



2.7 DEFINITION OF TERMS USED

Proposal: the construction of a Private Hospital at 35 Water Street Wahroonga, consisting of two (2) new interconnecting buildings to be built across the south central part of the site, south of Rippon Grange. The Proposal also includes the refurbishment of historic Rippon Grange, reinstatement of significant landscape elements, and the rehabilitation and reconstruction of areas of BGHF Habitat.

Subject Property: comprises Lot 1 DP 726091 (only). The Property (formerly known as the John Williams Respite Care Centre) is 2.13 hectares in size, and occupies land bounded by Water Street (north) and Young Street (east).

Region: is an area approximately 10 kilometres in diameter, centred on the Subject Property

Locality: for the purposes of this VMP, describes an area within one (1) kilometre of the Subject Property and includes land in the grounds of The Bush School (~ 100 metres north), Clive Evatt Reserve (~425 metres north east), Turiban Reserve South (~245 metres east), and Turiban Reserve North (~260 metres north east).

Habitat - an area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, and including any biotic or abiotic components present.

Ecological Community – described as an assemblage of species occupying a particular area.

Endangered Ecological Community – a community that is likely to become extinct unless the circumstances and factors threatening its survival cease to operate.

Critically Endangered Ecological Community – a community that in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with criteria prescribed by the Threatened Species Conservation Regulation 2002

UBM: UBM Ecological Consultants Pty Ltd: formerly trading as Urban Bushland Management Consultants ('UBMC')

DECC: NSW Department of Environment & Climate Change

NPWS: National Parks & Wildlife Unit of DECC

DWE: NSW Department of Water & Energy (formerly Department of Sustainable Natural Resources)



2.8 STATUTORY & PLANNING CONTEXT

A number of local planning policies, as well as State and Federal Acts and Policies apply to the management of remnant native vegetation in Ku-ring-gai Local Government Area. The most relevant of these, as they relate to the Proposal, are listed in Table 2.1, below.

Table 2.1: Summary of Policies, Planning & Legislative Requirements

GOVERNMENT LEVEL	RELEVANT POLICY /LEGISLATION	RELEVANCE TO SUBJECT PROPERTY
LOCAL	Ku-ring-gai Planning Scheme Ordinance	Lot 1 DP 375262 is zoned 5(a) Special Uses (Hospital) (Ku-ring-gai Municipal Council 2006).
	Plan of Management for KRG Council Bushland Reserves 2006	Council's Bushland PoM provides practical overarching guidance for the management of bushland reserves in the LGA The companion document to the Plan - 'Operation Information' - contains specific requirements & actions for individual reserves, with species lists and an overview of the relevant legislation and Recovery Plans. While not strictly applicable to bushland on private land, the PoM provides valuable information on local bushland species, habitats and ecological communities.
	Biodiversity Strategy May 2006	Among the Strategy Objectives are: - to prevent loss of local native biodiversity on public and private lands by eliminating/ameliorating threatening processes - to protect, enhance and where appropriate, increase local biodiversity on public and private lands - to protect and enhance aquatic and terrestrial ecosystems and habitats and connectivity between reserves. The VMP (as written) addresses each of the Strategy objectives listed above.
STATE	<i>Threatened Species Conservation Act 1995</i>	A single threatened flora species – Magenta Lilly Pilly (<i>Syzygium paniculatum</i>) – was recorded. This species has been planted widely throughout the Region, and is likely to be of horticultural origin rather than a natural occurrence. A single critically endangered ecological community – Blue Gum High Forest ('BGHF') – was recorded within part of the Subject Property. The community has been highly simplified, both structurally and floristically due to long-term severe disturbances. The Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>), is listed as 'vulnerable' under the Act. The Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>) is listed as a 'vulnerable' species throughout NSW.



GOVERNMENT LEVEL	RELEVANT POLICY /LEGISLATION	RELEVANCE TO SUBJECT PROPERTY
	<i>Noxious Weeds Act 1993(Amended 2005)</i>	There are 13 noxious weed species occurring within the Subject Property (see Section 4.3.4) As the landowner <i>Waterbrook</i> has a legal responsibility to control noxious weeds on the property and to prevent their spread to adjoining land.
	<i>Rural Fires Act 1997 / Amendment 2002</i>	The Subject Property is <u>not</u> classified as Bush Fire Prone Land (Ku-ring-gai Council 2002). Accordingly, no Asset Protection Zones are required to be established.
	State Environmental Planning Policy 19 – Bushland in Urban Areas	No areas within, or adjacent to the Subject Property are zoned as Community Land. Therefore the SEPP does <u>not</u> apply.
	State Environmental Planning Policy 44 – Koala Habitat	The Subject Property is not considered to constitute potential Koala habitat. Therefore, a Koala Plan of Management is <u>not</u> required.
	<i>Environmental Planning & Assessment Act 1979 – Part 3A amendment August 2005</i>	The project to develop a Hospital falls within the class of development included in Schedule 1 as “development that is declared to be a project in which Part 3A of the Act applies”.
	State Environmental Planning Policy (Major Projects) May 2005	Aims to identify project of economic, social or environmental significance to the State or regions of the State, so as to provide a consistent and comprehensive assessment and decision-making process for the development. Schedule 1 of the SEPP (Part 3A projects – classes of development) includes ‘Hospitals’ as development of the kind to which Part 3A applies.
	Sydney Regional Environmental Plan #20 – Hawkesbury Nepean River (#2, 1997)	The aim of the SREP is to “protect the environment of the Hawkesbury-Nepean River system by ensuring the impacts of future land uses are considered in a regional context”. Of relevance to this VMP, is the requirement that the ecological processes of the Catchment must be managed so that the diversity of flora and fauna communities, species and genetics is conserved and enhanced. In this regard, the impacts of the proposed development on the critically endangered BGHF Ecological Community will be minimal. The Proposal includes the rehabilitation and reconstruction of BGHF Habitat on the Subject Property. The Proposal has been supported by a Species Impact Statement (Cumberland Ecology March 2009) and a Vegetation Management Plan (UBM February 2009).



GOVERNMENT LEVEL	RELEVANT POLICY /LEGISLATION	RELEVANCE TO SUBJECT PROPERTY
COMMONWEALTH	<i>Environment Protection and Biodiversity Conservation Act 1999</i>	A single threatened flora species – Magenta Lilly Pilly (<i>Syzygium paniculatum</i>) – was recorded. This species has been planted widely in the Region, and these plants are likely to be horticultural plantings, i.e. not naturally occurring. A single threatened ecological community – Blue Gum High Forest ('BGHF') – was recorded within part of the Subject Property. The community has been highly simplified, both structurally and floristically due to long-term and severe disturbances. As the BGHF on the Subject Property is < one (1) hectare in size, the Commonwealth Department of Environment, Water, Heritage & the Arts ('DEWHA') has declined to consider the proposal as significant. The Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>), is listed as 'vulnerable' under the Act. This species is known to occur in the Locality and may, on occasion, utilise the resources of the Subject Property.



3 PLAN PREPARATION - METHODOLOGY

3.1 LITERATURE REVIEW

During the preparation of this VMP, a number of previous studies and investigations for the Subject Property, Locality and Region were consulted.

As the VMP is intended to serve as a 'stand alone' Report, data and other background information has been sourced from these documents, and where appropriate incorporated into the Plan. All such information has been appropriately referenced.

The main documents referenced were:

- *Flora and Fauna Assessment / Opportunities and Constraints Report for Lot 1 DP 375262 (John Williams Respite Care Centre) and Lot 1 DP 726091 (64 Billyard Avenue, Wahroonga).* (UBMC February 2005);
- *Flora and Fauna Assessment for the former John Williams Respite Care Centre* (UBMC July 2006);
- *Review of Ecological Issues & Proposed Development at 35 Water Street, Wahroonga* (Footprint Green July 2006);
- *Identity and Condition of Native Vegetation at 35 Water Street, Wahroonga* (Smith & Smith, December 2006); and
- *Species Impact Statement for a residential development Waterbrook @ Wahroonga, 35 Water Street, Wahroonga* (Cumberland Ecology, November 2007).
- *Vegetation Management Plan for Blue Gum High Forest Habitat – a guide to the rehabilitation and reconstruction of a native vegetation community at Waterbrook @ Wahroonga* (UBM Ecological Consultants December 2007).
- *Species Impact Statement 35 Water Street, Wahroonga* – (Cumberland Ecology, March 2009).

Other reports, investigations and literary references are included in the References Section 9 of the VMP.

In preparing the VMP, consideration was given to concerns raised by Ku-ring-gai Council and the John Williams Neighbourhood Committee ('JWNC') with respect to the impact of the proposed development on the remnant BGHF Habitat occurring within the Subject Property. Accordingly, correspondence and related documentation prepared by Council, its consultants, and by consultants engaged by the JWNC were reviewed, and each of the main issues raised have been addressed (see Section 4 Management Issues and Recommendations).



3.2 FIELD INVESTIGATIONS

Field survey and weed mapping was undertaken by Judith Rawling (BA, DipEd, DipEnvStud, MEnvStud), Belinda Pellow (DipAppSc, Ag), Kylie Reed (B. Env. Sc [Hons]) and Gabriel Wardenburg (B. EnvMgt) on 1 and 9 October 2008. Site visits and supplementary investigations were undertaken on a number of occasions in September and October.

These investigations were undertaken to update information and data provided in the previous investigations (UBMC 2005, 2006), Species Impact Statement (Cumberland December 2007) and VMP (UBM December 2007); with the last two (2) documents having been prepared in support of a previous Development Application.

Potential impacts of the new Proposal – the construction of a Private Hospital - and management issues for individual locations/sites within the identified BGHF Habitat areas were identified, while a range of management strategies and remedial actions were considered.

Methods used to undertake the condition of vegetation (weed) mapping for the Subject Property are described below.

3.3 CONDITION OF VEGETATION MAPPING

Field survey and supplementary weed mapping was undertaken on 1 October 2008. New investigations were undertaken in order to update floristic data presented in the Flora & Fauna Assessment Report (UBM 2006) and subsequent VMP (UBM December 2007).

Vegetation boundaries were mapped in October 2007 to show the extent of the BGHF Habitat areas. This area was confirmed in October 2008. The vegetation map includes the extended area of BGHF Habitat in the south-western sector of the Subject Property identified by Smith & Smith (2006) as 'potential' BGHF Habitat (see Figure 2.1) - described in this VMP as 'Non-Core areas'.

A Thales MobileMapper GPS unit was used to log data in the field, with locations being recorded in three (3) second increments. The MobileMapper is a hand-held unit, accurate of up to three (3) metres under favourable conditions, and allowing for rapid translation of data into a Geographical Information System ('GIS'). This allowed for the identification and survey of a number of discrete 'weed polygons'.

A revised list of weed (or introduced) species was prepared; with abundance/density recorded for each polygon surveyed. Weed Polygons were established in 2007 to identify the keystone and secondary weeds present and to determine their relative abundance within the BGHF Habitat. The previous VMP (UBM 2007) recommended that all keystone weeds should be targeted as a matter of priority, and a table of proposed control methods for each species was compiled.

In October 2008, five (5) of the same Polygons (A-E) were re-visited and re-assessed to identify any changes in weed abundance and species composition. All "weeds" were identified within each polygon, and each was given an abundance rating of <25%, 25-50%, 50-75% or 75-100%.



Polygon F surveyed in October 2007 was not re-surveyed in 2008 because it is located in an area not currently being considered for development (i.e. residual Lot 1 Billyard Avenue). An additional polygon – also called Polygon F – was established in the former Croquet Lawn in 2008.

For each weed species the following information was noted:

1. Noxious Weed and Class
2. Listed as an Environmental Weed (Nuisance Plant) by Ku-ring gai Council; and
3. Listed as a Keystone or Secondary Weed by UBM (2007)

Areas/sites within the designated BGHF Habitat areas showing signs of native plant regeneration (i.e. indicating site resilience) were also noted.

Weed polygons mapped are shown in Figure 4.4 and results of the six (6) polygons surveyed are presented in Tables A to G in Appendix 4.

In addition to work carried out by UBM, in September 2008 Cumberland Ecology revised survey polygons first established in late-2007. Cumberland surveyed for both native and introduced species in each polygon, however they also estimated the % weed cover in each polygon. The results of these investigations are presented in Table 4.3.



4 SITE DESCRIPTION

4.1 LOCATION & SETTING

The Subject Property is located in the northern Sydney suburb of Wahroonga, about one (1) kilometre from the Wahroonga Shopping Centre and Railway Station. The character of the surrounding area is described as:

“...a well established leafy residential area. The Lots are larger than average found in Sydney, and the gardens are landscaped and well maintained. The exception to the surrounding residential dwellings is ‘The Bush School’, which is located opposite the site in Water Street” (R. Olssen for Ku-ring-gai Council, December 2006).

The former John Williams Respite Care Centre is 2.13 ha in size and occupies land bounded by Water Street (north) and Young Street (east). The property backs onto residential development in Billyard Avenue (south) and Plymouth Close (west)

The complex of buildings extant on the Subject Property comprise a one (1) and two (2) storey brick construction (former) hospital and two (2) and three (3) storey brick buildings known as 35 Water Street. These buildings are set in grounds which have been extensively landscaped over a number of years, although part of the site retains some native vegetation – most particularly a stand of mature Sydney Blue Gums *Eucalyptus saligna* in the western sector of the Property.

Some of the Sydney Blue Gums may be remnants of the original vegetation while others (particularly those occurring in a straight line on the Water/Young Street frontages) would appear to have been planted.

Table 4.1 provides a Site Definition for the Subject Property for which this VMP has been developed.

**Table 4.1: Summary of Site Definition**

TITLE INFORMATION	The former John Williams Hospital at 35 Water Street, Wahroonga, in Ku-ring-gai Local Government Area, Northern Sydney.
OWNERSHIP	<i>Waterbrook at Wahroonga Pty Ltd</i>
LOCATION	The land is bounded by Water Street (north) and Young Street (east); backing onto residential development in Billyard Avenue (south) and Plymouth Close (west).
CO-ORDINATES	<u>Latitude</u> : 33 degrees,43 minutes, 7 seconds <u>Longitude</u> : 151 degrees,7 minutes,,31 seconds
TOTAL AREA	21,320 sq metres (2.13 ha) comprising Lot 1 DP 375262
ZONING	Lot 1 DP 375262 is zoned 5(a) Special Uses (Hospital) (Ku-ring-gai Municipal Council 2006)



4.2 PHYSICAL ENVIRONMENT

The physical characteristics of the Subject Property and Locality are summarised in Table 4.2.

Table 4.2: Physical Features of the Subject Property & Environs

FEATURE	DESCRIPTION
Topography	The Subject Property is located on gently sloping land, with a moderately steep (10%) gradient from north-west to south-east - towards Young Street and Billyard Avenue. Site elevation ranges from 200m AHD at the top to 176m AHD at the lower southern site boundary, towards Billyard Avenue.
Geology	The geology has been mapped as Ashfield Shale (Rwa), which is a unit (or substrate) of the Wianamatta Group Shales. It typically comprises black to dark-grey shale and laminite (Herbert 1983).
Soil Landscape Unit	The Subject Property is located on the Glenorie (gn) Soil Landscape Unit. Glenorie soils are erosional landscapes, comprising shallow to moderately deep red podzolic soils on crests, moderately deep red and brown podzolic soils on upper slopes, deep yellow podzolic soils on lower slopes and humic gleys, yellow podzolic soils and gleyed podzolic soils along drainage lines (Chapman & Murphy 1989). Glenorie Soil Landscape comprises undulating to rolling low hills with a local relief of 50-80 m, and slopes of 5-20%. Ridges, hillcrests and valleys are narrow (Chapman & Murphy 1989). <u>Limitations:</u> As the gardens at Rippon Grange were developed in the late 19th Century, and have until recently been maintained as a managed landscape, it may be assumed that the native soil profile described above has been extensively modified. The former Croquet Lawn has been subject to cut and fill to create this facility, which is enclosed on all sides by sandstone walls of varying heights.
Local Hydrology	The Subject Property is located with the Lovers Jump Creek Catchment. There is no external catchment inflow to the site. There are no natural drainage lines within, or in close proximity to the Subject Property. Runoff drains generally overland, to the south-east. An ephemeral drainage line runs from north to south along the western side of the driveway in the south-eastern portion of the Subject Property. Existing stormwater drainage is limited to the developed areas, and consists of building roof drainage and sparsely located surface inlet pits on pavement, with discharge to Council's stormwater system at Billyard Avenue (LHO Group, <i>Drainage Concept Plan</i> November 2008).
Climatic Details	The mean daily maximum temperature is 22.3°C, with highest temperatures recorded in December, January and February. The mean daily minimum temperature 11.0°C, with lowest temperatures recorded in June, July and August. Mean annual rainfall is 1,068.0 mm; with February, March and April recording the highest mean levels (Bureau of Meteorology 2006, Pennant Hills #067047). Note: the suburb of Wahroonga (along with neighbouring Turramurra) receives the highest annual rainfall in the Sydney area.



