APPENDIX A

Department of Infrastructure, Planning and Natural Resources

Disposal of Surplus Government Land at Seaforth

Precinct A1 - Development Options

Report for Discussion with Residents

July 2003

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1. Introduction

The Department of Infrastructure, Planning and Natural Resources (DIPNR, formerly PlanningNSW) and the Roads & Traffic Authority have proposed the development of the surplus Government lands in Wakehurst Parkway between Judith St and Kirkwood St.

Development options are impacted by two environmental concerns namely:

- The presence of endangered species in the western part of the proposed development site (part of the threatened Duffys Forest eco-system);
- Threat of bushfire developing in Garigal National Park and spreading to the proposed development site.

Sensitive development of the site, as proposed, is considered a viable option. The proposal as suggested in this Report provides for:

- Certainty in the scope of development and funding to undertake immediate measures to protect the endangered species and enhance the protected area;
- Protection of endangered species by implementation of an active long term preservation and management strategy;
- Positive bushfire asset protection measures will protect both the projected new residences and existing privately owned residences.

This report seeks to canvass the issues and present a strategy for the development of the site taking into account all valid constraints.

DIPNR has commissioned a number of studies and reviews to assist in the understanding of the potential of the site.

2. Flora

2.1 Protection of Endangered Flora

URS undertook two studies of the flora in the area. The first was incorporated in the LesryK Report (December 2001). The second report was prepared following advice from URS that more details on the definition and description of Duffys Forest flora had been published. At the same time local residents were drawing attention to the fact that a number of endangered plants appeared to be growing near the Wakehurst Parkway section of the proposed subdivision.

The second URS Report (dated 23 July 2002) verified that the vegetation was Duffys Forest and identified the presence of endangered plant species. A copy of the Report is included in **Appendix A**.

URS offered the following recommendations and conclusions:

- The land to the west of the existing dirt track is considered to be Duffys Forest vegetation within the meaning of Provision No 4 of the Scientific Committee's Final Determination (2002) for this plant community;
- An SIS would not be required if development was restricted to the east of the dirt track provided certain additional measures were implemented such as:
  - Measures to divert stormwater runoff from any retained bushland area;
  - The adoption of a buffer between the actual building envelopes and downslope areas of retained bushland;
  - Continuation of cessation of mowing activities in areas west of the existing dirt access track to allow the site to naturally regenerate to a woodland structure which will, in turn, partially discourage pedestrian traffic from these areas.

It was agreed by DIPNR/RTA and residents that the site should be further re-assessed by an independent third party.

The reassessment was undertaken by Teresa James in September 2002 (see copy of Report in **Appendix B**). Ms James provided the following conclusions and recommendations:

- The native vegetation to the west of the access track is of national, state, regional and local conservation significance and consequently there are ecological constraints to future development;
- All remnant and regenerating vegetation west of the dirt access track be protected by fencing to prevent unnecessary disturbance and damage;
- A bush regeneration program be initiated with the local community;
- An appropriate buffer zone (at least 10 metres wide) and fire protection zone be provided between the bushland and any new development with the buffer zone including the dirt access track;

- The area should not be used as a thoroughfare i.e. the present track should be closed;
- Measures need to be developed to divert stormwater run-off from the residential areas away from the bushland area but retaining the natural drainage line within the lower section to ensure survival of those plants that require locally damp conditions.

From the above reports it was clear that the area needs protection and that a suitable buffer zone needs to be provided.

DIPNR then sought the views of Hayes Environmental as to the best approach to be adopted for the preservation of the front part of the site and the development of the rear of the site. In essence, Hayes Environmental agreed with the need for protection of the site but proposed the use of a positive buffer rather than a passive one to prevent run-off from the developed part of the site. The key recommendations were:

- The eastern part of the site could be developed with five lots as previously proposed;
- A concrete laneway and drainage should be placed at the front of the Lots to act as a positive buffer;
- The eastern part of the site should be protected and a natural bush track be delineated through the site and a small picnic table placed at the southern end this would be particularly beneficial to land care workers.

A copy of the Report is provided in **Appendix C**.

Conacher Travers were engaged to provide a bushfire threat assessment. The Report is discussed in Section 2.2 with a copy provided in **Appendix D**. They were provided with a concept plan of a possible 5 Lot layout that addressed the criteria proposed by Hayes Environmental.

The assessment determined that the bushfire threat to the proposed development is **high** and that any fire burning in the bushland to the west of Wakehurst Parkway would present a **moderate/high** level of vulnerability to the future dwellings within the subdivision.

Conacher Travers concluded that development was possible provided any future buildings were sited within a defined preferred building footprint. More importantly they recommended that all of the area recommended for protection should be maintained as an Inner Asset Protection Area because of the likelihood of fires coming from the north-west from Garigal National Park and jumping the road.

This proposed Inner Asset Protection Zone would be required to protect the existing privately owned residences whether or not there was development of the vacant DIPNR/RTA lands.

As this had serious implications for the protection of the endangered flora. Advice was again sought from Hayes Environmental (see **Appendix E**). They provided the following assessment:

"The Bushfire Protection Assessment raises some issues with regard to protection of threatened species on the Precinct A1 site. The report identifies that the whole of the Bushland Preservation Area on the site should be managed as an Inner Protection Zone for bushfire hazard reduction. This is illustrated on Schedule 1 [of the Conacher Travers Report].

"In general, an Inner Protection Zone should be managed as an almost fuel-free zone. This is usually achieved through a combination of access tracks and roadways, and mown lawn. This management would clearly impact upon the Duffy's Forest ecological community, and also upon the threatened plant species known or potentially present.

"More specific details for management of an Inner Protection Zone are provided in Appendix 1 of the Bushfire Protection Assessment report. Trees are permitted within an Inner Protection Zone if the canopy does not form a link with the shrub layer, and at maximum densities specified in Table 2.

"I have roughly calculated the densities of existing trees in the Bushland Preservation Area (based on the trees illustrated on Schedule 1, and the boundary of the Asset Protection Zone (APZ) indicated on Schedule 1), and compared these with densities specified in Table 2 [of the Conacher Travers Report] :

- *there are no trees within the first 5m of the asset protection zone, this being the area from the building zone to the proposed access track. This is consistent with requirements in Table 2;*
- *there are approximately 3 trees in the next 5m of the APZ (ie between 5-10m from Lots 3, 4 and 5), within an area of approximately 480 m^2. This is less than 1 tree per 100 m^2;*
- *there are approximately 6 trees in the next 10m of the asset protection zone (ie between 10-20m of Lots 3, 4 and 5), within an area of approximately 960m^2. This is less than 10 trees per 400 m^2.*

*"**It appears that no trees will need to be removed from the Bushland Preservation Area for asset protection**. However, the actual number and arrangement of trees depends on an individual assessment being undertaken (page 5 of Appendix 1).*

*"Shrubs are also permitted within an Inner Protection Zone, where cover is 10-15%, and in some cases up to 30%. Again, this must be specifically assessed by an experienced bushfire protection manager. There are currently few shrubs present on the site, and these are generally more than 20m from the building zones. **It is likely that the majority of shrubs present could be retained on the site, mainly where these are not linked to tree canopies**.*

"In general, the understorey/grass layer should be mown. This poses a particular threat to Pimelea curviflora ssp curviflora, *a threatened plant species known to occur on the site.* Pimelea curviflora ssp curviflora *is a small woody plant which grows up to 0.5m in height, and flowers from September to January*

(Robinson 1991; Fairley & Moore 1995). Plants present on the site are generally 5-15cm in height, and have regenerated from woody rootstock (James 2002).

*"*Pimelea curviflora ssp curviflora *is known to be regenerating in only a few parts of the Bushland Preservation Area, all west of the proposed walking track.* ***This species could be protected if grassland areas to the west of the proposed walking track were slashed to no less than 0.4 to 0.5m in height****. Grassland to the east of the proposed walking track could be mown regularly.* ***It may be possible to identify a few areas west of the proposed walking track which are particularly important for the species, and retain these as 'bush gardens', whilst mowing or slashing the majority of the Bushland Preservation Area.***

"A second threatened plant species, Microtis angusii, *is considered possibly occurring on the site (James 2002). This plant would be present as underground tubers for most of the year, producing leaves and flower in late winter and spring (James 2002). This plant would be less susceptible to mowing and slashing, if the Bushland Preservation Area was not mown or slashed during its reproductive season. This reproductive season is outside of the normal bushfire danger season.*

"In summary, it appears possible that the Bushland Preservation Area could be maintained for the dual purposes of asset protection and threatened species protection. However, this will need to be achieved through specific on-site discussions between an ecologist and an experienced bushfire protection manager. Responsibility for on-going maintenance of the area will need to be addressed."

DIPNR have advised their commitment to planning outcomes that meet the legitimate expectations of the community in terms of both asset protection and threatened species protection.

In light of this they have agreed to the implementation of all of the recommendations.

2.2 Bushfire Protection

As pointed out above, Conacher Travers determined that the bushfire threat to the proposed development is **high** and that any fire burning in the bushland to the west of Wakehurst Parkway would present a **moderate/high** level of vulnerability to the future dwellings within the subdivision.

They provided seven recommendations for the development of the site. In summary these are:

- Future dwellings should be sited within preferred building footprints with this requirement being a condition of development of each Lot;
- Asset protection zones should be provided to the future buildings within the proposed subdivision. As mentioned in Section 2.1 the total area of the surplus land should be an Asset Protection Zone;

- Fuel management within the Asset Management Zone should be in accordance with the management guidelines for an Inner Protection Zone;
- Future buildings should be constructed in accordance with Australian Standard AS 3959 *"Construction of Buildings in Fire Prone Areas"*;
- Roof gutters and valleys to all buildings should be leaf proofed;
- A hydrant supply system should be provided to each building in accordance with the requirements of AS2419.1-1994;
- A turning head should be provided to allow truck turning at the end of the Right of Carriageway.

DIPNR has indicated its intention to implement all of the recommendations presented by Conacher Travers. A plan of management of the Asset Protection Zone will need to be developed to meet the dual purposes of asset protection and threatened species protection.

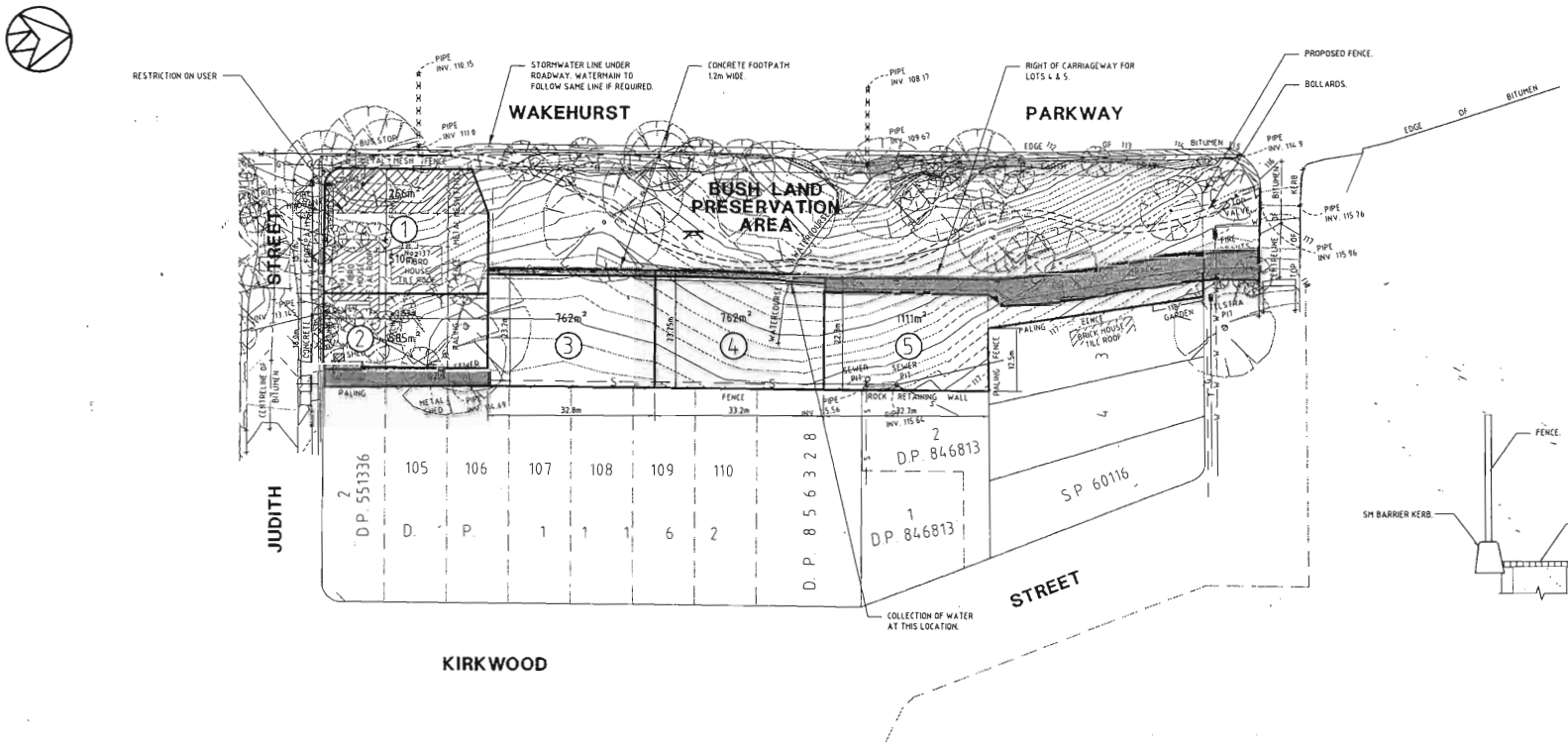
3. Proposed Concept

It is considered that all of the concerns described above can be addressed with an environmentally sensitive five Lot development. A draft proposal is shown in **Figure 1**.

The proposal contains the following key elements:

- Five lot subdivision east of the dirt track;
- Vegetation preserved west of dirt track;
- Provide within the boundary of the proposed lots a concrete right of carriageway or footpath together with drainage to collect all run-off on the proposed subdivision side of dirt track. This run-off will be piped to Wakehurst Parkway avoiding any endangered vegetation;
- A marked earthen walking track will be provided to ensure that the site can be traversed but the vegetation protected. Stewart Park near Epping Boys High School at Epping Road/Vimera Road Marsfield is a possible model;
- A picnic table will be placed to the south of the protected area;
- Specific areas of endangered species occur to the west of the proposed walking track and will e retained as "bush gardens";
- Mowing/slashing will be restricted to the east of the walking track or partly to the west as agreed with an ecologist on site;
- Residences will have to incorporate all of the bushfire protection measures recommended in the Conacher Travers Report.

It is proposed that The Bushland Preservation Area would be placed under care, control and management of Council.



PLAN
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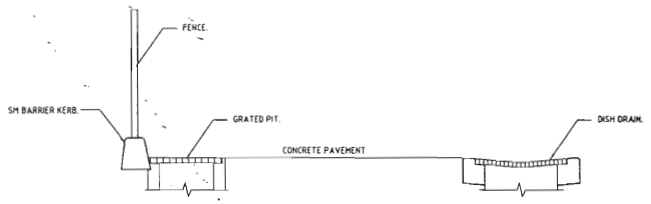

TYPICAL SECTION
OF CONCRETE PAVEMENT
IN FRONT OF LOTS 3,4 &5

NOTES

- RESTRICTION ON USER
- PROPOSED FENCE
- PROPOSED STORMWATER
- PROPOSED WALKING TRACK (LOCATION INDICATIVE)
- PROPOSED PICNIC TABLE (LOCATION INDICATIVE)
- PROPOSED LOT No. (1)
- RESTRICTION AS TO USER POTENTIAL ROAD RESERVE

5 0 10 20 30 m
1:500 @ A1

DATE: March 2003

SEAFORTH PRECINCT A1
CONCEPT 1

Appendix A

Vegetation Assessment – Precinct A1, North Seaforth – Draft for Discussion

Report by URS dated 23rd July 2002

URS

July 23 2002
Project No. 46154-005

LesryK Environmental Consultants
20 Woodfield Avenue
Bundeena NSW 2230

Attention: Deryk Engel

Dear Deryk,

Subject: Vegetation Assessment - Precinct A1, North Seaforth – DRAFT FOR DISCUSSION

Introduction and Background

URS Australia Pty Ltd (URS) was commissioned by GHD Group (formerly Egis Consulting) to undertake an additional vegetation survey and assessment of previously mown areas within Precinct A1 RTA Lands at North Seaforth. Precinct A1 has been subject to previous vegetation survey and assessment by URS (see References section of this report). The objective of the present study is to identify and assess the nature and extent of native plant regeneration within previously mown areas of the Precinct lands (it is understood that mowing activities have ceased on the lands since April 2002) and to confirm whether any natural plant regeneration occurring in the previously mown areas constitutes Duffys Forest, listed as an Endangered Ecological Community under the NSW *Threatened Species Conservation Act* 1995 (TSC Act). Duffys Forest has been recorded within and just beyond the road reserve on the subject lands in previous surveys undertaken by URS.

Soils and Geology

The subject lands are mapped as being part of the Somersby Soil Landscape Unit, being underlain by Hawkesbury Sandstone with overlying laterite gravels and clay (Chapman and Murphy 1989). Inspection of soils during present and past site surveys verified this mapping to be accurate with surficial soils comprising gravel, sands and sandy silts (refer Plate 1).

Site Description

The subject remnant is comprised of a 3000 square metre (150 m by 20 m) linear bushland strip situated across from Garigal National Park to the north of Judith Street. The remnant is bordered to the north by Wakehurst Golf Course, to the south and east by residential properties and to the west by Garigal National Park (across the Wakehurst Parkway). A dirt access trail bissects the middle portion of the site (Plate 5).

The site supports a Silvertop Ash (*Eucalyptus sieberi*) – Scribbly Gum (*E. haemastoma*) – Common Sandstone Stringybark (*E. oblonga*) Open Woodland. This remnant supports a partially cleared native overstorey and understorey within or just beyond the road reserve. The subject

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lands situated beyond the woodland strip (to the east) have been subject to past mowing activities and thus comprises only low groundcover.

Methodology

A groundcover search for native seedlings was undertaken across the previously mown areas of the site via a total of eight (8) 1 m^2 dimension grids staked to the ground wherein all vascular taxa observed within and overhanging each grid was recorded on proforma field data sheets (presence/absence only). A percent cover of all native taxa observed on the site was also estimated.

The objective of the search was to inventory plant taxa that may have germinated and/or grown since cessation of mowing activities earlier this year and to assess percent ground cover of native plant taxa. A Duffys Forest Index (DFI) based on regrowth taxa within previously mown areas was calculated (Smith 2000) in an attempt to determine whether the site regrowth constituted Duffys Forest vegetation.

A Section 5A Assessment under the NSW *Environmental Planning and Assessment Act* 1979 was also carried out to determine whether possible site redevelopment may constitute a significant impact on listed Threatened species, populations and communities and consequently whether the preparation of a Species Impact Statement (SIS) would be required should a development option be pursued.

