APPENDIX 1

CONCEPT PLANS

Urbis (2008)

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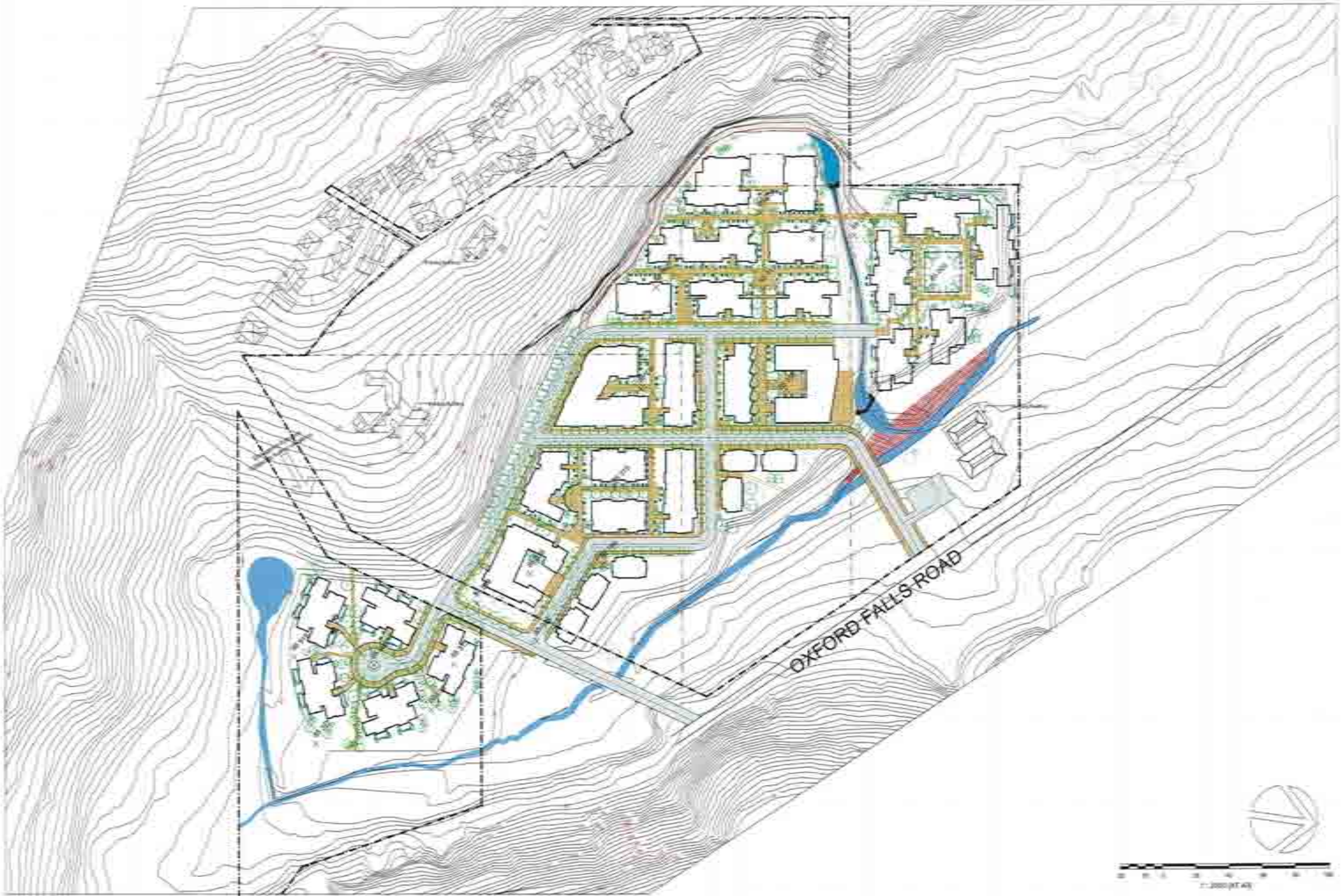

