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Bushland Plan of Management:

Everglades Retirement Gardens
Lot 20, DP 833218, Hillview St, Woy Woy

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1.0 Introduction

In Section 7 (Ameliorative measures) of the Species Impact Statement prepared by Robert Payne of ES&M for the Everglades Retirement Village on the new Lot in the subdivision of Lot 17 DP 833218 Hillview St, Woy Woy (the Site, Figure 1), it was stated that:

The areas of local native vegetation to be retained and bush-regenerated are to be conserved as a Formal Conservation Area with:

- *A bushland plan of management be prepared; and*
- *A formal conservation covenant be placed over the retained local native vegetation.*

The bushland plan of management is to include:

- *Clear aims;*
- *Realistic targets;*
- *Regular monitoring (1, 3, 6, 12, 18, 24 monthly then yearly) which includes monitoring of any corrective action requests in reports;*
- *objectives;*
- *Regular reporting (including corrective action requests and reassessment of targets as required) within one month post monitoring;*
- *The bush regeneration works are to be carried out by qualified bush regenerators under the supervision of a bush regenerator/restoration ecologist with at least 5 years experience.*

A total of approximately 6,433 m² of bushland is to be carefully regenerated (Figure 2 of this report, Figure 8 of Chase Burke & Harvey, Ref:04/061, dated June 2007) as part of the Bushland Plan of Management (BPM).

The approximately 6,433 m² of bushland to be bush regenerated forms the conservation area on the Site. Other vegetation to be retained includes the "courtyard area" with a large existing Corkwood tree (*Endiandra sieberi*).

The BPM has been prepared in response to the ameliorative measures specified in the Species Impact Statement and subsequently discussed and negotiated with Gosford City Council (GCC) and the Department of Environment & Conservation (DEC) for the Site. The BPM has been prepared in accordance with the Department of Infrastructure, Planning and Natural Resources - *How to prepare a vegetation management plan* (Appendix 1) and NSW National Parks and Wildlife Services – *General Guidelines for Environmental Management Plans* (Appendix 2).

The vegetation of the Site has been mapped by Benson and Fallding (1981), Benson and Howell (1994), National Parks and Wildlife (NPWS 2000, 2003) and surveyed by Bell (2004a, 2004b) cited in Clements and Rodd (2005). The flora data recorded by Robert Payne in five 20 m x 20 m quadrats was used in the BPM (Table 1, Figure 3).

It should be noted in this report that the term "weed" refers to all exotic and non-local native species.

The brief CVs of the authors of the BPM are given in Appendix 3.

2.0 Vegetation on the Site

Vegetation on the Site with the two co-dominant species (*Angophora floribunda* and *Eucalyptus botryoides*) recorded is considered to be the endangered ecological community *Umina Coastal Sandplain Woodland* (UCSW) in the Sydney Bioregion.

The vegetation on the Site is bushland fragmented by tracks and surrounded by:

- Residential properties to the north;
- A 30 m wide partly cleared Council owned reserve fronting Veron Street in the south;
- Hillview Street to the east; and
- A 25 m wide drainage reserve to the west.

It has been cleared in the past and subject to fire events. Higher levels of disturbance are evident along the boundaries and in the wetter areas to the North (James 2005).

The vegetation on the Site has previously been described by Payne (2005):

- The central part of the Site is dominated by canopy trees of *Corymbia gummifera* (Red Bloodwood) with an understorey of *Xanthorrhoea arborea* (Grass Tree) and pockets of *Lomandra longifolia* (Spiny Mat Rush) and *Dianella caerulea* var. *producta* (Dianella).
- Along the Hillview Street frontage and part of the northern boundary is forest vegetation dominated by *Eucalyptus botryoides* (Bangalay) with a few *Angophora floribunda* (Rough-barked Apple) being present as canopy trees. The understorey and mid storey vegetation is well developed with a *Banksia serrata* (Old Man Banksia) understorey.
- The western boundary beside the drain comprises a young vegetation community of *Eucalyptus robusta* (Swamp Mahogany) forest along with *Melaleuca quinquenervia* (Broad-leaved Paperbark). This community has poorly developed mid and understorey.

In the five 20 m x 20 m quadrats (Figure 3), the composition of species recorded was:

Quadrats	Total	Native	Exotic
1	41	28	13
2	26	17	9
3	22	21	1
4	21	21	0
5	22	18	3

The exotics recorded in the five quadrats were *Asparagus officinalis*, *Bidens pilosa*, *Canna indica*, *Cinnamomum camphora*, *Conyza* sp., *Ehrharta erecta*, *Hydrocotyle bonariensis*, *Lantana camara*, *Ligustrum lucidum*, *Melinis repens*, *Nephrolepis cordifolia*, *Pennisetum clandestinum*, *Petunia* sp., *Rhaphiolepis indica*, *Senna pendula* var. *glabrate*, *Senna* sp. and *Zantedeschia aethiopica*. It is likely that a greater number of exotic species are present on the Site, notably *Andropogon virginicus*, *Ipomea indica*, *Hypochaeris radicata* and *Sida rhombifolia*.

3.0 Threats to the existing vegetation

Threats listed in the Final determination in paragraph 7 are:

7. *Umina Coastal Sandplain Woodland* has been extensively cleared for suburban development and remnants are not within conservation reserves. Remnants are very small and threatened by mowing and slashing, weed

invasion, sand extraction and modified fire regimes. Weed species include Lantana camara, Chrysanthemoides monilifera, Ipomoea cairica, Paspalum urvillei, Bidens pilosa, Pennistenum villosum, Coreopsis lanceolata and Ehrharta erecta.

The proposed development may potentially impact vegetation on the Site by:

- Changes to the surface water flow;
- Accidental vehicle and pedestrian movements;
- Increased exposure to sunlight;
- Habitat fragmentation;
- Mowing and slashing;
- Weed invasion; and
- Modification of fire regime.

3.1 Managing potential threats to the retained bushland and bushland managed buffer

In order to minimise the potential impacts:

- Stormwater and runoff from non-porous surfaces is not to be directed into the conservation area;
- The conservation area is to be clearly identified and fenced during the construction period;
- Increased exposure to sunlight will be mediated through careful bush regeneration and buffer edge planting;
- Existing access tracks within the conservation area are to be bush regenerated in order to reduce existing fragmentation (except for dedicated access tracks);
- The conservation area is to be defined and edged to reduce risk of mowing and slashing, with sprinkler use for bush fire management; and
- Weed invasion shall be minimised through careful and ongoing bush regeneration with regular monitoring and implementation of corrective action requests.

4.0 Bushland Plan of Management

4.1 Aim

The aim of the BPM is to conserve and enhance the vegetation within the approximately 6,433 m² bushland conservation area.

4.2 Management objectives

The management objectives are:

1. Conserve and enhance the flora and fauna species diversity and their habitat requirements in the conservation area during construction and in the long term; and
2. Monitoring and maintenance of the conservation area, including maintaining combustible ground fuels as specified by the appropriately qualified Bushfire Consultant immediately prior the fire season.

The satisfaction of each management objective will be contingent on meeting specific targets. The specific targets associated with each management objective are presented in Table 2. Table 2 outlines the details of vegetation management, with time frames for carrying out the tasks to complete each management objective.

The implementation of the BPM is to occur over an initial primary weed removal period, after which on-going maintenance will be required.

4.2.1 Management objective 1 - conserve and enhance the conservation area

In order to protect, conserve and enhance the existing vegetation of the conservation area, the following are required:

- Identify rehabilitation resources in any areas to be cleared within the development area;
- Collection of local native seed for propagation and for direct seeding of the existing tracks and disturbed areas;
- Protection of the existing vegetation in the conservation area;
- Soil preparation of disturbed areas within the conservation area, as required;
- Develop a dense planted perimeter for the conservation area;
- Weed management;
- Reduce fragmentation by the re-establishment the local native species in the existing tracks and disturbed areas in the conservation area;
- Avoid planting exotic and non-local native species within landscaped areas of the development area; and
- Implement careful bush regeneration.