Results

A total of thirty-seven (37) plant taxa from nineteen (19) families was recorded within previously mown areas on the subject lands during the present study (Attachment A). All plant taxa were recorded on the western side of the dirt access track that bissects the site. Little evidence of native plant regeneration was observed on the eastern side of the dirt track during past and present studies, presumably due to the presence of introduced grasses as well as areas of suspected stockpiled fill material (overgrown with introduced grasses). Plant taxa recorded comprised both overstorey and understorey species with all taxa recorded less than 30 cm in height. Percent groundcover of plant taxa recorded during the present study in previously mown areas was estimated to be approximately 30 percent and thus the extent of natural plant regeneration in this area is considered to be moderate.

Regrowth vegetation recorded during the present study is no doubt sourced from the soil seed bank from both recent and more historical fruiting seasons and has presumably survived partially intact from past mowing activity. Duffys Forest remnants situated across the Wakehurst Parkway in Garigal National Park and in Precinct A2 would be expected to provide additional sources of species recruitment onto the subject lands.

Based on the assemblage of species listed in both the Scientific Committee's Final Determination for Duffys Forest and Smith and Smith (2000), regrowth vegetation in previously mown areas on the site is considered to constitute Duffys Forest vegetation. No additional positive or negative diagnostic species (Smith 2000) were recorded on Precinct A1 lands during the present study and thus the Duffys Forest Index (DFI) calculated for the Precinct A1 lands in a previous assessment of the site by URS (calculated to be 57) would remain the same. A high index number (say 50 or

greater) indicates a relatively high confidence of the presence of Duffys Forest for a particular remnant.

One additional mature low shrub, *Pimelea curviflora* var. *curviflora*, was recorded to the immediate west of the dirt track in the central portion of the site. The shrub was approximately 20 cm in height and was in flower.

Conclusions

Based on the above findings, areas within Precinct A1 lands situated to the west of the existing dirt rack are considered to constitute Duffys Forest vegetation, within the meaning of provision No. 4 of the Scientific Committee's Final Determination (2002) for this plant community. This provision notes that at any one time, seeds of some species may only be present in the soil seedbank with no above ground individuals present.

The Section 5A Assessments carried out as part of the present study concluded that the impacts on both Duffys Forest and *Pimelea curviflora* var. *curviflora* as a result of possible site redevelopment **within these areas** would be expected to be significant and that the preparation of a Species Impact Statement (SIS) would be required.

The preparation of an SIS for possible site redevelopment within areas to the east of the dirt access track on the site would not be expected to be required given that this development option would not directly remove an area of Duffys Forest vegetation. Development in this area, however, should be sympathetic to the Duffys Forest remnant in this Precinct and should include:

- Measures to divert stormwater runoff away from any retained bushland areas;
- The adoption of a buffer between actual building envelopes and downslope areas of retained bushland; and
- Continuation of cessation of mowing activities in areas west of the existing dirt access track to allow the site to naturally regenerate to a woodland structure which will, in turn, partially discourage pedestrian traffic in these areas from adjacent development (children, bikes, etc.).

Referral to the Federal Minister of the Environment for approval to remove individual *Pimelea curviflora* var. *curviflora* plants would be expected to be required given the absence of population data in the locality for this species. Vegetative cloning of these individuals and subsequent transplantation in a Duffys Forest remnant in Garigal National Park across the Wakehurst Parkway from the subject lands is recommended to ensure the long term protection of this taxon in the immediate locality. It is recommended that this measure be adopted even if site redevelopment is restricted to areas ~~west~~ east of the existing dirt access track.

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Keith, D. (1996) Fire-driven extinction of plant populations: a synthesis of theory and review of evidence from Australian vegetation. Proceedings of the Linnean Society of NSW:116:37-78.

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Yours faithfully,
URS AUSTRALIA PTY LTD

Isaac Mamott
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John Simpson
Senior Ecologist

Attachment A Floristic List (Precinct A1 – previously mown areas)
Attachment B Section 5A Assessments, Duffys Forest and *Pimelea curviflora* var. *curviflora*
Attachment C Revised Vegetation Map – Precinct A1
Attachment D Photographic Record
Attachment E Limitations

Attachment A –

Floristic List

DRAFT FOR DISCUSSION

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Floristic List

Key:

A1= those taxa recorded in Precinct A1(previously mown areas) during present study
+ = Positive diagnostic species for Duffys Forest (per Smith and Smith 2000)
- = Negative diagnostic species for Duffys Forest (per Smith and Smith 2000)
*=introduced and non-endemic taxa (garden escapees, pests)
bold TAXA = listed as Threatened under NSW *Threatened Species Conservation Act* 1995

Note: The flora list represents species recorded on the site during the botanical survey and should not be interpreted as a comprehensive list of all species present, given the ephemeral nature of many plant species (that is, surveys over many years would be required to obtain a comprehensive list of all species occurring in an area).

Table A-1 Floristic List of North Seaforth Precinct A1 (previously mown areas)

Grouping and Family	Botanical Name	Common Name	Diagnostic species (Duffys Forest)
Angiosperms			
(Monocotyledons)			
Cyperacae	*Caustis flexuosa*	Curly Wig	
Iridaceae	*Patersonia sericea*	-	
	Dianella revoluta		+
Lomandraceae	*Lomandra glauca* ssp. *glauca*		
	Lomandra gracilis	-	
Poaceae	*Aristida vagans*	Three-awn Speargrass	+
	Aristida ramosa	Three-awn Speargrass	
	Austrodanthonia tenuior	-	
	*Cynodon dactylon**	Common Couch	
	Entolasia stricta	Wiry Panic	
	*Imperata cylindrica**	Blady Grass	
Stackhousiaceae	*Stackhousia viminea*		
Stylidiaceae	*Stylidium graminifolium*	Trigger Plant	
(Dicotyledons)			

Grouping and Family	Botanical Name	Common Name	Diagnostic species (Duffys Forest)
Apiaceae	*Actinotus minor*		
	Xanthosia tridentata	Rock Xanthosia	
Casuarinaceae	*Allocasuarina sp.(probably either littoralis or distyla)*	She-oak	
Dilleniaceae	*Hibbertia empetrifolia*	Trailing Guinea Flower	
	Micrantheum ericoides		
Epacridaceae	*Epacris microphylla*	Coral Heath	-
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge	
Fabaceae/Faboideae	*Bossiaea heterophylla*	Variable Bossiaea	
	Dillwynia retorta	Heathy Parrot Pea	
	Dillwynia floribunda	-	
	Pultenaea elliptica		
Fabaceae/ Mimosoideae	*Acacia terminalis*	Sunshine Wattle	
	Acacia myrtifolia	Myrtle Wattle	
Haloragaceae	*Gonocarpus micranthus*	-	
Myrtaceae	*Eucalyptus sieberi (sapling)*	Silvertop Ash	
	Baeckea sp.	Heath Myrtle	
	Melaleuca armillaris		
	Kunzea ambigua	Tick Bush	
	Leptospermum polygalifolium ssp. polygalifolium	Tea-Tree	
Proteaceae	*Banksia serrata*	Old Man Banksia	
Rubiaceae	*Richardia stellaris**	-	
Sapindaceae	*Dodonea triquetra*	Hop Bush	
Sterculiaceae	*Lasiopetalum ferrugineum* var. *ferrugineum*	Rusty Petals	
Thymelaeaceae	***Pimelea curviflora* var. *curviflora***		+

Attachment B
Section 5A Assessments

URS

Section 5A Assessments

Pimelea curviflora var. *curviflora*

A Section 5A Assessment under the *Environmental Planning and Assessment Act* 1979 has been carried out below to determine whether or not the impacts from possible site redevelopment of Precinct A1 lands will have a significant impact on the Threatened shrub species, *Pimelea curviflora var curviflora*, and consequently whether or not the preparation of a Species Impact Statement is required should the development option be pursued in this area.

Pimelea curviflora var. curviflora

(a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The life cycle components of the multi-stemmed low shrub *Pimelea curviflora* var. *curviflora*, essentially comprising recruitment, reproduction and the formation of seed banks, along with other physiological and ecological data such as habitat, response (sensitivity) to fire and an increased nutrient load, is poorly understood. A Draft Recovery Plan for the species detailing ecological, biological and conservation data known to date has reportedly not been prepared by NPWS. The NSW Scientific Committee Final Determination for the species indicates that the plant is rare within its restricted distribution on sandstone and lateritic soils in northern Sydney and that it can survive fire via its underground tuberous roots (NSW Scientific Committee 1998).

Three plants were recorded in Precinct A1 on top of the road cutting just beyond the road reserve and near a dirt access track that bissects the site in a previous flora survey of the site carried out by URS. A fourth mature plant to 20 cm in height was recorded to the immediate west of the access track as part of the present study. Two individuals of the species were previously recorded by URS in the northern section of Precinct A2 within the road reserve although these individuals were not recorded in follow up investigations but may be present in the soil seed bank. All four individual plants recorded in Precinct A1 were in flower. Smith and Smith (2000) note that this species was recorded on the western side Wakehurst Parkway in Garigal National Park across from the Precinct A2 remnant, and thus the 4 individuals recorded are expected to be part of a subset of a local population of this species. No details on the estimated size of the local population of the species were ascertained at the time of report preparation. The NSW Scientific Committee Final Determination for the species notes that most sites where the species has been recorded support only a few plants or estimates of less than 100 plants (NSW Scientific Committee 1998).

Removal of one or more of the 4 plants recorded may not result in a significant reduction in the genetic diversity and viability of the local plant population, although no definitive statement to this effect can be made without accurate information on the local plant population size.

Should the development option be pursued in Precinct A1, measures to mitigate the impacts of loss of these plants as part of the local populations should be undertaken via a process of direct translocation and cloning (with relocation to a patch of Duffys Forest habitat in Garigal National Park across the Wakehurst Parkway). Assuming this is successful, this would ensure the retention of the existing local plant genome and provide greater security to the population. Direct transplantation of the four individual plants and surrounding soil into suitable Duffys habitat in GNP is a recommended option to maintain the existing plant genome should these individuals require removal as part of site redevelopment. Vegetative cloning of these individuals and

subsequent transplantation of cuttings in a Duffys Forest remnant in Garigal National Park across the Wakehurst Parkway from the subject lands is recommended to ensure the long term protection of this population subset in the immediate locality. It is recommended that this measure (cloning) be adopted even if site redevelopment is restricted to areas east of the existing dirt access track. Work done to date on some *Pimelea* taxa by Bloombery and Maloney (1994) and Sydney Native Nurseries (Matt Bannerman pers. comm.) indicate moderate to good success in reproducing clones from cuttings and from direct transplanting assuming appropriate techniques are used.

Further assessment within the Duffys Forest remnants in GNP and wakehurst Golf Course would be useful in determining the local population size of the plant taxon.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

Not applicable

(c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Pimelea curviflora var. *curviflora* is generally restricted to northern Sydney and is closely associated with the Duffys Forest vegetation community. Clearing of Duffys Forest vegetation to the west of the dirt access track would be expected to constitute removal of a significant area of known habitat for the species, given the restricted occurrence of its habitat in the locality.

Habitat for the species in the immediate locality consists of approximately 5.4 hectares of Duffys Forest at Manly Dam Reserve, 0.4 hectares of Duffys Forest across from the existing Precinct A2 lands in Garigal National Park and 0.3 hectares of Duffys Forest vegetation within Precinct A2. Manly Dam Reserve and GNP both afford quality habitat and long term security for the species in the locality.

(d) *whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community*

The proposal will not result in any further isolation of the species to other areas of potential habitat.

(e) *whether critical habitat will be affected.*

The study area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995.

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The taxon is known from Lane Cove and Garigal National Parks as well as from a number of Warringah Council reserves, including Manly Dam and Frank Beckman (Terrey Hills). No definitive statement can currently be made in relation to adequate representation in conservation reserves for the species given the insufficient information regarding populations sizes and population health in these reserves.

Based on the above discussion, it is difficult to predict whether the species is adequately conserved in conservation reserves within its restricted geographical range.

(g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening processes.

"Clearing of native vegetation" is a prescribed key threatening process under both Schedule 3 of the *Threatened Species Conservation Act* 1995, as amended, and the Commonwealth's Environment

Protection and Biodiversity Act 1999. Clearing of any area of native vegetation, including areas less than 2 hectares in extent, is recognised as a major factor contributing to the loss of biological diversity. Clearing has been identified as a threat to *Pimelea curviflora* var. *curviflora* as it is listed as Vulnerable Species under Schedule 2 of the TSC Act.

(h) whether any threatened species, populations or ecological community is at the limit of its known distribution.

Pimelea curviflora var. *curviflora* is closely associated with Duffys Forest vegetation and thus is probably at or near its present southern distributional limit at North Seaforth.

Section 5A Assessment Conclusion

Further assessment in Garigal National Park and Manly Dam Reserve would assist in determining the local plant population size of *Pimelea curviflora* var. *curviflora* which would in turn assist in more accurately assessing impacts on the taxon from possible site redevelopment. Based on the precautionary approach, the impact from removal of these plants on the local population may be significant and thus the preparation of a Species Impact Statement is recommended, should site redevelopment occur to the west of the dirt access track.

The preparation of an SIS for the plant taxon would not be expected to be required should site redevelopment be restricted to areas east of the dirt access track given the low potential for natural regeneration in this area. It is recommended that vegetative cloning (as described above) be adopted even if site redevelopment is restricted to areas east of the existing dirt access track to maintain the existing local genome for this species. This is due to the possibility of an increased likelihood of the species being indirectly impacted upon from predicted increased pedestrian traffic associated with development.

Attachment B
Section 5A Assessments

Duffys Forest

A Section 5A Assessment under the *Environmental Planning and Assessment Act* 1979 is carried out below to determine whether or not the impacts from the proposal will have a significant impact on the Endangered Ecological Community, Duffys Forest, recorded within Precinct A1 lands and consequently whether or not the preparation of a Species Impact Statement is required should the development option be pursued in this area.

Duffys Forest

(a) *in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

Not Applicable

(b) *in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.*

The life cycle components of the characteristic assemblage of species that comprise Duffys Forest, essentially comprising recruitment, reproduction and the formation of seed banks, along with other physiological and ecological data such as habitat, response (sensitivity) to fire and an increased nutrient load, is partially understood. A Draft Recovery Plan for Duffys Forest is currently being prepared (pers.comm., NPWS).

Removal of Duffys Forest vegetation within Precinct A1 lands (west of dirt access track) which is essentially contiguous with a similar size remnant in Garigal National Park and which comprises the southern-most distribution of the community within its geographic range (and forms part of the only Duffys remnant in Manly LGA) would be expected to result in a significant reduction in the genetic diversity and viability of the community in the locality. Given the restricted range of this plant community and the extent of its clearance (85% cleared), any remaining remnants, no matter how small, particularly those at its limit of distribution, must be considered of high conservation value.

Site redevelopment restricted to areas east of the dirt access track which at present do not support Duffys Forest vegetation and are unlikely to naturally regenerate to Duffys Forest vegetation would not be expected to result in a significant impact on local viability of the community.

(c) *in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.*

Approximately 240 hectares of this community remain in northern Sydney within NPWS and Council reserves and on unreserved lands (Smith and Smith 2000). Given the restricted range of this plant community and the extent of its clearance (85% cleared), any remaining remnants, no matter how small, particularly those at its limit of distribution, must be considered a significant area of known habitat. Consequently, removal of Duffys Forest vegetation within Precinct A1 lands (west of dirt access track) would be considered a significant area of known habitat for the community.

Site redevelopment restricted to areas east of the dirt access track which at present do not support Duffys Forest vegetation and are unlikely to naturally regenerate to Duffys Forest vegetation would not be considered a significant area of known habitat for the community.

(d) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community

The proposal will not result in any further isolation of the community to other areas of potential habitat.

(e) whether critical habitat will be affected.

The study area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995.

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Smith and Smith (2000) note that mapping of Duffys Forest confirmed that the plant community has a restricted and highly fragmented distribution. The total area of the plant community is 239.9 hectares (ha), of which 116.8 ha (49%) is in NPWS reserves, 35.9 ha (15%) is in reserves managed by local Councils or trusts and 87.2 ha (36%) is unreserved (Smith and Smith 2000). The estimated original extent of the community was about 1500 ha which correlates to 16% of this area presently remaining.

Based on this data, Duffys Forest can be considered adequately conserved throughout its restricted geographical range.

(g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening processes.

"Clearing of native vegetation" is a prescribed key threatening process under both Schedule 3 of the *Threatened Species Conservation Act* 1995, as amended, and the Commonwealth's Environment Protection and Biodiversity Act 1999. Clearing of any area of native vegetation, including areas less than 2 hectares in extent, is recognised as a major factor contributing to the loss of biological diversity. Clearing has been identified as a threat to Duffys Forest as it is listed as an Endangered Ecological Community under Schedule 1 Part 3 of the TSC Act.

(h) whether any threatened species, populations or ecological community is at the limit of its known distribution.

The Precinct A1 (and A2) remnants forms the southern distributional limit of the plant community in northern Sydney.

Section 5A Assessment Conclusion

Clearing of Duffys Forest vegetation (road reserve woodland strip plus regenerating grassland areas west of dirt access track) within Precinct A1 lands would be expected to result in a significant impact upon the life cycle requirements of the characteristic assemblage of species that comprise Duffys Forest and thus the preparation of a Species Impact Statement would thus be required should development be pursued in these areas.

Site redevelopment restricted to areas east of the dirt access track which at present do not support Duffys Forest vegetation and are unlikely to naturally regenerate to Duffys Forest vegetation would not be expected to result in a significant impact on the local viability of Duffys Forest vegetation in the locality and thus the preparation of a Species Impact Statement would not be expected to be required for such a development scenario. Notwithstanding the above, the adoption of measures to minimise indirect impacts from site redevelopment (east of the dirt access track) on retained areas of bushland (west of the dirt access track) described in the 'Conclusions' section of this letter report is recommended.