Oxford Falls Retirement Resort

Oxford Falls Road, French Forest, NSW - Australia

CP-07 - ACCESSIBILITY AND LANDSCAPE CONCEPT

LAYOUT

CONCEPT-DESIGN

SC07095 Date: 21/10/2008

Issue to Consultants use and information Scale: A3 @ 1:2000 Rev: A

urbis

APPENDIX 2

THE ECOLOGICAL MANAGEMENT OF BUSHFIRE ASSET PROTECTION ZONES
John Travers (2004)

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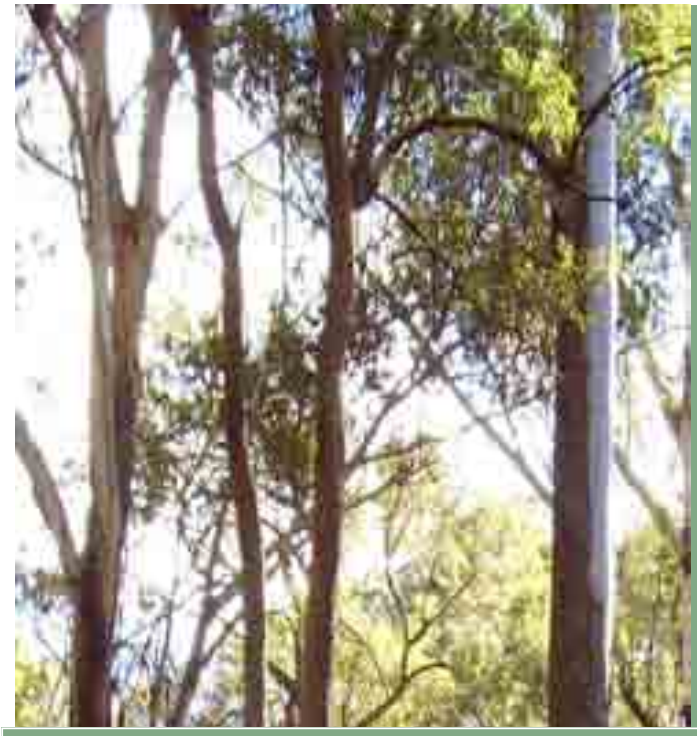
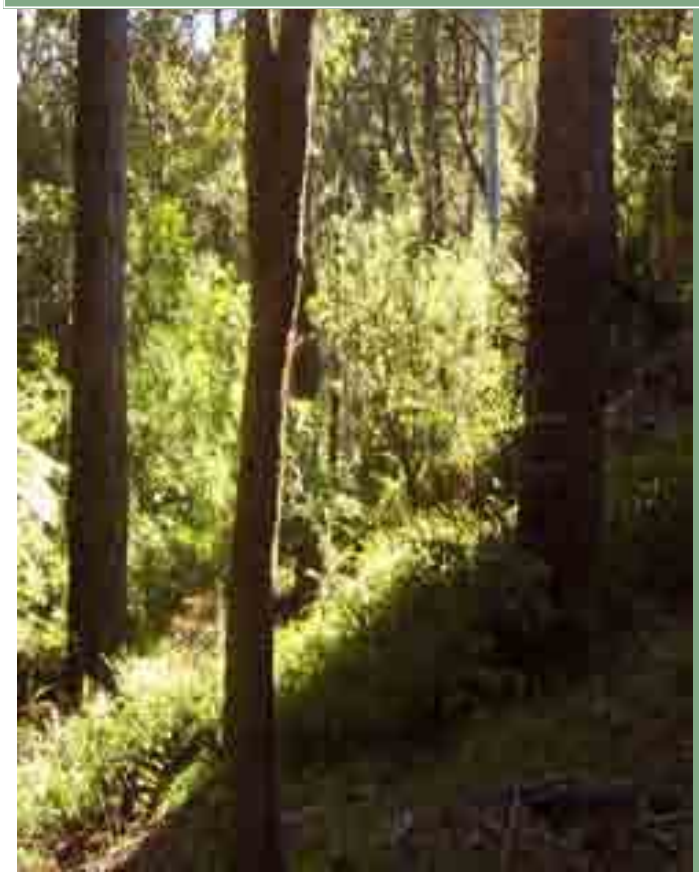


