PLANNING
BUILDING
HERITAGE
URBAN DESIGN

CITY PLAN SERVICES

16 April 2015

Our Ref: 14054

Steve Findlay
Warringah Council
Civic Centre, 725 Pittwater Road,
DEE WHY, NSW, 2099

Dear Steve,

RE: 2014SYE120 WARRINGAH DA2014/1062: RESIDENTIAL CARE FACILITY AND ASSOCIATED WORKS AT POR 1113 OXFORD FALLS ROAD, FRENCH FOREST

In response to the Joint Regional Planning Panel (JRPP) record of deferral dated 12 March 2015 in relation to the subject application, please find attached the following documentation for the revised proposal:

1. Schedule of Changes;
2. Architectural plans DA2.01-2.10 Rev B, elevations DA3.01-3.03 Rev B, and sections DA4.01-4.12 Rev B, by Marchese Partners;
3. Landscape Plans by JCA dated April 2015
4. Biodiversity Management Plan by Travers Bushfire and Ecology dated April 2015; and
5. Addendum to Bushfire Protection Assessment by Travers Bushfire and Ecology dated April 2015.

The changes to the original proposal to address the issues raised by the JRPP do not change the number of beds or total floor space of the original proposal (7m2 less). They are discussed below in the order as documented in the Panel Decision.

ITEM 1A. RELOCATION OR REDUCTION OF THE CAR PARKING

Car parking has been reduced and relocated to areas outside of the prescribed setback zones as described in the accompanying Amended Landscape Plans (Attachment 3 to our letter). The number of car spaces has been reduced from 30 to 17 in total, but remains in excess of the DCP guideline of 11 spaces. The low intensity of the proposal as lodged is further reduced by this significant reduction of proposed car parking.

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ITEM 1B. ASSET PROTECTION ZONE

The previously proposed Asset Protection Zone (APZ) for Special Fire Protection Purposes (SFPP) on the neighbouring private land has been removed and thus the owner's consent for the APZ is no longer relevant or necessary. The removal of this APZ further reduces the already low impacts of this proposal.

The Addendum to Bushfire Protection Assessment (BPA) (Attachment 5 to our letter) details this change, including the consequential increase in eastern SFPP APZ size on the subject property. This APZ is now 70m wide when measured from the eastern boundary of Barnes Road reserve, which is still proposed to be managed by the applicant as an APZ and documented via Positive Covenant with Council.

This has necessitated some design amendments as described under the next heading.

The revised proposal is confirmed by Travers Bushfire and Ecology to be consistent with the PBP regulations as is outlined in the attached BPA.

ITEM1C. AMENDED DRAWINGS

As indicated, changes to the built form have been made as a result of APZ relocation to ensure compliance with the Planning for Bushfire Protection 2006 (PBP). These are described in the Schedule of Changes (Attachment 1) and in the amended architectural plans (Attachment 2).

The amendments do not materially alter the essential features or nature of the original proposal and principally involve relocating some accommodation or communal resident (SFPP) uses out of the new APZ zone. The only uses that remain in the new SPFF APZ zone comprise loading, back of house, storage, kitchen and administration in buildings 1, 2 and 6 and require a lesser APZ from the fire hazard on the neighbouring lands. The uses may be readily separated from the 9(c) Aged Care Uses by fire doors and fire walls and given different classification under the Building Code of Australia (BCA).

Changes to Building 6 significantly reduce its bulk and height by a full storey close to eastern site boundary. The accommodation units are relocated to a new first floor of building 2 and to the northern end of Building 4. The new storey on Building 2 is screened from the dwellings to the west by the previously proposed 2 storey Building 1 and screen planting on the western boundary. The two new units added to Building 4 result in a minor increase in its built form a large distance from the site boundaries. It is submitted that the visual impacts of the proposal are reduced due to the changes.

ITEM 1D. BUSHLAND REGENERATION

The attached Biodiversity Management Plan (BMP) (Attachment 4) proposes regeneration of the northern part of the site via expansion of the previously documented habitat corridor from 24m wide to between 30m and 50m wide and by significant planting of native trees and shrubs in the northern APZ (IPZ) and north of buildings 4 and 5.

As detailed in the BMP, the previously proposed habitat corridor, including riparian restoration, is expanded to 6,900m2, providing significantly more fully structured Sandstone Gully Forest. Canopy planting between the habitat corridor and the northern internal access road now amounts to some 9,350m2 of the site. The measures will provide substantially increased foraging area and benefit to local fauna and will preclude future development of buildings in the northern part of the site.

To comply with PBP provisions, the planting of clumps of trees and shrubs in the APZ and north of buildings 4 and 5 must be restricted to 20% of the area of the APZ and in addition to the already proposed APZ management actions. This will minimise the fire risk to the proposed and existing adjoining development posed by revegetation of this large area of the site and is documented in the BPA and BMP.

Walking tracks and rest areas are proposed between the internal road and APZ to promote active and passive outdoor recreation (walking, bird watching etc) to be derived from the reforested northern part of the site. Similar landscape features have been approved in the previous application DA2013/0575.

The following excerpt from the relevant Schedule in the BMP indicates the proposed regeneration of the northern part of the site and should be read in conjunction with the attached Landscaped Plans.

Except from Bushland Management Plan (Travers Bushland & Ecolcogy)

CONCLUSION

We consider that the proposed amendments to the scheme satisfy all of the issues raised by the JRPP in the Record of Deferral date 12 March 2015. The revised scheme remains consistent with all relevant controls and considerations as described in the SEE for the original scheme, further reduces the already low intensity and low impacts of the proposal and significantly increases native reforestation. We therefore consider that it warrants a favourable determination.

Yours sincerely,

David Ryan
Executive Director

ATTACHMENTS

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Schedule of Changes

DA2014/0575
APRIL 2015

ARCHITECTURAL
Building 1:
▪ Level 105.5: kitchen and storage areas are located in the part of the building which is located within the APZ zone
▪ Level 109.5: units are located on the area outside the APZ zone
Building 2:
▪ Level 105.5: re-arrangement of the entry area, the terminal units are relocated from level 1 to ground
▪ Level 109.5: relocation of the units which originally were located in building 6.
Building 3:
▪ Level 98.9: cinema has been replaced with the gym
Building 4:
▪ Level 91.9: additional unit, Relocation of the elevator
▪ Level 94.7: additional unit
Building 5:
▪ General: the building has slightly been moved to the west in order to be outside the APZ zone
▪ Level 91.9: additional back of house, administration and toilets
▪ Level 94.7: layout adjusted to suit the revised APZ zone
Building 6:
▪ General: the two storey building with ILU's has been removed and replaced with a single storey back of house and storage facility on level 98.9
PARKING AND ROADS
▪ Deletion of 14 car parking bays adjacent to shared boundary to 50 Barnes Road. Revised parking layout set back by 10 metres from western boundary and now accommodates 8 car parking spaces including 1 disabled space
▪ Deletion of 5 car parking spaces (including 3 disabled spaces) adjacent to the southern boundary facing onto Barnes Road. Relocation of 3 parking bays outside the southern boundary 20 metres set back zone.
▪ 11 parking spaces are provided to the front of the aged care centre. An additional 6 bays for staff are provided adjacent to the Manager's cottage at the north western portion of the site. A total of 17 parking spaces are provided for the proposed development.
▪ The emergency vehicular turning head has consequently been relocated eastwards to avoid conflict with the extended corridor planting.

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BUSHFIRE

- The APZ has been removed from the private land to the east. The new APZ setback is from the eastern edge of Barnes Road and has required reduction of the building footprint and the buildings within the setback have a single storey and contain areas where no residents live or stay for a long period of time. The area contains back of house, kitchen, storage etc.

BIODIVERSITY

- Habitat corridor area increased in width and area to 5,250m^2
- New reforestation between northern access road and habitat corridor, area of 9,350 m^2
- Total area of planting between access road to northern property boundary, approx., 16,250 m^2

LANDSCAPE

Pasture Meadows

- The pasture meadows forming the lower northern portion of the site have been specified for native bushland rehabilitation with species selected from the Proposed Bushland Rehabilitation Schedule and which are consistent with 'Sydney Sandstone Gully Forest' vegetative community.
- This rehabilitation planting will be coordinated and interfaced with the Biodiversity Management Plan (BMP) for the wildlife corridor proposed for the northern and north-western perimeter of the site (Refer to Travers BMP Report). It will also accommodate the recreational footpath as described below in paragraph 3.0
- Existing exotic pasture grasses and other identified weeds will be eradicated using the same methods as for the wildlife corridor.
- All species will be selected and located by a specialist Bushland Rehabilitation contractor and implemented under their site supervision.
-

Recreational Footpath

- Provision of a ramp from the grassed lawn terrace north of Building 4 (at RL 91.9) leading down and across the driveway to the meadows at the northern portion of the site. A meandering footpath is provided for passive recreational purposes with regular rest and sitting stations. Two of the rest points are facing the dam and detention basin so that bird life may be enjoyed. This footpath is a variation to the previously approved footpath within the meadows in DA No. 2013/0575.
- The footpath has been complemented with native planting endemic with the flood plain of the creek being 'Sydney Sandstone Gully Forest'. Also refer to 'Pasture Meadows' above. The clumps of trees and understorey plants will mature to provide nesting and refuge habitats at the same locations as the rest and seating spots along the curvilinear footpath.

Buildings 1 and 2

- The ground floor of Building 1 now accommodates a kitchen, bathroom and stores.
- Provision of a goods and delivery ramp for hand pushed trolleys from the arrival courtyard to kitchen and storage room on south side of Building 1. Access into the building is via double swing doors at southern end of ground floor corridor.
- Provision of planting along the east façade of Building 2 to soften the hard appearance.

Building 4

- The terrace on the west side of Building No 4 at RL 94.7 has been reshaped to accommodate 2# new rooms within Building No. 4.
- The pergola over part of the terrace has been re-orientated to align with the revised building façade

- The footpath and steps for staff to access the complex from parking bays located adjacent to the manager's cottage have been realignment to the west side of building No. 4

Building 5

- Revised pedestrian access from the landscape garden area at RL. 94.67 into the south-east corner of Building 5 adjacent to Room No. 5.2.03.

Building 6

- The footprint and levels of this building have been reduced to comply with the southern boundary APZ setbacks. The memorial garden has been extended in width to the south-eastern façade of Building 6.
- A disabled ramp (1 in 20) has been designed to provide access from the lower floor level area and swimming pool deck at RL 98.87 within Building 6, to the middle terraced garden at RL 99.41.

Planting Species

- Proposed planting species for the revised landscape plans have remained the same as per DA No. 2014/1062 for which no objections were raised by Council's landscape officer, but which were subject to conditions as recommended.

Travers

bushfire & ecology

Bushland Regeneration and Biodiversity Management Plan

Barnes Road,
Frenchs Forest

April 2015
(REF: A14054Bio)

Travers

bushfire & ecology

Bushland Regeneration and Biodiversity Management Plan

Barnes Road,
Frenchs Forest

Report Authors:	Michael Sheather-Reid & Lindsay Holmes
Date:	16th April 2015
Approved by:	Michael Sheather-Reid (Senior Ecologist)
File:	A14054Bio

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be interpreted without reference to the entire report.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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List of abbreviations

APZ	asset protection zone
BPA	bushfire protection assessment
BMP	bushland regeneration and biodiversity management plan
CLUMP	conservation land use management plan
CPW	Cumberland Plain Woodlands
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from 4/07)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from 10/09)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from 4/11)
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESMP	ecological site management plan
FF	flora and fauna assessment
FM Act	*Fisheries Management Act 1994*
FMP	fuel management plan
HTA	habitat tree assessment
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)
OPA	outer protection area
PBP	*Planning for Bush Fire Protection 2006: A Guide for Councils, Planners, Fire Authorities and Developers*
POM	plan of management
RF Act	*Rural Fires Act*
RFEF	*River-flat Eucalypt Forest*
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SEPP 44	*State Environmental Protection Policy No 44 – Koala Habitat Protection*
SEWPAC	Federal Department of Sustainability, Environment, Water, Population and Communities
SSTF	Shale-Sandstone Transition Forest
SIS	species impact statement
SULE	safe useful life expectancy
TPO	tree preservation order
TPZ	tree preservation zone
TRRP	tree retention and removal plan
TSC Act	*Threatened Species Conservation Act 1995*
VMP	vegetation management plan

Introduction 1

Travers bushfire & ecology has been engaged to prepare a Bushland Regeneration and Biodiversity Management Plan (BMP) for the proposed low care senior's facility site off Barnes Road, Frenchs Forest. Details of the proposed development are in section 1.1 of the report.

1.1 Purpose of the BMP

The purpose of the BMP is to specify the management requirements to regenerate a 30m wide biodiversity corridor along the northern boundary of the site and to define APZ management practices that maximise the retention of native vegetation and associated habitat.

The northern biodiversity corridor is to link heath vegetation adjacent to the north-western corner of the site, to riparian and sandstone gully forest vegetation along the Middle Creek tributary in the north-eastern corner of the site. In conjunction with open space areas created by the asset protection zones, this corridor provides potential foraging habitat and connectivity for arboreal mammals, microbats and forest owls.

The BMP is to provide guidelines for the management of asset protection zones, weed control works, riparian zone restoration and protection or enhancement of foraging habitat for local fauna.

There is existing site condition is shown on Figure 1.

Figure 1 – Aerial appraisal

Photo 1 – Biodiversity corridor - existing cleared land adjoining the northern boundary

The BMP covers the entire site which includes revegetation works, bushland regeneration works, weed control, APZ management, tree protection and fauna habitat protection and enhancement.

The following objectives for management of the site include:

- Weed control targeting noxious and environmental weeds,
- Revegetation of the 30m wide biodiversity corridor with sandstone gully forest vegetation,
- Restoration and stabilise the riparian zone,
- Hollow-bearing tree protection works, supervision of dismantling and nest box installation,
- Fuel reduction in asset protection zones to be achieved by selective vegetation removal to be mostly achieved through the removal of understorey weeds,
- Undertake monitoring, auditing and maintenance activities to ensure an effective and a stable restoration outcome ensuring compliance with the BMP specifications.

Schedule 1 – Vegetation Management Works of this BMP provides a plan of works within the site and associated APZ's, and the performance targets to be achieved by contractors undertaking restoration works. Schedule 1 has been prepared to be issued to potential contractors undertaking the restoration works.

1.2 Proposed development

Proposed development of the site covers the southern portion of the site where much of the existing buildings are currently located. The entire lot is to be managed as an asset protection zone excluding the proposed biodiversity corridor. The southern APZ's extend into the Barnes Road corridor as an outer protection area (OPA).

