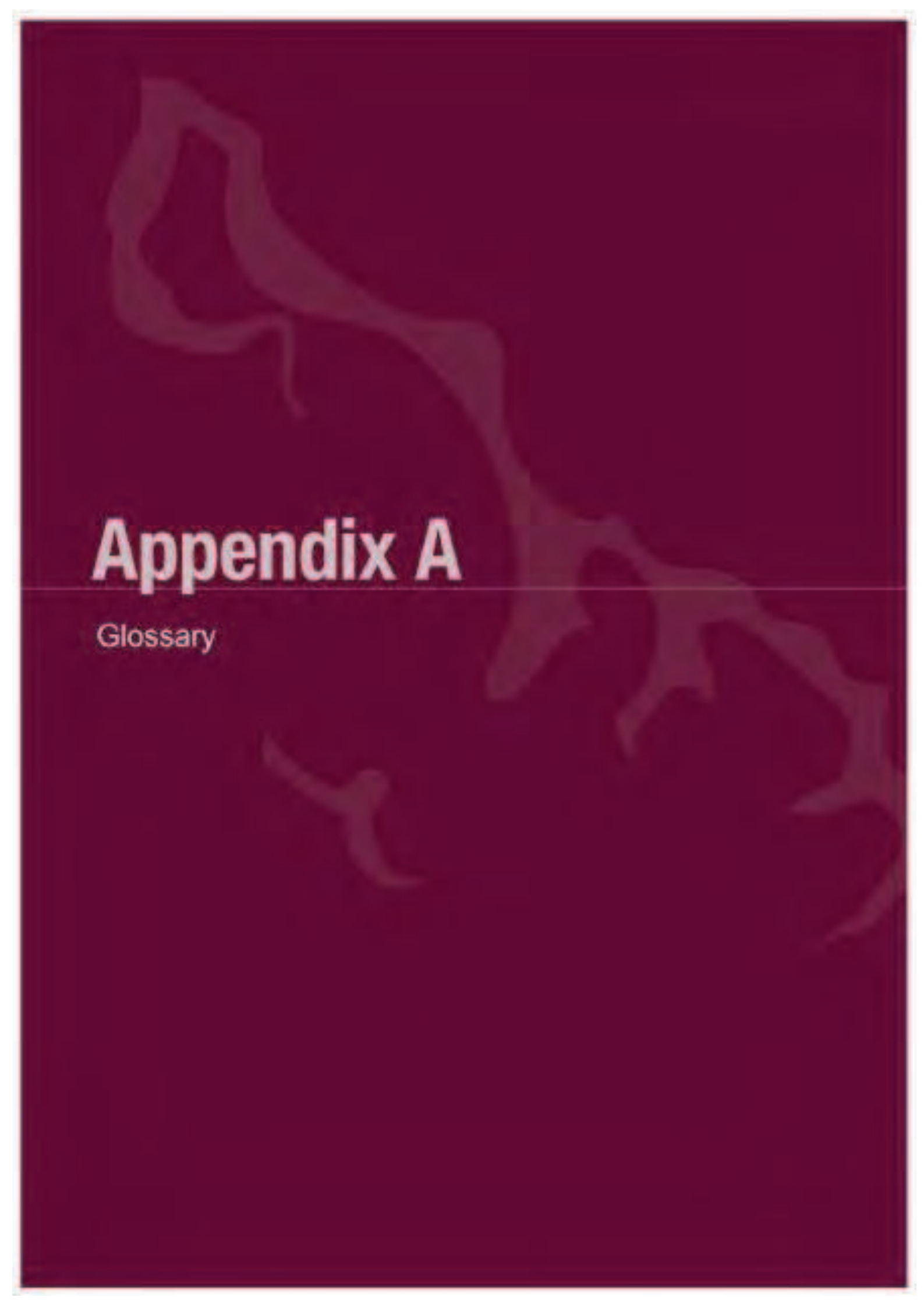




# Appendix A

Glossary

## APPENDIX A: Glossary

Note: definitions for terms are also included in the Dictionary contained within the SEPP.

**“Abutting Dwelling”** is a building containing one dwelling, on a single block of land, that is designed and constructed on a zero lot line immediately adjacent to another dwelling on a different lot that is also built to the zero lot line and is structurally independent of any other dwelling. See Figure 1.

**“Articulation Zone”** is the area that provides relief from blank facades and can include verandahs, porches, awnings, shading devices, bay windows, pergolas and the like. A carport is not considered part of the articulation zone.

**“Building footprint”** means the area of land measured at finished ground level that is enclosed by the external walls of a building.

**“Detached Dwelling”** is a building containing one dwelling, on a single block of land, that is not attached to any other dwelling. See Figure 1.

**“Gross floor area”** means the sum of the floor area of each storey of a building measured from the internal face of external walls, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes:

- a. the area of a mezzanine within the storey, and
- b. habitable rooms in a basement, and
- c. any shop, auditorium, cinema, and the like, in a basement or attic, but excludes:
- d. any area for common vertical circulation, such as lifts and stairs, and
- e. any basement:
  - storage, and
  - vehicular access, loading areas, garbage and services, and
- f. plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
- g. car parking to meet any requirements of the consent authority (including access to that car parking), and
- h. any space used for the loading or unloading of goods (including access to it), and
- i. terraces and balconies with outer walls less than 1.4 metres high, and
- j. voids above a floor at the level of a storey or storey above.

**“Flood Planning Levels (FPLs)”** are the combinations of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans. Flood planning area is the area of land below the FPL and thus subject to flood related development controls. The concept of flood planning area generally supersedes the ‘flood liable land’ concept in the 1986 Manual. Flood Prone Land is land susceptible to flooding by the PMF event. Flood Prone Land is synonymous with flood liable land.

**“Manor House”** means a means a 2-storey building containing 4 dwellings, where:

- (a) each storey contains 2 dwellings, and
  - (b) each dwelling is on its own lot (being a lot within a lot within a strata scheme or community title scheme), and
  - (c) access to each dwelling is provided through a common or individual entry at ground level,
- but does not include a residential flat building or multi-dwelling housing.

**“Principal dwelling”** means the largest dwelling house on a lot, measured by gross floor area.

**“Principal private open space”** means the portion of private open space which is conveniently accessible from a living zone of the dwelling, and which receives the required amount of solar access.

**“Private open space”** means the portion of private land which serves as an extension of the dwelling to provide space for relaxation, dining, entertainment and recreation. It includes an outdoor room.

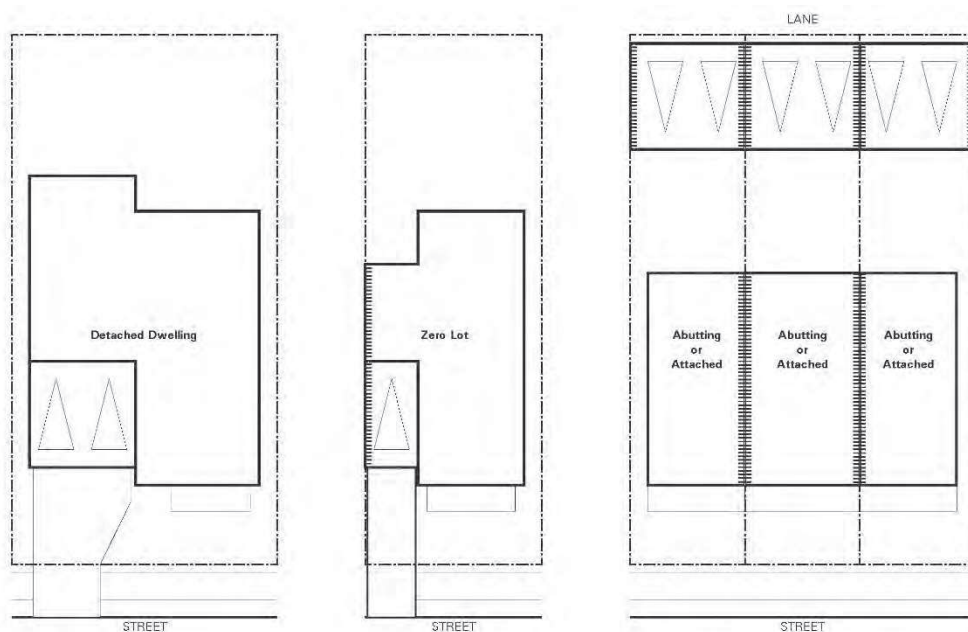
**“Residential net developable area”** means the land occupied by development, including internal streets plus half the width of any adjoining access roads that provide vehicular access, but excluding public open space and other non residential land.

**“Studio Dwelling”** means a dwelling that:

- (a) Is established in conjunction with another dwelling (the *principal dwelling*), and
- (b) Is on its own lot of land, and
- (c) Is erected above a garage that is on the same lot of land as the principal dwelling, whether the garage is attached to, or separate from, the principle dwelling.

but does not include a demi-detached dwelling.

**“Zero lot line dwelling”** is a building containing one dwelling, on a single block of land, that is constructed with an exterior wall on one of its side boundaries but is not attached or abutting to any other dwelling. See **Figure 1**.



**Figure1:** Detached, zero lot line, abutting and attached dwellings

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# Appendix B

List of Preferred Planting Species

The map displays the Annangrove Precinct, outlined in red. A central area is highlighted in green, representing the Non-Indigenous Zone. This zone includes several streets, notably Bruce Rd, White Gum Rd, and a large section of the main thoroughfare running through the center. Surrounding areas include Rouse Hill to the west and Kellyville to the south. Major roads like Annangrove Road, Colgran Avenue, and Curtis Road are clearly marked. A legend in the top right corner identifies the red outline as the 'Precinct boundary' and the green fill as the 'Non-Indigenous Zone'. A scale bar at the bottom left indicates distances up to 500m, and a north arrow is located in the bottom left corner.

## Legend

\* Tree species suitable for streets with no footpaths

\*\* Tree Species suitable for streets with footpaths

| Indigenous Species Suitable for Planting in The Hills Shire |                        |                 |                  |                 |                           |                   |
|-------------------------------------------------------------|------------------------|-----------------|------------------|-----------------|---------------------------|-------------------|
| Botanical Name                                              | Common Name            | Plant Community |                  |                 |                           |                   |
|                                                             |                        | Bird Attracting | Shale Cap Forest | Sandstone Soils | Cumberland Plain Woodland | Transition Forest |
| <i>Allocasuarina littoralis</i>                             | Black She-oak          |                 |                  | ■               | ■                         | ■                 |
| <i>Allocasuarina torulosa</i>                               | Forest Oak             |                 | ■                | ■               |                           | ■                 |
| * <i>Angophora costata</i>                                  | Smooth-barked Apple    | ■               | ■                | ■               |                           | ■                 |
| * <i>Angophora floribunda</i>                               | Rough barked Apple     | ■               | ■                | ■               |                           | ■                 |
| <i>Banksia serrata</i>                                      | Old Man Banksia        | ■               |                  | ■               |                           |                   |
| ** <i>Backhousia citriodora</i>                             | Lemon Scented Myrtle   | ■               |                  |                 |                           |                   |
| ** <i>Buckinghamia celcissima</i>                           | Ivory Curl             | ■               |                  |                 |                           |                   |
| <i>Casuarina cunninghamiana</i>                             | River She-oak          |                 |                  |                 | ■                         |                   |
| <i>Casuarina glauca</i>                                     | Swamp She-oak          |                 |                  | ■               | ■                         |                   |
| <i>Ceratopetalum gummiferum</i>                             | NSW Christmas Bush     | ■               |                  | ■               |                           |                   |
| * <i>Corymbia gummerifera</i>                               | Red Bloodwood          | ■               |                  | ■               |                           |                   |
| * <i>Corymbia maculata</i>                                  | Spotted Gum            |                 |                  |                 |                           | ■                 |
| ** <i>Cupaniopsis anacardioides</i>                         | Tuckeroo               |                 |                  |                 |                           |                   |
| ** <i>Elaeocarpus eumundii</i>                              | Smooth Leaved Quandong | ■               |                  |                 |                           |                   |
| ** <i>Elaeocarpus reticulatus</i>                           | Blue Berry Ash         | ■               | ■                |                 |                           |                   |
| * <i>Eucalyptus crebra</i>                                  | Narrow Leaved Ironbark | ■               |                  |                 | ■                         | ■                 |

# Indigenous Species Suitable for Planting in The Hills Shire

| Botanical Name           | Common Name                | Plant Community |                  |                 |                           |                   |
|--------------------------|----------------------------|-----------------|------------------|-----------------|---------------------------|-------------------|
|                          |                            | Bird Attracting | Shale Cap Forest | Sandstone Soils | Cumberland Plain Woodland | Transition Forest |
| *Eucalyptus fibrosa      | Broad Leaved Ironbark      | ■               |                  |                 | ■                         | ■                 |
| *Eucalyptus gummifera    | Red Blood Wood             | ■               |                  | ■               |                           |                   |
| *Eucalyptus haemastoma   | Scribbly Gum               | ■               |                  | ■               |                           |                   |
| *Eucalyptus moluccana    | Grey Box                   | ■               |                  |                 | ■                         | ■                 |
| *Eucalyptus paniculata   | Grey Ironbark              | ■               | ■                | ■               |                           | ■                 |
| *Eucalyptus pilularis    | Blackbutt                  | ■               | ■                | ■               |                           |                   |
| *Eucalyptus punctata     | Grey Gum                   | ■               |                  | ■               |                           | ■                 |
| *Eucalyptus robusta      | Swamp Mahogany             | ■               |                  | ■               |                           |                   |
| *Eucalyptus saligna      | Sydney Blue Gum            | ■               | ■                | ■               |                           |                   |
| *Eucalyptus sideroxylon  | Red Ironbark               | ■               |                  |                 |                           |                   |
| *Eucalyptus tereticornis | Forest Red Gum             | ■               |                  |                 | ■                         | ■                 |
| Harpullia pendula        | Tulipwood                  | ■               |                  |                 |                           |                   |
| **Hymenosporum flavum    | Native Frangipani          | ■               |                  |                 |                           |                   |
| *Melaleuca decora        | White Feather Honey myrtle | ■               |                  |                 | ■                         |                   |
| Lophostemon confertus    | Brush Box                  | ■               |                  |                 |                           |                   |
| **Podocarpus elatus      | Plum Pine                  | ■               |                  |                 |                           |                   |
| *Syncarpia glomulifera   | Turpentine                 | ■               | ■                | ■               |                           | ■                 |