Attachment C
Vegetation Map -Precinct A1

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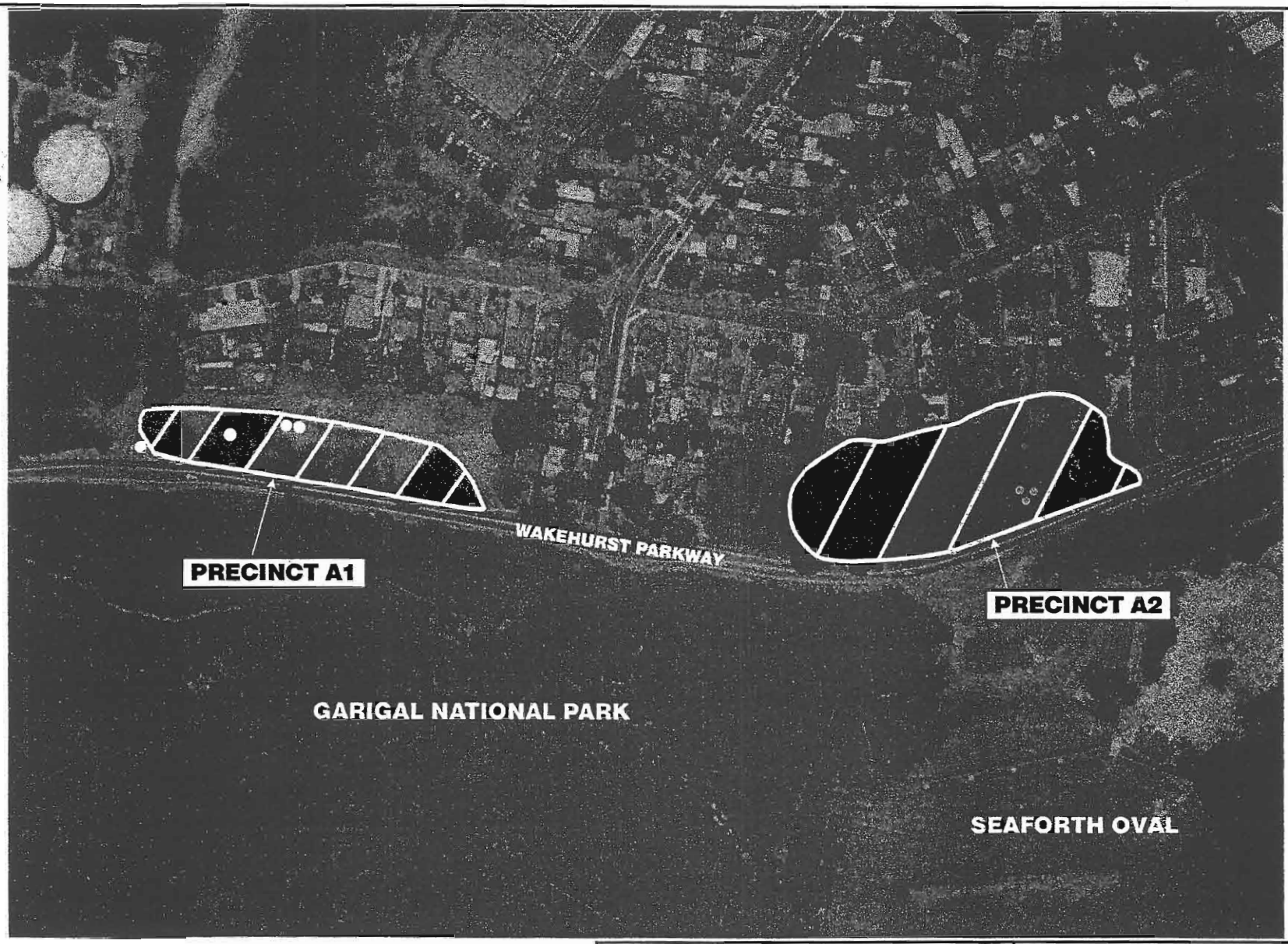

KEY

DUFFYS FOREST

PROSTANTHERA SP

DARWINIA DIMINUTA

PIMELEA CURVIFORA VAR. CURVIFLORA

CLIENT: **EGIS CONSULTING**

PROJECT: **VEGETATION ASSESSMENT, NORTH SEAFORTH**

TITLE: **DISTRIBUTION OF RARE AND THREATENED FLORA PRECINCT A, NORTH SEAFORTH**

DESIGNED: **IM** DRAWN: **DF** DATE: **12/03/02**

APPROVED: **IxM** DATE: **23.7.02** STATUS: **DRAFT**

PROJECT: **46154-005** CAD FILE: **003.CDR** REVISION: **B**

URS

FIGURE: **1**

Attachment D
Plates

Attachment D
Plates

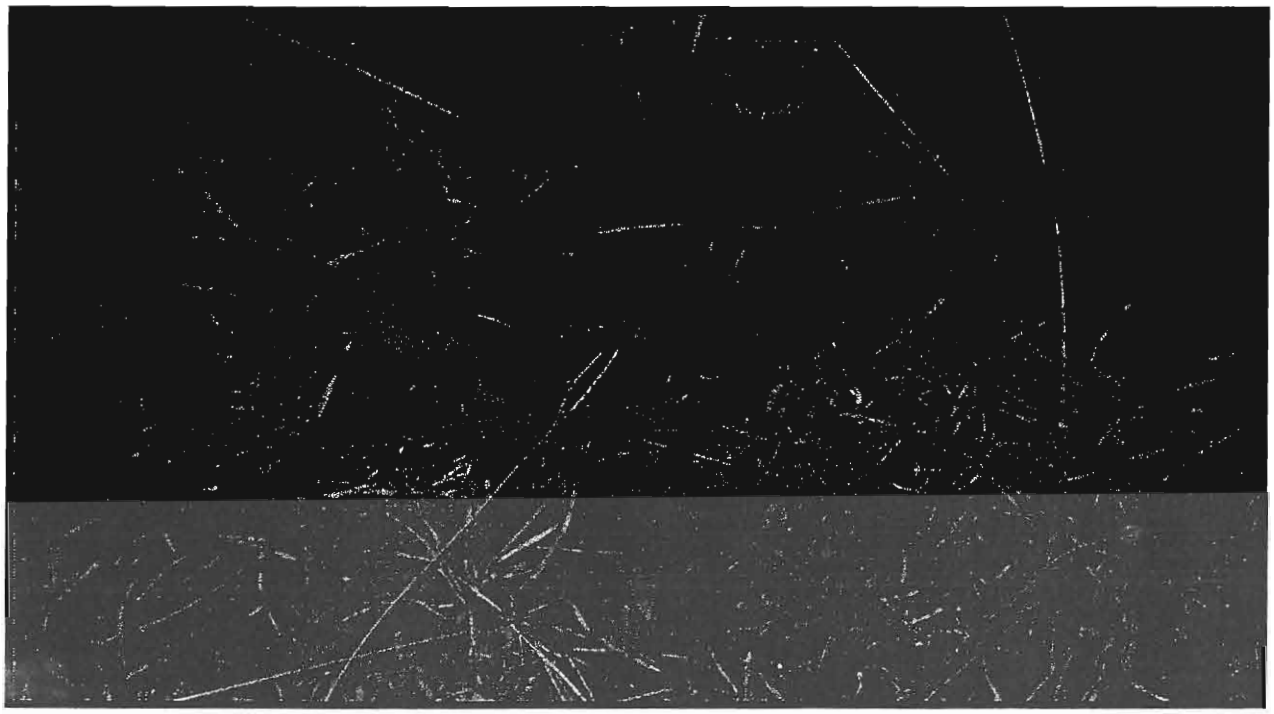

Plate 1 - *Eucalyptus sieberi* seedling.

Plate 2 – Two mature individuals of *Pimelea curviflora var. curviflora.*

Attachment D
Plates

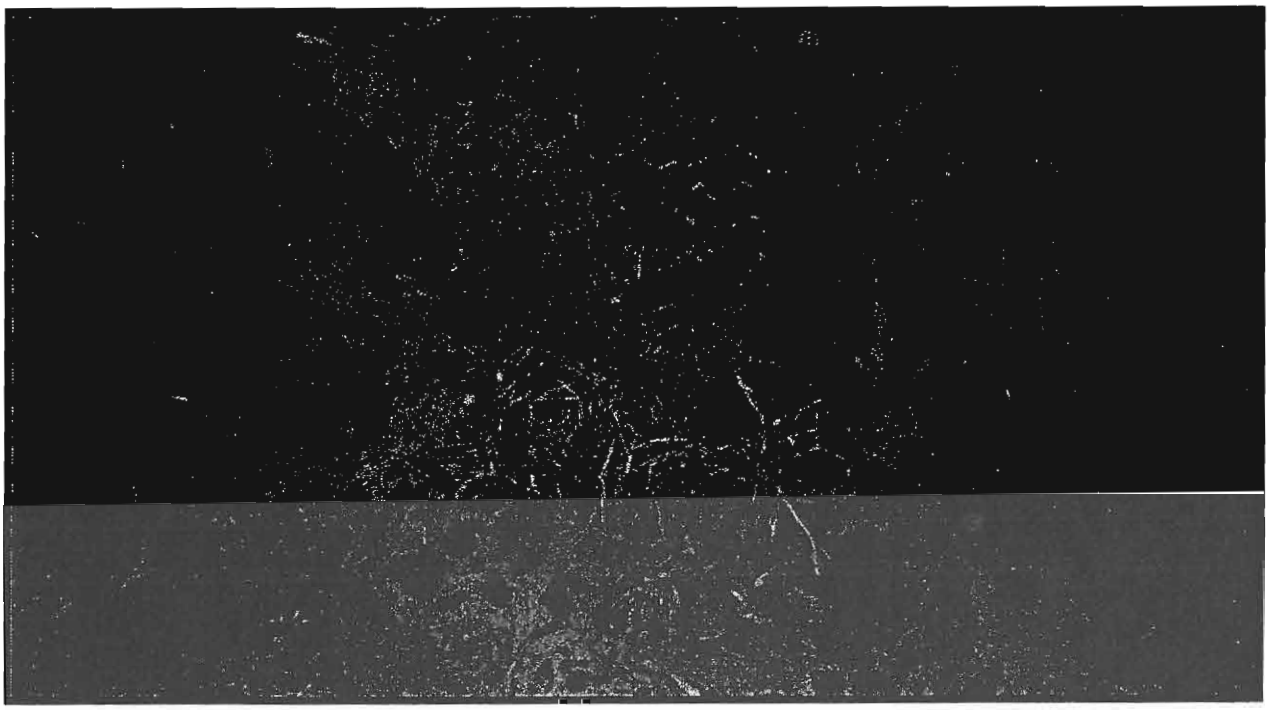

Plate 3 – Laterite gravel and sandy silt.

Plate 4 – *Bossiaea heterophylla* seedling.

Attachment D
Plates

Plate 5 – View looking south at Precinct A1 Lands. Native plant regeneration is evident in foreground to the right of the dirt access trail.

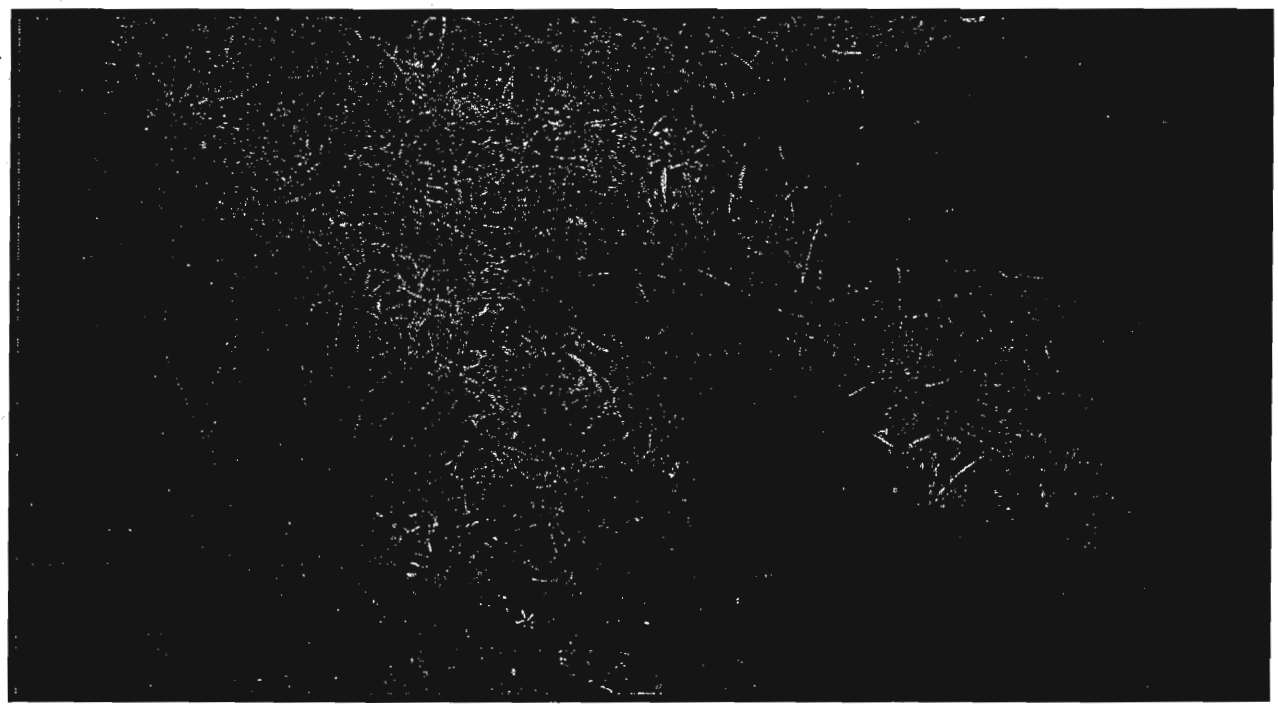

Plate 6 – Young *Kunzea ambigua* shrubs with two *Eucalyptus sieberi* seedlings.

Attachment E –

Limitations

URS Australia Pty Ltd (URS) has prepared this report for the use of Lesryk Environmental Consultants and GHD Group in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of works described in the URS proposal, dated July 11 2002 for the project.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between June and July 2002 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full and should be read in conjunction with previous URS reports prepared for the site (refer Reference list).

No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

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Appendix B

Flora Survey and Assessment for Precinct A1, Judith St, North Seaforth

Report by Teresa James dated September 2002

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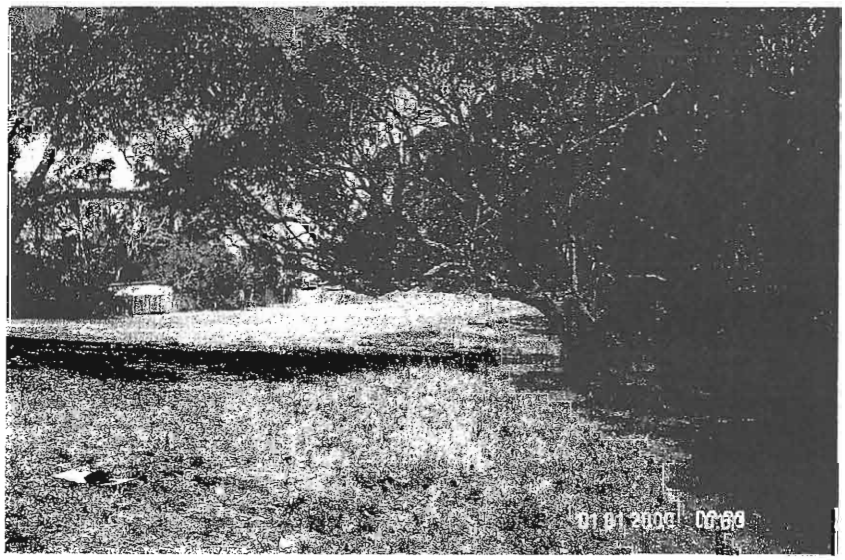
Flora survey and assessment for Precint A1, Judith Street, North Seaforth

Teresa James September 2002



Report to GHD Pty Ltd for NSW Planning and Roads &Traffic Authority

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Flora survey and assessment for Precint A1, Judith Street, North Seaforth

Executive summary

A strip of land (Precint A1), located east of the Wakehurst Parkway at North Seaforth, is currently under consideration for subdivision and re-development by Planning NSW. The land had been regularly mowed for many years until April 2002. Surveys undertaken following the cessation of mowing in lower parts of the site (including this study) indicate the presence of Duffy's Forest and the threatened species *Pimelea curviflora* var. *curviflora*, both of which are listed under the *Threatened Species Conservation Act* 1995 (TSC Act). A third TSC Act species, the endangered orchid *Microtis angusii* may also be present along with further species of national and regional significance. Despite the small size and a long history of clearing and disturbance, the site has excellent regeneration potential and supports a high diversity of native species with further species likely to appear over time. In contrast, vegetation in upper parts of the site consists of mowed grassland dominated by exotic species.

As a consequence of the high conservation significance of vegetation at the site, there are ecological constraints to future re-development of the land. The current development proposal includes a bushland protection area in lower parts of the site, however, indirect impacts are likely to significantly affect the long-term viability of this area. The need for a Species Impact Statement is confirmed by the findings of this report. The long-term viability of the bushland area is likely to depend on the establishment of a buffer zone between any development and the proposed bushland area, control of stormwater and the implementation of a bushland management plan. The proposed development, in its present form, is incompatible with these requirements. An alternative development option is discussed that allows some development at the southern end of the site and the incorporation of land in upper parts of lots 3, 4 and 5 into existing residential blocks.

1. Introduction

1.1 Background

A strip of Roads & Traffic Authority (RTA) land (Precint A1), located east of the Wakehurst Parkway at North Seaforth, is currently under consideration for subdivision and re-development by Planning NSW. The land has been regularly mowed for many years. A vegetation survey and assessment of Precint A1 was initially undertaken by URS Australia Pty Ltd in March 2002 as part of a larger study of RTA lands. Following the cessation of mowing in April 2002, an additional survey was carried out by URS (July 2002b) to document the nature and extent of native plant regeneration at the site. A total of thirty-six native species were recorded including four plants of the threatened species *Pimelea curviflora* var. *curviflora*. The regenerating vegetation was identified as Duffy's Forest which is listed as an endangered ecological community under the *Threatened Species Conservation Act* 1995 (TSC Act). Since the July survey further regeneration has occurred with several other species of conservation significance and additional plants of *Pimelea curviflora* var. *curviflora* observed by local residents. A further survey has been requested, therefore, to more fully document regeneration at the site and to re-evaluate the conservation significance of the vegetation and any constraints to re-development.

1.2 The site

Precint A1 comprises an area of approx. 150 m x 50 m that is bordered to the south and east by residential properties, to the north by Wakehurst Golf Course and to the west by the Wakehurst

Parkway and Garigal National Park. It occupies part of a north-south ridge-line with the highest point (120 metres a.sl.) in the north-east corner of the site. The land slopes gently towards the Wakehurst Parkway. The local geology is Hawkesbury Sandstone (outcropping near the road) with overlying lateritic gravels and clay. The soil belongs to the Somersby soil landscape. An undefined drainage line runs across the site towards the Wakehurst Parkway. Even during dry periods the soil along this drainage line, particularly in lowers parts of the slope, remains quite damp.

A dirt track runs through the middle of the site with land above still mowed up to adjoining houses. Below the track previously mowed areas have been allowed to regenerate and these intergrade with patches of remnant trees and associated vegetation of the Duffy's Forest ecological community.

1.3 Literature review

Native vegetation at the site has been described previously by URS (2002a,b) as part of a larger survey of RTA lands in the local area. The site occurs within the area covered by the Sydney 1:100 000 map sheet as documented by Benson & Howell (1994). Information on Duffy's Forest is provided in Benson & Howell (1994), Smith & Smith (2000) and NPWS (2001). A full listing of references is provided at the end of the report.