The northern portion of the site is currently a managed pasture with young planted trees along the northern boundary. The far north-eastern corner forms part of a riparian zone with some remnant vegetation. The Barnes Road corridor is in part formed with a gravel access but contains remnant native vegetation with dense understorey weeds.

In 2013 Council approved the development of a low care seniors living facility on the site. The approval involved the refurbishment of the existing dwelling as well as bushfire

protection measures, including asset protection zones both within the site and the adjoining land (Barnes Road Reserve and Lot 1336 DP 752038).

The proposed asset protection zones for the current DA pull back from the adjoining lands and only impact to an outer protection area standard within the Barnes Road corridor. Therefore permission from adjoining land owners is only required from Council.

The proposal involves expanding the capacity of an approved residential aged care facility on the site from 10 beds within the existing dwelling house, to a 45 bed facility contained within the existing building and proposed additional buildings on site (Figure 2).

The proposal also involves the refurbishment of the existing residence located within the north-western portion of the site. This building will be used as a manager's residence.

It is proposed that all restoration works shall be undertaken by a qualified bushland regeneration company under the guidance of a project ecologist with audit reporting submitted to Council over a time period of approximately 4 years, which includes 1 year for revegetation establishment in the wildlife corridor and APZ's, and 3 years of maintenance works.

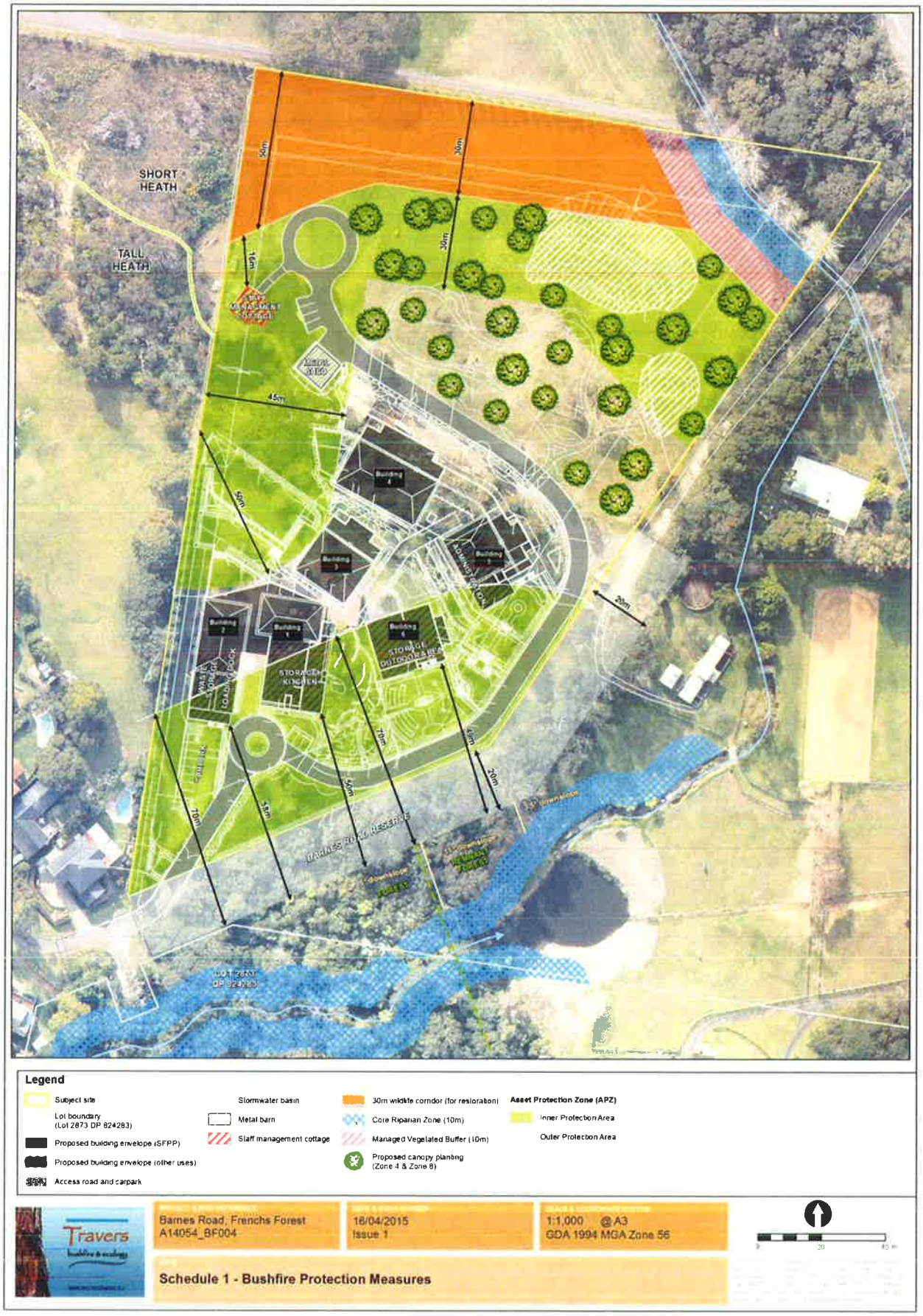


Figure 2 – Site plan including bushfire protection measures

Management Context 2

The following sections provide a brief description of the site.

2.1 Site description

Table 1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 1– Site features

Location	Lots 1113 DP 752038 Barnes Road, Oxford Falls
Local government area	Warringah
Grid reference	337700E and 6264700N
Elevation	Approximately 78-114m AHD
Topography	Situated on flat to undulating land. Gradients are generally 0-15%, with steeper grades of up to approximately 70% in the west.
Geology and soils	Soils; Oxford Falls – Moderate to deep soils in valleys with underlying Sandstone. Lambert – Generally shallow soils over Hawkesbury Sandstone. Hawkesbury – Steep inclines, shallow soils. Geology; Hawkesbury Sandstone.
Catchment and drainage	Surface flows within the subject site flow into an unnamed tributary that cuts within the north eastern portion of the subject site, Middle Creek.
Vegetation	Open Forest, scrub / heath and cleared areas. Refer to Sections 3 & 4.
Existing land use	Residential (rural) and grazing by horses
Clearing	Approximately 75% of the subject site is cleared vegetation for paddocks, landscaping, a tennis court and homestead.

2.2 Vegetation description

Four (4) vegetation communities were identified within the study area through ground truthing. Each of these communities is represented within the subject site with only a very small portion of Community 4 entering the north-west portion of the site.

- Vegetation Community 1 – Peppermint – Angophora Woodland / Open Forest
- Vegetation Community 2 – Exotic Grassland with Scattered Trees
- Vegetation Community 3 – Aquatic Herbfield (Creek line and dams)
- Vegetation Community 4 – Kunzea – Tea-tree Tall Heath

Vegetation Community 1 – Peppermint – Angophora Woodland / Open Forest

This vegetation community may be part of the broadly accepted nomenclature of Sandstone Gully Forest.

Occurrence – This vegetation community occurs in sections of the subject site which do not contain arable soil.

Structure – Woodland or Open Forest with a canopy cover of approximately 10-35% and height of approximately 15-23m. The understorey consists of a variable, but generally moderate, shrub layer to 10m high and sparse to moderate groundcover of herbs, ferns and grasses in drier areas. In the moister areas, where the soil depth is skeletal, the understorey consists mostly of dense fern and sedge species, whilst the overstorey cover is reduced and the mid storey replaced with those species favouring wetter conditions such as *Banksia ericifolia*. The height of the tree species in areas exposed to a high incidence of rock outcropping is reduced, as is the density of trees. This is evident in the central section of the western escarpment area.

Disturbances – This vegetation community has been disturbed by the construction of access roads and moderate to severe incursions of weeds such as Pampas Grass, Senna and Lantana.

This community would have once been equivalent to Sydney Sandstone Gully Forest.

Photo 2 – Peppermint – Angophora Woodland / Open Forest vegetation adjacent to Oxford Falls Road, part of the better condition vegetation.

Common Species

Trees: *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood).

Shrubs: *Acacia parramattensis* (Sydney Green Wattle), *Banksia ericifolia* (Heath-leaved Banksia), *Banksia spinulosa* (Hairpin Banksia), *Ceratopetalum gummiferum*, *Elaeocarpus reticulatus* (Blueberry Ash), *Leptospermum polygalifolium* (Tantoon), *Phyllanthus hirtellus* (Thyme Spurge), *Pittosporum undulatum* (Sweet Pittosporum) and *Platylobium formosum* (Handsome Flat-pea).

Groundcovers: *Cryptostylis erecta* (Bonnet Orchid), *Entolasia marginata* (Bordered Panic), *Gonocarpus teucroides* (Raspwort), *Imperata cylindrica* (Blady Grass), *Lepyrodia scariosa*, *Lomandra longifolia* (Spiky-headed Mat-rush), *Smilax glyciphylla* (Sarsparilla) and *Xanthosia pilosa*.

Weeds: *Ageratina adenophora* (Crofton Weed), *Centaurium erythraea* (Pink Stars), *Conyza albida* (Tall Fleabane), *Cortadeia selloana* (Pampas Grass), *Hedychium gardnerianum* (Ginger Lily), *Hypochaeris radicata* (Flatweed), *Ipomoea indica* (Blue Morning Glory), *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet), *Lonicera japonica* (Honeysuckle), *Nephrolepis cordifolia* (Fishbone Fern), *Plantago lanceolata* (Ribwort) and *Senna pendula* var. *glabrata*.

Photo 3 – Peppermint – Angophora Woodland / Open Forest vegetation in the central western portion of the subject site containing a high level of exotic plant disturbance.

Vegetation Community 2 – Exotic Grassland with Scattered Trees

Occurrence – This vegetation community occurs in the sections of the subject site with arable soil. This community is highly disturbed and it is likely that it was previously Peppermint – Angophora Woodland / Open Forest.

Structure – Dense groundcover of herbs and grasses with scattered trees and shrubs.

Disturbances – This vegetation community is the result of agricultural activities.

Common Species

Trees: *Angophora costata* (Smooth-barked Apple), *Casuarina cunninghamiana* (River Oak), *Eucalyptus piperita* (Sydney Peppermint) and *Eucalyptus punctata* (Grey Gum).

Shrubs: *Acacia parramattensis* (Sydney Green Wattle), *Ceratopetalum gummiferum* (Christmas Bush) and *Pittosporum undulatum* (Sweet Pittosporum).

Groundcovers: *Centella asiatica* (Swamp Pennywort) and *Cynodon dactylon* (Common Couch).

Weeds: *Acacia saligna* (Golden Wreath Wattle), *Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Callistemon sp.* Cultivar (Crimson Bottlebrush), *Centaurium erythraea* (Pink Stars), *Conyza sumatrensis* (Tall Fleabane), *Euphorbia peplus*, *Hydrocotyle bonariensis* (Pennywort), *Hypochaeris radicata* (Flatweed), *Ligustrum sinense* (Small-leaved Privet), *Modiola caroliniana* (Red-flowered Mallow), *Nephrolepis cordifolia* (Fishbone Fern), *Pennisetum clandestinum* (Kikuyu), *Plantago lanceolata* (Ribwort), and *Trifolium repens* (White Clover).

Photo 4 – Heavily impacted zone in the middle of the Peppermint – Angophora Woodland / Open Forest

This community would have once been equivalent to Sydney Sandstone Gully Forest. There are many planted specimens of trees within this community, particularly in the northern portion of the subject site in close proximity to the tennis courts.

Photo 5 – Some scattered trees (mostly planted) in close proximity to one of the existing dwellings.

Vegetation Community 3 – Aquatic Herbfield

Occurrence – This vegetation community occurs along the tributary of Middle Creek including the drainage line and immediate embankments, generally between the top of bank on each side of the drainage line.

Structure – Moderate to dense herbfield to a height of approximately 1-2m, together with occasional exotic shrubs.

Disturbances – This community has been disturbed by modification of sections of the watercourse (more so north of the current study site) and incursions of weeds.

Photo 6 – Riparian vegetation along the drainage line.

Common Species

Native: *Hydrocotyle peduncularis* (Pennywort), *Juncus usitatus* (Common Rush), *Panicum bisulcatum* (Blackseed Panic), *Persicaria hydropiper* (Water Pepper) and *Typha orientalis* (Cumbungi).

Weeds: *Ageratina adenophora* (Crofton Weed), *Erythrina sykesii* (Coral Tree), *Ligustrum* spp. (Small and Broad-leaved Privets), *Colocasia esculenta* (Taro), *Cyperus eragrostis* (Umbrella Sedge), *Hydrocotyle bonariensis* (Pennywort), *Ludwigia peruviana*, *Ranunculus repens* (Creeping Buttercup), *Salix sp.* (Willow), Pampas Grass (*Cortaderia selloana*) and *Tradescantia fluminensis* (Wandering Jew).

Photo 7 – Vegetation surrounding the dam along the western boundary.

Vegetation Community 4 – Kunzea – Tea-tree Tall Heath

Occurrence – This vegetation community occurs mostly within Lot 80 to the west of the subject site, with a small portion entering the site.

Structure – Heath or scrub type vegetation with a height of generally 2.5-4m. There are very few emergent trees within this community. The shrublayer is thick and dense to approximately 50-75% foliage cover. The understorey is variable in density but usually sparse with very few grasses but does contain low growing shrubs, herbs and sedges.

Disturbances – This vegetation community has some weed influences but not to the extent of Vegetation Community 1.

Common Species

Shrubs: *Acacia longifolia* (Sydney Golden Wattle), *Banksia ericifolia* (Heath-leaved Banksia), *Epacris crassifolia, Epacris microphylla* (Coral Heath), *Grevillea buxifolia* (Grey Spider Flower), *Kunzea ambigua* (Tick Bush) and *Leptospermum polygalifolium* (Tantoon).

Groundcovers: *Dianella caerulea* (Flax Lily), *Empodisma minus, Imperata cylindrica* (Blady Grass), *Lepidosperma filiforme* and *Lomandra longifolia* (Spiky-headed Mat-rush).

Weeds: *Agapanthus praecox* (Agapanthus), *Andropogon virginicus* (Whisky Grass), *Aristea ecklonii* (Blue Stars), *Asparagus aethiopicus* (Asparagus Fern), *Cortaderia selloana* (Pampas Grass) and *Ligustrum sinense* (Small-leaved Privet).

Photo 8 – Tall Heath vegetation looking westerly on the eastern edge.

2.3 Baseline weed mapping

A baseline weed condition map was produced in April 2015. It shows the good, fair, poor and very poor areas of remnant bushland across the site. The existing vegetation is classed into the following vegetation condition categories which are in accordance with the Ku-ring-gai Municipal Council weed mapping guidelines (1995);

- Good – up to 10% weed coverage
- Fair – 10-30% weed coverage
- Poor 30-60% weed coverage
- Very Poor – greater than 60% weed coverage.