4.2.1.1 Identify rehabilitation resources in any areas to be cleared

Prior to commencement of works on the Site:

- *Macrozamia communis* and *Xanthorrhoea resinifera* individuals within the building footprint to be cleared shall be clearly marked with surveyors tape prior to clearing the development area. These individuals are to be replanted and where practicable utilised in landscaping and/or the disturbed areas of the conservation area.
- Small plants from the areas to be cleared within the development area are to be identified and marked with surveyor tape for use in the disturbed areas and/or landscape areas;
- All workers on the Site are to be fully inducted as to the conservation significance of the retained vegetation in the conservation area;
- Trees to be retained within the development area are to be assessed by an arborist and appropriate protection be installed; and
- Prior to clearing in the development area, vegetation to be cleared is to be assessed by a fauna consultant.

4.2.1.2 Collection of local native seed for propagation and for direct seeding of the existing tracks and disturbed areas

In order to retain the genetic integrity of the vegetation in the conservation area, plant material to be used for revegetation on the conservation area is to be restricted to local endemic species and local provenance seed collected on the Site.

Seed collection from areas being cleared for the development is to be carried out by nurseries specialising in growing local native flora. Any collections from the conservation area for propagation or direct seeding are to be limited to less than 20% of the ripe seed, in accordance with current best practice (Ralph 1994, Mortlock 1998).

The seeds and propagation material are to be used to grow tubestock. A nursery specialising in growing local native flora will conduct the propagation.

In order to promote long-term natural regeneration, seed collection from the future living seed bank is to be in accordance with the conservation guidelines (Ralph 1994, Mortlock 1998). Creation of a seed bank will assist ongoing maintenance of the area.

Prior to commencement of works on the Site,

- Local native seed, seed bearing branches and identified small plants within the development area are to be collected and will be re-used in the disturbed area within the conservation area; and
- *Lomandra longifolia* and *Dianella caerulea* seed will be collected for the planting of the protective edge of the bushland buffer

4.2.1.3 Protection of the existing vegetation in the conservation area

A sediment control fence and other appropriate coloured fencing required by the supervising ecologist is to be installed by the contractor to:

- Clearly identify the areas of bush regeneration and revegetation;
- Reduce the risks of machinery inadvertently damaging the conservation area; and
- Prevent the use of open areas as dumps.

Sediment control fences are required during the bush regeneration phase to limit weed seed spread. During the construction of any future development, sediment fencing will reduce the risk of sediment movement into the bushland conservation area, in accordance with Gosford City Council Erosion and Sediment Control policy.

All fencing is to be checked at regular intervals.

4.2.1.4 Develop a densely planted perimeter of the conservation area

Post construction and prior to occupancy, a physical barrier on the outer edge of the bushland buffer is to be densely planted with locally sourced *Lomandra longifolia* and *Dianella caerulea* in areas of less dense vegetation.

The dense planting, especially of the spiky plant *Lomandra longifolia* reduces the risk of accidental intrusion by residents and visitors to the conservation area and provides a formerly defined edge to the conservation area. The dense monocot planting creates a physical barrier and visual separation as well as reduces the risk of invasion from edges of exotics.

Fencing of the property of the boundary will be required, if there is risk of dumping and illegal entry.

4.2.1.5 Weed management

Weed management occurs in three stages, namely:

- Primary weed control, involving initial weed removal works removing the bulk of the weed infestations. This work includes mechanical removal using on-site equipment to remove larger individuals and scalp the soils in areas of high infestation;
- Secondary weed control, involving follow-up removal of weed regrowth; and
- Tertiary weed control, involving maintenance following monitoring.

4.2.1.6 Reduce fragmentation by the re-establishment of the local native species in the existing tracks and disturbed areas in the bushland conservation area

Revegetation will aim to link currently fragmented areas of native vegetation to create vegetation corridors and to increase the viability of the native vegetation to be conserved.

Revegetation of open areas with local native species requires:

- On-going weeding;
- Collection of seed and propagation material;
- Plant propagation; and
- Planting of tubestock as required.

Some of the seed collected from stock plants and from onsite material will be used in the direct seeding. In the later stages of the bushland regeneration works, cut seed bearing branches may also be used to introduce seed to any remaining open areas.

The construction of a boardwalk in the bushland conservation area may be provisioned if:

- The construction occurs on existing tracks, where practicable;
- No vegetation is cleared during or after construction on either side of the boardwalk; and
- Bush regeneration along the boardwalk is ongoing to prevent the tracking of seeds into the bushland conservation area.

4.2.1.7 Avoid planting exotic and non-local native species in landscape areas

In relation to landscaping, in order to maintain bushland integrity, the areas that are proposed to be landscaped are to be planted with local native species of local provenance.

4.2.1.8 Implement careful bush regeneration

Except where otherwise specified, all works are to be carried out by suitably qualified and experienced bush regenerators, with supervision by a restoration ecologist where required.

Bush regeneration of the conservation area is to follow the following procedures:

4.2.1.8.1 Bush regenerators

Bush regeneration works are to be carried out in teams of at least two bush regenerators with at least one having qualification of at least NSW TAFE certificate II in Bush Regeneration or equivalent experience.

4.2.1.8.2 Primary removal

Primary removal of exotic species including but not limited to:

- *Lantana camara* (Lantana)
- *Chrysanthemoides monilifera subsp. rotundata* (Bitou Bush)
- *Canna indica* (Indian Shot, Canna Lily)
- *Ligustrum lucidum* (Broad Leaved Privet)
- *Cinnamomum camphora* (Camphor Laurel)

- *Ochna serrulata* (Mickey Mouse Plant)
- *Senna pendula* var. *glabrate* (Senna)
- *Zantedeschia aethiopica* (Arum Lily)
- *Nephrolepis cordifolia* (Fishbone Fern)

All vegetative material must be bagged and removed from the Site, as required by the supervising ecologist/bush regenerator. Recommended methods for removal are given in Table 3.

Seed heads of other exotics encountered during primary removal should also be bagged and removed from the Site, as required by the supervising ecologist/bush regenerator.

4.2.1.8.3 Secondary Maintenance

Secondary maintenance includes the removal of all exotic species listed in Table 3, and any others that are subsequently recorded. Particular attention needs to be paid to the following areas:

- The wetter areas in the north of the Site adjacent to the residential dwellings; and
- Edges of the conservation area, including the existing tracks within the bushland.

Attempts should be made to prevent access to the tracks through the bushland by:

- Blocking access to the tracks with placement of seed-bearing (where possible) native vegetative material cleared from the development area; and
- Direct seeding using available seed from the Site.

In areas of pure stands of exotic species, other control methods than those listed in Table 3 may be applied as necessary. Attempts to control *Andropogon virginicus*, *Ehrharta erecta*, *Stenotaphrum secundatum* will only be effective when a sufficient vegetation cover is present.

Skilled restoration ecologists and bush regenerators may vary the techniques used, depending on seed availability and climatic conditions in order to achieve successful outcomes.

4.2.1.8.4 Follow up

Maintenance bush regeneration is essential for the control of all of these species.

A record of works completed should be supplied to the supervising ecologist for inclusion in the monitoring reports.

Any bush regeneration correction action requests arising from the monitoring reports are to be incorporated into the follow up weeding program.

4.2.1.9 Maintenance of combustible fuel loads

In order to minimise risk of uncontrolled bushfire, a suitably qualified Bushfire Consultant is to assess the fuel loads within the Conservation Area in the annual inspection in August of each year:

- Ground litter fuel loads exceeding 8 tonnes/hectare (dry weight) shall be removed by raking and hand removal; and
- Elevated combustible fuels, such as dead branches and shrubs shall be cut and removed by hand.

The required removal is to be the satisfaction of the Bushfire Consultant, before the commencement of the designated Bushfire Danger Period (1 October to 31 March).

The corrective action for the removal of fuel loads is to be carried out under the supervision of the restoration ecologist/supervising bush regenerator.

4.2.3 Management objective 3 – Monitoring and maintenance

The aim of monitoring and maintenance is to ensure that the maintained bushland is being kept in good condition, not being invaded by weeds, with less than 8 tonnes/hectare combustible ground fuels immediately prior to the fire season.

Prior to commencement of bush regeneration works, discussions are to be held with Council's Bushland Officer.

Maintenance is required for the life of the Everglades Retirement Gardens project. Maintenance is required to include sediment and erosion control during the construction phase, weed control, additional direct seeding and additional tubestock planting required for achieving successful rehabilitation of the conservation area.

In the early phase of the project, sediment and erosion controls are to be inspected weekly, requests for corrective actions made where required and implemented promptly by the contractor.