# Indigenous Species Suitable for Planting in The Hills Shire

|                                  |                           | Plant Community |                  |                 |                           |                   |
|----------------------------------|---------------------------|-----------------|------------------|-----------------|---------------------------|-------------------|
| Botanical Name                   | Common Name               | Bird Attracting | Shale Cap Forest | Sandstone Soils | Cumberland Plain Woodland | Transition Forest |
| ** <i>Stenocarpus sinuatus</i>   | Fire Wheel Tree           | ■               |                  |                 |                           |                   |
| * <i>Syzygium leuhmannii</i>     | Small Leaved Lilly Pilly  | ■               |                  |                 |                           |                   |
| ** <i>Tristaniaopsis laurina</i> | Water Gum                 | ■               |                  | ■               |                           |                   |
| ** <i>Waterhousia floribunda</i> | Weeping Lilly Pilly       | ■               |                  |                 |                           |                   |
| <b>Shrubs</b>                    |                           |                 |                  |                 |                           |                   |
| <i>Acacia binervia</i>           | Coast Myall               |                 |                  | ■               |                           |                   |
| <i>Acacia decurrens</i>          | Sydney Green Wattle       |                 |                  |                 | ■                         | ■                 |
| <i>Acacia elata</i>              | Mountain Cedar Wattle     |                 |                  | ■               |                           |                   |
| <i>Acacia floribunda</i>         | White Sallow Wattle       |                 |                  | ■               | ■                         |                   |
| <i>Acacia implexa</i>            | Hickory                   |                 | ■                | ■               | ■                         | ■                 |
| <i>Acacia longifolia</i>         | Sydney Golden Wattle      |                 |                  | ■               |                           |                   |
| <i>Acacia parramattensis</i>     | Parramatta Green Wattle   |                 |                  | ■               | ■                         | ■                 |
| <i>Banksia spinulosa</i>         | Hair-pin Banksia          | ■               |                  | ■               |                           | ■                 |
| * <i>Callicoma serratifolia</i>  | Black Wattle              |                 |                  | ■               |                           |                   |
| <i>Callistemon citrinus</i>      | Crimson Bottlebrush       | ■               |                  | ■               |                           |                   |
| <i>Callistemon lineraris</i>     | Narrow Leafed Bottlebrush | ■               |                  | ■               | ■                         |                   |
| <i>Callistemon pinifolius</i>    | Bottlebrush               | ■               |                  | ■               |                           |                   |
| <i>Callistemon salignus</i>      | Willow Bottlebrush        | ■               |                  | ■               |                           |                   |
| <i>Davesia ulicifolia</i>        | Gorse Bitter Pea          |                 |                  | ■               |                           | ■                 |
| <i>Dodonea triquetra</i>         | Common Hop Bush           |                 |                  | ■               | ■                         |                   |

# Indigenous Species Suitable for Planting in The Hills Shire

| Botanical Name                     | Common Name              | Plant Community |                  |                 |                           |                   |
|------------------------------------|--------------------------|-----------------|------------------|-----------------|---------------------------|-------------------|
|                                    |                          | Bird Attracting | Shale Cap Forest | Sandstone Soils | Cumberland Plain Woodland | Transition Forest |
| <i>Dodonea viscosa</i>             | Hop Bush                 |                 |                  |                 | ■                         |                   |
| <i>Gravillea mucronulata</i>       | Green Spider Flower      | ■               |                  | ■               |                           |                   |
| <i>Grevillea linearifolia</i>      | White Spider Flower      | ■               |                  | ■               |                           |                   |
| <i>Hakea salicifolia</i>           | Willow Leaved Hakea      | ■               |                  | ■               |                           |                   |
| <i>Hakea sericea</i>               | Bushy Needlebush         | ■               |                  | ■               | ■                         | ■                 |
| <i>Hibbertia diffusa</i>           | Guinea Flower            |                 |                  |                 | ■                         |                   |
| <i>Indigofera australis</i>        | Indigofera               |                 | ■                | ■               | ■                         | ■                 |
| <i>Kunzea ambigua</i>              | Tick Bush                | ■               |                  | ■               |                           | ■                 |
| <i>Leptospermum polygalifolium</i> | Lemon Scented Tea-tree   | ■               |                  | ■               | ■                         |                   |
| <i>Leucopogon juniperus</i>        | Bearded Heath            |                 | ■                |                 |                           | ■                 |
| <i>Lomandra longifolia</i>         | Spiny-head Mat-rush      |                 | ■                | ■               | ■                         | ■                 |
| <i>Melaleuca bracteata</i>         | Black Tea Tree           |                 |                  |                 |                           |                   |
| <i>Melaleuca linearifolia</i>      | Snow-in-Summer           | ■               |                  | ■               | ■                         |                   |
| <i>Melaleuca nodosa</i>            | Ball Honey Myrtle        | ■               |                  | ■               | ■                         |                   |
| <i>Melaleuca styphellioides</i>    | Prickly Leaved Paperbark | ■               |                  | ■               | ■                         |                   |
| <i>Melaleuca thymifolia</i>        | Thyme-leaf Honey-myrtle  | ■               |                  | ■               | ■                         |                   |
| <i>Oxylobium ilicifolium</i>       | Native Holly             |                 |                  | ■               |                           |                   |
| <i>Pimelia linifolia</i>           | Rice Flower              |                 |                  | ■               |                           | ■                 |
| <i>Pittosporum revolutum</i>       | Sweet Pittosporum        | ■               |                  | ■               |                           |                   |
| <i>Polyscias sambucifolia</i>      | Elderberry Panax         | ■               |                  | ■               |                           |                   |

# Indigenous Species Suitable for Planting in The Hills Shire

| Botanical Name               | Common Name           | Plant Community |                  |                 |                           |                   |
|------------------------------|-----------------------|-----------------|------------------|-----------------|---------------------------|-------------------|
|                              |                       | Bird Attracting | Shale Cap Forest | Sandstone Soils | Cumberland Plain Woodland | Transition Forest |
| <i>Pultanea villosa</i>      | Bush Pea              |                 |                  |                 | ■                         | ■                 |
| <b>Groundcovers</b>          |                       |                 |                  |                 |                           |                   |
| <i>Adiantum aethiopicum</i>  | Maidenhair Fern       |                 | ■                | ■               |                           |                   |
| <i>Danthonia sp.</i>         | Wallaby Grass         |                 |                  | ■               | ■                         | ■                 |
| <i>Dianella caerulea</i>     | Blue Flax Lily        | ■               |                  | ■               | ■                         | ■                 |
| <i>Dianella revoluta</i>     | Mauve Flax Lily       | ■               |                  | ■               | ■                         |                   |
| <i>Dichelachne crinita</i>   | Longhair Plume Grass  |                 |                  | ■               | ■                         |                   |
| <i>Dichelachne micrantha</i> | Shorthair Plume Grass |                 |                  | ■               | ■                         |                   |
| <i>Gahnia aspera</i>         | Saw-sedge             | ■               |                  | ■               |                           |                   |
| <i>Gahnia clarkei</i>        | Tall Saw-sedge        | ■               |                  | ■               |                           |                   |
| <i>Gahnia melanocarpa</i>    | Black Fruit Saw-sedge | ■               |                  | ■               |                           |                   |
| <i>Gahnia seiberana</i>      | Saw-sedge             | ■               |                  | ■               | ■                         |                   |
| <i>Geranium solanderi</i>    | Native Geranium       |                 |                  | ■               | ■                         |                   |
| <i>Lepidosperma laterale</i> | Variable Sword Sedge  |                 |                  | ■               |                           |                   |
| <i>Microlaena stiptoides</i> | Weeping Grass Meadow  |                 | ■                | ■               | ■                         | ■                 |
| <i>Poa</i>                   | Tussock Grass         |                 | ■                | ■               |                           |                   |
| <i>Pratia purpurascens</i>   | White Root            |                 |                  | ■               | ■                         |                   |
| <i>Stipa sp.</i>             | Speargrass            |                 |                  | ■               | ■                         |                   |
| <i>Themeda australis</i>     | Kangaroo Grass        |                 | ■                | ■               | ■                         | ■                 |
| <i>Viola sp.</i>             | Native Violet         |                 |                  | ■               | ■                         |                   |
| <i>Wahlenbergia communis</i> | Native Bluebell       |                 |                  | ■               | ■                         |                   |
| <b>Climbers</b>              |                       |                 |                  |                 |                           |                   |

### Indigenous Species Suitable for Planting in The Hills Shire

| Botanical Name               | Common Name          | Plant Community |                  |                 |                           |                   |
|------------------------------|----------------------|-----------------|------------------|-----------------|---------------------------|-------------------|
|                              |                      | Bird Attracting | Shale Cap Forest | Sandstone Soils | Cumberland Plain Woodland | Transition Forest |
| <i>Clematis aristata</i>     | Toothed Clematis     |                 | ■                | ■               | ■                         |                   |
| <i>Clematis glycinoides</i>  | Old Mans Beard       |                 |                  | ■               | ■                         |                   |
| <i>Glycine clandestina</i>   | Love Creeper         |                 | ■                |                 |                           | ■                 |
| <i>Hardenbergia violacea</i> | False Sarsaparilla   |                 | ■                | ■               | ■                         | ■                 |
| <i>Hibbertia scandens</i>    | Golden Guinea Flower |                 | ■                |                 |                           |                   |
| <i>Kennedia rubicunda</i>    | Dusky Coral pea      |                 |                  | ■               | ■                         |                   |
| <i>Pandorea pandorana</i>    | Wonga Wonga Vine     |                 | ■                | ■               |                           |                   |

### Non-Indigenous Species Suitable for Planting in The Hills Shire

| Botanical Name                      | Common Name          |
|-------------------------------------|----------------------|
| <b>Trees</b>                        |                      |
| * <i>Agonis flexuosa</i>            | Willow Myrtle        |
| ** <i>Banksia integrifolia</i>      | Coastal Banksia      |
| ** <i>Bauhinia purpurea</i>         | Butterfly Tree       |
| * <i>Brachychiton populneus</i>     | Kurrajong            |
| ** <i>Callistemon viminalis</i>     | Weeping Bottlebrush  |
| ** <i>Callitris columellaris</i>    | White Cypress Pine   |
| ** <i>Callitris rhomboidea</i>      | Port Jackson Cypress |
| ** <i>Calodendron capense</i>       | Cape Chestnut        |
| <i>Casuarina littoralis</i>         | Black She-Oak        |
| ** <i>Celtis australis</i>          | Nettle Wood          |
| <i>Eucalyptus cladocalyx</i> 'Nana' | Dwarf Sugar Gum      |
| * <i>Eucalyptus elata</i>           | Willow Peppermint    |

| Non-Indigenous Species Suitable for Planting in The Hills Shire |                        |
|-----------------------------------------------------------------|------------------------|
| Botanical Name                                                  | Common Name            |
| *Eucalyptus eximia                                              | Yellow Bloodwood       |
| Eucalyptus ficifolia                                            | Scarlet-flowering gum  |
| *Eucalyptus leucoxylon                                          | White Ironbark         |
| *Eucalyptus melliodora                                          | Yellow Box             |
| *Fraxinus Americana                                             | White Ash              |
| *Fraxinus excelsior 'Aurea'                                     | Golden Ash             |
| *Fraxinus 'Raywoodii'                                           | Claret Ash             |
| **Jacaranda mimosifolia                                         | Jacaranda              |
| **Lagerstroemia indica var. Indian Summer                       | Crepe Myrtle           |
| **Leptospermum petersonii                                       | Lemon-scented Tea Tree |
| *Magnolia grandiflora                                           | White Magnolia         |
| **Melaleuca liniifolia                                          | Flax-leaf Paper Bark   |
| Melaleuca stypheloides                                          | Prickly Paper Bark     |
| *Nyssa sylvatica                                                | Tupelo                 |
| **Pyrus calleryana                                              | Ornamental Pear        |
| **Pistachia chinensis                                           | Chinese Pistache       |
| *Quercus coccinea                                               | Scarlet Oak            |
| *Quercus ilex                                                   | Holly Oak              |
| *Quercus palustris                                              | Pin Oak                |
| *Schinus molle var ariera                                       | Peppercorn Tree        |
| *Ulmus parvifolia                                               | Chinese Elm            |
| <b>Shrubs</b>                                                   |                        |
| Abelia grandiflora                                              | Glossy Abelia          |
| Aucuba japonica                                                 | Japanese Laurel        |
| Azalea sp.                                                      | Azalea                 |
| Bauera rubroides                                                | Native Dog Rose        |
| Berberis thunbergii 'Atropurpurea'                              | Japanese Berberis      |
| Boronia floribunda                                              | Pink Boronia           |