Figure 3 shows the vegetation condition and locations of dominant weeds.

It is proposed that all weeds within the site and asset protection zones will be removed as part of the fuel reduction process and regenerated in accordance with those zones objectives (Section 3.1).

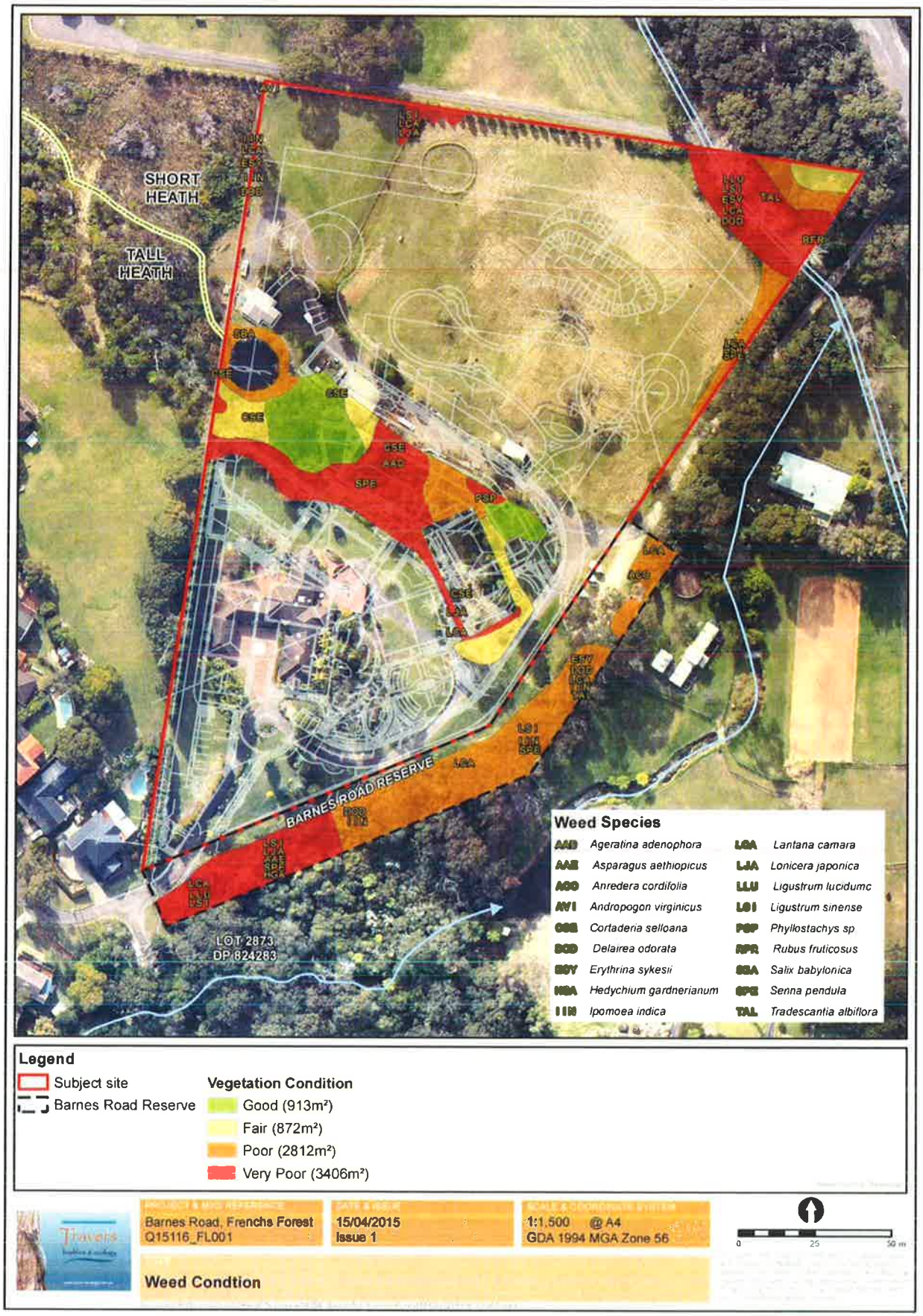


Figure 3 – Weed condition assessment

Restoration Strategy 3

3.1 Management strategy and zone objectives

The site has been broken into seven (7) distinct zones for the purposes of management, each with its own tasks and objectives. Zoning is shown on Schedule 1.

3.1.1 Zone 1 – Northern Biodiversity Corridor

A restored wildlife corridor is to be revegetated that links the heath vegetation at the north-western boundary to the gully forest vegetation at the foot of the Middle Creek tributary in the north-eastern corner of the site.

The zone is currently devoid of natural vegetation and there is a small amount of invasive weeds present (photo 1, photo 9). There is to be a high density of Banksia and other heath species planted within this corridor to encourage foraging for the Eastern Pygmy Possum which are known to occur in the local area.

Photo 9 – Cleared vegetation in zone 1.

The main weeds of concern in this zone include a small patch which contains *Ligustrum sinense, Lonicera japonica* and *Lantana camara*. All three (3) species are noxious weeds in Warringah LGA. The appropriate methodology for control is described in Attachement 1.

Figure 4 – Vegetation Management Zones

3.1.2 Zone 2 – Middle Creek Tributary

This zone refers to the core riparian area of the Middle Creek tributary and is to be managed as a fully vegetated riparian zone.

The area is currently almost devoid of any natural vegetation containing planted Eastern Cottonwood (a Poplar species) with an exotic understorey of Coral Trees, Privets, Lantana, Cape Ivy and Wandering Jew.

The objective of the zone is to remove exotic trees, eradicate invasive weeds, embankment stabilisation, and planting of sandstone gully species and macrophytes as appropriate for local watercourses.

There are many weeds of concern in this zone, in particular *Ligustrum* spp., *Erythrina sykesii, Lantana camara, Tradescantia albiflora* and *Delairea odorata*. All but the *Delairea odorata* and *Tradescantia albiflora* are listed as noxious weeds within Warringah LGA. *Delairea odorata* is an invasive vine species which is climbing through the weedy shrub layer on the peripheral areas of this zone where more light is available.

Control methods for all species are described in Attachment 1. *Tradescantia albiflora* is an exotic ground cover that typically flourishes on creek embankments and moist sites in shaded areas. It covers a large portion of the existing embankments. Removing the *Tradescantia* increases the risk of bank erosion; therefore jute meshing and replacement vegetation cover will need to be established as soon as practical after the *Tradescantia* is removed.

Jute matting or jute mesh is to be laid over the embankment and then planted with tussock grasses, sedges and shrubs which can tolerate moister soils. Control of *Tradescantia* is variable through hand weeding, raking and application of herbicides. The use of Glyphosate products on this species has a limited success rate but Starane (another suitable herbicide) has a much higher kiss rate. Starane is to be applied in accordance with the herbicide label and the Protection of Environment Operations Act (1997).

Photo 10 – Hefty woody and invasive weeds on the periphery of the core riparian area.

Photo 11 – Ludwigia peruviana on the other side of the Barnes Road corridor in the drainage line amongst a multitude of other weed species

Photo 12 – Close up of Ludwigia peruviana in flower

The noxious aquatic weed *Ludwigia peruviana* occurs on the south-eastern side of Barnes Road in the riparian zone. It is a class 3 noxious weed and requires treatment such that it does not spread further along the drainage line. All parts of the plant need to be bagged and disposed of at an approved waste facility. Once established it is a difficult species to control, so therefore requiring targeted attention.

3.1.3 Zone 3 – North-eastern Remnant Bush Regeneration

This area includes the fair-poor quality remnant vegetation in the far north-eastern corner outside of the core riparian area. This area is moderately to heavily affected by exotic and invasive weed species but regeneration needs to be encouraged through bushland regeneration low impact methods.

Weed invasion from the drainage line is extending upslope into this zone. There has also been some minor clearing works which have disturbed the soil and made it more favourable for exotic species, limiting the amount of native species regeneration. Common weed species in this zone include *Ligustrum sinense, Ageratina adenophora, Senna pendula* and *Lantana camara.*

The objective of the zone is to improve native species diversity and cover through a combination of hand weeding and natural regeneration limiting the need for any revegetation works.

Photo 13 – Remnant vegetation in the far north-eastern corner of the site.

3.1.4 Zone 4 – Northern Asset Protection Zone (Inner Protection Area)

This area contains the northern APZ between the proposed development and the biodiversity corridor which is to be managed in accordance with *Planning for Bush Fire Protection* 2006. The area is currently devoid of any natural vegetation but is to act as an arboreal stepping stone to the proposed corridor along the northern boundary. The ecological value of the APZ landscape is improved by selective planting of canopy species such that an APZ complaint landscape is created. All canopy trees are limited in terms of cover and canopy connectivity to be considered an actively managed asset protection zone.

The APZ is to be planted with canopy vegetation as discontinuous trees to an average density between 1 tree per 200m^2 to 1 tree per 400m^2, or may be planted as very small clumps of 2-3 trees with separated canopy between clumps. No shrubs are proposed for planting.

The ground layer of vegetation also needs to be maintained and managed regularly to reduce fuel loads (every 4 weeks in summer and 8 weeks in autumn, winter and spring).

Weeds in this zone largely comprise pasture grasses and occasional annuals.

Revegetation of this zone should contain smooth-barked tree species in preference for rough-barked species. Suitable species may include *Angophora costata, Eucalyptus haemastoma, Eucalyptus tereticornis, Corymbia maculata, Eucalyptus punctata* and

Eucalyptus deanei, although preference of species should be given to those occurring in the adjacent bushland and can be sourced locally.

Photo 14 – Looking south over currently managed lands that will form part of the northern APZ.

3.1.5 Zone 5 – Western Asset Protection Zone (Inner Protection Area)

The objective of Zone 5 is to retain and improve the quality of remnant vegetation, continually supress invasive species and to ensure compliance with APZ standards.

This area contains the APZ on the western side of the northern most buildings. Where there is existing remnant vegetation, this area is to be managed to remove existing weeds hence reducing the fuel loads. The shrub layer will be largely removed to comply with *Planning for Bush Fire Protection* 2006 and as such, no revegetation works will be undertaken.

Photo 15 – Remnant vegetation within the APZ of Zone 5.

The amount of remnant native and exotic vegetation post development in this zone will be significantly reduced to meet the standards of an inner protection area.

The main weeds requiring control in this zone include *Cortaderia selloana, Ligustrum sinense, Phyllostachys* sp., *Nephrolepis cordifolia, Senna pendula* and *Ageratina adenophora.*

3.1.6 Zone 6 - Southern Asset Protection Zone (Inner Protection Area) and Landscaping as per Landscape Plans

This area contains the APZ to the southern aspect of the proposed buildings. A large portion of the vegetation has been planted and there is limited ecological value for retention of existing vegetation.

Photo 16 – Planted vegetation around the existing dwelling.

The objective of the zone is to reduce the bushfire risk to the southern aspect, minimise spread of invasive weeds and to manage the removal of any affected hollow-bearing trees.

3.1.7 Zone 7 – Southern Asset Protection Zone - Barnes Road Reserve (Outer Protection Area)

The majority of the Barnes Road reserve is heavily infested with a range of woody weeds and invasive vine species. It is intended to be managed as an outer protection area through the removal of weed understorey, retention of canopy and restoration of native ground layer species.

The density of trees throughout the zone is low and requires significant removal of understorey weeds to be APZ (outer protection areas) compliant. The objective of Zone 7 is to remove invasive weeds to be compliant to the standard of an outer protection area, prevent the regeneration of midstorey species to a maximum 50% cover and revegetate or regenerate native groundcover.

The western end of Zone 7 is heavily infested with *Ligustrum* spp., *Lantana camara, Senna pendula, Lonicera japonica* and *Asparagus aethiopicus.* The central and eastern parts of Zone 7 contain a higher level and diversity of invasive vines including *Ipomoea indica, Delairea odorata* and *Anredera cordifolia,* as well as the presence of *Erythrina sykesii* (Coral Tree).

Photo 17 – Invasive vines within the road reserve (eastern end of Zone 7).

Photo 18 – Dense coverage of Privets in the road reserve (western end of Zone 7).

Zone 7 forms part of an existing access to adjoining property, therefore access to that property must be maintained for the transport of stock.

3.1.8 Zone 8 – Landscaping with Native Canopy Planting

Zone 8 is located in the central-northern portion of the site to the immediate north of the proposed development area. This zone is to contain a bound and compacted gravel footpath and landscaped planting as per Landscaping Plans (John Chetham & Associates).

To enhance this area whilst not contributing to changes in asset protection zone management, the Zone is to be planted with native canopy species at no greater than 1 tree

per 200m^2, similar to that prescribed for Zone 4. Tree species should be largely smooth-barked and mown underneath.

3.2 Site preparation

Initial site preparation for the purposes of this BMP includes the installation of protective fencing to restrict access, commence weed removal, removal of waste, delineate the boundary of conservation areas and the extent of APZ's. Site preparation also includes the sourcing or growing of local provenance native plant stock for revegetation works.

3.2.1 Permanent protection fencing

Permanent protection fencing shall be installed on the perimeter of the proposed wildlife corridor as a 5-plain wire rural strand fence (see Schedule 1), extending for the full length of the corridor. The fencing is to contain a minimum of two locked vehicle access gates to for revegetation, maintenance, weed control and regeneration.

A second permanent protective fence will be installed as a 5-plain wire rural strand fence on the south-eastern road corridor boundary for the full extent of the asset protection zone to delineate the extent of the outer protection area as shown on Schedule 1.

All trees planted within the asset protection zone will be permanently protected by a 2m square x1m high post and rail fence inclusive of a wire mesh with 25mm opening for protection against grazing animals and mechanical damage. The reason is to provide long term protection to the planted trees and to ensure that inadvertent damage is avoided.

3.2.2 Temporary protection fencing

Temporary protection fencing in the form of a 1.8 m relocatable construction proof fence will be provided immediately surrounding the affected construction area (Schedule 1) as shown on Schedule 1 – Vegetation Management Works. This will protect any areas from trampling and compaction association with the construction works. The fence will ensure that all native vegetation within the Barnes Road Corridor is protected from vehicle movements, sediment deposition and free of waste or construction materials. Access to Barnes road corridor is to be provided for weed control purposes prior to during and after contruction.

Sediment fencing is to be installed at the base of the temporary protection fencing as a primary sediment collection measure. It is to be installed with 'kickbacks' and maintained to prevent rill erosion along the fence and is to include sediment fence kickbacks on sloped lands to slow water directed along the fence. The sediment fence is to be reinforced at all low drainage points with additional hay bales to support the fence against the weight of trapped sediment.