All rehabilitation works are to be monitored, with reports prepared at regular intervals (1 month, 3 months, 6 months, then 6 monthly during the next 18 months, followed by annual reporting) detailing the success of rehabilitation works and any corrective action requests. The reports are to include details of rainfall, works done, further works required, a photographic record of works and photographs from the fixed monitoring points.

As increases in native species diversity and decreases in exotic species diversity over time are indicative of success of the rehabilitation works, data from the fixed transects is to be recorded six monthly or yearly, depending on plant growth.

Results of the monitoring are to be discussed with the on site live-in Village Manager. Any issues that arise through the monitoring process are to be addressed and corrective actions implemented in association with the Village Manager. The works arising from corrective action requests will be monitored and reported in the subsequent documents.

5.0 Setting targets

The works program has been designed with a series of targets. Targets are measurable, detailed performance requirements arising from the objectives. Often more than one target may be required to achieve a single objective. These targets are set with the monitoring reports specifying whether the targets have been met. In the reporting, the targets are reviewed and new targets specified as required.

The long term objectives for the conservation area are to:

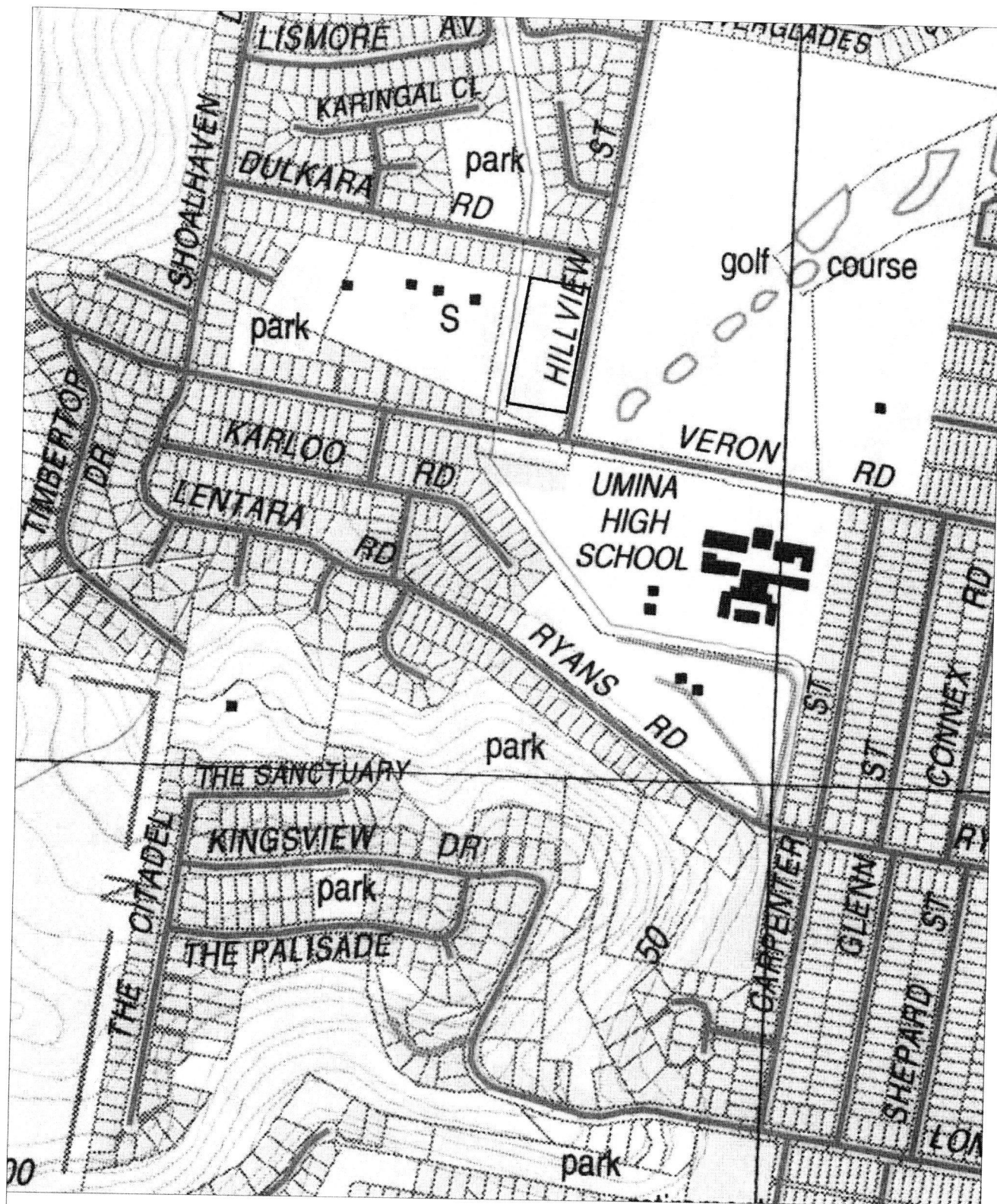
1. Conserve and enhance the flora and fauna species diversity and their habitat requirements in the bushland surrounding the proposed development during and after construction; and
2. Monitoring and maintenance of the conservation area.

The targets and actions required for the implementation of the Bushland Plan of Management are set out in Table 2.

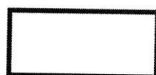
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Figures



Legend



Site location

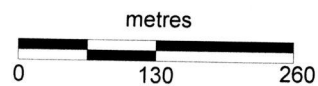


Figure 1.
Location of the Site

PROPOSED LOT 19

CREEK

TOP OF BANK

VERON ROAD

HILLVIEW STREET

KERB & GUTTER

EXISTING

FOOTPATH

CONCRETE

CONCRETE

NOTE: any tree not coded is *Corymbia gummitera* - Red Bloodwood

SAPLINGS CODE

RB = *Corymbia gummitera* - Red Bloodwood
 RBA = *Angophora floribunda* - Rough-barked Apple
 B = *Eucalyptus tereticornis* - Bangalay
 BI = *Banksia serrata* - Old Man Banksia
 RM = *Eucalyptus resinifolia* - Red Mahogany
 GT = *Xanthorrhoea arborea* - Grass Tree

TREE CODE

BS = *Banksia serrata* - Old Man Banksia
 AF = *Angophora floribunda* - Rough-barked Apple
 ER = *Eucalyptus robusta* - Swamp Mahogany
 MQ = *Allocasuarina quinquenervia* - Broad-leaved Paperbark
 EB = *Eucalyptus polyoides* - Bangalay