4.3 BIOLOGICAL ENVIRONMENT – FLORA

Information in the following section of the VMP has been sourced from the Flora and Fauna Assessment for the Former John Williams Respite Care Centre (UBMC July 2006) and utilised in an earlier Vegetation Management Plan (UBMC December 2007). Supplementary information has also been sourced from the previous (December 2007) and current (March 2009) Species Impact Statements prepared by Cumberland Ecology.

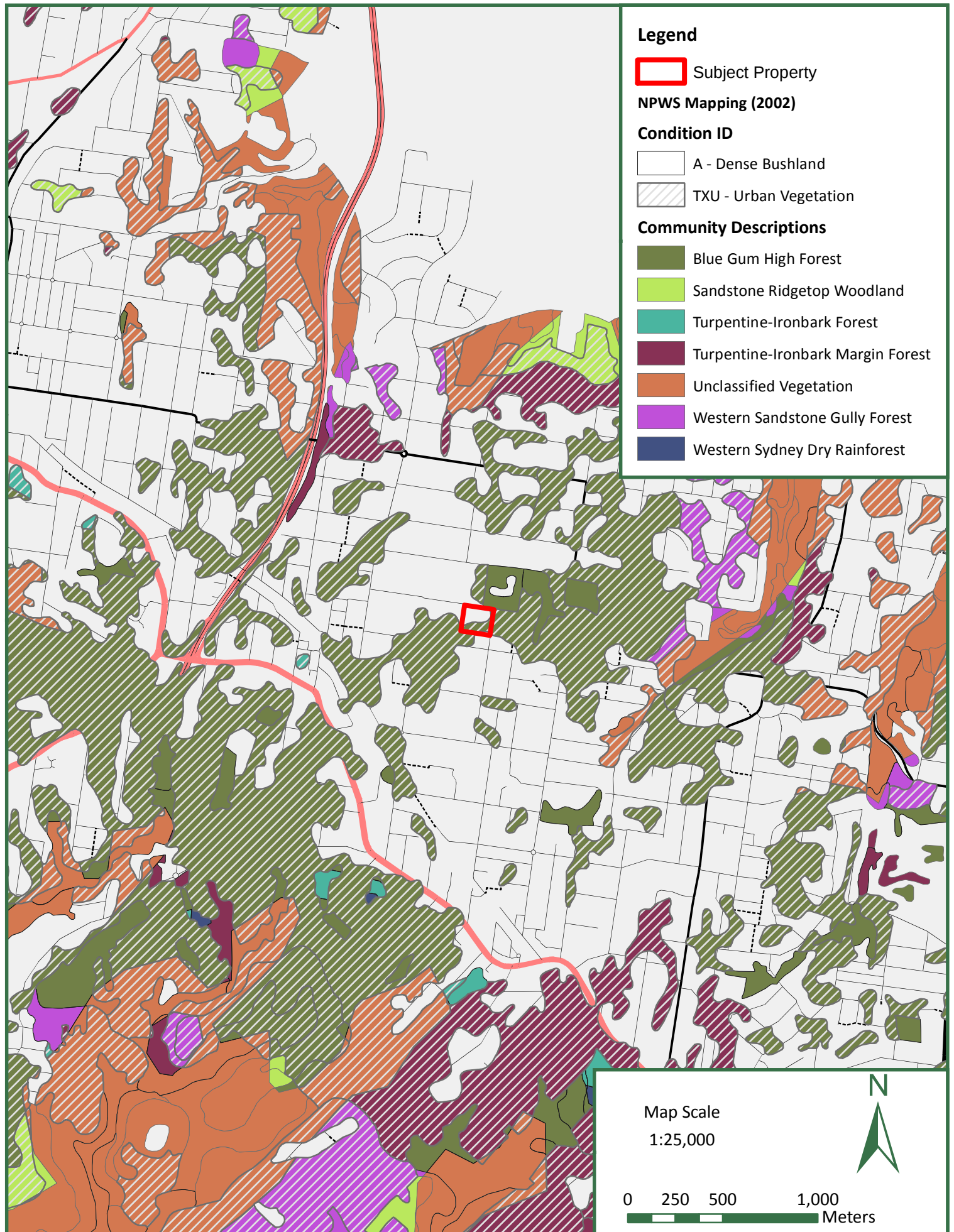
4.3.1 Vegetation Mapping

The NSW National Parks and Wildlife Service⁸ has produced a series of vegetation maps at the smaller scale of 1:25 000 (NPWS 2002) which mapped all bushland remnants greater than 0.5 hectares in size.

NPWS (2002) mapped some vegetation within the Subject Property as **Blue Gum High Forest**. The condition of the community is mapped as “Txu” (canopy cover < 10% over urban development), and its conservation significance is classified as “Urban Remnant Trees (Critically Endangered Communities)”. There is a small stand of “Core” Blue Gum High Forest mapped directly north of Water Street (see Figure 4.1) – this presumably representing vegetation in The Bush School.

A description of the native vegetation community extant within the Subject Property and the dominant plants within each vegetation layer (or stratum) – as determined by site survey and quantitative analysis - is provided in Section 4.3.2.

⁸ Now the NPW Group within the NSW Department of Environment & Conservation (‘DECC’)





4.3.2 Community Description

On 21 July 2006, the NSW Scientific Committee released a new Preliminary Determination which proposes to list the *Blue Gum High Forest in the Sydney Basin Bioregion* as ‘critically endangered’. The Final Determination was gazetted on 20 April 2007 (see Appendix 1).

The description of the BGHF community in the Final Determination is far more prescriptive than that used in the previous Determination (gazetted 5 September 1997), and (from interpretation) would appear to include individuals and small stands of Sydney Blue Gum growing over an introduced or weedy understorey and lawns. Accordingly, the area of BGHF Habitat considered to be extant within the Subject Property has been substantially increased - from ~2,600 sq metres to 6,350 sq metres.

Part of the Subject Property is occupied by a floristically and structurally simplified form of BGHF (~6,350 sq metres – 0.64 ha), as shown in Figure 2.1⁹. Most of the vegetation has been severely modified, and is considered to be irreversibly altered to the point where the original native vegetation community (BGHF) would be unlikely to regenerate naturally to form a viable, fully functional native vegetation community. Due to the Property’s long-term land uses, recurring disturbance events, and suspension of ecological processes, **site resilience** is estimated as ‘low to absent’ across most of the Property, and even in the larger remnants, estimated only as ‘low to moderate’ (see Section 6.3 for a discussion of **resilience**¹⁰).

A few components of the BGHF community remain in parts of the Subject Property, but these are mainly restricted to mature canopy trees growing over lawns, garden beds, and /or a weedy understorey. Other native plants occur in the herb layer (groundcover stratum), and comprise a small palette of disturbance-tolerant species commonly found in bushland, private gardens, parks and vacant land in the Locality and Region. The indigenous shrub stratum is sparse to absent (having been largely replaced by introduced horticultural species and woody weeds).

Accordingly these areas have been described as **BGHF Habitat**, rather than as a BGHF Ecological Community (as described in the Final Determination – see Appendix 1).

A description of the single native vegetation community in the Subject Property and the dominant plants within each vegetation or stratum are provided below.

Blue Gum High Forest

Structure

Moderate to sparse cover of large canopy trees, up to 25 metres in height. The shrub layer density is moderate to sparse, reaching up to approximately five (5) metres in height. The groundcover is moderate to dense, and reaches up to approximately one (1) metre in height.

⁹ As mapped by Smith & Smith 2006, and used in the draft SIS (Cumberland Ecology October 2008)

¹⁰ Site resilience being described as the vegetation community’s ability to recover naturally from disturbance.



Common Species (* denotes exotic species)

Trees

Dominated by Sydney Blue Gum (*Eucalyptus saligna*), with rare occurrences of Rough-barked Apple *Angophora floribunda* and Turpentine *Syncarpia glomulifera*.

Shrubs

Commonly occurring shrubs include Large-leaved Privet *Ligustrum lucidum**, Montpellier Broom *Genista monspessulana**, Sweet Pittosporum *Pittosporum undulatum*, Willow Bottlebrush *Callistemon salignus*, Celery Wood *Polyscias elegans*, Sydney Golden Wattle *Acacia longifolia* var. *longifolia*, White Tick Bush *Kunzea ambigua*, Camphor laurel *Cinnamomum camphora**, Olive *Olea europaea* ssp *cuspidata**, and Small-leaved Privet *Ligustrum sinense**.

Groundcovers & Vines

Common groundcover and vine species include Asparagus 'Fern' *Asparagus aethiopicus**, Weeping Meadow Grass *Microlaena stipoides* var. *stipoides*, Kidney Weed *Dichondra repens*, Basket Grass *Oplismenus imbecillis*, Japanese Honeysuckle *Lonicera japonica**, Agapanthus *Agapanthus africanus**, Forest Hedgehog Grass *Echinopogon ovatus*, Love Creeper *Glycine clandestine*, and Fishbone Fern *Nephrolepis cordifolia**.

4.3.3 Indigenous Flora Species

4.3.3.1 Threatened Species

A single threatened flora species comprising two (2) individuals – Magenta Lilly Pilly *Syzygium paniculatum* is present. This plant, which occurs naturally within littoral or gallery rainforest along the NSW Coastal District (Benson & McDougall 1998), is listed as 'vulnerable' under the TSC and EPBC Acts. However, the species has been planted widely in gardens and public parks in the Locality, and the plants in the Subject Property are thought to be horticultural specimens rather than natural occurrences (location shown in Figure 2.1).

No other flora species of National or State conservation significance listed as a ROTAP¹¹, or listed on the Schedules of the EPBC or the TSC Acts were located during previous (UBMC 2005/2006, Cumberland 2007) or current (UBM 2008, Cumberland 2008) surveys.

The likelihood of occurrence of other threatened species in the Subject Property is considered to be 'low' given its long history of cultivation as a garden and other severe disturbances to the original vegetation in the Locality. Local land uses, as noted in historical sources, including logging from the 1820s, followed by orcharding, and after the extension of the railway in 1890 (between 1895 and 1903), development as an exclusive residential area (www.villagevoice.com.au).

4.3.3.2 Floristic Biodiversity

Indigenous (floristic) biodiversity for the Subject Property is 'low' due to long-term disturbances such as (early) clearing of the understorey vegetation, extent of horticultural planting and cultivation, earthworks, construction, alterations to the 'natural' fire regime, altered hydrology and other disturbances. In recent years, in the absence of garden maintenance, weed invasion (including the

¹¹ Listed in *Rare or Threatened Australian Plants*, Briggs and Leigh 1996



unchecked spread of many former garden plants) has occurred. Indigenous plants are mainly restricted to individuals or small stands of remnant canopy trees, some few large shrubs or sub-canopy trees, and a limited number of herbaceous ground covers.

It is also likely that a number of the 'native' species recorded are horticultural introductions. At least some 'native' species within the site have been planted; some still having planting stakes positioned beside them. As it was fashionable in the 1960s and 1970s to plant a range of generally 'Australian native species', it is considered likely that some of the species recorded as being indigenous occurrences are actually horticultural plantings.

The condition of the native vegetation and assessment of the Subject Property's existing conservation values has been confirmed by recent investigations carried out by UBM (September/October 2008) and by Cumberland Ecology during the preparation of a Species Impact Statement (Cumberland Ecology –March 2009).

4.3.4 Introduced / Weed Species

Of a total of 229 flora species recorded within the Subject Property, 190 species (83%) are introduced (horticultural) species or weeds (UBMC 2006/2007). Of these, 81 species (42.6%) are trees or shrubs (some classified as 'significant' plantings), 19 are vines or scramblers, and the remainder (163) are herbaceous species. Twelve (12) of the herbaceous species (26.4%) present are introduced grasses – several being popular domestic turf species (see Appendix 2)¹².

Using the results of updated surveys undertaken in support of the new SIS, Cumberland Ecology has prepared a table showing the % of exotic species in the projected foliage cover of each stratum of the BGHF Habitat areas. This is presented as Table 4.3. Polygon locations are shown in Figure 4.3.

Table 4.3: Percentage of Exotic Species in Projective Foliage Cover of Each Stratum

(Source Cumberland Ecology March 2009)

Quadrat	Canopy	Small Tree	Shrub	Groundcover
1	40	40	100	95+
2	0	100	70	95+
3	0	70	95+	95+
4	0	50	80	80
5	0	5	100	90
6	0	90	70	95+
7	100	absent	100	70
8	0	absent	100	40
9	20	absent	absent	90

¹² **Note** that the flora list in Appendix 2 does not include all the horticultural plantings at Rippon Grange.



Data presented in Table 4.3 indicates that throughout the BGHF Zone, most of the understorey strata contained very high proportions of introduced species. The distribution of the tree stratum varied greatly, while the small trees stratum generally contained high proportions of exotic weeds (especially Privet *Ligustrum* spp and *Ochna serrulata*). Groundcovers in most quadrats were almost totally dominated by weeds and introduced garden plants, which is not surprising considering that most of the area now described as BGHF Habitat was established and for many years maintained as a garden.

The following introduced species recorded within the Subject Property are listed as ‘**Noxious Plants**’ in Ku-ring-gai Local Control Area (*Noxious Weeds Act 1993 – Amended 2005*).

- Asparagus ‘Fern’ (*Asparagus aethiopicus*) – Class 4;
- Blackberry (*Rubus fruticosus*) – Class 4 ;
- Camphor Laurel (*Cinnamomum camphora*) – Class 4;
- Cape Broom (*Genista monspessulana*) – Class 3;
- Climbing Asparagus (*Asparagus plumosus*) – Class 4;
- Madeira Vine (*Anredera cordifolia*) – Class 4;
- Morning Glory (*Ipomoea indica*) – Class 4;
- Ochna (*Ochna serrulata*)- Class 4;
- Oxalis (*Oxalis* spp.) – Class 5;
- Privet – Broad-leaf (*Ligustrum lucidum*) – Class 4;
- Privet – Narrow-leaf (*Ligustrum sinense*) – Class 4;
- Rhizomatous Bamboo (*Phyllostachys* spp.) – Class 5; and
- Wandering Jew (*Tradescantia fluminensis*) – Class 4.

Actions Required For Noxious Weed Classes

- 1** The plant must be eradicated from the land and the land must be kept free of the plant
- 2** The plant must be eradicated from the land and the land must be kept free of the plant
- 3** The plant must be fully and continuously suppressed and destroyed
- 4** 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
- 5** The requirements in the *Noxious Weeds Act 1993* (as amended 2005) for a notifiable weed must be complied with

In addition to the 13 Noxious Weeds listed above, many garden plants popular in the last Century have naturalised widely throughout the property: such garden escapes are considered to be ‘**Environmental Weeds**’ when they invade native bushland.

A list of indigenous and introduced plant species recorded within the Subject Property is provided in Appendix 2, along with an indication of relative abundance (UBMC 2006 & 2007).

Note: The list of species provided in Appendix 2 is not intended to be a comprehensive list of all species present, and represents only those species that were recorded while undertaking searches for indigenous species of National or State conservation concern known for, or expected to occur, in



the Region. It is quite possible that this list could be increased as additional surveys are undertaken, particularly as variations in seasonal and climatic conditions come into play.

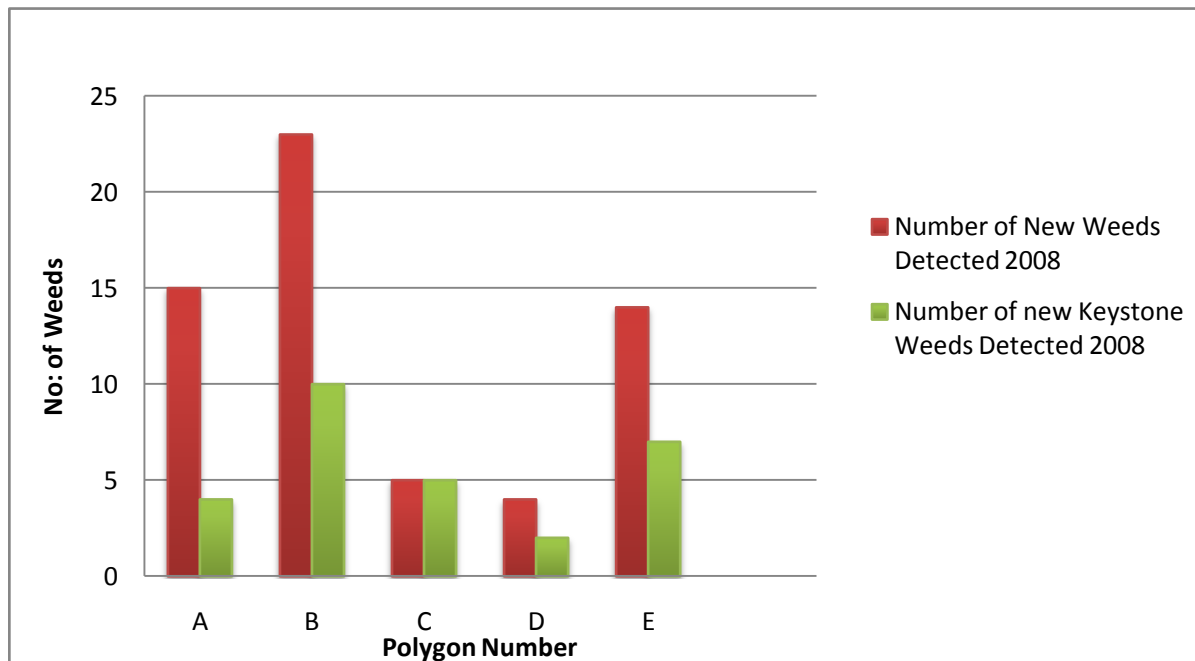
4.3.5 Updated Weed Mapping

In order to provide some point of comparison with weed mapping undertaken by UBM in 2007, the weed polygons established in the BGHF Habitat approximately 12 months ago were revisited.