3.2.3 Tree protection zones

Very few trees within the construction area will be retained. All retained trees within the site inclusive but not limited to T662, T705, T406 and T709 will require tree protection to minimise risk damaging of the tree's root system or trunks. A tree protection zone of a minimum 5m radius from the base of the tree is to be set up around each nominated tree (refer to Landscaping plan by John Chetham & Associates). Tree protection zones will use temporary star pickets and plastic bunting that demarcates the tree protection zone.

For development purposes, any encroachment of more than 25% into the tree protection zone will require specialist arborist advice.

3.2.4 Hollow-bearing trees

There are three (3) hollow bearing trees within or adjacent to the construction works area of which one (1) will be retained (HT0036). The remaining hollow bearing trees (HT0030 and HT0042) are to be removed. A tree protection zone of 5m is to be applied to HT0036 (tree tag T406 see Schedule 1 for location). Should any damage be incurred to a tree to be retained then rectification of the damage is to be undertaken in accordance with the advice of an AQ5 qualified tree consultant.

All contractors works are to be managed such that all due care is taken to prevent damage to trees to be retained and is not to remove any hollow bearing tree without first receiving instruction from the fauna ecologist. A fauna ecologist is to be present at the removal of each habitat tree. Refer to section 3.6 for habitat tree management specifications.

3.3 Weed management

Much of the remnant bushland on site is moderately to heavily degraded by weed invasion. Figure 3 shows the weed condition of each patch of remnant vegetation within the site as well as the main invasive species at selected locations.

Some highly invasive and persistent weed species found within the bushland areas of the site include:

Table 2 – Main invasive species on site

Scientific name	Common name
Ageratina adenophora	Crofton Weed
Andropogon virginicus	Whisky Grass
Anredera cordifolia	Madeira Vine
Asparagus aetheopicus	Asparagus Fern
Canna indica	Indian Shot
Cortaderia selloana	Pampas Grass
Delairea odorata	Cape Ivy
Dipogon lignosus	Dolichos Pea
Erythrina X sykesii	Coral Tree
Hedychium gardnerianum	Ginger Lily
Ipomoea indica	Blue Morning Glory
Lantana camara	Lantana
Ligustrum lucidum	Broad-leaved Privet
Ligustrum sinense	Small-leaved Privet
Lonicera japonica	Honeysuckle
Nephrolepis cordifolia	Fish-bone Fern
Phyllostachys sp.	Bamboo
Rubus fruticosus ssp. agg.	Blackberries
Senna pendula var. *glabrata*	-
Tradescantia albiflora	Wandering Jew
Zantedeschia aethiopica	Arum Lily

These weeds have significant implications to natural regeneration of the remnant bushland. With regards to the success of revegetation works, these and other common invasive weeds in the locality are a threat and will require targeted weed control and ongoing eradication throughout the planting and maintenance period. Attachment 1 contains a comprehensive list of weed species, the most appropriate control techniques, noxious weed class and priority.

3.3.1 Weed management strategy

Given the presence of invasive environmental and noxious weeds on site, a combination of selective spraying, hand removal and competitive planting techniques will be used to control weeds. The weed control priorities are listed in Attachment 1.

Weeding works are to be carried out by an appropriately qualified and licensed bushland regeneration company under the direction of or audited by a consulting project ecologist. Supervisors should possess a minimum of a Certificate IV in Conservation and Land Management or a biological science degree, with at least five (5) years of field experience.

There are currently a number of low impact bush regeneration techniques used in bushland management for the removal of weeds. The bush regeneration process (Buchanan, 1989) involves:

- The *Bradley Method* of minimal soil disturbance during weed removal
- Hand removal and mechanical assisted clearing
- The use of herbicides
- The use of fire (pile burns)
- Biological controls

Employing the *Bradley Method* for regeneration requires the removal of weeds in phases. Stages of weed removal can be broken into three (3) components:

Primary weeding

All weeds within the Very Poor areas as shown in Schedule 1 will be removed from the site. All weed materials need to be selectively isolated from native vegetation and disposed of separately to native brush which can be mulched. This involves removal of weeds through targeted herbicide use and hand removal.

Timing – 3-6 months

Secondary or follow-up weeding

Secondary or follow-up weeding involves intensive weeding in areas that have already received primary work. This follow-up weeding is to remove weed regrowth or weeds that were overlooked during the primary weeding.

Timing – 3-6 months post primary weeding

Maintenance weeding

After primary and secondary weeding and natural regeneration of the bushland, the area should be able to resist most weeds. However, weeds will re-establish on the site from bird, wind, water transport and other seed or propagule dispersal mechanisms within the site. Maintenance weeding should be undertaken 3-6 times a year until such time as the resistance of the bushland to weeds increases, then only requiring hand weeding on a needs basis. Maintenance weeding is to be conducted for a minimum period of five (5) years by the appointed bushland regeneration company. After that time, the community association will manage the lands in perpetuity.

With primary and secondary weed control works expected to last approximately 12 months, and maintenance over five (5) years, the bushland Regeneration Company and independent project ecologist are to be actively managing on site for a minimum of five (5) years.

3.3.2 Herbicide use

The use of herbicides is needed where hand removal of weeds is impractical. The use of *Glyphosate* based herbicides is recommended in accordance with the manufacturers labels. Within 5m of a drainage line only *Roundup Bi-active* ® or equivalent formulations can be used.

Other regularly used herbicides include *Garlon* ®, *Brushoff* ®, *Brush Killer* ® and *Starane 200* ®. *Starane 200* ® may be utilised on *Tradescantia* near the drainage line but must avoid any direct or indirect contamination within the stream.

Grazon DS is not considered a safe chemical to use within high soil moisture zones and that significant off target kill of woody species and aquatic fauna has been tentatively linked to *Grazon DS*. It is recommended that this herbicide is not to be used on site.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds. The disadvantage is that no single herbicide is effective on all weed species, thus the herbicide used needs to achieve an effective kill.

In general, *Travers bushfire & ecology* supports that the use of herbicides in non-ecologically sensitive areas can be undertaken if:

- there are small areas of dense weeds with few or no native plants to protect;
- there are large areas of predominantly weed coverage;
- application can be undertaken without the risk of spray drift or off target kills, and
- weeds are growing too rapidly for physical removal.

The potential for destabilising soils and causing erosion on embankments and slopes as a result of spraying vegetation with herbicide needs to be considered prior to commencement of weed control works, in particular along the drainage line (Zone 2).

Only operators with *Chemcert* or equivalent training must undertake the spraying of weeds. The operator must evaluate the success of each treatment after a set period of time, according to the labelled effective treatment of each species for each herbicide. Care must be taken when applying herbicides near water bodies due to the sensitivity of the waterways and resident flora and fauna to runoff containing these herbicides.

All herbicides must be applied according to the herbicide label and provisions of the *Protection of the Environmental Operations Act (NSW PEO Act 1997).*

All noxious and environmental weeds need to be eradicated and controlled across the entire site. Garden waste and weed propagules (seeds, tubers etc.) need to be periodically collected and disposed of at an approved waste transfer facility and shall not be dumped on adjacent bushland or allowed to be washed downstream.

3.4 Revegetation works

Revegetation is proposed for Zone 1, Zone 2, Zone 4 and Zone 8. Consideration of minor revegetation works in Zone 7 is also possible, dependent upon natural regeneration of native ground layer species following removal of invasive weed species.

All revegetation material is to be:

- tubestock or hiko cells (mature stock may be used in landscape plantings or asset protection zones),
- native species endemic to the locality with a certificate of local provenance, and

- propagated from seed sourced from within the Sydney Basin Bioregion with preference given to northern Sydney sandstone areas.

Zone 1 – Northern Biodiversity Corridor

Revegetation of a fully structured Sandstone Gully Forest will be undertaken within Zone 1 to provide a corridor linkage across the northern perimeter of the site. An embankment from the proposed stormwater treatment basin in part impacts this area. As it is only of minor impact the embankment can be revegetated with shrub and groundcover species that provide foraging habitat and do not impact on the structural integrity of the basin wall.

Native plant species diversity is to be a minimum of twenty five (25) species and includes trees, shrubs and mid-storey species, grasses, creepers and other ground covers. Planting is to focus predominantly on tree and shrub species that will shade out the existing understorey. Ground layer planting will focus on hardy native grass and ground covers that establish good cover from a planting density for 1 groundcovers plant per square meter. All existing exotic species will be eradicated as part of the site preparation works prior to planting.

Recommended species for revegetation of this zone are provided in Attachment 2.

The approximate area of Zone 1 is 5250m^2. Canopy trees are to be planted at 1 per 50m^2, shrubs and mid-storey species at 1 per 4m^2. These densities have been chosen to provide a highly dense vegetation structure similar to the adjoining sandstone heath and gully forest vegetation types. Thus the expected number of plants is:

- Canopy trees – 105
- Shrubs and mid-storey plants – 1300
- Tubestock or hiko planting of 5250 ground covers

Shrub species must include a high proportion of Banksias and other foraging species potential arboreal mammals such as Eastern Pygmy Possum.

The following methodology may be adopted for the ground layer restoration works;

- Eradicate all exotic ground layers species through, herbicide application, physical hand removal and bed preparation for seeding and planting (minimum depth of ameliorated soil is to be 100mm).
- Direct seeding of native grasses and other shrub species at an application rate of 8 tonne per hectare (supplementary panting is required).
- Tubestock or hiko planting of 5250 ground covers (including grasses and other typical endemic native species at a density of 1 per m^2).

Direct seeding is to be undertaken over the entire biodiversity corridor to provide a more diverse ground layer, the diversity is to be enriched through tubestock planting of other grass species and ground layer vines. Ground cover plantings should contain a high proportion of hardy species including but not limited to *Lomandra longifolia, Dianella* spp., *Hardenbergia violacea* and *Imperata cylindrica.*

Direct seeding of ground layer species

Controlling the regrowth of pasture grass and maximising survival of directly seeded grasses is difficult in the field. The cost savings however can be significant of direct seeding is undertaken with good bed preparation. The diversity of species that can be regenerated is also maximised by combining seeding and tubestock planting of ground layers species.

It is recommended that the grass species utilised are *Microlaena stipiodes* and *Themeda australis.* Other species are appropriate to the locality and should be considered when order

local provenance collected seed for direct seeding projects. *However b*y reducing the complexity of species used in direct seeding, selective herbicides can be used to control other exotic weed species without impacting on selected native species. Once the grasses become established, tubestock planting is to supplement species diversity.

The existing pasture grass is to be killed with a repeated series of glyphosate sprays over several months. This will required a period of approximately six (6) months to achieve reasonable control. Once effective kill has been established the soil bed is to be prepared by deep ripping and tilling to a minimum of 100mm in depth. Further soil improvers may be used to improved germination rates. Once effective wed control and bed preparation is achieved, the area is to be direct seeding lightly incorporating seed into the surface. Selective pre-emergent herbicides and or spot spraying is used to control broadleaf weed species or resistant exotic grasses. Hand weeding is recommended for wood weeds.

A minimum of 8kg per hectare of seed using locally occurring native species is to be direct drilled preferably in late winter and early spring. Time to full establishment is variable from 8 weeks to 18 months depending on the timing, bed preparation, weed control and weather conditions.

Zone 2 – Middle Creek Tributary

Zone 2 is heavily infested with woody weeds, exotic vines, Tradescantia and planted Poplar trees.

Revegetation works within this zone should be staged to limit potential erosion issues through exposing bare ground.

Photo 19 provides an example of creek stabilisation and restoration works of a creek line of similar size.

After removal of weeds, the area needs to be stabilised with rock revetment and jute mesh. Jute based Coir logs at the base of the embankment are used to control flows, protect the base of the embankment and to provide a point of purchase for plants. Jute mesh or matting is laid for at least 4m on either side of the channel would is intended to cover most of the embankment to the top of bank.

Native plant species diversity is to be a minimum of twenty (20) species and includes trees, shrubs and mid-storey species, grasses, creepers and other ground covers, as well as macrophytes.

The area of Zone 2 is approximately 1050m^2. Assuming the creek line is 1.5m wide on average, the planting area is 975m^2. Canopy trees are to be planted at 1 per 50m^2, shrubs and mid-storey species at 1 per 4m^2 and ground covers at 3 per m^2. Macrophytes are to be planted within the creek line in small clumps of approximately 2m x 0.5m with 5-10 plants per clump, and approximately 10 clumps in total. Thus the expected number of plants is:

- Canopy trees – 20
- Shrubs and mid-storey plants – 250
- Grasses and ground covers – 2925
- Macrophytes - 80

Before creek line treatment

Coir logs along creek edge following removal of weeds, jute mat / jute mesh on embankment to be installed and planted with native plants.

Photo 19 – Creek embankment stabilisation example.

Zone 4 – Northern Asset Protection Zone (Inner Protection Area)

This zone is to be managed as an inner protection area. At present there is no vegetation of significance and is managed.

The APZ is to be planted with canopy vegetation only as indicated on Schedule 1 at a density of 1 tree per 200m^2 to 1 tree per 400m^2, the base of trees may also be planted as with native shrubs.

The ground layer of vegetation also needs to be maintained and regularly slashed or mowed to keep to maximum of 100mm in height. To remain APZ compliant the grass areas need to be managed at a minimum every 4 weeks in summer and 8 weeks in winter).

Stormwater basins are to be established in Zone 4 and are planted to specifications as noted in the Landscape Plan (John Chetham & Associates). All plantings must be APZ complaint.

The area of Zone 4 is 5300m^2. The basin and landscaping areas comprise approximately 30% of Zone 4, therefore the effective revegetation area is approximately 3700m^2. Canopy trees are to be planted at 1 per 200m^2, thus the expected number of plants is:

- Canopy trees – 20

The planted species diversity is to be a minimum of three (3) within Zone 4. The planting of canopy species is too restricted to smooth bark species with selected shrub species that are suitable for asset protection zones. The advice of the project ecologist/bushfire consultant should be sought to select specific species for the locality and of foraging value.

Zone 7 – Southern Asset Protection Zone - Barnes Road Reserve (Outer Protection Area)

No specific revegetation works are proposed as there appears to be potential for natural regeneration noted by the presence of native grasses and ground covers amongst the Privet infested area. Enrichment planting is recommended where natural resilience is low. No additional canopy trees are to be planted in the zone as it forms an outer protection area and no additional trees are required to be removed.

Native shrubs may be regenerated or planted to achieve a maximum of 50% by cover. Revegetation of shrub species is to focus on high foraging value species such as banksias and selected Acacias.

Fuel reduction prior to the commencement of the bushfire season is to be undertaken to achieve an effective fuel load of 4 to 8 tonnes per hectare.