Travers

environmental

The Ecological Management of Bushfire Asset Protection Zones



A CASE STUDY AT THE WALLARAH PENINSULA

John Travers

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Key Words: asset protection zones, fuel, bushfire hazard reduction, litter & biomass.

1.0 INTRODUCTION

A study has been undertaken on several proposed residential allotments within the Wallarah Peninsula Landscape. The project has been undertaken to support the intentions of the *Bushfire Protection Assessment Volume 1* and the *Ecological Assessment Flora and Fauna Volume 2* prepared by *Conacher Travers* in 2004 and which were submitted as part of the Development Application/s for Stages 8-12 of the Lakes Sector, Wallarah Peninsula. The project follows on from earlier work undertaken over lots contained in Stages 1-7.

The study forms part of the *Fuel Management Plan* (2007) prepared by *Conacher Travers* initially in 2004 to establish a perpetual management plan for the lands covered by the Development Application and the adjacent lands owned by Lensworth Wallarah.

Hazard management within the Wallarah Peninsula is required to be undertaken in accordance with the recommendations contained in the Wallarah Master Planning documents, namely the *Ecological Site Management Plan* (*Manidis Roberts* 2003) and *Bushfire Management Plan* (*Conacher Travers* 2003).

The Masterplan provides a framework for the orderly development of the residential landscape whilst delivering perpetual conservation outcomes. The Masterplan was approved by Lake Macquarie City Council in 2003 and contains several other disciplines such as open space, stormwater etc which also direct the way the landscape will be managed in the Wallarah Peninsula environment.

1.1 Project Aim

The purpose of this study is to demonstrate that fuel management prescriptions can be achieved at the same time as honouring ecological considerations of the Masterplan.

The ecological stewardship of the Wallarah Peninsula project is the primary aim of the *Conservation and Land use Management Plan* prepared as part of the local environmental study in 2001.

1.2 Background

Conacher Travers undertook an environmental and ecological validation process as part of the confirmation that the design of the development of Stages 8-12 conforms to the ecological outcomes and prescriptions as outlined in the Masterplan. The process and its outcomes are detailed in the *Ecological Assessment Volume 1* (*Conacher Travers* 2004). In this validation process, the preliminary lot layout was judged against and adjusted to conform to the principles and objectives enunciated in the ecological considerations within the *Ecological Site Management Plan* (*Manidis Roberts* 2003) and the specifications provided in the *Bushfire Protection Assessment Report* (*Conacher Travers* 2004).

This process was a long and iterative one that began at a landscape wide level and reduced to assessment of individual trees and clumps of understorey vegetation. Fuel load requirements for areas delineated as asset protection zones were also taken into account, especially when considering vegetation understorey retention. The positioning, size and suitability of the individual development envelopes were assessed by a multidisciplinary team against criteria for each of the proposed 164 residential lots.

In order to satisfy the ecological requirements, significant changes were made to the preliminary layout as a result of the validation process.

1.3 Study Location

Three (3) new sites were identified in addition to the two (2) sites used in Version 1 of this study. Sites were selected based on aspect and vegetation communities to best represent the general landscape of Stages 8-12.

1.4 Study Methodology

The methodology involved:

- Selecting sites that were representative of typical landscape characteristics of a residential allotment.

- The undertaking of a floristic assessment of all living and dead vegetation to analyse the presence and or absence of plants species on site. Floristic sampling was then undertaken to establish plant species composition within quadrats. Other environmental characteristics were also recorded.