The results of the weed polygons resurveyed indicate that there has been an overall increase in the number of weeds in each polygon, when compared to survey results in 2007. Changes in the abundance of individual weed species have been highlighted in Figure 4.2.

Results of the six (6) weed polygons surveyed in 2008 are presented in Appendix 4.

Figure 4.2: Changes in Weed Species Numbers between 2007 and 2008 for each Polygon



A site map showing vegetation condition and location of weed polygons recently surveyed (October 2008) is presented in Figure 4.3.

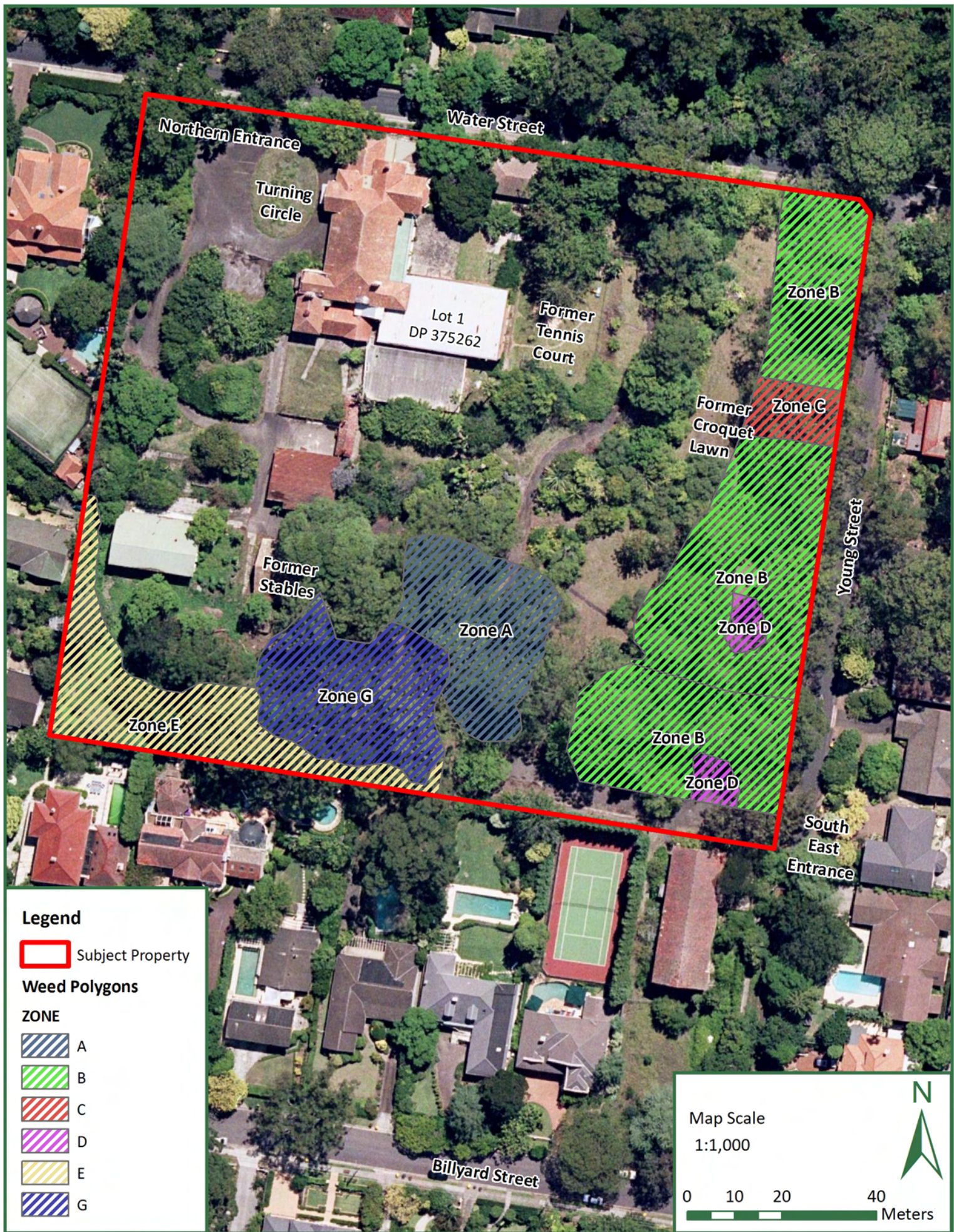


Figure 4.3: Vegetation Condition (Weed Mapping UBM October 2008)





4.4 CONDITION & INTEGRITY OF BLUE GUM HIGH FOREST

BGHF Habitat mapped by UBMC (2006) comprised two (2) separate stands of native vegetation, totalling ~ 2,600 sq metres in size and located in the eastern, south-eastern and central sectors of the Property. For the purposes of this VMP, these areas are described as Core BGHF Habitat areas.

These **Core BGHF Habitat** areas have a generally intact canopy of characteristic Sydney Blue Gums, Blackbutts and other mature trees over a weed infested mid-storey and groundcover strata. The mid-storey contains dense woody weed thickets, generally dominated by two (2) species of Privet – a noxious weed. However, some native resilience is indicated by the scattered occurrence of a small number of disturbance-tolerant native shrubs such as Wattles *Acacia* spp, Forest-oak *Allocasuarina torulosa*, and Sweet Pittosporum *Pittosporum undulatum*. The groundcover is occupied by Asparagus 'Fern' *Asparagus aethiopicus*, Fishbone Fern *Nephrolepis cordifolia*, Agapanthus *Agapanthus praecox*, Japanese Honeysuckle *Lonicera japonica*, and other garden escapes.

Within these stands are several small clearings which were formerly open lawn. Garden escapes and other scattered weeds are present, although recent site investigations (September/October 2008) indicate that these lawns are being progressively invaded from the edges (see Plate 5). Some disturbance-tolerant native groundcovers are also present, growing in gaps in the sparse turf or on edges where light levels are highest. These include Love Creeper or Glycine *Glycine clandestina*, Basket Grass *Oplismenus imbecillis*, Weeping Meadow Grass *Microlaena stipoides*, Hedgehog Grasses *Echinopogon* spp., and Kidney Weed *Dichondra repens*.

Some natural regeneration of native shrubs, including Acacias¹³, White Tick Bush *Kunzea ambigua*, Celerywood *Polyscias elegans*, and a single Woolly Pomaderris *Pomaderris lanigera* (the latter probably a planted specimen) were noted in clearings (as indicated above), adjacent to the existing remnants.

¹³ Not all *Acacia* species regenerating are locally indigenous species (e.g. *Acacia baileyana*, *A. podyrfolia*)



Plate 5: Progressive weed invasion in the open lawn area, Management Zone 1: woody weeds encroaching into grassland from the edges

A third '**Non-Core BGHF Habitat**' area (as mapped by Smith & Smith 2006) is located in the south-western sector of the Subject Property behind the Stables – an area which includes part of the former Service Area (see Figure 4.5). The inclusion of this area as BGHF because individual BGHF canopy trees remain *in situ*, added another 3,750 sq metres to the area originally identified as BGHF (Habitat).

This Non-Core area comprises mature canopy trees (Sydney Blue Gums and others) over rock-edged garden beds containing introduced horticultural specimens (Camellia, Azalea, Photinia, Agapanthus and Clivia) and unmaintained lawns (Plate 6). Large parts of this area are rapidly being overtaken by exotic vines and scramblers such as Morning Glory *Ipomoea indica*, Black-eyed Susan *Thunbergia alata*, and the succulent ground cover Wandering Jew *Tradescantia fluminensis*.

Because this area lacks (native) floristic diversity in the mid-storey and ground cover layers, and consequently lacked structural integrity, and because of its long-term use, partly as a cultivated garden and partly as a Service Area, this third Non-Core Area was not included in the original BGHF mapping undertaken by UBMC 2006).

Despite the floristic and structural traits exhibited by this third Non-Core area, Smith & Smith (2006) have chosen to interpret the description of the Ecological Community provided in the new Final Determination (see Appendix 1) in a very broad sense; thus providing for remnant trees over lawn and/or an introduced or weedy understorey to be considered as part of the BGHF community.



Plate 6: Mature canopy trees over rock-edged garden beds with horticultural specimens and weeds, adjoining unmaintained lawns within Non-Core BGHF Habitat Area, Management Zones 3-4



4.5 BIOLOGICAL ENVIRONMENT – FAUNA

Information in the following section of the VMP has been sourced from the Flora and Fauna Assessment for the Former John Williams Respite Care Centre (UBMC July 2006), Vegetation Management Plan (UBM February 2009) and Species Impact Statements (Cumberland Ecology March 2009).

4.5.1 Fauna Species

During the field survey conducted (UBMC 2006); four (4) native mammals, 15 native birds and two (2) reptiles were recorded within the Subject Property. In addition to these native species, a number of introduced animals were also detected, or indicated as occurring (see Appendix 3).

In relation to those native species recorded, it is interesting to note that none of the smaller, understorey-associated birds such as Thornbills, Wrens or Finches were detected during the field surveys. The developed, landscaped and regularly maintained nature of the hospital site pre-closure is considered to have modified the site to such an extent that these birds have become locally extinct.

Remediation strategies set out in this VMP are aimed at meeting the habitat needs of these species, and may in time attract small birds back into the site (provided that local populations remain to facilitate the re-colonization of the site). Provision of some areas of open grassland and some areas with dense plantings of shrubs would provide refuge, breeding and foraging opportunities for these small birds should they be present within the surrounding urban area (see Section 4.5).

The presence of the native, (although highly aggressive and territorial) Noisy Miner *Manorina melanocephala* is considered to limit the diversity of Honeyeaters and other canopy birds. Similarly, predators that have benefited from the modified urban landscape such as Magpies *Gymnorhina tibicen*, Currawongs *Strepera glaucina*, Butcherbirds *Cracticus* spp, and the Australian Raven *Corvus coronoides* are considered to have adversely affected the diversity of the site. Such species - known as 'Increasers' (Reid 1999) - are highly adaptable species that have thrived in urban environments.

Rehabilitation of the bushland remnants to exclude these larger birds, thereby attracting other native species back into the site, would require the creation of a well developed vegetation community comprising dense mid-storey, understorey and ground cover strata. However, as this type of dense understorey vegetation is not characteristic of the BGHF Ecological Community, it may not be practical to attempt to implement these works.

Conservation Value of the Native Fauna Species in the Subject Property

Of those native animals recorded:

- The Grey-headed Flying Fox (*Pteropus poliocephalus*), is listed as 'vulnerable' under both the EPBC and TSC Acts; and



- The Gang-gang Cockatoo (*Callocephalon fimbriatum*) is listed as both a 'vulnerable' species throughout NSW and as an 'endangered population' within the Ku-ring-gai and Hornsby Local Government Areas.

During the field survey (UBMC 2006), these animals were observed either adjacent to the Subject Property or flying overhead. Given these species' habit of foraging on eucalypts, there is some potential that one or both species will be recorded within the Subject Property at some stage.

Rehabilitation of the BGHF Habitat using locally occurring eucalypts, combined with the retention of (non-weedy) existing native and exotic trees (the Grey-headed Flying Fox is known to forage on fruits and pollen of exotic plants), would ensure that foraging opportunities for these species are maintained within the Subject Property (see Section 7.9).

The remainder of the native species recorded within the Subject Property are 'Protected' (as defined by the NSW *National Parks and Wildlife Act 1974*), but are considered to be common to abundant throughout the surrounding Region. None of the species recorded were of regional conservation concern within the Ku-ring-gai Local Government Area; all species being likely, or known to be present within the surrounding network of residential areas and conservation reserves (Ku-ring-gai Council 2003).

A comprehensive list of fauna species recorded or known to have historically occurred in the vicinity of the study area, along with their detection methods, can be sourced from the *Flora and Fauna Assessment for the Former John Williams Respite Centre* (UBMC 2006).

4.5.2 Description of Habitat Types

Two (2) habitat types¹⁴ were observed within the Subject Property:

- A modified environment; and
- A eucalypt woodland.

Descriptions of the structure and value of each of these habitats for native species are provided below.

Modified Environment

The Modified Environment occupies approximately half of the Subject Property, incorporating the unoccupied hospital, and its associated abandoned playgrounds, driveways, footpaths, carports, cleared land, unkempt landscaped areas, paved areas, retaining walls, garden beds and so forth. The vegetation is dominated by a wide range of landscape and horticultural species (both native and introduced plants), as well as the occasional remnant native species.

The majority of trees present are up to 15 metres in height, with no hollows suitable for the roosting or breeding needs of native species being evident. However, it is acknowledged that at least one (1)

¹⁴ Habitat types are described according to their structure or formation, and not according to the nomenclature provided by a plant community description (eg BGHF).



of the exotic, landscape plantings is hollow-bearing. The understorey is to four (4) metres in height, while groundcovers are about 30 cm high and of a high density in most places.

An ephemeral drainage line runs from north to south along the western side of the driveway in the south-eastern portion of the site. Due to its apparently ephemeral nature, its location within an urban catchment, and the presence of high concentrations of weeds and other exotic plants, this drainage channel was not considered to provide any significant resources for any native animals.

The Modified Environment is characteristic of the gardens and residential properties that surround the Subject Property: no habitat features within this area are unique to the Subject Property or locality generally. The modified environment is considered not to be significant for the local occurrence of any viable populations of those animals listed under the Schedules to either the Commonwealth *EPBC Act* or NSW *TSC Act*.

A number of common to abundant urban-tolerant native animals have been recorded within this Modified Environment: this habitat type meeting components of these species' life cycle requirements.

The development of this habitat type (whether through construction of dwellings and associated infrastructure, or clearing and reconstruction of BGHF Habitat – as proposed in this VMP) will cause the loss and local displacement of a number of these individuals, although as a group their tolerance and adaptability to modified areas is expected to permit their re-establishment/re-occupation of the site post-development.

While the proposed development may result in the loss of a number of individuals from the fauna groups recorded, the proposed development is not expected to decrease the diversity of species present post-development due to the species' tolerance and urban adaptability.

To minimise the loss of any individuals that may be present within the Modified Environment, recommendations have been provided that are expected to cater for the foraging, dispersal and sheltering needs of these animals (see Section 7.9).

Eucalypt Woodland

The Eucalypt Woodland is mainly located within the eastern and southern portions of the Subject Property (see Figure 4.4). At these locations, a canopy of 25 metre high mature eucalypts is present; seven (7) of which are hollow-bearing (hollow diameter $\leq 100\text{mm}$).

Given the size of those hollows present, it is possible that they would be suitable for the roosting and breeding needs of several of the smaller hollow-dependant native animals (particularly the microchiropterans [insectivorous bats]). Several Common Ringtail Possums *Pseudocheirus peregrinus* and during field investigations, Common Brushtail Possums *Trichosurus vulpecula* were observed foraging within this environment. Therefore, the Eucalypt Woodland is considered to be of some value for the local presence of these species.

Note: the loss of hollow-bearing trees has been given a preliminary listing as a Key Threatening Process ('KTP') by the NSW Scientific Committee established under the NSW *TSC Act*.



Plate 7: Tall canopy trees provide habitat and serve as a local filter corridor through the locality for arboreal mammals and birds

The understorey within the Eucalypt Woodland is variable, up to four (4) metres in height, and is a mixture of native and exotic shrubs, while the groundcover is a high-density layer of exotic grasses, vines and weeds to 30 cm in height. Some fallen logs and ground debris is present. All of the native species recorded within the Eucalypt Woodland are considered to be urban tolerant animals, i.e. species that would be commonly recorded within the surrounding gardens and parklands.

Because the majority of the Eucalypt Woodland is proposed for retention and enhancement (weed control, indigenous planting), existing resources for those species would be retained. Given the tolerance of those species detected within this habitat type to urban development and infrastructure, it is expected that the further development of the site and its re-occupation would not adversely affect their overall presence.

However, it is noted that the Common Ringtail Possum *Pseudochieris peregrinus* is a species usually associated with a medium to high density understorey stratum (in urban areas this can consist of both native and exotic plants). Within the Subject Property, this species currently has a vegetation structure suitable for the construction of its nesting dreys.