As part of site auditing and direction of works, the project ecologist/bushfire consultant is to advise if any supplementary planting or vegetation management works is required to achieve the standards of an Outer Protection Area.

Zone 8 – Landscaping with Native Canopy Planting

Within Zone 8, only canopy revegetation is proposed. It is to be essentially compliant with asset protection requirements described for Zone 4 whereby the maximum planting density is to be 1 tree per 200m^2. Tree should be planted outside of the landscaping beds as the Landscape Plan already has some trees proposed. All additional trees to be planted in this zone (to the Landscape Plan) are to be native species from Schedule 1. Preference should be given to smooth-barked species so as to limit and bushfire hazard, and mown underneath.

3.4.1 Mulching

Mulching is an efficient method to impede the establishment of weed species, soil erosion, compaction and desiccation. However it is to be only used where natural regeneration will not occur or light soil stabilisation is required.

Incorporating the mulch in to the soil surface will also improve soil structural stability but allow natural regeneration to occur. No mulching is to be laid in areas where direct seeding has been undertaken.

Any native vegetation requiring removal (e.g. within the adjacent development area) shall be immediately mulched or chipped and stockpiled on site to be used for the site's restoration at the completion of works.

Mulch is to be placed at a depth of 75-100mm covering any areas of revegetation (excluding regeneration sites).

Areas surrounding the stems/trunks of plants are to be kept free from mulch, thereby reducing the incidence of collar rot on retained or planted flora.

Mulch from Privet, Camphor Laurel, Coral Tree, Poplar, Willow, Wandering Jew, Bridal Creeper, aquatic or declared noxious weeds are not to be used. The contractor shall ensure that any mulch used is properly composted before use.

3.4.2 Revegetation protection

Protection of revegetation areas is important to the success of plantings, as is the timing and economic benefits in the long term. Protection measures include:

- Protective fencing in the form of a five plain wire strand fence and or a fully installed sediment and erosion control fence reducing access to the revegetation site by grazing animals such as rabbits and native mammals,
- Plant guards around plants – to minimise loss by grazing animals, frost protection and dehydration
- Baiting of rabbits (quarterly baiting over a minimum of 3 years) – use of Pindone (1080) to minimise rabbit burrows and grazing.
- Jute mats or mulching to minimise weed regrowth around the planted stock

3.5 Sediment and erosion control

A temporary sediment fence is to be installed adjoining all conservation and revegetation areas in close proximity to construction works. The creek embankment is to be stabilised and or coir logs are to be installed for bank protection and in-stream plant (section 3.4 – zone 2).

Sediment fencing is to be installed (Figure 4) at the base of the temporary protection fencing as a primary sediment collection measure along the southern edge of Zone 1, the northern edge of Zone 7 and at specified locations in Zone 5 as shown on Schedule 1.

Kick-backs are to be installed along all sections of sediment fencing that run downslope to prevent erosion down the sediment fence. The sediment fence is to be supported by fixed hay bales on low drainage points of the fence where concentrated runoff is directed through the fence.

Sediment and erosion controls throughout the construction area must be installed in accordance with Landcom's 'Managing Urban Stormwater: Soils and Construction' (2004) (see Figures 4 and 5). Techniques used for erosion and sediment control on site are to be adequately maintained and monitored at all times, particularly after periods of rain, and shall remain in proper operation until all development activities have been completed and the site is sufficiently stabilised with vegetation.

All outlets are to be installed and stabilised with a combination of a head wall, rock stabilisation and in channel planting of sedges (Figure 6).

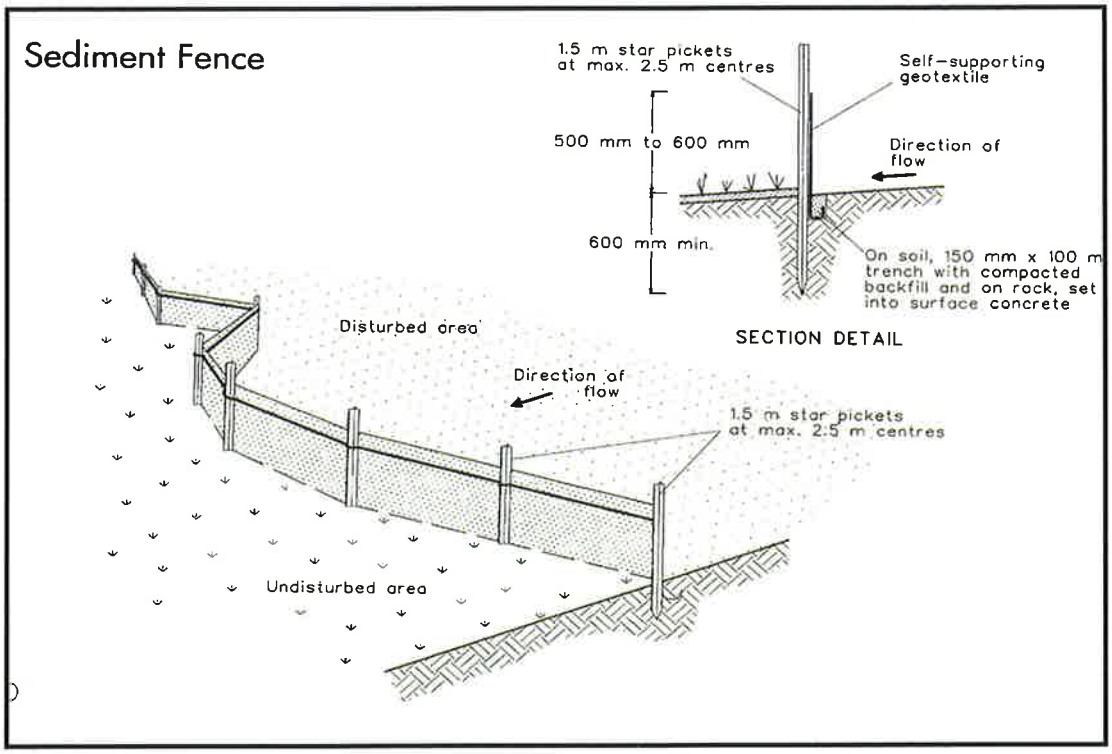


Figure 5 – Generic installation detail of geotextile filter fence

If outlet scour protection is required, it should be installed in accordance with Figure 5. The extent of scour protection is to be determined in consultation with the project ecologist but is to extend to the maximum extent of potential downstream scour. Additional plants are to be installed to assist in stabilisation of moist soils surrounding the outlet. If required, plants are to come from a local source and be typically present in the local area (see Attachment 2).

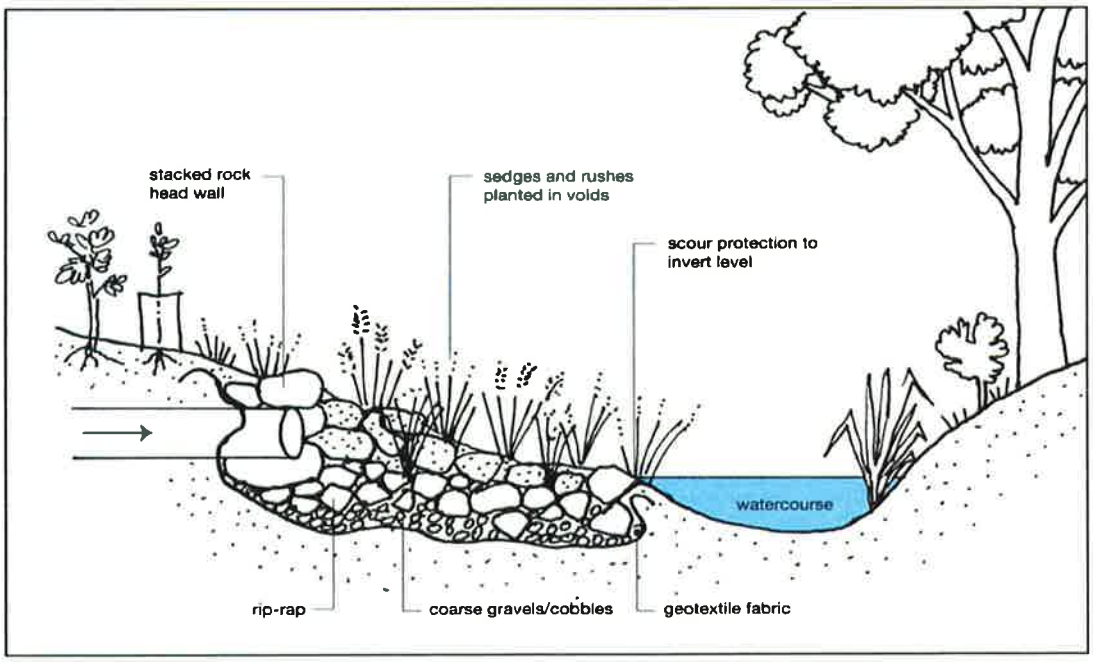


Figure 6 – Outlet scour protection
(Source – NSW DPI - Office of Water Guidelines for Controlled Activities on Waterfront Land – Guidelines for Outlet Structures 2012)

3.6 Hollow-bearing trees and nest box installation

Tree hollows provide critical roosting and overnight shelter for many fauna species. Provided the trees that contain hollows are in a healthy condition, they may be considered as "Ecologically Significant" if they contain breeding fauna or suitable breeding locations for threatened hollow dependent specie. Ecologically significant hollow bearing trees should be retained as a high priority. Re-locating existing hollows or installing nest boxes of similar size in nearby remaining trees may assist in providing some compensation for any hollow bearing trees that need to be removed for the proposed development.

It is likely that HT0030 and HT0042 will be required for removal for proposed building 5 and 6. It is possible that HT0036 may be retained in close proximity to the proposed buildings and can be given a tree protection zone of 5m.

The three (3) hollow-bearing trees listed above are to be adequately marked in the field prior to the commencement of construction works.

Should hollow-bearing trees be required for removal, the following is dismantling procedure is to be used:-

I) Where possible and practical, hollow bearing limbs identified for removal should have the hollow sections collected and re-erected. Where this is not feasible, due to unstable decaying timber, artificial nest boxes providing accommodation of similar size to the removed hollows are to be erected in suitable locations.

II) All replacement nest boxes are to be secured to trees at a minimum height of four (4) metres above ground level facing the east to northeast direction. Nest boxes and re-erected limbs are not to be placed near locations where public access is planned along reserve areas. All nest boxes and re-erected limbs will be inspected annually and any damaged, or in danger of falling, are to be repaired or replaced.

A fauna ecologist is to locate appropriate trees and locations for installing the nest boxes.

On-ground refugia should be retained where possible consisting of rocks, logs, and wherever appropriate dense under-storey native vegetation.

3.6.1 Nest box installation and specifications

The nest boxes shall be of a similar sized aperture as those removed (e.g. 0-5cm or 5-10cm). Boxes should be constructed all of weatherproof timber (marine ply), screw fasteners and external paint. Nest-boxes with hinged lids make it easier to clean and also to catch occupants for examination (If required). The ratio of nest boxes required is 2 boxes per hollow removed. All nest boxes shall be placed in conserved bushland such as in Zone 3, retained trees in Zone 5 or with less preference, Zone 7.

The positioning of the nest box should also consider damage caused by branch fall. The placement of a box under a solid leader branch is recommended to provide a degree of protection to the box.

The type and size of nest boxes to be installed is to consider the type of fauna that occur in the locality to provide shelter and breeding habitat for threatened species and prey species.

A minimum of 10 nest boxes are to be installed including at least two (2) microbat boxes. At least two (2) large boxes are to be installed for forest owl species. All other nest boxes should be of small to medium size for general hollow dependent fauna species such as possums, gliders, parrots and cockatoos.

Program of Works 4

The program of works (Table 3) is aimed at providing a management framework for enacting revegetation, maintenance; monitoring and auditing reasonably required to manage the conservation areas, riparian corridor, biodiversity corridor and sites vegetation.

Site rehabilitation including weed control works is to be undertaken in accordance with the program of works and Schedule 1 – Vegetation Management Works.

Prior to commencement of any works on site, a team of bushland regenerators and an independent project ecologist is to be appointed by the land owner(s) or project manager(s). The bushland regeneration team will be responsible for undertaking most of the ameliorative works on the bushland and establishment of wildlife corridor.

4.1 Program of works

For the purposes of the program of works, the listed tasks are divided into stages.

Stage 1

Typically Stage 1 involves pre-construction activity works such as the installation of protective fencing (temporary and permanent), tree protection zones and sediment fencing. It also includes the identification of hollow-bearing trees that require removal and any proposed stag-watching or similar (if required) prior to removal.

Preparation of pest fauna management may be undertaken during this phase or prior to revegetation works commencing.

Setting up of monitoring points is vital prior to construction and clearing works to establish baseline data.

Compliance certification shall be issued for the set-up of various protection measures once satisfactorily completed.

Stage 2

This usually describes the works which are undertaken in conjunction with demolition and construction of buildings, roads and services. It is during this period that the protection of remnant vegetation is critical to minimising accidental loss of trees or associated vegetation. It is also during this phase that primary and secondary weeding works are completed, as well as commencement of revegetation works.

Work during this stage includes the supervised removal of hollow-bearing trees by the fauna ecologist, installation of nest boxes, maintenance of protective measures and mulching.

Practical completion of each task will be determined by the project ecologist at which point maintenance works will commence. During this stage the project ecologist will issue compliance certificates to Council. Should there be a delay in the completion of works for any reason, then the Stage 2 works phase may be extended.

Asset protection zones are also likely to be set-up during this stage.

Stage 3

Stage 3 works are to commence after certification of primary and secondary weed control works, and initial revegetation works, often coinciding with completion of on-site construction works. This stage of works consist of maintenance activities, unless further contingency works are identified by the project ecologist for auditing purposes. Maintenance will be undertaken by a fully qualified bush regeneration crew for a minimum of five (5) years post completion of stage 1 and 2.

All bush regeneration crews working on site are required to have at a minimum TAFE Certificate Level II Bush Regeneration qualifications or equivalent to undertaken weeding and revegetation works. All staff are to be supervised by a qualified bush regeneration Supervisors should possess a minimum of a Certificate IV in Conservation and Land Management or a biological science degree, with at least five (5) years of field experience.