| Non-Indigenous Species Suitable for Planting in The Hills Shire |                              |
|-----------------------------------------------------------------|------------------------------|
| Botanical Name                                                  | Common Name                  |
| <i>Brunfelsia latifolia</i>                                     | Yesterday-today-and-tomorrow |
| <i>Callistemon citrinus</i>                                     | Crimson Bottlebrush          |
| <i>Callistemon speciosus</i>                                    | Albany Bottlebrush           |
| <i>Choisya ternata</i>                                          | Mexican Orange Blossom       |
| <i>Coleonema pulchrum</i>                                       | Pink Diosma                  |
| <i>Coprosma repens</i>                                          | Mirror Bush                  |
| <i>Correa alba</i>                                              | White Correa                 |
| <i>Cyathea cooperii</i>                                         | Rough-barked Tree Fern       |
| <i>Daphne odora</i>                                             | Winter Daphne                |
| <i>Epacris longiflora</i>                                       | Fuchsia Heath                |
| <i>Epacris obtusifolia</i>                                      | Bluntleaf Heath              |
| <i>Fraxinus griffithii</i>                                      | Evergreen Ash                |
| <i>Gardenia</i> sp.                                             | Gardenia                     |
| <i>Grevillea</i> hybrids                                        | Grevillea, var               |
| <i>Hebe</i> 'Blue Gem'                                          | Veronica                     |
| <i>Hibiscus rosa-sinensis</i>                                   | Chinese Hibiscus             |
| <i>Hydrangea macrophylla</i>                                    | Hydrangea                    |
| <i>Juniperus chinensis</i> 'Japonica'                           | Chinese Juniper              |
| <i>Juniperus communis</i> 'Hibernica'                           | Irish Juniper                |
| ** <i>Lagerstroemia indica</i>                                  | Crepe Myrtle                 |
| <i>Lambertia formosa</i>                                        | Mountain Devil               |
| <i>Leptospermum scoparium</i>                                   | Manuka                       |
| <i>Leptospermum squarrosus</i>                                  | Peach Flowered Tea Tree      |
| ** <i>Magnolia soulangeana</i>                                  | Japanese Magnolia            |
| ** <i>Melaleuca bracteata</i>                                   | Black Tea Tree               |
| <i>Melaleuca incana</i>                                         | Grey Honey Myrtle            |
| <i>Melaleuca nesophila</i>                                      | Showy Honey Myrtle           |
| ** <i>Michelia figo</i>                                         | Port Wine Magnolia           |

| Non-Indigenous Species Suitable for Planting in The Hills Shire |                     |
|-----------------------------------------------------------------|---------------------|
| Botanical Name                                                  | Common Name         |
| <i>Murraya paniculata</i>                                       | Orange Jasmine      |
| <i>Rhododendron indicum</i>                                     | Rhododendron        |
| <i>Russelia equisetiformis</i>                                  | Coral Bush          |
| <i>Thuja occidentalis</i>                                       | Common Yew          |
| <i>Viburnum tinus</i>                                           | Laurustinus         |
| <i>Westringia fruticosa</i>                                     | Coastal Rosemary    |
| <i>Acacia brownii</i>                                           | Heath Wattle        |
| <i>Coprosma kirkii</i>                                          | Kirk's Coprosma     |
| <i>Grevillea fasciculata</i>                                    | Grevillea, var      |
| <i>Grevillea x gaudichaudi</i>                                  | Prostrate Grevillea |
| <i>Grevillea</i> 'Poorinda Royal Mantle'                        | Grevillea, var      |
| <i>Juniperus conferta</i>                                       | Shore Juniper       |
| <i>Parthenocissus quinquefolia</i>                              | Virginia Creeper    |

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# Appendix C

## Environmental Management Plan

## **APPENDIX C: Environmental Management Plan**



**NORTH KELLYVILLE PRECINCT**

**Environmental Management Plan**

For:

**GROWTH CENTRES COMMISSION**

April 2008

Final Report

**Cumberland Ecology**

PO Box 2474, Carlingford Court 2118

**Report No. 6090RP2**

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology

Approved by: David Robertson

Position: Project Director

Signed: \_\_\_\_\_

Date: 20 April, 2008

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# Introduction

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## 1.1 Purpose

Cumberland Ecology has been engaged by the Growth Centres Commission to prepare an Environmental Management Plan (EMP) for lands identified as Constrained Lands within the North Kellyville State Environmental Planning Policy (Amendment No.X). These areas have previously been identified as being of high conservation value (see below) and provide important habitat and wildlife corridors within the Baulkham Hills Local Government Area (LGA).

This EMP provides a framework for the restoration and maintenance of these areas, which includes the riparian vegetation along Cattai Creek and parts of Smalls Creek, and adjacent vegetation that will be conserved on steep lands. Priority actions to be undertaken in these areas include weed removal and, in some places, revegetation. The Plan is based on a five year management regime but also provides provisions for ongoing long-term maintenance. This EMP is expected to form an appendix within the final Development Control Plan (DCP) for the precinct.

## 1.2 Background

The Growth Centres Commission (GCC) was established in 2005 under the *Growth Centres (Development Corporations) Act 1974*. The Commission's role is to develop land use and infrastructure plans, recommend land release sequencing, and co-ordinate infrastructure delivery and funding within the South West and North West Growth Centres. The North Kellyville Precinct forms part of the North West Growth Centre. It is envisaged that there is potential for between 4,500 and 5,000 dwellings and a future population of between 12,500 and 15,000 people within this precinct. It is also envisaged that one main retail centre will be established and two smaller retail centres as well as one or two primary schools.

The Growth Centres contain a number of areas that have biodiversity values, including endangered vegetation, threatened species habitat and wildlife and riparian corridors. In order to address issues relating to biodiversity, a Conservation Plan was prepared for the Department of Planning (DoP) as the basis for seeking a grant of "Biodiversity Certification" to the Growth Centres SEPP<sup>1</sup>. The Conservation Plan outlined how the

SEPP and an accompanying package of actions will maintain or improve biodiversity values. These include:

- Protection of 967 ha of land containing 643 ha of high quality native vegetation through Environment Conservation and Recreation Zones identified by the SEPP;
- Protection of a further 880 ha of native vegetation through development controls identified by the SEPP and associated Development Code; and
- Implementation of a conservation offsets programme to secure the protection of at least 2,300 ha of priority, high quality vegetation in Western Sydney and the Sydney Basin.

Biodiversity Certification has been granted for the Sydney Region Growth Centres, subject to a number of conditions. These include the protection of “existing native vegetation” identified within the Conservation Plan as occurring within the “Transitional Lands” of North Kellyville and the protection of particular populations of threatened flora species recorded from the precincts.

Biodiversity Certification removes the need to assess impacts on threatened species at the development stage within the precinct. However development within the precinct will still aim to retain as much existing vegetation and habitat as possible, as this will both complement the broader biodiversity outcomes and contribute to local amenity and open space delivery.

As part of the precinct planning process, a Biodiversity Assessment was prepared for the precinct in 2007 by Cumberland Ecology<sup>2</sup>. This report provided a baseline technical study of aquatic and terrestrial flora and fauna habitat within the precinct to contribute towards the production of an Indicative Layout Plan (ILP). This report included a review of the biodiversity values present within the precinct, and provided recommendations regarding management of retained vegetation which enable long term protection and management of high conservation value areas, while facilitating the development outcomes for the precinct.

The ILP has sought to retain existing vegetation and habitat within the precinct and provides for the protection and maintenance of the biodiversity values within the precinct. This has been done by retaining important patches and corridors of vegetation wherever possible and retaining and developing around significant landscape and topographical features.

### 1.3 Description of the Study Area

The North Kellyville Precinct is bounded by Smalls Creek to the west, Cattai Creek to the east and Samantha Riley Drive to the south. Most of the precinct consists of gently undulating land, however slopes greater than 10 degrees are present near drainage lines and near Cattai Creek and Smalls Creek. The precinct comprises 707 ha of

predominantly rural residential land and is divided by few major roads; Foxall Rd and Hezlett Rd, running north to south in the southern part of the precinct and Barry Rd, Hillview Rd and Stringer road running north to south in the northern part of the precinct. Many of the existing residential lots are long and narrow, running from the creeks up to main roads. Typically, the part of the block closest to the road has been cleared for a house and garden, and sometimes for livestock, and usually some vegetation has been retained near the creeks. The condition of this vegetation varies considerably depending on the landowner. Some landowners have under-scrubbed the vegetation significantly so that little remains except for canopy trees, but in other places there is an intact understorey.

Most of the land in the centre of the precinct has been highly modified from its pre-European state. The precinct was originally used mainly for grazing and much of the land has been cleared and existing land uses include large rural residential lots, chicken farms, market gardens and plant nurseries. Most of the flatter, more fertile areas in the precinct have been cleared and remnant vegetation is mostly restricted to steeper or less fertile conditions. Steep slopes are found mostly in the gullies adjacent to Cattai Creek and Smalls Creek, and there is a nearly continuous band of vegetation running north-south along these gullies. Several ephemeral watercourses flow into Cattai Creek and Smalls Creek. The riparian zone is heavily degraded by weeds for most of its extent, however on the slopes above it the vegetation is in relatively good condition with minimal weed invasion. Some stands of remnant vegetation are present within the largely cleared central part of the site. However these are for the most part highly degraded.

## 1.4 Terminology

This report uses the following terminology:

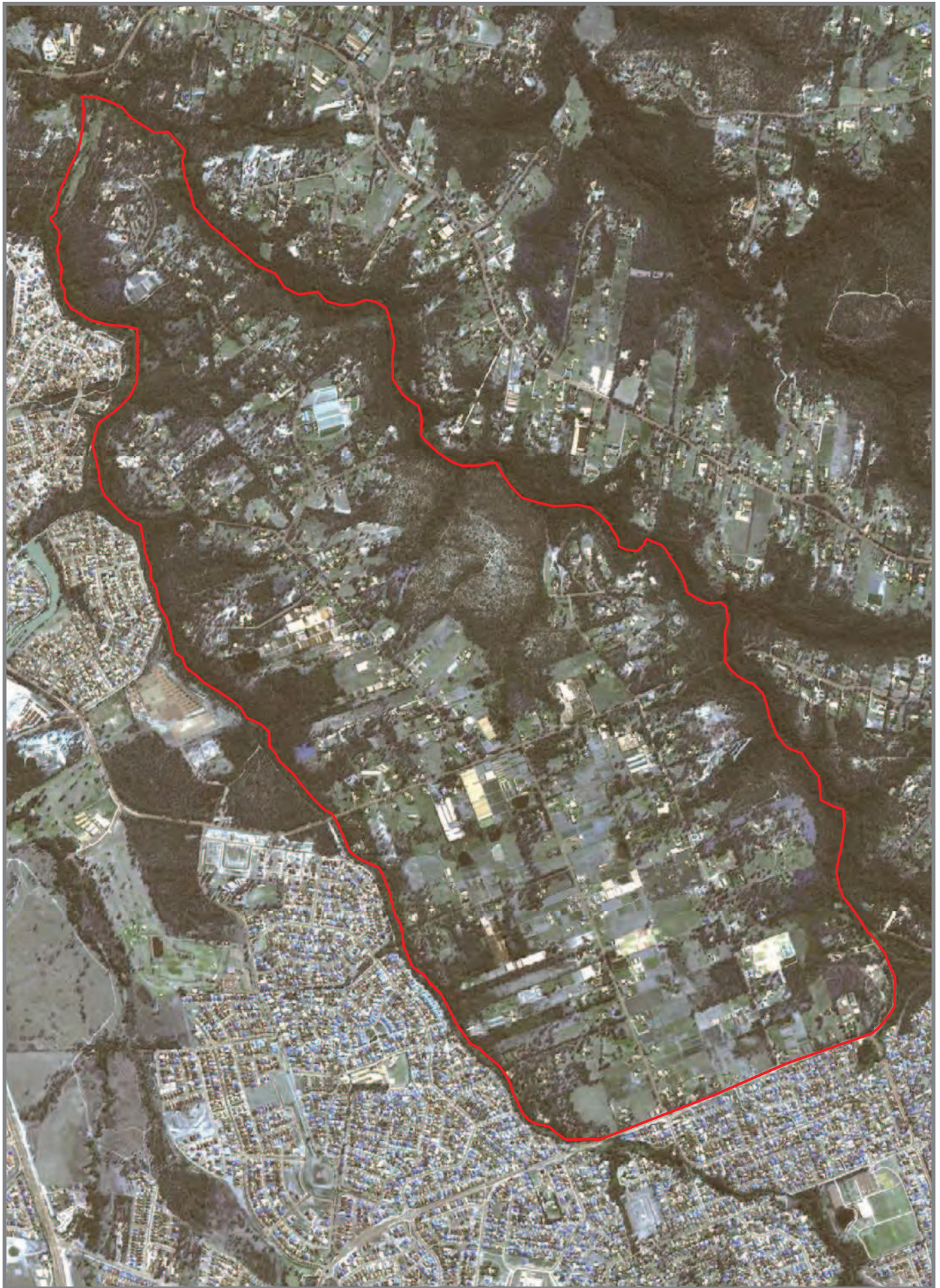
- **The precinct** is the North Kellyville Growth Centres Commission Precinct;
- **The subject site** is the land to which this EMP applies and consists of the Constrained Lands occurring in zones E3 and E4 within the Precinct; and
- **Threatened species, populations or endangered ecological communities** refer to species, populations or ecological communities that are listed as being threatened or endangered in either the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Threatened Species Conservation Act 1995* (TSC Act).

## 1.5 Aims

The aim of this report is to guide the restoration and maintenance of land that occurs on Constrained Land within zones E3 and E4 within the precinct. In general this includes riparian and heavily sloped land that occurs within the precinct boundary along the edge of

Cattai Creek and parts of the riparian and sloped land adjacent to Smalls Creek (refer to the Figures in Section 2). These areas have previously been identified as being of high conservation value and this EMP provides regeneration guidelines that cover the rehabilitation of creek lines, weed removal, native species re-planting and ongoing maintenance.

