees are generally small (<20cms DBH) and regenerating.

Potential Threatened Species and Endangered Ecological Communities

Flora – Lower Hunter Spotted Gum/Ironbark forest throughout

Fauna - Squirrel Glider – known to occur on nearby property
 Woodland Birds – known to occur in the locality
 Nomadic Winter Visitors – known to occur in the locality, foraging only
 Forest Owls – mainly foraging, few nesting opportunities noted

Bats- foraging and roosting (tree roosting species only)

Property D

Cleared pastureland except for scattered old growth trees, some providing a selection of hollows. A small area of remnant forest occurs in the south-eastern corner, however, the whole property is grazed by horses and Eastern Grey Kangaroos resulting in no or very sparse natural shrub and ground cover.

Potential Threatened Species and Endangered Ecological Communities

Flora – *Grevillea montana* (ROTAP listed only)
Lower Hunter Spotted Gum/Ironbark forest, small remnant in south-east corner

Fauna - Diamond Firetail – known to occur on site
Eastern Bent-wing Bat – probable record from property
Little Bent-wing Bat - probable record from property
Other Woodland Birds – known to occur in the locality, limited habitat
Nomadic Winter Visitors – known to occur in the locality, limited foraging only
Forest Owls – limited foraging, some nesting opportunities noted
Additional Bats- foraging and roosting (tree roosting species only)

Property DD

Predominantly cleared with dwelling and sheds in the front half of the property. Scattered Spotted Gum, Ironbark, Turpentine and Smooth-barked Apple occur. At the rear of property Spotted Gum/Ironbark/Grey Gum/Red Mahogany/White Stringybark forest is dominant with Turpentine along an ephemeral creek line. Two medium sized dams provide habitat for waterfowl and frogs as well as a foraging site for insectivorous bats. Some dense patches of *Melaleuca/ Leptospermum* regrowth occur in the rear of the lot and ground cover is very sparse as a result grazing by horses, rabbits and Eastern Grey Kangaroos.

Potential Threatened Species and Endangered Ecological Communities

Flora – Lower Hunter Spotted Gum/Ironbark forest remnant at rear of lot

Fauna - Greater Broad-nosed Bat – probable record from property
Eastern Bent-wing Bat – recorded from property
Little Bent-wing Bat - recorded from property
East-coast Freetail-bat – probable record from property
Southern Myotis – possible recording over the rear dam
Grey-headed Flying-fox – feeding in Smooth-barked Apple on site
Squirrel Glider – known to occur on nearby property
Woodland Birds – known to occur in the locality
Nomadic Winter Visitors – known to occur in the locality, foraging only
Forest Owls – mainly foraging, no nesting opportunities noted

Property E & F

Predominantly cleared grazing land with scattered old growth trees, dominated by Spotted Gum, Grey Gum and White Stringybark with a few Ironbarks. Several trees noted to provide a variety of tree hollows. Eastern boundary adjoins Werakata National Park. Two moderate sized farm dams

provide habitat for waterfowl and frogs as well as a foraging site for insectivorous bats. A house and sheds occur on each of the properties.

Potential Threatened Species and Endangered Ecological Communities

Flora – Lower Hunter Spotted Gum/Ironbark forest, small remnants and scattered trees

Fauna- Squirrel Glider – known to occur on nearby property
 Woodland Birds – known to occur in the locality
 Nomadic Winter Visitors – known to occur in the locality, foraging only
 Forest Owls – mainly foraging, some nesting opportunities noted
 Bats- foraging and roosting (tree roosting species only)

Property G and H

Spotted Gum/Ironbark regenerating forest that has been burnt within the last two years occurs over much of the properties. No dwelling occurs on G and a house and sheds occur in the south-west corner of property H, where, from Figure 2, larger trees appear to occur.

Potential Threatened Species and Endangered Ecological Communities

Flora – Lower Hunter Spotted Gum/Ironbark forest predominant

Fauna- Squirrel Glider – known to occur on nearby property
 Woodland Birds – known to occur in the locality
 Nomadic Winter Visitors – known to occur in the locality, foraging only
 Forest Owls – mainly foraging, few nesting opportunities noted
 Bats- foraging and limited roosting (tree roosting species only)

Property I

Scattered Spotted Gum/Grey Gum and White Stringybark mostly regenerating, although occasional hollow bearing old growth trees occur. Turpentines occur in depressions and Ironbarks are scarce across the property. The northern part of Property I (fronting Abernathy Street) has a more natural tree cover and some native ground cover occurs, whereas much of the remainder of the site is grazed. A large dam occurs, which provides habitat for waterfowl and frogs as well as a foraging site for insectivorous bats, particularly the Southern Myotis. A house and sheds and clearing occurs in the centre of the property. A strip of trees, some being mature and hollow bearing, occurs along the roadside verge of Southams Road.

Potential Threatened Species and Endangered Ecological Communities

Flora – Lower Hunter Spotted Gum/Ironbark forest remnants

Fauna- Squirrel Glider – known to occur on nearby property
 Woodland Birds – known to occur in the locality
 Nomadic Winter Visitors – known to occur in the locality, foraging only
 Forest Owls – mainly foraging, few nesting opportunities noted
 Bats- foraging and roosting (tree roosting species only)

Property J

Largely cleared and grazed with scattered Grey Gums, Spotted Gums and Ironbarks, particularly in the rear/southern part of the property. There is good roadside vegetation, dominated by Spotted Gums and Grey Gums, adjoining this property along Richmond Street and Abernathy Street. A house and sheds occur in the northern part of the property with a large shed in the rear of the site. The property adjoins Aberdare State Forest on its southern boundary.

Potential Threatened Species and Endangered Ecological Communities

Flora – nil

Fauna- Woodland Birds – known to occur in the locality
Nomadic Winter Visitors – known to occur in the locality, limited foraging only
Bats- foraging and limited roosting (tree roosting species only)

Property JJ

Predominantly cleared apart from a strip of trees along Southams Road. A house, sheds and a medium sized dam are present. The property adjoins Aberdare State Forest on its southern boundary.

Potential Threatened Species and Endangered Ecological Communities

Flora – nil

Fauna- Woodland Birds – known to occur in the locality
Nomadic Winter Visitors – known to occur in the locality, limited foraging only
Bats- foraging and limited roosting (tree roosting species only)

Property K

Predominantly cleared with a dwelling and gardens in the northeast corner.

Potential Threatened Species and Endangered Ecological Communities

Flora – nil

Fauna – foraging insectivorous bats

Property L/M

Although much of the property is grazed by stock a reasonable tree cover occurs in the western and southern part of the site. The north-eastern part of property is predominantly cleared and a house and sheds occur. Dominant tree species are Spotted Gums, Ironbark, Grey Gum and White Stringybark. A drainage line runs roughly north-south through the property and in these moister areas Paperbarks, Turpentines and Forest Red Gums occur. Although much of the vegetation is regenerating, scattered larger trees up to 25-30m high are present

Potential Threatened Species and Endangered Ecological Communities

<i>Flora</i> –	Lower Hunter Spotted Gum/Ironbark forest in the western drainage lines, plus small remnants of Lower Hunter Redgum Forest.
<i>Fauna</i> –	Squirrel Glider – known to occur on nearby property Woodland Birds – known to occur in the locality Nomadic Winter Visitors – known to occur in the locality, foraging only Forest Owls – mainly foraging, no nesting opportunities noted Bats- foraging and roosting (tree roosting species only)

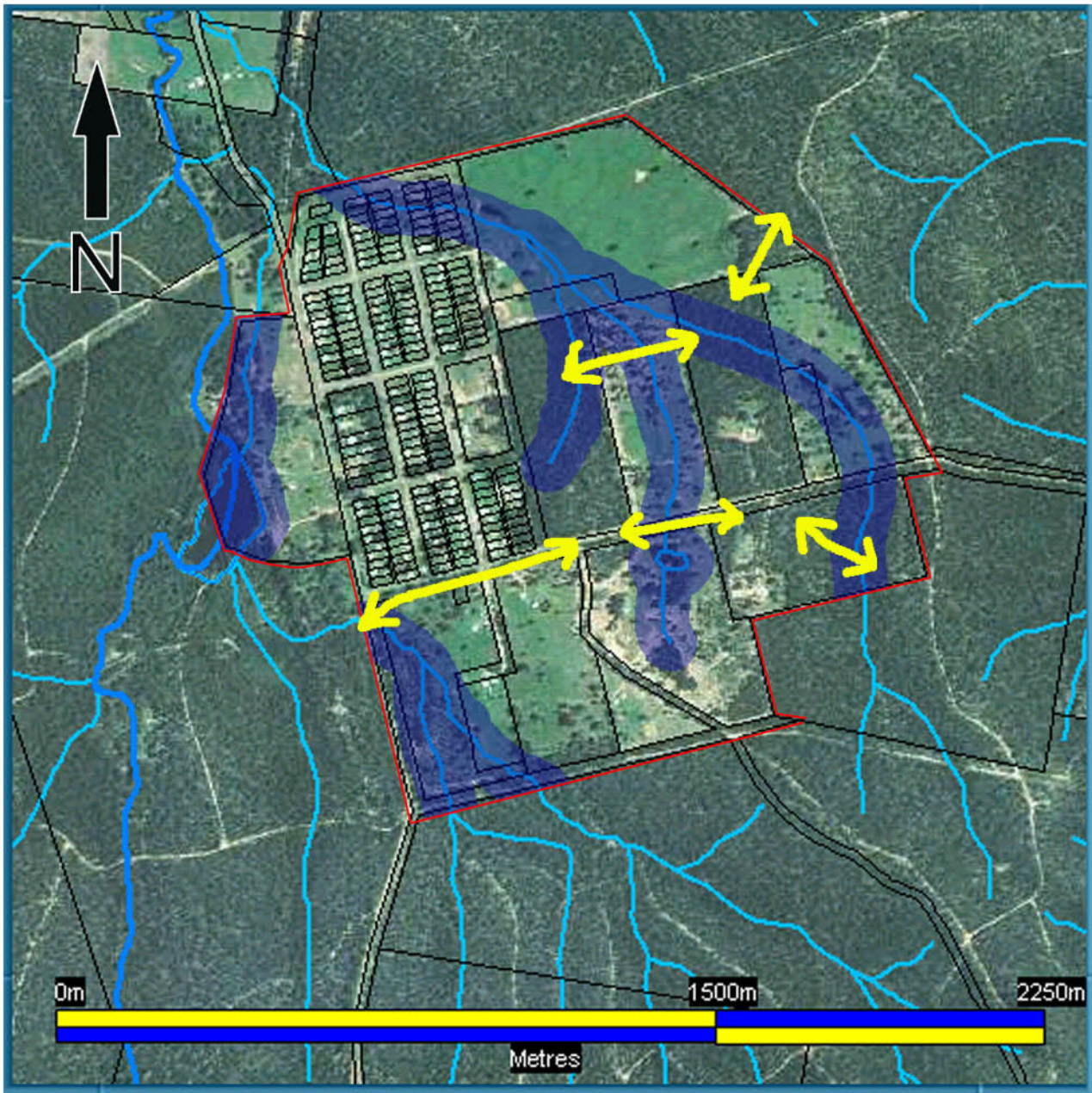
A summary of the assessment of each property has been prepared and is shown in Table A3.1 in Appendix 3. Each property has been ranked for its apparent importance as habitat for threatened fauna (Table A3.2). As was to be expected, those properties with intact or reasonably intact natural vegetation scored the highest (Properties B, C, G, H and Poppethead Reserve west). However, properties with mid range scores and predominantly cleared (DD, E, F, I & L /M) picked up points as a result of scattered hollow bearing old growth trees. Areas with a score in the bottom half of the ratings were generally cleared of trees and considered to be of low habitat value. However, property D with a score of 10 still has some value for threatened species, as many of the remaining trees contained hollows suitable as nest/roost sites for owls and bats. Also when in flower, these trees would provide some foraging resources for nectar feeding species (Swift Parrot, Regent Honeyeater, Black-chinned Honeyeater and Grey-headed Flying-fox). The threatened Diamond Firetail was also recorded at a small dam in the north-east of the site.

3.2 Corridors and Habitat Links

A view of the air photo of the precinct shows that the study area consists of Kitchener Township in the north-west and a mixture of cleared agricultural small holdings and forest remnants. Apart from the road corridor to Cessnock in the north west corner, the whole precinct is surrounded by forested land, (Werakata National Park in the north and east and Aberdare State Forest to the south and west). Currently there appear to be corridors through the precinct linking the naturally vegetated properties, particularly B and C, with the National Park with the State Forest. There is a direct link from the State Forest through H/G to C and then through the north-east corner of D to the National Park. The trees in the rear of DD also link B to C and this is seen as being important for the continued existence of the Squirrel Glider in the precinct. Movement to the west is compromised by Kitchener Township, however, scattered trees in the southern part of town and along Abernethy Street provide a potential route (see Figure 3 for current corridor links). It is interesting to note that the remaining threatened species with potential to occur, apart from the Koala, are mobile, flying species and therefore, broken corridors can be crossed.

3.3 Riparian Habitat

The drainage lines within the precinct form part of the headwaters of Black Creek. Black Creek is listed as a prescribed stream as it is a tributary of the Hunter River. Therefore, all drainage lines may be classed as Category B, Protected Lands under the *Native Vegetation Conservation Act 1997* (to be replaced by the *Native Vegetation Act 2003*) and the *Rivers and Foreshores Improvement Act 1948* (eventually to be replaced by the *Water Management Act 2000*). If it is determined that the drainage lines are Protected Lands, then a buffer of 20m from each stream bank may be required and this would place serious constraints on urban development within the precinct (see Figure 3). Whether identified protected land that is currently cleared would need to be re-vegetated is unclear. If this is the case, then by the time bushfire asset protection zones are put in place, there would be very little developable land available (see Bushfire Hazard Assessment figures). Discussions with



Key





-  Current Wildlife Corridor
-  Kitchener Precinct Boundary
-  Creek/Drainage Line
-  Approximate Creek/Drainage Line Buffer



Figure 3: Wildlife Corridors and Creek Buffers	
Kitchener Precinct Flora and Fauna Assessment Report	April 2005

Aerial Photo source: iPlan

the Department of Infrastructure Planning and Natural Resources (DIPNR) will be essential in order to determine whether the drainage lines within the precinct are protected lands and if so, what options are available. It is possible that a drainage plan for the precinct can be designed in such a way that the water is treated on site prior to its release down stream. This may avoid the necessity to re-vegetate creeklines and some section could be piped underground.

3.4 Development Options

Based on the above information, three separate scenarios are discussed below;

- a) All lots within the precinct are developed for urban development;
- b) Lot B and linking corridors are retained as habitat areas; and
- c) All of the existing vegetation remnants are retained as habitat.

Option A

This would achieve a maximum yield for urban settlement, however, remnants of endangered ecological communities and known or potential habitat for threatened species would be lost. It is recognised that not all trees would need to be removed from the precinct area. This is demonstrated by the level of trees retained in parts of the existing Kitchener township, however, not all of the available lots are currently developed, therefore, tree number may be artificially elevated. The expected scattered trees across the precinct would still provide a reduced seasonal food source for nomadic threatened species such as the Swift Parrot, Regent Honeyeater, Black-chinned Honeyeater and Grey-headed Flying-fox. Limited roosting/nesting and foraging habitat would also be available for bats and birds in general. The current drainage lines would need to be incorporated into the precinct drainage system, which would most likely be underground. A 30-40m asset protection zone would be required around all precinct boundaries adjoining the Werakata National Park or Aberdare State Forest (Building Code and Bushfire Hazard Solutions, 2005).

Option B

This option would provide a reasonable yield for urban development, whilst still retaining a more rural atmosphere, in that larger lot sizes would be required to retain a scattered tree cover. The retention of Lot B as a public reserve would retain the best quality habitat within the precinct, as it is the only large remnant that has not been recently burnt. It is also known habitat for the Squirrel Glider and likely habitat for the Swift Parrot and several bat species. Therefore, a remnant of possibly two endangered ecological communities and habitat for threatened species would be retained. With regards to the Squirrel Glider, suitable corridors to the bushland surrounding the precinct would need to be retained, so as to maintain the viability of the population. Scattered trees, with trunks approximately 30-40m apart, would provide a potential corridor providing that glide paths are not obstructed by buildings or tall fencing. Drainage options are expected to be similar to Option 1, although some vegetated sections of creek line could be retained as part of a fauna corridor, for instance in Lots DD and C. The drainage lines and associated vegetation in Lot L could also be considered for retention within larger lots, although a restriction on land use would need to be applied to protect the riparian vegetation. In addition to the asset protection zones described in Option 1, a 30m buffer zone would be required around Lot B. Some hazard reduction work, such as thinning, under scrubbing and burning would also need to be carried out as part of a management plan for the reserve.

Option C

This option would present extremely limited development opportunity, particularly if the protection of drainage lines and creation of asset protection zones are taken into account. If the drainage lines are taken out of the equation, there would be increased opportunity to develop the more cleared properties, such as A, D, E, J, JJ and K as well as parts of DD, F, I and L. Most of the endangered ecological community remnants as well as known and potential threatened fauna habitat would be retained, however, for these remnants to remain as viable habitat, links between remnants and to the surrounding National Park and State Forests will need to be kept intact or improved. Given the large areas of forest surrounding the precinct, it could be argued that the remaining remnants have a reduced value of importance to threatened species and that the loss of these areas would not be significant. However, given the past disturbance regimes within Werakata National Park and Aberdare State Forest, such as regular bush fires, logging for mining timber and other mining activities, it is possible that the more intact remnants (Lots A, C, H & G) and the scattered mature, hollow bearing trees have greater importance to the local fauna.

4.0 CONCLUSIONS

The flora and fauna assessment carried out for the Kitchener Precinct has identified that no threatened flora species are expected to occur. However, much of the remaining vegetation has been identified as a recently listed endangered ecological community, Lower Hunter Spotted Gum/Ironbark Forest. Small remnants of another endangered ecological community, Hunter Lowland Red Gum Forest may occur in Properties B and L as well as in the Poppethead Reserve.

Fauna surveys carried out on properties D and DD have identified the presence of seven threatened species and there is potential for a further 12 species to occur at least on occasion. It should be pointed out that it is highly unlikely that all of these 19 threatened fauna species will occur within the precinct.

The rezoning and subsequent development of rural land in the precinct has the potential to isolate remnants of habitat and may prevent movement of arboreal and terrestrial species across the landscape if either Options B & C are chosen. Therefore, the design of any potential subdivision should aim to retain adequate habitat connection between forest remnants. This could be achieved by placing larger lot sizes in these areas and retaining riparian vegetation, if present. It is noted that no permanently flowing streams occur within the precinct and most drainage lines are no more than a depression or shallow creek bed. If Option A is chosen these issues will not apply.

Any subdivision of properties outside the existing township will be subjected to close scrutiny in regards to the Rural Fires Act, 1997 as amended. This will be particularly so for those properties bordering the Werakata National Park and Aberdare State Forest as well as the remaining naturally vegetated properties within the precinct. The creation of asset protection zones, 30-40m wide, will place some restrictions on lot layout. This will place additional pressure on the owners of vegetated properties to clear or modify the existing vegetation. Care will need to be taken that this does not reach a level that will threaten the existence of the species known of most likely to occur, particularly the Squirrel Glider. Scattered trees can be accommodated within an asset protection zone, provided that the crowns are not touching. As Squirrel Gliders are known to glide up to 50m, depending on the height of the trees, a spacing of 30-40m should be adequate for the species to move through the landscape. The endangered Swift Parrot and Regent Honeyeater are less likely to be affected by habitat loss within the precinct, given their nomadic nature and the large areas of surrounding bushland, however, at least the Swift Parrot is known to return to preferred habitat on a yearly basis.

Despite the above constraints, it is our view that some subdivision could be accommodated within the predominantly cleared land of the precinct without having a significant impact on the current flora and fauna diversity. In our view, Option A – develop all lots within the precinct, is not an appropriate option, particularly given the presence of endangered ecological communities and the high number of threatened species known or likely to occur. In our view, Option B – retain Lot B and corridors to surrounding forests, provides for both a reasonable level of development and the retention of some habitat within the precinct, whereas, Option C would provide considerably less development opportunity but greater habitat retention.

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6.0 APPENDICES

Appendix 1. Flora Species Recorded in the Study Area

The following is a list of all flora species recorded within the study area. Please note that this list may be not fully comprehensive, and should be regarded as an indication of the flora present. A period of some years is often needed to identify all species present in an area, particularly for cryptic or seasonally detectable species (such as orchids and small grass-like herbs).

Notes:

* indicates an exotic or introduced native species

R indicates locally indigenous species that are potentially suitable for revegetation or replanting works

Nomenclature follows Harden (1990, 1992, 1993, 2002), Harden & Murray (2000) and subsequent recent revisions.

CLASS FILICOPSIDA (Ferns)

MARSILEACEAE

Marsilea mutica R A Nardoo

SINOPTERIDACEAE

Cheilanthes sieberi subsp. *sieberi* R Mulga Fern

CLASS CYCADOPSIDA (Cycads)

ZAMIACEAE

Macrozamia communis R Burrawang
Macrozamia flexuosa Burrawang

CLASS MAGNOLIOPSIDA (Flowering Plants)

Subclass Magnoliidae (Dicotyledons)

AMARANTHACEAE

*Alternanthera pungens** Khaki Weed

APIACEAE

Platysace ericoides R Heathy Platysace

ASTERACEAE

Chrysocephalum apiculatum Yellow Buttons
*Conyza bonariensis** Fleabane
Epaltes australis -
*Gnaphalium coarctatum** Cudweed
*Helianthus annuus** Common Sunflower
*Hypochaeris radicata** Catsear
Ozothamnus diosmifolius R Ball Everlasting/Pill Flower
Senecio linearifolius Fireweed Groundsel
*Tagetes minuta** Stinking Roger
Vernonia cinerea var. *cinerea* -

BRASSICACEAE

*Lepidium bonariense** Peppercross

CAMPANULACEAE

Wahlenbergia communis R Tufted Bluebell

CELASTRACEAE

Maytenus silvestris R Narrow-leaved Orange Bark

CHENOPODIACEAE

*Chenopodium album** Fat Hen/White Goosefoot

CRASSULACEAE

Crassula sieberiana subsp. *sieberiana* Austral Stonecrop

DILLENIACEAE

Hibbertia linearis Showy Guinea Flower

Hibbertia pedunculata R Guinea Flower

Hibbertia riparia R Guinea Flower

ERICACEAE

Lissanthe strigosa R Peach Heath

Melichrus urceolatus R Urn Heath

Monotoca scoparia R Prickly Broom Heath

EUPHORBIACEAE

Breynia oblongifolia R Coffee Bush

Phyllanthus gunnii A Spurge

Phyllanthus hirtellus R Thyme Spurge

Poranthera ericifolia Heath-leaved Poranthera

FABACEAE - Subfamily Faboideae

Bossiaea obcordata Spiny Bossiaea

Chorizema parviflorum Eastern Flame Pea

Daviesia ulicifolia R A Bitter Pea

Desmodium varians R Slender Tick-trefoil

Glycine clandestina R A Love Creeper

Hardenbergia violacea R False Sarsaparilla

Jacksonia scoparia Dogwood

Podolobium ilicifolium Prickly Shaggy Pea/Native Holly

*Trifolium arvense** Haresfoot Clover

*Trifolium repens** White Clover

FABACEAE - Subfamily Mimosoideae

Acacia elongata R Swamp Wattle

Acacia falcata R Falcate Wattle

Acacia longifolia subsp. *longifolia* R Sydney Golden Wattle

Acacia lunata Lunate-leaved Acacia

Acacia myrtifolia R Myrtle Wattle

Acacia parvipinnula R Silver-stemmed Wattle

Acacia ulicifolia R Prickly Moses

GENTIANACEAE

*Centaurium erythraea** Common Centaury

GOODENIACEAE

Goodenia hederacea var. *hederacea* R Violet-leaved Goodenia

HYPERICACEAE

*Hypericum perforatum**# St John's Wort

LAMIACEAE

*Marrubium vulgare** Horehound

LAURACEAE

Cassytha glabella Devil's Twine

Cassytha pubescens Devil's Twine

LOBELIACEAE

Pratia purpurascens R White Root

LORANTHACEAE

Muellerina eucalyptoides A Mistletoe

MALVACEAE

<i>Modiola caroliniana</i> *		Redflower Mallow
<i>Sida rhombifolia</i> *		Paddy's Lucerne