Table 3 - Program of works

Action	Responsibility
Stage 1	
• Formation of site management team and establish supervision and consultation processes – minimum project ecologist, and site manager	• Site project manager
• Erection of temporary and permanent fencing, erosion control fencing, tree protection zones and sediment control fencing	• Site manager / bush regenerator contractor / project ecologist
• Rabbit baiting	• Contractor
• Marking of hollow-bearing trees to be removed and undertake any required survey prior to removal	• Fauna ecologist
• Commencement of seed collection and propagation contracts	• Bushland regenerator / project ecologist
• Set up monitoring points and other baseline data	• Project ecologist
• Provide certificates of compliance	• Project ecologist
Stage 2	
• Supervision of hollow-bearing tree removal and nest box installation	• Fauna ecologist / tree climber
• Commencement of primary weed control	• Suitably qualified bushland regenerator
• Monitor fencing and erosion control measures (monthly – especially after heavy rain) and replace if requires	• Contractor with advice of project manager
• Commencement of secondary weed control	• Bushland Regenerator
• Installation of jute mat / jute mesh as required on creek embankment	• Bushland Regenerator

• Undertake direct seeding and revegetation works	• Bushland Regenerator / Contractor
• Maintenance of protective fencing	• Bushland Regenerator / Contractor
• Provide certificates of compliance	• Project ecologist
Stage 3	
• Enrichment planting within direct seeded and revegetation areas if required.	• Contractor with advice of project ecologist
• Continuation of regeneration and weed control maintenance.	• Contractor / suitably qualified bushland regenerator
• Monitoring of quadrats, revegetation works, weed control works and protection devices	• Project ecologist
• Conduct maintenance beyond five (5) years as required	• Site manager with advice of project ecologist

Schedule 1 identifies the location of the planned restoration and vegetation management works in relation to the proposed development.

4.2 Monitoring

The project ecologist is responsible for supervision and overseeing of works stipulated in the BMP and monitoring / auditing of works undertaken by the bushland regeneration team.

Monitoring of the progress of weed removal, plant growth, natural regeneration and protection measures is to be undertaken at regular intervals by the appointed project ecologist who will submit compliance statements to Council at the completion of each major item undertaken within the BMP. At the beginning of the contract, the project ecologist shall set up monitoring points at the approximate locations noted on Schedule 1 that include a photographic record prior to works being undertaken, then quadrat sampling to test the success of the works.

4.2.1 Proposed monitoring quadrats and photo points

Proposed quadrat monitoring points are shown on Schedule 1 – vegetation management works. The entire site is however to be monitored using site wide rapid assessment approaches.

4.2.2 Monitoring activities

Monitoring activities shall include the following:

1. A photographic record for comparative purposes taken on an annual basis.
2. Flora quadrats to measure the growth and density of the revegetation area and to monitor weed densities at selected locations.
3. An overall vegetation condition map based on standard bush regeneration vegetation condition assessment methodology.
4. Monitoring of damage caused by rabbits or other grazing animals.
5. Monitoring the condition of permanent and temporary protective fencing.
6. Monitoring of erosion control measures including need for any rectification works.

7. Monitoring of fuel load levels in APZs (Zone 4, 5, 6 and 7).
8. Monitoring of protected trees in APZs and encroachment of any works into the tree protection zones.

Monitoring of the site is required at the commencement of construction works. This will allow the determination of pre and post condition of the vegetation and its habitat and may include identification of any areas suffering from disturbance, sedimentation or in need of contingency rehabilitation, weed control, stabilisation or maintenance of rehabilitated or regenerating areas.

The monitoring and review process will focus on the presence / absence of exotic species, floristic diversity of the bushland, structural integrity of the bushland, revegetation progress and success, and monitoring of any sediment fencing or protective fencing.

Inspections of the site by the project ecologist should be undertaken prior to, during and post operations to ensure that vegetated areas designated for retention and exclusion zones are adequately marked and that other appropriate protection procedures are being maintained.

An inspection is to be undertaken by the project ecologist every month during primary restoration works, with the submission of a compliance certificate at the completion of the revegetation works. The restoration area is to be maintained to a high standard, with no future encroachments of new landscaping beds, tree removal, installed or repaired services, driveways, fences or buildings except for that shown on Schedule 1 - Vegetation Management Works.

Following the completion of Year 1, 2, 3 and year 4 of the maintenance period, the project ecologist is to determine whether any additional contingency works are required to satisfactorily achieve the performance targets. After the completion of 5 years of maintenance, ongoing maintenance activities are to be undertaken by the respective land owners or management.

4.3 Compliance certification

Compliance certificates will be issued by the project ecologist for the following items:

- Engagement of a bush regeneration company and independent project ecologist
- Satisfactory installation and maintenance of all protective fencing (permanent and temporary), tree protection zones, as well as sediment and erosion control measures
- Ongoing application of rabbit baiting
- Satisfactory completion of revegetation planting works including planting of tree, shrub and ground cover species at the required densities and direct seeding works
- Satisfactory completion of primary weed control works
- Satisfactory completion of secondary weed control works and revegetation maintenance
- Satisfactory completion of nest box installation at 2:1 for all removed hollows
- Satisfactory completion of removal of temporary protection features
- Satisfactory achievement of restoration performance targets as shown on Schedule 1 – Vegetation Management Works and the restoration performance targets (Section 4.4)

4.4 Restoration performance targets

The site audits are to assess the achievement of the following restoration performance targets:

1. All protective fencing (temporary and permanent), sediment controls, and tree protection zones are to be installed prior to clearance of any vegetation.

2. Monitoring points and quadrats are to be installed prior to commencement of restoration works. Seven (7) points in total at approximate locations as marked on Schedule 1.

3. Fauna ecologist to mark hollow-bearing trees around the development and be present when any are required for removal. Nest box replacement in remnant bushland areas with a minimum of 10 nest boxes.

4. Weed control and revegetation works are to be carried out by a qualified bushland regeneration contractor for a minimum period of 1 year of primary and secondary works, and 5 years of maintenance works. Weed control targets should be a maximum of 15% cover at the end of year 1 for each zone progressing to less than 5% at the end of year 5.

5. Effective stabilisation of all lands and embankments.

6. Weed control prioritisation as per Attachment 1, where noxious weeds and invasive vines have high or very high priorities.

7. All revegetation areas to be planted at densities specified in section 3 of the report and stabilised. It is expected that a minimum 90% survival rate is to be achieved and contingency planting undertaken if greater losses are experienced.

8. Revegetation is to be undertaken utilising certified local provenance collected seed preferably from sandstone vegetation types. A minimum of 25 native species are to be used across the entire site and specifically within the northern Biodiversity Corridor.

9. All revegetation areas are to be stabilised, plants protected from grazing animals and rabbit baiting continued throughout the entire 5 year maintenance period. Any damaged plants are to be replaced with new stock.

10. Supplementary tubestock planting in all direct seeded areas subject to expected plant establishment rates. A minimum 90% cover to be achieved in all areas

11. Within the Zone 7, a target of 90% groundcover, and a minimum 20% shrub layer shall apply at the end of year 3 (Zone 7). Fuel reduction is to be undertaken annually prior to the bushfire season to be OPA compliant (4-8 tonnes/ha).

12. All stormwater outlets are to be stabilised with geotextile overlain with rock boulders in accordance with NSW DPI - Office of Water's Controlled Activity Guidelines (2012) for stormwater outlets.

13. All works as per this VMP are to be certified compliant by a project ecologist achieving the restoration performance targets. Contingency works undertaken as recommended by the project ecologist to achieve the restoration performance targets.

4.5 Typical timeline of restoration works

The following typical timeline (Figure 7) is provided to indicate the overall timing of restoration works. The commencement of the maintenance period is subject to the completion of primary and secondary weed control works as certified by the project ecologist. A certificate of completion will be required as evidence of satisfactory results. The restoration works by the appointed bushland regeneration company and auditing by the independent project ecologist is to be undertaken for a minimum period of 5 years.

Upon engagement, contractors are expected to meet the following typical schedule of works.

Typical 1 + 5 year maintenance timeline

ID	Task Name	Duration	Primary and Secondary Restoration Works												Year 1 Maintenance												Year 2 Maintenance												Years 3-5		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	3	4	5
1.0	**PROJECT INITIATION**	1 month																																							
1.1	Preparation of contract schedules	1 month																																							
1.2	Submission of fee proposals	3 weeks																																							
1.3	Contractor approvals & engagement of project ecologist	1 week																																							
2.0	**SITE PREPARATION AND PROPAGATION**																																								
2.1	Install fencing or boundary markers	1 month																																							
2.2	Updated vegetation condition assessment & installation of monitoring plots	1 week																																							
2.3	Seed collection	6 months																																							
2.4	Plant propagation (initial)	6 months																																							
2.5	Jute meshing of unstable surfaces	1 week																																							
2.6	Install sediment and erosion control measures	2 weeks																																							
2.7	Creek line embankment installation and protection	Ongoing																																							
2.8	Monitor, audit & issue compliance certification	Ongoing																																							
3.0	**WEED CONTROL**																																								
3.1	Primary weed control	6 months																																							
3.2	Secondary weed control	6 months																																							
4.0	**REVEGETATION ESTABLISHMENT**	5 months																																							
4.1	Installation of pest control - pindone baiting	2 weeks																																							
4.2	Installation of plants with guards and initial watering	4 months																																							
4.3	Direct seeding (Zone 1)	1 month																																							
4.3	Additional watering for the first six (6) months	6 months																																							
4.4	Weed control around revegetation areas	6 months																																							
4.5	Issue construction compliance certification	1 week																																							
5.0	**BUSH REGENERATION & REVEGETATION MAINTENANCE**																																								
5.1	Watering, maintenance, weed control and repairs	5 years																																							
5.2	Pest control - Pindone baiting	2 years																																							
5.3	Ongoing bushland regeneration of existing bushland areas	4 years																																							
6.0	**MAINTENANCE PERIOD MANAGEMENT AUDITING AND MONITORING**																																								
6.1	Contractor supervision / monitoring	5 years																																							
6.2	Ongoing supervision / auditing / monitoring	5 years																																							
6.3	Submission of compliance certification	5 years																																							
7.0	**CONTINGENCY WORKS (Subject to Audits)**	5 years																																							
7.1	Site preparation	2 weeks																																							
7.2	Replacement planting	1 month																																							
7.3	Watering & maintenance	3 months																																							
7.4	Medium term maintenance	6 months																																							
7.5	Submission of compliance certification	1 week																																							

Contingency

Contingency

Figure 7 – Typical restoration timeline (3 plus years)

Weed Control Priorities

A1

Table A1.1 – Noxious weed control classes

Control class	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.*
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	There are no requirements to control existing plants of Class 5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.

Table A1.2 – Weed control priorities

Scientific name	Common name	Family	Noxious weed class	Priority	Treatment techniques
Acer negundo	-	Aceraceae		Medium	Cut and paint with Glyphosate
Acetosa sagittata	Turkey Rhubarb	Polygonaceae	4	High	Herbicide spray; dig out bulbs
Agapanthus praecox	Agapanthus	Amaryllidaceae		Low	Dig out
Ageratina adenophora	Crofton Weed	Asteraceae		Medium	Hand pull; herbicide spray
Ageratum houstonianum	Blue Billygoat Weed	Asteraceae		Low	Hand pull; herbicide spray
Amarathus viridis	Green Amaranth	Amaranthaceae		Low	Hand pull; herbicide spray
Anagalis arvensis	Scarlet Pimpernel	Primulaceae		Low	Hand pull; herbicide spray
Andropogon virginicus	Whisky Grass	Poaceae		Medium	Hand pull; herbicide spray
Anredera cordifolia	Madeira Vine	Basellaceae	4	Very High	Skirt and spray; bag and dispose of tubers. Consider using Starane
Araujia sericifera	Moth Vine	Apocynaceae		High	Hand pull; herbicide spray
Asparagus aetheopicus	Asparagus Fern	Asparagaceae	4	High	Dig out
Avena sativa	Oats	Poaceae		Low	Hand pull; herbicide spray
Axonopus fissifolius	Narrowleaf Carpet Grass	Poaceae		Low	Herbicide spray
Bidens pilosa	Cobblers Pegs	Asteraceae		Low	Hand pull; herbicide spray
Briza maxima	Quaking Grass	Poaceae		Low	Hand pull; herbicide spray
Canna indica	Indian Shot	Cannaceae		Low	Dig out
Centaurium erythraea	Pink Stars	Gentianaceae		Low	Hand pull; herbicide spray
Centaurium tenuiflorum	-	Gentianaceae		Low	Hand pull; herbicide spray
Cestrum parqui	Chilean Cestrum	Solanaceae	4	High	Cut and paint with Glyphosate
Cinnamomum camphora	Camphor Laurel	Lauraceae	4	High	Cut and paint with Glyphosate
Colocasia esculenta	Taro	Araceae		Low	Dig out
Conyza sumatrensis	Tall Fleabane	Asteraceae		Low	Hand pull; herbicide spray
Coreopsis lanceolata	Coreopsis	Asteraceae		Low	Hand pull; herbicide spray
Cortaderia selloana	Pampas Grass	Poaceae	3	Very High	Dig out; herbicide spray
Cyperus brevifolius	Mullumbimby Couch	Cyperaceae		Low	Hand pull; herbicide spray
Cyperus congestus	-	Cyperaceae		Low	Hand pull; herbicide spray
Cyperus eragrostis	Umbrella Sedge	Cyperaceae		Low	Hand pull; herbicide spray
Delairea odorata	Cape Ivy	Asteraceae		Very High	Skirt and spray
Dipogon lignosus	Dolichos Pea	Fabaceae	4	High	Skirt and spray

Table A1.2 – Weed control priorities

Scientific name	Common name	Family	Noxious weed class	Priority	Treatment techniques
Ehrharta erecta	Panic Veldtgrass	Poaceae		Low	Hand pull; herbicide spray
Epidendrum sp.	Crucifix Orchid	Orchidaceae		Low	Dig out
Erythrina crista-galli	Coskspur Coral Tree	Fabaceae	4	High	Cut and paint with Glyphosate; dispose of branches
Erythrina X sykesii	Coral Tree	Fabaceae		High	Cut and paint with Glyphosate; dispose of branches
Euphorbia peplus	-	Euphorbiaceae		Low	Hand pull; herbicide spray
Gomphocarpus fruticosus	Milkweed	Apocynaceae		Low	Hand pull; herbicide spray
Hedychium gardnerianum	Ginger Lily	Anthericaceae		Medium	Dig out
Heliotropium amplexicaule	Blue Heliotrope	Boraginaceae		Low	Hand pull; herbicide spray
Hydrocotyle bonariensis	Pennywort	Apiaceae		Low	Herbicide spray
Hypochaeris radicata	Flatweed	Asteraceae		Low	Hand pull; herbicide spray
Impatiens walleriana	Busy Lizzie	Balsaminaceae		Low	Hand pull; herbicide spray
Ipomoea indica	Blue Morning Glory	Convolvulaceae	4	Very High	Skirt and spray
Lantana camara	Lantana	Verbenaceae	4	High	Cut and paint with Glyphosate; hand pull; herbicide spray
Ligustrum lucidum	Broad-leaved Privet	Oleaceae	4	High	Cut and paint with Glyphosate; hand pull; herbicide spray
Ligustrum sinense	Small-leaved Privet	Oleaceae	4	High	Cut and paint with Glyphosate; hand pull; herbicide spray
Lilium formosanum	-	Liliaceae		Low	Dig out; herbicide spray
Lonicera japonica	Honeysuckle	Caprifoliaceae	4	Very High	Skirt and spray, scrape and paint
Ludwigia peruviana	-	Onagraceae	3	Very High	Dig out as much of the root system as possible, bag and dispose all material
Modiola caroliniana	Red-flowered Mallow	Malvaceae		Low	Herbicide spray
Monstera deliciosa	-	Araceae		Low	Hand pull; dig out; cut and paint with Glyphosate
Morus alba	Mulberry	Moraceae		Low	Cut and paint with Glyphosate
Musa acuminata	Banana	Musaceae		Low	Cut and paint with Glyphosate
Nephrolepis cordifolia	Fish-bone Fern	Davalliaceae		Medium	Dig out
Paspalum dilatatum	Paspalum	Poaceae		Low	Hand pull; herbicide spray