Removal of this stratum (albeit mainly comprised of weed thickets) has the potential to reduce the distribution of available nesting sites, thereby affecting the local population of the Common Ringtail Possum.

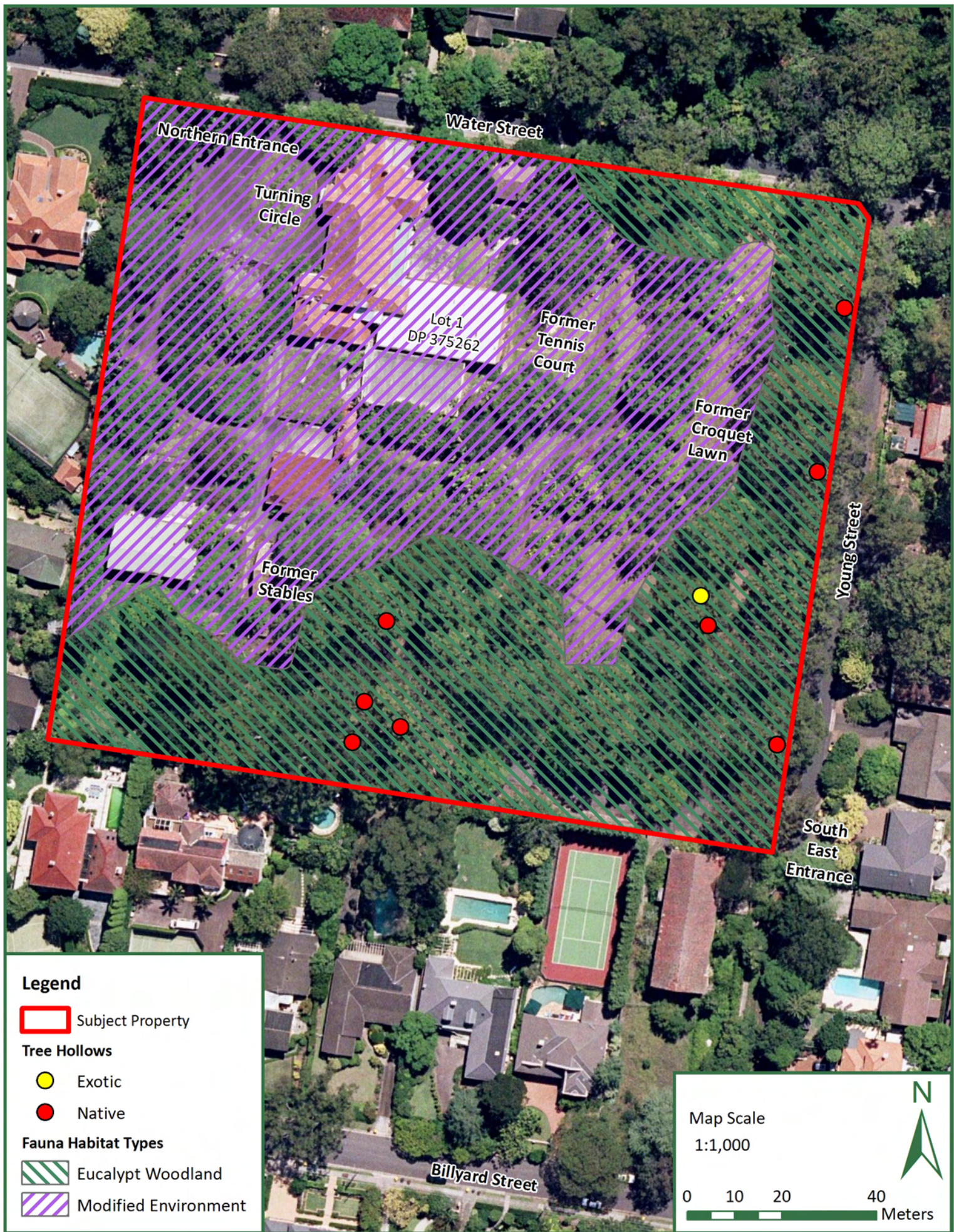


Figure 4.4: Fauna Habitat Map (UBMC 2006)





4.5.3 Wildlife Corridors & Vegetation Links

A review of aerial photography that covers the Wahroonga area clearly shows the overall 'leafy character' of the suburb, the Subject Property being part of this environment. The former John Williams Respite Centre site is in no way unique within this landscape, and does not stand out in comparison to any of the other woodland stands.

The site is not considered to form a significant component of any regionally important dispersal corridors. Species traversing through and across the site would also be moving through and over the adjacent residential properties and urban areas.

The closest areas of native bushland to the Subject Property are:

- Wahroonga Public School (the Bush School) (~ 100 metres north). This is located on the opposite side of Water Street, near its intersection with Young Street.;
- Clive Evatt Reserve (~425 metres north east) – bushland is in good to moderate condition as bush regeneration work has been undertaken in recent years. Similar in topography and aspect to subject property (note potential for seed indigenous collection);
- Turiban Reserve South (~245 metres east) – lower part of Reserve is contained within a steep sided gully. Remnant trees over a weed understorey (note little potential for indigenous seed collection); and
- Turiban Reserve North (~260 metres north east). Upper part of reserve on slightly sloping land is in good condition as bush regeneration works are underway: very bare understorey (leaf litter) (note potential for some indigenous seed collection).

For ground-traversing species to disperse between the Subject Property and these bushland reserves they would need to negotiate several roads, cross through residential properties, and to gain access to Clive Evatt Reserve, cross a cleared playing ground. The native species expected to be traversing through and across the Study Area are all considered to be urban- tolerant animals, i.e. species that are adapted to negotiating and moving through urban environments.

Recommendations have been provided to ensure that the dispersal patterns of those ground-traversing native species recorded occupying the former Respite Care Centre are not adversely affected by the redevelopment of the site (see Section 7.9).



4.6 CULTURAL & HISTORICAL ENVIRONMENT

Rippon Grange was built by Mr Frederick Sargood as a private residence in the late 1890s, but was later sold to Mr E.R. Williams, Managing Director of Woolworths Australia Ltd.

In 1951, Mr Williams gave his residence and the surrounding six (6) acres to the Royal Alexander Hospital for Children to be used for children suffering from poliomyelitis. He asked that the Hospital be named for his son John, who had died in the 2nd World War.

In 1980, the property was taken over by the Hornsby and Ku-ring-gai District Hospital, which managed the Hospital for intellectually and physically handicapped children and adolescents.

Latterly known as the John Williams Respite Care Centre, the Hospital was until 2005, under the control of the NSW Department of Community Services ('DOCS'), when it was sold to *Waterbrook at Wahroonga Pty Ltd* who are proposing its redevelopment as a Private Hospital.

Photographs sourced from the book *The Railways Come to Ku-ring-gai* (Cook 1991) show the remnant bushland along the eastern boundary, as well as providing early views of Water Street, Billyard Avenue and Burns Road. The leafy character of the new suburb – with many mature native trees remaining, especially along the road verges – is a feature of these photographs.



Plate 8: Water Street, Wahroonga in the early 20th Century



4.7 MANAGEMENT ZONES

The native vegetation in the Subject Property to be rehabilitated and/or reconstructed totals some of 8,004 sq metres (~0.8 hectares), representing a 26.04 % increase on the area of BGHF identified by Smith & Smith (2006).

This area has been divided into five (5) **Management Zones**, according to the characteristic vegetation, its condition/health, location within the Subject Property, and the different management strategies proposed to achieve the Zone's designated future land use (i.e. bushland, indigenous landscaping or restored heritage gardens).

Accordingly, Management Zones have been determined as follows (see Figure 4.6).

- Management Zone 1 - existing BGHF Habitat, Young/Water Streets – East and South-eastern Areas
- Management Zone 2 - BGHF trees with some native understorey, with introduced plantings - Central Area
- Management Zone 3 - canopy trees over lawns and garden beds – South Western Area
- Management Zone 4 - includes the existing buffer zone planting on the south-western property boundary.
- Management Zone 5 - incorporates the five (5) areas designated as 'compensatory offsets' between the BGHF Habitat (as mapped) and adjacent land uses (e.g. private gardens, lawns, or development).

Section 5 of the VMP addresses a number of management issues identified for all, or individual Management Zones, and provides a series of recommendations for amelioration of existing and potential future impacts, including those potential impacts of development identified by Council and others.

Section 6 provides a general Basis for Management (of bushland), while Section 7 provides a discussion on the BGHF rehabilitation and reconstruction processes identified for the Subject Property.



Figure 4.5: Management Zones for BGHF Habitat





5 MANAGEMENT ISSUES & RECOMMENDATIONS

5.1 REQUIREMENTS OF THE THREATENED SPECIES LEGISLATION

The Subject Property at Wahroonga supports an important, although highly simplified remnant of the Blue Gum High Forest ('BGHF') Ecological Community – a community listed as 'critically endangered' under the Schedules of the NSW *TSC Act*. As the only critically endangered ecological community in NSW, BGHF has a very high conservation value at local, regional, State and National levels of significance.

In addition, three (3) threatened species – the Magenta Lilly Pilly (*Syzygium paniculatum*), the Grey-headed Flying Fox (*Pteropus poliocephalus*) and Gang-gang Cockatoo (*Callocephalon fimbriatum*) are known to occur, or to utilise the resources of the Subject Property.

The Magenta Lilly Pilly (although thought to be a horticultural specimen) and the Grey-headed Flying Fox are listed as 'vulnerable' under both the *EPBC* and *TSC Acts*; while the Gang-gang Cockatoo is listed as a 'vulnerable' species throughout NSW and as an 'endangered population' within the Kuring-gai and Hornsby Local Government Areas.

Management objectives for the BGHF Habitat at Wahroonga are stated as follows:

- i) To conserve and rehabilitate those areas of BGHF Habitat occurring within the Subject Property and promote local biodiversity values; and
- ii) To manage the bushland rehabilitation and reconstruction process to ensure the retention of suitable habitat for those threatened and/or significant flora and fauna species present within the Subject Property and environs.

Under the terms of the NSW environmental legislation, Local Government must assess the impacts of any proposed activity which might adversely impact on the endangered ecological community or any threatened species or populations, and where these are likely to occur, it must identify strategies to minimise any such impacts.

In addition, development on adjoining land may also have a significant impact on the bushland's natural values, so that such activities must be carefully assessed by the Approval Authority prior to development consent being granted. Such impacts are not restricted to development activities *per se* as unless carefully planned, weed control, revegetation, infrastructure development, and even routine management activities could have a potentially damaging effect on threatened species and their habitats.

In requiring the protection and rehabilitation of the BGHF Habitat within the Subject Property, and the preparation of a special plan of management ('this VMP'), the NSW Department of Planning is acting to fulfil its legal obligations under the terms of the *TSC Act*.



Previously, under the terms of the *TSC Act*, the National Parks & Wildlife¹⁵ Group Division of DECC was required to prepare **Recovery Plans** for species, populations and endangered ecological communities within five (5) years of the gazettal of the Final Determination. These Plans were designed to assist consent and determining authorities in the assessment of impacts on listed species, population or ecological communities, and members of the public interested in becoming involved in conservation activities.

In 2004, reforms the *TSC Act* were made to better integrate threatened species management with land use planning, and to improve the development assessment process. As part of the reform, the Threatened Species **Priorities Action Statement** ('the PAS') was introduced. The PAS is currently in draft form, and can be viewed at: www.threatenedspecies.environment.nsw.gov.au.

The PAS lists high priority actions for BGHF such as: developing criteria and targets for protection of remnants and threat abatement actions; liaising and supporting landholders to secure protection of remnants, and providing assistance with the preparation of site specific plans of management. The undertaking of priority weed control works and rehabilitation/restoration/bush regeneration works at identified 'priority sites' are also flagged as high priority.

Recommendations:

1. Adopt and implement a comprehensive VMP (this Report) which provides the framework for the rehabilitation of BGHF Habitat areas within the Subject Property, and which also provides for the reconstruction (via removal of competing weeds followed by an indigenous planting program) of BGHF Habitat where currently only the native tree canopy remains *in situ*.
2. As it is essential that the locations of any threatened species, populations or significant areas of habitat are identified prior to weed clearance, a targeted search should be carried out, and where such occurrences are identified, these should be tagged and protective measures set in place.
3. Such locations must be identified (with a GPS), marked on a site map, and the map updated as required. All personnel undertaking on-grounds works must be inducted to the site and provided with relevant information (species descriptions, location maps). It will be the responsibility of the Proponent's Project Manager to ensure that all personnel are kept fully informed.
4. Adopt low impact weed control strategies which take the presence of all significant species, populations and ecological communities into account, and avoid all unnecessary damage to habitat areas. The Bush Regeneration approach to habitat restoration is strongly recommended (see Section 6.2).
5. Where unavoidable damage to Habitat is likely to occur, contractors are to consult with the Project Manager, who will in turn contact the Environmental Consultant appointed to oversee and monitor on-ground works. Any works likely to result in damage to

¹⁵ Previously National Parks & Wildlife Service – now NPW Group of DECC



threatened species, populations or their habitats must not be undertaken without written permission from the Project Manager and/or Environmental Consultant¹⁶.

6. Bush Regeneration strategies must consider the need to maintain (or create) suitable habitat for those significant/listed flora and fauna species known to occur. Where the (unchecked) growth of shrubs as *Pittosporum undulatum* (for example) threatens the integrity of such habitats, remedial measures must be undertaken to restore suitable site conditions.

5.2 MANAGING THE IMPACTS OF DEVELOPMENT

5.2.1 Protection of BGHF Habitat

The proposed East Wing will be sited adjacent to, and marginally within, Core BGHF Habitat adjacent to Young and Water Streets (see Figure 1.2). The total area of BGHF Habitat to be removed for the construction of the East Wing will be about 42 sq. metres. This represents less than 1% of the total BGHF area identified by Smith and Smith (2006).

The Arboricultural Impact Assessment Report (Tree Wise Men March 2009) has recommended the removal of 15 trees within the area designated as BGHF Habitat. Of the trees to be removed, only four (4) trees (three [3] BGHF species and one [1] introduced species) will be impacted by the proposed development. The remaining 11 trees are regarded as weed species, dangerous or dead and need to be removed.

In keeping with these requirements, the VMP recommends that prior to the commencement of construction works a secure Construction Zone around the East Wing building must be clearly defined. It is anticipated that a '**Construction Corridor or Zone**' will be established around any building within the BGHF mapped area of not greater than three (3) metres in width, measured from the outer wall of the proposed buildings. The Construction Corridor will be required for worker access and to install essential drainage, pipeworks, and other associated works.

Areas of mapped BGHF Habitat adjacent to the construction zone must be protected by the erection of exclusion and sediment fencing, which must stay in place for the duration of the works. Among the potential impacts of construction on the BGHF Habitat are: inadvertent incursion and damage to vegetation by machinery or deposition of waste material or fill soil, trenching to install essential services (drains, power lines), and the potential for increased runoff, resulting in soil erosion and increased weed growth. Careful planning prior to commencement of works will serve to reduce or negate these potential impacts.

In-ground pipeworks should be avoided wherever possible within the mapped BGHF areas. Where this is unavoidable, the **Critical Root Zones** ('CRZ') of trees to be retained should be avoided. Where all other alternatives have been considered, and running in-ground pipework through CRZ's is

¹⁶It will be necessary for Waterbrook (as the landowner) to obtain a Section 91 license from the NSW Department of Environment & Conservation to carry out works in an endangered ecological community.



unavoidable, in-ground pipeworks are to be bored within the CRZ offset or hand-dug, with no roots greater than 50mm to be cut.

The Site Arborist is to monitor all trenching within CRZ offsets. If horizontal boring is to be used within the CRZ offsets, the top of the bore is to be greater than 600mm below the PL at the base of the tree.

Trees within the construction zone or immediately adjacent which have been identified for retention must be protected by individual wooden tree shields and ideally, by supplementary fencing (see *Arboricultural Impact Assessment Report Tree Wise Men March 2009*). Guidelines for the installation of scaffolding have been provided in Figure 5.1. Further, ground protection should be provided within the Primary Root Zones ('PRZ') of all retained trees.