2. Methodology

2.1 Field survey

Field survey was conducted on 16 and 23 August. Due to the small size of the site, quantitative sampling e.g. use of quadrats was not considered to be appropriate. The entire site was carefully walked and searched although survey effort was concentrated on the area below the track. The following activities were undertaken:

- all native plant species and more common exotic species were recorded;
- plant specimens were collected to confirm identifications as required;
- the general location of significant plant species was noted;
- targeted search for *Pimelea curviflora* var. *curviflora.*

2.2 Taxonomy & conservation status

The naming of plant species follows Harden (1990-1993) with updates from the Royal Botanic Gardens, Sydney. Plant community identification and conservation status (including species) is based on Benson & Howell (1994), Smith & Smith (2000) and the TSC Act.

2.3 Limitations of survey

The number of plant species recorded in this brief, snapshot survey will be an underestimate of the actual species present. A more accurate and comprehensive survey would need to be undertaken at different times of the year to account for seasonal variation. In particular, during the cooler months many herbs and grasses are unidentifiable through lack of fertile material or due to hidden stages of the life-cycle. Both the recent URS survey (URS 2002b) and this survey were conducted during winter. Furthermore, early spring growth and flowering is likely to be retarded this year due to the recent dry conditions. In view of the early stage of regeneration in parts of the site (four months since cessation of mowing), accurate documentation of species diversity would also require surveys over an extended period of several years.

3. Results

3.1 Plant communities

Two main vegetation types were observed at the site, mown grassland to the east of the dirt track and remnant/regenerating open-forest to the west or below.

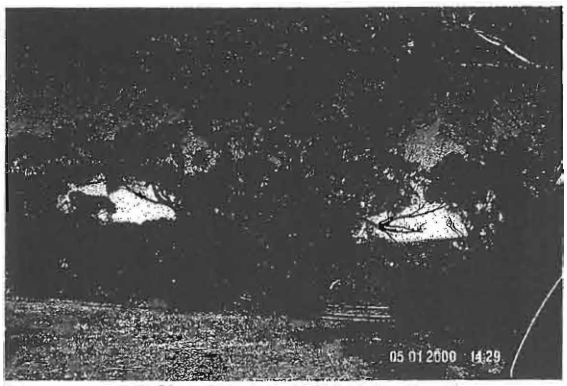
Mown grassland

The strip of land above the dirt track continues to be regularly mown. At the time of this survey the vegetation was closely cropped and many of the grasses and taller herbs were not readily identifiable. The grassland appears to be dominated by exotic species in most parts including Carpet Grass *Axonopus affinis,* Parramatta Grass *Sporobolus indicus* var. *capensis,* Sweet Vernal Grass *Anthoxanthum odoratum,* Plaintain *Plantago lanceolata,* Brazilian Whitlow *Richardia* spp. and Clover *Trifolium repens*. Closer towards the houses and in wetter parts associated with the drainage line, soil modification and weed invasion has resulted in conditions unfavorable for local native species. For a distance of c. 4 m above the dirt track, however, the soil surface is predominantly bare with a high concentration of lateritic gravel. In this area native species are more likely to survive the mowing regime and competition from exotic species. Native species observed include *Aristida ramosa, Schoenus* sp., and small regeneration shoots of *Allocausarina* and *Eucalyptus*. It is likely that a greater range of native species occur in this area and these would regenerate if mowing ceased.

Mown grassland above track

Duffy's Forest

As identified by URS (2002b), remnant and regenerating vegetation in lower parts of the site (below track) is consistent with Duffy's Forest as described under the TSC Act. The main tree species are Silvertop Ash *Eucalyptus sieberi,* Scribbly Gum *E. haemastoma,* Stringybark *E. oblonga and* Black She-oak *Allocasuarina littoralis*. A range of shrub and herb understorey species occur in association with the remnant trees, particularly along the bank near the road. More open areas have been regularly mowed but are now in the early stages of regeneration. Common species of the intact and regenerating areas include *Micrantheum ericoides, Phyllanthus hirtellus, Xanthosia tridentata, Kunzea ambigua, Dodonaea triquetra, Acacia myrtifolia, Gompholobium glabratum* and *Lasiopetalum ferrugineum.* Common grasses and sedges include *Entolasia stricta, Aristida* spp., *Eragrostis brownii, Lomandra glauca, L. filiformis, Schoenus imberbis* and *Lepidosperma laterale*.



Remnant Duffys Forest


Early stages of regeneration

Some 52% of the plant species listed as being characteristic of Duffy's Forest in the Final Determination have been recorded from the site (see appendix 1). Most of the remaining species recorded are also known to be associated with the community.

3.2 Plant species

3.2.1 General

A total of 107 native plant species (excluding those not native to the site) have been recorded from the site during this survey, the URS survey (July 2002) and from opportunistic records (see appendix 1). This is a significantly high level of species richness considering the size of the area (<0.5 ha), past disturbance, the early stages of regeneration and recent dry conditions (see table 1). The only documented remnants of Duffys Forest (Smith & Smith 2000) with a higher level of species richness are significantly larger (e.g. Eurabba Road, Duffys Forest with 139 species recorded from 4.5 ha). Furthermore, many larger sites have considerably less species (e.g. Forest Way, Garigal NP with 86 species from 17 ha).

3.2.2 Significant species

Of the native species recorded at the site, three (possibly four) taxa are of national and state significance. The location of these species is indicated in figures 1 and 2. These species are discussed below:

Pimelea curviflora var. curviflora (Curved Rice-flower)
An inconspicuous subshrub or shrub mostly to c. 50 cm high with clusters of small red to yellow flowers. This variety is distinguished from other varieties of the species by the sparse coarse, appressed hairs, flower colour and curved fruits. It grows in woodland or forest communities on sandstone where there is generally a strong clay and laterite influence. Most records are from the Hornsby Plateau in Duffys Forest and Shale Sandstone Transition Forest, both endangered ecological communities listed under the TSC Act. The taxon is currently known from about 20 locations, many of which are threatened by development, and is not adequately protected within conservation reserves. *Pimelea curviflora var. curviflora* is listed as endangered under both the TSC Act and the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act).

During this survey twenty-eight plants of *Pimelea curviflora var. curviflora* were recorded from below the track in the northern and central parts of the site. All areas west of the track provide potential habitat for this taxon. Plants were mostly between 5 and 15 cm high with few stems and were regenerating from woody rootstock. No seedlings were seen. Several plants were in flower at the time of the survey. Most plants observed were in previously mowed areas, with the few plants occurring in more intact patches of vegetation near the road being larger and well-branched.

Pimelea curviflora var. *curviflora*
- small plant regenerating from rootstock. Flowers yellow to red.

Microtis angusii (Angus's Onion Orchid)
Non-flowering plants of an Onion Orchid or *Microtis* have recently been recorded from the site by Peter Eygelshoven of the Australian Native Orchid Society and a member of the NPWS Recovery Team for *Microtis angusii*. Further verification is needed to determine whether these plants are the more common *M. unifolia* or the recently described and endangered *M. angusii*. Both species have been recorded previously from Duffys Forest in the local area; a record of *M. angusii* has been confirmed about 0.5 km from the site. Material has been taken for DNA analysis (Kate Inwood *pers. comm.*) to allow a positive identification to be made in the absence of flowering material. *Microtis angusii* is a terrestrial orchid that is present only as underground tubers for most of the year. It produces leaves and flowers in late winter and spring although flowering may be delayed this year due to the dry conditions. It is known to be able to reproduce both by seed and vegetatively by the formation of tubers.

Several plants of the *Microtis* have been observed in damp soil associated with the drainage line in the lower part of the site. *Microtis angusii* is known from very few sites and is a poorly known taxon. It is listed as an endangered species under the TSC Act and the EPBC Act.

Lomandra brevis (Tufted Mat-rush)
An inconspicuous, small tufted perennial plant that is endemic to the Sydney region. Occurs in forest or woodland on sandstone-derived soils, often with a clay influence. Recorded as rare with most records in northern Sydney. *Lomandra brevis* has been recorded previously from several remnants of Duffys Forest. It is listed as a Rare or Threatened Australian Plant (ROTAP) and coded 2RC-(Briggs & Leigh 1996).

At the site several plants of *Lomandra brevis* were observed scattered through the lower section of the site, particularly close to the Wakehurst Parkway. These plants were generally growing in shady, grassy areas below larger trees and shrubs although some plants were also observed regenerating in more open areas which had been previously mown. The plants were not flowering at the time of the survey.

Darwinia diminuta
A small shrub that grows in heath or open-woodland in sandy loam soils on stony ridge-tops. It is a local endemic which is now rare. Most records are from Ingleside, Manly and Loftus districts, but it has not been recorded previously from Duffys Forest. *Darwinia diminuta* is listed as a Rare or Threatened Australian Plant (ROTAP) and coded 3Rci (Briggs & Leigh 1996). No populations in the Ingleside-Manly area are known to be conserved. Only one plant of *Darwinia diminuta* was observed in the lower northern part of the site. It was an older plant, very woody with short branches. Flowers were present.

Three species recorded (two requiring confirmation) for the site are considered to be of regional conservation significance (REG) (see appendix 1). These are species that are considered rare or threatened in northern Sydney as assessed by Benson & Howell (1994) and Smith & Smith (2000).

3.3 Condition of vegetation and threatening processes

The site is likely to have once supported woodland or open-forest with intact tree, shrub and ground layers. Subsequent clearing of the vegetation, impacts from adjoining developments and maintenance of open areas by mowing has resulted in considerable degradation of the site. Trees and associated understorey species are restricted to patches in lower parts of the site, soils are often exposed or modified and weedy exotic species are common.

Weedy exotic species commonly occurring at the site include Coreopsis *Coreopsis lanceolata*, Wild Watsonia *Watsonia* sp., Brazilian Whitlow *Richardia* spp., Lantana *Lantana camara,* African Lovegrass *Eragrostis curvula*, Panic Veldt *Ehrarta erecta*, Buffalo Grass *Stenotaphrum secundum* and Parramatta Grass *Sporobolus indicus* var. *capensis*. The western Australian wattle *Acacia saligna* is also present at the site and on adjoining land to the north and south. This species grows and spreads quickly and needs to be controlled. The narrow shape of the site with its extensive boundaries and the location of residential properties upslope contribute significantly to the general vulnerability of the site. Disturbance zones along boundaries may experience an increase in soil temperatures, increased desiccation and physical damage, increased transfer of dust, seeds, insects and disease from adjoining areas, changed soil moisture levels and surface runoff rates with increased rates of erosion and transport of soil and nutrients and increased invasion by diseases and exotic species (Saunders *et. al.* 1991, Hobbs 1993). Such changes or "edge effects" clearly have a degrading impact on native vegetation. A study on urban remnants in Sydney by Dostal (2000) has indicated that such "edge effects" may dominate within the first 20 m and often extend to at least 40 m.

Despite this history of disturbance and the attributes of the site, surveys indicate that the vegetation is highly resilient and has potential for significant regeneration over lower parts of the area. A large range of native species survive in refuge areas, e.g. at base of trees or along steeper bank near road, and these include tree, shrub and herb species. Many plants also survive underground in the form of woody rootstock that re-sprouts when conditions allow, and in the soil seed-bank. The native species can out-compete weedy exotic species in the infertile sandstone-derived soils and lateritic gravels typical of lower areas of the site. The close proximity of bushland to the north and west will also provide an important source of propagules. The long-term viability of vegetation at the site, however, is low unless ongoing threatening processes are controlled. The clearing and degradation of habitat, fragmentation, weed invasion, inappropriate fire regimes, physical damage from inappropriate access and disturbance, and nutrient enrichment are recognized threats to Duffys Forest and associated species including *Pimelea curviflora* var.

curviflora. The Clearing of Native Vegetation is now listed as a Key Threatening Process under Schedule 3 of the TSC Act and also under the Commonwealth EPBC Act.

Good regeneration of herbs and grasses observed at the Site

4. Conservation significance and ecological constraints to development

The presence at the site of an endangered community and several plant species of national and state significance pose considerable ecological constraints to future development of the site. The site is also considered important at a regional and local level in providing habitat for over 100 plant species characteristic of the Duffys Forest, a community which is restricted to northern Sydney. In comparison to other remnants of Duffys Forest this is a significantly high level of species richness. Furthermore the number of species recorded to-date is likely to be an underestimate due to the snapshot nature of surveys which were undertaken during the cooler months and during the early stages of regeneration. The concentration of threatened species within such a small area is also considered significant. Table 1 compares a range of remnants of Duffys Forest in relation to size, species richness and the presence of significant species.

Table 1: Comparison of remnant size, species richness and presence of significant species in Duffys Forest (information from Smith & Smith 2000)

Site name	Size (ha)	Number of native species	Species of national & state significance
Precint A1	**0.4**	**103**	***Pimelea curviflora var. curviflora; Darwinia diminuta; Lomandra brevis; ?Microtis angusii***
Oates Place, Belrose	0.6	81	*Pimelea curviflora var. curviflora; Grevillea caleyi*
Frank Beckman Reserve, Terry Hills	1.0	113	*Pimelea curviflora var. curviflora; Lomandra brevis;*
Ku-ring-gai Wildflower Garden	1.7	79	None
Park Circuit, Manly Dam Res.	2.3	62	None

Manning Street, Manly Dam Res.	2.6	77	*Pimelea curviflora var. curviflora; Angophora crassifolia*
Eurabba road, Duffys Forest	4.5	139	*Pimelea curviflora var. curviflora; Epacris purpurascens var. purpurascens; Lomandra brevis*
Warringah Road, Frenchs Forest	5.4	112	None
Aquatic Drive, Frenchs Forest	7.6	137	*Pimelea curviflora var. curviflora; Lomandra brevis*
Forest Way, Garigal NP	17.3	86	*Grevillea caleyi; Lomandra brevis*

Obligations under both the TSC Act and the EPBC Act are relevant in relation to Duffys Forest, *Pimelea curviflora* var. *curviflora* and possibly *Microtis angusii*, if confirmed as present at the site. Any development of the site is likely to have a direct and/or indirect impact on the threatened community and species due to the small size and nature of the area. Eight-part tests undertaken by URS (July 2002) concluded impacts resulting from general re-development within the site were likely to be significant and a Species Impact Statement would, therefore, be required. A development concept has recently been proposed by Planning NSW and the RTA (August 2000), that allows for the development of five lots above the track and protection of vegetation below in a bushland preservation area. This proposal is not likely to result in significant direct impacts, however, indirect impacts on the adjoining bushland area will need to be carefully assessed. Such impacts are likely to be compounded by the small size and shape of the proposed bushland area, its isolation by roads and development, and the lack of any buffer zone adjoining the development. Under these conditions the long-term viability of the bushland is questionable.

5. Conclusion & recommendations

The Precint A1 land, west of the existing dirt track, supports a small area of remnant and regenerating Duffys Forest, an endangered ecological community listed under the TSC Act. With approx. 84% of the original distribution of Duffys Forest now cleared, all remaining remnants are considered significant (NPWS 2001). Despite the small size and a long history of clearing and disturbance, the site has excellent regeneration potential and currently supports a high diversity of native species including three species of national or state conservation significance and a fourth species, the endangered orchid *Microtis angusii* may also be present. Further species are likely to appear over time during the regeneration process.

In contrast vegetation east of the existing track comprises mowed grassland that is largely dominated by exotic species. Lower parts of this section associated with outcrops of lateritic gravels, however, supports several native species and some regeneration is likely to occur should mowing cease. There are no records of threatened species from this section of the site although potential habitat exists for *Pimelea curviflora* var. *curviflora* in lower parts.

Native vegetation in lower parts of the site is of national, state, regional and local conservation significance and consequently there are ecological constraints to future development. The development concept proposed by Planning NSW and the RTA provides for a bushland protection area west of the track, however, indirect impacts are likely to affect the long-term viability of this area. The need for a Species Impact Statement (SIS) is confirmed by this report to allow for a detailed assessment of indirect impacts and to provide for mitigation of these impacts as required. The following recommendations are made in relation to the present and future management requirements of threatened flora at the site.

- All remnant and regenerating native vegetation west of the track to be protected immediately by fencing to prevent unnecessary disturbance and damage.

- A bush regeneration program to be initiated within the protected area as soon as possible to prevent further degradation of bushland. In view of local support for the bushland, community involvement in the management of this area is recommended. A detailed management plan to be developed in the longer term. Removal of *Acacia saligna* from the site is recommended.

- Provision of an appropriate buffer zone and fire protection zone between the bushland area and any new development will be essential. This will help to contain soil enrichment and disturbance away from core bushland thereby reducing the spread of weedy species, and allow for an appropriate fire regime to be adopted. The buffer zone should be managed to encourage the growth of native grass and herb species i.e. not mowed as regularly or severely as present. The buffer zone could include the present track.

- The area should no longer be used as a general through-fare i.e. close present track. Issues relating to the need for a track, an appropriate route and design should be addressed in the management plan.

- Measures developed to divert stormwater runoff from residential areas away from bushland area, however, it will be important to retain a natural drainage line within lower section to ensure the survival of those native species dependant on locally damp conditions e.g. *Microtis, Schoenus, Hypericum.*

- A monitoring program established to monitor the growth and health of threatened species at the site.

It is likely that the long-term viability of the proposed bushland preservation area will depend on the establishment of a buffer zone at least 10 m in width between the bushland protection area and any development above, control of stormwater from the development and on the implementation of a bushland management plan. The proposed development in its present form is incompatible with these requirements. Development of lots 1 and 2 should have no significant impact, however, lots 3, 4 and 5 would be too small and inaccessible for development once the buffer zone is incorporated unto the design. An alternative option for these lots is for the remaining land to be sold and incorporated into existing residential blocks adjoining the Site, depending on the interest of relevant landowners. In this case, strict controls over the dumping of garden waste and the seepage of excess water and chemicals into the reserve area will need to be addressed in the management plan. Such development opportunities that are compatible with the protection of bushland at the Site are shown in Figure 3.