LAND UNDER A COSEVATION PLAN

DEVELOPMENT AREA

CLUMPS OF GRASS TREES

TREE

GRASS TREE

SAPLING

Client: Providence Projects

Date: April 2006

Ref: 04/061

Drawn by: S. MORRISON

Reduction Ratio: 1:250

Scale: 0 25 50 75 100 125 150

Supervised by: I. HARVEY & J. FEENEY

Check: R. FLETCHER

Lot No. 17

Project No. D.P. 833218

LGA. CO. 31

Locality. WOODWAY

Lot No. 0.5 m

AHD

ASIAN HEIGHT DATUM

DATE: PM 195997

Parish. PATONCA

County. NORTHUMBERLAND

Rel. 4.122

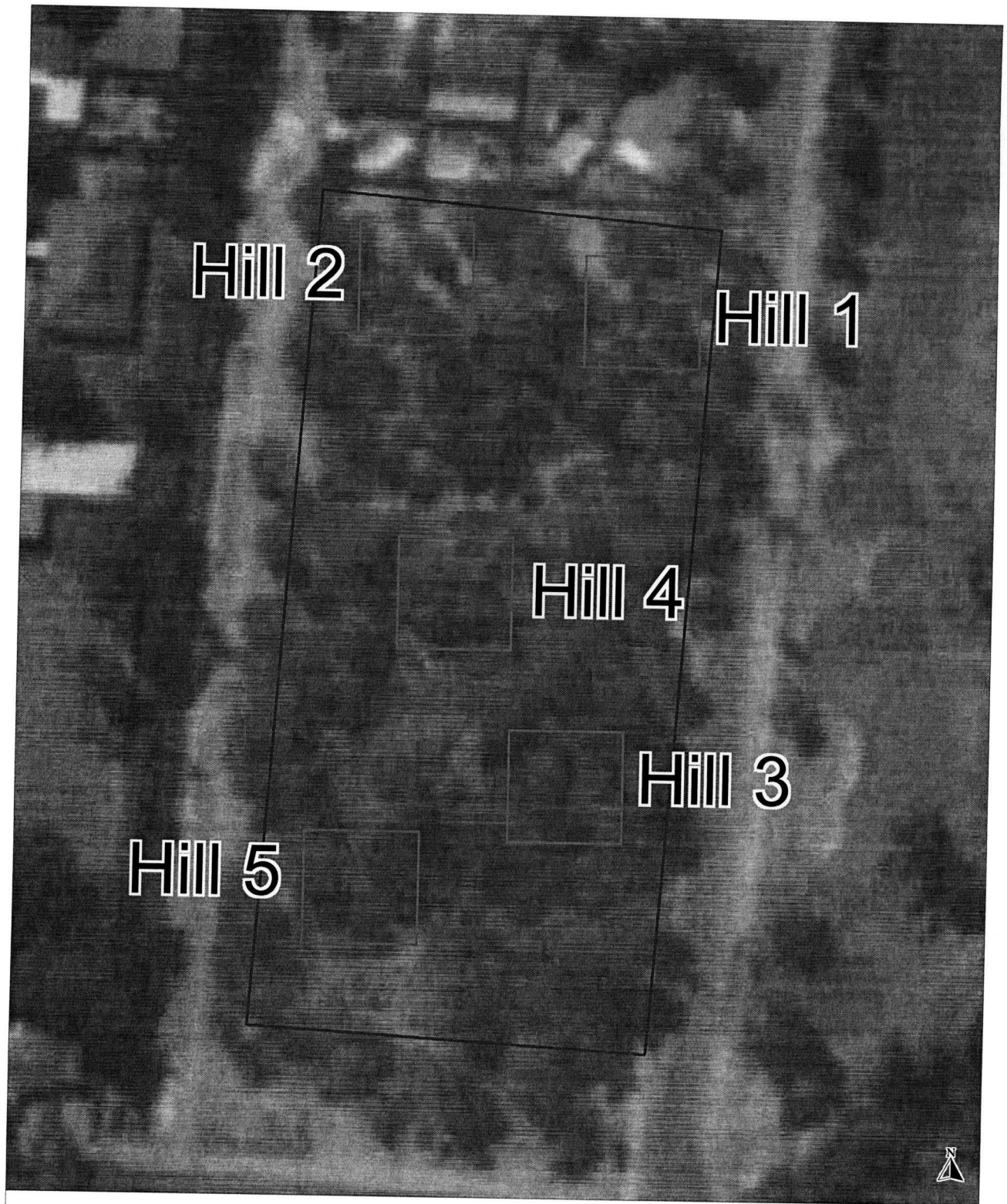
MAP SHOWING VEGETATION AFFECTED/PROTECTED OVER SUBJECT SITE AT THE CORNER OF HILLVIEW STREET AND VERON ROAD WOODWAY

Figure 8

PLAN 2 OF 2 A1

CHASE BURKE HARVEY

LAND TWO & LAND THREE OWNERS



Legend



Study Area



Approximate location of quadrat

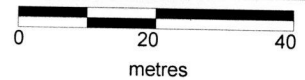


Figure 3.
Approximate sampling locations on the Site by Robert Payne

Tables

Table 1
Species recorded by Robert Payne on the Site

Exotic	Scientific name	Common name	Hill1	Hill2	Hill3	Hill4	Hill5
	<i>Acacia brownii</i>		1			1	
	<i>Acacia longifolia</i>	Sydney Golden Wattle	1				2
	<i>Acacia suaveolens</i>	Sweet Wattle	1	1	1	2	1
	<i>Allocasuarina littoralis</i>	Black She-Oak	1		1	1	
	<i>Allocasuarina torulosa</i>	Forest She-oak			1		
	<i>Amperea xiphoclada</i>	Broom Spurge					2
	<i>Angophora floribunda</i>	Rough-barked Apple	1	3			
*	<i>Asparagus officinalis</i>	Asparagus	1	4			
	<i>Baloskion tetraphyllum</i> subsp. <i>meiostachyus</i>	Tassel Cord-rush, Tassel Rush	4		3	1	3
	<i>Banksia serrata</i>	Saw Banksia, Old Man Banksia		1		4	
*	<i>Bidens pilosa</i>	Farmer's Friend, Cobblers Pegs, Beggar's Ticks		1			
	<i>Blechnum indicum</i>	Swamp Water Fern					2
	<i>Bossiaea heterophylla</i>		1			3	
	<i>Breynia oblongifolia</i>	Coffee Bush	3	4			
*	<i>Canna indica</i>	Indian Shot	1				
*	<i>Cinnamomum camphora</i>	Camphor-laurel	2	2	1		1
	<i>Comesperma ericinum</i>	Heath Milkwort					2
*	<i>Conyza</i> sp.						1
	<i>Corymbia gummifera</i>	Red Bloodwood	1		3	1	
	<i>Cymbopogon refractus</i>	Barbed Wire Grass				1	
	<i>Desmodium</i> sp.		1				
	<i>Dianella caerulea</i>	Blue Flax-lily	4		5	2	3
	<i>Dianella caerulea</i> var. <i>producta</i>		2	4			
	<i>Digitaria breviglumis</i>				1		2
*	<i>Ehrharta erecta</i>	Panic Veldgrass	1				
	<i>Endiandra sieberi</i>	Hard Corkwood				1	
	<i>Eriostemon australasius</i>	Wax Plant			3		
	<i>Eucalyptus botryoides</i>	Bangalay	3	2			
	<i>Eucalyptus robusta</i>	Swamp Mahogany	1	1		1	4
	<i>Eustrephus latifolius</i>	Wombat Berry		1			
	<i>Gahnia clarkei</i>	Saw-sedge					2
	<i>Glochidion ferdinandi</i>	Cheese Tree	1	1	1		
	<i>Glycine clandestina</i>	Twining Glycine		1			
	<i>Gompholobium grandiflorum</i>	Wedge-pea	1				
	<i>Gompholobium latifolium</i>	Golden Glory Pea				1	

Exotic	Scientific name	Common name	Hill1	Hill2	Hill3	Hill4	Hill5
	<i>Gonocarpus tetragynus</i>		1		1		
	<i>Hybanthus monopetalus</i>	Slender Violet-bush			2		
*	<i>Hydrocotyle bonariensis</i>	Beach Pennywort		1			
	<i>Hydrocotyle peduncularis</i>	Pennywort	1				
	<i>Imperata cylindrica</i>	Blady Grass	1	1	1		2
	<i>Juncus usitatus</i>						1
	<i>Kennedia rubicunda</i>	Dusky Coral-pea					1
*	<i>Lantana camara</i>	Lantana	4	5			1
	<i>Leptospermum polygalifolium</i>	Yellow Tea-tree, Tautoon Tea-Tree	3			2	2
	<i>Leucopogon attenuatus</i>				1		
*	<i>Ligustrum lucidum</i>	Broad-leaved Privet		1			
	<i>Lobelia dentata</i>						
	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush					
	<i>Lomandra longifolia</i>	Honey Reed, Spike Mat-rush	1	1	2	5	
	<i>Macrozamia communis</i>	Burrawang	1		1		
	<i>Melaleuca linariifolia</i>	Flax-leaved Paperbark		1			
	<i>Melaleuca quinquenervia</i>	Broadleaved Paperbark	1	1			1
*	<i>Melinis repens</i>	Red Natal Grass	3	4			
	<i>Mitrasacme polymorpha</i>	Mitre Weed				1	
	<i>Monotoca elliptica</i>	Tree Broom-heath			2	3	
*	<i>Nephrolepis cordifolia</i>	Fishbone Fern	1				
	<i>Opercularia aspera</i>	Common Stinkweed	1				
	<i>Oplismenus aemulus</i>	Broad-leaved Basket Grass	2				
	<i>Pandorea pandorana</i>	Wonga Vine		1			
*	<i>Pennisetum clandestinum</i>	Kikuyu	1				
*	<i>Petunia</i> sp.		1				
	<i>Pittosporum undulatum</i>	Pittosporum	1		1		
	<i>Platysace lanceolata</i>	Lance-leaf Platysace	2		2	1	1
	<i>Platysace linearifolia</i>					1	
	<i>Pomax umbellata</i>	Pomax	4	3	3	4	2
	<i>Pteridium esculentum</i>	Bracken	6	4	6	5	7
*	<i>Rhaphiolepis indica</i>	Indian Hawthorn	1				
	<i>Ricinocarpos pinifolius</i>	Wedding Bush				2	
*	<i>Senna pendula</i> var. <i>glabrata</i>		1	3			
*	<i>Senna</i> sp.			3			
	<i>Smilax glyciphylla</i>	Sweet Sarsaparilla			2		1
	<i>Themeda australis</i>	Kangaroo Grass		3	1		3
	<i>Xanthorrhoea resinifera</i>	Grass-tree	3		3	4	