This plan covers a period of 5 years and includes Key Performance Indicators to enable an assessment to be made at the end of the five years as to whether the conservation and restoration objectives have been met. Recommendations for achieving ongoing maintenance by individual landholders are also made, with suggested provisions for Council regulation.



0 500 1000  
Meters

Figure 1.1

Aerial photograph showing North Kellyville Precinct

## Environmental Values

---

### 2.1 The Subject Site

The subject site to which this EMP refers includes all Constrained Lands located within the E3 and E4 zones within the precinct (refer to Figure 2.1). Primarily, this consists of large tracts of riparian vegetation running along Cattai Creek and parts of Smalls Creek, as well as vegetation that occurs on the associated slopes and gullies adjacent to the creek lines. The subject site also includes part of an extended area of bushland within the Heath Road remnant. An endangered ecological community occurs on the subject site as well as several threatened flora species and habitat for a wide diversity of fauna.

The riparian corridors contain high levels of weed infestation; however they constitute large areas of continuous habitat that form important habitat linkages throughout the precinct and the region. They also contribute significantly to other biodiversity values such as water quality in Cattai Creek and Smalls Creek. The sloped areas outside of the riparian zone are generally in better condition although weed invasion varies significantly across the site, depending on soil type, slope, aspect, etc.

# NORTH KELLYVILLE PRELIMINARY INDICATIVE LAYOUT PLAN DRAFT INDICATIVE LAYOUT PLAN

1 APRIL 2008

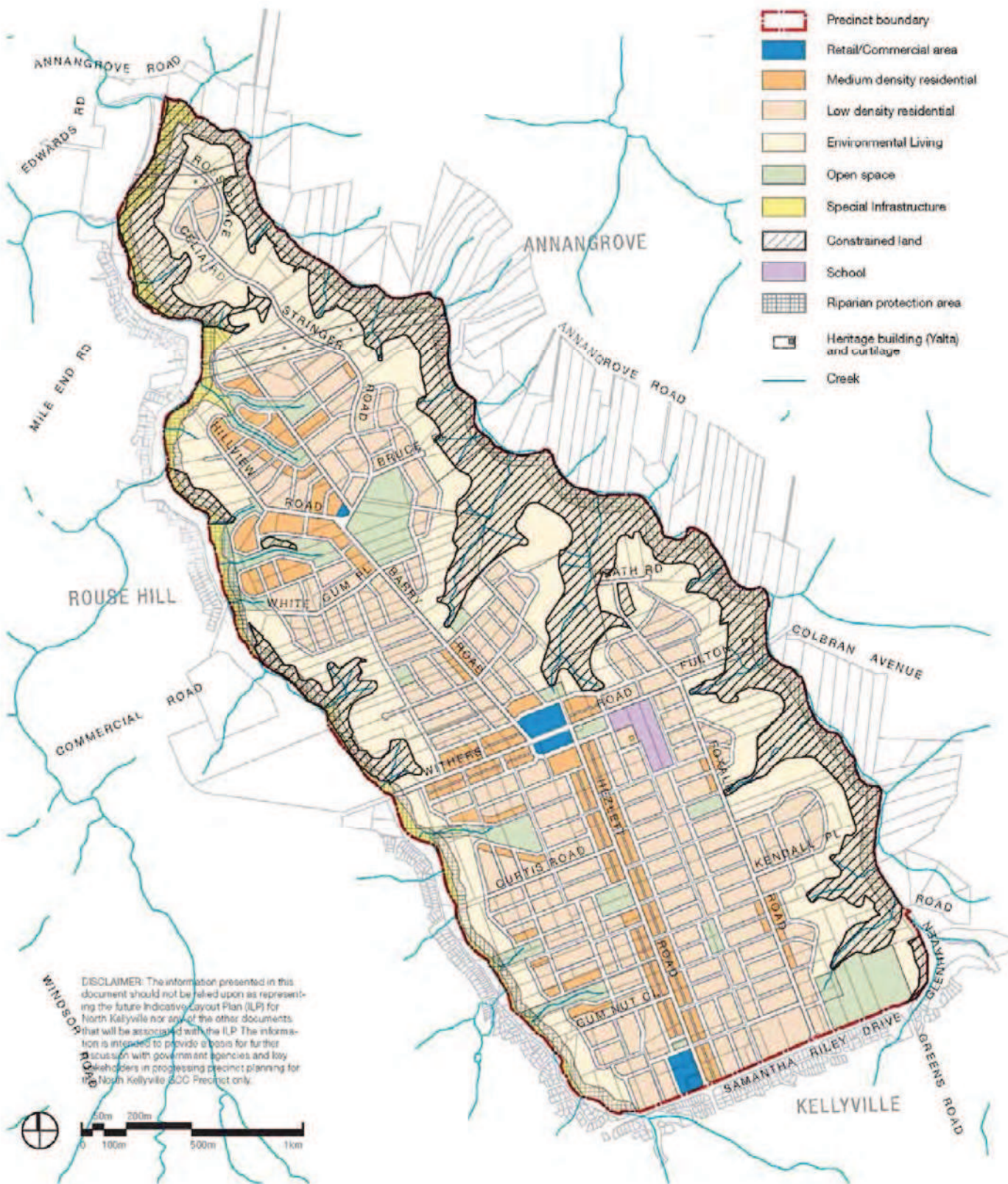
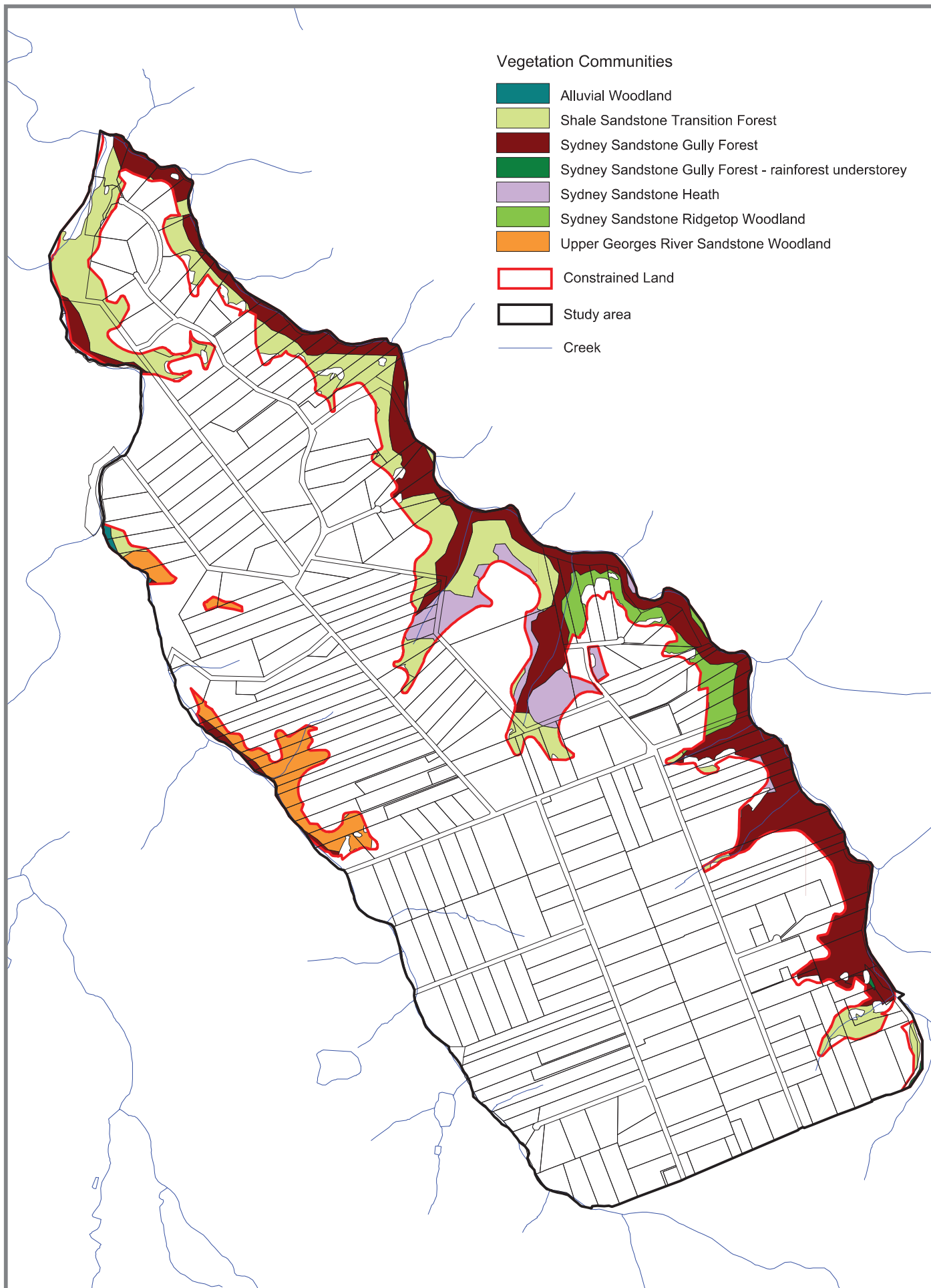


Figure 2.1

North Kellyville Draft Indicative Layout Plan  
Reproduced from the Indicative Layout Plan



0 0.5 1  
Kilometres

Figure 2.2

Vegetation within the Constrained Land

## 2.2 Vegetation Communities

Broad-scale mapping of the vegetation in the precinct was conducted by NSW National Parks and Wildlife Service in 2003, largely with reference to aerial photography. Some ground-truthing of this mapping was undertaken by EcoLogical in 2005 for the preparation of the draft Conservation Plan<sup>3</sup> and by Cumberland Ecology in 2007 for the preparation of the Biodiversity Assessment<sup>2</sup>. The vegetation communities that fall within the subject site include:

- Shale Sandstone Transition Forest;
- Sydney Sandstone Gully Forest;
- Sydney Sandstone Heath;
- Sydney Sandstone Ridgetop Woodland;
- Upper Georges River Sandstone Woodland; and
- Alluvial Woodland.

Of these communities, Shale Sandstone Transition Forest and Alluvial Woodland are listed as EECs under the TSC Act.

Figure 2.2 illustrates the broad vegetation communities that have been mapped within the subject site. Descriptions of each vegetation community are provided in Appendix A

### 2.2.1 *Riparian Vegetation of Cattai Creek and Smalls Creek*

The vegetation in the riparian zone along Cattai Creek and Smalls Creek is largely composed of Sydney Sandstone Gully Forest with small areas of Alluvial Woodland occurring along parts of the creekline. This zone is almost wholly vegetated and provides important fauna habitat and connectivity to other areas outside of the subject site. Although the riparian zone is degraded and characterised by heavy weed invasion throughout most of its length, it is still considered to be an ecologically important area and a high priority for conservation. Cattai Creek and Smalls Creek have been classified as Category 1 streams.



**Photograph 2.1**      **Degraded Riparian Zone of Cattai Creek**

### ***2.2.2 Upper Slope and Ridge-top Woodlands***

The upper slope and ridgetops in the subject site consist of heaths and woodland in relatively good condition. The vegetation communities in these areas include Sydney Sandstone Ridgetop Woodland, Upper Georges River Sandstone Woodland and Sydney Sandstone Heath. Crevices and caves are common and they provide good habitat for fauna to bask on and shelter underneath. The upper slope and ridgetop areas have a complex habitat structure that provides habitat for many fauna species and some of the threatened species recorded from the locality have the potential to utilise these areas. Weeds are rare on the upper slopes and ridge-tops and these areas tend to support a high diversity of flora.

The viability of these kinds of habitats is usually very good due to a low level of past disturbance and low levels of weeds. The soil on the upper slopes and ridges is typically nutrient poor and relatively dry and weeds do not flourish in these conditions. Higher areas are not subject to nutrient enriched stormwater runoff which is particularly detrimental to gully vegetation and riparian zones. Disturbance by humans is also relatively low in these areas, probably because they are frequently rocky and steep and therefore unable to support intensive agriculture.

An area of particular conservation significance within the subject site is the Heath Road remnant. This is a relatively large area of high quality and relatively undisturbed bushland and several threatened flora species have been recorded from within this area.



**Photograph 2.2**      **Upper Slope and Ridge-top Vegetation**

## **2.3 Soil and Topography**

The majority of the subject site is on Hawkesbury colluvial soil associated with the major creeks and tributaries. Upper slopes are on Blacktown residual soils. The width of the riparian zone varies and numerous sub-tributaries occur along the length of the subject site. On the upper slopes and ridge tops, the soil is typically thin and sandstone outcrops are common, often forming benches and cliff lines.

## **2.4 River Flows**

Cattai Creek and Smalls Creek are freshwater tributaries of the Hawkesbury-Nepean River and form the north, eastern and western boundaries of the precinct. These two creeks generally have some flow at all times, especially after rainfall<sup>4</sup>. Several un-named tributaries are present within the precinct but these are ephemeral streams that only flow when sufficient rain has fallen.

## 2.5 Flora and Fauna

### 2.5.1 Threatened Flora Species

Several threatened flora species have been recorded in the precinct, including populations of: *Hibbertia superans*, *Eucalyptus* sp. Cattai, *Darwinia biflora*, *Epacris purpurascens* var. *purpurascens* and *Leucopogon fletcheri* subsp. *fletcheri*.

These populations tend to be strongly associated due to their habitat requirements and restricted distribution and are located largely in and near the Heath Road remnant on predominantly sandstone geology.