MYRTACEAE

<i>Angophora bakeri</i>	R	Narrow-leaved Apple
<i>Angophora costata</i>	R	Smooth-barked Apple
<i>Callistemon rigidus</i>	R	Stiff Bottlebrush
<i>Corymbia maculata</i>		Spotted Gum
<i>Eucalyptus canaliculata</i>		Large-fruited Grey Gum
<i>Eucalyptus canaliculata x punctata</i>		Large-fruited Grey Gum Intermediate
<i>Eucalyptus fibrosa</i>		Broad-leaved Red Ironbark
<i>Eucalyptus globoidea</i>	R	White Stringybark
<i>Eucalyptus punctata</i>	R	Grey Gum
<i>Eucalyptus resinifera</i> subsp. <i>resinifera</i>	R	Red Mahogany
<i>Eucalyptus tereticornis</i>	R	Forest Red Gum
<i>Leptospermum parvifolium</i>	R	Small-leaf Tea-tree
<i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i>	R	Lemon-scented Tea-tree
<i>Leptospermum trinervium</i>	R	Paperbark Tea-tree
<i>Melaleuca linariifolia</i>	R	Snow-in-summer
<i>Melaleuca nodosa</i>		Ball Honey-myrtle
<i>Melaleuca sieberi</i>	R	Sieber's Paperbark
<i>Melaleuca stypelioides</i>		Prickly-leaved Paperbark
<i>Melaleuca thymifolia</i>		Thyme Honey-myrtle
<i>Syncarpia glomulifera</i>	R	Turpentine

ONAGRACEAE

<i>Ludwigia peploides</i> subsp. <i>montevidensis</i> *		Water Primrose
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OXALIDACEAE

<i>Oxalis corniculata</i> *		A Wood Sorrell
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PITTOSPORACEAE

<i>Billardiera scandens</i> var. <i>scandens</i>	R	Apple Dumplings
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PLANTAGINACEAE

<i>Plantago lanceolata</i> *		Common Plantain
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POLYGONACEAE

<i>Acetosella vulgaris</i> *		Sheep Sorrell
<i>Persicaria decipiens</i>	R	Slender Knotweed

PORTULACACEAE

<i>Portulaca oleracea</i>		Pigweed/Purslane
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PRIMULACEAE

<i>Anagallis arvensis</i> *		Pimpernel
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PROTEACEAE

<i>Banksia spinulosa</i> var. <i>collina</i>		Hill Banksia
<i>Grevillea montana</i> Poorly Known 2KC-	R	A Spider Flower
<i>Hakea sericea</i>	R	Bushy Needlebush
<i>Persoonia linearis</i>	R	Narrow-leaved Geebung

RUBIACEAE

<i>Pomax umbellata</i>	R	Pomax
<i>Richardia humistrata</i> *		

SANTALACEAE

<i>Exocarpus cupressiformis</i>	R	Cherry Ballart
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SAPINDACEAE		
<i>Dodonaea triquetra</i>	R	Common Hop Bush
SOLANACEAE		
<i>Solanum nigrum</i> *		Blackberry Nightshade
THYMELACEAE		
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	R	Rice Flower
VIOLACEAE		
<i>Viola hederacea</i>	R	Native Violet
Subclass Liliidae (Monocotyledons)		
ANTHERICACEAE		
<i>Tricoryne simplex</i>	R	Yellow Rush-lily
CYPERACEAE		
<i>Cyperus gracilis</i>	R	-
<i>Eleocharis sphacelata</i>	R	Tall Spike-rush
HAEMODORACEAE		
<i>Haemodorum planifolium</i>		Strap-leaf Bloodroot
HYDROCHARITACEAE		
<i>Ottelia ovalifolia</i>		Swamp Lily
LOMANDRACEAE		
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	R	Iron Grass
<i>Lomandra longifolia</i>	R	Spiny-headed Mat-rush
PHILYDRACEAE		
<i>Philydrum lanuginosum</i>		Woolly Frogsmouth
PHORMIACEAE		
<i>Dianella revoluta</i> var. <i>revoluta</i>	R	Spreading Flax Lily
POACEAE		
<i>Aristida vagans</i>	R	A Three-awn Speargrass
<i>Austrodanthonia</i> sp.		Narrow-leaved Carpet Grass
<i>Axonopus affinis</i> *		Quaking Grass
<i>Briza maxima</i> *#		Couch
<i>Cynodon dactylon</i> *		Longhair Plumegrass
<i>Dichelachne crinita</i>	R	Hedgehog Grass
<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	R	Wiry Panic
<i>Entolasia stricta</i>	R	Brown's Love Grass
<i>Eragrostis brownii</i>	R	Blady Grass
<i>Imperata cylindrica</i> var. <i>major</i>		Paspalum
<i>Paspalum dilatatum</i> *		Kikuyu
<i>Pennisetum clandestinum</i> *		Tussock Grass
<i>Poa labillardieri</i>		Kangaroo Grass
<i>Themeda australis</i>	R	
TYPHACEAE		
<i>Typha orientalis</i>	R	Bullrush/Cumbungi
XANTHORRHOEACEAE		
<i>Xanthorrhoea fulva</i>	R	A Grass-tree

Appendix 2. Fauna recorded within the Study Area

Notes:

AMG reference for site

Map Grid 56 Easting 347000 Northing 6361000

:* indicates introduced / non-endemic species

Bold indicates a threatened species

V - Vulnerable, E – Endangered, M- Migratory

Observation types:

O	observed	W	Heard	H	Hair, feathers or skin
F	tracks/scratchings	P	scat	E	Nest/roost
T	Trapped or netted	Y	Bone or teeth	Z	In raptor/owl pellet
K	Dead	X	In scat	R	Road kill
M	Miscellaneous	U	Ultrasonic call	d	Definite identification
p	Probable identification	?	Possible ID		

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Mammals						
Family: <i>PETAURIDAE</i>						
<i>Petaurus breviceps</i>	Sugar Glider			1	H	1138
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		1	O	1137
Family: <i>PHALANGERIDAE</i>						
<i>Trichosurus vulpecula</i>	Common Brushtail Possum			3	O	1113
Family: <i>MACROPODIDAE</i>						
<i>Macropus giganteus</i>	Eastern Grey Kangaroo			10	O	1265
Family: <i>PTEROPODIDAE</i>						
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V		1	O, H	1280
Family: <i>MOLOSSIDAE</i>						
<i>Mormopterus sp2 (Adams et. al.1988)</i>	A Freetail-bat				U, d	1049
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V			U, p	1329
<i>Tadarida australis</i>	White-striped Freetail-bat				U, d	1324
Family: <i>VESPERTILIONIDAE</i>						
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V			U, d	1341
<i>Miniopterus australis</i>	Little Bent-wing Bat	V			U, d	1346
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat			1	T	1334
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat				U, d	1349
<i>Chalinolobus morio</i>	Chocolate Wattled Bat				U, p	1351
<i>Myotis macropus</i>	Southern Myotis	V			U, ?	1357
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V			U, p	1361
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat				U, p	1364
<i>Scotorepens orion</i>	Eastern Broad-nosed Bat				U, p	1365
<i>Vespadelus vulturnus</i>	Little Forest Bat				U, d	1379
Family: <i>LEPORIDAE</i>						
<i>Oryctolagus cuniculus</i> *	Rabbit			5	O	1510
<i>Lepus capensis</i> *	Brown Hare			2	O	1511

Appendix 2. continued

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Reptiles						
Family: <i>SCINCIDAE</i> <i>Tiliqua scincoides</i>	Eastern Blue-tongued Lizard			1	O	2580
Amphibians						
Family: <i>MYOBATRACHIDAE</i> <i>Crinia signifera</i> <i>Uperoleia sp.</i>	Common Eastern Toadlet				W	3134
Family: <i>HYLIDAE</i> <i>Litoria fallax</i>	Eastern Dwarf Tree Frog			3	O, H	3183
<i>Litoria latopalmata</i>	Broad-palmed Frog			2	O, H	3191
<i>Litoria peronii</i>	Peron's Tree Frog				H	3204
<i>Litoria tyleri</i>	Tyler's Tree Frog				H	3214
<i>Litoria verreauxii</i>	Verreaux's Tree Frog				H	3215
Avifauna						
Family: <i>ANATIDAE</i> <i>Chenonetta jubata</i>	Australian Wood Duck			8	O	0202
<i>Anas superciliosa</i>	Pacific Black Duck			2	O	0208
<i>Anas gracilis</i>	Grey Teal			2	O	0211
Family: <i>PODICIPEDIDAE</i> <i>Tachybaptus novaehollandiae</i>	Australasian Grebe			2	O	0061
Family: <i>PHALACROCORACIDAE</i> <i>Phalacrocorax carbo</i>	Great Cormorant			1	O	0096
Family: <i>ARDEIDAE</i> <i>Egretta novaehollandiae</i>	White-faced Heron			1	O	0188
Family: <i>ACCIPITRIDAE</i> <i>Aquila audax</i>	Wedge-tailed Eagle			1	O	0224
Family: <i>FALCONIDAE</i> <i>Falco longipennis</i>	Australian Hobby			1	O	0235
<i>Falco cenchroides</i>	Nankeen Kestrel					0240
Family: <i>RALLIDAE</i> <i>Gallinula tenebrosa</i>	Dusky Moorhen			2	O	0056
Family: <i>CHARADRIIDAE</i> <i>Elseya melanops</i>	Black-fronted Dotterel					0144
<i>Vanellus miles</i>	Masked Lapwing			2	O, E	0133
Family: <i>COLUMBIDAE</i> <i>Phaps chalcoptera</i>	Common Bronzewing			4	O	0034
<i>Ocyphaps lophotes</i>	Crested Pigeon			6	O	0043
<i>Geopelia placida</i>	Peaceful Dove					0030
<i>Geopelia humeralis</i>	Bar-shouldered Dove				W	0032
Family: <i>CACATUIDAE</i> <i>Calyptorhynchus funereus</i>	Yellow-tailed Black-cockatoo				H	0267
<i>Eolophus roseicapillus</i>	Galah			6	O	0273
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo				H	0269
Family: <i>PSITTACIDAE</i> <i>Platycercus eximius</i>	Eastern Rosella			4	O	0288

Appendix 2. continued

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Avifauna - continued						
Family: <i>CUCULIDAE</i>						
<i>Cuculus pallidus</i>	Pallid Cuckoo			1	O	0337
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo					0338
<i>Eudynamis orientalis</i>	Common (Pacific) Koel			1	H	0347
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo			1	O	0348
Family: <i>STRIGIDAE</i>						
<i>Ninox boobook</i>	Southern Boobook			1	H	0242
Family: <i>AEGOTHELIDAE</i>						
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar			2	H	0317
Family: <i>ALCEDINIDAE</i>						
<i>Dacelo novaeguineae</i>	Laughing Kookaburra			1	H	0322
<i>Todiramphus sanctus</i>	Sacred Kingfisher			1	W	0326
Family: <i>CORACIIDAE</i>						
<i>Eurystomus orientalis</i>	Dollarbird			1	O	0318
Family: <i>CLIMACTERIDAE</i>						
<i>Cormobates leucophaeus</i>	White-throated Treecreeper				E	0558
Family: <i>PARDALOTIDAE</i>						
<i>Pardalotus punctatus</i>	Spotted Pardalote			2	O	0565
<i>Gerygone olivacea</i>	White-throated Gerygone			1	O	0453
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill					0484
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			5	O	0486
<i>Acanthiza nana</i>	Yellow Thornbill			2	O	0471
Family: <i>MELIPHAGIDAE</i>						
<i>Philemon corniculatus</i>	Noisy Friarbird			2	O	0645
<i>Manorina melanocephala</i>	Noisy Miner			2	O	0634
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater			1	O	0614
<i>Lichenostomus melanops</i>	Yellow-tufted Honeyeater			1	O	0619
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill			1	O	0591
Family: <i>PETROICIDAE</i>						
<i>Microeca fascinans</i>	Jacky Winter			4	O	0377
<i>Eopsaltria australis</i>	Eastern Yellow Robin			1	O	0392
Family: <i>PSOPHODIDAE</i>						
<i>Psophodes olivaceus</i>	Eastern Whipbird			1	H	0421
Family: <i>NEOSITTIDAE</i>						
<i>Daphoenositta chrysoptera</i>	Varied Sitella			2	O	0549
Family: <i>PACHYCEPHALIDAE</i>						
<i>Pachycephala rufiventris</i>	Rufous Whistler			1	O	0401
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			1	O	0408
Family: <i>DICRURIDAE</i>						
<i>Grallina cyanoleuca</i>	Magpie-lark			2	O	0415
<i>Rhipidura leucophrys</i>	Willie Wagtail			3	O	0364
Family: <i>CAMPEPHAGIDAE</i>						
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			2	O	0424

Appendix 2. continued

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Avifauna - continued						
Family: <i>ORIOLIDAE</i> <i>Oriolus sagittatus</i>	Olive-backed Oriole			1	H	0671
Family: <i>ARTAMIDAE</i> <i>Cracticus nigrogularis</i>	Pied Butcherbird			1	O	0700
<i>Gymnorhina tibicen</i>	Australian Magpie			4	O	0705
<i>Strepera graculina</i>	Pied Currawong			20	O	0694
Family: <i>CORVIDAE</i> <i>Corvus coronoides</i>	Australian Raven			2	O	0930
Family: <i>CORCORACIDAE</i> <i>Corcorax melanorhamphos</i>	White-winged Chough					0693
Family: <i>PTILONORHYNCHIDAE</i> <i>Ptilonorhynchus violaceus</i>	Satin Bowerbird			1	H	0679
Family: <i>PASSERIDAE</i> <i>Stagonopleura guttata</i>	Diamond Firetail	V				0652
Family: <i>DICAEIDAE</i> <i>Dicaeum hirundinaceum</i>	Mistletoebird			1	O	0564
Family: <i>HIRUNDINIDAE</i> <i>Hirundo neoxena</i>	Welcome Swallow					0357
Family: <i>STURNIDAE</i> <i>Sturnus vulgaris</i> *	Common Starling					0999
<i>Acridotheres tristis</i> *	Common Myna					0998

Appendix 3. Summary of Habitat Attributes and Ranked Importance as Habitat

Table A3.1. Summary of Habitat Attributes of Individual Properties

Property	Dominant Tree Species	Tree Cover	Native Ground/shrub cover	Grazed/mowed	Recent Fires	Presence of old growth trees	No of Potential/ known threatened fauna species
A	-	V. Low	No	Yes	Nil	?	4 very limited foraging
B	SG/I/GG	Forest	Yes	No	Nil	Limited/ Scattered	13 EEC - HRGF?
C	SG/I/WS/T	Forest	Yes	No	Yes	Limited/ Scattered	13
D	SG/I/AC/WS	V Low Forest SE corner	Low SE corner	Yes	No	Scattered paddock trees	9 –10 limited foraging some roosting for bats
DD	SG/I/GG/T	Mod nth part Low sth part	Low-mod in nth part only	Yes	No	Scattered trees	13 – mainly foraging, limited roosting
E/F	SG/I/GG/WS	Low-mod	Limited in F	Yes	No	Scattered paddock trees	13 – foraging and roost/nest sites for bats, owls and Squirrel Glider
G/H	SG/I	Regen Forest	Yes	No?	Yes	Appear limited	10-12 – mainly foraging
I	SG/I/GG/WS/T	Low-mod	Regen nth and sth parts	Yes	Sth part?	Limited/ Scattered	10-12 – mainly foraging
J	SG/I/GG	Low	No	Yes	No?	Limited/ Scattered	7- 8 – mainly foraging
JJ	SG/I/GG	Low	No	Yes	No?	Limited/ Scattered	7 - 8 – mainly foraging
K	SG/I/GG	V Low	No	Yes	No?	Limited/ Scattered	4 - very limited foraging
L/M	SG/I/GG/FRG/T/Paperbarks	Mod	Mod south & west	Yes	No	Limited/ Scattered	13 – mainly foraging, limited roosting EEC - HRGF?
LALC, Bellbird	SG/I south GG/I/WS north	Low	Limited	Yes	No	Limited/ Scattered	7-8 – mainly foraging, limited roosting
Poppethead Res.	SG/I/GG/FRG/GB/ Paperbarks	Low-east Mod - west	Low-east Mod-high west	Yes-east No- west	Yes	Scattered trees –west only	13-14 - mainly foraging, (e.g. bats over the dam) and limited roosting

Table A3.2. Ranking of Importance of Individual Properties

Property	Tree Cover	Native Ground/ shrub cover	Grazed/ mowed	Presence of old growth trees	No of Potential/ known threatened fauna species	Rank Score out of 25
A	1	1	1	1	1	5
B	5	5	5	3	4	22
C	4	4	4	2	4	18
D	1	2	1	3	3	10
DD	3	3	1	2	4	13
E/F	3	2	1	3	4	13
G/H	4	4	4	2	3	17
I	3	3	2	2	3	13
J	1	1	1	1	2	6
JJ	1	1	1	1	2	6
K	1	1	1	1	1	5
L/M	3	3	2	2	4	14
LALC, Bellbird St	2	1	1	2	2	8
Poppethead Res.	2 – east 4 - west	1 – east 3 - west	1 – east 5 - west	1 – east 2 - west	1 4	6 - east 18 - west

Explanation of Scores

Scale of 1 – 5

1 = very poor value; 2 = low to moderate value; 3 = moderate value; 4 = moderate to high value; 5 = high value

Therefore, the highest total scores represent the estimated best potential habitat.

**ADDENDUM TO
FLORA AND FAUNA ASSESSMENT
OF THE KITCHENER TOWNSHIP PRECINCT,
CESSNOCK LGA**

DRAFT REPORT

Prepared for
GLENDINNING MINTO & ASSOCIATES PTY. LTD.



ECOTONE ECOLOGICAL CONSULTANTS Pty Ltd

39 Platt Street, Waratah NSW 2298
phone: (02) 4968 4901 fax: (02) 4968 4960
e-mail: ecotone@hunterlink.net.au

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TABLE OF CONTENTS

1.0 INTRODUCTION AND BACKGROUND..... 3
2.0 METHODS..... 3
3.0 RESULTS 3
 3.1 Vegetation Communities..... 3
 3.2 Condition of the Natural Vegetation 5
 3.3 Endangered Ecological Communities 5
 3.4 Threatened or Significant Flora Species 5
 3.5 Threatened Fauna Species..... 6
4.0 CONCLUSIONS 7
5.0 REFERENCES 8
6.0 APPENDIX: UPDATED HABITAT ATTRIBUTES SUMMARY AND PROPERTY RANKING. 9

LIST OF TABLES

Table 1. Summary of Habitat Attributes of Individual Properties. 9
Table 2. Ranking of Importance of Individual Properties..... 10

LIST OF FIGURES

Figure 1. Distribution of Vegetation Communities 4

1.0 INTRODUCTION AND BACKGROUND

This Addendum to the Flora and Fauna Assessment for the Kitchener Precinct Study (Ecotone Ecological Consultants 2005) has been prepared at the request of Mr Ian Glendinning of Glendinning Minto & Associates Pty Ltd as part of the preparation of the Kitchener Local Environmental Study (LES) for Cessnock City Council. The addendum has been prepared in response to additional flora and fauna survey and assessment work required by the NSW Department of Environment and Conservation (DEC).

The additional work for this addendum has involved a field survey over all properties within the precinct area. The purpose of the survey was to map the boundaries of vegetation communities within the precinct area and accordingly to determine which communities correspond to endangered ecological communities (EECs) and their distribution within the precinct area. Until this work was carried out, only two of the properties within the precinct had been assessed in the field, with the remainder of the precinct assessed by aerial photograph examination supplemented by 'over the fence' observations. This more complete survey of the precinct has allowed for a more accurate and specific determination of the distribution of EECs and the presence of threatened species.

2.0 METHODS

The precinct area was visited by two observers on the 12th October 2006. Each property that had not been substantially cleared of its natural vegetation was surveyed on foot. The boundaries between vegetation communities were determined by visual assessment of the spatial changes in species composition, and the boundaries recorded by taking grid reference readings of the boundary at frequent intervals using a hand-held GPS unit. The grid references of any opportunistically sighted threatened or significant flora or fauna species were also recorded. Note that the total precinct area was not covered, and therefore it was not possible to map the full distribution of threatened species through the site.

The grid references were then used to map the boundaries of the vegetation communities, using MapInfo. An assessment was made into which of the communities constituted EECs, by reference to the Final Determinations for the relevant listed communities.

3.0 RESULTS

3.1 Vegetation Communities

Four natural vegetation communities were recognised throughout the precinct, plus one artificial community which generally consists of cleared land. These are as follows:

1. Cleared pasture with or without scattered trees or remnant tree clumps;
2. Cabbage Gum/Red Gum/Grey Box Forest;
3. Dry Spotted Gum/Ironbark Forest;
4. Moist Spotted Gum/Ironbark Forest with Ball Honeymyrtle and/or other paperbarks;
5. Transitional Forest between Communities 2 and 4.

Community 1 occupies the major area of land throughout the precinct. Community 2 is restricted to the floodplains of major watercourses, and only occurs at the western end of the precinct. Community 3 occupies the drier flat top and upper slope areas, merging into Community 4 where the land becomes lower and moister. Community 4 usually contains Ball Honeymyrtle and/or other *Melaleuca* or moist-adapted species. Community 5 occurs on higher floodplain land adjoining more steeply upward sloping land usually adjacent to Communities 2 and 3. The distribution of the communities within the precinct area is shown on Figure 1.

Figure 1. Distribution of Vegetation Communities

3.2 Condition of the Natural Vegetation

The natural vegetation communities (2 through 5) are mostly regrowth from past clearing, and all show various degrees of disturbance, including partial tree removal, underscrubbing, grazing and minor weed invasion. In general, old-growth and mature trees are infrequent and scattered in all parts of the study area. The vegetation in best condition occurs on Lots 520 DP755215 and Lots 1 and 2 DP1057609. The vegetation on Lot 522 is in reasonably good condition at the southern end of the lot, but parts of the natural vegetation have recently been cleared at the northern end of this lot.

3.3 Endangered Ecological Communities

Of the natural vegetation communities, Community 1 is consistent with “Hunter Lowland Redgum Forest” according to the habitat and typical species assemblage as set out in the Final Determination for the EEC (NSW Scientific Committee 2002). Communities 3 and 4, in spite of some key differences in species composition due to habitat differences, are both consistent with the EEC “Lower Hunter Spotted Gum-Ironbark Forest” according to the Final Determination for the EEC (NSW Scientific Committee 2005). Community 5 is transitional between the two EECs. Therefore, all natural vegetation communities (exclusive of Community 1) within the Kitchener Precinct Area represent an endangered ecological community according to the NSW TSC Act 1995. There are no equivalent threatened ecological communities listed by the Commonwealth EPBC Act 1999, therefore it is concluded that no Commonwealth listed EECs occur within the Precinct Area.

3.4 Threatened or Significant Flora Species

One, and possibly two, threatened flora species were detected opportunistically within the study area during the field survey:

1. *Grevillea parviflora* subsp. *parviflora* (Vulnerable, TSC Act 1995 and EPBC Act 1999) was detected on Lot 520 DP755215 and Lot 1 DP1057609, but it could occur elsewhere within the precinct. The plants tended to occur within Vegetation Community 3, particularly near the transition to Community 4 and tended to occur as clumps of several scattered stems, possibly arising from the one rootstock;
2. Some plants suspected of being *Rutidosia heterogama* (Vulnerable, TSC Act 1995 and EPBC Act 1999) were detected along the fenceline of Lot 522 DP755215, in the slashed strip by the front fence along Abernethy Road. A specimen of the plant has been sent to the Royal Botanic Gardens, Sydney, and is awaiting confirmation of identity. It could also occur elsewhere within the precinct.

One significant flora species listed by ROTAP (Briggs and Leigh 1996) was also recorded on several lots (*Grevillea montana*). The presence of this species within the precinct was already established from previous surveys. It is more widespread within the precinct than *Grevillea parviflora*, and occurred in Communities 3, 4 and possibly 5; but not Community 2. The species is a common component of the understorey flora within the precinct.

According to DEC Atlas records (which now provide exact locations), *Grevillea parviflora* subsp. *parviflora* has previously been recorded in the precinct area, within Lot 520 DP755215. Several nearby records also occur outside the precinct area. *Rutidosia heterogama* has previously been recorded to the south east of the precinct area. *Eucalyptus parramattensis* subsp. *decadens* has previously been recorded to the north of precinct area. This species is not expected to occur within the precinct because the preferred sand-swamp woodland habitat that the species usually grows in does not occur in the study area.

3.5 Threatened Fauna Species

One threatened fauna species, the Grey-crowned Babbler, was opportunistically recorded in two locations during the field survey – on Lots 520 and 522, DP755215. A group of individuals was observed at both locations during the survey. These could have been the same individuals at both sites. The additional threatened fauna species predicted to occur in the main assessment report (Ecotone Ecological Consultants 2005) may occur within the habitats available. This is currently being assessed by supplementary fieldwork.

4.0 CONCLUSIONS

The supplementary assessment for the Kitchener Precinct presented in this addendum has accurately mapped the vegetation communities within the entire precinct area, and identified the communities that constitute Endangered Ecological Communities (EECs) according to the NSW TSC Act 1995. It was determined that all remaining natural vegetation within the Kitchener Precinct qualifies as either *Lower Hunter Spotted Gum-Ironbark Forest* or *Hunter Lowland Redgum Forest*. On one lot a transition between the two EECs was present. The natural vegetation in the bulk of the precinct area consisted of the former EEC, which occurred either as a dry variant on higher or sloping ground, or a moist variant on lower ground with Ball Honeymyrtle and paperbarks. The denser clumps of trees in cleared pasture areas could also represent small, highly disturbed remnants of the EEC with little or no above ground understorey.