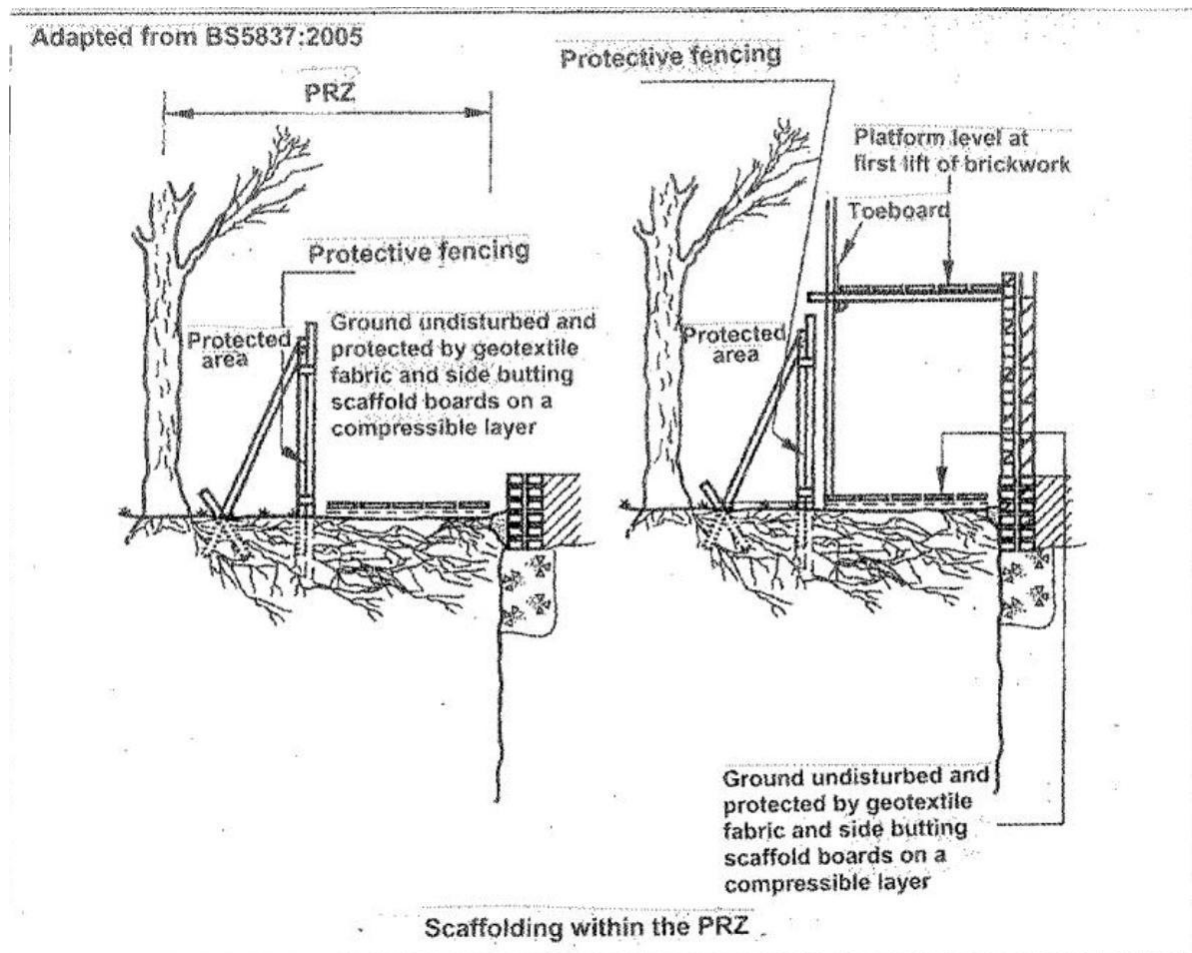
Recommendations:

1. Generic guidelines for the protection of native vegetation during construction have been developed, and are included in the VMP as Appendix 8.
2. Recommendations for the protection of significant trees have been included in the *Arboricultural Impact Assessment Report (Tree Wise Men March 2009)*. These are prescriptive for the Subject Property, and include recommendations for: i) retention of significant trees, ii) canopy pruning iii) protection of trees during construction, particularly pipeworks and other hydraulic works, v) erection of scaffolding; and vi) transplanting of selected trees.
3. Where the East Wing encroaches into the BGHF, protection should include the installation of exclusion fencing as well as sediment and runoff control measures prior to the construction of stormwater drainage. These are to be maintained in good order for the duration of the construction period.
4. As both construction activities and limited runoff can potentially impact on the BGHF Habitat unless contained, it is recommended these protective measures be considered as priority works. Protective measures will include the use of sediment fencing and installation of fixed hay bales along these boundaries (as per Appendix 8).
5. Scaffolding, if required should be installed as per Figure 5.1, and wherever possible scaffolding should be avoided or reduced in width to minimise canopy pruning.
6. Ground protection should be provided within the Primary Root Zones ('PRZ') of all retained trees (mulch, woodchips, and duck boards, sacking or similar).
7. During the construction period, no heavy motor vehicles are to be used within the mapped BGHF Habitat areas – this serving to prevent potential root compaction and damage to the CRZ of significant and/or BGHF canopy trees.
8. Similarly, there is to be no storing of heavy pallets or materials for an extended period over areas identified as CRZs, or within those parts of the Construction Zone located within the mapped BGHF areas.



9. The construction manager shall ensure that a suitably qualified arborist carries out regular site inspections during the construction period to ensure that protection requirements to the BGHF and retained trees are being adhered to. Any non-conformances are to be reported to the Principal Certifying Authority.

Figure 5.1: Protective Devices for Trees In or Adjacent to the Construction Zone





5.3 CHANGES TO HYDROLOGICAL PATTERNS / RUNOFF & DRAINAGE

Ku-ring-gai Council has also expressed some concern that an increase in overland flows and changes to sub-surface drainage patterns as the result of construction may impact on the BGHF Habitat (specifically on the remnant canopy trees). Excessive moisture, pollutants and nutrients carried from development in runoff waters are widely acknowledged as threats to native vegetation in the urban environment.

In considering the likelihood of such impacts occurring as the result of the Proposal, it must be acknowledged that in light of the long-term development of the Subject Property (>100 years), substantial changes to 'natural' drainage patterns on the site would already have occurred. The remnant BGHF trees on the site have adjusted to these shifts in local hydrology, with most indigenous (and introduced) trees remaining in relatively good condition. It is considered that the proposed construction works would not serve to alter local drainage patterns to such an extent that the BGHF Habitat would be further impacted.

A *Hydraulic Services Report* and *Drainage Concept Plan* (LHO Group, February 2009) have been prepared to assist the Proponent and Architect in the planning of the proposed development.

The *Drainage Concept Plan* (LHO Group, February 2009) addresses stormwater quantity and quality issues, and the design of the stormwater drainage plan prepared for the proposed development. This Plan has been prepared in accordance with Ku-ring-gai Council's requirements (DCP-47, April 2005), and provides detailed recommendations for on-site retention (demand post-construction), detention of stormwater, roof, surface drainage and basement drainage, subsoil drainage and stormwater quality control. The drainage system is designed to cover the 100 year ARI storm event.

Critical to ameliorating the impacts of runoff from the development area into the BGHF Habitat are measures such as on-site retention and detention, and the control of surface and sub-surface flows from the development site into the BGHF Habitat areas

The BGHF Habitat will remain essentially intact. Specific protection measures for the BGHF Habitat are provided by the *Concept Drainage Plan* (LHO Group, February 2009), and have been stated as follows:

1. It is proposed to install a drainage pipe in two (2) locations within the Habitat where the spacing between the pipelines and the trees is adequate so as to not cause any damage to the tree roots during construction.
2. Excavation will be by hand where required to minimise impact on tree roots, particularly in or near nominated CRZs, and proper erosion control measures will be used to minimise any disturbance to existing natural ground.
3. Immediately after completion of the drainage, a restoration program will be undertaken, including bush regeneration and revegetation.
4. Drainage installation will be co-ordinated with any hydrogeological relief measures that may be required.



The *Hydraulic Services Report* (LHO November 2008) has been prepared to address stormwater drainage, sanitary plumbing and drainage, water supply for domestic, irrigation and fire fighting uses and provision of gas services.

With relation to the impact of such services on the BGHF Habitat, LHO state that while it is generally not required to provide sewer, water and gas services concept plans for this section of the Subject Property, the *Hydraulic Services Report* has provided commentary on the design development and installation of in-ground services to ensure protection of the threatened BGHF extant on the property.

Protective measures for the BGHF Habitat are set out as follows:

1. The Hydraulic Services Report provides for all in-ground services to be designed and installed so as to avoid interference with the BGHF Habitat, and where it is not possible to locate in-ground pipework outside the Habitat, then this pipework is to be installed to enable adequate spacing between the pipelines and trees so as to not damage tree roots during excavation.
2. In BGHF Habitat areas, all work will be carried out by hand, with boring used as an alternative in areas designated as Critical Root Zones ('CRZs'), (as per the recommendations of the *Tree Impact Statement*, Tree Wise Men March 2009).
3. Similarly, proper erosion control measures will be used to minimise disturbance to natural ground, and restoration works will be carried out post construction (as above).
4. Drainage installation will be co-ordinated with any hydrogeology relief measures that may be required.

During the construction phase, a sediment and erosion control procedure will be implemented to follow the requirements of the NSW Department of Housing publication *Soil & Water Management for Urban Development* (August 1998).

This procedure, together with the recommended sediment fencing and hay baling along individual building footprint boundaries adjacent to BGHF Habitat (see Appendix 8) will serve to control overland and sub-surface flows into the BGHF Habitat.

Given the safeguards provided, it is anticipated that the existing drainage pattern between the landscaped portions of the landscaped grounds and the existing BGHF Habitat would remain essentially unchanged as the result of the Proposal. Nor will there be any significant change in local hydrological patterns into or from, those areas identified for the reconstruction of BGHF Habitat.

Recommendations:

1. Recommendations of the *Drainage Concept Plan* and the Hydraulic Services Report (LHO Group November 2008) are to be fully implemented, with maximum protection afforded to those areas of BGHF Habitat identified in Figures 2.1 and 4.6.
2. Based on data set out in the *Hydraulic Services Report* (LHO Group November 2008), there is to be no increase in overland or sub-surface water flow into or from those areas of existing (or core) BGHF Habitat identified in Figures 2.1 and 4.6.



3. Nor is there to be any significant change in local hydrological patterns into, or from, those areas identified for the reconstruction of BGHF Habitat – i.e. ‘no net increase’ (see Figures 2.1 and 4.6).

5.4 CHANGES TO HYDROLOGICAL PATTERNS DUE TO EXCAVATION

The following information has been sourced from Dickson & Associates (2007). It refers to the previous development application which proposed a building adjoining the BGHF Habitat in the south-eastern part of the Subject Property. It is anticipated that the information contained below will also be applicable to the development of the East Wing Building as part of the current Proposal. Should it be necessary, this section of the VMP will be updated on receipt of the new Hydrogeotechnical Report (pending).

Kur-ging-gai Council has also expressed some concern about the potential impacts of excavation for construction purposes on any BGHF trees located adjacent or downslope of the new East Wing (see Figure 1.2). Council is of the opinion that excavation as forming of basement car parking will significantly change overland and subsurface water flows into the BGHF, and contribute to the decline or death of individual trees.

This and other related issues have been addressed by D.F. Dickson & Associates Consulting and Geotechnical Engineers (February 2009). In summary, and with reference to baseline data quoted and available in the public domain, the Dickson Report provides the following information.

In the Subject Property, the substrate comprises shales from the Ashfield Shale Unit of the Wianamatta Group, and residual clays derived from the overlying shales. There has been some misconception that significant lateral groundwater flows could occur within the shale which may be accessed by the Sydney Blue Gums, and altered by the basement car park construction. This is incorrect as the clays in fact act as an aquiclude - forming a permeable layer below a water source, and preventing water movement.

The root system of the Sydney Blue Gum is relatively shallow, with about 66% of the root system contained within the first 600mm or so of the soil. The Blue Gum does not form a deep reaching tap root. Information provided by Tree Wise Men (correspondence June 2008), indicates that this species is susceptible to uprooting, particularly in moist shallow soils. Exposure of soils through removal of vegetation could subject the surface roots to drying, but this need not be an issue if appropriate measures are taken during the construction phase.

The design of the basement car park is to be ‘fully tanked’ (as required by DWE), and does not rely on pumping of ground water for its structural integrity. The proposed design is a ‘closed system’ which will be watertight, thus avoiding any changes to current hydrological patterns. Design will include installation of a hydraulic filter to the basement to match the hydraulic properties of the existing undisturbed site so that there will be minimal disturbance to groundwater flows and levels. This system is described as ‘passive’, and may incorporate control drains to maintain the current water table, with its seasonable fluctuations.



Dickson concludes that “It must be remembered that the primary aim of both the developer and Council is the preservation and sustainable maintenance of the BGHF. To this end, it would be far more advantageous to both parties to understand the pre-existing soil moisture levels in the soils surrounding the root zones and (to understand) how with varies with rainfall (i.e. infiltration rate vs. evapo-transpiration)”.

Dickson goes on to state that “Technically, there is no reason that the proposed (East Wing) basement cannot be designed and constructed so that the effect or potential changes to the water regime within the BGHF would be undetectable”.

Outcomes of the hydrogeological investigations, which included the installation of pesiometres across the Property to measure subsurface flows, are fully detailed in the Interim and Supplementary Hydrogeological Investigation Reports (Dickson, May & June 2008).

Recommendations:

1. The recommendations provided by Dickson (Hydrogeology Investigation Reports February 2009) are to be adopted in full.
2. The design and construction of the basement car park to the East Wing is to be a water-tight, closed drainage system which does not alter surface or sub-surface flows into the BGHF.
3. Exposed soil within the CRZ of BGHF and other significant trees as the result of construction works is to be mulched with an appropriate material to prevent surface drying and possible impacts to the surface roots of such trees. The use of mulch is a temporary measure, with such material being removed off site at the conclusion of works.

5.5 OTHER MANAGEMENT ISSUES

5.5.1 Fragmentation of BGHF / Linkages & Vegetation Corridors

There has been some concern that the Proposal will fragment or further isolate those areas of BGHF Habitat occurring within the Subject Property, and reduce the habitat value of these areas for native fauna. It has also been suggested that the development as proposed will serve to disrupt linkages for native flora and fauna between the Subject Property and other local bushland reserves (KRG Council, December 2006, R. Lembit 2006).

The results of previous (UBMC 2006, Cumberland 2007) fauna surveys undertaken for the former John Williams Respite Care Centre; assessment of current habitat values; and the position of the Subject Property within the Locality have been discussed in Section 4.5 of the VMP. The limited diversity of native fauna recorded in all previous surveys, or considered likely to utilise the resources of the Subject Property on occasion, and the possible reasons for this, have also been discussed.

Within the Subject Property, areas of BGHF Habitat and individual/small stands of native canopy trees are separated by existing buildings, footpaths, parking areas, lawns and garden beds, while other occurrences of BGHF in the Locality exist as individual or disjunct stands of canopy trees over exotic gardens in private property, or occur in small bushland reserves, with a generally disturbed or weedy understorey.



Habitat for all but a small number of highly mobile fauna species (e.g. birds, arboreal mammals) in the Subject Property and Locality is already fragmented, with local connectivity retained only through the tree canopy (see Figure 4.5).

However, it is acknowledged that the dense (weedy) understorey in the Subject Property provides habitat for small ground dwelling fauna (e.g. skinks), for invertebrates, and for the Common Ring-tailed Possum (see Section 4.5.2). Clearing the introduced and weedy understorey to reinstate an entirely native vegetation form will (at least temporarily) reduce available fauna habitat.

Under the Proposal, BGHF Habitat will be rehabilitated and restored in a broad arc stretching from Young & Water Streets (east) through the centre of the property, and, using reconstruction techniques pioneered by the bush regeneration industry, and extend BGHF Habitat into the southern and south-western corners of the Property (see Figure 4.6). As a result, fragmentation within the Subject Property will be substantially reduced over time, and disjunct stands of BGHF Habitat will be reconnected through the native shrub and ground cover strata - a connection which at this time is sparse to non-existent.

These works will serve to enhance connectivity through the shrub and ground cover layers (whereas it currently exists only through the tree canopy). Currently, connectivity through the tree canopy includes utilisation by native and introduced fauna of both native and introduced (horticultural specimen) trees.

In summary, the BGHF Habitat within the Subject Property will NOT be *ecologically* fragmented, and will continue to provide habitat for those urban tolerant fauna known to utilise the resources of the property and the locality generally (see Section 4.5.1). Connectivity to adjoining BGHF trees and small remnants (e.g. the Bush School) will not be compromised; in fact it should be improved by the rehabilitation and reconstruction works proposed.

While this is the case, in some instances the reinstating of a 'pure' BGHF vegetation community (as recommended by Council and other stakeholders), is expected, due to the lack of a dense understorey in this habitat type in nature, to lead to the local extinction (i.e. within the site) of at least one (1) native species – the Common Ring-tailed Possum (see Section 4.5.1).

Recommendations

Note: the recommendations set out below apply to the protection and enhancement of fauna habitat within the Subject Property and Locality generally (see Section 4.5).

1. Avoid clearing dense weed thickets in spring (nesting time for birds).
2. Clear weed thickets gradually and in a mosaic fashion to minimise disruption to fauna habitat (adopting the precautionary principle in considering that such habitat does exist on-site).
3. Inspect garden beds and weed thickets for presence of dreys and nests, and if these, or any live animals are encountered, cease work and contact the local chapter of WIRES to remove these to a secure site.