### 2.5.2 Fauna Species

A wide range of threatened fauna species have been recorded from within or near the precinct and have potential habitat within the precinct. These include but are not limited to large forest birds, such as the Glossy Black Cockatoo (*Calyptorhynchus lathami*) and the Powerful Owl (*Ninox strenua*); small forest birds such as the Regent Honeyeater (*Xanthomyza phrygia*); microchiropteran bats; amphibians such as the Red-crowned Toadlet (*Pseudophryne australis*); and one invertebrate, the Cumberland Plain Land Snail (*Meridolum corneovirens*).

The riparian corridors of Cattai Creek and Smalls Creek constitute large areas of contiguous native vegetation, which form part of a biodiversity corridor throughout the precinct and are important for the dispersal of native fauna throughout the precinct and the wider district. In this area there is high floristic diversity and habitat for a wide range of fauna is present.

## Associated Issues

---

### 3.1 Weeds

Weeds have the potential to adversely impact on native biodiversity as they alter ecosystem function, degrade natural vegetation and seriously limit the long-term sustainability of natural resources.

#### 3.1.1 Relevant Legislation

*i. Noxious Weeds Act 1993*

The *Noxious Weeds Act 1993* provides for the identification, classification and control of noxious weeds in New South Wales. Changes to the Act came into force in March 2006 via the *Noxious Weeds Amendment Act 2005*. Plants that are declared noxious weeds by the Minister are placed into the following weed control categories:

➤ Class 1 – State Prohibited Weeds

These are plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.

➤ Class 2 – Regionally Prohibited Weeds

These are plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.

➤ Class 3 – Regionally Controlled Weeds

These are plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.

➤ Class 4 – Locally Controlled Weeds

These are plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

➤ Class 5 – Restricted Plants

These are plants that are considered likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

A noxious weed that is classified as a Class 1, 2 or 5 noxious weed is referred to in the Noxious Weed Act as a notifiable weed.

ii. *Weeds of National Significance (WONS)*

Weeds of National Significance are a list of weeds that have been prioritised for control on the basis of:

- Invasiveness;
- Impacts;
- Potential for Spread; and
- Socioeconomic and Environmental aspects.

Weeds of National Significance (WONS) recorded from the precinct include: Willows (*Salix* sp.), Lantana (*Lantana camara*), Alligator Weed (*Alternanthera philoxeroides*), Bridal Creeper (*Asparagus asparagoides*) and Blackberry (*Rubus fruticosus* agg.).

### **3.1.2 Weed Species in North Kellyville**

Weed distribution within the North Kellyville Precinct is strongly influenced by past and present land uses, with the greatest weed infestations occurring in the riparian zones of Smalls and Cattai Creeks and in the small tributaries that flow into them where the moisture and nutrient levels are often elevated due to stormwater pollution.

The degradation of native riparian vegetation along NSW water courses is listed as a key threatening process (KTP) under the *Fisheries Management Act 1994* (FM Act). A major cause of riparian degradation is the invasion by exotic weed species.

Table 3.1 presents a list of the most significant weeds for the precinct. These have been either recorded from the precinct or have been recorded from the Baulkham Hills LGA and have significant potential to occur in the precinct. Appendix B provides a full list of weeds known to occur within the Baulkham Hills LGA.

**Table 3.1 NOXIOUS WEEDS AND WEEDS OF NATIONAL SIGNIFICANCE RECORDED FROM THE PRECINCT OR HAVING THE POTENTIAL TO OCCUR WITHIN IT**

| Species                                                          | Listing                 | Control Requirements                                                                                                                                                                                                                                          |
|------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alligator weed ( <i>Alternanthera philoxeroides</i> )            | Class 3 Noxious<br>WONS | The plant must be fully and continuously suppressed and destroyed                                                                                                                                                                                             |
| Blackberry ( <i>Rubus fruticosus</i> aggregate species)          | Class 4 Noxious<br>WONS | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed. This is an All of NSW declaration |
| Bridal creeper ( <i>Asparagus asparagoides</i> )                 | Class 5 Noxious<br>WONS | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. This is an All of NSW declaration                                                                                                                                 |
| Green cestrum ( <i>Cestrum parqui</i> )                          | Class 3 Noxious         | The plant must be fully and continuously suppressed and destroyed                                                                                                                                                                                             |
| Lantana ( <i>Lantana</i> species)                                | Class 5 Noxious<br>WONS | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. This is an All of NSW declaration                                                                                                                                 |
| Mother-of-millions ( <i>Bryophyllum</i> species and hybrids)     | Class 3 Noxious         | The plant must be fully and continuously suppressed and destroyed and the plant may not be sold, propagated or knowingly distributed                                                                                                                          |
| Paterson's curse ( <i>Echium</i> species)                        | Class 4 Noxious         | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority                                                                                                       |
| Prickly pear ( <i>Opuntia</i> and <i>Cylindropuntia</i> species) | Class 4 Noxious         | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed. This is an All of NSW declaration |
| Broad-leaf Privet ( <i>Ligustrum lucidum</i> )                   | Class 4 Noxious<br>WONS | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed                                    |
| Narrow-leaf Privet ( <i>Ligustrum sinense</i> )                  | Class 4 Noxious<br>WONS | The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed                                    |
| Willows ( <i>Salix</i> species)                                  | Class 5 Noxious<br>WONS | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. This is an All of NSW declaration                                                                                                                                 |

### 3.1.3 Weed Invasion on the Subject Site

Weeds are a significant problem within the subject site, particularly along riparian corridors where introduced woody and herbaceous weed species compromise the integrity of the native ecosystem. Balloon Vine (*Cardiospermum halicacabum*) and Narrow-leaved Privet (*Ligustrum sinense*) in particular, dominate large tracts of the riparian zone across the subject site.

Exotic invasive species are a particular issue along drainage lines where seeds can be transported from upstream. High levels of nutrients can also enter the riparian zone through overland or storm water flows favouring the success of introduced species.

The vegetation on the steep slopes away from the creeks is significantly less weed invaded than the riparian zones. The soil on the upper slopes and ridges is typically nutrient poor and relatively dry and weeds do not flourish in these conditions.

Exotic plants can provide good nesting habitat for native fauna and the removal of weeds will need to be carried out in stages, with exotic cover replaced by native species to provide alternative nesting and sheltering sites for fauna.

Weeding methodologies for the subject site and general best practice principles are outlined in Chapter 5.

## 3.2 Water Quality and Aquatic Habitats

Water quality in Cattai and Small's Creeks varies and is highly dependent on catchment uses<sup>5</sup>. Current impacts on the creeks include urban stormwater runoff, treated sewage discharges and agricultural runoff. In general, areas closer to urban development are subject to urban stormwater run-off whilst further downstream, pollution levels are reduced due to the natural assimilation processes of the creek<sup>6</sup>.

The environmental management objectives for the precinct include improvement and maintenance of water quality within the two main waterbodies, Cattai and Small's Creeks. Most of the aquatic ecosystem will not be impacted on by development within the precinct, but will benefit from the imposition of managed riparian corridors. These will improve the aquatic environment by acting to filter water entering the waterways and intercepting nutrients and sediment. Re-vegetation and maintenance of riparian vegetation along both creeks will reinforce bank stability and slow overland flows from storm events by intercepting such flows. Erosion control and riparian re-planting are covered in the following sections of this Plan

### **3.3 Erosion and Run-off**

Land zoned for development within the precinct will be subject to some vegetation removal. Although this will take place outside of the subject site that this plan relates to, the removal of vegetation can create indirect environmental impacts down-slope, such as topsoil erosion and deposition, and increased nutrient flows. All remnant vegetation will need to be protected during construction and measures put in place to prevent any pollution of waterways. Construction methods in the development area should follow an appropriate soil and water management plan that addresses these issues to prevent indirect impacts occurring within conserved areas.

### **3.4 Bushfire**

The Rural Fire Service (RFS) has mapped areas of land within the precinct as containing bushfire prone land due to steep slopes and dense bushland along the riparian corridor of Cattai Creek and some areas of Smalls Creek.

As a bushfire mitigation measure, APZs will be established between the Constrained Lands and future residential development. Vegetation within the APZs will be required to be maintained at a reduced level and allow use by fire trucks to combat outbreaks of bushfire. The APZs are located outside of the area to which this EMP relates and therefore are not discussed further here. Vegetation within APZs should be managed in accordance with a bushfire management plan.

### **3.5 Cultural Heritage**

It is recommended that bush regenerators and on-site workers be briefed on the presence and location of any adjacent sites of cultural heritage prior to any works beginning on the subject site. A precautionary approach should be adopted in these areas to minimise the risk of damaging the integrity of Aboriginal and European cultural heritage.

## Riparian Assessment and Rehabilitation

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### 4.1 Overview

Due to the size of the riparian corridors and the variable condition of the vegetation along the creek-lines it is not practical at this stage to prepare a detailed vegetation management plan for the entire subject site. Therefore, several sub-sections have been assessed in detail to provide examples of the rehabilitation work that would need to be undertaken along different sections of the creek-line and the surrounding retained bushland. This also enables more accurate costs to be assigned to each sub-section, rather than a general estimate for the entire site.

The chosen subsections include:

- Zone 1: the most southerly end of the subject site near Samantha Riley Drive;
- Zone 2: a mid-section of Cattai Creek with numerous associated sub-tributaries in and adjacent to the Heath Road remnant,
- Zone 3: the northern part of the subject site near the confluence of Cattai Creek and Seconds Ponds Creek.

The locations of these sub-sections are shown in Figure 4.1 below, with more detailed descriptions provided in the following section.

This EMP sets parameters and guidelines regarding the regeneration and rehabilitation techniques that should be used to improve the conservation values of the subject site. Any future plans to carry out works within the land to which this EMP relates, should follow the objectives and principles set out in this management plan, and all proposed work should be in keeping with the desired future outcomes for the site, as listed below.

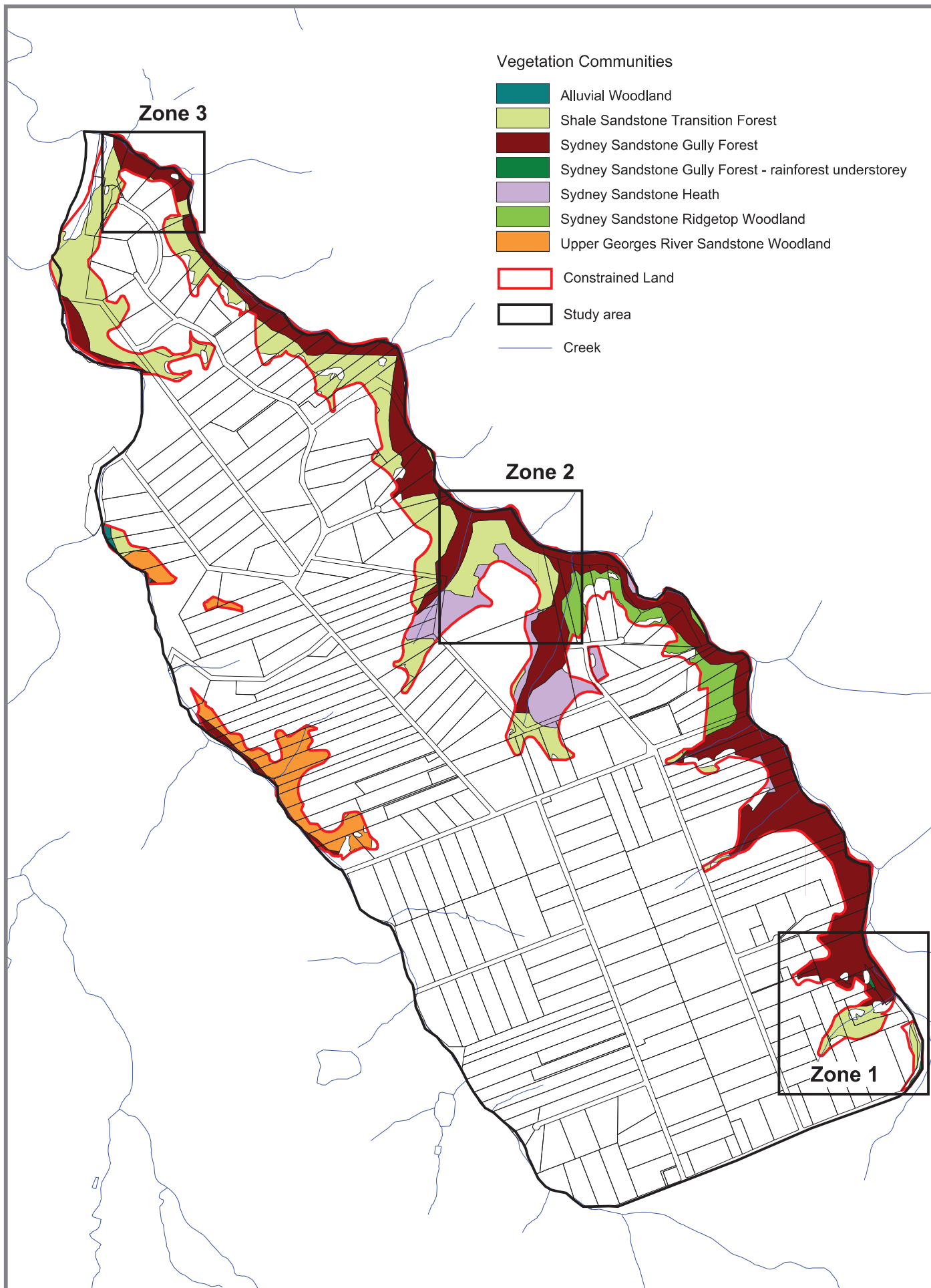


Figure 4.1

Locations of chosen sub-sections for detailed assessment

## 4.2 Aims and Desired Future Outcomes

The aim of this EMP is to set principles and guidelines to achieve the following performance based outcomes, using a range of integrated best practice techniques:

- Control threats affecting the health of remnant riparian and surrounding vegetation and inhibiting the regeneration potential of these plant communities;
- Increase species diversity and percentage cover of riparian vegetation plant species throughout designated bushland areas within the subject site;
- Improve the resistance of riparian vegetation and adjacent bushland areas to future weed colonisation and establishment related threats, by initiating the two above aims;
- Use measurable indicators to monitor regeneration responses and to assist in prioritizing bushland regeneration works during the proposed works programme;
- Implement supplementary bushland reconstruction plantings within specified management zones to restore structural elements of the plant communities, where these are absent or are not likely to regenerate naturally, using appropriate local native plant materials; and
- Identify monitoring and reporting procedures to measure progress against expected outcomes.