- The assessment of the bushfire hazard on the landscape. Fuel sampling occurred in accordance with the fuel sampling procedures identified by *Conacher Travers* in the initial *Fuel Management Plan 2004.*

- The presentation of the results in a graphical way that will enable an understanding of what *Stockland Wallarah* propose in each allotment.

  And specifically,

Floristic sampling to establish plant species composition - Floristic survey of the vegetation on the sites/s was undertaken by *Conacher Travers* Botanists using standard quadrat survey techniques.

Sampling vegetation fuels - Sampling of fuel weights was taken from three (3) sampling areas using standard fuel survey sampling techniques – see Annexure 1.

Survey positioning - The site/s has been accurately identified in relation to an extensive tree survey and subsequent plan prepared by *Carman Surveyors*.

2.0 RESULTS

The plants recorded on each site are relative to Sites A, B, C, D or E field data. Fuel sample data is shown in Table 4a, 4b & 4c.

2.1 Sampling Selection

Sample Area A is located within Lot 127 - Stage 7
Sample Area B is located within Lot 197 - Stage 10
Sample Area C is located within Lot 173 - Stage 9
Sample Area D is located within Lot 255 - Stage 11
Sample Area E is located within Lot 275 - Stage 12

2.2 Floristics

The floristics of the sample areas represents two different vegetation communities, namely: Smooth-barked Apple Forest and Spotted Gum Forest. The surveys for Sample Areas A and B were undertaken in early 2004 whilst the surveys for Sample Area C were undertaken in August 2004.

Table 1 - Site Characteristics

Sample Area	A	B	C, D & E
Forest Type	Smooth-barked Apple Forest	Spotted Gum / Ironbark Forest	Spotted Gum / Ironbark Forest
Structure	Woodland with a canopy cover of approximately 30 % and height of approximately 7-22 metres. Average height 11.45 metres. Average canopy spread of 6.18 metres. The understorey consists of a sparse to moderate shrub layer to 6 metres high and a dense groundcover of herbs and grasses.	Open Forest with a canopy cover of approximately 40 % and height of approximately 8-18 metres. Average height 11.52 metres. Average canopy spread of 9.42 metres. The understorey consists of a sparse to moderate shrub layer to 1.5 metres high and a dense groundcover of herbs and grasses	Open forest with a canopy cover of approximately 20% and height of approximately 10-20 metres. Average height 11.53 metres. Average canopy spread of 8.23 metres. The understorey consists of a moderate shrub layer, generally to 2 metres high and a dense groundcover of herbs and grasses.
Disturbances	This vegetation community is relatively undisturbed, apart from incursions of weeds	This vegetation community is relatively undisturbed	This vegetation community is relatively undisturbed
Years since fire	<24	4.5	4.5

Table 2a - Species Numbers on Sample Area A

Quadrats are 4x2 metres = 8 m^2
Smooth-barked Apple Forest

Sample Quadrat	Trees	Shrubs	Herbs	Ferns
1	1	4	2	0
2	0	3	4	0
3	1	4	1	0
4	1	2	2	0
5	1	2	2	0
6	0	0	2	0
7	1	2	2	0
8	0	2	2	0
9	0	4	3	0
10	1	0	3	0
11	1	3	2	1
12	1	3	1	1
13	1	3	2	1
14	0	3	3	1
15	0	1	2	1
16	1	3	3	0
17	2	4	3	0
18	0	1	3	0
19	0	2	2	0
20	0	1	1	0
21	0	1	1	0
22	1	1	2	0
23	0	4	3	1
24	0	2	2	1
25	0	1	1	1
26	0	2	1	1
27	0	2	2	1
28	0	1	0	0
29	0	2	1	0
30	0	1	2	0
31	1	2	0	0
32	1	0	2	0
33	0	1	2	0
34	0	1	1	0
35	0	0	1	0
Mean	0.42	1.94	1.88	0.28
Adjusted Mean*	0.84	3.88	3.76	0.56

* Note: Table 2a and 2b represent two sites which used two different quadrat sizes. This means that the Mean figures are different and require adjustment. The data set then becomes representative as opposed to being specific.