Exotic	Scientific name	Common name	Hill1	Hill2	Hill3	Hill4	Hill5
	<i>Xanthosia pilosa</i>					1	
*	<i>Zantedeschia aethiopica</i>	Arum Lily, Calla Lily	1				

Table 2 - Implementation of management objectives

Management objectives:

1. Conserve and enhance the flora and fauna species diversity and their habitat requirements in the bushland surrounding the proposed development during and after construction
2. Monitoring and maintenance of the bushland conservation area

Management objective	Task	Target	Time frame
1	Bushland conservation area is to be fenced off to prevent vehicle damage. This fencing incorporates sediment and erosion control measures. The sediment fencing is to be checked regularly by the supervising ecologist. Any damage to the fencing is to be rectified by the building contractor immediately.	The Conservation Area protected from sediment movement and damage during construction period.	Week 0 → end of construction
1	All workers on the Site are to be fully inducted as to the conservation significance of the retained vegetation in the conservation area	Limit movement of building works during construction period.	Week 0 and when required during construction period
1	Trees to be retained within the development area are to be assessed by an arborist and appropriate protection be installed. Protection to be inspected regularly by the supervising ecologist.	Limit damage to trees within the development area during construction period.	Week 0
1	Prior to clearing in the development area, the vegetation is to be assessed by a fauna consultant.	Minimise risk to native fauna.	Week 0
1	Restoration ecologist / bush regenerators and Village Manager are to meet on site with Council's Bushland Officer to discuss particulars of the bushland regeneration strategy.	Clarify works on the Site.	Week 1
2	Fixed photographic points are to be set up along the transects and from points within the development and on the boundary in consultation with Council's bushland officer.	For documenting change over time.	Week 1

1	Identification and collection of rehabilitation resources.			Week 1 and during construction
1	Primary weeding of exotic species in the bushland conservation area using bush regeneration techniques, as required by the supervising ecologist.		Maximise the use of the onsite resources. 30% reduction in weed occurrence in the first 6 weeks, further 30% reduction in the next 6 weeks.	Weeks 1 – 12
1	Creating a visual and physical barrier to the buffer zone using tightly planted native species (<i>Dianella caerulea</i> and <i>Lomandra longifolia</i>) sourced from local seed.		Minimise risk of accidental incursion into conservation area and to provide a low fire risk perimeter to the development.	After construction but early on along the boundary to Hillview St.
1	Secondary weeding of exotic species in the entire bushland conservation area.		Reduction of weed regrowth.	Week 4 and when required
2	Monitor combustible ground fuels within the Conservation Area by an appropriately qualified Bushfire Consultant. Monitoring will include annual inspection and determination of fuel weights throughout the Conservation Area.		Combustible ground and elevated fuels maintained at less than 8 Tonnes/hectare by raking and hand removal	Annual inspection in August during the life of the project Maintenance work is to be completed by 1 October.

2.	Monitoring of the progress of the bushland regeneration works is to be carried out regularly and a document prepared and submitted to the relevant authority. Monitoring will include: - Photographs from fixed locations; - Works done; - Any issues arising that require corrective actions, such as rubbish dumping or erosion. Issues arising are to be immediately addressed by the landowner; - Annual reports from appropriately qualified Bushfire Consultant and documentation of the implementation of the associated corrective actions involving removal of ground litter and dead above ground fuel reduction;	Documentation of changes over time. Reduction of risk to the conservation area by the implementation of any required corrective action requests. Ensure compliance with the agreed Conservation Covenant and Bushfire requirements as part of the reporting.	Month 1, 3, 6, 12, 18, 24 then yearly.
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Table 3.
Expected exotic species and recommended control method

Botanical Name	Common Name	Control Method
<i>Andropogon virginicus</i>	Whisky Grass, Broomsedge	Removal of seed heads and rhizomes
<i>Asparagus officinalis</i>	Asparagus	Removal of rhizomes, fruits contained and removed from site
<i>Bidens pilosa</i>	Farmer's Friend, Cobblers Pegs, Beggar's Ticks	Removal of seed heads and hand weeded
<i>Canna indica</i>	Indian Shot	Removal of rhizomes and seeds
* <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	Bitou Bush	Cut and paint stems at base, vegetation and seeds removed from site
<i>Cinnamomum camphora</i>	Camphor-laurel	Scrape and paint stems and trunk.
<i>Conyza</i> sp.	Fleabane	Removal of seed heads and hand weeded
<i>Ehrharta erecta</i>	Panic Veldgrass	Removal of seed heads and hand weeded
<i>Hydrocotyle bonariensis</i>	Beach Pennywort	Leave <i>in situ</i>
<i>Hypochaeris radicata</i>	Catsear, False Dandelion	Removal of seed heads and hand weeded
<i>Lantana camara</i>	Lantana	Cut and paint stems at base, all vegetative matter must be removed
<i>Ligustrum lucidum</i>	Broad-leaved Privet	Cut and paint stems at base, all vegetative matter removed
<i>Melinis repens</i>	Red Natal Grass	Removal of rhizomes and seeds
<i>Nephrolepis cordifolia</i>	Fishbone Fern	Removal of rhizomes and spores
<i>Ochna serrulata</i>	Mickey Mouse Plant	Scrape and paint stems and trunk.
<i>Pennisetum clandestinum</i>	Kikuyu	Removal of seed heads and hand weeded
<i>Petunia</i> sp.	Petunia	Removal of seed heads and hand weeded
<i>Rhaphiolepis indica</i>	Indian Hawthorn	Hand removal of saplings, mature plants cut and paint stems.
<i>Senna pendula</i> var. <i>glabrata</i>	Senna	Cut and paint stems at base, vegetation and seeds removed from site
<i>Sida rhombifolia</i>	Paddy's Lucerne	Hand removal, cut and paint stems
<i>Sonchus oleraceus</i>	Common Sow-thistle, Milk-	Removal of seed heads

Botanical Name	Common Name	Control Method
	thistle	and hand weeded
<i>Stenotaphrum secundatum</i>	Buffalo Grass	Removal of seed heads and hand weeded
<i>Verbena rigida</i>	Purple Verbena	Removal of seed heads and hand weeded
<i>Zantedeschia aethiopica</i>	Arum Lily, Calla Lily	Removal of rhizomes and seeds

* on the Gosford City Council Noxious Weed Declaration List.

Appendices

Appendix 1

Department of Infrastructure, Planning and Natural Resources undated
How to prepare a vegetation management plan

Department of Infrastructure, Planning and Natural Resources

How to Prepare a Vegetation Management Plan

(Version 4)

1. Assess the Site and determine constraints: flora and fauna (previous studies, endangered species & ecological communities/existing vegetation communities, etc.); habitat and corridor values; topsoil/litter layer quality; hydrology/hydraulics (flooding, surface waterrunoff/drainage, velocities, water table, etc.); frost areas; fire issues; contaminants; acid sulphate soils; salinity, roads and pathways, railways, airfields, service infrastructure (water, sewerage, gas, electricity, communications); stock and herbivore access (rabbits, hares, ducks, etc.); shadow zones; drainage; topography (slope, aspect, soils, geology, erosion, deposition); weeds and weed sources, risk of vandalism, public safety issues, etc.

2. Define project tasks: Describe each task necessary for the implementation of the plan, how each task will be done, the duration of each task, the priority order for each task and who will be responsible for undertaking each task.

3. Prepare a time frame (eg Gantt chart): Address all tasks in the project.

4. Liaise: contact Council Bushcare Officer, landcare or bushcare groups.

5. Provide details on seed collection and propagation: Local native species only to be used - identify local native seed sources, check on any licences required - identify who will propagate.

6. Prepare maps/diagrams and plant species lists: Describe existing vegetation, constraints, vegetation and natural features to be retained, proposed vegetation (species/communities, zonation from water to land, corridors/linkages, spacings, tubestock/virocells/long stems/direct seeding, etc.), sediment and erosion control, stabilisation works, etc.