Table A1.2 – Weed control priorities

Scientific name	Common name	Family	Noxious weed class	Priority	Treatment techniques
Paspalum quadrifarium	Tussock Paspalum	Poaceae	4	High	Hand pull; herbicide spray
Paspalum urvillei	Vasey Grass	Poaceae		Low	Hand pull; herbicide spray
Passiflora edulis	Passionfruit	Passifloraceae		Low	Hand pull; herbicide spray
Pennisetum clandestinum	Kikuyu	Poaceae		Low	Herbicide spray
Phyllostachys sp.	Bamboo	Poaceae	4	Very High	Cut and paint with herbicide
Phytolacca octandra	Inkweed	Phytolaccaceae		Low	Hand pull; herbicide spray
Plantago lanceolata	Ribwort	Plantaginaceae		Low	Hand pull; herbicide spray
Populus deltoides (or Populus sp.)	Eastern Cottonwood	Salicaceae		Low	Cut and paint with Glyphosate
Ranunculus repens	Creeping Buttercup	Ranunculaceae		Low	Herbicide spray
Ricinis communis	Castor Oil Plant	Euphorbiaceae	4	High	Cut and paint with Glyphosate; hand pull; herbicide spray
Rubus fruticosus ssp. agg.	Blackberries	Rosaceae	4	Very High	Herbicide spray; dig out
Rumex crispus	Curled Dock	Polygonaceae		Low	Herbicide spray
Salix babylonica	Weeping Willow	Salicaceae	4	High	Cut and paint with Glyphosate; stem injection
Senecio madagascariensis	Fireweed	Asteraceae	4	Medium	Hand pull; herbicide spray
Senna pendula var. *glabrata*	-	Fabaceae	4	Medium	Cut and paint with Glyphosate; hand pull; herbicide spray
Setaria parvifolia	Slender Pigeon Grass	Poaceae		Low	Herbicide spray
Sida rhombifolia	Paddy's Lucerne	Malvaceae		Low	Herbicide spray
Solanum americanum	Glossy Nightshade	Solanaceae		Low	Hand pull; herbicide spray
Solanum mauritianum	Tobacco Bush	Solanaceae		Low	Cut and paint with Glyphosate; herbicide spray
Solanum nigrum	Blackberry Nightshade	Solanaceae		Low	Hand pull; herbicide spray
Stenotaphrum secundatum	Buffalo Grass	Poaceae		Low	Herbicide spray
Taraxacum officinale	Dandelion	Asteraceae		Low	Hand pull; herbicide spray
Tradescantia albiflora	Wandering Jew	Commelinaceae		High	Rake; herbicide spray with Starane
Trifolium dubium	Yellow Suckling Clover	Fabaceae		Low	Herbicide spray

Table A1.2 – Weed control priorities

Scientific name	Common name	Family	Noxious weed class	Priority	Treatment techniques
Trifolium fragiferum	Strawberry Clover	Fabaceae		Low	Herbicide spray
Trifolium repens	White Clover	Fabaceae		Low	Herbicide spray
Verbascum virgatum	Twiggy Mullein	Scrophulariaceae		Low	Hand pull; herbicide spray
Verbena bonariensis	Purple Top	Verbenaceae		Low	Hand pull; herbicide spray
Verbena quadrangularis	Flaxleaf Fleabane	Verbenaceae		Low	Hand pull; herbicide spray
Zantedeschia aethiopica	Arum Lily	Araceae		Low	Dig out; herbicide spray

Revegetation List

A2

Table 2.1 provides a list of recommended species for revegetation works across the site. Approximately 95% of species occur either on site or on adjoining land blocks, with a few additional species added for macrophyte planting.

For the purposes of those species listed below, trees are generally species that are expected to grow to 8m or taller in height and shrubs are typically 0.5-8m in height at maturity.

Table 2.1 – Revegetation list

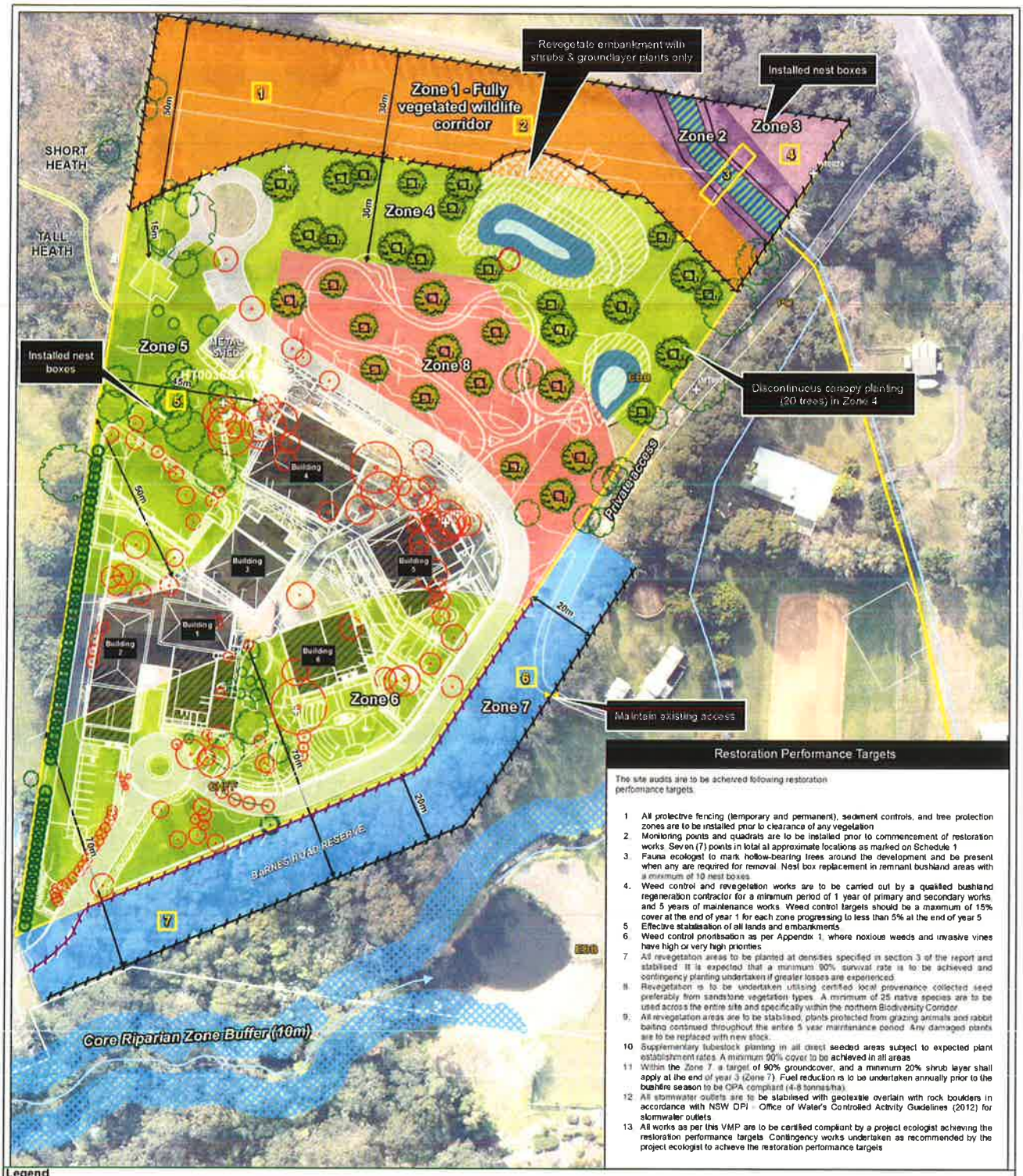
Scientific name	Common name	Family	Management Zone
Trees			
Allocasuarina littoralis	Black She-oak	Casuarinaceae	1
Angophora costata	Smooth-barked Apple	Myrtaceae	1 2 4
Acacia decurrens	Black Wattle	Mimosaceae	1 2
Acacia parramattensis	Sydney Green Wattle	Mimosaceae	1 2
Banksia serrata	Old Man Banksia	Proteaceae	1 2
Brachychiton acerifolius	Illawarra Flame Tree	Sterculiaceae	1 2
Casuarina glauca	Swamp Oak	Casuarinaceae	2
Corymbia gummifera	Red Bloodwood	Myrtaceae	1 2
Corymbia maculata	Spotted Gum	Myrtaceae	1 2 4
Eucalyptus botryoides	Southern Bangalay	Myrtaceae	1 2
Eucalyptus deanei	Mountain Blue Gum	Myrtaceae	1 2 4
Eucalyptus haemastoma	Scribbly Gum	Myrtaceae	1 2 4
Eucalyptus paniculata	Grey Ironbark	Myrtaceae	1 2
Eucalyptus piperita	Sydney Peppermint	Myrtaceae	1 2
Eucalyptus punctata	Grey Gum	Myrtaceae	1 2 4
Eucalyptus robusta	Swamp Mahogany	Myrtaceae	2
Eucalyptus sieberi	Silvertop Ash	Myrtaceae	1
Melaleuca quinquenervia	Broad-leaved Tea Tree	Myrtaceae	2
Melaleuca styphelioides	Prickly-leaved Tea Tree	Myrtaceae	2
Shrubs			
Acacia floribunda	Sally Wattle	Mimosaceae	1 2 4
Acacia linifolia	Flax Wattle	Mimosaceae	1 2 4
Acacia longifolia	Sydney Golden Wattle	Mimosaceae	1 2 4
Acacia suaveolens	Sweet Scented Wattle	Mimosaceae	1 2 4
Acacia terminalis	Sunshine Wattle	Mimosaceae	1 2 4
Acacia ulicifolia	Prickly Moses	Mimosaceae	1 2 4
Banksia ericifolia	Heath-leaved Banksia	Proteaceae	2
Banksia oblongifolia	-	Proteaceae	2
Banksia spinulosa	Hairpin Banksia	Proteaceae	1 2 4
Callicoma serratifolia	Black Wattle	Cunoniaceae	2
Callistemon citrinus	Crimson Bottlebrush	Myrtaceae	1 2 4
Ceratopetalum gummiferum	Christmas Bush	Cunoniaceae	1 2 4
Crowea saligna	Lance-leaf Crowea	Rutaceae	1 4
Dillwynia floribunda var. *floribunda*	Parrot Pea	Fabaceae	1 2 4
Dillwynia retorta	Eggs and Bacon	Fabaceae	1 2 4

Table 2.1 – Revegetation list

Scientific name	Common name	Family	Management Zone
Dodonaea triquetra	Hop Bush	Sapindaceae	1 2 4
Elaeocarpus reticulatus	Blueberry Ash	Elaeocarpaceae	1 2
Epacris crassifolia	-	Epacridaceae	1 2 4
Eriostemon australasius	Pink Wax Plant	Rutaceae	1 4
Grevillea buxifolia	Grey Spider Flower	Proteaceae	1 4
Grevillea speciosa	Red Spider Flower	Proteaceae	1 4
Hakea sericea	Silky Hakea	Proteaceae	1 2 4
Hakea teretifolia	Dagger Hakea	Proteaceae	1 2 4
Hibbertia aspera	-	Dilleniaceae	1 4
Kunzea ambigua	Tick Bush	Myrtaceae	1 4
Leptospermum polygalifolium	Tantoon	Myrtaceae	1 2 4
Melaleuca ericifolia	Swamp Paperbark	Myrtaceae	2
Ozothamnus diosmifolius	Ball Everlasting	Asteraceae	1 2 4
Persoonia lanceolata	Lance-leaved Geebung	Proteaceae	1 4
Persoonia levis	Broad-leaved Geebung	Proteaceae	1 4
Persoonia pinifolia	Pine-leaved Geebung	Proteaceae	1 4
Phebalium squamulosum subsp. *squamulosum*	-	Rutaceae	1 4
Pimelea linifolia	Slender Rice Flower	Thymeleaceae	1 4
Platylobium formosum	Handsome Flat-pea	Fabaceae	1 4
Platysace linearifolia	Narrow-leafed Platysace	Apiaceae	1 4
Pultenaea daphnoides	Large-leaf Bush-pea	Fabaceae	1 4
Pultenaea stipularis	-	Fabaceae	1 4
Viminaria juncea	Native Broom	Fabaceae	1 4
Vines			
Billardiera scandens	Apple Dumplings	Pittosporaceae	1
Cayratia clematidea	Slender Grape	Vitaceae	1
Cissus hypoglauca	Water Vine	Vitaceae	2
Hardenbergia violacea	False Sarsaparilla	Fabaceae	1 2
Eustrephus latifolius	Wombat Berry	Luzuriagaceae	1
Kennedia rubicunda	Dusky Coral-pea	Fabaceae	1 2
Smilax glyciphylla	Sarsaparilla	Smilacaceae	1
Herbs and Grasses			
Austrostipa pubescens	Tall Spear Grass	Poaceae	1 2 4
Carex appressa	Tall Sedge	Cyperaceae	2
Centella asiatica	Swamp Pennywort	Apiaceae	1 2 4
Commelina cyanea	Scurvy Weed	Commelinaceae	1 2 4
Dianella caerulea	Flax Lily	Phormiaceae	1 2 4
Dianella prunina	-	Phormiaceae	1 2 4
Dichelachne crinita	Long-hair Plume Grass	Poaceae	1 2 4
Echinopogon caespitosus	Tufted Hedgehog Grass	Poaceae	1 2 4
Eleocharis sphacelata	-	Cyperaceae	2
Entolasia marginata	Bordered Panic	Poaceae	1 2 4
Entolasia stricta	Wiry Panic	Poaceae	1 2 4
Gahnia clarkei	Saw Sedge	Cyperaceae	2
Hydrocotyle peduncularis	Pennywort	Apiaceae	1 2 4
Imperata cylindrica	Blady Grass	Poaceae	1 2 4
Juncus usitatus	Common Rush	Juncaceae	2
Lomandra longifolia	Spiky-headed Mat-rush	Lomandraceae	1 2 4
Microlaena stipoides	Weeping Grass	Poaceae	1 2 4
Oplismenus imbecillis	-	Poaceae	1 2 4
Schoenoplectus validus	-	Cyperaceae	2

Vegetation Management Works

S1



Restoration Performance Targets

The site audits are to be achieved following restoration performance targets.