Table 2b - Species Numbers on Sample Area B

Quadrats are 4x4 metres =16 m^2
Spotted Gum / Ironbark Forest

Sample Quadrat	Trees	Shrubs	Vines	Herbs	Ferns
1	0	8	1	10	1
2	0	4	0	6	1
3	0	12	2	12	0
4	0	7	3	7	0
5	1	7	2	9	0
Mean	0.2	7.6	1.6	9	0.4

Table 2c - Species Numbers on Sample Areas C, D & E

Quadrats are 4x4 metres =16 m^2
Spotted Gum / Ironbark Forest

Sample Quadrat	Trees	Shrubs	Vines	Herbs	Ferns
C	7	15	5	19	0
D	7	20	10	19	0
E	4	15	0	19	1
Mean	6	16.6	5	19	0.3

Note: The equal number of Herb species presented in Column 5 are correct.

2.3 Fuel Samples

The fuel samples collected in 2002/3 by *Conacher Travers* over the Wallarah Peninsula and presented in the *Bushfire Management Plan 2003* revealed that the average aerial fuel weights varied. See Table 3 below.

Table 3 - Fuel Weights Sampled in 2002/3

	Litter layer T/ha	Grass / Forbes t/ha	Shrub (t/ha)	Total t/ha
Smooth-barked Apple Forest (n=34)	12.7	3.4	2.6	18.7
Spotted Gum/Ironbark Forest (n=23)	10.2	2.2	1.5	13.9
Mean	11.45	2.8	2.05	16.3

N = number of samples taken by Conacher Travers

The fuel samples collected in 2004 by *Conacher Travers* over the three smaller study sites subject to this study revealed that the average aerial fuel weights also varied. Variation was likely due to the time that elapsed since the last bushfire. See;

- Table 4a for Sample Area A,
- Table 4b for Sample Area B and
- Table 4c for Sample Areas C, D & E.

Table 4a - Fuel Weights Sampled in 2004 for Sample Area A Smooth- barked Apple Forest

	Litter T/ha	Grasses / Forbes t/ha	Shrub t/ha	Total t/ha
Sample 1	4.0	0	0	4.0
Sample 2	16.56	2.34	2.82	21.72
Sample 3	11.42	1.75	2.92	16.09
Sample 4	12.18	1.23	2.41	15.82
Sample 5	10.38	1.89	2.63	15.32
Average	10.90	2.27	2.15	14.59
* Average of 34 sites in similar vegetation	12.70	3.40	2.60	18.70
** Average of 57 other sample sites in two different vegetation communities	11.45	2.80	2.050	16.30

Table 4b - Fuel Weights Sampled in 2004 for Sample Area B
Spotted Gum/Ironbark Forest

	Litter T/ha	Grasses / Forbes t/ha	Shrub t/ha	Total t/ha
Sample 1	14.40	2.20	0	16.60
Sample 2	4.50	2.20	0	6.70
Sample 3	10.80	2.20	0	13.00
Sample 4	13.50	0.45	1.17	15.12
Sample 5	23.40	5.85	0	29.25
Average	13.32	2.58	0.23	16.13
* Average of 23 sites in similar vegetation	10.20	2.20	1.50	13.90
** Average of 57 other sample sites in two different vegetation communities	11.45	2.80	2.05	16.30

Table 4c - Fuel Weights Sampled in 2004 for Sample Areas C, D & E
Spotted Gum/Ironbark Forest