## 4.3 Best Practice Vegetation Management

The following factors were considered in determining the most appropriate restoration and rehabilitation methods for the subject site:

- Adapting best practice restoration principles and techniques and conforming to statutory requirements; and
- Liaison with providers of established and innovative restoration and rehabilitation techniques and products, to assist in the formulation of the most appropriate restoration and rehabilitation designs and strategies for the subject site.

Appropriately experienced and qualified personnel should carry out all proposed bush regeneration and reconstruction works. There is some scope to involve the community in aspects of the proposed restoration works, provided that appropriately experienced and qualified staff supervise them. All proposed native vegetation restoration recommendations outlined in this EMP should ensure compliance to recognised bushland management best practice guides, such as:

- Bush Regeneration, Recovering Australian Landscapes<sup>7</sup>;
- The Bush Regenerators' Handbook<sup>8</sup>;
- Methods advocated by the Australian Association of Bush Regenerators ([www.aabr.org.au](http://www.aabr.org.au)); and
- Bringing Back the Bush to Western Sydney-Best Practice Guidelines for Bush Regeneration on the Cumberland Plain<sup>9</sup>.

Generally, a minimum impact approach is recommended to ensure that any works on site have as little impact as possible on the natural stream processes and the ecological functioning of the area that is being rehabilitated. It is always preferable, where possible, to regenerate bushland rather than attempting to reconstruct it, not only from the point-of-view of minimizing expensive engineering and re-planting schemes but to work with the existing ecosystem to assist it in its own natural regeneration process, through existing native plant recruitment from nearby propagules or seeds stored in the soil bank.

## 4.4 Definitions of Regeneration and Reconstruction

### 4.4.1 Bushland Regeneration

McDonald<sup>10</sup> gives the following definition for bush regeneration: *where resilience exists...and only removal of obstacles and minor amendment of abiotic conditions are needed to effect recovery by natural regeneration...It applies to areas (of disturbed bushland) where there is perceived native plant resilience in the form of soil stored and/or nearby propagules, which together with time and some degree of intervention in the form of hydrological or heat treatments and weed control will affect recovery by natural regeneration.*

The Australian Association of Bush Regenerators defines bush regeneration as: *the practice of restoring bushland by focusing on reinstating and reinforcing the system's ongoing natural regeneration processes.*

DIPNR<sup>9</sup> define "Assisted Natural Regeneration" as: *aiming to trigger the growth of native propagules (such as seed, tubers or rhizomes etc) already present on site or having the ability to migrate onto the site, and aided by suitable management, to allow natural regeneration processes to occur.*

This form of *in-situ* restoration will be collectively referred to as: "bushland regeneration" in this report.

#### **4.4.2 Bushland Reconstruction**

McDonald<sup>10</sup> gives the following definition for bushland reconstruction: *where resilience is depleted...and abiotic condition or biotic elements need wholesale importation or major amendment before ecosystem functions can recommence.*

Bushland reconstruction should be implemented in areas where native plant resilience is depleted due to past disturbance mechanisms, but site conditions are still suitable for the “reconstruction” (re-planting and /or re-seeding) of local riparian vegetation plant species and associations. This may also include restoring currently missing structural layers such as the shrub or tree layers in areas where resilient native ground layer species still persist and have the potential to spread naturally.

DIPNR<sup>9</sup> define Reconstruction through Revegetation as: *involving the introduction of locally indigenous plant species, modelled on the diversity and structural characteristics of the original plant community. It is carried-out by planting or re-introducing propagules.*

This form of *ex-situ* restoration will be collectively referred to as: “bushland reconstruction” in this report.

### **4.5 Zone Descriptions**

Three zones within the subject site have been identified as representative sub-sections of the subject site as a whole, and are analysed in more detail here. The quality of the vegetation varies along the creeks and these sub-sections are indicative of the different levels of management that may be required in order to restore them adequately. Descriptions of the zones are provided below:

#### **4.5.1 Zone 1:**

Zone 1 occurs in the most southerly end of the subject site near Samantha Riley Drive, where Cattai Creek and associated sub-tributaries are heavily infested with Balloon Vine and Privet. Weed infestation continues upslope to the top of the ridge-line in these areas right up to the boundary of the subject site. Photographs 4.1 and 4.2 indicate the extent of the weed infestation in this zone.

**Photograph 4.1      Balloon vine infestation at the southern end of the subject site**



*Photograph 4.1 depicts a heavily balloon vine infested section of Cattai Creek downstream of the old Glenhaven Road bridge in Zone 1.*

**Photograph 4.2      Privet infested creekline in zone 1**



*The photograph above shows a section of heavily privet infested creekline on one of the tributaries that runs into Cattai Creek near the old Glenhaven Road bridge, (Zone 1). This area also has quite heavily infested sections of privet on the more elevated parts of the site.*

#### 4.5.2 Zone 2:

Zone 2 occurs in the mid section of the subject site, around the Heath Road area. This section of bushland is generally in much better condition than that of zone 1, with relatively weed-free bushland occurring on the steeper slopes. However, pockets of relatively heavy weed infestation occur along parts of the creekline and the shallower slopes, as shown in the photograph below.

**Photograph 4.3 Weeds along the riparian zone in zone 2**



*This photograph shows a section of privet and honeysuckle infested creekline on one of the tributaries that runs into Cattai Creek near Heath Road (Zone 2). This area is quite weed free on the more elevated parts away from the creek, whilst the area to the left of the image is surrounded by cleared land with a heavy groundcover of kikuyu grass.*

**Photograph 4.4 Privet along the creekline in zone 2**



*Photograph 4.4 shows a section of quite heavy privet along Cattai Creek in the Heath Road Remnant area (Zone 2). This area is in general is significantly less degraded than Zone 1 and 3 and, as such, supplementary planting will probably not be required in similar areas. Better quality bushland is also in closer proximity to the riparian areas in Zone 2.*

**Photograph 4.5**      **Good quality bushland in zone 2**



*The photograph above illustrates a section of relatively good quality bushland less than 50-metres from the main Cattai Creek channel, in the Heath Road Remnant vicinity in Zone 2.*

**Photograph 4.6**      **Balloon vine infestation at the confluence of Cattai Creek and a sub-tributary in zone 2**



*Photograph 4.3 shows a section of quite heavily balloon vine affected riparian vegetation in the Zone 2 vicinity near one of the main side creek confluences with Cattai Creek in the Heath Road Remnant area. Although generally less degraded than Zones 1 and 3, Zone 2 is still reasonably affected by weed competition along the main Cattai Creek channel and adjoining tributaries.*

### 4.5.3 Zone 3

Zone 3 occurs in the northern section of the subject site near Ross Place. This zone has been subject to some clearing over recent years, both by local residents and the Rural Fire Service and is generally more open along the creeklines. Localised burning, grazing and mowing has taken place in this zone, however balloon vine and privet infestation occur in areas that are not currently being managed.

**Photograph 4.7 Open vegetation in zone 3**



*The photograph above shows a section of reasonably open riparian vegetation in the zone 3 vicinity that has been subject to ongoing mowing and grazing and some weed removal. Fleabane (a weed that is toxic to stock) can be seen in the foreground, whilst Balloon Vine (background left) is prevalent in the areas that have not been cleared.*

**Photograph 4.8 Privet occurrence in zone 3**



*Photograph 4.8 shows a section of privet infested riparian vegetation in the Zone 3 vicinity along the creekline adjacent to mown land.*

## 4.6 Rehabilitation Methods

The majority of the subject site is affected by weed infestation, particularly along the creekline and shallower slopes where weeds are reasonably dominant. Primary weeding will need to take place across the entire subject site. Where weed infestation is heavy, initial weed removal will need to be followed by supplementary planting of native species. It is not considered necessary to carry out re-planting across all areas however. Zone 2, for example, is less prone to weed infestation and weed removal and maintenance weeding in this area (and other sections of the creeklines that are in a similar condition) is likely to be sufficient to encourage the natural regeneration of native plants. Zones 1 and 3 will require some re-planting due to the amount of weeds that need to be removed. Zone 1 in particular, and other areas of the site that are particularly weed infested, are likely to require extensive re-planting of natives to replace former weed-covered areas.

The methodologies for site rehabilitation are discussed in more detail below. Although they are discussed in terms of zones 1, 2 and 3, these zones are representative of different sections of the subject site that are in a similar condition: zone 1 representing heavily weed infested areas; zone 2 being relatively weed-free and zone 3 being prone to moderate weed infestation. The aim of this EMP is to provide indicative costs and set guidelines that govern the way in which the subject site will be rehabilitated and managed in the future. It is recommended upon the re-development of each parcel, an individual vegetation management plan (VMP) be prepared for sites adjoining nominated areas. VMPs must adhere to the principles and guidelines set out in this EMP.

### 4.6.1 *Primary Bush Regeneration Weeding*

Across the subject site, the bushland along the creek edges is, in general, heavily infested with privet and balloon vine. In zone 1, weed infestation occurs over a fairly broad area, not only along the creekline but throughout adjoining internal tributaries to the top of the adjacent slopes. In zone 2, heavy privet and balloon vine infestation also occurs along the creekline but the width of infestation is generally less extensive. Additionally, areas adjoining the side creeks and adjacent properties are typically less affected by weed competition. In zone 3, weed infestation again occurs over a fairly wide area along the main creekline as well as in the side creeks, however, the quality of the bushland in this zone is in slightly better condition than that in Zone 1.

Primary weeding will include:

- the selective spraying of weeds, with selective and non selective herbicides in situations where damage to adjoining native plants can be avoided;
- cutting/scraping and painting deep rooted woody weeds and climbers with hand tools, chainsaws and brushcutters and painting cut stumps with herbicides containing Glyphosate or Picloram;

- target drilling and injecting certain large tree weeds such as willow with herbicides such as Glyphosate and a Garlon/diesel mix; and
- selective hand removal of weeds; and wicker wiping of tall herbaceous weeds in situations where damage to proximate, low growing native plants can be avoided.

In zones 1 and 3, there may be some provision to clear weeds in very heavily infested areas with a machine such as a excavator mounted forestry mower, as long as this work can be implemented without damaging proximate native plants and the soils of the area. There is less scope for mechanical clearing of weeds in zone 2 due to the higher presence of native plants this area. Many of the better quality bushland areas across the subject site will require very little ongoing management and will not require replacement re-planting following primary weeding activities.

#### **4.6.2 Jute Mat Mulching Planting Areas**

Jute matting will need to be installed after weed clearance in erosion prone areas in order to stabilise the soils in these places. Jute matting will largely be concentrated around the edges of the main creekline and adjoining drainage lines. The extent of jute matting required will depend on the extent of weed clearance in each area and prevalence of bare soil. As a guide, it is estimated that 40% of heavily weed infested areas will require jute matting (as in zone 1) and approximately 20% of moderate-heavily weed infested areas (as in zone 3). No replanting or jute matting is likely to be required in areas of better quality bushland, as in zone 2, as natural regeneration is expected to be sufficient in these areas.

#### **4.6.3 Supplementary Bushland Reconstruction Plantings**

As with jute matting above, it is expected that natural regeneration will take place in areas that have a higher percentage of native species as in Zone 2. Therefore re-planting will not be required in these areas. In heavily-weed infested areas, re-planting may be required across as much as 40% of the site. Recommended re-planting densities are as follows:

- Local native groundcovers: 4-plants per m<sup>2</sup>;
- Shrubs: 1 shrub per 2m<sup>2</sup>; and
- Trees at 1-plant per 9m<sup>2</sup>.

Plants should be installed in hiko tubes with 5-grams of water retaining crystals and 5-grams of slow release fertiliser for each plant (refer to Chapter 5 for general planting guidelines).

It is estimated that initial weeding and re-planting will take place over the first 12 months. Generally these activities can be carried out concurrently to minimise erosion and secondary weed invasion of bare soil.

#### **4.6.4 *Twelve months maintenance weeding***

After planting is complete, reconstructed areas should be maintained by appropriately qualified personnel, selectively spot spraying and hand weeding around native plants, watering plants and replacing dead plants as needed.

Provision should be made to water newly reconstructed areas, as required, in the first 3 months after installation (on at least 4-5 occasions, depending on rainfall conditions).

#### **4.6.5 *Three years on-going weeding and maintenance***

Follow-up weeding and maintenance should be implemented for a minimum period of three continuous years after primary weeding and revegetation works have been completed. After the 3 year follow-up and maintenance period has been completed, a review should be conducted to determine ongoing on-site maintenance requirements.

### **4.7 Costs**

Costs for weeding, re-planting and maintenance have been provided individually for all three zones to provide further detail on the extent of work that is required along different sections of the subject site. The cost of regeneration will vary across the subject site depending on the quality of the bushland and extent of weeds within each lot. Individual blocks are likely to be sold off in 2 ha units therefore costs have been averaged out to provide an overall cost for regenerating and managing a 2 ha unit/lot within the subject site over a five year period.