6. References

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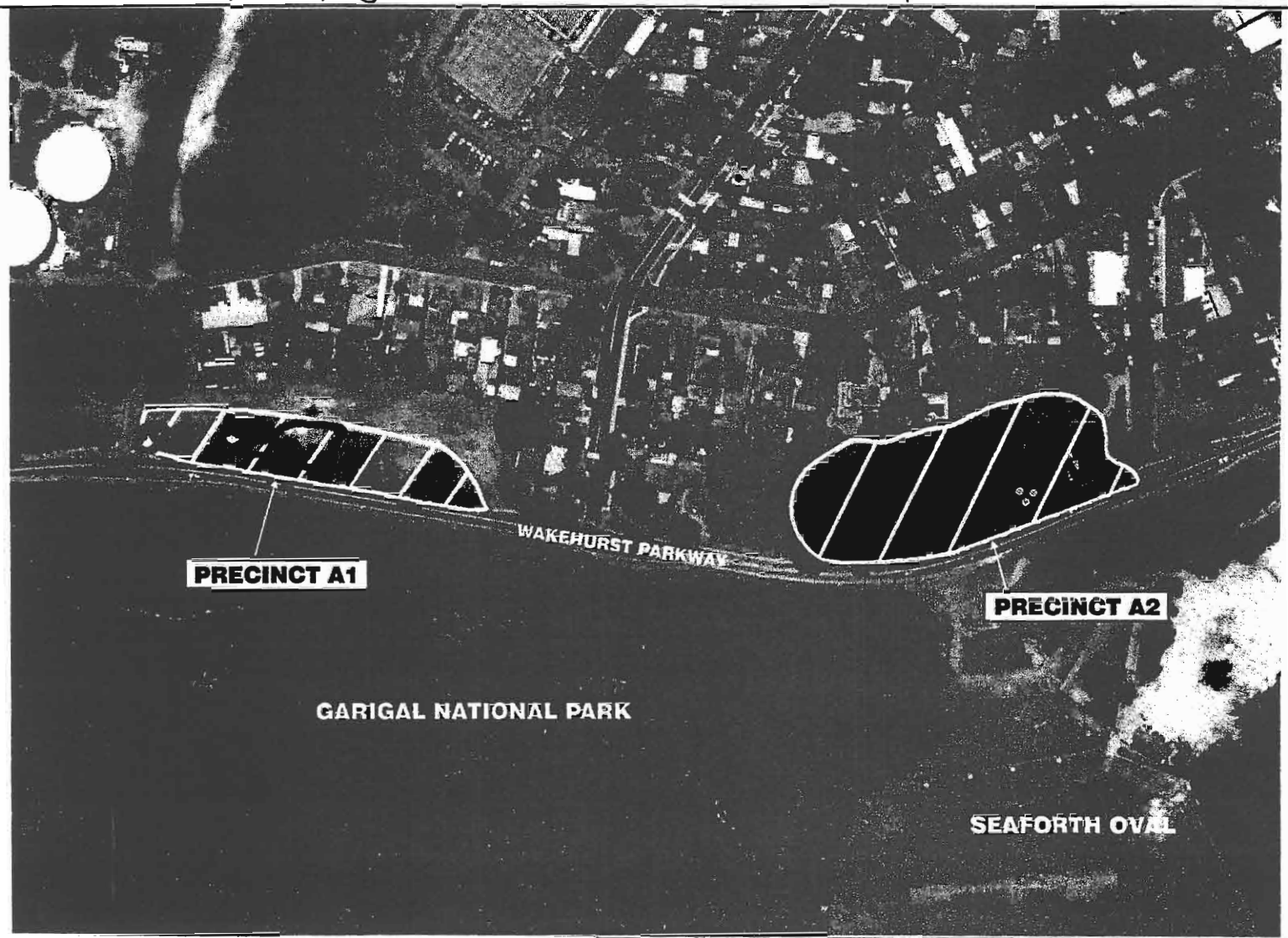
Figure 1: Location of Duffys Forest and Pimelea curviflora at Precint A1. Based on map prepared by URS



KEY

DUFFYS FOREST

PROSTANTHERA SP

DARWINIA DIMINUTA

PIMELEA CURVIFORA VAR. CURVIFLORA

O Main areas of regenerating Pimelea curviflora var. curviflora

CLIENT: EGIS CONSULTING

PROJECT: VEGETATION ASSESSMENT, NORTH SEAFORTH

TITLE: DISTRIBUTION OF RARE AND THREATENED FLORA PRECINCT A, NORTH SEAFORTH

DESIGNED: IM
DRAWN: DF
DATE: 12/03/02

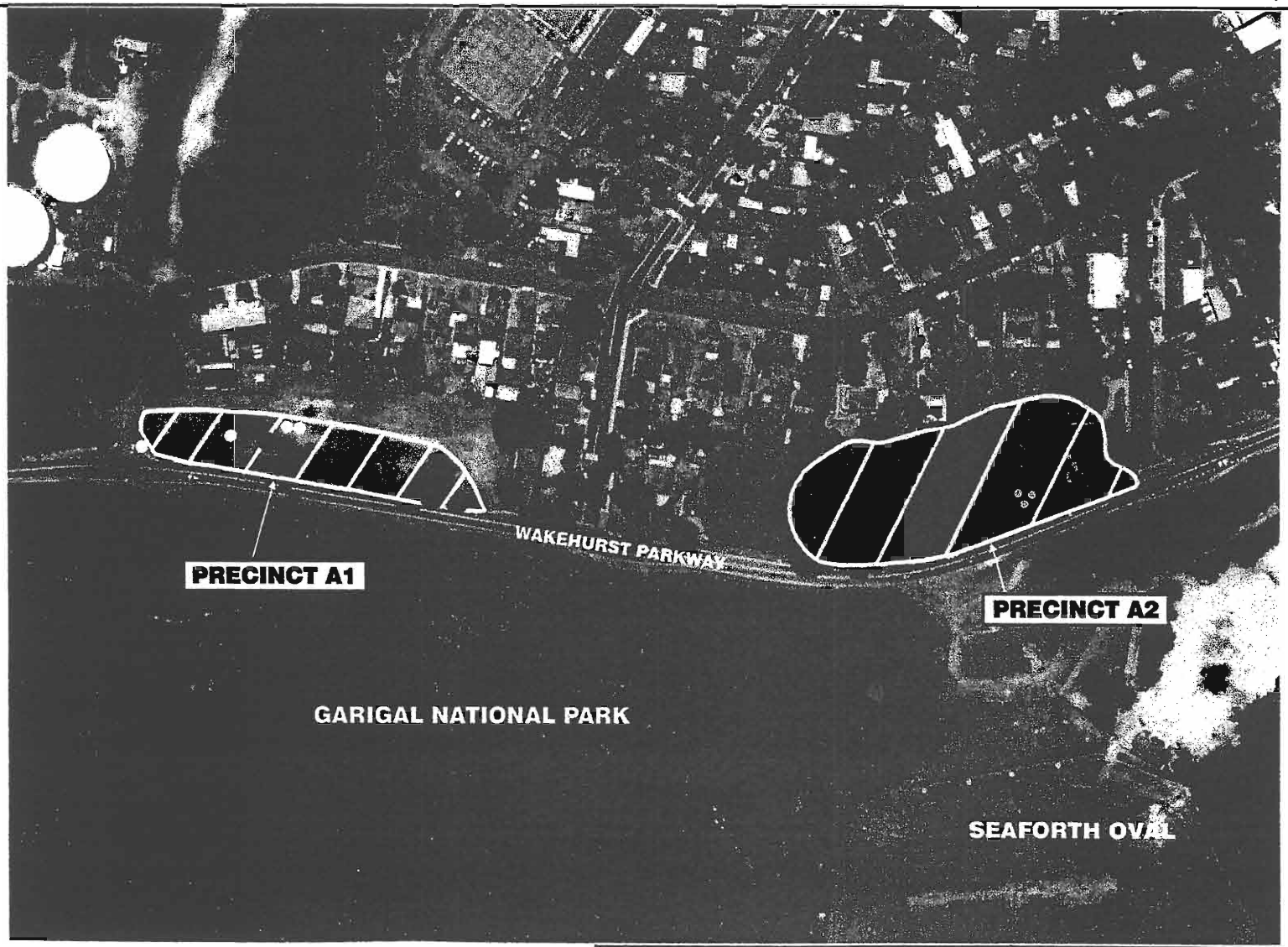
APPROVED:
DATE:
STATUS: DRAFT

PROJECT: 46154-005
CAD FILE: 003.CDR
REVISION: B

URS

FIGURE: 1

Figure 2: Location of Lomandra brevis and Microtis angusii at Precinct A1. Based on map prepared by URS



KEY

DUFFYS FOREST

PROSTANTHERA SP

● DARWINIA DIMINUTA

○ PIMELEA CURVIFORA VAR. CURVIFLORA

● LOMANDRA BREVIS

● MICROTIS ? ANGUSII

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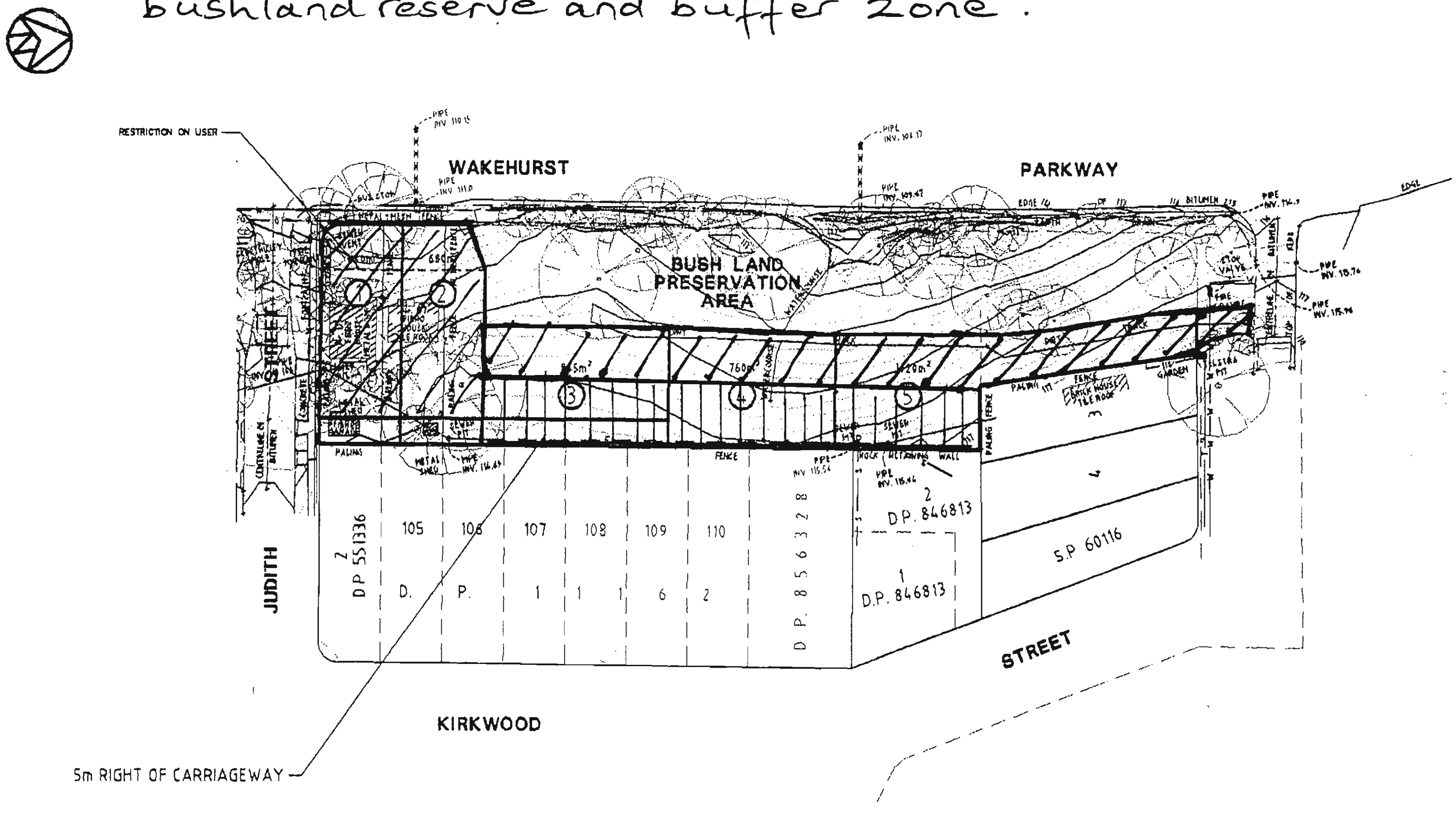
URS

FIGURE: 1

Figure [illegible] development opportunities [illegible] the [illegible] a bushland reserve and buffer zone.



Proposed Buffer Zone

Development zone as per original proposal

Potential development zone - option to incorporate into existing blocks i.e. lots 107, 108, 109, 110 etc.

1:500 @ A1

DATE: August 2002

Appendix 1: Native plant species recorded from Seaforth Precint A1

T.A. James (August 2002)

Key

DF = Duffys Forest ecological community
Occurrence in Duffys Forest & conservation significance based on Smith & Smith 2000; Benson & Howell 1994
TSCA = *Threatened Species Conservation Act 1995*
EPBC = *Environment Protection & Biodiversity Conservation Act 1999*
REG = Regionally significant in northern Sydney
ROTAP = Rare or Threatened Australian Plant (Briggs & Leigh 1996)
2RC- = geographic range <100 km; rare; adequacy of conservation unknown
3RC- = geographic range 100 km+; rare; adequacy of conservation unknown

Plant groups & families	Plant species	Listed in Final Det. for DF(2002)	Recorded generally from DF (Smith 2000)	Notes, conservation status		
Ferns						
SINOPTERIDACEAE	Cheilanthes sieberi		+			
Dicotyledons						
APIACEAE	Actinotus minor	+	+			
	Platysace linearifolia	+	+			
	Xanthosia tridentata	+	+	Frequent small shrub		
ASTERACEAE	?Lagenifera gracilis		+	Rosette only- flowers to confirm. REG SIG.		
BAUERACEAE	Bauera microphylla			Only B. rubioides recorded previously for Duffys Forest		
CASUARINACEAE	Allocasuarina littoralis	+	+	Frequent small tree/shrub		
	A. distyla		+			
CLUSIACEAE	Hypericum gramineum			Restricted to damper soils along drainage line		
DILLENIACEAE	Hibbertia empetrifolia		+			
	H. linearis		+			
DROSERACEAE	Drosera auriculata		+	Damp lower slopes		
	D. spatulata			Damp lower slopes		

ELAEOCARPACEAE	Elaeocarpus reticulatus		+			
EPACRIDACEAE	Epacris microphylla		+			
	E. pulchella	+	+			
	Monotoca scoparia		+			
EUPHORBIACEAE	Micrantheum ericoides	+	+	Frequent small shrub		
	Phyllanthus hirtellus	+	+	Frequent small shrub		
	Omalanthus populifolius		+	Few seedlings		
FABACEAE	Bossiaea heterophylla	+	+			
Faboideae	Dillwynia floribunda var. floribunda		+			
	D. ?phylicoides			REG SIG.Not recorded previously from region. Genus currently under revision.		
	D. retorta	+	+			
	Gompholobium glabratum		+			
	Hovea linearis	+	+			
	Mirbelia rubiifolia		+			
	Pultenaea elliptica	+	+			
	P. linophylla	+	+			
	P. stipularis		+			
Mimosoideae	*Acacia baileyana			Garden escape		
	A.decurrens		+			
	A. linifolia	+	+			
	A. longifolia		+			
	A. myrtifolia	+	+			
	*A. saligna			Native to WA. Tree in adjoining garden; locally naturalised. Aggressive coloniser.		
	A. suaveolens	+	+			
	A. terminalis subsp.aurea		+			
	A. ulicifolia	+	+			
GOODENIACEAE	Dampiera stricta	+	+			
HALORAGACEAE	Gonocarpus micranthus					
	G. teucrioides	+	+			

LAURACEAE	Cassytha glabella		+			
LOGANIACEAE	?Logania pusilla		+	Seedling only- more mature plant needed. REG SIG.		
MYRTACEAE	Angophora costata	+	+			
	Baeckea diosmifolia		+			
	B. imbricata					
	Callistemon citrinus		+			
	Corymbia gummifera	+	+			
	Darwinia diminuta			**1 plant seen. Rare local endemic. ROTAP - 3RCi, Not known to be conserved in local area.**		
	Eucalyptus haemastoma	+	+			
	E. oblonga		+			
	E. sieberi	+	+			
	Kunzea ambigua		+			
	Kunzea parvifolia		+			
	Leptospermum polygalifolium subsp. polygalifolium		+	Recorded by URS 2002 only.		
	Leptospermum trinervium	+	+			
	Melaleuca armillaris			Recorded by URS 2002 only.		
PITTOSPORACEAE	Pittosporum undulatum		+			
PROTEACEAE	Banksia serrata	+	+	Recorded by URS 2002 only.		
	B. integrifolia		+			
	Grevillea buxifolia var. buxifolia	+	+			
	?Hakea sericea	+	+	Kate Inwood *pers. comm.*		
	Persoonia pinifolia	+	+			
RUBIACEAE	Opercularia varia		+			
RUTACEAE	Boronia ledifolia	+	+			
	Zieria pilosa		+			
SAPINDACEAE	Dodonaea triquetra	+	+			

SMILACACEAE	Smilax glyciphylla		+			
STACKHOUSIACEAE	Stackhousia viminea		+			
STERCULIACEAE	Lasiopetalum ferrugineum	+	+			
STYLIDIACEAE	Stylidium graminifolium		+	Recorded by URS 2002 only. Possibly confused with S. lineare.		
	S.lineare					
THYMELAEACEAE	**Pimelea curviflora var. curviflora**		**+**	**TSCA - Vulnerable. c. 28 plants**		
Monocotyledons						
CYPERACEAE	Caustis flexuosa		+			
	Cyathochaeta diandra	+	+			
	Cyperus polystachyos		+			
	Lepidopserma laterale	+	+			
	Ptilothrix deusta		+			
	Schoenus ericetorum		+			
	S. imberbis		+	Damp soils		
IRIDACEAE	Patersonia sericea	+	+			
LOMANDRACEAE	**Lomandra brevis**		**+**	**ROTAP - 2RC- Several plants observed in shady sites**		
	L. cylindrica		+			
	L. filiformis subsp. filiformis		+			
	L. glauca	+	+			
	L. gracilis		+			
ORCHIDACEAE	Cryptostylis sp.		+	Basal leaf only; several plants at base of tree		
	Glossodia minor		+			
	Microtis ? angusii or the common M. unifolia			**TSCA & EPBC - Endangered. Basal leaves only at present. Recorded by Peter Eygelshoven. Flowering material needed &/or DNA testing to confirm**		

PHORMIACEAE	Dianella caerulea	+	+			
	D. prunina		+			
	D. revoluta		+	Recorded by URS 2002 only		
POACEAE	Aristida ramosa					
	A. vagans		+			
	Austrodanthonia tenuior		+			
	Austrostipa pubescens	+	+			
	Cynodon dactylon					
	Deyeuxia decipiens		+	**REG SIG.**		
	Dichelachne micrantha		+			
	Echinopogon caespitosus		+			
	Entolasia stricta var. stricta	+	+			
	E. stricta var. hirsuta					
	Eragrostis brownii		+			
	Imperata cylindrica		+			
	Microlaena stipoides		+			
	Paspalidium distans		+			
RESTIONACEAE	Lepyrodia scariosa		+			
XANTHORRHOEACEAE	Xanthorrhoea media	+	+			
XYRIDACEAE	Xyris ?gracilis		+	One plant only observed.		