	Litter T/ha	Grasses / Forbes t/ha	Shrub t/ha	Total t/ha
Sample 1 – Area C	13.55	7.35	0.55	7.15
Sample 1 – Area D	0.73	0.15	1.20	0.69
Sample 1 – Area E	10.25	0.15	7.25	5.88
Average	8.17	2.55	3.00	4.57
* Average of 23 other sample sites in similar vegetation	10.20	2.20	1.50	13.90
** Average of 57 other sample sites in two different vegetation communities	11.45	2.80	2.05	16.30

***** *These were an average of **s**amples taken in 2002 by Conacher Travers within Spotted Gum Forest during a site wide assessment for the Bushfire Management Plan as part of the North Wallarah Peninsula Masterplan, and as shown in Table 3.*

*** These were an average of samples taken in 2002 and again in 2003 by Conacher Travers within Spotted Gum Forest and Smooth-barked Apple Forest during a site wide assessment for the Bushfire Management Plan as part of the North Wallarah Peninsula Masterplan, and as shown in Table 3.*

2.4 Limitations of the Survey

The survey was undertaken on lands west of the pacific Highway and does not represent fuels east of the Pacific Highway in the Coastal and northern Sectors.

The survey estimates fuel weights as they are correct at the time of the survey. The sites were selected from fire history records. Fire has a major impact upon fuel accretion in the natural landscape. The lack of fire generally has a major contributing fact to increased fuel weight over time.

Thus the sites were selected showing either no fire during a 25 year period (Sample Area A) and other areas subject to recent fire (< 5 years) i.e. within Sample Areas B, C, D & E). Specifically:

Sample area A within Lot 127 of Stage 7 last burnt prior to 1980.
Sample area B within Lot 197 of Stage 10 last burnt in October 2000.
Sample area C within Lot 173 of Stage 9 last burnt in prior to 1980.
Sample area D within Lot 255 of Stage 11 last burnt in October 2000.
Sample area E within Lot 275 of Stage 12 last burnt in October 2000.

It is known that fuel weights for Spotted Gum forest and Smooth-barked Apple Forest can achieve an upper fuel weight of some 25 tonnes per hectare at which time equilibrium occurs (Luke, 1978). This means that fuel accumulation and fuel breakdown occurs at much the same rate and no increase in fuel weight occurs.

Fuel rates generally accumulate over a period of 0-7 years after a fire. At 7 years or thereabouts fuel accretion slows markedly. It is the case that fuel will accumulate in excess of year 7 but the accumulation will be slower than in the period 0-7 years.

In respect of this survey fire history has been assessed and the results are provided in Figure 7 of the *Fuel Management Plan 2004*.

3.0 DISCUSSION

The results in Tables 4a, 4b and 4c show that the major fuel on the sample sites that contribute to bushfire behaviour are the leaf litter and twigs (Surface fuels).

The fuel weights of the aerial shrub layer were found to be minimal. e.g. (2.60 t/ha for Sample A, 0.23 t/ha Sample B, and 3.00 t/ha for an average of Sample Areas C, D & E) and well within the tolerance level of an Inner Protection Area Level being less than 4 t/ha.

On the other hand, surface fuel weights would require modification to achieve the desired performance standard of an Inner Protection Area. For example the litter layer samples indicated an average of 10.90 t/ha for Area A, 13.32 t/ha for Area B and 8.17 t/ha for an average of Sample Areas C, D & E, whilst the remaining insitu grasses/forbes vegetation had an average sample weight of 2.27 t/ha for Area A, 2.58 t/ha for Area B and 2.55 t/ha for an average of Sample Areas C, D & E. The results show that the living vegetation is a low component of the overall fuel weight (16%).

In this example the litter layer contains the most fuel weight on the site and its modification will largely contribute to the specification required for an Inner Protection Area.

3.1 Generalities of the Site

As a general rule different vegetation types have different natural fuel loads in different strata. This is manifested in the Wallarah Peninsula landscape in that the development area supports Spotted Gum/Ironbark Forest and Smooth-barked Apple Forest – see Table 1. These forest associations are different in their structural presentation. For example;