4. Avoid using herbicide on plants with ripe or ripening fruit (eaten by birds).
5. Retain tree canopy and linkages within the Subject Property and (wherever possible) consider linkages to trees in adjoining properties (i.e. replant indigenous trees in gaps/clearings to reinstate linkages where these are absent).
6. Rehabilitation strategies for the Subject Property should include the preservation and/or replacement locally occurring eucalypts, combined with the retention of (non-weedy) existing native and exotic trees (the Grey-headed Flying Fox is known to forage on fruits and pollen of exotic plants). This will ensure that foraging opportunities for this species are maintained within the Subject Property
7. In developing the planting plan for those areas proposed to be 'reconstructed' as BGHF Habitat, develop bands of native vegetation through the Subject Property (rather than planting single or lines of trees), with a range of native shrubs and understorey vegetation incorporated into the planting design.
8. Provide some areas of open grassland and some areas with dense plantings of shrubs in order provide refuge, breeding and foraging opportunities for small birds should they be present within the surrounding urban area, and thus available to recolonise the Subject Property post rehabilitation.
9. Through Council, encourage local landowners to preserve and/or reinstate areas of BGHF Habitat within their own properties wherever Blue Gum canopy trees have been retained, and ensure that the Tree Preservation Order is enforced when development applications are submitted.

5.5.2 Controlling Weeds & Garden Escapes

Of a total of 229 flora species recorded within the Subject Property, 190 species (83%) are introduced (horticultural) species or weeds. Of these, 81 species (42.6%) are trees or shrubs (some classified as 'significant' plantings), 19 are vines or scramblers, and the remainder (163) are herbaceous species. Twelve of the herbaceous species (26.4%) present are introduced grasses – several being common lawn (turf) species (see Appendix 2)¹⁷.

Most of the 'weeds' in the BGHF Habitat areas have been introduced as horticultural plantings; while others have spread unchecked from the adjoining gardens and unmanaged land. The majority of these weeds are plants widely used in the latter half of the 20th Century, and now acknowledged as 'Environmental Weeds' in the Sydney Region. Thirteen (13) species are listed as 'Noxious Plants' for the Ku-ring-gai Local Control Area (see Section 4.3.4).

The *Noxious Weeds Act 1993* (as Amended 2005) provides for the control of noxious weeds. Of the 13 noxious weeds occurring, 11 are Class 4 weeds¹⁸ (see Section 4.3.4). Regional Weed Management Plans have been prepared for the majority of these Class 4 weeds, and these Plans

¹⁷ **Note** that the list in Appendix 2 does not include all the horticultural plantings occurring at Rippon Grange.

¹⁸ Action for Class 4 - 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



have been endorsed by the Noxious Weeds Advisory Committee to the Minister of Primary Industries. Council is the enforcing body for the Act.

Recommendations for targeted weed control have been made for those areas of Core BGHF Habitat Areas, and for those Non-Core BGHF Habitat Areas proposed to be cleared, replanted and maintained as 'reconstructed' BGHF Habitat.

Recommendations:

Management Zones 1 and 2 (Existing BGHF Core Habitat Areas)

1. Prioritise work in the existing BGHF Core Habitat (MZ 1 and MZ 2) while considering the need to protect and retain habitat for native flora and fauna.
2. The need to protect culturally significant plantings is also stressed (some plantings are to be retained within the BGHF Core Habitat areas – see Table 7.1)
3. Undertake a targeted weed control program in the existing BGHF Habitat (MZ 1 and MZ 2), focusing efforts on control/eradication of species identified in Table 7.2.
4. Weed control shall focus on the control/eradication of species listed as 'Noxious Plants' and as 'Keystone Environmental Weeds': minor garden escapes and secondary weeds are to be treated as time and resources allow.
5. Weeds are to be treated according to a seasonal weeding 'calendar' – with the primary aim of preventing flowering and fruiting (the weed calendar is to be prepared by the bush regeneration contractor undertaking works and will form part of the Site Action Plan).
6. Appendix 5 provides a number of recommended weed control methods, including hand weeding techniques and herbicide application. Herbicide application must be undertaken strictly in accordance with the product's label directions.
7. Plants bearing ripening or ripe fruit should not at any time be treated with herbicide (as identified on the weed calendar) in case they are ingested by bird and other animals.
8. Weed debris is to be removed from the work site, stockpiled for removal and/or mulching or chipping. Debris containing seed heads, bulbs, corms, rhizomes or other propagative parts shall not be retained for mulching/composting, but should be removed from the site to a designated landfill depot.
9. Weed timbers from species such as Indian Coral Tree, Privet and Camphor laurel should not be chipped for re-use as mulch, as all have a marked tendency to regenerate from fragments.
10. It is also recommended that if possible, the bulk of primary weed clearance be carried out at some time during the construction phase as a variety of machinery will be available on site, and trucks will be able to pick up stockpiled debris and polluted soils and transport them to a designated landfill site.

**Management Zones 3, 4 and 5 (Reconstructed BGHF Habitat, including Offsets)**

1. Remove keystone/target weeds (as per Table 7.2) from those areas identified for reconstruction of BGHF Habitat, being cognisant of the methods and procedures listed as Items 4-9, above.
2. Remove (or relocate to other sites within the heritage gardens) significant small trees or shrubs and other introduced plantings from the garden beds (see Table 7.1). Dismantle garden beds and rockeries.
3. Treat lawn areas to be removed with a grass-selective herbicide (e.g. Fusilade), prior to soil disturbance. When turf is dead, scalp turf and underlying weedy topsoil to a depth of 10 cm. A repeat treatment may be required to treat regrowth from broken rhizomes. Remove weed debris and weedy topsoil off-site.
4. Protect trees and ensure site preparation works (e.g. scalping/ripping) does not impact on CRZ of nearby trees (see recommendation of Tree Management Plan, Tree Wise Men March 2009).
5. Proceed with BGHF Habitat Reconstruction Program (see Section 8.5 Protocols for Revegetation).

Recommendations

Note: the recommendations set out below also apply to the protection and enhancement of fauna habitat within the Subject Property and Locality generally.

1. Avoid clearing dense weed thickets in spring (nesting time for birds).
2. Clear weed thickets gradually and in a mosaic fashion to minimise disruption to fauna habitat (adopting the precautionary principle in considering that such habitat does exist on-site).
3. Inspect garden beds and weed thickets for presence of dreys and nests, and if these, or any live animals are encountered, cease work and contact the local chapter of WIRES to remove these to a secure site.
4. Avoid using herbicide on plants with ripe or ripening fruit as this may be eaten by birds and other animals).
5. Retain tree canopy and linkages within the Subject Property and (wherever possible) consider linkages to trees in adjoining properties (i.e. replant indigenous trees in gaps/clearings to reinstate linkages where these are absent).
6. Rehabilitation or landscaping strategies for the Subject Property should include the preservation and/or replacement locally occurring eucalypts, combined with the retention of (non-weedy) existing native and exotic trees (the Grey-headed Flying Fox is known to forage on fruits and pollen of exotic plants). This will ensure that foraging opportunities for this species are maintained within the Subject Property.



7. In developing the landscape plan for those areas proposed to be 'reconstructed' as BGHF Habitat, develop bands of native vegetation (rather than planting single or lines of trees), with a range of native shrubs and understorey vegetation incorporated into the planting design.
8. Provide/retain some areas of open grassland and some areas with dense plantings of shrubs in order provide refuge, breeding and foraging opportunities for small birds should they be present within the surrounding urban area, and thus available to recolonise the Subject Property post rehabilitation.
9. Through Council, encourage local landowners to preserve and/or reinstate areas of BGHF Habitat within their own properties wherever Blue Gum canopy trees have been retained, and ensure that the Tree Preservation Order is enforced when development applications are submitted.

5.5.3 Managing Edge Effects

Concern has been expressed about the fragmentation of the BGHF within the Subject Property as the result of the proposed development, with a concurrent increase in edge effects.

Edge effects – i.e. impacts at the interface of developed or recreational areas and the bushland – are increased where the ratio between the bushland 'core' and its perimeters is decreased, thereby presenting a large exposed edge which is vulnerable to a range of disturbance events. Such impacts include the incremental loss of vegetation due to routine maintenance activities (often described as 'mower creep'), damage to vegetation by tracking or vandalism, increased weed invasion, changes in hydrology, increased or decreased light levels, and potentially, overshadowing of bushland by nearby buildings. Additionally, long exposed edges provide increased opportunities for predation by feral or domestic animals, while at the same time, opportunistically providing additional feeding niches (or sites) for native fauna and providing for wider dispersal of native plants (via pollination and ultimately, seed dispersal) .

The configuration of any bushland remnant is critical in reducing the impact of edge effects. Generally, the longer and narrower the shape of the remnant, edge effects will increase proportionally, thereby putting the core bushland at risk. Conversely, a large consolidated remnant has a smaller edge to core ratio, and is less likely to suffer from edge effects.

In the Subject Property, the long-term use of the site, first as a residence and latterly as a hospital set in extensively landscaped grounds, and including recreational areas, garden beds, paved roads and pathways, has served to significantly fragment the BGHF community which once likely occurred on the Property. Given the size and shape of the BGHF remnants remaining, all of the BGHF Habitat in the Subject Property can be said to be (unavoidably) 'edge affected'. In effect, most of the potential negative impacts set out above have already taken place.

The proposed development of the Property as a Private Hospital will not further fragment the remnant BGHF and increase edge effects: in fact, the reconstruction of BGHF Habitat between the existing remnants in the eastern, central and south-western sectors of the Property will serve to



rationalise site boundaries and reconnect currently disjunct stands of trees and understorey vegetation and thus to reduce edge effects.

Overshadowing and Shading - The construction of the East Wing, while providing some overshadowing, cannot reasonably be expected to significantly decrease light levels such that the Sydney Blue Gums are affected. In fact, the proposed rehabilitation of the south-eastern remnant will remove the dense stand of woody weeds and vines from the understorey, and (within site constraints) reinstate more appropriate light levels, which will help to promote the recovery of the ecological community.

Arborist Peter Castor (Tree Wise Men March 2009) has stated that “the additional but seasonably variable shadowing from the proposed buildings is not expected to have a significant detrimental impact on the long-term retention of the assessed (BGHF) trees. In the main, the canopies of these trees are above the line of the proposed shadows and on sunny days the photosynthesis will be unchanged. On cloudy days, the proposed shadows become irrelevant to vegetation growth”. Castor goes on to state that “the understorey and ground cover plants are currently shadowed by the canopy trees above¹⁹”, and that ‘the increased shadows will not have a significant impact on plant survival as ambient light levels will be sufficient to maintain growth”.

Recommendations

1. The interface between the BGHF habitat and the East Wing Building are to be managed in order to provide a protective buffer zone to the bushland.
2. An average distance of two (2) metres for the buffer zone is proposed. This buffer zone or interface area may be landscaped with appropriate native species, but is not to be turfed with aggressive species such as Kikuyu Grass which will rapidly invade into the BGHF. If possible, the buffer zone should be gravelled or paved, or otherwise delineated from the bushland. The use of water permable ‘soft paving’ in the interface or buffers zones (e.g. Netpave-25 or similar) is highly recommended.
3. The list of native species proposed for planting in order to re-instate BGHF Habitat (both in Core and Non-Core Bushland and the Offsets) incorporates those BGHF species which occur naturally in light to medium shade levels. This list should be used as a guide to all revegetation (planting) works carried out under the bushland management programs described elsewhere in this VMP as Assisted Natural Regeneration and Restoration.

¹⁹ And, it should be noted, by thickets of woody weeds



6 BASIS FOR MANAGEMENT OF URBAN BUSHLAND

The following section Basis for Management; is largely generic in nature. It has been included in this VMP in order to provide important background information, and to create a framework for the rehabilitation and reconstruction of BGHF Habitat in the Subject Property at Wahroonga. Protocols for indigenous revegetation (planting) and weed control have also been included.

6.1 GUIDING PRINCIPLES

The management of any natural area should be guided by the following broad principles:

- To **protect** bushland remnants from further loss and the effects of existing and future threatening processes;
- To **identify** all biodiversity and geo-diversity elements;
- To **conserve** significant items/areas by mitigating or removing threatening process and promoting those natural processes required to ensure long-term viability;
- To **enhance** species diversity in highly simplified or degraded remnants not capable of restoration and in non-remnant areas;
- To **provide** corridors and linkages between remnants to facilitate movement and to encourage the flow of genetic material; and
- To **provide** opportunities for passive recreation in a controlled manner consistent with its ecological values.

In preparing the VMP for the BGHF Habitat in the Subject Property, each of the above-listed principles has been considered, and relevant management issues addressed.

6.2 BUSH REGENERATION

The most commonly used approach to the rehabilitation of native plant communities (bushland) is Bush Regeneration, which is defined by the Australian Association of Bush Regenerators as:

.....the practice of restoring bushland by focusing on reinstating and reinforcing the system's on-going natural regeneration processes (AABR, no date).

The Bush Regeneration approach (basically removing weeds and encouraging native plant regeneration from *in situ* seed sources) is suitable only for those sites the soil seed bank is intact, where mature native plants occur in sufficient numbers to provide source material, and where there is sufficient species diversity to restore the major structural components of the vegetation community (i.e. each stratum).

Representative species of each stratum – i.e. the canopy, shrub and groundcover – must be present or (potentially) be present in the soil seed bank for natural regeneration to function as the primary



rehabilitation process. Such bushland is described as 'structurally intact', and conforms to the definition provided by *State Environmental Planning Policy No-19 – Bushland in Urban Areas*²⁰.

Regeneration of the native vegetation community from existing seed sources cannot occur where the potential for natural regeneration from *in situ* sources (i.e. 'site resilience') is absent.

The Bush Regeneration approach incorporates a number of or strategies and methodologies; the most commonly used are:

Natural Regeneration – which involves removing weed using a combination of hand weeding and the application of selective herbicides; and then caring for the native seedlings that subsequently colonise the site?

Assisted Natural Regeneration – which combines traditional bush regeneration methods (e.g. weeding) with seed collection, propagation and planting of locally indigenous tubestock to supplement natural (unassisted) regeneration.

Reconstruction or Restoration – which is used where a native vegetation community has been completely lost, but where the biophysical attributes of the site (e.g. soil type, soil nutrient status, hydrological regime) are still within levels which remain tolerable to local native species. Reconstruction techniques centre on the planting of locally indigenous species in the proportions, range and densities similar to those present in the original (pre-disturbance) vegetation community.

Fabrication – which is used where the original native vegetation community is no longer present, and where the site's biophysical attributes have changed to the point where the original vegetation community cannot be reconstructed or recreated (i.e. where site conditions have changed so dramatically that simply replanting with local native species is impractical). Fabrication of a new vegetation community will necessarily take place over a long period of time (up to 10-years). The timeframe for fabrication will depend on the feasibility of ameliorating site impacts and of course, on the resources available for on-ground works.

²⁰ SEPP-19 definition of "bushland" means land on which there is vegetation that is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation.



6.3 POTENTIAL FOR REGENERATION – ECOSYSTEM RESILIENCE

Ecosystem resilience is defined as “the degree, manner and pace of restoration of the structure and function of the original ecosystem after disturbance” (Westman 1978), or put more simply, as the ability of an ecosystem to recover from disturbance.

When assessing site resilience, key indicators are the standing biomass of remaining native plants (particularly naturally regenerating seedlings), and the potential reservoir of propagative material (seeds, spores, rhizomes) in the soil seed bank, although the latter is difficult to assess accurately without extensive trials.

In the Subject Property at Wahroonga: -

Resilience in some parts of the Subject Property (e.g. Management Zones 3 and 4) (see Figure 4.6), is expected to be ‘low’ or even possibly ‘absent’ because of the impact of past land uses, including excavation and deposition of fill, enrichment of the parent soils through the incorporation of compost and garden topsoil, replacement of native understorey with horticultural specimens and introduced turf grasses, changes to local drainage patterns, weed invasion and the suppression of the natural fire regime, with a consequent loss of viability in the soil seed bank.

However, for those areas identified as potential BGHF Habitat in Management Zones 1 and 2, and possibly in parts of Zone 5 where some of the proposed offsets are located in close proximity to Core Areas (see Figure 4.6), and where parent soils have not been overly disturbed, site resilience is expected to be ‘moderate’, with some sites of increased resilience in more open areas where native understorey plants have managed to re-establish in the absence of dense weed thickets or planted shrubs.

Where site resilience is ‘low’ or ‘absent’, reconstruction of the native vegetation community through the clearing of weeds and other unwanted vegetation, followed by broad-scale replacement planting will be required.

In areas with more potential for natural regeneration (i.e. where some site resilience is anticipated), if after a period of (say) 12 months, natural regeneration is sparse (or absent), enrichment planting will be necessary to stabilise soils and to provide a native understorey to serve as habitat for native flora and fauna.

Note: It must be stressed that the natural regeneration of a few shrubs or native ground covers in a degraded site does not indicate that the site is capable of regenerating naturally (i.e. without planting) to a floristically and structurally intact bushland habitat.