**Table 4.1 ESTIMATED COSTS FOR THE REGENERATION AND MAINTENANCE OF A 2HA LOT OVER 5 YEARS**

| Proposed Activity/Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Unit | \$ per unit | No. Units | \$ sub-total ex GST |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|-----------|---------------------|
| <b>1. PRIMARY BUSH REGENERATION WEEDING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |             |           |                     |
| <b>Zone 1: Primary bush regeneration weeding sweep of 2 HECTARES (I.E. 20,000M<sup>2</sup> AREAS)</b> of heavily weed and stormwater affected riparian and adjoining bushland. Primary weeding in zone 1 areas will include cutting/scraping and painting woody weeds and climbers as well as herbicide spraying of herbaceous weeds and climbers in situations where damage to adjoining native plants can be avoided. There may be some provision to clear weeds in very heavily infested areas with a machine such as a excavator mounted forestry mower, as long as this work can be implemented without damaging proximate native plants and the soils of the area.                                                                                                                                                                                                                                                                                                                                                                         |      |             |           |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | m2   | \$3.40      | 20000     | \$68,000.00         |
| <b>Zone 2: Primary bush regeneration weeding sweep of 2 HECTARES (I.E. 20,000M<sup>2</sup> AREAS)</b> of moderately weed and stormwater affected riparian and adjoining bushland. Primary weeding in Zone 2 areas would include cutting/scraping and painting woody weeds and climbers as well as herbicide spraying of herbaceous weeds and climbers in situations where damage to adjoining native plants can be avoided. There is less scope for mechanical clearing of weeds due to the higher presence of native plants in Zone 2 in comparison with Zone 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |             |           |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | m2   | \$2.60      | 20000     | \$52,000.00         |
| <b>Zone 3: Primary bush regeneration weeding sweep of 2 HECTARES (I.E. 20,000M<sup>2</sup> AREAS)</b> of moderate-heavy weed and stormwater affected riparian and adjoining bushland. The quality of bushland in Zone 3 was generally in slightly better condition than Zone 1, but not as good as Zone 2. The bushland along the creek edges was observed as being in general heavily infested with privet, with balloon vine infestation over a fairly broad area. Also areas adjoining the side creeks and adjoining properties appeared to be quite weed-infested. Primary weeding will include cutting/scraping and painting woody weeds and climbers as well as herbicide spraying of herbaceous weeds and climbers in situations where damage to adjoining native plants can be avoided. There may be some provision to clear weeds in very heavily infested areas with a machine such as a excavator mounted forestry mower, as long as this work can be implemented without damaging proximate native plants and the soils of the area. |      |             |           |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | m2   | \$3.40      | 20000     | \$68,000.00         |
| <b>Average price per 2 ha lot</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |             |           | <b>\$62,666.67</b>  |

## 2. JUTE MAT MULCHING PLANTING AREAS

**Zone 1: Supplying and installing stabilising jute matting** after weed clearing has been completed and before planting to stabilise soils in relevant areas. Jute matting will mostly be concentrated around the edges of the main creeklines and adjoining drainage lines. It is assumed that approximately 40% of Zone 1 will require jute matting. 40% of 20,000m<sup>2</sup>=8000m<sup>2</sup>

|    |        |      |             |
|----|--------|------|-------------|
| m2 | \$5.70 | 8000 | \$45,600.00 |
|----|--------|------|-------------|

**Zone 2: No replanting or jute matting is proposed in Zone 2 as natural regeneration is expected to be sufficient in Zone 2 areas.**

|    |        |   |        |
|----|--------|---|--------|
| m2 | \$5.70 | 0 | \$0.00 |
|----|--------|---|--------|

**Zone 3: Supplying and installing stabilising jute matting** after weed clearing has been completed and before planting to stabilise soils in relevant areas. Jute matting will mostly be concentrated around the edges of the main creeklines and adjoining drainage lines. It is assumed that approximately 20% of Zone 1 will require jute matting. 20% of 20,000m<sup>2</sup>=4000m<sup>2</sup>

|    |        |      |             |
|----|--------|------|-------------|
| m2 | \$5.70 | 4000 | \$22,800.00 |
|----|--------|------|-------------|

**Average price per 2 ha lot**

**\$22,800.00**

## 3. SUPPLEMENTARY BUSH RECONSTRUCTION PLANTINGS

**Zone 1: Replanting local native groundcovers at 4-plants per m<sup>2</sup>, shrubs at 1 plant per 2m<sup>2</sup> and trees at 1-plant per 9m<sup>2</sup>.** This equates to 4.61 plants being planted per m<sup>2</sup> at each site. It is assumed that approximately 40% of Zone 1 will require replanting at this rate. Planting will mostly be concentrated around the edges of the main creeklines and adjoining drainage lines. 4.61 plants x 8000m<sup>2</sup>=36,880 plants per hectare x 2= 73,760 plants per 2-hectares. Includes the supply & installation of a plant in a hiko tube, the installation of each plant, the supply and installation of 5-grams of water retaining crystals, 5-grams of slow release fertiliser for each plant and 4-5 hand waters.

|      |        |       |              |
|------|--------|-------|--------------|
| tube | \$4.20 | 73760 | \$309,792.00 |
|------|--------|-------|--------------|

**Zone 2: No replanting is proposed in Zone 2 as natural regeneration is expected to be sufficient in Zone 2 areas.**

|      |        |   |        |
|------|--------|---|--------|
| tube | \$4.20 | 0 | \$0.00 |
|------|--------|---|--------|

**Zone 3: Replanting local native groundcovers at 4-plants per m<sup>2</sup>, shrubs at 1 plant per 2m<sup>2</sup> and trees at 1-plant per 9m<sup>2</sup>.** This equates to 4.61 plants being planted per m<sup>2</sup> at each site. It is assumed that approximately 20% of Zone 3 will require replanting at this rate. Planting will mostly be concentrated around the edges of the main creeklines and adjoining drainage lines. 4.61 plants x 4000m<sup>2</sup>=18,440 plants per hectare x 2= 36,880 plants per 2-hectares. Includes the supply & installation of a plant in a hiko tube, the installation of each plant, the supply and installation of 5-grams of water retaining crystals, 5-grams of slow release fertiliser for each plant and 4-5 hand waters.

|      |        |       |              |
|------|--------|-------|--------------|
| tube | \$4.20 | 36880 | \$154,896.00 |
|------|--------|-------|--------------|

**Average price per 2 ha lot**

**\$154,896.00**

#### 4. 12 MONTHS MAINTENANCE BUSH REGENERATION WEEDING

##### Zone 1: first 12-month maintenance weeding treatment of 2

**HECTARES (I.E. 20,000M<sup>2</sup> AREAS)** of heavily weed and stormwater affected riparian and adjoining bushland, post-primary weeding and revegetation.

m2 \$5.40 20000 \$108,000.00

##### Zone 2: first 12-month maintenance weeding treatment of 2

**HECTARES (I.E. 20,000M<sup>2</sup> AREAS)** of moderately weed and stormwater affected riparian and adjoining bushland.

m2 \$4.10 20000 \$82,000.00

##### Zone 3: first 12-month maintenance weeding treatment of 2

**HECTARES (I.E. 20,000M<sup>2</sup> AREAS)** of moderate-heavy weed and stormwater affected riparian and adjoining bushland.

m2 \$4.90 20000 \$98,000.00

**Average price per 2 ha lot**

**\$96,000.00**

#### 5. ON-GOING MAINTENANCE BUSH REGENERATION WEEDING FOR YEARS 3-5 IN A 2 HA LOT

**YEAR 3 maintenance weeding treatment in a 2 ha lot**

m2 \$3.84 20000 \$76,800.00

**YEAR 4 maintenance weeding treatment in a 2 ha lot**

m2 \$3.07 20000 \$61,400.00

**YEAR 5 maintenance weeding treatment in a 2 ha lot**

m2 \$2.20 20000 \$44,000.00

**TOTAL AVERAGE COST FOR REGENERATING AND MAINTAINING A 2 HA LOT OVER 5 YEARS**

**\$518,562.67**

## 4.8 Schedule of Works

This EMP relates to a period of five years from when subdivision consent is granted. It is recognised that all lots will be developed at different times and therefore regeneration will be staggered across the site with individual five year plans beginning and ending at different times. A Gannt Chart outlining an indicative schedule of works for a five year plan can be found in Appendix C.

Ongoing maintenance will be required after the initial five year period. The roles and responsibilities for ongoing tasks are outlined in Chapter 6 of this report.

## General Principles for Weeding and Re-Planting

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### 5.1 Weed Control Guidelines

A strategic approach to weed control will need to be employed to maximise the results for the weeding effort. This necessitates weeding in accordance with seasonal variations in rainfall and weed growth, botanical flowering times and treatment affectivity.

#### 5.1.1 Species Specific Control Measure

Control of weeds requires application of species-specific measures to prevent spread and establishment of weeds in addition to the general weed control measures such as prevention. Control measures for each species need to focus on different aspects of control. This can be related to the habitat of the weed, such as in gullies, native vegetation or cleared areas, as well the life-cycle and method of spread that is most likely in the precinct.

The following section outlines species-specific control measures for groups of species.

##### i. Perennial Grasses

|                            |                                                                                                                                                                                                                                                                                            |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Species:</b>            | Pampas Grass, African Love Grass                                                                                                                                                                                                                                                           |
| <b>Chemical Control:</b>   | Use of registered appropriate chemicals within Inner Protection Areas and along edges to control African Love Grass. Take particular care in spot-spraying African Love Grass to avoid impact on threatened non-target species i.e. <i>Grevillea juniperina</i> subsp. <i>juniperina</i> . |
| <b>Mechanical Control:</b> | Cut flower heads of Pampas Grass.                                                                                                                                                                                                                                                          |
| <b>Biological Control:</b> | None available.                                                                                                                                                                                                                                                                            |

##### ii. Herbaceous Weeds

|                 |                               |
|-----------------|-------------------------------|
| <b>Species:</b> | Bridal Creeper, Crofton Weed. |
|-----------------|-------------------------------|

- Chemical Control:** Spot-spraying is an effective control for Bridal Creeper, providing follow-up treatment in consecutive years is conducted. Thoroughly spraying Crofton Weed during its peak growing period, during late summer or autumn, is an effective control measure for this weed<sup>11</sup>.
- Mechanical Control:** Physically remove and dispose of herbaceous weeds responsibly. Care must be taken to remove the entire tuberous root system to minimise regeneration. Ripping or ploughing an area of Crofton weed will control the weed if the area is suitable for this method<sup>11</sup>.
- Biological Control:** Some biological controls may have an effect on Bridal Creeper, these being a chalcid wasp, a moth larva and a rust fungus. The trypetid gall fly can be used to control Crofton Weed<sup>11</sup>.

### iii. *Woody Perennials*

- Species:** Blackberry, Narrow-leaved Privet, Broad-leaved Privet, African Boxthorn,, African Olive, Cotoneaster, Castor Oil Plant, Lantana, Balloon Vine.
- Control Priority:** *High* –due to threats to native vegetation and the potential for high future costs of control.
- Chemical Control:** Control all species (except Blackberry) by cut and paint with undiluted herbicide registered for this application or stem injection. Spot spray Blackberry, which occurs in dense infestations. Follow-up spray and cut stump applications to ensure that native species have a chance to grow in areas where these species have been removed.
- Mechanical Control:** Pull out small seedlings. Generally removal with tractors and machinery results in inappropriate disturbance level and will result in a high level weed germination and soil disturbance.
- Biological Control:** No biological controls are currently available.

### 5.1.2 *Flowering and Treatment Times*

The flowering, fruiting and appropriate treatment times should be known for each targeted weed species to allow for effective management of these species within the precinct. A schedule of the flowering times of each species to be removed should be included in the preparation of a vegetation management plan by bushland regenerators and treatment should be conducted seasonally, prior to seed set for each species. Flowering or fruiting plants are a high priority for removal, particularly due to the connected nature of ecosystem components along stream corridors that allow weed seeds to disperse downstream.

### **5.1.3 Manual Weed Removal**

Manual removal is an appropriate form of control for some weeds species, when all viable parts of the plant are removed from the soil and site (roots, fruiting material and rhizomes). All weeds removed by hand should be handled according to best practice bush regeneration techniques to prevent subsequent seed set from the removed weeds, and the unviable plant material should be retained on site to provide mulch and natural leaf litter to protect the soil surface.

### **5.1.4 Use of Herbicides**

All herbicides should be used according to recommendations on the herbicide label. Appropriate Personal Protective Equipment (PPE) should be worn and consideration given to time of day, likelihood of rainfall, wind direction and likely impact on native species as per guidelines on the label. Use of glyphosate will be appropriate for most species. Near to water courses, an appropriate form of the herbicide should be used to minimise impact to aquatic life and amphibians such as RoundUp Bioactive®, and herbicide use should be avoided within 5m of the creek or wetland edges. Runoff is a likely way for herbicide residue to enter watercourses therefore chemical treatment should be avoided prior to or directly after rains.

All chemical treatment should be carried out according to best practice guidelines.

### **5.1.5 Ecological Burn Piles**

Woody weeds can be stacked in ecological burn piles and burnt in accordance with the Rural Fire Service's guidelines for pile burning (*Standards for Pile Burning*) which can be found on the RFS website. This treatment is only suitable for woody weeds and advice should be taken from the local RFS as to whether it is suitable for specific areas within the subject site.