At least one and possibly two threatened flora species listed by the NSW TSC Act 1995 and Commonwealth EPBC Act 1999 were opportunistically recorded during the field survey. Several clumps of *Grevillea parviflora* subsp. *parviflora* were recorded on two lots, and could occur elsewhere within the precinct. A plant suspected of being the vulnerable *Rutidosis heterogama* was recorded at the front of one lot, near Abernethy Street. Its identity is currently being confirmed by the Royal Botanic Gardens. One significant flora species, *Grevillea montana*, had been previously recorded within the precinct and was found to be common and widespread throughout the study area as a result of the field survey. This species is not listed by legislation but is on the ROTAP database (Briggs and Leigh 1996). Future development of the precinct should aim to maximise the retention of occupied habitat for all threatened and significant flora species, in addition to the two EECs.

One threatened fauna species, the Grey-crowned Babbler, was opportunistically recorded on two lots during the field survey. Otherwise, the conclusions made in the original assessment report regarding the potential presence of threatened fauna species and the broad recommendations for subdivision and future development of the precinct to maximise conservation of threatened fauna still apply. Further targeted fauna survey work that is currently being undertaken within the precinct should clarify the presence and distribution of threatened fauna within the precinct and allow for more informed and specific recommendations regarding conservation of threatened fauna.

The supplementary survey has allowed for a refinement of the property attributes and rankings of properties according to the habitat values of each property. This has not resulted in major changes in the habitat attributes and consequent rankings of each property according to their habitat quality. The main difference is that the habitat quality of Lot 522 DP756215 (Property C) has decreased since the original report due to recent clearing at its northern end. The condition of other properties has not changed significantly, but a couple of properties were overall found to be in slightly better condition (partly due to the discovery of threatened flora species) and others in slightly worse condition than estimated previously. The updated attributes and rankings tables are presented in the Appendix. Overall, however, the conclusions from the main report regarding the relative impact of the three broad development options (A, B or C) on flora and fauna is not changed by this addendum to the report.

5.0 REFERENCES

Briggs, J. D. & Leigh, J. H., 1996. *Rare or Threatened Australian Plants*. CSIRO Publications.

Ecotone Ecological Consultants, 2005. *Flora and Fauna Assessment of the Kitchener Township Precinct, Cessnock LGA*. Prepared for Peter Mekeig.

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6.0 APPENDIX: UPDATED HABITAT ATTRIBUTES SUMMARY AND PROPERTY RANKING.**Table 1. Summary of Habitat Attributes of Individual Properties.**

Property	Dominant Tree Species	Tree Cover	Native Ground/shrub cover	Grazed/mowed	Recent Fires	Presence of old growth trees	No of Potential/ known threatened species/ EEC Presence	Rank
A	-	V. Low	No	Yes	No	A couple of mature paddock trees	4 - very limited foraging	11
B	SG/I/GG	Forest	Yes	No	No	Limited/ Scattered – one big habitat tree	13 EEC – LHS GIF <i>Grevillea parviflora</i>	1
C	SG/I/WS/T	Forest	Only in uncleared areas	Boundaries slashed	Yes	Limited/ Scattered	13 EEC – LHS GIF Possibly <i>Rutidosis heterogama</i>	4
D	SG/I/AC/WS	Low Forest in SE corner	Only in SE corner	Yes	No	Scattered paddock trees	9 – 10 limited foraging some roosting for bats EEC – LHS GIF (SE corner)	8
DD	SG/I/GG/T	Mod nth part Low sth part	Low-mod in nth part only	Yes	No	Scattered trees	13 – mainly foraging, limited roosting	7
E/F	SG/I/GG/WS	Low-mod	Limited in F	Yes	No	Scattered paddock trees	13 – foraging and roost/nest sites for bats, owls and Squirrel Glider	6
G/H	SG/I	Forest	Yes	No	Yes	Limited/ Scattered	13 – mainly foraging EEC – LHS GIF <i>Grevillea parviflora</i>	2
I	SG/I/GG/WS/T	Low-mod	Regen nth and sth parts	Yes	Sth part?	Limited/ Scattered	10-12 – mainly foraging EEC – LHS GIF	5
J	SG/I/GG	Low, exc. S end	Mostly not	Yes	No?	Limited/ Scattered	7- 8 – mainly foraging EEC – LHS GIF (S end)	8
JJ	SG/I/GG	Low	No	Yes	No?	Limited/ Scattered	7 - 8 – mainly foraging	10
K	SG/I/GG	V Low	No	Yes	No	Limited/ Scattered	4 - very limited foraging	10

Continued...

Table 1, cont.

L/M	SG/I/GG/CG/FRG/ Paperbarks	Mod	Mod south & west	Yes	No	Limited/ Scattered	13 – mainly foraging, limited roosting EECs – HLRGF, LHSGIF & transitional	4
LALC, Bellbird	SG/I south GG/I/WS north	Low	Limited	Yes	No	Limited/ Scattered	7-8 – mainly foraging, limited roosting	9
Poppethead Res.	SG/I/GG/FRG/GB/ Paperbarks	Low-east Mod - west	Sparse-east Mod-high - west	Yes-east No- west	Yes	Scattered trees – west only	13-14 - mainly foraging, (e.g. bats over the dam) and limited roosting EECs – HLRGF & LHSGIF	10 - east 3 - west

Tree species: SG – Spotted Gum, I – Ironbark, GG – Grey Gum, AC – *Angophora costata*, T – Turpentine, WS – White Stringybark, CG – Cabbage Gum, FRG – Forest Red Gum, GB – Grey Box

EECs: HLRGF – Hunter Lowland Redgum Forest, LHSGIF – Lower Hunter Spotted Gum-Ironbark Forest

Rank: 1 (best) – 11 (worst) based on total scores from Table 2 below.

Table 2. Ranking of Importance of Individual Properties.

Property	Tree Cover	Native Ground/ shrub cover	Grazed/ mowed	Presence of old growth trees	No of Potential/ known threatened species/EECs	Rank Score out of 25
A	1	1	1	1	1	5
B	5	5	5	3	4	22
C	3	3	3	2	4	15
D	1	2	1	3	3	10
DD	2	2	1	2	4	11
E/F	2	2	1	3	4	12
G/H	5	5	5	2	4	21

Continued...

Table 2, cont.

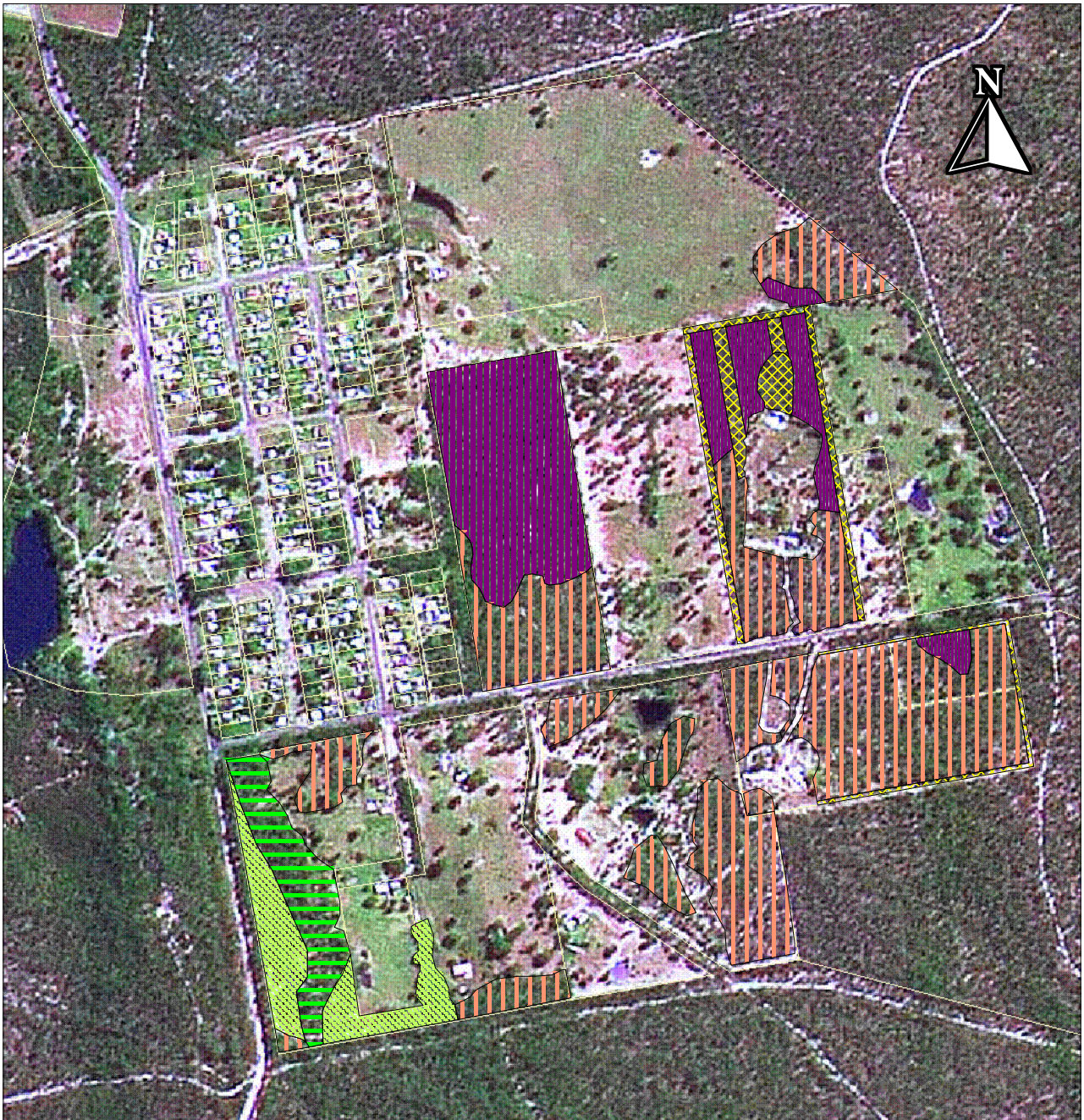
I	3	3	2	2	3	13
J	3	2	1	1	3	10
JJ	1	1	1	1	2	6
K	1	1	1	1	2	6
L/M	3	3	2	3	4	15
LALC, Bellbird St	2	1	1	2	2	8
Poppethead Res.	2 – east 4 - west	1 – east 3 - west	1 – east 5 - west	1 – east 2 - west	1 4	6 - east 18 - west

Explanation of Scores






Scale of 1 – 5

1 = very poor value; 2 = low to moderate value; 3 = moderate value; 4 = moderate to high value; 5 = high value

Therefore, the highest total scores represent the estimated best potential habitat.



Key to Vegetation Communities

-  Partially Cleared Bushland
-  Hunter Lowland Redgum Forest
-  Lower Hunter Spotted Gum Ironbark Forest (dry)
-  Lower Hunter Spotted Gum Ironbark Forest (moist)
-  Transitional Spotted Gum Ironbark/Hunter Lowland Redgum Forest



Kitchener Re-Zoning Precinct

Indigenous Cultural Heritage

June 2006

McCardle Cultural Heritage Pty Ltd
P.O. Box 166,
Adamstown, NSW, 2289
Ph: 0412 702 396
Fax: 02 4952 5501
Email: mcheritage@iprimus.com.au



Report No: J04011

Approved by:	Michael McCardle
Position:	Project Director
Signed:	
Date:	June 2006

Approved by:	Penny McCardle
Position:	Project Manager
Signed:	
Date:	June 2006

This report has been prepared in accordance with the scope of services described in the contract or agreement between McCardle Cultural Heritage Pty Ltd (MCH), ACN: 104 590 141, ABN: 89 104 590 141, and Cessnock City Council. The report relies upon data, surveys, measurements and specific times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by Cessnock City Council. Furthermore, the report has been prepared solely for use by Cessnock City Council and MCH accepts no responsibility for its use by other parties.

CONTENTS

1	INTRODUCTION	
1.1	OVERVIEW	1
1.2	SCOPE OF WORKS	1
1.3	STUDY AREA & PROPOSED USE OF THE STUDY AREA	1
1.4	STATUTORY CONTROLS	1
1.5	REPORT STRUCTURE	3
2	ENVIRONMENTAL CONTEXT	
2.1	INTRODUCTION	4
2.2	TOPOGRAPHY	4
2.3	GEOLOGY	5
2.4	SOILS	5
2.5	CLIMATE	6
2.6	WATERWAYS	6
2.7	VEGETATION	7
2.8	LAND USES	7
2.9	DISCUSSION	8
3	ARCHAEOLOGICAL CONTEXT	
3.1	REGIONAL ARCHAEOLOGICAL CONTEXT	9
3.2	NSW NPWS ABORIGINAL HERITAGE INFORMATION MANAGEMENT SYSTEM	11
3.3	LOCAL ARCHAEOLOGICAL CONTEXT	11
3.4	PREDICTIVE MODEL	13
3.5	ARCHAEOLOGICAL POTENTIAL IN THE PRECINCT	14
3.6	HERITAGE REGISTER LISTINGS	14
3.7	PREDICTIVE STATEMENT & EXPECTED SITES	14

REFERENCES

LIST OF FIGURES

		<i>Follows Page</i>
FIGURE 1.1	KITCHENER PRECINCT	1
FIGURE 3.1	LOCAL LOCATION OF KNOWN SITES	11

1 INTRODUCTION

1.1 OVERVIEW

McCardle Cultural Heritage Pty Ltd (MCH) has been commissioned by Cessnock City Council to undertake this report for the Kitchner re-zoning precinct and is derived from a detailed study undertaken in Kitchner (MCH 2005). This report provides an archaeological predictive model that highlights areas of expected archaeological sensitivity and will assist in future planning.

The report is broad based only and can be applied to the Kitchner area. However, further detailed archaeological assessments must be undertaken prior to any development in the area.

1.2 SCOPE OF WORKS

The following tasks were carried out:

- review of relevant statutory registers and inventories for indigenous cultural heritage including the NSW NPWS Aboriginal Heritage Information Management System (AHIMS) for known archaeological sites, the State Heritage Register, the Register of the National Estate, the Cessnock Local Environmental Plan and the Register of the National Trust;
- review of local environmental information (topographic, geological, soil, geomorphological and vegetation descriptions) to determine the likelihood of archaeological sites and specific site types, prior and existing land uses and site disturbance that may affect site integrity;
- review of previous cultural heritage investigations to determine the extent of archaeological investigations in the area and any archaeological patterns;
- development of a predictive archaeological statement based on the data searches and literature review;

1.3 STUDY AREA & PROPOSED USE OF THE STUDY AREA

The study area consists of the town ship of Kitchener (refer to *Figure 1. 1*).

It is intended that the area will be rezoned and in the future.

1.4 STATUTORY CONTROLS

Land managers are required to consider the effects of their activities or proposed development on the environment under several pieces of legislation.

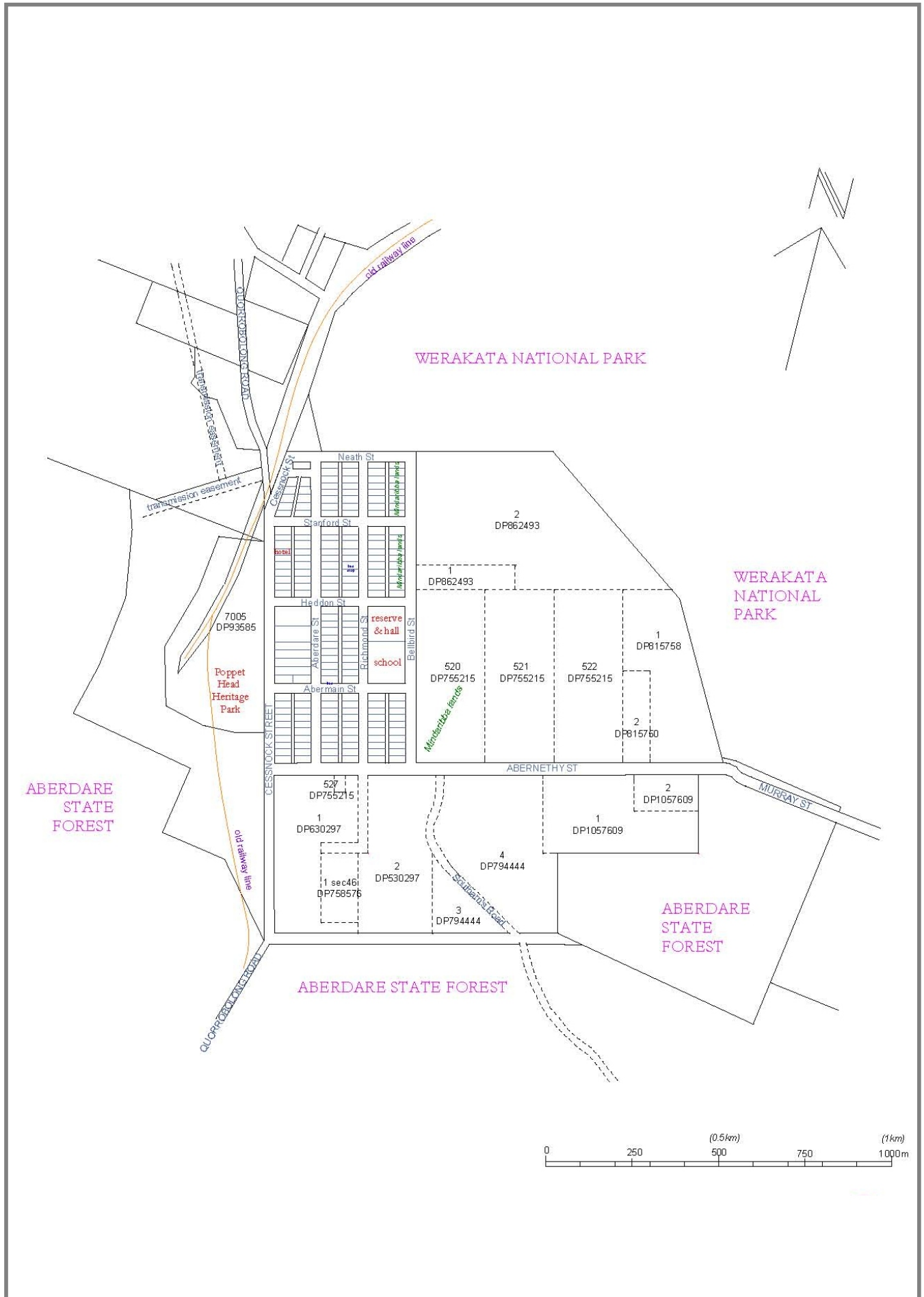


Figure 1.1 Kitchener Precinct

Indigenous cultural heritage in NSW is protected and managed under the following Commonwealth and State legislation:

- *New South Wales National Parks and Wildlife Act 1974, Amendment 2001* (State)

All indigenous objects within the state of New South Wales are protected under Section 90 of the National Parks and Wildlife Act 1974 (NPW Act), (State). Under s.5 of the Act, “object” means any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

Sites of traditional significance that do not necessarily contain archaeological materials may be gazetted as “Aboriginal places” and are protected under Section 84 of the Act. This protection applies to all sites, regardless of their significance or land tenure. Under Section 90, it is an offence to knowingly disturb, damage or destroy objects or Aboriginal Places without the prior written consent of the Director-General of National Parks and Wildlife.

Amendments introduced by the National Parks & Wildlife Amendment Act 2001, include renaming Section 90 “consent” to “Heritage Impact Permit”, removal of the term “knowingly” from Section 90, and adding “reasonable precaution” and “due diligence” as defences against prosecution under the amended Section 90. These are yet to commence.

- *Environmental Planning and Assessment Act 1979, (EP&A Act), (State)*

The EP&A Act requires that environmental impacts be considered in land-use planning, including impacts on indigenous and non-indigenous heritage. Local Environmental Plans prepared in accordance with the EP&A Act identify permissible land use and development constraints, and determine the level of environmental assessment required.

The NSW NPWS provides guidelines for Aboriginal heritage assessment, including those conducted under the EP&A Act 1979. Where indigenous heritage assessment is conducted under the Integrated Development Approval process, a more detailed set of NPWS guidelines applies.

- *The Heritage Act 1977 (State)*

The Heritage Act 1977 protects the natural and cultural history of NSW with emphasis on non-indigenous cultural heritage through protection provisions and the establishment of a Heritage Council. While Aboriginal heritage sites and objects are protected primarily by the NPW Act 1974, if an Aboriginal site, object or place is of great significance it can be protected by a heritage order issued by the Minister on the advice of the Heritage Council.

- *The Aboriginal and Torres Strait Islander Heritage Protection Act 1984, Amendment 1987 (Commonwealth)*

The Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth) protects areas and/or objects that are of significance to Aboriginal people and are under threat of destruction. A significant area or object is defined as one that is of particular importance to Aboriginal people according to Aboriginal tradition. The Act can, in certain circumstances, override state and territory provisions, or it can be implemented in circumstances where state or territory provisions are lacking or are not enforced. The Act must be invoked by or on behalf of an Aboriginal or Torres Strait Islander or organisation.

- *The Australian Heritage Commission Act 1975 (Commonwealth)*

The Australian Heritage Commission Act 1975 (Commonwealth) established the Australian Heritage Commission. The Commission identifies places to be included in the National Estate and maintains a register of places considered significant in terms of their association with particular community or social groups for social, cultural or spiritual reasons. The Act does not include specific protective clauses.

1.5

REPORT STRUCTURE

This report has the following structure:

Chapter 2 outlines the environmental context, and

Chapter 3 provides the archaeological context.

2.1 INTRODUCTION

The location, nature and distribution of Aboriginal cultural materials in a landscape are strongly influenced by environmental factors such as topography, geology, landforms, climate, geomorphology, hydrology and the associated soils and vegetation (Hughes and Sullivan 1984). These factors largely dictate the availability of plants, animals, water, raw materials, the location of suitable camping places, ceremonial grounds, burials, and suitable surfaces for the application of rock art.

Environmental factors also affect the degree to which cultural materials have survived in the face of both natural and human activities and influence the likelihood that sites will be detected during ground surface survey. Site detection is dependent on a number of environmental factors including surface visibility (as determined by the nature and extent of ground cover including grass and leaf litter etc), the survival of the original land surface and associated cultural materials (due to alluvial and colluvial deposition) and the exposure of the original landscape and associated cultural materials (by erosion, ploughing, vehicle tracks etc) (Hughes and Sullivan 1984). In combination, these processes and activities determine the likelihood of both surface and subsurface cultural materials surviving and being detected, thus aiding in constructing predictive models of Aboriginal site location.

It is consequently necessary to have an understanding of the environmental factors, processes and activities, all of which affect site location, preservation, detection during surface survey and the probability of the presence of subsurface cultural materials.

2.2 TOPOGRAPHY

The topographical context is important in identifying potential factors relating to past Aboriginal land use patterns. Story *et al* (1963) divided the Hunter Valley into eight main sub-regions including the Southern Mountains, Central Goulburn Valley, Merriwa Plateau, Liverpool and Mt Royal Ranges, Barrington Tops, North-Eastern Mountains, Central Lowlands and the Coastal Zone.

The study area is located within the Central Lowlands, (a broad lowland belt approximately 15 kilometres wide) which lies at the centre of the region. It is bounded on all sides by steep rugged country with the exception of the far west, where the Cassilis Gate provides access to the interior. To the south is dissected plateau country; to the north and west are the Liverpool Range and Barrington Uplands. The Central Lowlands are dominated by alluvial formations consisting of open undulating grassland and level plains.

2.3 GEOLOGY

The nature of the surrounding and local geology has a number of implications for Aboriginal land use, primarily in relation to the procurement of stone resources or materials for the manufacture of stone tools.

According to the Newcastle Coalfield Regional Geological Map (1995), the Cessnock region lies within the Permian marine and freshwater sediments of the Sydney Basin. More specifically, the north of the study area is situated on the Permian Dalwood Group, which consists of mudstone, sandstone, shale, basic lava and tuff whilst the Branxton Formation in the south features mudstone, sandstone and conglomerate.

The availability and distribution of stone materials has a number of archaeological implications. Evidence of stone extraction and artefact manufacture are typically concentrated in areas of stone availability. However, stone can also be transported for artefact manufacture and/or trading across the region.

Within the Central Lowlands, silcrete and mudstone are commonly found in creek line deposits, such as those observed at Black Hill and Woods Gully (Kuskie and Kamminga 2000:183). Quartz is also commonly available locally as pebble-sized fragments included in alluvial and colluvial deposits (Baker 1997).

2.4 SOILS

The nature of the surrounding soil landscape has implications for Aboriginal land use and site preservation, primarily in relation to vegetation patterns and the preservation of organic materials and burials.

Soils are produced as a result of the weathering of the underlying geological formations (Story *et al* 1963). The Kitchner Precinct consists of one major soil landscape: the Branxton Soil Landscape.

Extending over large areas between Singleton and Cessnock, the Branxton soil landscape is dominated by undulating low hills and rises with numerous small creek flats. The parent material is in situ weathered rock derived from alluvium and colluvium, and parent rocks include sandstone, mudstone, siltstone, shale, tuff, coal, conglomerate and limestone (Kovac and Lawrie 1991:106-108).