7. Provide details on site preparation:

- protection of plants to be retained
- installation of sediment and erosion control devices
- completion of any site works (if any)
- weed control (techniques and sequences of removal)
- application of herbicides
- topsoil/litter layer storage
- soil remediation
- surface preparation (leveling, deep ripping, scarifying, mulching etc.)
- surface stabilisation - (needs to be suitable for the site/vegetation brushmatting, sterile cover crops, binding sprays, etc.)
- site drainage

8. Describe the planting program and method: Detail how it will be done, staging and also consider the installation of weed mats, mulch, stakes & ties, tree guards and the use of fertiliser types (justify their need), water-retaining crystals, etc.

9. Describe site and vegetation maintenance: Sediment and erosion control, watering, replacement of plant losses, weed control, disease and insect control, mulch, etc. (Note: DIPNR requires a minimum of two years maintenance after last plantings completed).

10. Describe the monitoring and review process: Include a method of performance evaluation, assessing the need for replacing plant losses, addressing deficiencies and six-monthly reporting.

11. Address other issues: Signage, relevant legislation, planning instruments/guidelines, OH&S, community involvement, liaison with DIPNR and others, how other parts of the site and adjacent areas can be managed to compliment the vegetation strategy (weed control, drainage, etc.), etc.

12. Prepare a costing: For the implementation of all stages and all components of the work - show details on unit cost, materials, labour, monitoring/ maintenance/ reporting, etc.

Appendix 2.

**NSW National Parks and Wildlife Services - *General Guidelines for
Environmental Management Plans***

NSW NATIONAL PARKS AND WILDLIFE SERVICE

General Guidelines for Environmental Management Plans

An Environmental Management Plan (EMP) is designed to provide a framework for the management of environmental issues throughout the lifetime of a consent for development, and usually provides for management:

- during all construction stage/s;
- during the lifetime of the operation; and,
- following completion of the operation.

The specific issues addressed in an EMP will vary from site to site and depend significantly upon the consents or approvals issued. These guidelines set out some principles to be considered when preparing EMPs for the management, rehabilitation and conservation of:

- areas of native vegetation;
- habitat for native flora and fauna, including threatened species; and
- Aboriginal sites and places, including both known and potential archaeological sites and areas of cultural heritage significance.

It is considered that the establishment of an EMP will assist the proponent and/or site manager to:

- clearly identify and plan for areas of conservation significance;
- synthesise planning, management and operational constraints;
- identify objectives, strategies and actions required to provide appropriate management of areas of conservation significance;
- identify contingency and monitoring mechanisms, and responsibilities for implementation, to ensure that the objectives are being achieved; and
- assist in meeting the requirements of the *Environmental Planning and Assessment Act 1979 (EP&A Act)*, *National Parks and Wildlife Act 1974 (NP&W Act)*, *Threatened Species Conservation Act 1995 (TSC Act)*, *Rural Fires Act* and *Native Vegetation Conservation Act 1997*.

Broadly, the EMP would include the following sections:

- **Land status and management** - identifies the tenure of the site (such as private or Crown land) and the land manager (eg. a government agency, private individual or a company).
- **Planning Framework** - identifies those existing planning requirements which form the basis of the EMP, including relevant provisions of:
 - Local (LEPs) and Regional (REPs) Environmental Plans;
 - State Environmental Planning Policies (SEPPs);
 - Regional Vegetation Management Plans (RVMPs);
 - Fire Management Plans;
 - Catchment Management Plans;
 - Conservation Plans for cultural heritage;
 - Plans of Management under the NPW Act;

- other Environmental Management Plans;
 - relevant policies such as the NSW Biodiversity Strategy and Coastal Policy;
 - Recovery Plans and Threat Abatement Plans; and,
 - Species Impact Statements (as described further below).
- **Objectives** - clearly identifies the desired outcomes of the EMP, including those outcomes required by the consents and/or approvals for the site.
- **Strategies** - establishes a framework for meeting the objectives of the EMP.
- **Actions** - the work plan, including details of how, where and by when work is to be carried out.
- **Monitoring** - details any monitoring programs to be carried out, and establishes assessment criteria and target achievements.
- **Contact protocols** - outlining procedures and any notifications to be given before works commence, together with contact details for the site or project manager (including emergency contact details).
- **Contingency Plans** - identifies actions to be taken should monitoring identify that objectives are not being met, or in the event that unusual circumstances arise (such as new threatened species being revealed, further Aboriginal relics being located or wildfire occurring).

Specific Contents of EMPs

To be an effective and useful document for site management, the EMP should include the following minimum information:

- map(s) placing the proposal in a regional and local setting;
- descriptions of the various operational activities that relate to the objectives of the EMP;
- detailed site maps illustrating:
 - a) the distribution of pre-activity vegetation and Aboriginal heritage and identifying how that is to be altered by the proposal; and,
 - b) areas of conservation significance;
 - c) the proximity of all proposed activities in relation to areas of conservation significance;
 - d) areas designated for rehabilitation, site conservation work or to be set aside for conservation purposes;
- detailed descriptions of the vegetation communities and any known threatened flora species in the study area;
- detailed description of the significant fauna species within the study area;
- identification and maps of the locations of essential habitat for any threatened species, populations or ecological communities;
- mapping of the location of all Aboriginal sites (including known and potential archaeological sites and areas of cultural heritage significance) within the study area and an assessment of the cultural significance of these;
- identification of habitat corridors and linkages between areas of remnant native vegetation which may assist faunal movement through the area;
- identification of any buffer areas; and,
- may also contain one or more aerial photographs of the site.

Other plans or reports, including Species Impact Statements, Recovery Plans

and Threat Abatement Plans

The EMP should have regard to other plans including any Species Impact Statements (SISs), Recovery Plans (RPs) and/or Threat Abatement Plans (TAPs) that are relevant to the site.

These documents include specific management requirements for:

- threatened species, populations, and ecological communities, and their habitats;
- critical habitat; and,
- key threatening processes.

Unlike most other tiers of the planning framework, these documents provide specific and detailed requirements for the management and conservation of threatened species matters.

Aboriginal heritage and community consultation

Measures for the management and conservation of sites or areas of Aboriginal heritage significance in an EMP should be developed in direct consultation with the local Aboriginal community, including any local Aboriginal Land Councils, known Tribal Elders Corporations and Native Title claimants. The advice of independent anthropologists or archaeologists may be sought to provide specialist input. To obtain a list of Land Councils or Native Title claimants contact:

NSW State Aboriginal Land Council
PO Box W125
PARRAMATTA NSW 2150
Ph: (02) 9689 4444

Department of Aboriginal Affairs
Level 5, 83 Clarence Street
SYDNEY NSW 2000
Ph: (02) 9290 8700
February 1999

Note that many developments may also require a consent to damage or destroy an Aboriginal relic or Aboriginal place from the Director-General of the NPWS under s.90 of the NP&W Act. In most cases, decisions on whether to grant a s.90 consent for a particular proposal are now considered as part of an integrated development application under the EP & A Act. The NPWS has separate guidelines that further explain the integrated development assessment process as it relates to Aboriginal sites and places.

The form of the protection/management of a site of natural or cultural heritage significance may include any of, but is not limited to, the following:

- either total or partial exclusion of works on or access to some or all areas;
- exclusion of specified activities from some or all areas;
- permanent or temporary (e.g. during construction) fencing;
- collection of "relics" (maybe linked to subsequent restoration);
- site conservation works (eg. erosion control, graffiti removal, etc);
- regular monitoring by the Aboriginal community;
- participation of Aboriginal community representatives during some stages of the process or specified activities;

- detailed recording of sites (including art, etc), followed by regular monitoring; and/or
- site interpretation

Part 2 – Management Issues

The following sections outline the issues associated with specific management requirements, some or all of which may apply to an EMP to varying degrees.

• *Fire Regimes*

The existing fire regime of an area is a key factor in determining ecological systems and functions. In particular, the impact of fire on species composition (diversity and relative abundances) can be highly significant.

There are a range of legal requirements and guidelines related to planning for bush fires that must also be considered in drawing together an EMP for fire management, such as the provisions of the Rural Fires Act 1997 and Australian safety standards associated with fire radiation zones around buildings and other structures.