### **5.1.6 Minimising the potential for weeds to spread from construction areas**

There is potential for weeds to spread during construction and development. To prevent weed transport during development by vehicles, personnel, wind and water, the following guidelines should be adhered to by all personnel and contractors in the precinct:

- avoid working in or travelling through weed infestations when they are in flower or seeding (warmer months) where possible. Machinery, equipment and footwear should be cleaned down before leaving areas containing weeds during clearing and earthworks;
- stay on formed tracks wherever possible. During clearing and earthworks when this is not feasible machinery, equipment and footwear should be cleaned down before leaving the Precinct;

- where appropriate, establish a fixed clean down site and clean down all vehicles at regular intervals after coming in contact with weeds, and all vehicles that arrive from known weed-infested areas, with high pressure hoses or compressed air;
- contain the water and materials from the clean down site and regularly inspect for weeds species;
- maintain buffers to the boundaries of the conserved bushland areas and along roads and tracks; and
- work from the clean to infested areas when spraying or slashing and start weed control from the outer edges of infestations working inwards. This is important for weeds such as Blackberry.
- always re-establish vegetation as soon as possible and where practicable after construction earthworks in accordance with an appropriate *Soil Management Plan*;
- monitor disturbed areas and all sediment and erosion control structures to ensure that they are functioning correctly and prescribe follow-up weed spraying to ensure that any germinating weed does not set seed;
- weeds in the development area should be removed before any land is filled; and
- use weed free fully composted mulch and topsoil when carrying out revegetation or landscaping and earth works to prevent competition from weeds species and reduce weed invasion. All topsoil to be brought in to the Environmental Living Zone should be certified weed free.

### **5.1.7 Community Initiatives**

#### *i. Controlling the planting of invasive species*

In order to avoid the introduction of additional weeds into the precinct, restrictions on which plants are allowed to be grown in land adjacent to the riparian zone (Environmental Living) may be effective. Planting of locally endemic native plants in landscaping should be encouraged. Invasive plants should be identified in appropriate literature supplied to residents and developers as well as recommended local native alternative plants.

#### *ii. Partnerships*

There may be the potential for practical partnerships to be formed in implementing weed control activity as part of this EMP. Weed control is likely to be most effective when it is conducted in a coordinated way throughout a catchment area. This is particularly relevant for rehabilitating watercourses as weed invasion from upstream can undo expensive and time consuming remediation works. As outlined above, Privet removal is one of the

highest priorities in rehabilitating the riparian zone. There may be potential for weed control efforts in the precinct to be coordinated with Cattai Landcare's project "Privet out of Cattai". This project has received grant funding through the Environmental Trust and Local Government Advisory Group, and involves an awareness-raising, training, weed control and revegetation program targeting Privet in Cattai Creek catchment from Castle Hill through Annangrove and Box Hill to Maraylya. The main aim of the project is to initiate community action towards controlling Privet in the upper parts of Cattai Creek (in the first phase). Baulkham Hills Council supports this program and has pledged to provide education, encouragement and support for the removal of Privet from private properties. A designated Project Officer has been appointed to coordinate the project and to provide advice and support for participating landowners.

## 5.2 Re-planting

### 5.2.1 Selection of Plant Species

Species selected for re-planting should be those that are characteristic of the plant communities where the re-planting is taking place. These communities include: Shale Sandstone Transition Forest, Sydney Sandstone Gully Forest, Sydney Sandstone Heath, Alluvial Woodland, Upper Georges River Sandstone Forest and Sydney Sandstone Ridgetop Woodland. Appendix D contains an indicative species list of the plants that occur within these vegetation communities and would be suitable for re-planting on site. However, when species are chosen for re-planting in specific areas other factors should also be taken into account including the topography, aspect, soil type and proximity to water of the area to be planted.

The ecological value of the site can also be improved by creating additional habitat for native fauna that may utilise the site and planting threatened flora, where appropriate. The precinct supports several populations of threatened flora species including: *Hibbertia superans*, *Eucalyptus* sp. Cattai, *Darwinia biflora*, *Epacris purpurascens* var. *purpurascens* and *Leucopogon fletcheri* subsp. *fletcheri*. These species could potentially be used in revegetation and landscaping works to aid their conservation (a licence is required for the collection of threatened plant species).

Edges of creeklines should be planted with species that can improve aquatic habitat. Species such as *Phragmites australis* and *Baumea juncea* provide sheltering habitat for amphibians and fish and also take up nutrients from the soil prior to them entering waterways, helping to control nutrient input into aquatic environments. Where possible, habitat features for fauna should be retained and/or added, such as woody debris and other shelter/nesting features.

Feral rabbits are present within the precinct and it is advisable that newly planted tubestock be accompanied with tree guards where appropriate to protect the fresh foliage from predation.

All revegetation works, including seed collection and transplanting should be carried out by suitably qualified bush regenerators.

### **5.2.2 Mulching and Erosion Control**

The potential erosion of exposed surfaces is high after vegetation has been cleared. Implementation of appropriate mulching will minimise erosion in the short and long terms.

Where weed control has resulted in bare areas of soil in the riparian zones, additional measures can be employed in conjunction with the replanting of the riparian zones to reduce erosion such as the use of jute matting on the edges of the creek to hold the banks in place while vegetation is taking hold.

Green waste that is collected and wood chipped on site will be preferentially used on upper slopes where flooding is a lesser threat. Fresh mulch is to be left stockpiled or lain in situ for a minimum of 3 weeks prior to planting to allow the material to settle and mature, preventing chemical burning of freshly planted tubestock.

### **5.2.3 Plant Supply**

The majority of the seeds for propagating plants of local provenance can be sourced from the site and surrounding areas prior to clearing. A qualified seed collector should collect seed from all strata including grasses and ferns. It is likely however, that not all of the species intended for replanting in order to re-establish the natural community will be available on site. Any additional seed required should be of local provenance, collected from within the North Kellyville area, preferably not more than 10 kilometres from the site.

The proposed bush regeneration and revegetation works timing has been applied to an initial works/construction period, (actual times will depend on the corresponding project works starting date), an initial 12-month maintenance period and a further 3-year site maintenance period. It should be noted that the collection of suitable local native seed to allow for the propagation of suitable plants for any works is likely to need to occur well before any works are proposed. It should be considered that the peak time to collect any local native seed is between the November-January peak seed maturity period in any given year, with other plant species requiring collection before and after this peak time. Also, it note that it takes between 16-20 weeks to grow-on native plants from sowing to plants being ready for planting.

## **5.3 Vegetation Maintenance**

Inspection of rehabilitation areas should be undertaken after each planting phase is completed, and monthly thereafter until plants have established. Areas where noxious / serious weeds have been treated should be inspected on a fortnightly basis following initial treatment to assess when and if repeat treatments are necessary.

### **5.3.1 Flood and Storm Damage**

During the establishment period of newly planted areas, seeds and juvenile plants in the riparian zone are most vulnerable to damage from storm events. During such an event, there is also the risk of top soil being removed. Enough seed should be collected to allow for replacement plantings beyond the initial establishment period. Seeds can then be propagated at a local commercial or community nursery.

### **5.3.2 Replacement of Dead Plants**

Dead plants are to be removed and replaced one for one during the course of maintenance of regenerating vegetation within the first 3 years of vegetation establishment.

## **5.4 Ongoing Maintenance and Management**

Ongoing management will be focused on weed control measures, replacement of dead or damaged native vegetation seedlings, management of erosion issues and sedimentation damage that may interfere with plant health and habitat values.

## Monitoring and Reporting

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### 6.1 Roles and Responsibilities

#### 6.1.1 *First Five Years*

The primary responsibility for the implementation of the works outlined in this EMP will rest with the land owner or be required as consent condition issued by the consent authority. Every lot within zones E3 and E4 that includes an area within the constrained lands will require a five year vegetation management plan that includes some or all of the bush regeneration and reconstruction activities outlined above. Qualified bush regenerators must carry out the regeneration work. Council will be responsible for monitoring the work that has been carried out.

Key Performance Indicators have been outlined below that allow for an assessment of whether the expected outcomes for the site (see section 4.2) have been achieved. The final report to Council must address these issues and the developer will be responsible for proving that the site has been adequately restored before handing responsibility over to individual land owners. A site inspection should be conducted by Council to ensure compliance and a written approval issued to the developer as a record that the rehabilitation work has been approved. If management objectives are not met within the five year time period, the developer will continue to be responsible for regeneration activities until the KPIs have been adequately achieved.

#### 6.1.2 *On-going Long Term Maintenance*

On going maintenance for each lot will be the responsibility of the individual landowner. Council will be responsible for long-term monitoring to ensure that maintenance activities continue (refer to long-term implementation below).

### 6.2 Implementation: First Five Years

This plan relates to the first five years of rehabilitation and management, where the objective will be to restore the relevant parts of the site back to a natural state to enable ongoing long-term maintenance to be carried out in a cost-effective manner.

### **6.2.1 Site Inspection and Adaptive Management**

The objectives for the rehabilitation of the subject site are outlined in Section 4.2. A project manager/supervisor should be assigned by the developer to co-ordinate, supervise and manage all works within the lot and related correspondence with Council. The project manager will be responsible for:

- The prioritisation of maintenance tasks and their allocation to personnel;
- Regular inspection of weed invasion and the implementation of methods that control weed re-colonisation at the earliest possible opportunity to minimise weed spread as well as costs;
- Regular inspection of re-planting initiatives and the co-ordination of adaptive management tasks as necessary;
- Co-ordinating and implementing the formal monitoring program and the preparation of annual reports to Council;
- Reviewing activities on an annual basis and re-prioritising actions as needed.

The site should be inspected at least once a month by the project manager whilst primary weeding and re-planting activities are taking place. Once this phase is complete, inspections should be conducted every three months for the next year, then every six months after that for the life of the VMP.

## **6.3 Monitoring Program**

As well as regular site inspections and maintenance checks, a formal monitoring program needs to be implemented to enable ecological improvements to be documented and reported to Council.

Before implementing any management actions, baseline monitoring is required so that initial conditions can be recorded prior to any management occurring on the site.

The following activities are to be conducted as part of a formal monitoring program:

- Establish a series of fixed monitoring points. Three monitoring points (per 2 ha lot) should be established as a minimum. If re-planting is required, at least one monitoring point should be located within an area designated for re-planting;
- Use the monitoring point to form the corner of a 20x20m quadrat. Conduct a floristic survey within the quadrat, noting any weeds and stating the relative abundance of weed species (using the Braun-Blanquet scale), as well as projective foliage cover of native species in each strata.

- Take photographs from each monitoring point from the same aspect each year and compare photographs to previous years;
- Record numbers of failed plantings in each quadrat (where appropriate);
- Note any other weed outbreaks or required management actions.

Monitoring should take place prior to the commencement of the activity, then every six months for the first two years during primary weeding and re-planting and annually thereafter for the duration of this plan.

## 6.4 Key Performance Indicators (KPIs)

The expected outcomes for the site are described in Section 4.2. KPIs are outlined below that will enable an assessment to be made of whether the objectives set out in this EMP are being achieved. Not all of the KPIs below will be relevant to all lots within the subject site (i.e not all areas require re-planting). However these should be used as a guide when preparing individual VMPs for each lot.

It is suggested that the KPIs include:

- *The distribution of weeds:* significant ecological weeds should be reduced to very low percentage cover levels;
- *The distribution of native species:* native plant species cover should increase to high percentage cover levels;
- *Percentage of plant losses in reconstruction areas:* plant losses should not exceed 10% of total plantings in any one planting area;
- *Erosion control:* erosion should not spread to previously uneroded areas and banks should become stabilised through increased vegetation cover;

The KPIs listed here will need to be reported on annually and shown to be achieved at the end of the five year period in order for the management of the site to be handed over to individual landowners (see below).

## 6.5 Reporting

A brief and concise report should be prepared annually by suitably qualified personnel and submitted to Council every year for the life of the VMP. The report will:

- Describe the regeneration/reconstruction works undertaken;
- Describe the outcomes of the management activities;

- State the findings of the monitoring activities;
- Report on the status of the KPIs;
- Discuss any problems encountered in implementing the VMP; and
- Recommend any adaptations or additions to the VMP.

The report should contain the photographs, as well as a short description of weeds in each quadrat and a short comparison of the photographs to the previous years. Any other notable occurrences of weeds should also be reported. The report should also recommend and prioritise areas where weed control should be targeted.

At the end of the five year period, a final report is to be produced that assesses whether the management activities have met the KPIs. If the KPIs have not been achieved, the developer will be responsible for continuing to manage the land until it can be shown that the KPIs have been met, to the satisfaction of Council.

The final report should incorporate recommendations for on-going long-term maintenance to enable residents to continue to manage the land in an appropriate manner. These should include techniques and timings for the removal of relevant weeds within each lot.

## 6.6 Implementation: Long-term Maintenance

### 6.6.1 Positive Covenants

There are a number of complications involved in having numerous landowners managing different sections of the conserved land, particularly in terms of individuals varying in the amount of effort made to manage their section of the conserved lands and the effect that this may have on neighbouring properties. Therefore it is recommended that the requirement for ongoing maintenance is set through the provision of a positive covenant such as a Section 88B or 88E agreement (refer to the *Conveyancing Act* 1919) which can dictate the use of the land in accordance with approved plans (such as a Vegetation Management Plan). This could simply relate to the ongoing management recommendations outlined in the final report for the site (submitted by the developer to Council) and should include provisions for on-going weed removal to ensure that weed cover does not spread to previously un-infested areas and requiring that any planting in conserved areas is limited to local native species. It would then be a condition of purchase that the landowner accepts responsibility for upholding the plan.

The practicalities of achieving this may be made simpler by setting up a Residents Association or similar to co-ordinate the management of the bushland in the conserved areas. This could initially be set up by the developer as an incorporated body, with the residents assuming responsibility for the plan as the lots were sold.

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