The main soils are Yellow Podzolic on midslopes with Red Podzolic Soils on crests. Yellow Soloths occur on lower slopes and in drainage lines, alluvial soils are present in some creeks and siliceous sands are found on flats within large valleys. Acid topsoils are encountered in some areas and soil pH ranges between 5.5 and 6.0 (Kovac and Lawrie 1991:106-108).

Tunnel and gully erosion is common in the yellow Soloths due to their high dispersibility. In contrast, erosion is limited within the alluvial soils and siliceous sands.

The deposition of alluvial sediments and colluvium movement of fine sediments (including artefacts) results in the relocation and burying of archaeological materials. The increased movement of soils via erosion is likely to impact upon cultural materials through the post-depositional movement of materials contained within the soil profile, specifically small portable materials such as stone tools.

2.5 CLIMATE

Climatic conditions would have affected the likelihood of the occupation of an area and also impacted upon the soils, vegetation and associated cultural materials (Kovac and Lawrie 1991). The area typically has a minimum average temperature of -3°C to 5°C and maximum average of over 28°C .

Mean annual rainfall is 740 millimetres, of which 50-60 millimetres falls in an average summer month and approximately 30 millimetres falls during the standard winter month. The increased intensity of rainfall during the warmer months is reflected in heightened rates of erosion and the associated movement of cultural materials (Kovac and Lawrie 1991:20-21).

2.6 WATERWAYS

The availability of water and the associated faunal and floral resources is one of the most important factors influencing patterns of past Aboriginal land use in this area.

Black Creek is situated to the east and west of the Kitchener township and there a number of tributaries surrounding the area.

The order of streams was determined by applying the Strahler method to the Cessnock 1:25 000 topographic map. The Strahler method dictates that upper tributaries do not exhibit flow permanence and are defined as first order streams. When two first order streams meet they form a second order stream. Where two-second order streams converge, a third order stream is formed and so on. When a stream of lower order joins a stream of higher order, the downstream section of the stream will retain the order of the higher order upstream section (Anon 2003; Wheeling Jesuit University 2002).

Stream order assessment is one way of determining the reliability of streams as a water source. Based on the climatic analysis (see *Section 2.5*), the Kitchner Precinct will typically experience comparatively reliable rainfalls under normal conditions and thus it is assumed that any streams above a third order classification will constitute a relatively permanent water source. As a third and fourth order stream, Black Creek would have provided reliable water and associated resources for much of the year. The creek lines present within area would have flowed during the wetter periods of the year and therefore should be considered ephemeral.

The availability of floral and faunal resources is of integral importance to patterns of past Aboriginal land use and occupation. The presence or absence of flora and fauna also influence the preservation and detection of surface cultural materials from past Aboriginal land use.

The majority of the Kitchener Precinct has been cleared, with present vegetation consisting of imported pasture grass species and small communities of new growth eucalypts, paperbarks and other native species. Prior to clearing, spotted gum, red ironbark and narrow leaved red ironbark may have been present (Kovac and Lawrie 1991:107).

Typically, due to vegetation cover, most artefacts identified through surface inspection are visible on exposures created by erosion or ground surface disturbances (Dean-Jones and Mitchell 1993; Kuskie and Kamminga 2000). The woodland, grass and leaf litter ground cover throughout much of the study area is expected to result in limited visibility, hence reducing the detection of surface cultural materials.

Evidence of the occupation of Australia extends back to 40,000 years ago (Mulvaney and Kamminga 1999) and dates to at least 20,000 years ago in the Hunter Valley (Koettig 1987). The impact upon the natural landscape of past Aboriginal occupation is thought to have been relatively minimal, however there have been some impacts resulting from 20,000 years of occupation and land use.

The deliberate lighting of fires for the purposes of driving game from cover, protection and vegetation alteration (fire stick farming) significantly influenced seed germination patterns, thus increasing diversity within the floral community.

Following European settlement of the Hunter Valley in the 1820s, many different land uses impacted upon the landscape. The Hunter Valley has been subjected to extensive logging and clearing, agricultural cultivation (ploughing), pastoral grazing, residential development and mining (Turner 1985). As a result, the landscape as a whole has experienced high levels of disturbance, resulting in the modification of large areas and the associated cultural materials.

Although specific records are not available, the study area was probably initially cleared for agricultural purposes during the mid-1800's when land grants were issued in and around Cessnock. Some parcels of land are primarily utilised for the grazing of horses, others have houses and other buildings. Town infrastructure has also occurred throughout. All of these land uses would have impacted upon the study area and associated cultural materials.

Although pastoralism is a relatively low impact activity, it is thought to disturb the top 10-12 centimetres of topsoil, primarily through ploughing (Koettig 1989). Pastoralism also has a number of associated disturbances including the clearing of vegetation, and the trampling and compaction of grazed areas, both of which accelerate the natural processes of sheet and gully erosion. These, in turn, impact upon the associated cultural materials by exposing them to trampling by hoofed animals and thus potential displacement and breakage (Yorston *et al* 1990). Furthermore, erosion typically causes lateral and horizontal movement of artefacts.

The grading and construction of tracks has a number of associated disturbances including the clearing of vegetation, and the damage and displacement of cultural materials. In addition, the natural processes of sheet wash and gully erosion are accelerated due to vegetation loss. Clearing and excavating for roads, infrastructure and buildings also damage and destroy sites.

2.9

DISCUSSION

The regional and local environment surrounding the study area would have provided a range of resources, including raw materials, fauna, flora and water. Black Creek is situated to the east and west of Kitchener township and the presence of ephemeral creek lines indicates that water and the associated resources would have been seasonally available, thereby constituting an adequate environmental background for seasonal occupation.

Natural agencies, including sheet wash erosion with the associated colluvial deposition, affect archaeological sites by altering the horizontal and vertical relationship of artefacts, changing artefact densities, and burying/re-burying artefacts. These natural agencies range from minor to moderate throughout the Kitchener Precinct and therefore some impact upon the archaeological evidence is expected.

However, land clearance would have resulted in the post-depositional movement of artefacts. These agencies may therefore change the horizontal and vertical relationship of artefacts, impact upon the composition and relative density of archaeological assemblages and bury/rebury artefacts due to the deposition of sediment. The impact of both anthropogenic and natural disturbances in the study area appears to have been high and therefore is expected to have had an impact upon the archaeological record.

Bearing in mind the above inter-related factors, site integrity cannot be assumed, yet nor can the possibility of intact archaeological deposits be dismissed.

A review of the archaeological literature of the broader Central Lowlands, and more specifically the Cessnock area, a NPWS AHIMS search and discussions with the appropriate Aboriginal groups will be discussed. This information provides a broader picture of the wider cultural landscape highlighting the range of site types present throughout the region and the frequency and distribution patterns of site locations. This background understanding of the archaeological record assists with the construction of a predictive model of site location for the study area.

3.1

REGIONAL ARCHAEOLOGICAL CONTEXT

The Central Lowlands have been the focus of a large number of archaeological assessments, the majority of which have been undertaken in relation to the expansion of the coal mining and power industries and, more recently, the increasing volume of residential sub-divisions associated with the growth of the region. A review of previous archaeological work undertaken throughout the region has been presented in previous reports (for example, Koettig and Hughes 1985; Brayshaw 1993; McDonald 1997; Haglund 1999; Kuskie 2000; HLA-Envirosciences 2002; AMBS 2002; MCH 2003; MCH 2004a; MCH 2004b). Based on this information it is possible to identify a number of trends in site location and patterning within the local area.

Open campsites are the most common site type identified within the area, closely followed by isolated finds. A range of other site types including scarred trees, rock shelters and art sites are also present however in far smaller numbers. It is apparent that the majority of sites contain stone artefacts. This is to be expected due to the durability of stone in comparison to other raw materials that consequently have not been preserved in the archaeological record.

In relation to an assessment of artefact raw material, it is important to note that there is a potential for discrepancies in the way in which archaeologists classify raw materials. This will consequently affect the proportional representation of raw materials within the recorded assemblages. However, as a whole, mudstone is the most common lithic raw material found in the region, followed by silcrete. Chert, quartz, quartzite, petrified wood, porcellanite, hornfels, porphyry and basalt also occur in smaller quantities.

Variation in the classificatory definitions employed by archaeologists will again significantly influence the range of artefact types identified within a study area. For example, the difference between a waste flake, a debitage flake and a flaked piece is subject to the means of classification applied by the recorder. Thus, it is not productive to attempt to quantify the proportionate representation of artefact types identified in previous studies. That said, in general terms, the most common artefact types are flakes, flake fragments and flaked pieces. Cores, edge-ground axes, millstones, grindstones, hammerstones and retouched and backed artefacts including backed blades,

bondi points, geometric microliths, eloueras and scrapers, also occur though in lower frequencies.

In general, the stone artefact assemblage in the area has been relatively dated to what was previously known as the Small Tool Tradition (10,000 years BP). On the basis of stone tool technology, the overwhelming majority of open sites within the region may be attributed to the Holocene period (Kuskie and Kamminga 2000).

However, evidence of earlier occupation in the region is postulated based on materials excavated at Glennies Creek, north of Singleton. Radiocarbon dated charcoal and geomorphological evidence suggests that artefacts found in the B-horizon were deposited between 10,000 and 13,000 BP (Koettig 1986a, 1986b), thus indicating that the Central Lowlands may have been occupied during the late Pleistocene period.

The relationship between site size, landform and distance to water is of integral importance to any discussion of regional archaeological patterns. However, it must be recognised that there are various factors that may influence the examination of these relationships. They include, but are not limited to:

- the fact that the landform on which a site area is observed may not necessarily be its origin, for example, artefacts from a crest may be relocated by erosion such that they are recorded further down a slope;
- the effects of biased landform sampling due to decisions made by archaeologists and as a result of restrictions relating to proposed development areas, levels of exposure on different landforms and variable recording by archaeologists. For example, the large percentage of sites found along creek lines may be (at least partially), a result of the focus of many cultural heritage surveys on this landform;
- artefact counts can be skewed due to factors such as the differing fragmentation levels of discrete stone types and levels of ground surface visibility. A very large number of sites/artefacts were located on exposures and yet no, or very few artefacts were visible away from these exposures. Thus, whilst a site may continue beyond the boundaries of an exposure, its visibility does not, making it difficult to accurately describe the extent of a site based upon survey only.

Consequently, any such discussion must be considered as purely indicative of expectations in terms of site location and distribution and by no means constitutes an irrefutable certainty.

On this basis, the following general predictions can be made for the study area:

- a wide variety of site types may be represented in the study area with open campsites and isolated artefacts by far the most common;

- lithic artefacts will primarily be manufactured from mudstone and silcrete with a variety of other raw materials also utilised but in smaller proportions;
- the likelihood of locating sites is greatest in close proximity to water;
- the probability of finding large sites increases significantly in close proximity to water; and
- surface sites located more than 50 metres from water will typically contain a small number of artefacts, however larger sites may still occur in elevated locations that provide expansive viewpoints.

3.2 *NSW NPWS ABORIGINAL HERITAGE INFORMATION MANAGEMENT SYSTEM*

A search of the National Parks and Wildlife Service's (NPWS) AHIMS has shown that 19 known Aboriginal sites are currently recorded within a five kilometres radius of the study area. The range of types includes 2 open campsites, 4 isolated finds, 1 natural mythological site and 13 artefact¹ sites. Site co-ordinates are not provided due to the need for site protection and conservation, however their general locations are shown in *Figure 3.1*.

3.3 *LOCAL ARCHAEOLOGICAL CONTEXT*

The majority of archaeological surveys and excavations throughout the Cessnock area have been undertaken in relation to environmental assessments for developments. The most relevant investigations (Brayshaw 1981, 1982; Djekic 1984; McIntyre 1984; Koettig 1990; Umwelt 2002; Baker 2003; MCH 2003) indicate differing results and observations based on surface visibility and exposure, alterations to the landscape (including mining, industrial and residential development), proximity to water sources and geomorphology. These are briefly discussed below.

Brayshaw (1981) assessed the area designated for the Cessnock Westward Urban Expansion. The survey was conducted across an area of thick grass cover, low surface visibility and minimal erosion and resulted in the identification of one quartz artefact in the wall of a dam. During another survey immediately to the east of Kurri Kurri, Brayshaw (1982) noted that dirt tracks within the study area provided surface exposure. No artefacts were identified and Brayshaw suggested the reason for this is that "where it is probable that Aborigines once foraged and hunted through the area, there is no large watercourse or other features to form a focus of occupation."

¹ Sites registered post-June 2001 are listed on the AHIMS record as containing certain site features, for example artefacts, art etc. Thus artefact scatters/open campsites and isolated finds are not separated out.

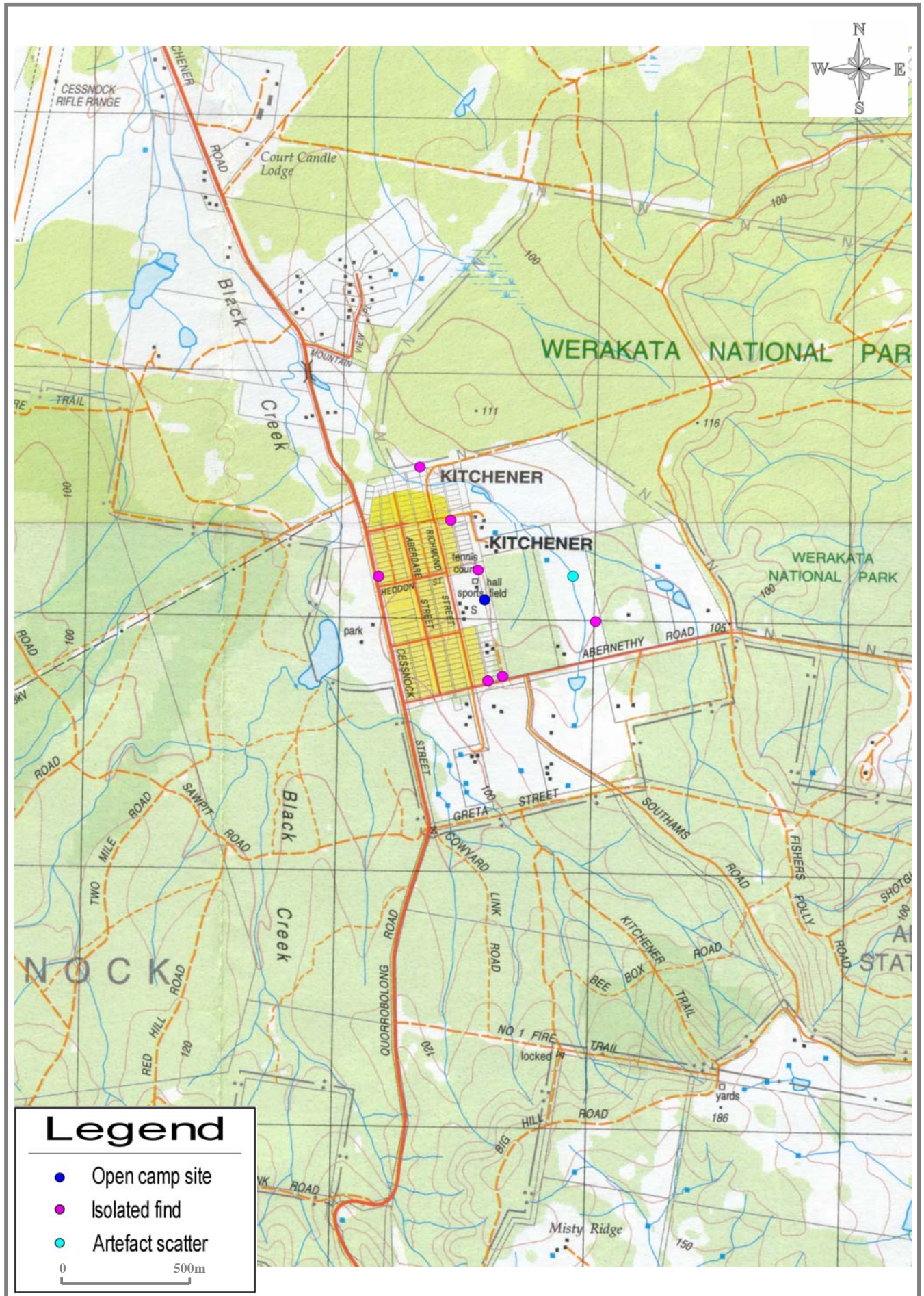


Figure 3.1 Local location of known sites

Source: 1:25 000 Topo Series, Cessnock & Quorrobolong

During a survey of the Kurri Kurri to Alcan 132kV transmission line (an area of 1.5 kilometres), Djekic (1984) identified five sites consisting of four open camp sites and one isolated find located on gentle sloping areas about one kilometre southeast of Swamp Creek and in close proximity to a small tributary creek. The sites were identified due to recent ground surface exposures including erosion and non-archaeological excavation. The remainder of the study area had low visibility and no further sites were identified.

Conducting a survey of Cessnock State Forest, McIntyre (1984) surveyed many landforms including undulating slopes and a small intermittent stream. No artefacts were identified and McIntyre attributed this to a lack of deep topsoil, past European land use activities and a lack of permanent water supply within one kilometre of the survey area.

Koettig (1990) undertook a survey of the proposed ICI Mining Services Technology Park at Richmond Vale, near Kurri Kurri. Dense grass and leaf cover obscured the ground surface except in areas of erosion and exposure. Eroded and exposed areas included tracks that traversed much of the area surrounding an unnamed creek along the western boundary of the study area. No artefacts were identified.

Previous land use and visibility were two factors noted by Umwelt (2002) as limiting the identification of Aboriginal artefacts during the survey at the Pioneer concrete plant between Cessnock and Abermain. Surface visibility was reduced due to thick vegetation and leaf cover. Works associated with the old Aberdare mine, rabbit burrows, rubbish from the Cessnock rubbish dump (located adjacent to the study area), cement footings and debris and the construction of a gravel road had affected the study area and any artefacts that would have been present. One artefact was identified outside the study area and within a constructed drainage line.

Following initial surveys of the Hunter Economic Zone (HEZ) area just east of Cessnock (Silcox 1990), ERM (Baker 2003) undertook test excavations of the HEZ area. Three landform areas were identified including Hebburn Creek, a north-south ridge that forms the drainage divide between watercourses, and the headwaters of the eastern tributaries (associated with present day swamps). Geomorphological investigations identified thin sandy colluvium on the eastern side of Hebburn Creek and thick aeolian sands on the western side. Soils on the north-south ridge are comprised of stony and sandy topsoil over sandstone bedrock or weathered sandstone clayey sand. Excavations revealed that artefacts were primarily recovered from the aeolian sand by Hebburn Creek, and a single artefact was located in the eastern tributary area. Based on these results, Baker (2003) argues that occupation patterns were concentrated in areas within close proximity to water sources with an outlook advantage.

MCH (2003) undertook the survey of a large residential subdivision at Cessnock for ACM Landmark. The survey area was relatively disturbed and situated over 250 metres from the nearest reliable water source. Visibility was comparatively high however only two isolated artefacts were present within

the area. Both artefacts were situated within 260 metres of water on a gentle slope formation.

During the course of a survey for the proposed sewerage system between Kitchener and Cessnock, seven sites were recorded in and around the township of Kitchener (MCH 2004b). Consequently, a potential archaeological deposit was identified in the elevated area along Bellbird Rd, Kitchener and a testing program was proposed. An additional PAD was also identified at the Cessnock end of the proposed pipeline.

MCH (2005) undertook an archaeological assessment for a Rezoning / Development Project at Kitchener. Visibility was low and the area had been cleared in the past. Two sites were identified. The first site consisted of 11 silcrete artefacts located within an erosion exposure approximately two metres from a drainage line. The recorded artefacts were actively eroding from the deposit and other possible artefacts remained partially concealed within the A horizon soils. The second site, an isolated artefact, was situated on a gentle slope within a large exposure associated with a shed. The sites identified during the survey are located well over 100 metres from permanent water but are in relatively close proximity to an ephemeral watercourse.

As indicated in the above studies, proximity to water possibly with a vantage point, was an important factor in determining suitable locations for past occupation. Surface visibility and exposures are significant factors in the identification of sites, with all sites recorded in areas of exposures and low vegetation. These findings are consistent with the regional archaeological pattern.

3.4

PREDICTIVE MODEL

Previous archaeological studies undertaken throughout the Central Lowlands and the Cessnock area in particular, provide a good indication of site types and site patterning in the area. The research has shown that occupation sites (artefact scatters and isolated finds) are the most common site types and are typically located along watercourses and in elevated areas. Artefact density is greatest within fifty metres of watercourses and may also be high in areas of elevation that are not necessarily closely associated with reliable water.

As discussed in *Section 2.6*, distance to water is varies throughout the Precinct, and therefore, there is a continuum in archaeological expectations across the precinct progressing from areas in close proximity to water which can be predicted to have a high potential for isolated artefacts and high density artefact scatters to those areas of low elevation at greater distance from water that accordingly are anticipated to have lower potential for isolated artefacts and low density artefact scatters. However, it must also be recognised that water courses may be seasonal only and this may have influenced the likelihood of long-term occupation.

The ability to determine the accuracy of these predictions based upon survey alone will be largely affected by ground surface visibility and the degree of

disturbance caused by clearing, man made tracks and drains and surrounding developments. Soil surface disturbance along the site means that the extent and spread of surface archaeological material may not reflect subsurface deposits (it may be more a reflection of differential disturbance and exposure).

3.5 *ARCHAEOLOGICAL POTENTIAL IN THE PRECINCT*

Based on a review of registered archaeological sites and the results of past archaeological studies, two site types are likely to occur within the study area.

- Open artefact scatters

Also described as open campsites, these deposits include archaeological remains such as stone artefacts, shell, and sometimes hearths. These sites are usually identified as surface scatters of artefacts in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing) and access ways can also expose surface campsites.

Stone artefacts are the most common archaeological remains. They are the most numerous of all the relics produced by Aboriginal occupation, and the least susceptible to post-depositional destruction and decay.

- Isolated finds

Isolated artefacts are usually identified in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing) and access ways can also expose surface artefacts.

3.6 *HERITAGE REGISTER LISTINGS*

The Australian Heritage Commission Register of the National Estate Database and the NSW Heritage Office State Heritage Register were searched for Aboriginal places. No sites were listed near the proposed development. However, not all indigenous places are listed, and the Heritage Commission is consulting with Traditional Owners to gradually include indigenous information. There are no indigenous heritage items listed on the Cessnock Local Environment Plan.

3.7 *PREDICTIVE STATEMENT & EXPECTED SITES*

Based on previous heritage surveys, the NSW NPWS AIHMS Register and discussions with the Aboriginal community, the Precinct is likely to contain evidence of past Aboriginal occupation, with the most likely site types being artefact scatters and isolated finds.

However, detailed assessment and survey is required prior to any development work.

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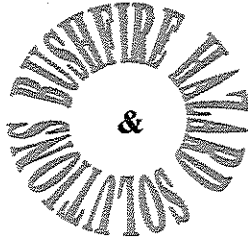
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BUSHFIRE HAZARD ASSESSMENT

KITCHENER PRECINCT N.S.W.



Report Reference No 50050

CONTENTS

	<u>Page No.</u>
ABSTRACT	02
1.0 INTRODUCTION	03
2.0 PURPOSE OF REPORT	03
3.0 SCOPE OF REPORT	03
4.0 REFERENCED DOCUMENTS AND PERSONS	03
5.0 BUSH FIRE HAZARD ASSESSMENT	04 - 11
5.01 Planning for Bushfire Protection	04
5.02 Location	04
5.03 Bushfire threat	05 - 07
5.04 Slope and topography	07
5.05 Vegetation	07 - 08
5.06 Asset Protection Zones	08 - 11
5.07 Fire Fighting Water Supplies	12
5.08 Access – Fire Services & Evacuation	13 - 14
5.09 Viable Constructional Method	15
5.10 Staged development	15
6.0 RECOMMENDATIONS	16
7.0 CONCLUSION	17
8.0 ANNEXURE	18
Annexure 01 List of referenced documents and attachments.	

ABSTRACT

When considering development potential for any area investigation must be made into all aspects of current legislative requirements that may affect those lands. This would include, but is not limited to Bushfire Mitigation matters. Where the application of the requirements for Bushfire Protection, in particular the creation of Asset Protection Zones, conflict with environmental constraints (eg Riparian Zones or sites containing Protected Species) and any other Planning Document (Scenic Protection Zones) then interested parties must consult to determine the most appropriate outcome for any development. The following extract from the Rural Fire Service's Service Standard V 4.1.3 highlights their role in this process.

"The Minister for Planning has made a Direction to local councils under Section 117 of the Environmental Planning and Assessment Act, 1979 requiring councils listed within the direction to consult with the Commissioner when preparing a draft Local Environment Plan (LEP) for land that is identified as bush fire prone on a bush fire prone land map."