The presence of such disturbance-tolerant, commonly occurring species is often used to support an oversimplified approach to bushland management which suggests that all degraded sites retain some resilience, and can, if given enough time and resources, be regenerated to a fully functioning ecosystem.



6.4 CHOOSING THE MOST EFFECTIVE STRATEGY

The Bush Regeneration approach usually applies to the rehabilitation of sites assessed as having ‘high to moderate’ resilience, relying on natural regeneration from *in situ* sources (existing native plants and seeds/root or rhizome fragments in the soil). Bushland in these categories will likely retain sufficient regenerative potential to re-establish the native vegetation community once weeds and other plantings have been removed.

Even in sites identified as ‘poor quality’ or ‘degraded’, on fill soils, or where the native vegetation has been cleared for many years, there are usually a few native plants remaining. Even so, in such areas, it is likely that the soil seed bank has been severely depleted (or is absent) – thereby greatly reducing the potential for natural regeneration. For such areas, other methods must be used.

In chronically degraded or cleared areas, the vegetation community must be reconstructed (restored), not regenerated. This will involve a broad scale and often expensive, planting program using locally indigenous species – some of which may have been lost to the site and Locality. Therefore, as a matter of economics if nothing else, every attempt should be made to stimulate natural *in situ* regeneration prior to undertaking a bushland reconstruction program.

In the Subject Property at Wahroonga: -

Management Zones 1 and 2 are proposed for rehabilitation, while **Management Zone 3, 4 and 5** are proposed to be reconstructed via a broad-scale indigenous planting program (Figure 6.1).

Bushland rehabilitation **Management Zones 1 and 2** will focus first on encouraging **Natural Regeneration**, (i.e. weed control followed by natural regeneration of native species).

After a period of time (say 12 months), following monitoring and re-assessment, it is possible that **Assisted Natural Regeneration** will be required (i.e. enrichment planting to increase species diversity, density and abundance). Management Zones identified for Natural and Assisted Natural Regeneration refer to areas of Core BGHF Habitat extant on the Subject Property (see Figure 4.6).

In contrast, sites with less potential to regenerate, i.e. **Management Zone 3**, and **Management Zone 4** and parts of **Management Zone 5** (compensatory offsets) will have to be ‘**Reconstructed**’ through an indigenous planting program. These areas have been cleared of native understorey vegetation for many years and currently occur as canopy trees over lawns and garden beds (although some grassed areas do retain a few herbaceous native ground covers).

This approach will involve clearing of most existing vegetation, thorough site preparation, soil remediation, possibly including minor earthworks and installation of drains, followed by broad-scale planting using locally indigenous species, with representatives of each of the tree, shrub and ground cover strata being re-instated.

However, at the present time, it is not anticipated that site conditions (soil chemistry, drainage patterns and climatic factors) in the proposed Reconstruction Zones will have been changed to such a degree that Fabrication of a new vegetation community will be required



However this assumption cannot be guaranteed; and new plantings will have to be monitored carefully over a period of time to see if they succeed. If plant failures are high, despite maintenance (say >20%), a further series of soil tests may be warranted (see Section 8.5.1). If this is the case, alterations to the VMP as they relate to soil remediation may be required.

Table 6.1: Summary of Areas of BGHF Habitat to be Rehabilitated / Reconstructed

Management Zone / VMP	Area of BGHF Habitat to be Rehabilitated / Reconstructed	Strategy/Method
MZ 1 – S & SE Core MZ 2 – Central Core	2,600 sq metres (per UBMC 2006)	Bushland Rehabilitation - Assisted Natural Regeneration (some planting after 12 months)
MZ 3 – SW Non-core MZ 4 – SW Non-core	3,750 sq metres (extra areas per Smith)	Reconstruction / Recreation via broad-scale planting
MZ 5 – Offsets	PLUS 1,770 sq metres offsets	Reconstruction / Recreation via broad-scale planting
All MZs	BGHF Total 8004 sq metres*	
	MINUS 116 sq metres for construction	
	Total BGHF 8,004 sq metres*	Treatments as above

*rounded

Figure 6.1: Summary of Management Zones





6.5 WEED ECOLOGY

The information provided in the following section, while again largely generic in nature, has been included in the VMP for the BGHF Habitat areas in the Subject Property at 35 Water Street Wahroonga in order to provide guidelines for the prioritisation of weed control tasks and on-going site maintenance.

6.5.1 Definition

A plant is only a weed where it interferes with a man's use of the land for particular purposes, with his well being, or with the quality of his environment (Moore 1975).

Invasion by unwanted plants is a major constraint on the conservation and management of habitat for native flora and fauna. Unwanted plants in a natural or man-made environment are generally called 'weeds'. This generic term includes such diverse groups as:

- Plants harmful to agriculture, human health and the community ('**noxious weeds**');
- Horticultural escapes from gardens and amenity plantings ('**environmental weeds**');
- Plants introduced from other parts of Australia, or local native plants growing out of their normal range ('**alien**' or '**non-indigenous native plants**');
- Plants commonly found in crops and pasture land ('**agricultural weeds**'); and
- Plants that commonly grow in wasteland, on roadsides and in other disturbed areas ('**ruderal weeds**').

6.5.2 Keystone (Target) Weeds

Some introduced species pose serious and immediate threats to the vegetation community they invade, eventually modifying the ecosystem to such a degree that many native plants are unable to survive. These ecosystem modifiers are called '**Keystone**' or '**Primary Target Weeds**', and they must be given priority in weed control program.

Note: A keystone weed may have a legal designation as a 'Noxious Plant' (*Noxious Weeds Act 1993, as Amended 2005*), or the species may be recognised as 'an environmental weed' in the Region – i.e. a plant which naturalises readily in bushland to the detriment of the native flora.

Typical keystone weeds in Sydney bushland, and represented in the Subject Property, include Privet *Ligustrum* spp, African Olive *Olea europaea* ssp *cuspidata*, Asparagus 'Fern' *Asparagus aethiopicus*, Wandering Jew *Tradescantia fluminensis*, Morning Glory *Ipomoea indica*, and Madeira vine *Anredera cordifolia*.

6.5.3 Secondary Weeds

Not all weeds constitute a threat to the plant communities they invade. Some annual weeds or herbaceous perennials may be naturalised in the vegetation community, and many are hardy pioneer species that establish in the early stages of recovery (i.e. '**succession**'). These weeds are



usually short-lived, and although they produce a copious amount of seed, these pioneering species will not survive once a shading canopy is re-established.

Because they are highly visible, often grow in dense thickets, and present an ‘untidy’ appearance, secondary weeds are often treated first – unfortunately providing little benefit, as they quickly recolonise bare soil sites created by weeding. Unless unlimited resources are available, secondary weeds do not warrant early treatment in the weeding schedule, as there are other, far more environmentally damaging weeds to contend with, especially when resources are limited.

Secondary weeds in the Subject Property include (primarily) herbaceous species such as Plantain *Plantago lanceolata*) Fleabane *Conyza* spp, Cobbler’s Pegs *Bidens pilosa*, and introduced grasses such as Common Couch *Cynodon dactylon*, and Perennial Veldt Grass *Ehrharta erecta*.

Non-indigenous natives such as Queensland Brush Box *Lophostemon confertus*, Lemon-scented Gum *Corymbia citriodora* and Cootamundra Wattle *Acacia baileyana*) and exotics such as Jacaranda *Jacaranda mimosifolia* are also considered to be secondary weeds in bushland unless they proliferate to such an extent that they threatened to suppress or displace native species.

See Table 7.1 for a list of significant introduced or non-indigenous natives within the BGHF Habitat that may be retained as mature plantings, provided that new seedlings/saplings are removed as they occur.

In the Subject Property at Wahroonga –

Target weeds for the Subject Property are listed in Table 7.2. Recommended control methods for each species listed are described in Appendix 5. Weeding priorities are listed in Section 6.6.

6.6 WEEDING PRIORITIES

Priority of works is to be determined according to the status of weeds present in each infestation. The following hierarchy is given to target weed infestations:

1. Weeds of National Significance (**‘WONS’**)²¹;
2. Noxious Weeds (Ku-ring-gai Local Control Area); then
3. Environmental Weeds – keystone species only.

A list of target weeds present is provided in Table 7.2, while Appendix 5 provides a number of options (hand weeding and herbicide application) for the control for the target species listed.

²¹ No ‘WONS’ occur within the BGHF Habitat areas at this time.



6.7 INDIGENOUS REVEGETATION

Revegetation in bush regeneration projects usually comprises ‘enrichment’ or supplementary planting in areas of low species diversity; and ‘bush landscaping’ on edge sites and buffers, or in landscaped garden beds to create an extended native habitat.

Enrichment planting is carried out to increase existing species diversity by planting small shrubs, herbs, grasses and occasionally, new canopy trees. Enrichment planting can also be used to increase habitat for native fauna, and/or to re-introduce species which are known to have once been part of the local vegetation community, but for some reason have now been lost.

Bush landscaping refers to the placement of new plants to in-fill clearings or gaps and link remnants, to establish buffer zones at the interface between bushland and developed areas, and to create complementary native gardens on adjoining sites.

Indigenous Revegetation Programs – whether enrichment planting or bush landscaping – should attempt to utilise only plant material grown from local native species (i.e. indigenous species) in order to maintain the genetic integrity of the bushland remnant, to provide habitat for local native fauna, but also to maintain ‘local character’.

Revegetation methods and techniques are discussed in Section 8.5. A list of locally indigenous plants appropriate for planting in the BGHF Habitat areas in the Subject Property at Water Street has been included as Appendix 6.

This list has been prepared with reference to the Final Determination for the BGHF Ecological Community (see Appendix 1), and following inspection of regenerated portions of several nearby reserves (Clive Evatt Reserve, Turiban Reserve North, The Glade Reserve). Existing site conditions and adjacent land uses have been taken into account. Local knowledge has also been used to ‘fine-tune’ the planting list.

It is not anticipated that all of the species listed in Appendix 6 will be used, but a wide range of species has been included to provide some degree of choice (especially as some of the species recommended may not be commercially available, or if grown from local seed, the species may not produce seed regularly and/or they may be difficult to propagate).

Note: commonly occurring species such as *Pittosporum undulatum* (considered to be over abundant in local bushland) have been excluded from the planting list.

Also note: small or delicate herbaceous species have not been included in the planting list as they would not only be difficult to propagate, but would most likely not be hardy under field conditions. Species such as Orchids, Vetches, Glycines, and the smaller Ground Lilies – although desirable in theory - would require a great deal of aftercare, which is unlikely to occur.

Threatened species such as *Syzygium paniculatum* should not be planted at any time.



If some of the less commonly occurring species in the local BGHF Ecological Community can be made available over time (propagated from locally collected seed or cuttings), these should be used to increase biodiversity values and further enhance habitat for native fauna.

However, it must be recognised that some locally indigenous flora species may have become locally extinct, so that seed and cuttings may not be available from nearby bushland reserves. If this is the case, plant material will have to be sourced from bushland reserves further afield. Provided that collection sources are within a 10 kilometre radius of the Subject Property, and are located on similar soils and topography, this should not present a problem.



7 MANAGING BLUE GUM HIGH FOREST REHABILITATION & RECONSTRUCTION

The following strategies and actions are to be implemented as part of the BGHF Rehabilitation and Reconstruction Program on the Subject Property at 35 Water Street Wahroonga.

7.1 MANAGEMENT STRATEGIES – THE POTENTIAL FOR NATURAL REGENERATION

Weed control is only one of a number of strategies required to achieve the broader goals of conserving, rehabilitating and managing native vegetation. The identification of keystone (primary target) weeds may vary between vegetation communities and between differing land use areas.

When planning a weed control program, factors that must be considered include:

- The degree of weed infestation;
- The length of time since weed establishment;
- The substrate (fill or natural soils);
- Soil stability and the potential for slippage or erosion;
- Site and local drainage conditions (hydrology); and
- The condition (health) of nearby remnant vegetation, which will provide propagules for the natural regeneration of the site.

Weed control is only the first step to the recovery (or rehabilitation) of a more desirable vegetation community (whether native bushland or a plantation).

Of primary importance is the potential for the ecosystem to recover after major disturbance i.e. '**site resilience**'.

In sites with 'low to moderate' weed density and/or those surrounded by good quality native bushland, the potential for recovery is good, with natural regeneration of natives species usually occurring from *in situ* sources (i.e. the soil seed bank) or volunteering from neighbouring bushland.

However, for those badly degraded sites or those that have suffered long-term or extensive disturbance, site resilience will usually be 'low to absent', so that attempts to achieve bush restoration will usually involve a broad-scale planting program.

Weeding to encourage the natural regeneration of native seedlings is the basis of the Bush Regeneration approach to the management of native vegetation communities.

While Bush Regeneration is generally associated with the restoration of bushland remnants in the urban environment, there is some scope for some use of its low-impact methods in the peri-urban



and rural environments, which historically has relied on grazing, slashing, burning, or the broad-scale application of herbicides to control weeds.

7.2 MANAGING THREATENED SPECIES

7.2.1 Flora Species

Only one (1) threatened flora species has been recorded for the Subject Property – Magenta Lilly Pilly (*Syzygium paniculatum*) - which occurs as two (2) specimens (likely to have been planted) – one along the Water Street boundary, and the other west of the old croquet lawn (see Figure 2.1). Neither of these specimens is located within the area designated for bushland rehabilitation or reconstruction, and no new buildings are proposed for this area.

However, the National Parks & Wildlife Group²² of DECC has long held that threatened species should not be planted, either in bush regeneration projects or in public parks and private gardens because in doing so, the species' genetic base may become 'polluted', and in natural areas at least, the line between natural occurrences and plantings may become indistinct.

Recommendations:

1. No additional Magenta Lilly Pilly, or any other species listed by the *TSC Act* as 'threatened' are to be included in the Landscape Plan for the Subject Property.
2. Where infrastructure works or refurbishment of the heritage gardens are likely to impact on the Magenta Lilly Pilly, protective measures are to be set in place prior to commencement of works. This also applies to any changes in drainage patterns.

7.2.2 Endangered Ecological Communities

The establishment of alien species (weeds and pest animals) is internationally recognised as the second greatest cause of biodiversity decline after habitat destruction. Weeds have become established throughout all Australian landscapes during the past two (2) decades and pose a threat to about half of the flora and fauna species in NSW.

Plants imported for horticultural purposes (primarily domestic gardens) make up about 2/3rds of Australia's agricultural and environmental weeds, with 18 species identified as being among the worst weeds in Australia.

Some 30% of Australia's declared noxious weeds are garden escapes. Accordingly, the NSW Scientific Committee established under the NSW *TSC Act* has made a preliminary determination to list escaped exotic garden plants as a Key Threatening Process²³.

A **Key Threatening Process** ('KTPs') is described as a threat to biodiversity. KTPs are listed under Schedule 3 of the NSW *TSC Act*, as provided for under Part 2 of the Act.

²² Previously National Parks & Wildlife Service

²³ www.environment.nsw.gov.au/determinations/gardenplantspd.htm



Three (3) KTPs are directly applicable to the management of the BGHF remnant in the Subject Property at Wahroonga: These are:

1. Establishment of Escaped Exotic Garden Plants – preliminary determination gazetted 29 August 2008;
2. Invasion and Establishment of Exotic Vines and Scramblers – final determination gazetted 21 April 2006;
3. Invasion of Native Plant Communities by Exotic Perennial Grasses - final determination gazetted 12 September 2003.

A number of other KTPs apply to the BGHF remnant on the Subject Property at Wahroonga. These are: Invasion, Establishment and Spread of Lantana (presently not on the site), Infection of Native Plants by *Phytophthora cinnamomi* (which, as an endemic component of most soils in Eastern NSW) may be activated as the result of soil disturbances, and Loss of Hollow-bearing Trees.

The BGHF remnant and adjoining habitats in the Subject Property have been chronically degraded by the invasion and establishment of escaped garden plants; with 13 of these escapes being declared Noxious Plants in Ku-ring-gai LCA (see Section 4.3.4). Where a garden escapes has not been declared as a Noxious Plant, the term 'Environmental Weed' has been used (see Section 6.5).

In Core BGHF Habitat areas (Management Zones 1 and 2), weeds and garden escapes have substantially replaced the indigenous shrub and ground cover layers. For Management Zones 3 and 4, community structure has been reduced to individual or small stands of canopy trees which have been retained over exotic gardens or lawns. There is no question that the unchecked spread of garden escapes has seriously compromised the integrity and viability of the BGHF Ecological Community in this site.

Similar recommendations are made for Management Zone 5 – which comprise a number of small 'compensatory offsets'; some of which adjoin existing BGHF Habitat areas.