Appendix C

Review of Previous Flora and Fauna Reports - Seaforth

Report by Hayes Environmental dated 18th February 2003

HAYES ENVIRONMENTAL

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Wombeyan Caves Road, High Range 2[illegible] 5
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Mob 0412 600 173
Email rhayes@hayesenv.com.au

Dr Robert Smith
GHD Pty Ltd
10 Bond Street
SYDNEY NSW 2000

18th February 2003

Dear Robert,

RE: Review of previous flora and fauna reports - Seaforth

I have reviewed documents provided to me regarding approximately 3000sqm of land referred to as Precinct A1 at North Seaforth. The land is bounded to the west by the Wakehurst Parkway, to the south by Judith Street, to the north by Kirkwood Street and to the east by existing residential development.

I subsequently inspected Precinct A1 on Thursday 13th February 2003. An existing dirt access track bisects the site along a north-south axis, with land to the east of the track characterised by open grassland/lawn, and land to the west of the track supporting a regenerating remnant of native vegetation. Two existing houses are located in the south, adjacent to Judith Street.

The native vegetation present to the west of the existing dirt access track has previously been identified as 'Duffy's Forest', an endangered ecological community listed under the *NSW Threatened Species Conservation Act 1995* (TSC Act). Several plant species listed as threatened under the TSC Act are also known to occur in this area.

Reviewed documents generally concur with regard to the extent, condition and ecological significance of the Duffy's Forest remnant occurring to the west of the existing access track. However, reviewed documents do not concur with regard to the future management of this remnant, or with regard to the development potential of land to the east of the existing track.

I agree with previous conclusions that a Species Impact Statement would be required for a development proposal which involves clearing of any of the Duffy's Forest remnant present to the west of the existing access track. I do not recommend that this option be pursued as I do not see that a development which would be likely to result in 'a significant impact' upon the Duffy's Forest at this location could be justified in social, economic or other terms.

It appears that development restricted to the east of the existing access track would not be likely to impose any direct impact upon Duffy's Forest, or upon threatened plant species. It is possible, however, that such development could still impose significant indirect impacts upon the adjacent Duffy's Forest or threatened plants.

Indirect impacts could include increased nutrient loading of soils due to stormwater run-off, increased chemical pollution (*eg* oils, detergents, pesticides) due to stormwater run-off, increased weed-invasion due to dumping of lawn clippings or escape of ornamental garden plants, increased trampling *etc*. A Species Impact Statement could be required if significant indirect impacts are likely, even if no direct vegetation clearing is proposed.

However, with careful design I believe it is possible that development restricted to the east of the existing access track could impose only minimal indirect impacts upon Duffy's Forest, or upon threatened plant species.

Perhaps the most useful and effective design feature likely to minimise indirect impacts upon adjacent downslope Duffy's Forest and threatened plants is the location of a roadway between proposed development and vegetation to be retained. The roadway should be designed to divert stormwater and other flows around the vegetation to be retained, and into Council's existing stormwater network. The roadway will also increase visibility of the vegetation remnant, potentially increasing its value to local residents, and reducing the likelihood of dumping of garden wastes, lawn clippings or rubbish.

Other design features which could be considered include:

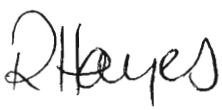
- a roadside kerb or suitable low fence which prevents vehicle access to the reserved area;
- a pedestrian access track through the reserved area, to minimise random trampling of regenerating vegetation. This track should be located using existing cleared areas as possible, and could include interpretative signs;
- a small picnic table or outdoor seat to encourage local resident 'ownership' of the reserved area. A feature such as this would be of value for future gatherings of bush regeneration teams, if local residents wish to manage and enhance the vegetation remnant.

In summary, I consider that a development proposal which restricts residential development to the east of the existing access track, and which is particularly designed to minimise potential indirect impacts upon adjacent downslope Duffy's Forest and threatened plants, would not require the preparation of a Species Impact Statement.

I am not aware of specific details for Asset Protection Zones which may be required at this site. If vegetation clearing for these zones is required within the Precinct A1 remnant, this may trigger the requirement for a Species Impact Statement.

Please do not hesitate to contact me for clarification of any point or to discuss these issues further.

Regards,



Rebecca Hayes
BSC (Env. Bio.) MEngMngt MEIA

Appendix D

Bushfire Protection Assessment for the Proposed Subdivision of Precincts A1 and A2 Wakehurst Parkway, Seaforth

Report by Conacher Travers dated April 2003

CONACHER TRAVERS

bushfire & ecological consultants

BUSHFIRE PROTECTION ASSESSMENT

FOR THE PROPOSED SUBDIVISION OF PRECINCTS A1 AND A2

WAKEHURST PARKWAY, SEAFORTH

APRIL 2003
(REF: 2466, 2467)

Conacher Travers Pty Ltd - ABN 49 083 610 173
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email: ecology@conachertravers.com.au • bushfire@conachertravers.com.au

BUSHFIRE PROTECTION ASSESSMENT

FOR THE PROPOSED SUBDIVISION OF PRECINCTS A1 AND A2

WAKEHURST PARKWAY, SEAFORTH

APRIL 2003

Conacher Travers

Bushfire and Environmental Consultants
Conacher Travers Pty Ltd A.B.N. 49 083 610 173

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Document No	Prep. date	Description	Issue	Verification by Author/s	Approved by Director
2466, 2467	February 2003		April 2003		

EXECUTIVE SUMMARY

A Bushfire Protection Assessment has been prepared by *Conacher Travers Pty Ltd* at the request of *G.H.D Pty Ltd* for the subdivision of surplus lands in the A1 and A2 Precincts, Wakehurst Parkway, Seaforth.

The proposed subdivision is deemed to be located within a bushfire prone area therefore under Section 91 of the *Environmental Planning & Assessment Act* 1979 is *"integrated development"* which under Section 100B of the *Rural Fires Act* must be submitted to the Commissioner of the Rural Fire Service for approval and issue of a *'Bushfire Safety Authority'*.

A *'Bushfire Safety Authority'* authorises development to the extent that it complies with matters considered by the Commissioner to be necessary to protect persons, property or the environment from danger that may occur from a bushfire.

This report provides an assessment of the potential bushfire threat to the development, the site-specific mitigation factors and recommends measures which will address the potential vulnerability of the development to bushfires burning within the adjoining bushland. It provides recommendations on the provision of Asset Protection Zones, access, water supplies and construction standards of future dwellings within the proposed subdivision.

Therefore, providing these recommendations are implemented and maintained, the proposed development provides reasonable compliance with the requirements of the NSW Rural Fire Services' *'Planning for Bushfire Protection 2001'*.

Graham Swain
Project Manager, Fire Planning - *Conacher Travers Pty Ltd*

John Delany
Fire Planner - *Conacher Travers Pty Ltd*

TABLE OF CONTENTS

BUSHFIRE THREAT ASSESSMENT

SECTION 1

INTRODUCTION

Conacher Travers Pty Ltd has been requested by *G.H.D Pty Ltd* to prepare a Bushfire Protection Assessment to assess the potential bushfire hazard and the accompanying bushfire threat affecting land for the residential subdivision of surplus land within Precincts A1 and A2 Wakehurst Parkway, Seaforth.

Schedule 1 provides an aerial view of the property and its surrounds.

1.1 AIMS OF THE ASSESSMENT

The aims of the bushfire threat assessment are to:

- Review the overall bushfire threats;
- Review the capability of the site to provide a safe development;
- Review the potential to carry out hazard management over the landscape;
- Provide advice on mitigation measures including the provision of Asset Protection Zones and Construction Standards;
- Review and provide advise on access and water supply;
- Review the evacuation capability of the area; and
- Advise on specific fire management issues.

1.2 PLANNING RELATIONSHIPS

This report has been prepared having regard to the following legislative and planning requirements.

1.2.1 Legislation

Environmental Planning and Assessment Act (EPA Act)

- Section 79C(1)(c) - in regard to the likely impacts of the development - e.g. natural hazards (bushfire risk); and the suitability of a site for development - e.g. bushfires.

- Section 79 BA requires Councils to be satisfied that developments in bushfire prone areas (other than those dealt with under Section 100B of the RFA) comply with *Planning for Bushfire Protection, 2001* before granting development consent.

Rural Fires Act 1997 (Amended)

- Section 100B provides for the issue by the Commissioner of the NSW Rural Fire Service of bushfire safety authorities for subdivision of bushfire prone land that could lawfully be used for residential or rural residential purposes or for development of bushfire prone land for a special protection purpose (eg. SEPP 5, Hospital, Nursing Home, Schools, etc).

- Sections 63 (1) and 63 (2) require public authorities and owners/occupiers of land to take all practicable steps to prevent the occurrence of bushfires on, and to minimise the danger of the spread of bushfires.

1.2.2 Planning Policies

- *Planning for Bushfire Protection - 2001 Rural Fire Service/Planning NSW* - This document was prepared by the Rural Fire Service in collaboration with Planning NSW and replaces Circular C10 (1983) and *Planning for Bushfire Protection 1991* prepared by the Department of Bush Fire Services.

  The 2001 revision of *Planning for Bushfire Protection* provides guidance on the planning and development control processes in relation to bushfire protection measures for subdivision and residential developments in bushfire prone areas. The document also addresses issues associated with Infill and Special Protection Developments e.g. SEPP 5, Schools and Nursing Homes.

1.3 PROJECT SYNOPSIS

Precincts A1 and A2 are located on the eastern side of Wakehurst Parkway and contain land within an existing residential subdivision of twenty six (26) lots which was acquired by the Roads and Traffic Authority for the widening of Wakehurst Parkway.

The acquisition for this land is no longer required however surveys of the land have revealed the existence of several vegetation species which have ecological significance.

The retention of the Duffys Forest vegetation within each precinct and *Darwinia dimunuta* and *Pimelea curviflora var. curviflora* within Precinct A1 and *Prostanthera SP* within Precinct A2 has driven the need to establish a new subdivision pattern which establishes five (5) new lots within Precinct A1 and two (2) new lots within Precinct A2. (Total seven (7) new lots).

Schedule 1 provides the development layout.

1.4 INFORMATION COLLATION

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

- Concept Plans prepared by *G.H.D Pty Ltd* dated August 2002 and March 2003.
- CMA of NSW 1:25,000 Manly Topographic Map.
- Sydney DLWC 1:25,000 Aerial Photograph.

Graham Swain of *Conacher Travers Pty Ltd* inspected the proposed development site in October 2002.

The development area was inspected to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire protection advantages and a visual appraisal of bushfire hazard and risk were also undertaken. (Bushfire protection advantages are those landscape features which act to suppress or mitigate a fire eg. escarpments, creeks, road and fire breaks etc.).

1.5 SITE DESCRIPTION

Location, Existing and Surrounding Landuse

Precinct A1 is located to the east of Wakehurst Parkway, extending in a narrow strip from Kirkwood Street in the north to Judith Street in the south.

The existing subdivision provides for two (2) lots off Kirkwood Street with ten (10) lots off Wakehurst Parkway. Two of these lots, adjacent to Judith Street are currently occupied by existing fibro cottages with access from Wakehurst Parkway.

Land to the north of Kirkwood Street consists of bushland whilst urban development is located to the east and south of the precinct.

Precinct A2 is located to the east of Wakehurst Parkway extending in a narrow strip from Judith Street in the north to Burnt Street in the south. The existing subdivision provides for sixteen (16) lots off Wakehurst Parkway. Three of these lots, adjacent to Judith Street are currently occupied by existing dwellings which will be retained.

Land to the north of Judith Street contains existing cottages in Precinct A2 whilst urban development adjoins the eastern and southern boundary.

The western aspect of both Precincts adjoins Wakehurst Parkway with Garigal National Park extending further to the west.

Topography

Precinct A1 contains land which slopes at 14% toward Wakehurst Parkway. Land beyond Wakehurst Parkway slopes to the west into Garigal National Park at 17-18%.

Precinct A2 contains a noll which is located in the centre of the precinct. Land to the north of the noll slopes to the north west to the intersection of Judith Street and Wakehurst Parkway at 3%. The land to the south of the noll slopes to the south east towards Burnt Street at 8%.

Land beyond Wakehurst Parkway slopes to the west into Garigal National Park at 18%.

Drainage

Drainage from both precincts is by overland flow into the existing stormwater drainage system on Wakehurst Parkway.

Vegetation Communities

Precinct A1

The undeveloped area of Precinct A1 consists of mown grass and a small strip of highly degraded Duffys Forest vegetation along the Wakehurst Parkway frontage.

The two developed lots within the southern portion of the precinct contain existing dwellings with landscaped gardens.

Precinct A2

The northern portion of this precinct contains three lots with existing dwellings within landscaped gardens.

The cleared area within the precinct (proposed Lots 1 and 2) consists of mown grass whilst the southern portion of the precinct contains Duffys Forest vegetation which will be retained within a Bush Land Preservation Area.

Vegetation within the Garigal National Park to the west of Wakehurst Parkway consists of Low Open Forest/Heath (Group 1 Vegetation).

SECTION 2

BUSHFIRE PROTECTION ASSESSMENT

2.1 BACKGROUND TO CURRENT PLANNING GUIDELINES

'Planning for Bushfire Protection' (Rural Fire Service, 2001) provides concepts for Class 1, 2 & 3 buildings in bushfire prone areas and guidance on the planning and development control processes in relation to bushfire protection measures and states that '*overall the intention of bushfire protection measures should be to prevent flame contact to a structure, reduce radiant heat to below the ignition thresholds for various elements of a building, to minimise the potential for embers to cause ignition and reduce the effects of smoke on residents and fire fighters*'.

The document provides a methodology for determining setback distances (Asset Protection Zones) and Bushfire Attack/Construction Standards required for habitable buildings in development for residential purposes that are designated as bushfire-prone.

Sections 2.2 and 2.3 uses this methodology to determine asset protection zones and construction standards required for future dwellings within the proposed subdivision.

2.2 BUSHFIRE PROTECTION ASSESSMENT

Section A2.3.1 of '*Planning for Bushfire Protection 2001*' provides a methodology for determining setback distances (Asset Protection Zones).

Tables 1 and 1(a) provide a summary of this assessment.

TABLE 1 – Bushfire Protection Assessment
Precinct A1

Aspect	Vegetation within 140m of development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Recommended Width of Asset Protection Zone (Table A2.2 and 2.4)	Width of Asset Protection Zone Provided
North	Low Open Forest north of Kirkwood Street	Group 1	Level	40 metres	60 metres to dwelling on Lot 5
East	Existing Urban Development	No Classification	-	No Requirement	Not Applicable
South	Existing Urban Development to south of Judith Street	No Classification	-	No Requirement	Not Applicable
West Lots 2 – 5 Lot 1	Low Open Forest with Garigal National Park, Wakehurst Parkway Road Reserve	Group 1	17-18%	50 metres (40 metre IPA, 10 metres OPA)	15 metres road width plus 30 metre setback to building (including managed bushland preservation area). Total 45 metres. 30metres

TABLE 1 (a) – Bushfire Protection Assessment
Precinct A2

Aspect	Vegetation within 140m of development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Recommended Width of Asset Protection Zone (Table A2.2 and 2.4)	Width of Asset Protection Zone Provided
North	Urban Development	No Classification	Level	No Requirement	Not Applicable
East	Urban Development	No Classification	-	No Requirement	Not Applicable
South	Low Open Forest	Group 3 (less than 1 hectare)	7% Upslope	20 metres	15 metres within managed bushland
West	Low Open Forest within Garigal National Park, Wakehurst Parkway Road Reserve	Group 1	18%	50 metres (40 metres IPA, 10 metes OPA)	18 metres road width plus 20 metres setback to building. Total 38 metres.

2.3 BUSHFIRE ATTACK ASSESSMENT

Section A3.3 of *'Planning for Bushfire Protection 2001'* provides a methodology for determining bushfire attack at construction stage for a Class 1, 2 & 3 building within a designated bushfire prone area.

Table 2 and 2(a) provides a summary of Bushfire Attack and resultant construction standards.

TABLE 2 – Bushfire Attack Assessment
Precinct A1

Aspect	Vegetation within 140m of development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Separation distance	Level of Bushfire Attack (Table A3.3)	Construction Standard
North	Low Open Forest north of Kirkwood Street	Group 1	Level	60 metes	Medium	Level 1 AS3959
East	Existing Urban Development	No Classification	-	Not Applicable	Low	No specific bushfire construction requirements *Note 1
South	Existing Urban Development to south of Judith Street	No Classification	-	Not Applicable	Low	No specific bushfire construction requirements *Note 1
West Lots 2 – 5	Low Open Forest within Garigal National Park, Wakehurst Parkway Road Reserve	Group 1	17-18%	41 metres	Extreme	Level 3 AS3959
Lot 1					Extreme	Level 3 AS3959

Note:

*1 Whilst aspects of the proposed dwellings which are rated as having a low level of Bushfire Attack do not require the implementation of specific bushfire construction standards *Conacher Travers Pty Ltd* recommends the implementation of Level 1 construction, in accordance with AS3959-1999 (amended), to these elevations.

TABLE 2 (a) – Bushfire Attack Assessment
Precinct A2

Aspect	Vegetation within 140m of development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Separation distance	Level of Bushfire Attack (Table A3.3)	Construction Standard
North	Urban Development	No Classification	Level	Not Applicable	Low	No specific bushfire construction requirements *Note 1
East	Urban Development	No Classification	-	Not Applicable	Low	No specific bushfire construction requirements *Note 1
South	Low Open Forest	Group 3 (less than 1 hectare)	7% Upslope	15 metres	Flame Zone	Beyond Scope of AS3959 *Note 2
West	Low Open Forest within Garigal National Park Wakehurst Parkway Road Reserve	Group 1	18%	38 metres	Extreme	Level 3 AS3959

Notes:

*1 Whilst aspects of the proposed dwellings which are rated as having a low level of Bushfire Attack do not require the implementation of specific bushfire construction standards *Conacher Travers Pty Ltd* recommends the implementation of Level 1 construction, in accordance with AS3959-1999 (amended), to these elevations.

*2 The southern aspect of the future dwelling on Lot 2 within Precinct A2 will be subject to radiant heat impact from the bushland within the adjoining Bushland Preservation Area. This area of bushland will be fuel managed and is isolated from bushland within Garigal National Park by Wakehurst Parkway. However, fires burning under north west winds provide the potential for this area to be ignited by flying embers. If this ignition occurs under these conditions, the fire will burn away from the dwelling on Lot 2 therefore reducing the likelihood of direct flame attack. Therefore a reduction in the Bushfire Attack Rating to Extreme, requiring Level 3 construction is a prudent assessment of the level of radiant heat impact.

SECTION 3

ASSESSMENT OF BUSHFIRE THREAT

3.1 BUSHFIRE THREAT ASSESSMENT

'Planning for Bushfire Protection' is a guideline and is not required to be used as a prescriptive determination for all localities. Modifications to these guidelines can be made where individual cases warrant such modification (RFS, 2001 BPP, page 3).

In these cases any departure from the guidelines should only occur in the presence of reasoned assessment and a holistic approach to the bushfire protection proposed at any such site / locality. Hence a bushfire threat assessment needs to be undertaken to adequately review all the factors that contribute to effective bushfire safety.