Flowing on from this the Rural Fire Services Development Control Note 004 also states:

Council should consider including the following 'standard' bushfire clause for a local government area wide LEP for those councils required to prepare a bush fire prone land map:

"This part applies to land identified as bush fire prone land on the Bush Fire Prone Land map prepared pursuant to Section 146(2) of the EP&A Act 1979, and certified by the Commissioner of the NSW Rural Fire Service.

In deciding whether to grant consent to any development on bush fire prone land, council shall

- i. have regard to, and be satisfied that, the relevant provisions of the Rural Fires Act 1997, the EP&A Act 1979, and the PBP guideline, or such Acts, Regulations or guidelines as may replace these, have been met; and*
- ii. consider whether the measures adopted to avoid or mitigate the threat from bushfire, including siting of development, design and construction of structures, clearing of vegetation, provision of Asset Protection Zones, landscaping and fire control aids such as roads and water supplies, are adequate for the locality; and*
- iii. consider the potential environmental impacts of measures proposed to avoid or mitigate the threat from bushfire.*

It is with consideration of these points and the legislated document Planning for Bushfire Protection 2001 that Building Code and Bushfire Hazard Solutions has undertaken an overview of development possibilities within the Kitchener precinct. The comments contained within this report are intended to provide information on the feasibility of any future rezoning of lands within this precinct and whether those lands could be considered viable for Residential or Special Protection Development purposes having regard to bushfire mitigation matters.

We have also made strategic recommendations that may be considered when undertaking a holistic approach to the future development within this precinct. Other matters including road infrastructure have also been commented on so that they could be considered within the design layout of any future development application for residential subdivision.

1.0 INTRODUCTION

The village of Kitchener is a small rural residential settlement located approximately 5 kilometres south of the main township of Cessnock. Kitchener currently consists of approximately 170 medium density allotments, a school, hotel and general store. Surrounding this main core residential area to the east and south are various sized rural and agricultural landholdings with the land use being predominately grazing land. To the west of the township there is a large public open space and heritage park and to the north is Werakata National Park.

Under Cessnock City Council's Bush Fire Prone Land Map the majority of the vegetation within the Kitchener precinct is classed as Category 2, with small areas of Category 1 Vegetation. Therefore any application to develop lands within this precinct would be subject to the application of Planning for Bushfire Protection - 2001 (P/BP).

2.0 PURPOSE OF REPORT

The purpose of this Bushfire Hazard Assessment is to provide an overview of the requirements of P/BP and to provide comments on any other strategic considerations that should be considered for the Kitchener Precinct having regard to bushfire mitigation matters. Whilst any development that can comply with P/BP would be viable having considered all bushfire mitigation measures alongside any environmental constraints P/BP in itself identifies the need for Local Environmental Plans (LEP) and Development Control Plans (DCP) to also address bushfire mitigation measures.

The comments contained within this report are not a formal application for any specific development application rather an investigation as to the viability of all opportunities for development within the Kitchener precinct and a summary of scenarios that may be pertinent to any future land use or rezoning application. They may assist in forming the basis of any specific conditions and / or bushfire mitigation measures that Council and / or the NSW Rural Fire Service elects to include in any amended LEP or DCP issued for the subject area.

3.0 SCOPE OF THIS REPORT

The scope of this report is limited to providing a bushfire hazard assessment and recommendations for the private allotments within the Kitchener precinct. Where reference has been made to the surrounding lands we have assessed those lands and may discuss bushfire impact and / or progression through those lands and possible bushfire impact to properties within the Kitchener precinct.

4.0 REFERENCED DOCUMENTS AND PERSONS

Comments provided are based on the requirements of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act), the RFS document known as 'Planning for Bushfire Protection - 2001' for the purposes of bushfire hazard determination and Australian Standard AS3959 - 1999 titled 'Construction of buildings in bushfire-prone areas' as amended for building / structural provisions.

The author has made several site visits to Kitchener and had discussions with Council, NSW Rural Fire Service and others to gather relevant background on this region.

5.0 BUSH FIRE HAZARD ASSESSMENT

5.01 Planning for Bushfire Protection - 2001

Properties considered to be affected by bushfire impact are determined from the local Bushfire Prone Lands Map as prepared by Council and or the Rural Fire Service. All property development within affected areas is subject to the conditions detailed in the legislated document known as 'Planning for Bushfire Protection - 2001' (P/BP). Set back distances for the purpose of creating Asset Protection Zones (APZ's) between any bushfire hazard and dwellings must be applied. The dwellings must then conform to corresponding regulations detailed in Australian Standard 3959 – 1999 'Construction of buildings in bushfire prone areas'.

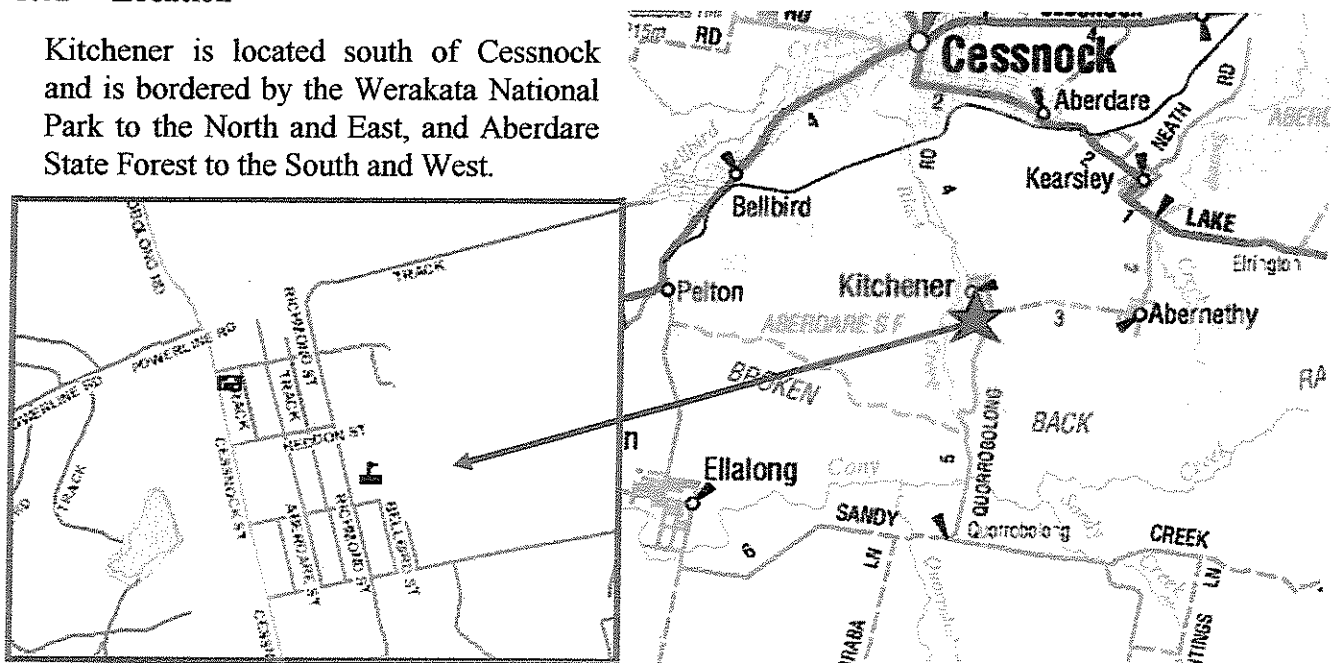
Planning for Bushfire Protection – 2001, (P/BP) formally adopted on the 1st August 2002 provides for the protection of property and life (including fire-fighters and other emergency service personnel) from bushfire impact.

The thrust of the document is to ensure that developers of new properties or sub-divisions include the constraints associated with the construction of buildings in bushfire prone areas within their proposed development sites. This includes Asset Protection Zones, road and access design criteria and constructional considerations as detailed in AS 3959 – 1999 Construction of buildings in bushfire prone areas. P/BP is applicable to proposed development inside a the mapped area of Category 1 or 2 Vegetation and also inside a buffer zone radius of 100m from a Category 1 vegetation or 30m from a Category 2 vegetation as depicted on the local Bushfire Prone Lands Map.

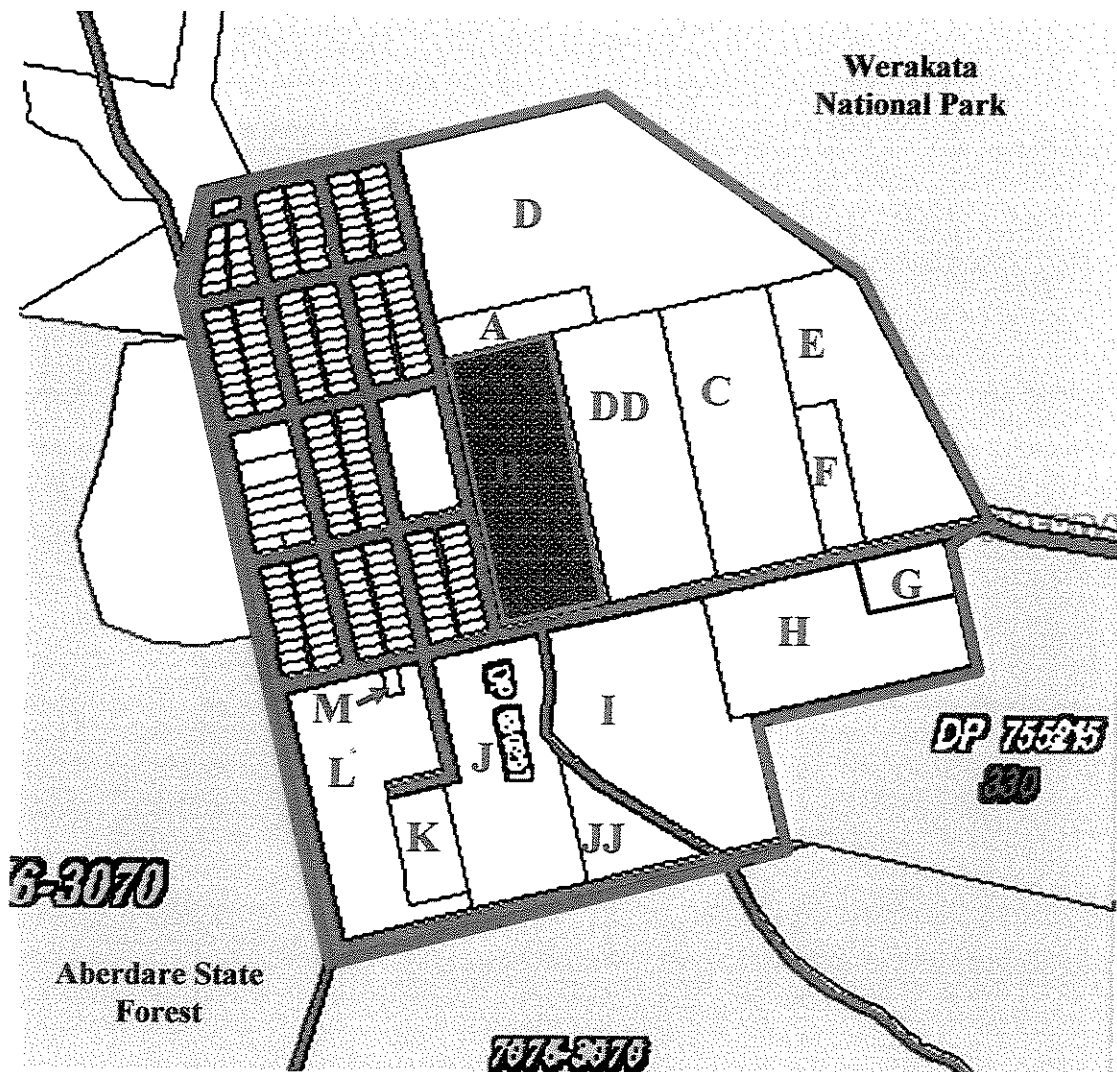
Any future rezoning within the Kitchener precinct should allow for the submission of a development application for future subdivision. For any subsequent development application to achieve consent from the determining authority (Cessnock Council) a Bushfire Safety Authority would be required to be sought from the Rural Fire Service under Section 100B of the Rural Fires Act 1997 for integrated development and the strict application of P/BP.

5.02 Location

Kitchener is located south of Cessnock and is bordered by the Werakata National Park to the North and East, and Aberdare State Forest to the South and West.



Map 01 & 02 Excerpt from streetdirectory.com showing location of Kitchener.



Map 03: Plan of the Kitchener township, showing Werakata National Park in yellow and Aberdare State Forest in green. Also noted is the area being investigated for rezoning (Kitchener precinct) outlined in red, with individual allotments labelled for reference within this report. The blue shaded area is Mindaribba Aboriginal Land which is significantly vegetated.

5.03 Bushfire threat.

The township of Kitchener is susceptible to bushfire impact from fires burning within the Werakata National Park or Aberdare State Forest. Additionally there are several large residential allotments and the Mindaribba Land within the precinct itself that contain sufficient vegetation that they should also be considered a potential bushfire threat. Whilst the Rural Fires Act does provide mechanisms to reduce or remove vegetation within private allotments for the purpose of reducing bushfire risk this is applicable to existing residential development only and should not be considered for integrated development applications.

Cessnock City Council has developed a Bushfire Prone Lands Map detailing bushfire prone vegetation within and surrounding this precinct. Ground truthing of this map identified only minor inaccuracies. These inaccuracies were considered to be not of a scale that they would influence the determination of any rezoning potential or the application of P/BP for any future development.

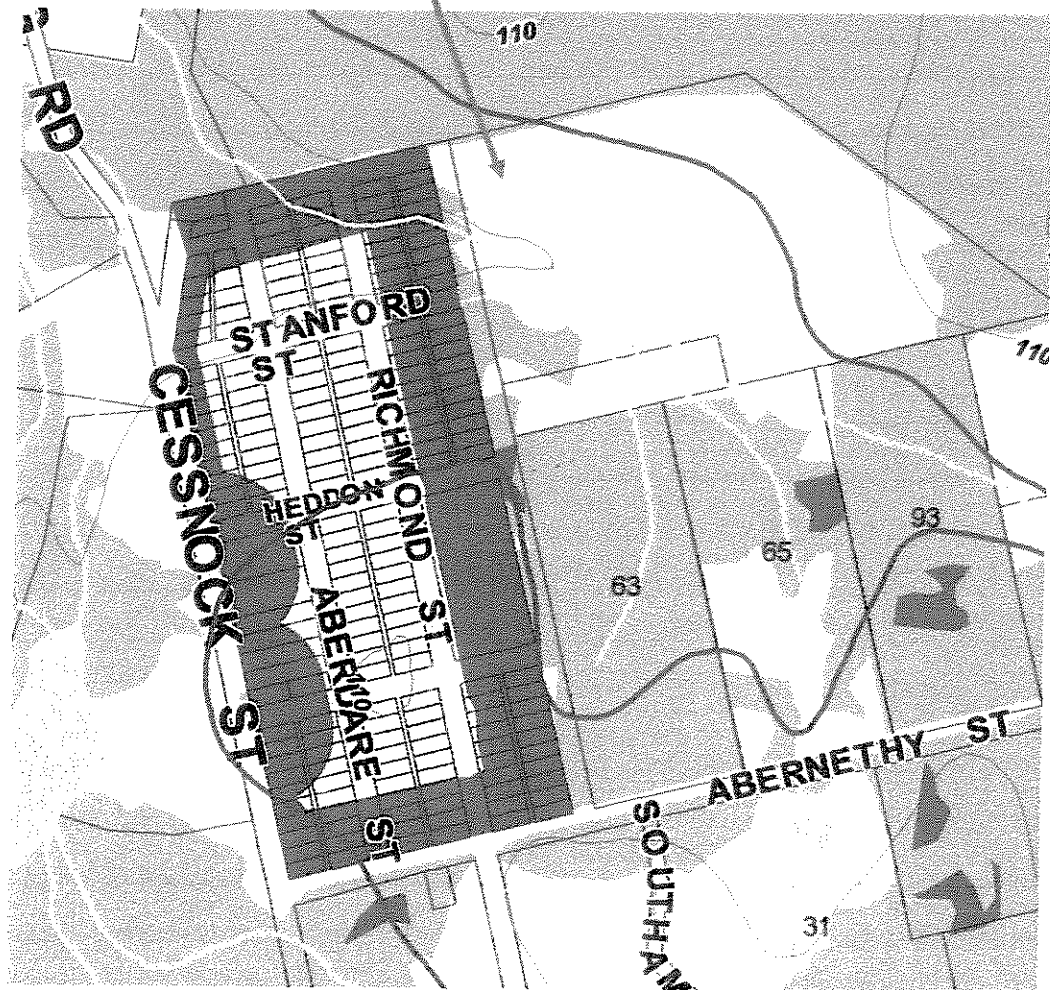
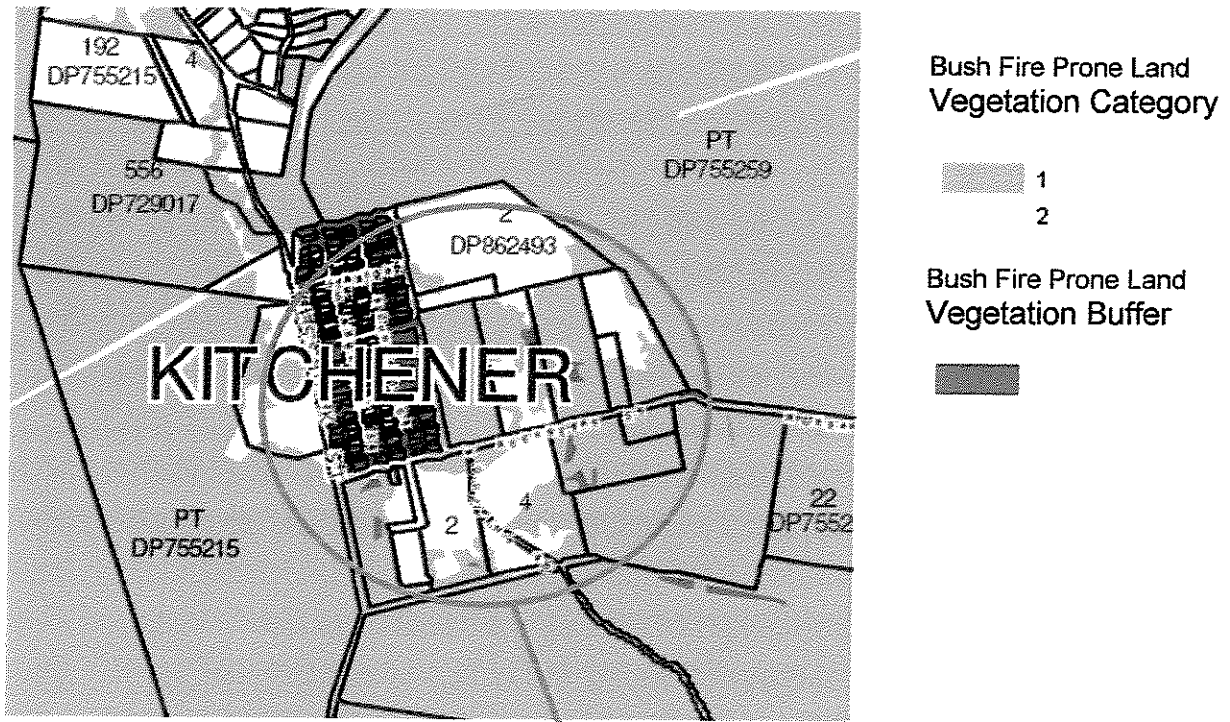


Image 01 and 02: Excerpts from Cessnock City Councils Bushfire Prone Lands Map.

The only major feature worthy of note is the presence of a large parcel of undeveloped land to the eastern aspect of the existing residential settlement (Lot B Map 03). This land was considered to contain Category 1 Vegetation and poses a hazard to the existing residences and the school, structures that were constructed prior to the current bushfire legislation and AS3959 - 1999. This land is owned by the Mindaribba Aboriginal Land Council. Any future development would require set backs (Asset Protection Zones) from this allotment however this will not reduce the risk this area poses to the existing township.

When taking a holistic approach to development in Kitchener we would suggest that consideration be given to this land having regard to bushfire impact. It would also be considered advantageous to develop land surrounding this allotment and as such remove any direct vegetation linkage to larger hazardous areas. We also recommend that access within this allotment be improved for fire fighting and / or fuel management purposes. This could be in the form of a perimeter fire trail or the like including walking trails with specific attention made to fuel management within the area immediately adjacent the school grounds. Ideally it would be preferable to develop this land for residential purposes or public facilities and apply an APZ from adjoining hazards, thus increasing the protection to the existing township.

Traditionally, fires have impacted Kitchener from the west and conversations with locals confirm that apart from incidents of arson (notably Oct 2002), major wildfires have always approached the township from the west or south west aspect. There are currently large areas of land that should be considered Strategic Protection Zones west of Quorrobolong Road (Public open space and Heritage Park) providing a sufficient fire break to the township from this aspect (approximately 100 metres width). We would suggest that these areas are continued to be maintained in a similar fashion.

Following on from this it would be pertinent to mention any possible development within allotment K, L, and M (Map 03). These allotments have potential to be impacted upon along the western aspect, traditionally the worst bushfire prone aspect. It would be imperative that any development within these allotments provide sufficient APZ detailed in P/BP to the west.

5.04 Slope and topography.

The required Asset Protection Zones vary according to the gradient and vegetation that would influence bushfire behaviour within the hazardous areas. While development on sites with gradients less than 18 degrees is not precluded, the increased setbacks would reduce the development potential (% land usage). Generally the hazard interfaces on the perimeter of the Kitchener precinct were found to be level or upslope from potential development sites. The exception was lots G and H (Map 03). These allotments had a potential bushfire impact from the east at a gradient of 5 – 10 degrees down slope. The land use return for these allotments would be reduced; however the opportunity for larger acreage allotments along this aspect could be explored.

5.05 Vegetation.

The vegetation within the Werakata National Park was found to be predominately Woodlands Group 2 with some areas of scrub and heath. The vegetation within Aberdare State Forest was more predominately a Closed Forest style structure. The average slopes affecting bushfire impact along the properties adjoining both Werakata National Park and Aberdare State Forest (with the exception of Lots G and H) were found to be 0 – 5 degrees upslope.

In comparison of these allotments there is no significant reduction in percentage land use due to the different vegetation structure found. This is due to the fact that Asset Protection Zones on gradients 0 degrees or more upslope require are the same for both Group 1 and 2 Vegetations (Table A2.2 P/BP).

Further investigation by a qualified ecologist would be required having particular regard to vegetation within lot JJ and I (Map 03). It may be that this vegetation is associated with a riparian zone along a natural watercourse. Should this be the case there may be a requirement on any future developer to retain this vegetation for ecological reasons. Any remnant vegetation that is of sufficient size or that is within the proximity of a larger hazard must also be considered a bushfire threat and appropriate APZ's must then be applied from this vegetation. It may be more appropriate to consider large allotment sizes in this area so as to be able to achieve the required Asset Protection Zones.

The same principle must also be applied to any other remnant vegetation within any of the allotments in the Kitchener precinct. Section 5.06 will include 3 possible scenarios for Asset Protection Zones depending upon ecological constraints.

5.06 Asset Protection Zones.

The determination of Asset Protection Zones must be made on a site specific bases for individual Development Applications. This would include consideration of the surrounding vegetation and the average slope that would influence possible bushfire impact to the development site. Any future residential development application must comply with the requirements detailed on Table A2.2 P/BP and also conform to the principles of any Development Control Plan (DCP) or Master Plan that may be in place for this area.

The following three scenarios are the likely Asset Protection Zones that would be applicable depending upon the extent of ecological constraints and may be included in any DCP or Master Plan for this locality. We have undertaken a perimeter inspection of this precinct and those slopes and vegetation types have been verified on site. We have not accessed each individual lot to average the slopes for 100 metres from possible building locations. In these instances the APZ's have been determined by slope analysis from the perimeter of the precinct and verified using topographic mapping of this area.

Within any area highlighted for possible re-vegetation we have assumed that this will occur in a manner similar to the predominate vegetation communities within the locality. Where Riparian Creek Corridors are likely we have allowed for a 20 metre wide strip of vegetation either side of the creek. We have then applied a 20 metre Asset Protection Zone from this vegetation. The final APZ determination from Creek Corridors would be subject to further negotiations with the Rural Fire Service and heavily depend on the nature of the re-vegetation.

Any Special Protection Development including schools, hostels, child care centres, aged care facilities or places providing temporary accommodation of a transient nature etc would require increased separation distances from bushfire hazard interfaces due to the nature of their occupancies. Any future development application should specifically detail locations of these types of developments on the overall site plan. Ideally these premises should be located centrally within a subdivision where they will benefit from the appropriate residential Asset Protection Zone and also the mutually supportive APZ of the maintained curtilages between them and any bushfire hazard interface. The separation distance between special protection developments must be in compliance with Table A2.3 of P/BP.