Management of fire regimes therefore requires consideration of: fire radiation zones; fire trails; fuel loads; frequency of burns; intensity of burns; and, both ecological components and ecological processes. For example: some species of flora require periodic burning to stimulate growth; some fauna are particularly susceptible to hot fires (e.g. the koala); fires usually cause successional shifts, altering the species composition and relative abundances of native vegetation in particular; fires can remove protective cover for native species; and, weed invasion can often follow in the wake of fires.

The EMP should clearly: establish the human and ecological constraints on fire management; establish a burning program; specify environmental conditions that should be considered at the time of burning; and, clearly identify any approvals that will be required.

Examples of possible provisions:

- fire radiation zones of 20m around all buildings;
- fire trails to be no more than 4m wide;
- only low-temperature or high-temperature burns to be attempted;
- Conservation Area No.6 to be burnt every 2 years with higher temperature burn;
- habitat of known threatened species to be protected from burning (this is dependent on the ecological requirements of particular species and communities); and
- protection of Aboriginal sites vulnerable to intense fire.

• *Hydrological Regimes and Erosion*

The systems that regulate the flow of water through a site, including both surface and groundwaters, can be significantly altered during site development and as a result of subsequent site use. The most obvious of these changes include altered surface flow

patterns resulting from construction of dams, modification of streams, increased paved areas, and altered drainage patterns.

Modification of these processes can affect threatened species and Aboriginal sites by either reducing or increasing water flows to any given area. The EMP can be required to provide systems for the management of hydrological processes where they may affect such values.

Ensuring that water regimes through areas of conservation significance remain unaltered may be a fundamental component of the EMP.

Examples of possible provisions:

- prevention of stormwater entering identified conservation areas;
- low-water contingencies during drought conditions;
- maintaining 'net' movement of water through the site;
- appropriate on-site water quality controls;
- monitoring systems.

• ***Landscape Systems***

Management of landscapes is particularly relevant where the threatened species or Aboriginal heritage values of the site are not discrete. In particular, Aboriginal heritage areas and ecological communities may require landscape management approaches in order to adequately provide for conservation.

Large areas of a property may be designated for conservation purposes with a combination of active and/or passive management techniques for that area. In a well planned site, a range of different conservation values may be captured in a single conservation area. This form of site management is encouraged as it is more effective than smaller site-by-site management techniques, however, more discrete techniques are necessary and appropriate in some cases. Landscape management will also require careful consideration of conservation principles such as connectivity and edge-to-area ratio.

Examples of possible provisions:

- prevention of grazing through some areas;
- grazing by soft-footed species only (e.g. kangaroos, camels etc);
- weed management to be carried out through that area to prevent spread of bitou bush;
- revegetation with shallow rooted plants only in Aboriginal midden or burial areas.

• ***Soil and Geological Features***

Maintenance of the soil and geological resources of a site is essential to maintain many of the ecological processes at work. Such resources are also often a key source of Aboriginal archaeological evidence.

Whilst loss of soil surfaces is considered by a consent authority in assessing a development proposal and issuing consent, the continued protection of exposed soil surfaces is also an issue for the EMP. This is particularly the case during construction stages and clearing activities when unsupported soil can become exposed to erosive forces.

The geological character and special features of a site can be equally important, particularly as a record of Aboriginal heritage and in providing specific habitat requirements for some flora and fauna species.

An EMP must provide for management of soil resources during construction stages, using appropriate erosion control techniques', and following construction, usually through revegetation programs.

Some areas may be fenced and protected, such as rock outcrops or specific patches of soil. Translocation is rarely a solution in managing these resources.

Landscaping and other techniques may also be needed following the completion of work.

Examples of possible provisions:

- sediment control traps to prevent flow of top-soil off site;
- fencing a rock outcrop from all use;
- netting/gauze to prevent top soil from being blown away during construction;
- re-establishing a small hill and natural drainage line.

• ***Isolation Factors and Corridors***

The role each part of a site plays as habitat for a species can be markedly affected by the location of appropriate corridors. For example, an isolated sandstone outcrop may be essential habitat for the Broad-headed Snake, but it may also need adjacent tree hollows to nest in, and a way of moving to another outcrop without risk of exposure to predators.

Corridors of vegetation are an example of these transport routes, others including drainage lines (such as creeks) and rocky ridgelines. Ensuring that these corridors provide links between and across the various habitat components of a site is one of the critical issues to be addressed in an EMP.

Whereas some areas may need to be protected for their corridor values, there is scope for revegetation and other forms of habitat restoration to also provide corridor links between habitat patches.

Examples of possible provisions:

- fencing ridgelines, creeklines or treelines;
- revegetation programs;
- prevention of grazing through corridor, except for 2 months of controlled grazing each year;

- active weed control.

- **Special Habitat Features**

A number of threatened species and other species of conservation concern are habitat specialists. This means that they must have specific habitat features available in order to carry out their normal life-cycle. Examples of these species include the Koala (requires a range of eucalypt species), Glossy Black-Cockatoo (feeds on species of Casuarinaceae), Broad-headed Snake (requires rock scales for shelter and tree hollows for nesting) and *Zannichelliapalustris* L. (requires freshwater for its entire lifecycle).

As these requirements are usually discrete they are often more readily managed, however special provision may be required in order to achieve conservation of certain aspects of these habitats.

Examples of possible provisions:

- fencing a creekline;
- protection of all Casuarinas on a site;
- preventing removal of ground wood, or selective removal only;
- leaving standing dead trees (stags);
- ensuring water levels of at least 0.4m at specified locations in a dam.

- **Fauna Movement**

The movement of fauna throughout a site is a separate issue, although it is clearly linked to some of the matters considered above. Fauna require freedom to move within and between habitat areas. The home range (the geographic area used by a species during its lifetime) varies between and within species groups.

There are a range of human-made and natural barriers to fauna movement and both must be considered. Human-made barriers include buildings, fences, artificial drains, dams, open fields, screens, roads etc. Natural barriers can be rivers, cliffs and chasms. Natural barriers can be as effective as man-made barriers in restricting movement for some species that had previously been used to more freedom of movement in the area of the development.

An EMP should provide for the movement of native species between areas of identified habitat, particularly targeting those species of conservation significance on the site.

There may also be areas of a site where the total exclusion of native fauna is the desired outcome. In these case the barriers used should prevent the transition of even the smallest native animals.

Examples of possible provisions:

- fences that prevent cattle from moving into conservation areas including single strand electric fences or strand fences without mesh;
- climbing poles along all fence lines to allow koalas and other arboreal animals to move across the fenceline;

- slowed traffic conditions, signage and lighting along roads at points of high fauna use;
- fine grade mesh, 2m high electrified fences to prevent movement of feral cats, foxes or dogs into an area supporting fauna of conservation significance;
- clearly labelled signs on all fences indicating that it is a conservation area;
- clearly labelled signs preventing people from entering sensitive areas.

- ***Domestic Animals***

Domestic animals, both stock animals and pets, can have direct and marked effects on sensitive areas. Stock in particular can have devastating effects on stream banks and vegetation cover and in promoting soil compaction, whilst dogs and cats can exert direct predator pressure on native fauna.

On a private site, domestic animals can be excluded or restricted in many ways. Covenants can be used to restrict domestic pet ownership.

Examples of possible provisions:

- complete prohibition against domestic animals on site;
- special rules for dogs and cats, such as curfews;
- fencing to prevent movement of stock into creeklines or other sensitive sites.

- ***Weed and Pest Control***

Weed and pest control are two of the most widely applied requirements of EMPs. The form of, and need for, these requirements are extremely varied and depend upon the species being controlled. Often an approval for a development may be subject to conditions requiring the control of weed or pest problems on a site.

The problems of weed intrusion are usually exacerbated by development, including: increased spread due to areas being cleared; increased intrusion into new areas due to a reduction in ecological integrity; edge effects; movement of domestic stock introducing new weed seeds; and, feed for domestic stock introducing new weed species or seed.

Pest control, including control of feral animals such as dogs, foxes, cats, pigs and goats, as well as 'vermin' such as introduced rats and birds, can be necessary to varying extents depending upon the conservation values of the site. Sensitive ecological communities may require baiting programs, direct removal and/or other techniques for control of introduced or other pest species. Pest and weed control may also be necessary to protect Aboriginal heritage sites, for example to reduce impacts from feral goats, but weed removal either by hand or poison may also damage some sites.

Examples of possible provisions:

- manual, chemical or biological removal of weed species;
- baiting programs for cats and dogs;
- fencing to exclude goats and pigs;
- fencing to exclude cattle, whilst also allowing wombats to move through;
- active revegetation and / or regeneration to exclude weed colonisation.