Such an assessment needs to analyse the actual bushfire 'threat'. The bushfire threat is normally considered to be the 'measure of potential' to cause damage to dwellings or an injury to person/s.

Developing in bushfire prone areas requires consideration of the overall threat upon a site and the way occupants of a site and or dwelling are able to cope in the event of a fire. The bushfire assessment process requires a breakdown of the issues relevant to bushfire threat assessment. This is achieved by a review of three prime 'cause & effect' factors i.e. hazard, risk and vulnerability and assesses the benefits of any naturally occurring mitigation factors.

The following provides the review of the three prime causes and effect factors:

3.1.1 Hazard Assessment

The hazard is the potential severity of a fire. Usually measured in terms of intensity (Kw/m), the factors that influence a bushfire hazard include climate and weather patterns, vegetation (fuel quantity, distribution and moisture) and slope (Planning for Bushfire Protection 2001).

In the assessment of hazard only the areas peripheral to the proposed development zone are normally assessed for a hazard rating. This is because it could be assumed that all fuel within the development areas would be removed or at least modified as part of living in a locality or occupying a site. The bushfire hazard is assessed on information involving the type of vegetation (and how well it burns during a bushfire) and the slope of the land within 140 metres of the precincts.

The western boundary of the precincts adjoin Wakehurst Parkway which in turn adjoins Garigal National Park and Seaforth Oval.

The bushland in Garigal National Park will provide the fuel source for bushfires burning towards the proposed development under the influence of north west and westerly winds. Therefore the potential bushfire hazard from these aspects will be high.

3.1.2 Risk Assessment

Bushfire risk is the chance of a bushfire igniting, spreading and causing damage to assets of value to the community and is related to the vulnerability of the asset ('Planning for Bushfire Protection 2001').

Fire History - Wildfire impacted Garigal National Park in 1997 causing no damage to the existing dwellings within the precincts.

Point of fire origin - The 1997 bushfire originated on the shores of Middle Harbour.

Likely ignition sources - It is most likely that accidental fire escapes or deliberately lit fires in the bushland areas within the Garigal National Park will be the primary ignition source for fires to the north west and west of the precincts.

Type of Risk - The proposed development is within a north westerly/westerly fire path, however the Wakehurst Parkway and the proposed Asset Protection Zones reduce the risk of direct fire impact.

Assessment of Risk

Moderate/High.

3.1.3 Assessment of Vulnerability

The vulnerability is the exposure of a site to severe fire behaviour such as excessive flame height and severe radiant heat flux, and the proximity of that site, to or from, safe areas. (The latter being as a result of a site being isolated, and if evacuation is required, then that may necessitate a route through potentially burning bushland).

Potential Impact Direction – North west and west.

Exposure of Proposed Development – The proposed development is exposed to impact of bushfires burning in vegetation within the Garigal National Park.

Nature of Potential Impact – In the event that fires should ignite within the bushland within Garigal National Park the potential impact will be radiant heat, ember and smoke attack.

Assessment of Vulnerability

High.

3.2 BUSHFIRE THREAT CONCLUSION

The assessment of the bushfire hazard has identified that the Hazard rating is HIGH. An assessment of risk and vulnerability has assessed the development as having a MODERATE/HIGH Risk and HIGH Vulnerability. The overall Bushfire Threat is therefore considered to be **HIGH**.

This rating confirms the need for the implementation of Asset Protection Zones and construction standards to the future dwellings.

SECTION 4

ISSUES ARISING FROM THE THREAT ASSESSMENT IN RELATION TO THE PROPOSED DEVELOPMENT

4.1 FIRE PROTECTION MEASURES

'Planning for Bushfire Protection 2001' provides a methodology for determining the setback requirements (Asset Protection Zones) and construction standards for habitable buildings in developments for residential purposes that are located within a designated bushfire prone area.

The Bushfire Threat Assessment (Section 3) provides a methodology for determining which level of potential vulnerability that a development may have from bushfires burning within the adjoining bushland.

This assessment has determined that the bushfire threat to the proposed development is High and that fires burning within bushland to the west of Wakehurst Parkway presents a Moderate/High level of vulnerability to the future dwellings within the subdivision.

The application of appropriate Asset Protection Zones, construction standards to the dwellings and fuel management on each lot will provide a level of protection which will reduce the vulnerability of the residents/fire fighters against the potential impact of bushfires.

4.2 BUILDING PROTECTION

The 'Bushfire Attack Assessment' (Section 2.3) of this report determined that the buildings within the proposed development have various levels of bushfire attack rating. Therefore, the future dwellings should be constructed to comply with the recommendations provided in Tables 2 and 2(a).

In addition, all valleys/gutters should be protected to prevent the build up of combustible material within the valleys/gutters. Materials used in the protection devices should have a flammability index of not greater than 5 (in accordance with AS1530.2).

4.3 LEGISLATIVE RESPONSIBILITY TO MANAGE HAZARDOUS FUELS

Section 63(2) of the *Rural Fires Act* requires that *'it is the duty of the owner or occupier (including Councils) of land to take the notified steps (if any) and any other practicable steps to prevent the occurrence of fires on, and to minimise the danger of the spread of fires on or from that land'*.

The private ownership of the land means that the owners will have an ongoing liability to manage those lands for the protection of themselves and their neighbours.

In the case where owners do not carry out their required fuel management of hazardous land the Council has the right to enter and clear lands and later bill the owner (Section 66).

There is no physical reason that could constrain hazard management from being successfully carried out by normal means e.g. mowing / slashing / hand brush cutting within

these zones. Precautions should be taken to avoid damage to threatened species within the Bushland Preservation Area.

4.4 EVACUATION SAFETY

The need to consider evacuation of the development is based on the 1994-1996 Coroner's Inquiry into the 1994 bushfires in NSW. The Coroner recommended that in the assessment of a development for urban areas, due consideration should be given to access for fire fighters and egress for residents during bushfire events.

This development provides safe egress from all dwellings within the proposed development site via Rights of Carriageways onto either Kirkwood Street, Judith Street or Burnt Street thence via Judith Street into an existing urban precinct way from the approaching fire.

4.5 AVAILABILITY OF FIRE FIGHTING SERVICES

There is a NSW Fire Brigade located at Manly and Forestville.

4.6 ACCESS FOR FIRE FIGHTING OPERATIONS

Precinct A1
Access to proposed Lots 1 and 2 will be directly off Judith Street. Access to Lot 3 will be via a 5 metre wide Right of Carriageway off Judith Street which will not allow access for fire fighting vehicles, however the length of the Right of Carriageway is 30m which will allow fire operations to be conducted from Judith Street. Similarly, access to Lots 4 and 5 will be via a minimum 5 metre wide Right of Carriageway off Kirkwood Street. A turning head should be provided between Lots 4 and 5 to allow truck turning.

Precinct A2
Access to Lots 1 and 2 will be via a 5 metre wide Right of Carriageway off Judith Street. Emergency access can be gained for fire fighting operations directly off Wakehurst Parkway.

4.7 WATER SUPPLIES

Reticulated water is available to the proposed development. Therefore no further water supply is required for fire fighting purposes other than a hydrant supply installed in accordance with Australian Standard AS2419-1 (1994).

A 30m long x 25mm diameter fire hose reel should be provided to the future dwellings on Lots 1, 2, 3, 4 and 5 within Precinct A1 and Lots 1 and 2 within Precinct A2.

SECTION 5

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

In the assessment of bushfire prone lands the fundamental question is whether or not an area is safe for the occupation of people in residential dwellings. The proposed development is within a bushfire prone area therefore the requirements of *'Planning for Bushfire Protection 2001'* apply. However a bushfire threat assessment has revealed that mitigating factors will reduce the potential bushfire impact to the development.

Therefore, in accordance with the potential bushfire threat the following recommendations provide reasonable compliance with the provisions of *'Planning for Bushfire Protection 2001'*.

5.2 RECOMMENDATIONS

Recommendation 1 - The future dwellings should be sited within the preferred building footprint nominated on Schedule 1 'Plan of Bushfire Protection Measures'. This recommendation should be a condition of development for each lot.

Recommendation 2 - Asset Protection Zones should be provided to the future dwellings within the proposed subdivision. They shall take the form of Inner Protection Areas, measured from the extremities of each dwelling with an Outer Protection Area extending beyond the Inner Protection Area (where necessary). The Asset Protection Zones shall be as nominated in Table 3 and a shown in Schedule 1.

TABLE 3 – Asset Protection Zones Precinct A1

Aspect	Inner Protection Area (Fuel Free)	Outer Protection Area (Fuel Reduced)	Total Asset Protection Zone Width
North	60 metres	Nil	60 metres
East	Nil	Nil	Nil
South	Nil	Nil	Nil
West Lots 2-5	30 metres plus 15 metres within Wakehurst Parkway	Nil	45 metres
Lot 1	15 metres + 15 metres within Wakehurst Parkway	Nil	30 metres

TABLE 3A – Asset Protection Zones Precinct A2

Aspect	Inner Protection Area (Fuel Free)	Outer Protection Area (Fuel Reduced)	Total Asset Protection Zone Width
North	Nil	Nil	Nil
East	Nil	Nil	Nil
South	15 metres	Nil	15 metres
West	20 metres plus 18 metres within Wakehurst Parkway	Nil	38 metres

Recommendation 3 - Fuel management within the Asset Protection Zone should be maintained by regular slashing / mowing in accordance with the Inner Protection Area management guidelines provided in Appendix 1.

Recommendation 4 - The application of the Australian Standard AS3959 *'Construction of Buildings in Bush Fire Prone Areas'*, in accordance with Part 2.3.4 of the *'Building Code of Australia'* should apply to all future dwellings within the proposed development site. Dwellings should be constructed to comply with the construction standards in accordance with Tables 2 and 2a (Section 2.3 of this Report).

Recommendation 5 - Roof gutters and valleys to all dwellings should be leaf proofed by the installation of an external gutter protection shroud or a gutter system that denies all leaves from entering the gutter and building up on that gutter. Any material used in such a system should have a flammability index of no greater than 5 (as measured against AS 1530.2).

Recommendation 6 - A hydrant supply system should be installed in accordance with Australian Standard AS2419.1-1994 with a 30 metre x 25mm diameter hose reel provided to each dwelling in accordance with AS2441-1988.

Recommendation 7 – A turning head should be provided within Lots 4 and 5 of Precinct A1 to allow truck turning at the end of the Right of Carriageway.

REFERENCES:

NSW Rural Fire Service (2001)- *'Planning for Bush Fire Protection - A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners.* NSW Rural Fire Service

Travers, J (1994) Hazard and Threat Assessment Training Module. JTA.

Walker, J. (1984) Fuel Dynamics in Australian Vegetation. In "Fire and the Australian Biota" Australian Academy of Science.

McArthur, (1967). A.G. Leaflet 107 Fire Behaviour in Eucalypt Forest A.G.McArthur, Canberra. Commonwealth of Australia Department of National Development. Forestry and Timber Bureau. (and reprinted later by) CSIRO Div. Forestry - Bush Fire Research Unit.1967.

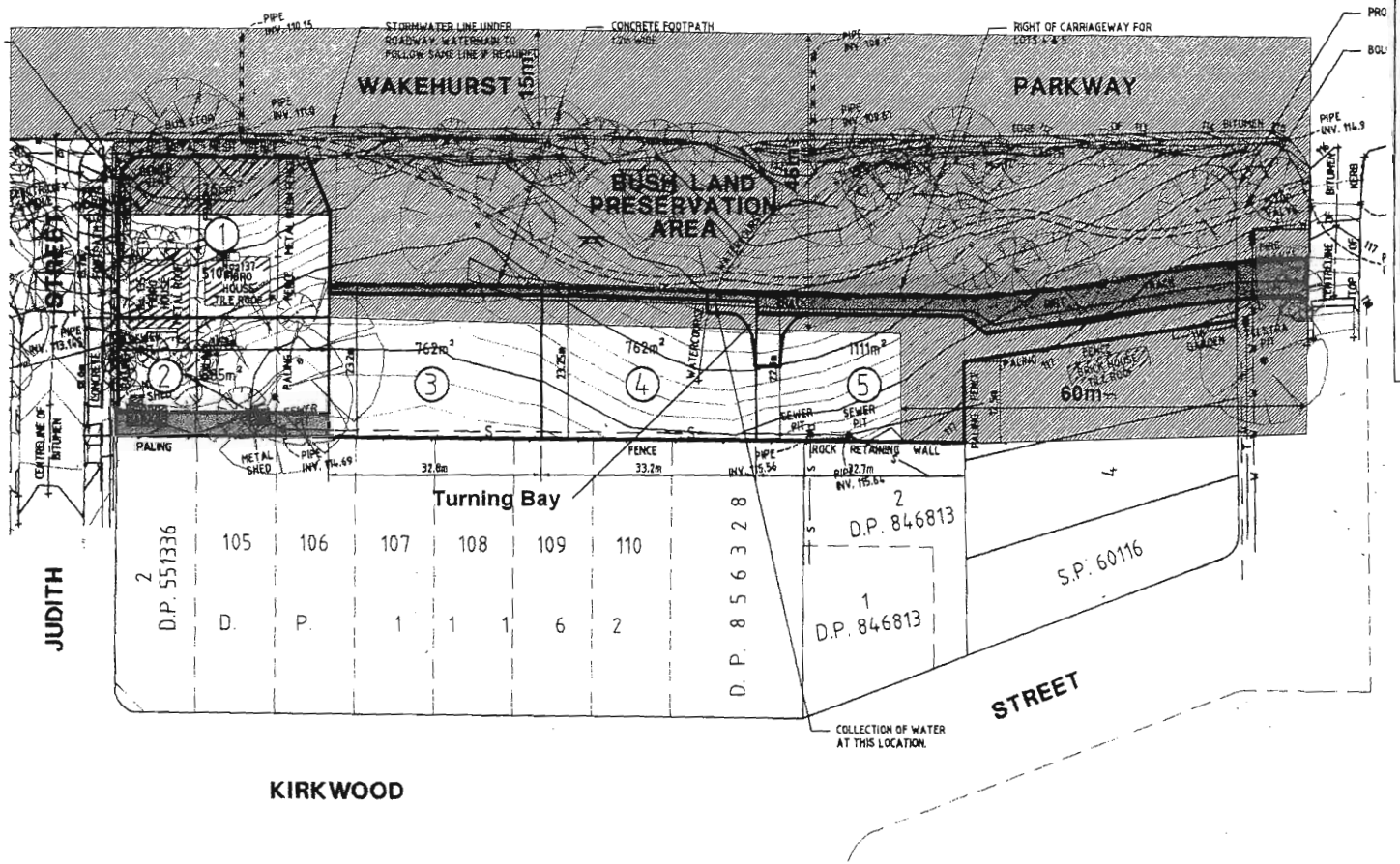
Australian Building Codes Board (1996) – Building Code of Australia, Class 1 and Class 10 Buildings Housing Provisions Volume 2.

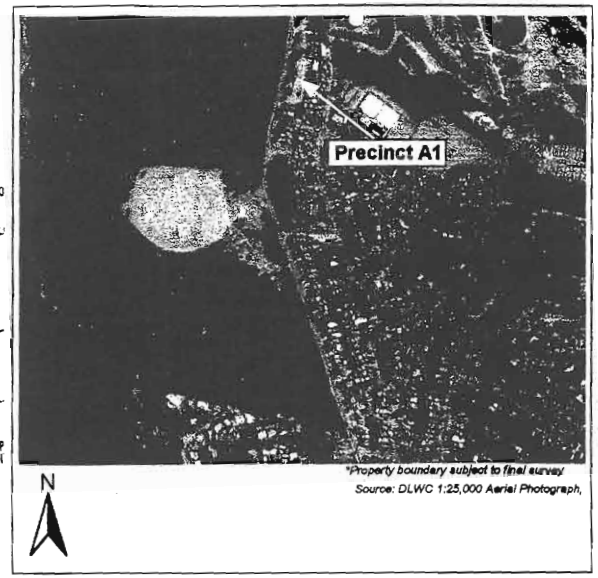
Councils of Standards Australia AS3959 (1999) – Australian Standard 'Construction of buildings in bush fire-prone areas'.

SCHEDULE 1

PLAN OF BUSHFIRE PROTECTION MEASURES

PRECINCT A1





Aerial photograph of property and surrounds

Legend

- Property Boundary
- Asset Protection Zone

N

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10 0 10 20 30 metres

Scale 1:800

Drawing No. 2466/S1	Date
Layout / Drawn by CS	14/04/03
Amendment	Date
A	
B	
C	

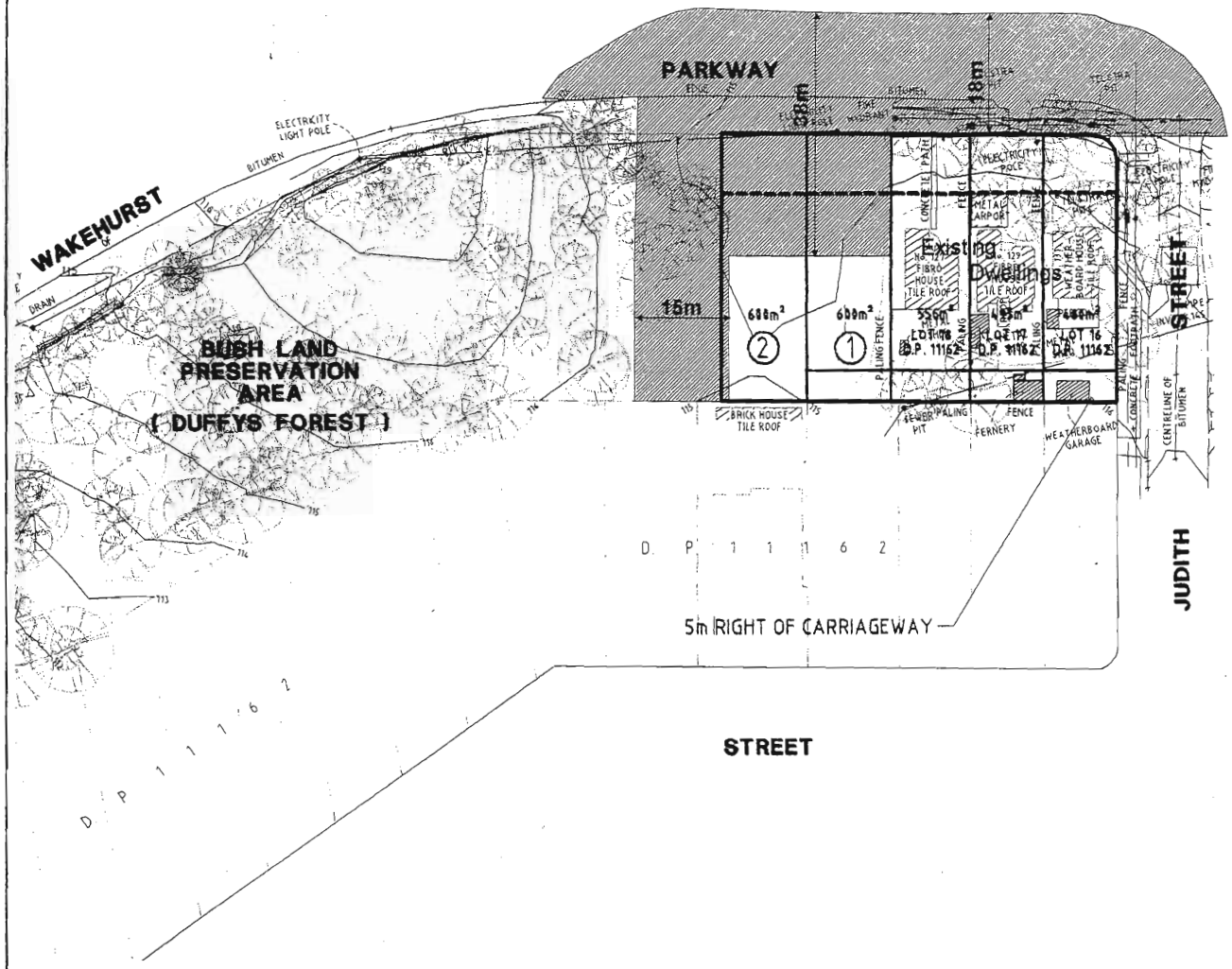
Schedule 1 -
Bushfire Protection Measures -
Precinct A1, Wakehurst Parkway, Seaforth

Source: Planning NSW & RTA

SCHEDULE 2

PLAN OF BUSHFIRE PROTECTION MEASURES

PRECINCT A2



*Property boundary subject to final survey
Source: DLWC 1:25,000 Aerial Photograph,

Legend

- Property Boundary
- Asset Protection Zone (Fuel Free)

N

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10 0 10 20 30 metres
Scale 1:800

Drawing No. 2457/S1		Date
Layout / Drawn by CS		15/04/03
Amendment		Date
A		
B		
C		

Schedule 2 -
Bushfire Protection Measures - Precinct A2, Wakehurst Parkway, Seaforth

Source: Planning NSW & RTA

APPENDIX 1

DETAILS OF ASSET (FIRE) PROTECTION ZONES

APPENDIX 1 – DETAILS OF ASSET (FIRE) PROTECTION ZONES

1.0 INTRODUCTION

The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

The area in which the fuel reduction occurs is referred to as an Asset Protection Zone. Asset Protection Zones are areas that are usually shown on 'plans' adjacent to either cultural or natural assets (eg. dwelling, rainforest). They act to significantly lessen the impact of intense fire. The Asset Protection Zone can be further identified by two sub-zones.