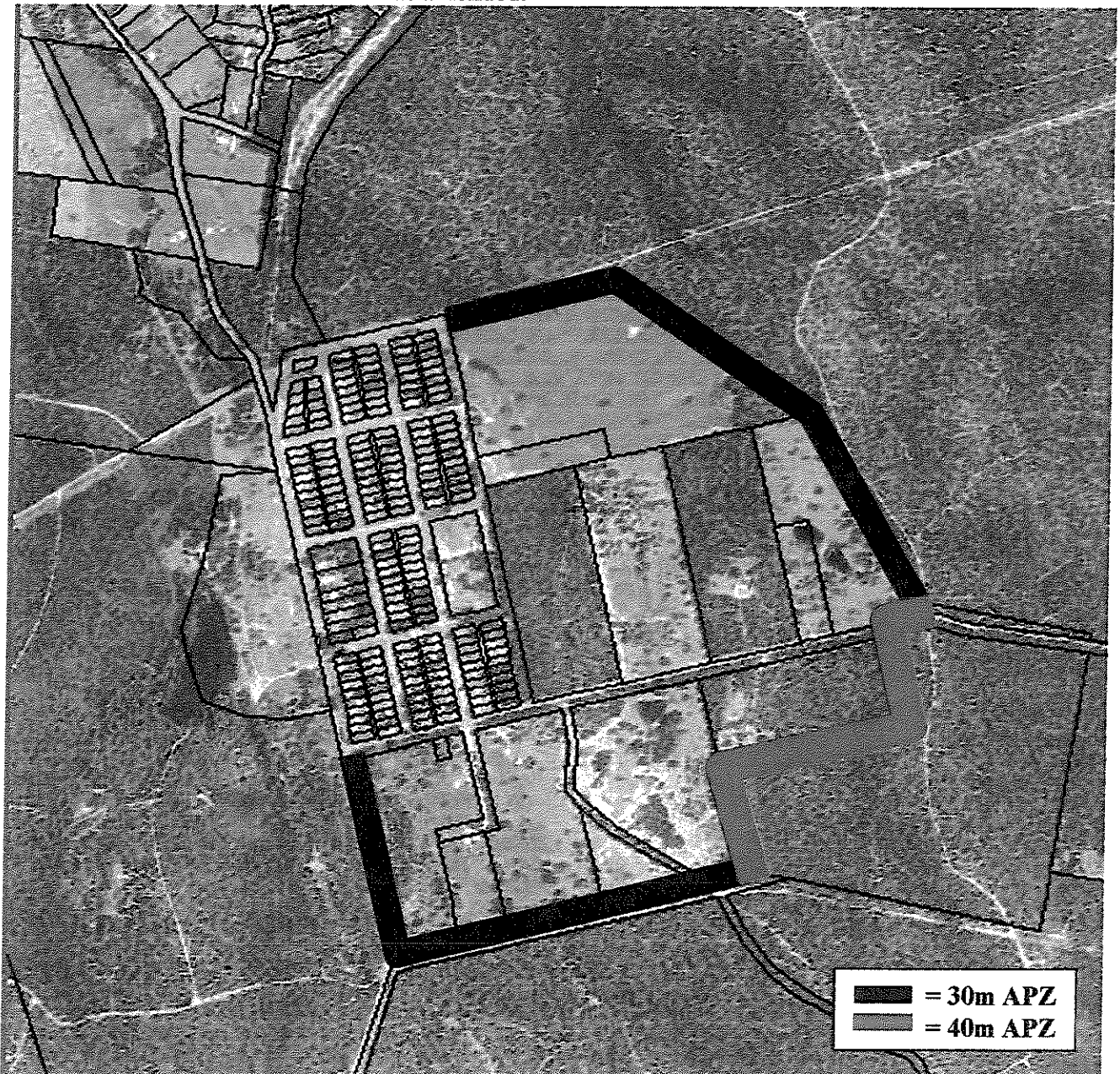
Other developments that should be precluded from the hazard interface area or immediately adjacent any APZ include service stations, chemical storage facilities, power generators, telephone exchange structures or other infrastructure style facility.

Land use that could be considered within the APZ for any development could include cemeteries, public open spaces, tennis courts, swimming pools, playing fields or the like. No fencing or structure should be installed in a manner that limits access for fire personnel to the hazard interface. A detailed summary of the requirements of an Asset Protection Zones is attached to this report.

Option 1

This scenario shows the location and depth of the Asset Protection Zones that would be required for residential purposes. This scenario is based upon the complete development of the whole township and the following assumptions have been made:

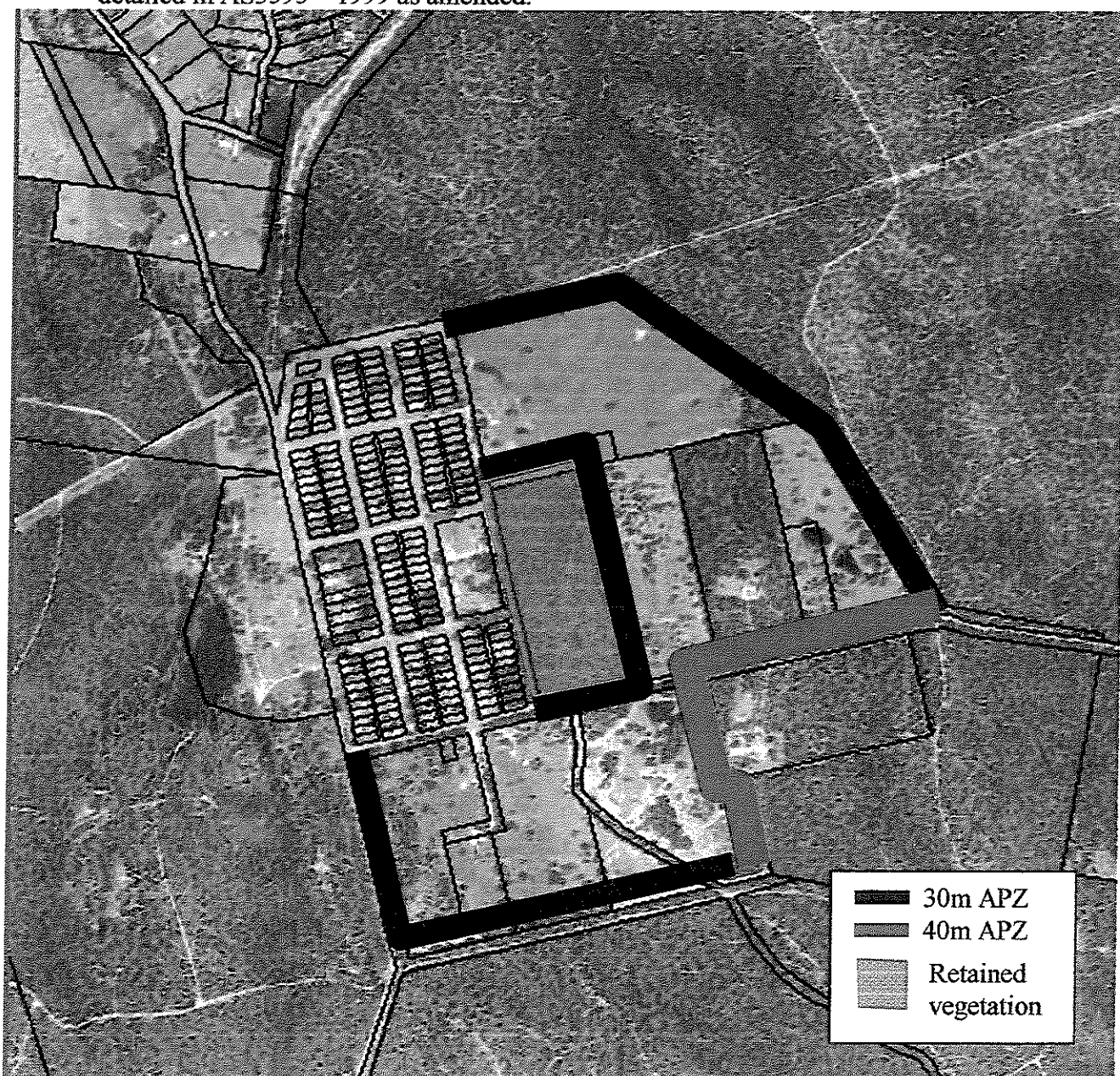
- ❖ Total removal of all vegetation,
- ❖ No environmental (flora and fauna) constraints,
- ❖ No revegetation of riparian corridors or fauna corridors,
- ❖ No restraints regarding vegetation management in scenic protection areas,
- ❖ No Aboriginal relics or protected sites,
- ❖ No Koala habitat or other SEPP constraints,
- ❖ No Special Protection Development including Schools, Aged Care, Places of Public Assembly etc along the hazard interface fringe. These types of developments generally require increased setbacks.
- ❖ The minimum requirements are based upon the need to conform with Level 3 construction as detailed in AS3595 – 1999 as amended.



Option 2

This scenario shows the location and depth of the Asset Protection Zones that would be required for residential purposes. This scenario is based upon only part development of the township and allowances have been made for the:

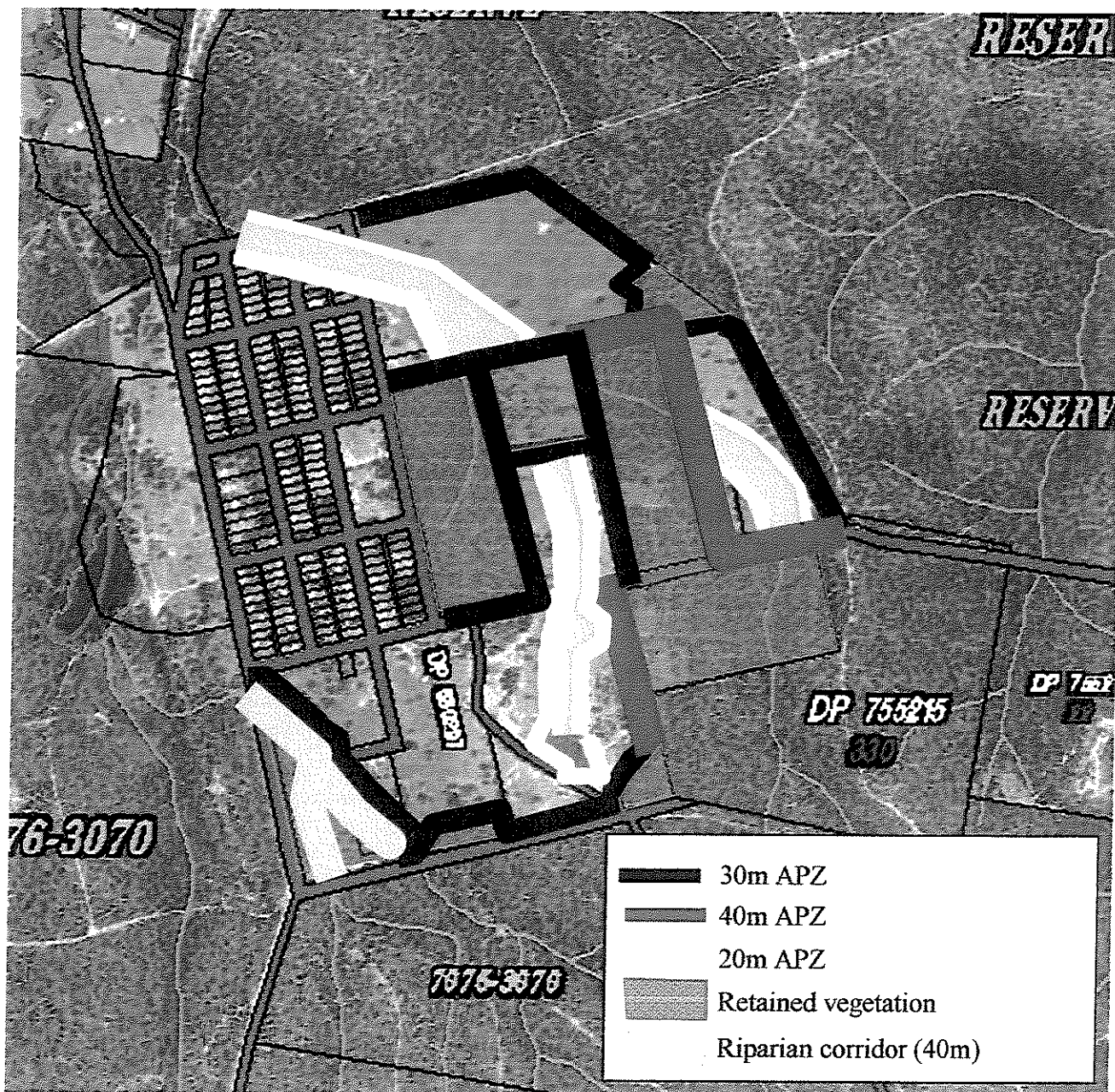
- ❖ Retention of large parcels of vegetation within private allotments,
- ❖ Minor environmental (flora and fauna) constraints,
- ❖ No revegetation of riparian corridors or fauna corridors,
- ❖ No restraints regarding vegetation management in scenic protection areas,
- ❖ Retention of possible Aboriginal relics or protected sites within Mindaribba Lands,
- ❖ No Koala habitat or other SEPP constraints,
- ❖ No Special Protection Development including Schools, Aged Care, Places of Public Assembly etc along the hazard interface fringe. These type of developments generally require increased setbacks.
- ❖ The minimum requirements are based upon the need to conform with Level 3 construction as detailed in AS3595 – 1999 as amended.



Option 3

This scenario shows the location and depth of the Asset Protection Zones that would be required for residential purposes. This scenario is based upon the following assumptions:

- ❖ Total retention of all vegetation with possible significance,
- ❖ 20m revegetation either side of riparian creek corridors
- ❖ Retention of a fauna corridors linking to Mindarriba property.
- ❖ Retention of possible Aboriginal relics or protected sites within Mindarriba Lands,
- ❖ No Special Protection Development including Schools, Aged Care, Places of Public Assembly etc along the hazard interface fringe. These types of developments generally require increased setbacks.
- ❖ The minimum requirements are based upon the need to conform with Level 3 construction as detailed in AS3595 – 1999 as amended.



5.07 Fire Fighting Water Supply

Any large scale development within the Kitchener precinct would include extension of the existing reticulated water supply. Any such works will need to comply with AS2419 within commercial, industrial or stata titled sites or the requirements of the local water authority in the area.

Any future development of a medium or high density nature may allow for strategically placed static water supplies dedicated for fire fighting purposes however where a reticulate mains exists this would be in excess of the minimum requirements of P/BP. Building Code and Bushfire Hazard Solutions has not undertaken any research or pressure testing of the water supply at this stage.

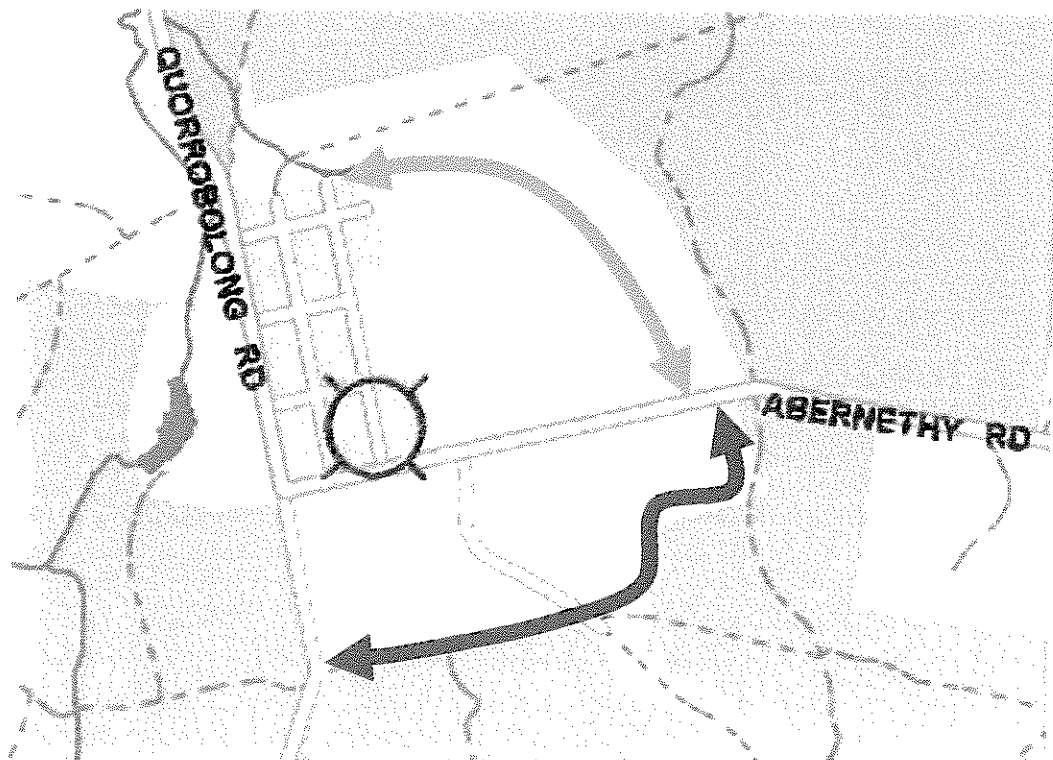
Where development in this precinct includes isolated rural allotments including dwellings which are not located within close proximity of a fire hydrant (60 -90 metres) then the provision of static water supplies dedicated for fire fighting purposes must be included. Generally a 22,000 litre water tank fitted with 65mm stortz fittings per property is considered appropriate.

5.08 Access – Fire Services & Evacuation

There are three major roads providing access to the township of Kitchener, being via Quorrobolong Road from Cessnock, Abernethy St from Abernethy or Quorrobolong Road from Quorrobolong. These roads provide suitable access for fire service vehicles from these directions. As these access roads traverse through National Parks, State Forest and large rural properties the possibility of fire appliances being restricted on these roads for short periods of time in a bushfire emergency must be considered. Large scale development within the township of Kitchener would benefit by the inclusion of an adequately staffed fire station. The cost for increased demand on emergency services can be accommodated from Section 94 contributions (see section 3.5 P/BP)

A fire trail extends from the north end of Bellbird Street (at the intersection of Neath Street) along the side of lots D and E linking back to Abernethy Road. A similar perimeter fire trail was present around the southern aspect of the precinct.

Any future Development Application would be required to consider perimeter roads along any hazard interface and alternative avenues of access and egress for residents and fire fighters. Should large scale development proceed within the northern portion of the Kitchener precinct it would be ideal to connect Neath Street (north) to Abernethy Road via lots D and DD, C or E (shown orange on the image below). Similarly should development proceed within the southern portion of the precinct Abernethy Road should also link to Quorrobolong Road via the southern portion of lots H, I, JJ, J K and L (shown pink on the image below). The resultant roadway would form a perimeter fire break and access for the township.



Map 04 Whereis.com excerpt of Kitchener precinct showing preferred perimeter road locations.

All other requirements for public roads and access drives with relation to bushfire mitigation matters are detailed within Chapter 4 P/BP and must be complied with for any future Development Application. Briefly these requirements are:

Public Roads:

- Roads should be two-wheel drive, all weather roads;
- Roads should be two-way, that is, at least two traffic lane widths (8m minimum) with shoulders on each side, allowing traffic to pass in opposite directions;
- The perimeter road should be linked to the internal road system at an interval of no greater than 500 metres in urban areas;
- Restrict the use speed humps and chicanes to control traffic;
- Roads should be **through** roads. Dead end roads are not recommended, but if unavoidable, dead ends should be not more than 200m in length, incorporate a minimum 12m radius turning circle, and should be clearly sign posted as dead ends;
- The capacity of road surfaces and bridges should be sufficient to carry fully loaded firefighting vehicles (approximately 28 tonnes or 9 tonnes per axle);
- Curves should have a minimum inner radius of 6m and be minimal in number to allow for rapid access and escape;
- The minimum distance between inner and outer curves should be 6m;
- Maximum grades should not exceed 15° and preferably not more than 10° or gradient specified by road design standards, whichever is the lesser gradient;
- There must be a minimum vertical clearance to a height of 6 metres above the road at all times;
- Roads should provide sufficient width to allow firefighting vehicle crews to work with firefighting equipment about the vehicle.
- Roads should be clearly sign-posted (with easily distinguished names) and buildings should be clearly numbered. Bridges should clearly indicate load rating;
- Roads should have a minimum total reserve width of 20m where they are a perimeter road as defined in section 4.2.2(c) of this document; and
- Roads should not traverse through a wetland or other land potentially subject to periodic inundation

Property Access Roads:

- A minimum trafficable width of 4m with an additional 1m wide strip on each side of the road kept clear of bushes and long grass.
- The road should have a passing bay about every 200m where possible, which should be 20m long by 3m wide, making a minimum trafficable width of 7m at the passing bay.
- The capacity of road surfaces and bridges should be sufficient to carry fully loaded firefighting vehicles (approximately 28 tonnes or 9 tonnes per axle).
- A minimum vertical clearance of 6m to any overhanging obstructions, including tree branches.
- Curves should have a minimum inner radius of 6m and be minimal in number to allow for rapid access and escape.
- The minimum distance between inner and outer curves should be 6m.
- Maximum grades should not exceed 15° and preferably not more than 10°.
- Roads should provide sufficient width to allow firefighting vehicle crews to work with firefighting equipment about the vehicle.
- Dwellings not sited within 200m of the road system should have an alternative access road providing emergency egress to the through road system; and
- Roads should be clearly sign-posted. Bridges should clearly indicate load limits.

5.09 Viable Constructional Method

The minimum required Asset Protection Zone under P/BP and detailed on Table A2.2 and 2.3 are based upon the need to conform to a Level 3 construction. Where development includes dwellings that exceed the minimum required Asset Protection Zones then the category of Bushfire Impact must be calculated from Table A3.3 which can reduce the required construction level for a dwelling. As this involves the specific detail of any future subdivision layout it must be addressed at that time.

It is germane to mention that to receive a Bushfire Safety Authority from the Rural Fire Service that any future DA must include a layout where any building construction standards are within the scope of AS3959 and therefore any development within the Kitchener precinct that complies with the requirements of P/BP then construction will be within the scope of AS3959-1999 as amended.

5.10 Staged development

The majority of the allotments both north and south of Abernathy Road are of a sufficient size that they could accommodate the minimum Asset Protection Zones required and still provide viable building platforms and sufficient land for associated infrastructure.

Having said this it would seem more appropriate to initially develop the allotments east of the existing township rather than create isolated pockets of medium - high density dwellings (i.e Lots A-B-D-DD, and L-M-J). This would also have the benefit of providing a strategic fire break to the existing township from the eastern aspect.

It would be beneficial to combine the smaller of the allotments (those labelled Lot A, F, G, K, JJ and M) with larger neighbouring allotments for future residential development proposals. It would be also advantageous to develop east of the existing township (Lots A, B D and DD) rather than increase the population exposed to bushfire impact from the west.

Any staged development must also maintain an Asset Protection Zone from the yet to be developed land when that land is considered to be a bushfire hazard. When staging development these APZ must be in accordance with P/BP. In order to conform with the RFS Development Note 002 if an easement is sought on adjoining undeveloped land then the easement shall contain not more than 50% of the total APZ required.

Where any development includes the provision of strategic Asset Protection Zones, public open spaces or parkland a bushfire hazard management plan should be compiled for those lands detailing the frequency and means of fuel management and the responsible agency/authority for those areas.

Lot B (Map 03) is Mindaribba Aboriginal Lands and may never be developed and as such remain a possible bushfire threat to any adjoining properties. Set backs (Asset protection Zones) in accordance with P/BP will be required from this allotment. We have also discussed the implications of access within and fuel management of this allotment.

6.0 RECOMMENDATIONS

Having regard to any future development within the Kitchener precinct we make the following recommendations having regard to bushfire mitigation matters:

- 1) That access within the Mindaribba lands (Lot B Map 03) be improved for fire fighting and / or fuel management purposes. This could be in the form of a perimeter fire trail or the like including walking trails with specific attention made to fuel management within the area immediately adjacent the school grounds
- 2) That strategic Asset Protection Zones must be provided for and maintained around the perimeter of any future development and include adequate access for fire services in accordance with P/BP.
- 3) That the existing strategic Asset Protection Zone west of the existing township is continued to be maintained in a similar fashion.
- 4) All future development applications for subdivision, special protection development or single residential allotments must comply with P/BP and AS3959 – 1999 as amended.
- 5) That the allotments east of the existing township are developed as a priority where the provisions of perimeter Asset Protection Zones when combined with a perimeter road, the existing Abernathy Road and the Strategic Zones to the west of Quarrobolong Road will provide improved bushfire protection to the township.
- 6) That where possible the smaller of the allotments in the precinct (those labelled Lot A F, G, K, JJ and M) are combined with larger neighbouring allotments for future residential development proposals.
- 7) That any isolated new residential dwellings or those located within larger rural allotments and not located within 90 metres of a hydrant include the provisions of a dedicated water supply of 22,000 litres for fire fighting purposes.
- 8) That where any development includes the provision of strategic asset protection zones, public open spaces or parkland a bushfire hazard management plan should be compiled for those lands detailing the frequency and means of fuel management and the responsible agency/authority for those areas.
- 9) That where development includes buildings that will be considered “Special Protection Development” they adhere to the APZ detail in Table A2.3 P/BP. Preferably these premises would be located centrally within the subdivision layout so that they benefit from the perimeter APZ’s and maintained curtilages between them and the bushfire hazard interface.
- 10) That any development within the northern portion of the Kitchener precinct where possible connect Neath Street (north) to Abernathy Road (Map 04)
- 11) That any development within the southern portion of the precinct where possible connect Abernathy Road to Quarrobolong Road via the southern portion of the precinct (Map 04)

7.0 CONCLUSION

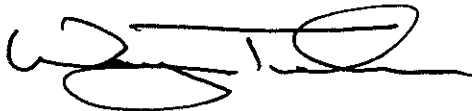
Given that the precinct is located in a Bushfire Prone Area under Cessnock City Councils Bush Fire Prone Lands Map any proposed development would need to meet the requirements of Planning for Bushfire Protection – 2001 and of the constructional requirements of Australian Standard 3959 – 1999.