- ***Overuse - vehicle or pedestrian traffic***

Good site management often requires mechanisms to ensure that sensitive areas are not degraded by overuse. In practice, absolute restriction is often neither feasible or desirable and in many instances a balance can be reached that meets both conservation and access objectives.

However, in some cases restrictions on access are necessary to ensure maximum protection of conservation values. This may include; areas containing habitat for threatened species (such as the Wollemi Pine); areas undergoing regeneration; already degraded areas; or areas not safe for general public access.

In addition, it may be appropriate to restrict access to areas and sites of Aboriginal heritage significance to minimise the risk of degradation or damage and to respect the spiritual or religious beliefs of Aboriginal peoples.

Examples of possible provisions:

- restricting or limiting access to some sites;
- temporary restrictions to allow regeneration;
- walking paths elevated and fenced to protect ground flora and Aboriginal sites;
- monitoring vehicular/pedestrian traffic.

- ***Waste and pollution management***

Waste materials and pollution that may result from the three stages of the lifecycle of a proposal include:

- solid, liquid and gaseous wastes: and,
- noise, odours and light pollution.

The waste products of any proposal are clearly identified as part of the consent process and frequently require ongoing management. EMPs are increasingly being used to manage pollution into water and air, and to manage putrescible and non-putrescible wastes.

Each of these factors can have marked effects on those issues of interest to the NPWS and containment is critical for the general purposes of environmental management and protection. Noise and light are both known to directly impact on habitat use by some fauna, some gaseous wastes inhibit plant growth and development, and odours can reduce the aesthetic value of national parks and other conservation reserves.

The EMP should incorporate specific provisions for the management and disposal of wastes, and the minimisation of pollution to the standards established by the Environment Protection Authority.

Examples of possible provisions:

- transportation and disposal of non-recyclable solid wastes produced during construction at a nearby landfill;
- composting of putrescible wastes;
- recycling of non-putrescible, recyclable waste products;
- screening to prevent light pollution.

- ***Rehabilitation and Restoration***

Rehabilitation or habitat restoration is usually incorporated as a key component of an EMP.

Rehabilitation tends to take the form of vegetation restoration, however it also needs to consider the need to re-establish other habitat components (such as dead logs, bushrock etc) and community processes (particular species may be needed to ensure ecological processes continue). This broader concept of habitat restoration is often a principle adopted by qualified bush regenerators.

The EMP should clearly identify those areas due for rehabilitation, the timing of rehabilitation works and the need for monitoring. Often rehabilitation processes are linked with other management processes such as weed control and landscaping.

All revegetation should use local native species, together with local soil types, which should be planted in abundances that imitate the naturally occurring local communities.

Examples of possible provisions:

- fence an area that is to be rehabilitated throughout the first 3 years of site use;
- replant trees in marked corridor areas at a ratio of 5 for every tree that is removed elsewhere on the site;
- landscape and revegetate a specified area using local endemic native plant species and / or seed sources;
- landscape and revegetate areas progressively as the site is developed.

- ***Ecological Integrity***

Finally, the ecological integrity of the site should be maintained as much as possible. Any development on site will reduce the ecological integrity of the site, however these impacts should be minimised wherever possible.

All of the categories above address individual components of the ecology of the site. However, the EMP has the capacity to draw these components together to provide a tool for comprehensive ecological management and provide opportunities for the conservation of Aboriginal heritage.

Many of the example provisions above can be combined to affect two or more different aspects of the conservation values of the site, and when combined carefully can produce synergistic cumulative effects.

Examples of possible provisions:

- fencing a creekline to restrict cattle, whilst allowing wombats and koala's to move through; using bait to reduce the numbers of foxes; and having a complete restriction on dogs to reduce the threat of koala kills;
- restrictions on the removal of dead or dying timber and Casuarina species; cat-proof fencing to exclude cats and an internal baiting program to remove feral cats from within an area enclosed for regeneration and protection of Glossy Black-Cockatoo;
- electro-fishing to remove predatory fish species, fencing to prevent cattle access and controlled release of water from the weir upstream to maintain habitat for a Green and Golden Bell Frog population;
- controls to minimise stormwater impacts on middens, restrictions on construction works in areas containing rock outcrops, limited pedestrian and vehicle access to specific Aboriginal sites, and opportunities for the local Aboriginal community to visit and interpret sites and monitor works.

Monitoring

An essential section of the EMP is the monitoring program. Every section of the EMP should have a list of desired outcomes and times to achieve those outcomes. The monitoring program should be established to measure progress towards those outcomes and modify strategies and actions accordingly if those outcomes are not being met.

Monitoring could include measuring regrowth, water-quality reports, soil testing, seasonal surveying for specified species to ensure continuance and/or increased abundance, and site inspections by representatives of the local Aboriginal community to ensure that relics or sites of Aboriginal heritage value are being maintained.

The employment of environmental officers or other specialists such as bush regenerators should ensure the quality and effectiveness of any management or protection works carried. Their role is especially important in the design and monitoring of ongoing regenerative work.

The results of monitoring are often required to meet consent or approval conditions and should be accurately recorded at all times. The results should also be accurately assessed to ensure that objectives are being met and a clear indication that this has been considered, including any assessment criteria used, well documented.

Contingency Planning

Unlike monitoring to achieve stated objectives, contingency plans should be in place in anticipation of the unexpected. Examples of this might include a new threatened species being sighted, breeding locations being found, or a new Aboriginal relic being unearthed during construction of an approved development.

The contingency plans might include immediate actions, such as halting work, seeking advice, seeking clarification on identifications or other options. They may also address longer term planning issues, such as development alternatives should the new 'find' prevent work proceeding.

Further Information

NPWS - General Guidelines for Environmental Management Plans dated February 1999

From time to time the NPWS produces documents that may assist in the preparation of an EMP, including technical documents on species management, guidelines for conservation planning or guidelines for protection of Aboriginal sites. For further information concerning these documents, contact the information desk of the NPWS on - (02) 9585 6333

For further information regarding Environmental Management Plans please contact:
Manager, Conservation Planning Unit Conservation, Programs and Planning Division
Central Directorate NSW National Parks and Wildlife Service

Appendix 3.
Brief CVs of the authors



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Brief CVs of authors of the Bushland Plan of Management

Dr AnneMarie Clements

Anne holds a M.Sc. (Macquarie Univ.) Thesis - *The vegetation of bushland in the northern Sydney area* and a Ph.D. (Univ. of Sydney) Thesis - *The vegetation of the sand masses of the mid-north coast of New South Wales* and has worked as plant ecologist for more than 20 years mapping and assessing vegetation, assessing and often ameliorating impacts of developments. Her major research interests include the impacts of urban development on bushlands and soil nutrients, elucidating naturally occurring vegetation patterns, effects of inundation and salinity levels on the distribution of estuarine vegetation (mangrove, saltmarsh, Casuarina fringing forest), effects of metal soil concentrations on plant growth and metal uptake, restoration ecology and re-establishment of components of native flora. She has worked closely with community groups, fauna consultants, town planners, geologists, engineers, lawyers, land developers and mining companies in planning and implementing optimal conservation strategies. She has utilised her research in the implementation of rehabilitation/conservation programs as part of sustainable development of sites. Four of these sites have won excellence awards for their quality and innovations, including "Excellence of Excellence" in 2000, Gold and Silver in NSW *Rivercare 2000*, Silver and Excellence in NSW Mineral Resources Excellence Awards and Excellence in the Earthmovers Awards.

Martin Sullivan

Martin holds a B Sc. in Biodiversity and Conservation (Macquarie University). Before joining Anne Clements and Associates, he worked as a bush regenerator at various sites across the Sydney region. He has experience in bushland and creekline rehabilitation, revegetation and regeneration. Martin is involved in vegetation surveys, research, data analyses, mapping and reporting.

Monique McKenzie-Gay

Monique holds a B. App. Sc. in Resource and Environmental Management (University of Canberra) and a Certificate II in Bush Regeneration from Ryde TAFE. Before joining Anne Clements and Associates this year, Monique worked as an Aerial Photo Interpretation Officer in the NSW Native Vegetation Mapping Program, CNR, DIPNR. She has also worked as a bush regenerator for Hurstville Council and various bush regeneration companies in the Sydney region.