Each has a specific role to play within an asset protection zone. These sub-zone areas are called the Inner Protection Area (Fuel Free Zone) and the Outer Protection Area (Fuel Reduced Zone). The sub-zones characterise the physical appearance of the landscape and in particular the way the combustible fuels shall appear after they are modified. (See Photos 1 - 6).

The Inner Protection Area is always located immediately adjacent to the asset/value at risk. The Outer Protection Area is located between the Inner Protection Area and the bushland.

When considering bush fire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

Table 1 – Fuel Layers

Fuel Layer Name	Location of Layer in vertical Column	Type of Fuel
Ground Fuels	Below ground level	Peatmoss (always below the surface)
Surface Fuels	0-200 mm	Litter layer (leaves & twigs)
Aerial Fuels	200 – 3000 mm	Shrubs and grasses
Canopy Fuels	> 3000 mm	Tree canopy

2.0 INNER PROTECTION AREA (I.P.A)

This area is *almost free* of all fuels, it usually takes the form of grassy areas, car parks, roads, concrete areas, track or trails. It does not imply the wholesale removal of all or every tree - see Table 2 for guidelines on the extent of trees that can occur within this zone.

Rationale: By its very nature this zone is intended to stop the transmission of flame and reduce the transmission of radiated heat by the elimination of available fuel. Thus its Inner Protection Area name. This area also allows airborne embers to fall safely thus stopping further outbreaks of fire to begin.

Fire Fighting Advantage: This zone allows safe fire fighting operations to occur and clear fire control lines to be implemented by fire fighters.

Measurability: A fuel free Inner Protection Area is measured in two ways. The weight of the fuel and the width of the zone. Practitioners measure fuel load in *tonnes per hectare*. It is assessed by measuring the weight of fuel in a small quadrat eg. 300mm by 300mm and equating that to a hectare. The width of the zone is the separating distance between an asset and the bushland.

Performance Standard: A safe load is between 0-3 t/Ha.

Photographic Montage Depicting Inner Protection Area

PHOTO – 1

Site Description: The site is a paved roadway. It separates two areas of bushland and is normally called in this instance a fire break.

Fire Behaviour: No fire could occur on this fire break but the narrow nature of the break would allow fire to pass between the two bushland areas without difficulty.

Maintenance: None required due to paved surface. Do not allow shrubs to grow.

Fuel Weight: Zero

PHOTO – 2

Site Description: The site is mineral earth. There is no fuel on this narrow strip. The narrow strip forms a narrow fire break between two areas of unmanaged bushland.

Fire Behaviour: No fire could occur on this mineral earth but the narrow nature of the fire break would allow fire to pass between the two bushland areas without difficulty.

Maintenance: Regular raking and removal of litter layer. Do not allow shrubs to grow.

Fuel Weight: Zero

PHOTO – 3

Site Description: This is a grassed fire trail on level land adjacent to unmanaged bushland. The grass height on the level lands is 20-50 mm.

Fire Behaviour: This area, if mowed regularly, would exhibit flame heights not above 300 mm (12 inches). Note: The grass in the bushland zone is approx' 400-500mm in height and would achieve flame heights approximate to 750 –1200mm (depending on fuel loadings and Fire Danger Index).

Maintenance: This fuel free zone is able to be managed by normal mowing means. Raking and removal of litter layer; and/or mowing of grasses; and raking and/or mowing. Fuel Weight in photo 4: < 2 T/Ha.

Fuel Weight: < 2 T/Ha.

PHOTO – 4

Site Description: This is a grassed Inner Protection Area with scattered trees, no shrub larger and minimal understorey. The grass height is maintained to provide < 3 tonnes per hectare.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare.

Photographic Montage Depicting Inner Protection Area

PHOTO – 5

Site Description: The site is a grassed Inner Protection Area with large smooth barked tree 5 metres clear of the dwelling.
The grass height is maintained to provide < 3 tonnes per hectare.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare

PHOTO – 6

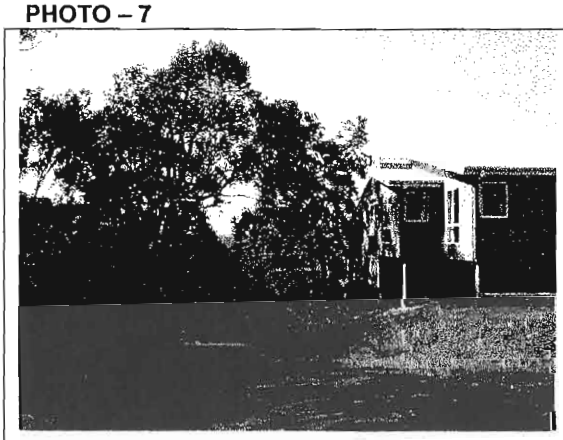
Site Description: This site shows a grassed Inner Protection Area with rock and landscaped areas constituting approximately 15% of the Inner Protection Area. Tree more than 5 metres from dwelling with no canopy connection to adjoining trees.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare to grass areas landscaped areas 3-4 tonnes/hectare.

PHOTO – 7



Site Description: This site shows an Inner Protection Area which includes a paved Access/Fire Trail. Smooth barked trees < 5 metres from fire aspect of dwelling.
Fuel loading to trail zero with grassed areas displaying approximately 3 tonnes/hectare.

Fire Behaviour: Fires impacting the bushland to the left of the Access/Fire Trail would loose intensity with the provision of the Inner Protection Area.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: Nil to Access/Fire Trail. 3 tonnes/hectare to grassed area.

PRESENCE OF SHRUBS IN AN INNER PROTECTION AREA

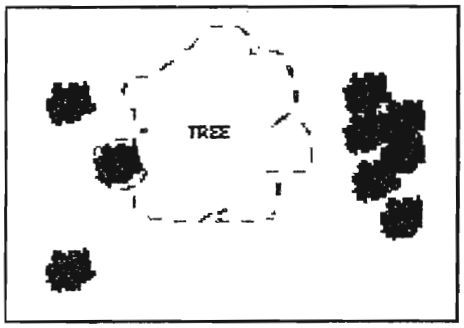
Shrubs may occur within an Inner Protection Area, but only where it is recommended by an experienced bush fire protection manager.

Thus landscaping works within the Inner Protection Area may occur in some instances. Where it is approved to occur, some 10-15 % and in some cases up to 30% of the Inner Protection Area may be able to be landscaped but always away from glass in buildings.

The design of the Inner Protection Area will be dependent on species selection and spatial arrangement.

Note: eg. 10 % means that for every 100 square metres (eg. 10 metres x 10 metres) only 10 % of that area may have a shrub component. The remainder would be free of shrubs see Figure 1. A 10 % landscaped shrub layer would add a further 1.5 tonnes of fuel to the overall hazard weight. To maintain the aggregate below 3 t/ha the ground fuels must be mown grass, or similar.

Figure 1 – Example of Spatial Arrangement in a Inner Protection Area



If a shrub layer is present the following table shows the additional fuel weights that should be added to the calculated surface fuels.

Shrub cover	Fuel Weight
10-30 %	2.5 tonnes / ha
35-50 %	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

PRESENCE OF TREES WITHIN AN INNER PROTECTION AREA

A tree may occur within an Inner Protection Area if the canopy does not form a link with shrubs. The reason is to lessen any chance for 'vegetation linking' and the capability for fire to extend into the canopy.

It is a basic premise in fire behaviour understanding that fire cannot occur in the canopy unless surface fuels such as grasses or shrubs are burning. This merging creates opportunity for fire to link with the canopy and therefore increase fire intensity by some significant amount.

Trees that have a canopy beginning near the ground (such as Forest Oaks *Allocasuarina*) form a continuous link with the tree canopy and shrubs. A forest canopy cannot therefore burn without fuel to feed that fire. In a 'tall open forest' where the trees are generally above 20 metres in height the canopy is separated from the land surface by some distance. In an 'open woodland' the low canopy height (usually < 5 metres) merges with the shrubland layer.

Knowing the relationship between the shrub layer and the tree canopy allows fire managers to design safer areas in the asset protection zones. It is for this reason that vegetation such as Forest Oaks are usually excluded from an Inner Protection Area.

Similarly in 'open forests' the height of the forest is sufficiently removed from the shrub layer. As a general rule trees are allowed within an Inner Protection Area where the density of those trees is commensurate with Table 2 below and located on slopes up to 20% with a Westerly aspect.

In respect of trees that can be located in a Inner Protection Area Table 2 provides guidelines.

Table 2 – Tree Density in Inner Protection Area

Distance from dwelling wall	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling
within 5 metres	No trees	No trees
between 5-10 metres	One tree per 100 m^2	2 trees per 100 m^2
Between 10-20 metres	<10 tree per 400 m^2.	<10 trees per 400 m^2

There are variations to Table 2.

- Trees vary in height and tree crown width /depth. Some trees have canopies that extend close to the ground (eg < 5 metres from the ground) whilst other trees have canopies that area high off the ground (> 15 metres off the ground). In some cases these tall trees do not have canopies that are affected by undergrowth / tall shrubs that could cause fire to burn into the canopy. Therefore if trees are isolated they do not form a significant risk.

- Similarly smooth barked trees are less of a hazard than heavily barked trees. The latter can cause fire to run up into the canopy and if there is sufficient wind the resulting fire can be of high intensity.

- Similar to the above, the number of trees per 100 m^2 depends on an individual assessment being undertaken to determine the 'type / size of tree', and its resultant potential impact upon a dwelling.

- The exposed side of a dwelling is the side that is directly affected by a moving fire particularly when fanned by wind. The non-exposed side of a dwelling is the side where fire is unlikely to come from either from a lack of wind, slope or other factors such as a lack of hazardous fuel.

3.0 OUTER PROTECTION AREA (O.P.A)

Rationale: This zone is designed to stop the development of 'intense' fires and the transmission of 'severe' radiated heat.

Physical Appearance: This area assumes all trees will remain but with a modified shrub / grass and litter layer. In some sparse vegetation communities the shrub layer may not require modification.

Fire Fighting Advantage: Reduced fire intensity. It achieves this by denying fire a significant proportion of the fuel to feed upon. Fuels containing small (or fine) leaves such as *Forest Oaks* (or similar) are targeted for removal due to the capacity to burn quickly and therefore feed fire up into adjacent trees.

Measurability: Practitioners measure fuel load in *tonnes per hectare*. It is assessed by way of measuring the load in a given small quadrat eg. 300mm by 300mm and equating that to a hectare.

Performance Standard: A safe load is between 4-6 T/Ha.

Note: An experienced / qualified bush fire protection practitioner should undertake an individual assessment of a site to determine the requirements within an Asset Protection Zone.

Photographic Montage Depicting Outer Protection Area

PHOTO – 1

Site Description: This area has a low tree and shrub density but a high presence of native grasses. Almost no litter layer present.

Fire Behaviour: The lack of shrubs means that fire behaviour will be less but the presence of the sloping lands and the heavy presence of grass means that fire can burn quickly up the slope with flame heights between 1200-1800mm.

Maintenance: Maintain the grass height. Shrubs can grow to what is pictured in Photo 1.

Fuel Weight: 2-3 T/Ha

PHOTO – 2

Site Description: This area has increased shrub density and the beginnings of those shrubs linking with the tree canopy. Litter layer is present, but less than 3 T/Ha. The shrub layer is approx' 3 T/Ha.

Fire Behaviour: The increase in shrubs means that fire behaviour will be high. Flame heights would be expected to be between 2000mm – 6000mm (depending on fuel loadings and Fire Danger Index).

Maintenance: Maintain the grass height and current density of shrubs.

Fuel Weight: 6 T/Ha.

PHOTO – 3

Site Description: This area has a low tree and shrub density but a high presence of native grasses.

Fire Behaviour: The heavy presence of native grass means that fire can burn quickly through the outer protection area with flame heights of between 1200-3m.

Maintenance: Remove and maintain grass layer/leaf litter by slashing/hand removal.

Fuel Weight: 6-8 tonnes/hectare

PHOTO – 4

Site Description: Outer Protection Area above dwelling showing large rock outcrops, low shrub and tree density.

Fire Behaviour: Fires impacting this area would burn down slope to the dwelling. Flame heights in the order of 1-2 metres.

Maintenance: Management of this area by slashing/hand removal/burning to maintain fuel loading to < 8 tonnes/hectare.

Fuel Weight: < 6 tonnes/hectare
Nil on rock ledges.

Appendix E

Review of Bushfire Protection Assessment Report – Seaforth Precinct A1

Report by Hayes Environmental dated 20th May 2003

HAYES ENVIRONMENTAL

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Dr Robert Smith
GHD Pty Ltd
10 Bond Street
SYDNEY NSW 2000

20th May 2003

Dear Robert,

RE: Review of Bushfire Protection Assessment report – Seaforth Precinct A1

I have reviewed the Bushfire Protection Assessment for the proposed subdivision of Precincts A1 and A2, Wakehurst Parkway, Seaforth, prepared by Conacher Travers in April 2003.

The Bushfire Protection Assessment raises some issues with regard to protection of threatened species on the Precinct A1 site. The report identifies that the whole of the Bushland Preservation Area on the site should be managed as an Inner Protection Zone for bushfire hazard reduction. This is illustrated on Schedule 1.

In general, an Inner Protection Zone should be managed as an almost fuel-free zone. This is usually achieved through a combination of access tracks and roadways, and mown lawn. This management would clearly impact upon the Duffy's Forest ecological community, and also upon the threatened plant species known or potentially present.

More specific details for management of an Inner Protection Zone are provided in Appendix 1 of the Bushfire Protection Assessment report. Trees are permitted within an Inner Protection Zone if the canopy does not form a link with the shrub layer, and at maximum densities specified in Table 2.

I have roughly calculated the densities of existing trees in the Bushland Preservation Area (based on the trees illustrated on Schedule 1, and the boundary of the APZ indicated on Schedule 1), and compared these with densities specified in Table 2:

- there are no trees within the first 5m of the asset protection zone, this being the area from the building zone to the proposed access track. This is consistent with requirements in Table 2;
- there are approximately 3 trees in the next 5m of the APZ (*ie* between 5-10m from Lots 3, 4 and 5), within an area of approximately 480sqm. This is less than 1 tree per 100sqm;
- there are approximately 6 trees in the next 10m of the asset protection zone (*ie* between 10-20m of Lots 3, 4 and 5), within an area of approximately 960sqm. This is less than 10 trees per 400sqm.

It appears that no trees will need to be removed from the Bushland Preservation Area for asset protection. However, the actual number and arrangement of trees depends on an individual assessment being undertaken (page 5 of Appendix 1).

Shrubs are also permitted within an Inner Protection Zone, where cover is 10-15%, and in some cases up to 30%. Again, this must be specifically assessed by an experienced bushfire protection manager. There are currently few shrubs present on the site, and these are generally more than 20m from the building zones. It is likely that the majority of shrubs present could be retained on the site, mainly where these are not linked to tree canopies.

In general, the understorey/grass layer should be mown. This poses a particular threat to *Pimelea curviflora* ssp *curviflora*, a threatened plant species known to occur on the site. *Pimelea curviflora* ssp *curviflora* is a small woody plant which grows up to 0.5m in height, and flowers from September to January (Robinson 1991; Fairley & Moore 1995). Plants present on the site are generally 5-15cm in height, and have regenerated from woody rootstock (James 2002).

Pimelea curviflora ssp *curviflora* is known to be regenerating in only a few parts of the Bushland Preservation Area, all west of the proposed walking track. This species could be protected if grassland areas to the west of the proposed walking track were slashed to no less than 0.4 to 0.5m in height. Grassland to the east of the proposed walking track could be mown regularly. It may be possible to identify a few areas west of the proposed walking track which are particularly important for the species, and retain these as 'bush gardens', whilst mowing or slashing the majority of the Bushland Preservation Area.

A second threatened plant species, *Microtis angusii*, is considered possibly occurring on the site (James 2002). This plant would be present as underground tubers for most of the year, producing leaves and flower in late winter and spring (James 2002). This plant would be less susceptible to mowing and slashing, if the Bushland Preservation Area was not mown or slashed during its reproductive season. This reproductive season is outside of the normal bushfire danger season.

In summary, it appears possible that the Bushland Preservation Area could be maintained for the dual purposes of asset protection and threatened species protection. However, this will need to be achieved through specific on-site discussions between an ecologist and an experienced bushfire protection manager. Responsibility for on-going maintenance of the area will need to be addressed.

Please do not hesitate to contact me to discuss these issues further.

Regards,

R Hayes

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