Recommendations:

1. For those species declared as 'Noxious Plants' there is a legal requirement for the landowner to control these plants and to prevent their spread to adjoining properties.
2. For both noxious and environmental weeds, the preliminary determination to declare garden escapes as KTPs means that in order to conserve and effectively management those areas of BGHF Habitat remaining *in situ*, a comprehensive weed control program should be undertaken at the earliest possible time.
3. Such a program should be carried out strictly in accordance with the recommendations and guidelines established by a formal Vegetation Management Plan prepared by a suitably qualified restoration ecologist.
4. Monitoring should be carried out as part of the BGHF Habitat Rehabilitation and Reconstruction Program, and this should take into account the possibility of the noxious *Lantana camara* invading the site from nearby bushland reserves (where it currently occurs).



5. Wherever possible within the constraints of the site, and where it does not compromise public safety, hollow-bearing trees should be retained.
6. In order to prevent the stimulation and/or importation and spread of the soil fungus *Phytophthora cinnamomi*, protocols for cleaning machinery and other hygiene measures should be established and strictly followed. This particularly important when vehicles or machinery used on site are brought in from weedy or polluted soils, or where the fungus is known to be active.

7.3 RETENTION OF CULTURALLY SIGNIFICANT PLANTINGS

A number of culturally significant trees have been identified in the *Arboricultural Impact Assessment Report* (Tree Wise Men, March 2009), these forming part of the heritage gardens at Rippon Grange. Some of these trees are located within areas identified for rehabilitation and/or reconstruction as BGHF Habitat.

This VMP proposes to retain culturally significant trees *provided* that they do not naturalise in the restored bushland and pose a threat to the floristic and structural integrity of the ecological community. Table 7.1 lists the significant existing introduced and non-indigenous plantings proposed for retention.

Recommendations:

1. Significant trees are to be protected during the BGHF Rehabilitation & Reconstruction Program by the erection of individual tree guards/shields and fencing – as per recommendations set out for native trees and described in Appendix 8.
2. See *Arboricultural Impact Assessment Report* (March 2009 & Appendix C) for additional protective measures for significant plantings to be retained *in situ*.

The species listed below have been planted in the BGHF Habitat areas. Unless otherwise stated, the significant cultural plantings and/or garden plants identified in Table 7.1 may be retained. However, in the BGHF Habitat areas all new seedlings/saplings will be removed as they occur.



Table 7.1: Significant Introduced Plantings in BGHF Habitat Areas

BOTANIC NAME	COMMON NAME	SIG. RANK	TREE NO.	MANAGEMENT ZONE			
				ZONE 1	ZONE 2	ZONE 3	ZONE 4
<i>Acacia elata</i>	Cedar Wattle	4	178	✓			
<i>Acmena smithii</i>	Lily Pilly	3	334	✓			
<i>Araucaria cunninghamiana</i>	Hoop Pine	3	148	✓			
<i>Callistemon salignus</i>	Willow Bottlebrush	4	346	✓			
<i>Callistemon salignus</i>	Willow Bottlebrush	4	347	✓			
<i>Casuarina glauca</i>	Swamp Oak	4	217				
<i>Ceratopetalum gummiiferum</i>	New South Wales Christmas Bush	4	119		✓		
<i>Corymbia citriodora</i>	Lemon-scented Gum	3	324	✓			
<i>Corymbia maculata</i>	Spotted Gum	3	103/104		✓		
<i>Cryptomeria japonica</i>	Japanese Cedar	4	301	✓			
<i>Cypressus sempervirens</i>	Italian Cypress	3	124/193	✓	✓		
<i>Elaeocarpus reticulatus</i>	Blueberry Ash	4	111		✓		
<i>Ficus rubiginosa</i>	Port Jackson Fig	4	122		✓		
<i>Jacaranda mimosifolia</i>	Jacaranda	4	120			✓	
<i>Jacaranda mimosifolia</i>	Jacaranda	3	117			✓	
<i>Juniper sp</i>	Juniper	3	145/146	✓			
<i>Liquidambar styraciflua</i>	Liquidambar	3	87			✓	
<i>Livistona australis</i>	Cabbage Tree Palm	3	341	✓			
<i>Palmae sp</i>	Palm	3	340	✓			
<i>Pinus radiata</i>	Monterey Pine	3	396	✓			
<i>Rhododendron sp.</i>	Rhododendron	3	129	✓			
<i>Strelitzia nicholi</i>	Giant Strelitzia	4	186	✓			

Note: Recommend retention of mature plants, but the removal of new seedlings as they occur. * Significance Ranking (Sig. Rank) from *Arboricultural Impact Assessment Report*, Tree Wise Men (March 2009). 1 = Most Significant, 4 = Least significant.



7.4 REMOVING WEEDS & INVASIVE GARDEN PLANTS

The location of weed polygons have been illustrated in Figure 4.4, and target weed species contained in each polygon are listed in Appendix 4. After a targeted weed program has been undertaken to remove these aggressive and free-seeding species (via a primary targeted weed sweep), comprehensive bush regeneration works may commence.

The Bush Regeneration approach will focus initially on weeding in sites which retain some native plants (i.e. those expected to retain at least some site resilience).

In Management Zones 1 and 2, these areas have been illustrated as ‘remnant trees over lawn/native plant beds (see Figure 4.6). This approach – often described as ‘weeding from good areas to bad’ – will encourage the natural regeneration of native species, while weeding around the perimeters of such areas will provide germination sites and micro-niche sites for the expansion of the native vegetation.

Weeds and other unwanted garden plants will be removed using a combination of low impact hand weeding techniques and selective herbicide application – the latter being confined primarily to ‘cut stump and poison’, tree injection and (for vines) ‘stem scrape and poison’. In some very weedy areas, targeted low-volume foliar spraying will be used.

It is recommended that because of the danger of accidental damage to non-target species, foliar spraying be kept to an absolute minimum, although the eradication of turf grasses and dense stands of weeds such as Fishbone Fern and Asparagus ‘Fern’ would be more thoroughly and economically controlled through the application of one of the selective herbicides registered for use on the species.

For those areas where few or no native plants remain *in situ* (illustrated as ‘remnant trees over weedy understorey - Management Zones 3, 4 and possibly some parts of Management Zone 5 – see Figure 4.6), unwanted vegetation may be ‘scalped’ or ‘stripped’ from the understorey using a range of methods and techniques, including the use of a small bobcat with low pressure tyres –this approach being applicable only if machinery can be manoeuvred without damaging native trees and shrubs.

Considering the size of the area to be treated and the large volume of weed debris to be disposed of, primary and secondary weeding over all Management Zones is expected to take 2-3 years (at least).

A high level of follow-up and maintenance weeding will be required for all regenerating sites as a matter of routine, and no enrichment planting is to take place until such time as weed regrowth is under control. To plant without effective weed control is to invite unacceptably high maintenance costs, and possibly the loss of many new plants.



Recommendations:

1. Adopt a strategic approach to weed control, targeting first those species with the most potential to naturalise in bushland, to persist and displace native understorey species, and to alter ecosystem function (see Table 7.2).
2. Prepare a weeding calendar, which allows for treatment of weed species before they flower/fruit, thereby maximising resources and weeding effort. This weeding calendar should form part of the Action Plan for on-ground works.
3. Utilise weed control techniques appropriate to the species to be controlled and the site in which they occurs: consider the economics of hand weeding vs. other techniques and the potential benefits of alternative methods.
4. Plan for the prompt and careful disposal of weed debris, and avoid stockpiling debris in areas with high public visibility.
5. Weed timbers are not to be chipped for re-use as mulch unless they can be guaranteed to be free of seed and other propagules. Debris should be removed to a landfill site.
6. Weed-free topsoil and native timbers may be stockpiled for reuse at a later date provided they are windrowed at a height of not more than 0.5 metres and stored for less than three (3) months. After this time, composting will dramatically reduce the viability of any stored native seed, rhizomes or root fragments.

Table 7.2: List of Target Weeds Identified in BGHF Habitat Areas

(Note: all plants listed are to be removed from BGHF Habitat areas)

BOTANIC NAME	COMMON NAME	STATUS *	COMMENTS
WOODY WEEDS			
<i>Acacia baileyana</i>	Cootamundra Wattle	Environmental weed	Non-indigenous native: spreads rapidly by seed
<i>Acer negundo</i>	Box Elder	Environmental weed	Remove seedlings from BGHF Habitat areas
<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	Environmental weed	Remove seedlings from BGHF Habitat areas
<i>Cinnamomum camphora</i>	Camphor Laurel	Noxious weed	Noxious in LGA. If retained, mature trees will continue to contribute a large number of seedlings
<i>Cotoneaster glaucophyllus</i>	Cotoneaster	Environmental weed	Planted widely within the Subject Property: monitor for seedlings in BGHF Habitat areas.
<i>Ficus pumila</i>	Creeping Fig	Environmental weed	Roots will damage stonework
<i>Genista monspessulana</i>	Montpellier Broom	Environmental weed	Noxious in LGA: widespread shrub of no floristic value: remove all specimens.



BOTANIC NAME	COMMON NAME	STATUS *	COMMENTS
<i>Jacaranda mimosifolia</i>	Jacaranda	Environmental weed (depending on location)	Remove all seedlings/saplings in BGHF areas if mature trees are to be retained elsewhere.
<i>Ligustrum lucidum</i>	Large-leaved Privet	Noxious weed	Noxious weed in LGA: remove all specimens within the property.
<i>Ligustrum sinense</i>	Small-leaved Privet	Noxious weed	Noxious weed in LGA: remove all specimens within the property.
<i>Morus alba</i>	White Mulberry	Environmental weed	Remove all seedlings/saplings in BGHF areas if mature trees are to be retained elsewhere.
<i>Ochna serrulata</i>	Mickey Mouse Plant	Noxious weed	Noxious weed: if retained, mature shrubs in gardens will continue to contribute a large number of seedlings.
<i>Olea europaea</i> var <i>cuspidata</i>	African Olive	Environmental weed	Mature plants in gardens will continue to contribute a large number of seedlings: remove all seedlings from BGHF Habitat areas
<i>Solanum mauritanum</i>	Wild Tobacco Tree	Ruderal weed	Remove plants from entire property
<i>Rubus fruticosus</i>	Blackberry	Noxious weed	Beginning to establish in various locations
HERBACEOUS WEEDS			
<i>Agapanthus praecox</i> = <i>africanus</i>	Agapanthus	Environmental weed	Maintain in garden beds: monitor for seedlings in BGHF areas
<i>Ageratina adenophora</i>	Crofton Weed	Agricultural / Ruderal weed	Remove where it occurs: indicative of drainage problems, so investigate source of water
<i>Ageratina riparia</i>	Mistflower	Agricultural / Ruderal weed	Small numbers near grotto, MZ 2
<i>Chlorophytum comosum</i>	Spider Plant	Environmental weed	
<i>Cirsium vulgare</i>	Scotch Thistle	Agricultural/Ruderal weed	
<i>Ehrharta erecta</i>	Perennial Veldt Grass	Environmental weed	Difficult to eradicate: mulch or over sow with native ground covers after herbicide application
<i>Hedychium gardnerianum</i>	Ginger lily	Environmental weed	Maintain in gardens but remove from BGHF Habitat areas



BOTANIC NAME	COMMON NAME	STATUS *	COMMENTS
<i>Lilium formosanum</i>	Formosa Lily	Environmental weed	Few individuals in gardens but will spread rapidly by seed unless all plants are removed
<i>Nephrolepis cordifolia</i>	Fishbone Fern	Environmental weed	Maintain in gardens: eradicate from BGHF Habitat areas.
<i>Parietaria judaica</i>	Pellitory / Asthma Weed	Noxious weed	Noxious weed: allergenic: mainly in rockeries
<i>Paspalum dilatatum</i>	Paspalum	Agricultural weed	Part of grassy sward, mainly in MZ 3
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Agricultural weed	Keep out of BGHF areas completely. Spreads by rhizomes (not seed) so keep away from interface sites with bushland
<i>Phyllostachys aurea</i>	Golden Cane / Bamboo	Noxious weed	Noxious weed in LGA: remove entirely
<i>Setaria</i> spp	Pigeon Grasses	Agricultural weed	Secondary weed: control as resources allow: mainly in grassland (MZ 3)
<i>Solanum nigrum</i>	Blackberry Nightshade	Ruderal weed	Secondary weed: poisonous berries
<i>Sporobolus virginicus</i>	Parramatta Grass	Agricultural weed	Secondary weed: control as resources allow: mainly in grassland (MZ 3 and 4, Polygon E)
<i>Stenotaphrum secundatum</i>	Buffalo Grass	Environmental weed	Used as turf in part of MZ 2 – remove (strip?) from BGHF Habitat areas completely
<i>Strelitzia nicolai</i> , <i>S. regina</i>	Bird of Paradise	Environmental weed (depending on location)	Remove seedlings/saplings from BGHF Habitat areas: leave mature plants & monitor
<i>Tradescantia fluminensis</i>	Wandering Jew	Noxious weed	Noxious weed in LGA: eradicate throughout entire property: spot spray or rake and monitor regrowth.
<i>Tropaeolum majus</i>	Nasturtium	Environmental weed	Secondary weed: control as resources allow:
<u>VINES & SCRAMBLERS</u>			
<i>Asparagus aethiopicus</i>	Asparagus Fern	Noxious weed	Noxious in LGA: Widespread: berries distributed by birds/foxes: ideally should be removed from entire property, but essential to remove from all bushland areas
<i>Asparagus plumosus</i>	Climbing Asparagus	Noxious weed	As above: but less invasive



BOTANIC NAME	COMMON NAME	STATUS *	COMMENTS
<i>Anredera cordifolia</i>	Madeira Vine	Noxious weed	Noxious in LGA: small infestation MZ 3: critical to eradicate as quickly as possible
<i>Araujia sericifera</i>	White Moth Vine	Environmental weed	Secondary weed: control as resources allow
<i>Hedera helix</i>	English Ivy	Environmental weed	Remove all plants from BGHF Habitat areas
<i>Jasminum polyanthum</i>	Jasmine	Environmental weed	Remove all plants from BGHF Habitat areas
<i>Hedera helix</i>	English Ivy	Environmental weed	Remove all plants from BGHF Habitat areas
<i>Ipomoea indica</i>	Morning Glory	Noxious weed	Noxious in LGA: mainly in MZ 3 / 4 Polygon F near old stables: rampant growth so must be eradicated
<i>Lonicera japonica</i>	Japanese Honeysuckle	Environmental weed	Remove all plants from BGHF Habitat areas
<i>Passiflora edulis</i>	Passionfruit	Environmental weed	Secondary weed: mainly in MZ 3 / 4 Polygon F: near old stables: eradicate where it occurs
<i>Thunbergia alata</i>	Black-eyed Susan	Environmental weed	Mainly in MZ 3 and 4, near old stables: eradicate
<i>Wisteria floribunda</i>	Wisteria	Environmental weed (depending on location)	Contain in landscaped gardens: monitor spread into BGHF Habitat areas and control

* see Section 4.3.4 for explanation of weed status

Note: not all introduced species or minor weeds have been including in the table above. Minor weeds (usually herbaceous species) such as chickweed, fleabanes, clovers and vetch have not been identified for weed control.



7.5 POTENTIAL IMPACT OF INTRODUCED PLANTS IN HERITAGE GARDENS

The following Table provides a list of garden plants occurring in the heritage gardens which are known to be invasive in native bushland (i.e. as environmental weeds). Many of these have also been listed as 'keystone' or 'target' weeds in the BGHF Habitat (see Table 7.2).

As the current Proposal includes the retention and refurbishment of the heritage gardens, these plants may impact on the bushland restoration project in the BGHF Habitat Areas unless they are strictly controlled. *This list is by no means exhaustive.*

Table 7.3: Introduced Plants in Gardens known to be Invasive in Bushland & Recommended for Removal

BOTANIC NAME	COMMON NAME
<i>Agapanthus praecox</i>	Agapanthus
<i>Asparagus aethiopicus</i> (Noxious)	Fern or Ground Asparagus
<i>Brachychiton acerifolius</i>	Illawarra Flame Tree
<i>Cinnamomum camphora</i> (Noxious)	Camphor laurel
<i>Celtis orientalis</i>	Hackberry
<i>Chlorophytum comosum</i>	Spider Lily
<i>Corymbia citriodora</i>	Lemon Scented Gum
<i>Cotoneaster glaucophyllus</i>	Cotoneaster
<i>Dietes vegeta</i>	Peacock Iris
<i>Hedera helix</i>	English Ivy
<i>Hedychium gardnerianum</i>	Yellow Ginger
<i>Jacaranda mimosifolia</i>	Jacaranda
<i>Jasminum polyanthum</i>	Chinese Jasmine
<i>Melia azedarach</i>	White Cedar
<i>Morus alba</i>	White Mulberry
<i>Nephrolepis cordifolia</i>	Fishbone Fern
<i>Ochna serrulata</i> (Noxious)	Ochna/Mickey Mouse Bush
<i>Olea europaea</i> var. <i>cuspidata</i>	African Olive
<i>Phoenix canariensis</i>	Phoenix / Canary Island Palm
<i>Phyllostachys aurea</i> (Noxious)	Golden Cane / Bamboo
<i>Ulmus parviflora</i>	Chinese Elm