The properties surrounding the Kitchener township within the investigation zone were generally found to be of a size and nature that the Asset Protection Zones and road infrastructure requirements detailed within P/BP could be accommodated as part of any future development application.

Areas have been identified where, should development proceed, then the subdivision design and road layout will provide improved protection to the existing township and improved access to the hazard interfaces for both fuel management and fire fighting purposes. Similarly opportunities to improve avenues of egress for residents also exist.

The merits of future development applications must be considered on an individual basis and must also comply with all applicable legislation at that time. Providing the requirements of P/BP (and/or any future changes to this legislation) are adhered to, the opportunities for future residential development within the investigation area is possible having regard to current bushfire mitigation requirements.

Prepared by
Building Code & Bushfire Hazard Solutions P/L



Wayne Tucker for

David McMonnies M. I. Fire E. M Cons Mgt.
C\50050 Kitchener Precinct Assessment BFH Rpt 01

Disclaimer:

Quote from Planning for Bushfire Protection 2001, *'notwithstanding the precautions adopted, it should always be remembered that bushfire burn under a wide range of conditions and an element of risk, no matter how small always remains.'*

Quote from Standards Australia, *'Although the standard is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any one building will withstand bushfire attack on every occasion.'*

Similarly my interpretations and opinions on bushfire protection are also given in the same good faith.

8.0 ANNEXURE 01

List of Referenced Documents

- a) Environmental Planning and Assessment Act 1979
- b) Rural Fire Services Act 1997 as amended
- c) "Planning for Bushfire Protection" - NSW Rural Fire Services 2001
- d) "Construction of buildings in bushfire prone areas" - A.S. 3959 – 1999 (as amended)
- e) Cessnock City Council's "Bush Fire Prone Lands Map"
- f) Acknowledgements to:
 - Whereis.com.au
 - Streetdirectory.com.au
 - UBD Directories.
 - Planning NSW-Iplan
 - TopoWeb / Copyright Department of Lands 2004

Attachments

- | | |
|---------------|---|
| Attachment 01 | Asset Protection Zones – Design Criteria. |
| Attachment 02 | Aerial View and Photo montage of the surrounding areas. |

**ATTACHMENT 01:
Asset Protection Zones
Design Criteria.**



Building Code & Bushfire Hazard Solutions P/L

(Pty. Limited) ACN 19057 337 774

PO Box 124 Berowra, NSW 2081

Telephone: (02) 9456.2288 Facsimile: (02) 9456.2277 Email: stumcm@ozemail.com.au

Asset Protection Zones

Introduction:

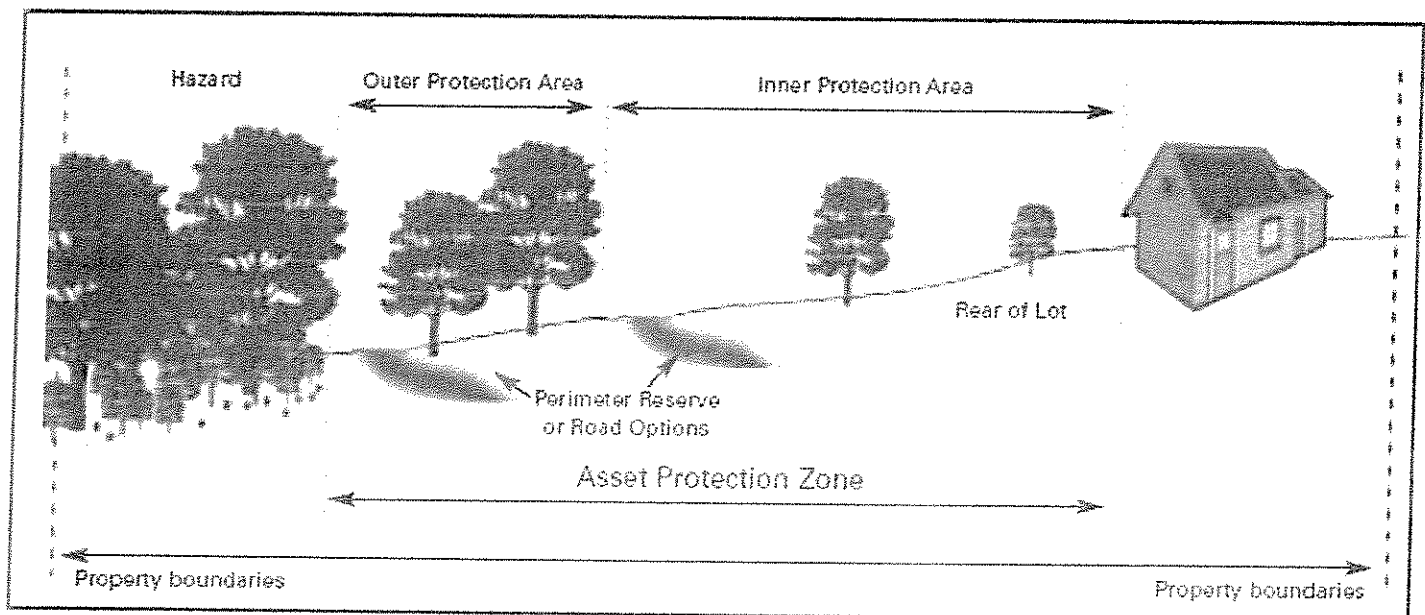
Where a bushfire hazard exists on or adjacent to the development site, an Asset Protection Zone is to be established on the hazard side of the development. Asset Protection Zones are required for any development adjoining a bushfire hazard area, whether it is a single dwelling, a group of isolated buildings or urban subdivision.

The Asset Protection Zone acts as a buffer zone between the development and the hazard. The primary purpose of an Asset Protection Zone is to ensure that a progressive reduction of bushfire fuels occurs between the bushfire hazard and any habitable structures within the development.

Components of an Asset Protection Zone:

The Asset Protection Zone (APZ) should incorporate:

- an **Outer Protection Area (OPA)**; and
- an **Inner Protection Area (IPA)**.



Outer Protection Area:

a) Location:

The Outer Protection Area is located adjacent to the hazard. Originally the Outer Protection Area would have been part of the bushfire hazard but has become an area where the fuel loadings are reduced.

b) Purpose:

The reduction of fuel in this area substantially decrease the intensity of an approaching fire and restricting the pathways to crown fuels; reducing the level of direct flame, radiant heat and ember attack on the Inner Protection Area.

c) Depth:

The depth of the OPA is largely dependent on the type of land use and vulnerability of the dwelling or persons affected. For residential development the OPA is usually 10m deep. For special protection development the OPA is usually 15m deep. Some variation may be possible in consultation with local fire authorities.

d) Fuel Loadings:

Within the Outer Protection Area any trees and shrubs should be maintained in such a manner that the vegetation is not continuous.

Fine fuel loadings within the OPA should be kept to a level where the fire intensity expected will not impact on adjacent developments. In the absence of any policy to the contrary, 8 tonnes per hectare of fuel is commonly used.

In grasslands, fuel height should be maintained below 10 centimetres.

Inner Protection Area:

a) Location:

The Inner Protection Area extends from the edge of the Outer Protection Area to the development.

b) Purpose:

The Inner Protection Area ensures that the presence of fuels, which could become involved in a fire, are minimised close to a development. Therefore the impact of direct flame contact and radiant heat on the development is minimised.

c) Depth:

The depth of the IPA is dependent upon the slope of the land. The greater the slope, the greater the intensity of any approaching fire and hence the greater the depth required for the IPA.

d) Fuel Loadings:

It is more practical to determine the specifications of the IPA in terms of performance than in terms of minimum fuel loadings.

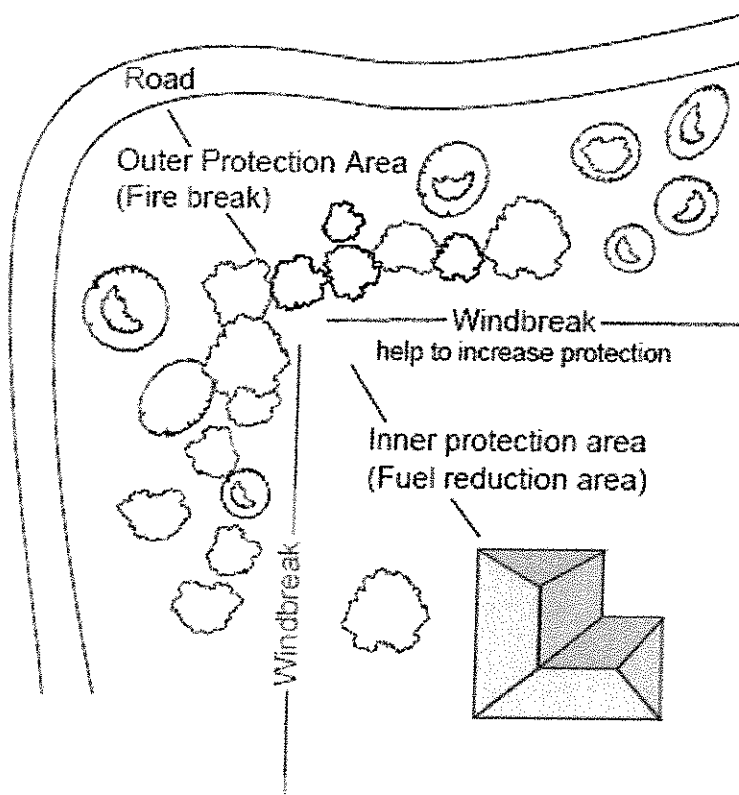
The performance of the Inner Protection Area must be such that:

- There is minimal fine fuel at ground level which could be set alight by a bushfire; and
- Any vegetation in the Inner Protection Area does not provide a path for the transfer of fire to the development – that is, the fuels are discontinuous.

The presence of a few shrubs or trees in the Inner Protection Area is acceptable provided that they:

- do not touch or overhang the building;
- are well spread out and do not form a continuous canopy;
- are not species that retain dead materials or deposit excessive quantities of ground fuel in a short period or in a danger period; and
- are located far enough away from the house so that they will not ignite the house by direct flame contact or radiant heat emission.

Woodpiles, wooden sheds, combustible material storage areas, large areas/quantities of garden mulch, stacked flammable building materials etc should not be permitted in the Inner Protection Area.



Reference has been made to the New South Wales Rural Fire Service document Planning for Bushfire Protection and other documents.

ATTACHMENT 02:

**Aerial View and Photo
montage of the
surrounding area.**

**REPORT
ON
STORMWATER MANAGEMENT STRATEGY**

**PROPOSED RESIDENTIAL EXPANSION
OF
KITCHENER**

October 2006

PETER SULLIVAN & ASSOCIATES PTY LTD
CONSULTING ENGINEERS

LEVEL 1, 152 DARBY STREET
NEWCASTLE NSW 2300

PHONE 4926 3980
FAX 4925 2133

STORMWATER MANAGEMENT STRATEGY

For

PROPOSED RESIDENTIAL EXPANSION

of

KITCHENER

1. INTRODUCTION

Glendinning Minto & Associates is currently preparing a report on behalf of Cessnock City Council in support of a rezoning of lands adjacent to the existing Village of Kitchener.

This report considers the stormwater management issues associated with the proposed rezoning and the extension and expansion of the Village of Kitchener.

The report provides a concept strategy for the collection, management, re-use and disposal of storm water runoff from the catchment.

The report also provides some comment on the Water Sensitive Urban Design (WSUD) approach to storm water management, which could be adopted here.

2. SITE DESCRIPTION

The area proposed for the expansion of Kitchener, is located to the east and south of the existing village of Kitchener and extends approximately 500 metres south of Abernethy Road and 900 metres of Bellbird Street.

3. CATCHMENT DESCRIPTION

The catchment extends southwards to approximately 1100 metres south of Abernethy Road. Here the catchment narrows and the watershed is situated on a knoll at Southhams Road.

Several ephemeral watercourses drain in a northerly or north-westerly direction towards the existing northern limits of Kitchener. Several farm dams are scattered over the site.

Current catchment land use includes:

- An area of the Aberdare State Forest at the southern limits.

- Areas of cleared grazing land.

- Areas of timbered land in private ownership.

- An area of the existing Village of Kitchener.

The topography comprises gentle slopes generally falling to the north.

The drainage depressions or watercourses converge towards the northern end of the catchment near to the northern limits of Kitchener. At the northern end of the site, the total contributing catchment area is 146.5 hectares.

4. DRAINAGE NETWORK

The drainage network should preferably follow the natural watercourses within the catchment.

With the development of the catchment it may be possible to re-direct some flows to follow the road layout. This is not recommended as the capacity of the roadways to act as floodways and carry the 1 in 100 year ARI flow is limited.

It is recommended that the watercourses be retained and upgraded as grassed floodways to carry the 1 in 100 year ARI flows. A pipe system would work in association with the floodway system which would carry the smaller more frequent flows.

5. WATER QUANTITY ISSUES

5.1 HYDROLOGIC MODELLING - INTRODUCTION

Hydrological modelling was carried out to determine the runoff generated in the catchment using the XP-RAFTS 2000 model. This modeling system is one of the methods recommended in Australian Rainfall and Runoff (1998).

The model inputs include:

- Subcatchment area
- Subcatchment slope
- Flow path lag times
- Catchment roughness
- Catchment pervious and impervious fractions and rainfall losses
- Rainfall characteristics (intensity-frequency-duration and temporal patterns).

The model generates flows from:

- Impervious surfaces (road, roofs and driveways)
- Pervious surfaces (lawns, parks and gardens),

and then produces a combined hydrograph at each sub-catchment outlet.

5.2 MODEL PARAMETERS

Based on the topographical features and land-use, the catchment was divided into a series of sub-catchments (represented by Nodes) which are then linked together along the lines of the stream network. The sub-catchment layout is shown in Figure 1.

Three land use types were identified in the study areas:

Forested: the area of the Aberdare State Forest in the south of the catchment, and some timbered land in private ownership.

Grazing: the bulk of the existing site, with short grasses and occasional trees.

Residential: the existing areas of the Village of Kitchener and the proposed development areas.

Each area was allocated a pervious and impervious fraction, and these are listed in Table 1.

Table 1: Catchment characteristics

CATCHMENT TYPE	% IMPERVIOUS	% PERVIOUS
Forested	0%	100%
Grazing	0%	100%
Residential	50%	50%

The Cessnock City Council Engineering Requirements for Development specifies an impervious area fraction of 0.45 (45%) [Item 6.15d]. As the anticipated lot yield has been nominated as 12 lots per hectare, a slightly higher fraction of 50% has been adopted.

The catchment roughness values used in the model are shown in Table 2.

Table 2: Catchment Roughness Values.

CATCHMENT TYPE	MANNINGS "n"
Forested	0.2
Grazing	0.05
Residential	0.015

The runoff lag times for the existing undeveloped catchment are based on velocity data published in the Queensland Department of Main Roads Road Drainage Design Manual. This manual lists approximate flow velocities based on the average slope of the catchments. The lag times were then calculated based on these velocities and the flow path lengths.

For the developed case, the analysis assumed that the links will be grassed floodways and the lag times are based on an average velocity of 1.5m/s.

Table 3: Flow Path Lag Times.

Link from	To	Length	Lag time Existing	Lag time developed	Comment
1	2	250	6	2.8	
2	3	270	6.3	3.0	
3	4	530	12.7	6.0	
4	8	10	0.1	0.1	Dummy link
8	10	10	0.1	0.1	Dummy link

Link from	To	Length	Lag time	Lag time	Comment
			Existing	developed	
10	11	10	0.1	0.1	Dummy link
11	12	300	9.0	3.3	
6	7	380	7.0	4.2	
7	8	10	0.1	0.1	Dummy link
9	10	10	0.1	0.1	Dummy link
14	12	150	3.5	1.0	

5.3 Rainfall Losses

The RAFTS model uses an Initial Loss – Continuing loss rainfall loss model. The loss rates adopted are shown in Table 4. As the loss rates only apply to the pervious areas, use of the same rates across the various catchment types is considered appropriate.

Table 4: Rainfall losses

CATCHMENT TYPE	INITIAL LOSS	CONTINUING LOSS
Forested	10 mm	2.5mm/hr
Grazing	10 mm	2.5mm/hr
Residential	10 mm	2.5mm/hr

5.4 Design rainfall characteristics

The intensity frequency duration parameters for the design events of various durations were obtained from The Cessnock City Council Engineering Requirements for development – Figure 6 Paxton.

PARAMETER			VALUES	
	DURATION	1 hour	12 hour	72 hour
	50 Year ARI	49.8mm/hr	11.75mm/hr	3.80mm/hr
	2 Year ARI	27.5mm/hr	5.90mm/hr	1.84mm/hr
Skew			0.07	
Geographical Factors	Latitude	32.91 S		
	Longitude	151.29 E		

5.5 Sub-Catchment Data

For the developed catchment, the sub-catchment details are as follows:

NODE	AREA	% IMPERVIOUS	SLOPE	MANNINGS 'n'	COMMENTS
1	31.3	0	3.6	0.200	
2	7.5	50	1.2	0.015	
3	25.0	50	1.6	0.015	
4	0	0			Dummy
6	18.1	50	6.1	0.015	
7	13.8	50	1.8	0.015	
8	0	0			Dummy
9	22.5	50	3.4	0.015	
10	0	0			Dummy
11	21.3	50	0.9	0.015	
12	0	0			Dummy
14	7.0	50	4.3	0.015	

Note: Dummy nodes and links are used solely to connect the drainage network together.

5.6 Flow modeling

Hydrologic modelling was undertaken for the 1 in 100year ARI event only. This recurrence interval was adopted as it is recognised as the standard for the protection of property and personal safety. It was considered that there was little benefit at this preliminary stage in considering lower recurrence interval flows. These lower ARI flows are typically considered at the subdivision stage when pipe systems are being designed.

The analysis has assumed a standard lot density of 12 lots per hectare across the areas of the catchment that are to be developed. This is an average figure and the final density will be higher and lower depending on the final subdivision plans. The final analysis should be undertaken when more accurate lot densities are established.

A range of storm durations was modeled to determine the critical flows. Model runs were undertaken for durations of 1 hour, 1.5 hours, 2 hours, 4.5 hours, 9 hours and 12 hours.

5.6.1 Modelling runs

Model runs were undertaken for the following scenarios:

- Existing catchment development – the small area of the existing Village of Kitchener and the adjacent rural lands.
- Fully developed catchment – the small area of the existing Village of Kitchener and the adjacent lands assumed to be developed as the new urban expansion of Kitchener.
- Fully developed catchment (as described above) and providing for roof water tanks to all new lots.
- Fully developed catchment (as described above) and providing for roof water tanks to all new lots and detention basins to control runoff from roads and other impervious surfaces.

5.6.2 Roof Water Tanks

An analysis was undertaken allowing for the inclusion of roof water tanks to all new lots ascertain the effect upon the flows from the developed catchment.

The analysis allowed for 10 kilolitre tanks to be provided to each lot and the tanks to be configured to provide 5 kilolitres of reuse supply and 5 kilolitres of detention storage. The upper half of the tank would be available for detention storage and be provided with a small diameter (nominally 20mm) outlet. The detention storage would then drain out slowly after the storm event.

The roof water tanks provided only partial (although significant) assistance in controlling the flows from the developed catchment for the 1 in 100year ARI events. In these major events the volume of runoff from an average roof area of 250 square metres is generally well in excess of 5 kilolitres.

The roof water tanks will provide more effective control to the lower recurrence interval storms.

A summary of the likely effectiveness in various storm events is contained in Appendix 1.

5.6.3 Detention Basins

While the roof water tanks provided some control to the peak stormwater flows, it was inadequate to compensate for the increased runoff from the roads and other paving areas. To provide control to the runoff from these areas, detention basins are also proposed. A series of basins scattered over the catchment has been proposed.

The location of the basins considered in the analysis are shown in Figure 2, and preliminary information on basin volumes and outlets is included in Appendix 3.

Consideration was given to the provision of one large basin at the lower end of the catchment, but preliminary indications were that the basin would require a volume of the order of 40,000 to 50,000 cubic metres. Given the fact that the

study area is in several ownerships, it was considered appropriate to distribute the required basins throughout the catchment rather than concentrate the facilities within one landholding.

The detention basin analysis is preliminary in nature, providing a guide for the planning process. The stormwater investigations detailed in this report are based on a catchment wide average lot density of 12 lots per hectare. The final lot yields are likely to be higher and lower than this subject to the detailed lot planning. The final detention basin analysis should be based on the final and more accurate lot densities.

In any event, some mechanism for sharing the trunk stormwater infrastructure costs will be required. This is beyond the scope of this report.

5.7 Catchment Flows

At the lower end of the catchment, (at Node 12) the stormflows for the various development scenarios are shown below:

Catchment Development Option	Peak Flow m³/s
Existing development	8.35
Developed catchment	41.93
Developed catchment with Roof water tanks	28.74
Developed catchment with Roof water tanks and Detention basins	10.12

The detention basin analysis is only preliminary in nature, so as to provide a guide for the planning process, it did not seem warranted to provide detailed basin designs to limit the developed and controlled flows to precisely not more than the existing and undeveloped site flows. Achieving an indication that adequate control could be achieved is considered sufficient for this study. The stormwater investigations detailed in this report are based on a catchment wide average lot density of 12 lots per hectare. The final lot yields are likely to be higher and lower than this subject to the detailed lot planning. The final detention basin analysis should be based on the final and more accurate lot densities.

The results of the modeling runs for all the various development scenarios considered is included in Appendix 4.

6. WATER QUALITY ISSUES

Development of residential subdivisions results in the generation of various pollutants that are not produced from an undeveloped catchment.

Various measures are available such as gross pollutant traps, proprietary systems that trap both gross and finer pollutants and water quality control ponds. During discussions with Council staff, it became apparent that water quality control ponds were a maintenance issue for Council and were not favoured.

It is therefore recommended that proprietary pollutant traps be utilized at the outlet to each of the detention basins. Examples of these are Ecosol, CDS, Humeceptor, and Cleansall.

7. GRASSED FLOODWAYS

It is envisaged that the existing ephemeral watercourses would be reconfigured as grassed floodways with a lower flow underground pipe system to convey the more frequent lower flows.

The anticipated shape of the floodways would be that of a broad shallow dish which would limit the flow velocities.

The width of the drainage channels will depend upon the final design of the drainage system and configuration of detention basins and other control measures, however it is expected that a maximum width of 20 metres would apply in the upper reaches of the catchment increasing to 40 metres downstream of Node 11.

8. CONCLUSION

The assessment described above confirms that an adequate stormwater drainage system can be implemented to provide controls to the increased levels of stormwater generated by the development of the catchment as part of the expansion of the Village of Kitchener.

As this assessment is only of a preliminary nature, it will require further 'fine tuning' at the subdivision stage when the lot and road layouts are available.

9. ADDENDUM – WATER SENSITIVE URBAN DESIGN

In recent years, the concept of Water Sensitive Urban Design (WSUD) has been introduced. This approach to stormwater drainage recognises that new urban development projects should incorporate more environmentally sustainable solutions.

WSUD methods suggest general principles that will work in reducing the negative impacts of urban development on the natural water cycle. By the implementation of such principles it is possible to achieve effects that include:

- Reduction of flood risk by controlling flood flows;
- Improved water quality; and
- Reduced demand for reticulated water by increasing the reuse or recycling of runoff.

Other associated effects would include:

- Reduction of erosion in waterways;
- More efficient use of water resources; and
- Protection of riparian ecosystems and habitat.

Measures available to implement such policies involve a mix of larger scale subdivisional works and individual lot works at the development phase of the project.

At the rezoning phase, the principles can be established in readiness for execution when earthworks commence.

9.1 STORMWATER CONTROL MEASURES

In the recent past it has been the practice to provide overall subdivision controls for stormwater quantity and quality controls through the use of larger subdivision scale works such as detention basins (quantity control) and artificial wetlands (quality control).

The WSUD approach would suggest that for a development project such as this, that individual lot control measures be implemented to manage runoff from the lots and separate controls be provided for the roadways.

This approach would then provide for management measures to be implemented as close as possible to the source, thereby minimising the requirement for end-of-pipe or downstream catchment measures

9.2 INDIVIDUAL LOT CONTROLS

On an individual lot basis, new houses can be designed so that they incorporate a variety of water sensitive measures, including rainwater tanks, porous paving, infiltration devices and landscape measures.

The BASIX regulations introduced by the NSW government require new dwellings to implement measures to reduce water consumption by 40%. These works can be used to reduce the effects of runoff from the lots on the total discharges from the catchment.

Whilst the ability of the subdivision developer has been limited in the implementation of these works, the BASIX requirements will assist in the adoption of these measures, and some can be nominated as requirement on the title at the time of sale. Others can be encouraged, or be requirements of Council for the house construction works.

Measures available at an individual lot level to implement water sensitive design policies include:

- Reuse of roof water for hot water, laundry use, toilet flushing or irrigation;
- Reuse of surface runoff for irrigation purposes; and
- Use of landscaping for cleansing runoff and conserving water.

Considering these measures in a little more detail:

Roof water would be collected into tanks for reuse for laundry use, toilet flushing or garden irrigation.

A component of the tanks would be for "on site detention" to reduce the impacts on downstream watercourses.

It is noted that the above measure is proposed in the recommendations for the Kitchener site.

During periods of prolonged or heavy rain, overflows from the tanks would be directed to a retention trench within the garden area. Excess runoff would then spill onto garden areas.

Paved areas could comprise porous paving, which allows for infiltration of some of the rain falling on these areas. Excess runoff from these paved areas would be directed to the retention trench or onto garden areas.

Landscaping measures can be used for the onsite disposal of runoff. Selection of appropriate species can also reduce the need for watering using mains water.

9.3 SUBDIVISION CONTROL MEASURES

With runoff from the lots being managed within the lots, separate measures need to be adopted to manage runoff from the roadways. The roadways comprise the road carriageway (impervious surface) and the verge areas which are mainly pervious (grassed or landscaped) and partly impervious (footpaths and driveways). It is the runoff from these impervious areas that requires control.

Permeable pavements, which are an alternative to typical impermeable pavements, allow runoff to percolate through the pavement to an underlying granular sub-base reservoir for temporary storage until water either infiltrates into the ground (unlikely for clay soils) or discharges to a stormwater outlet.

Benefits include:

- Removing sediments and attached pollutants by infiltration through an underlying sand/gravel media layer.
- Reducing runoff volumes by infiltration to the subsoils (not possible in clay soils).
- Delaying runoff peaks by providing retention/detention storage capacity and reducing flow velocities.
- Commercially available permeable pavements include pervious/open-graded asphalt, no fines concrete, modular concrete blocks and modular flexible block pavements.

The two main functional types of permeable pavements are:

- Infiltration (or retention) systems – temporarily holding surface water for a sufficient period to allow percolation into the underlying soils.
- Detention systems – temporarily holding surface water for short periods to reduce peak flows and later releasing into the stormwater system.

The parking lanes on the roads could be configured to be constructed of porous pavements, which allows runoff to infiltrate down into the porous bedding layer, leaving sediments at the surface. Stormwater then migrates either into a structural soil layer where street trees are provided or into the underground piped storm water system.

Infiltration of storm water into the structural soil layer will sustain the street trees, which enhance the streetscape.

Depending on the soil conditions, if infiltration is possible, the groundwater table will be replenished.

9.4 WSUD CONCLUSION

It is considered that various WSUD methods exist that could be proposed rezoning and urban development of the site can incorporate the principles and measures to:

- Control the rate of runoff from the development into downstream watercourses;
- Enhance the quality of runoff discharging from the site so that it does not adversely affect downstream receiving waters; and
- Facilitate more sustainable measures for the reuse and recycling of stormwater.

Peter Sullivan & Associates Pty Ltd

October 2006

APPENDIX 1

STORAGE VOLUMES OF ROOF WATER TANKS

This Appendix provides a summary of the likely impact of roof water tanks for detention control. This assessment assumes that only the detention storage (the upper half of a 10 kilolitre tank) is available at the start of the storm.

The assessment is based on a roof area of 250 square metres and 100% capture by the tank system, and summarises the volumes of runoff draining to the tanks in various storm events.

1 in 100 year ARI storm event

Duration	Rainfall Intensity	Total Rain	Volume of runoff
Minutes	Mm/hr	Mm	Cubic metres
5	201.7	16.8	4.2
10	150.8	25.1	6.3
15	123.9	31.0	7.7
20	108.6	35.5	8.9
30	84.9	42.5	10.6
60	55.8	55.8	14.0

1 in 10 year ARI storm event

Duration	Rainfall Intensity	Total Rain	Volume of runoff
Minutes	Mm/hr	Mm	Cubic metres
5	132.5	11.0	2.8
10	100.0	16.7	4.2
15	82.6	20.7	5.2
20	71.4	23.8	5.95
30	57.3	28.7	7.2
60	38.1	38.1	9.5

1 in 5 year ARI storm event

Duration	Rainfall Intensity	Total Rain	Volume of runoff
Minutes	Mm/hr	Mm	Cubic metres
5	116.9	9.7	2.4
10	88.5	14.8	3.7
15	73.4	18.35	4.6
20	63.5	21.2	5.3
30	51.1	25.6	6.4
60	34.2	34.2	8.6

The roof water tanks are most effective in catering for runoff for shorter duration lower recurrence interval storms.

APPENDIX 2

RAFTS MODELLING FOR ROOF WATER TANKS

While the catchment modelling for the developed catchment with on site detention controls uses a % impervious (where a value of 50% was adopted), the RAFTS water tank control module requires a more detailed input.

The input parameters used were determined as follows:

Lot density = 12 lots per hectare

This assumed:

2 lots @ 30m deep x 20m wide = fronting a road	1200 sq m
20m wide x 20m frontage =	400 sq m

i.e. 1600 sq metres for 2 lots or 800 sq metres per lot.

Within each lot the following break-up of pervious and impervious areas was adopted:

House roof	250 sq m
Driveway & paths	150 sq m
Total impervious	400 sq m
Pervious	200 sq m
Total Lot area	600 sq m

APPENDIX 3

DETENTION BASIN PARAMETERS

Listed below are the general parameters for the detention basins considered in the catchment modelling.

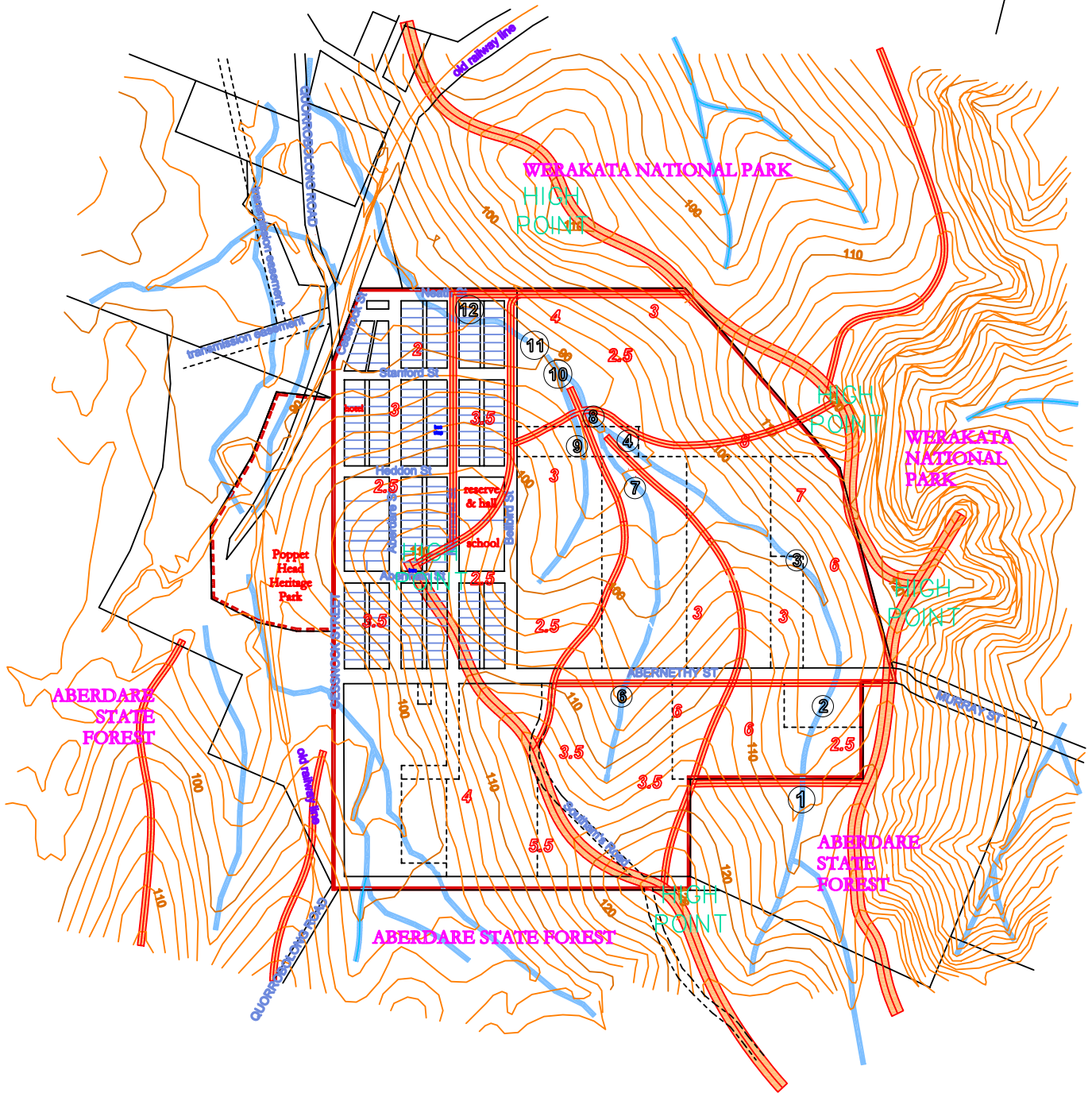
These parameters are indicative only to confirm that a system of basins can be implemented to provide adequate control to stormflows from the site.




BASIN	MAXIMUM VOLUME cubic metres	MAXIMUM DEPTH metres	OUTLET	ESTIMATED AREA sq metres
NODE 3	7000	2.5 1.5	3 x 600	7500 12500
NODE 4	14000	2.5 1.5	2 x 900	15000 25000
NODE 6	14000	2.5 1.5	2 x 900	15000 25000
NODE 7	14000	2.5 1.5	3 x 900	15000 25000
NODE 9	14000	2.5 1.5	2 x 750	15000 25000
NODE 11	28000	2.5 1.5	3 x 1200	35000 45000

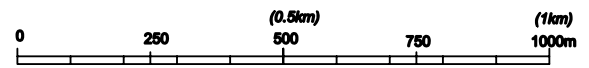
APPENDIX 4

CATCHMENT FLOWS

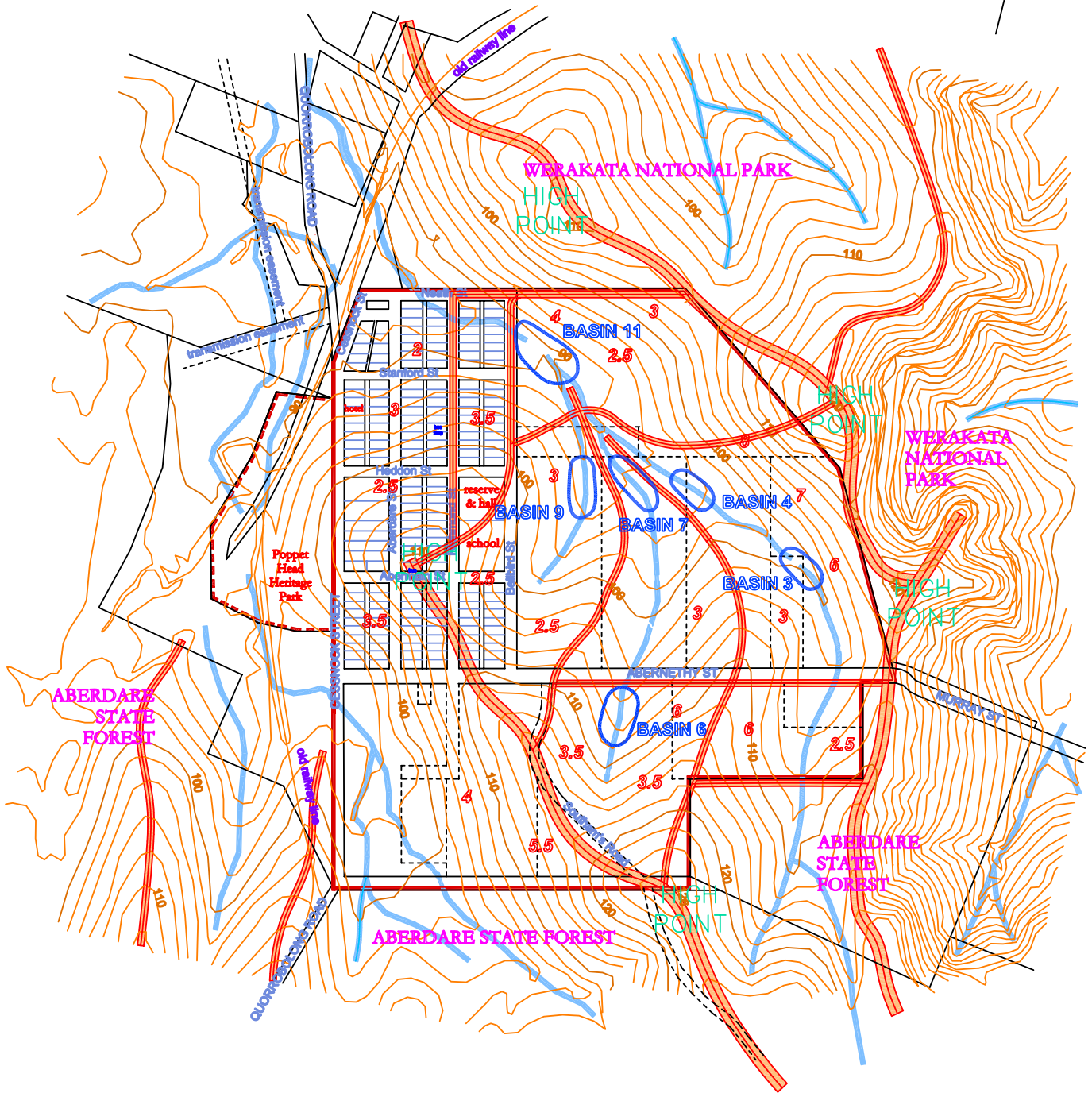
NODE	CATCHMENT CONDITIONS	STORM DURATION minutes - 100 YEAR ARI					
		60	90	120	270	540	720
1	EXISTING	0.69	0.94	1.12	1.48	1.81	1.63
2	EXISTING	0.81	1.09	1.30	1.75	2.15	1.97
	DEVELOPED	3.08	3.38	3.17	1.89	2.38	2.36
	DEV, RWT	2.06	2.24	2.42	1.85	2.39	2.36
	DEV, RWT,DTN BASINS	2.06	2.24	2.42	1.85	2.39	2.36
4	EXISTING	1.13	1.53	1.85	2.58	3.22	3.09
	DEVELOPED	10.96	11.69	11.30	6.74	5.34	5.53
	DEV, RWT	7.03	7.12	7.63	5.90	5.24	5.45
	DEV, RWT,DTN BASINS	3.30	3.30	3.50	3.45	3.80	3.60
6	EXISTING	0.69	0.92	1.04	1.15	1.32	1.16
	DEVELOPED	7.25	7.78	7.62	3.69	2.40	2.43
	DEV, RWT	5.87	6.16	5.94	3.64	2.39	2.42
	DEV, RWT,DTN BASINS	2.12	2.18	2.35	2.20	1.75	1.85
7	EXISTING	0.92	1.22	1.42	1.67	1.99	1.70
	DEVELOPED	11.15	11.75	12.13	6.49	4.22	4.27
	DEV, RWT	9.19	9.58	9.70	6.13	4.20	4.26
	DEV, RWT,DTN BASINS	3.20	3.25	3.40	3.40	3.02	3.02
9	EXISTING	2.59	2.71	2.88	2.86	2.37	2.44
	DEVELOPED	8.96	9.63	9.39	4.57	2.97	3.01
	DEV, RWT	6.15	6.78	6.82	4.33	2.96	3.01
	DEV, RWT,DTN BASINS	2.17	2.20	2.30	2.25	2.10	2.08
10	EXISTING	4.14	4.51	4.78	4.95	6.72	6.06
	DEVELOPED	30.01	32.08	31.17	17.77	12.52	12.80
	DEV, RWT	20.93	22.15	23.57	15.89	12.39	12.72
	DEV, RWT,DTN BASINS	8.60	8.84	9.19	9.15	8.93	8.72
11	EXISTING	4.67	5.07	5.40	5.97	7.93	7.16
	DEVELOPED	37.70	40.34	39.04	22.08	15.33	15.65
	DEV, RWT	24.20	25.95	27.66	19.19	14.99	15.43
	DEV, RWT,DTN BASINS	8.00	8.60	9.00	8.80	9.80	9.00
14	EXISTING	2.32	2.43	2.34	1.41	0.92	0.94
	DEVELOPED	2.79	3.00	2.92	1.43	0.93	0.94
	DEV, RWT	2.79	3.00	2.92	1.43	0.93	0.94
	DEV, RWT,DTN BASINS	2.79	3.00	2.92	1.43	0.93	0.94
12	EXISTING	4.90	5.47	5.84	6.22	8.35	7.49
	DEVELOPED	39.49	41.93	41.16	23.33	16.21	16.55
	DEV, RWT	25.38	26.75	28.74	20.70	15.78	16.24
	DEV, RWT,DTN BASINS	8.03	8.94	9.55	9.46	10.12	9.25






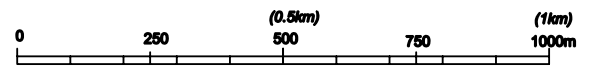
-  creeks/gullies
-  ridgelines
-  spurlines



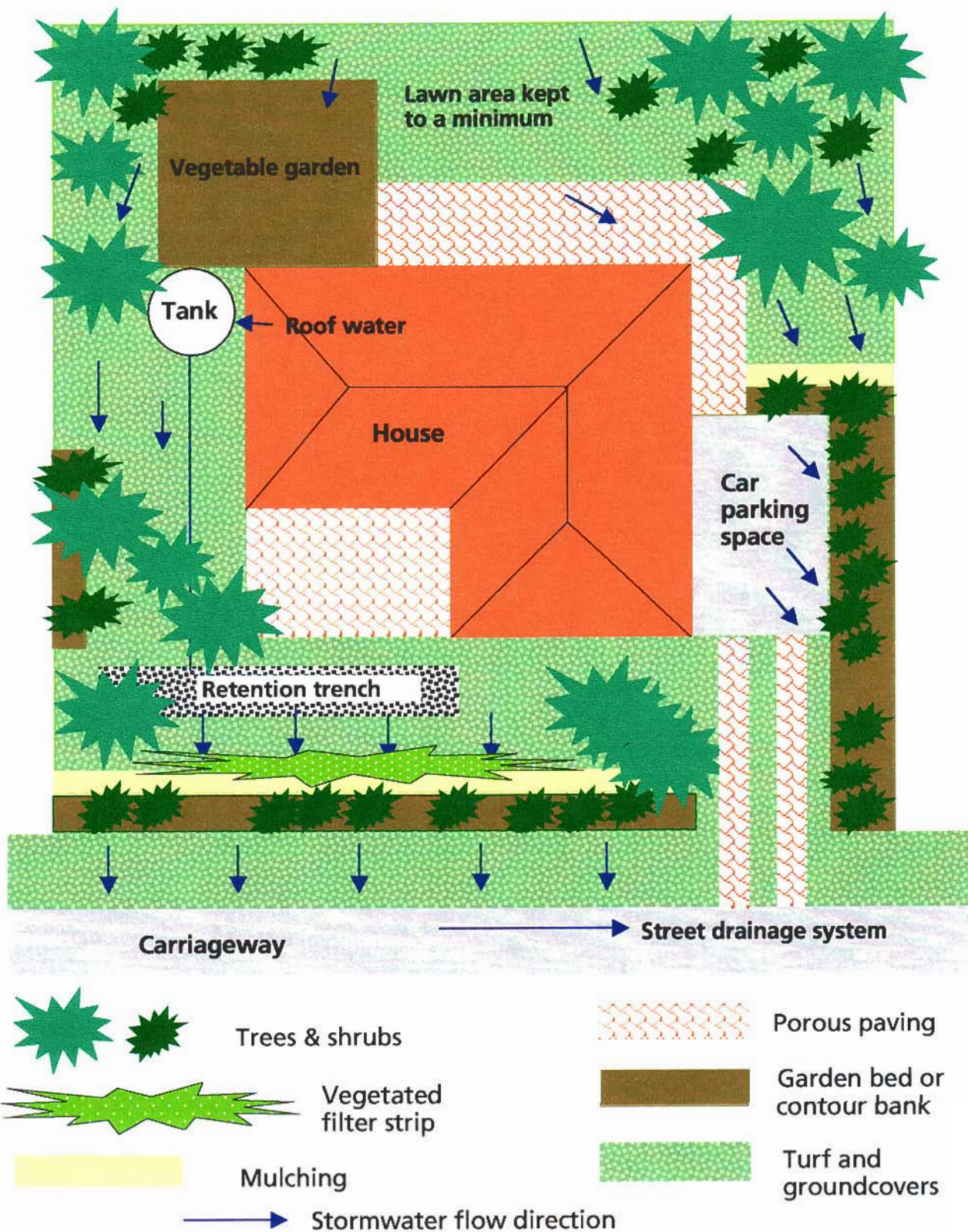
**KITCHENER LEP
STORMWATER CATCHMENT PLAN
FIGURE 1**



-  creeks/gullies
-  ridgelines
-  spurlines



**KITCHENER LEP
PROPOSED DETENTION BASIN LOCATIONS
FIGURE 2**



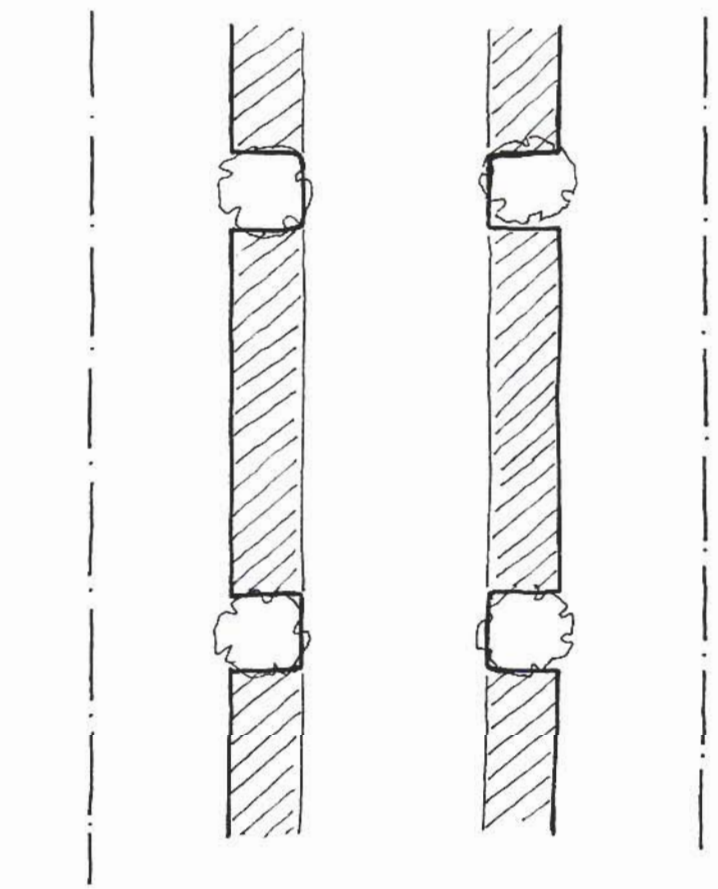
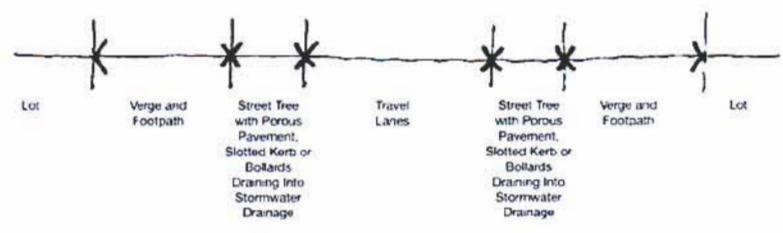
TYPICAL LOT TREATMENT

SOURCE:
 WATER SMART PRACTICE NOTES
 LOWER HUNTER & CENTRAL COAST REGIONAL
 ENVIRONMENTAL MANAGEMENT STRATEGY

FIGURE 4



SECTION



PLAN

PROPOSED ROAD TREATMENT

WITH CAR PARKING POROUS PAVING
& STREET TREES

SOURCE:
WATER SENSITIVE URBAN DESIGN TECHNICAL GUIDELINES
FOR WESTERN SYDNEY
UPPER PARRAMATTA RIVER CATCHMENT TRUST

FIGURE 5