1. All protective fencing (temporary and permanent), sediment controls, and tree protection zones are to be installed prior to clearance of any vegetation
2. Monitoring points and quadrats are to be installed prior to commencement of restoration works. Seven (7) points in total at approximate locations as marked on Schedule 1
3. Fauna ecologist to mark hollow-bearing trees around the development and be present when any are required for removal. Nest box replacement in remnant bushland areas with a minimum of 10 nest boxes
4. Weed control and revegetation works are to be carried out by a qualified bushland regeneration contractor for a minimum period of 1 year of primary and secondary works and 5 years of maintenance works. Weed control targets should be a maximum of 15% cover at the end of year 1 for each zone progressing to less than 5% at the end of year 5
5. Effective stabilisation of all lands and embankments
6. Weed control prioritisation as per Appendix 1, where noxious weeds and invasive vines have high or very high priorities
7. All revegetation areas to be planted at densities specified in section 3 of the report and stabilised. It is expected that a minimum 90% survival rate is to be achieved and contingency planting undertaken if greater losses are experienced.
8. Revegetation is to be undertaken utilising certified local provenance collected seed preferably from sandstone vegetation types. A minimum of 25 native species are to be used across the entire site and specifically within the northern Biodiversity Corridor
9. All revegetation areas are to be stabilised, plants protected from grazing animals and rabbit baiting continued throughout the entire 5 year maintenance period. Any damaged plants are to be replaced with new stock.
10. Supplementary tubestock planting in all direct seeded areas subject to expected plant establishment rates. A minimum 90% cover to be achieved in all areas
11. Within the Zone 7 a target of 90% groundcover, and a minimum 20% shrub layer shall apply at the end of year 3 (Zone 7). Fuel reduction is to be undertaken annually prior to the bushfire season to be OPA compliant (4-8 tonnes/ha).
12. All stormwater outlets are to be stabilised with geotextile overlain with rock boulders in accordance with NSW DPI - Office of Water's Controlled Activity Guidelines (2012) for stormwater outlets
13. All works as per this VMP are to be certified compliant by a project ecologist achieving the restoration performance targets. Contingency works undertaken as recommended by the project ecologist to achieve the restoration performance targets

Legend

- Subject site
- Lot boundary (Lot 2673 DP 824283)
- Access road and carpark
- Proposed building envelope (SFPP)
- Proposed building envelope (other uses)
- Stream Order 1
- Jute mat/mesh creek line embankments
- Basin and embankment planting as per landscaping plans (John Chetham & Associates)
- Macrophyte planting
- Open water

Management Zones

- Zone 1a - Northern Biodiversity Corridor (5250m²)
- Zone 1b- Shrub & ground layer planting only (150m²)
- Zone 2 - Riparian restoration and revegetation (1050m²)
- Zone 3 - Remnant Vegetation Bushland regeneration (450m²)
- Zone 4 - Northern APZ (IPZA (5300m²)
- Zone 5 -Western APZ (IPA) (4000m²)
- Zone 6 - Southern APZ (IPA) and Landscaping as per Landscape Plans (6700m²)
- Zone 7 - Southern APZ (OPA) (4250m²)
- Zone 8 - Landscaping with Native Canopy Planting (4050m²)
- Permanent 2.5m square x 1m high post and rail fence
- Monitoring quadrat with photopoints (Minimum of 5x5m)
- Temporary construction proof fence with sediment control fence(1.8m high and relocatable)
- Permanent rural type fence (5 - plain wire rural strand)
- Tree to be retained with Tree Protection Zone (TPZ)
- Tree for removal
- Install access gates
- Habitat tree
- Eastern Bentwing-bat
- Powerful Owl

Travers bushfire & ecology

Barnes Road, Frenchs Forest
A14054_V001

16/04/2015
Issue 1

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GDA 1994 MGA Zone 56

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Schedule 1- Vegetation Management Works

Travers

bushfire & ecology

bushfire protection assessment (addendum)

The Falls Estate
Lot 1113 DP 752038
Barnes Road, Frenchs Forest

FPA AUSTRALIA
Certified Business Bushfire Planning & Design

April 2015
(REF: A14054B2)

Travers

bushfire & ecology

Addendum Bushfire Protection Assessment

The Falls Estate
Lot 1113 DP 752038
Barnes Road, Frenchs Forest

Report Authors:	John Travers BPAD-L3 15195 & Nicole van Dorst BPAD-L2 23610
Plans prepared:	Trent Matheson & Emma Buxton
Checked by:	John Travers
Date:	15th April 2015
File:	A14054B2

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be relied upon as meaning it reflects any advice by this firm. The report does not suggest or guarantee that a bush or grass fire will not occur and or impact the development. The advice does advise on matters published by the NSW Rural Fire Service in their guidelines '*Planning for bush fire protection 2006*' and other advice available from that organisation.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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GLOSSARY OF TERMS

AHIMS	Aboriginal Heritage Information System
APZ	asset protection zone
AS1596	*Australian Standard – The storage and handling of LP Gas*
AS2419	*Australian Standard – Fire hydrant installations*
AS3745	*Australian Standard – Planning for emergencies in facilities*
AS3959	*Australian Standard – Construction of buildings in bushfire-prone areas 2009*
BAL	*bushfire attack level*
BCA	*Building Code of Australia*
BSA	bushfire safety authority
EP&A Act	*Environmental Planning & Assessment Act 1979*
FDI	fire danger index
IPA	inner protection area
LEP	Local Environmental Plan
OPA	outer protection area
PBP	*Planning for Bush Fire Protection 2006*
RF Act	*Rural Fires Act 1997*
RFS	NSW Rural Fire Service
SFPP	special fire protection purpose

EXECUTIVE SUMMARY

This addendum bushfire protection assessment has been undertaken for the proposed expansion of the recently approved (2013) low care seniors living facility at Barnes Road, Frenchs Forest.

A bushfire protection assessment was prepared by this firm in September 2014. A bushfire safety authority (BSA) was subsequently issued on 20 November 2014 (NSW RFS Ref: DA14/3053). This addendum report has been prepared based on a revised development layout, due to the removal of a portion (variable width) APZ which was previously approved in the adjoining Lot 1336 DP 752038 in the south.

Based on the revised development layout, this report seeks to amend Condition 2 of the BSA which states:

> *A 70 metre minimum APZ shall be provided to the south and south east of proposed buildings 1, 2 and 6 as shown on in Schedule 1 of the Bushfire Protection Assessment prepared by Travers Bushfire & Ecology dated 5 September 2014, ref. A14054B. Where the APZ lies outside the boundary of the site, it shall be protected by an easement with the land owner's consent.*

The revised proposal maintains the 70m APZ (within the development site and adjoining Barnes Road Reserve) to all buildings used for aged care (accommodation / gym / pool area). Buildings for non-aged care use (i.e. kitchen, storage, loading dock & offices) have been provided with a smaller APZ.

The proposed expansion of the low care seniors living facility is categorised by the NSW Rural Fire Service (RFS) as being a special fire protection purpose (SFPP) development. This classification requires the RFS to issue a *bushfire safety authority* (*BSA*) in accordance with *Planning for bush fire protection 2006* (*PBP*).

PBP dictates that the subsequent extent of bushfire attack that can potentially impact a SFPP building must not exceed a radiant heat flux of $10kW/m^2$. This rating assists in determining the size of the asset protection zone (APZ) to provide the necessary defendable space between hazardous vegetation and a building. The proposal also involves the approved upgrade of the existing residence to provide for a permanent staff management cottage. This building can have a reduced APZ based on a radiant heat flux of $29kW/m^2$. Similar buildings used for non-aged care (i.e. office & retail) are also provided with reduced APZ's.

The assessment found that bushfire can potentially affect the proposed development from the existing tall heath / short heath vegetation located to the north west, the forest vegetation associated with the creek line in the north-east and the forest within the adjoining residential land to the south resulting in possible ember and radiant heat attack.

The bushfire risk posed to the development can however be effectively mitigated if appropriate bushfire protection measures are put in place and managed in perpetuity.

The assessment has concluded that the proposed development will provide:

- Compliance with *PBP*

Other bushfire protection measures are planned and identified within the recommendations of this report.

TABLE OF CONTENTS

Introduction 1

Travers bushfire & ecology has been requested by *Dukor 24 Pty Limited to* undertake an addendum bushfire protection assessment for the proposed expansion of the low care seniors living facility at Frenchs Forest.

The proposed development is located on land mapped by *Warringah Council* as being bushfire prone. This triggers a formal assessment by the NSW Rural Fire Service (RFS) policy against the provisions of *Planning for Bush Fire Protection 2006 (PBP).*

1.1 Aims of the assessment

The aims of the bushfire protection assessment are to:

- Review the bushfire threat to the landscape
- Undertake a bushfire attack assessment in accordance with *PBP*
- Provide advice on mitigation measures, including the provision of asset protection zones (APZs), construction standards and other specific fire management issues
- Review the potential to carry out hazard management over the landscape

1.2 Project synopsis

In 2013 Council approved the development of a low care seniors living facility on the site. The approval involved the refurbishment of the existing dwelling as well as bushfire protection measures, including asset protection zones both within the site and the adjoining land (Barnes Road Reserve and Lot 1336 DP 752038).

Following the submission of a bushfire protection assessment, in September 2014, for the expansion of the site a bushfire safety authority (BSA) was issued on 20 November 2014 (NSW RFS Ref: DA14/3053).

This addendum report has been prepared based on a revised development layout, due to the removal of a portion (variable width) APZ which was previously approved in the adjoining Lot 1336 DP 752038 in the south.

The revised proposal involves demolishing the existing building and expanding the capacity of an approved residential aged care facility on the site from 10 beds to a 45 bed facility (refer Figures 1.1 – 1.4). The revised proposal also includes increasing the width of the wildlife corridor from 24m to a variable width 30 – 50m.

The revised proposal maintains the 70m APZ (within the development site and adjoining Barnes Road Reserve) to all buildings used for aged care (accommodation / gym / pool area). Buildings for non-aged care use (i.e. kitchen, storage, loading dock & offices) have been provided with a smaller APZ, as allowable under PBP.

Figure 1.1 – Site plan

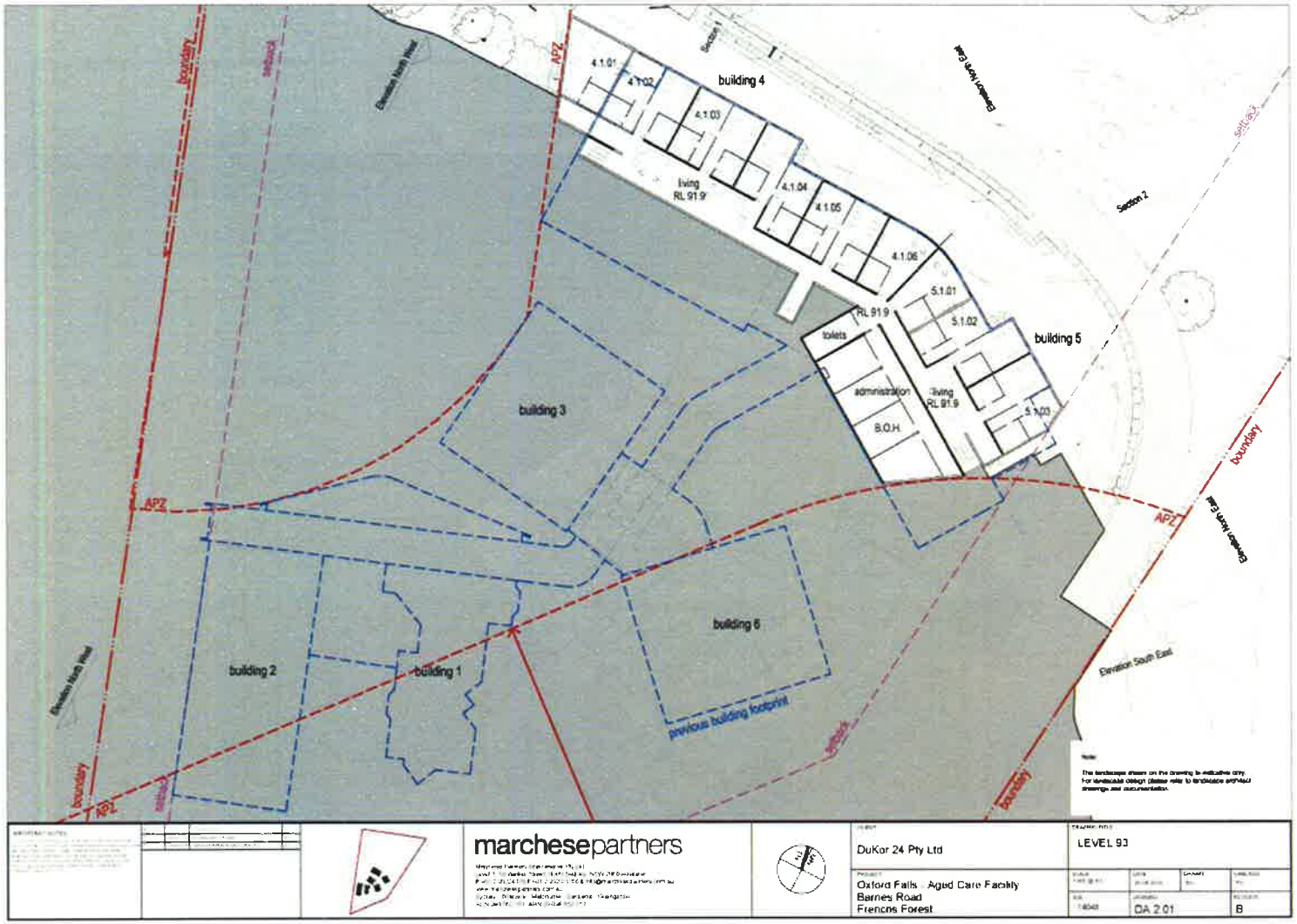


Figure 1.2 – Building use

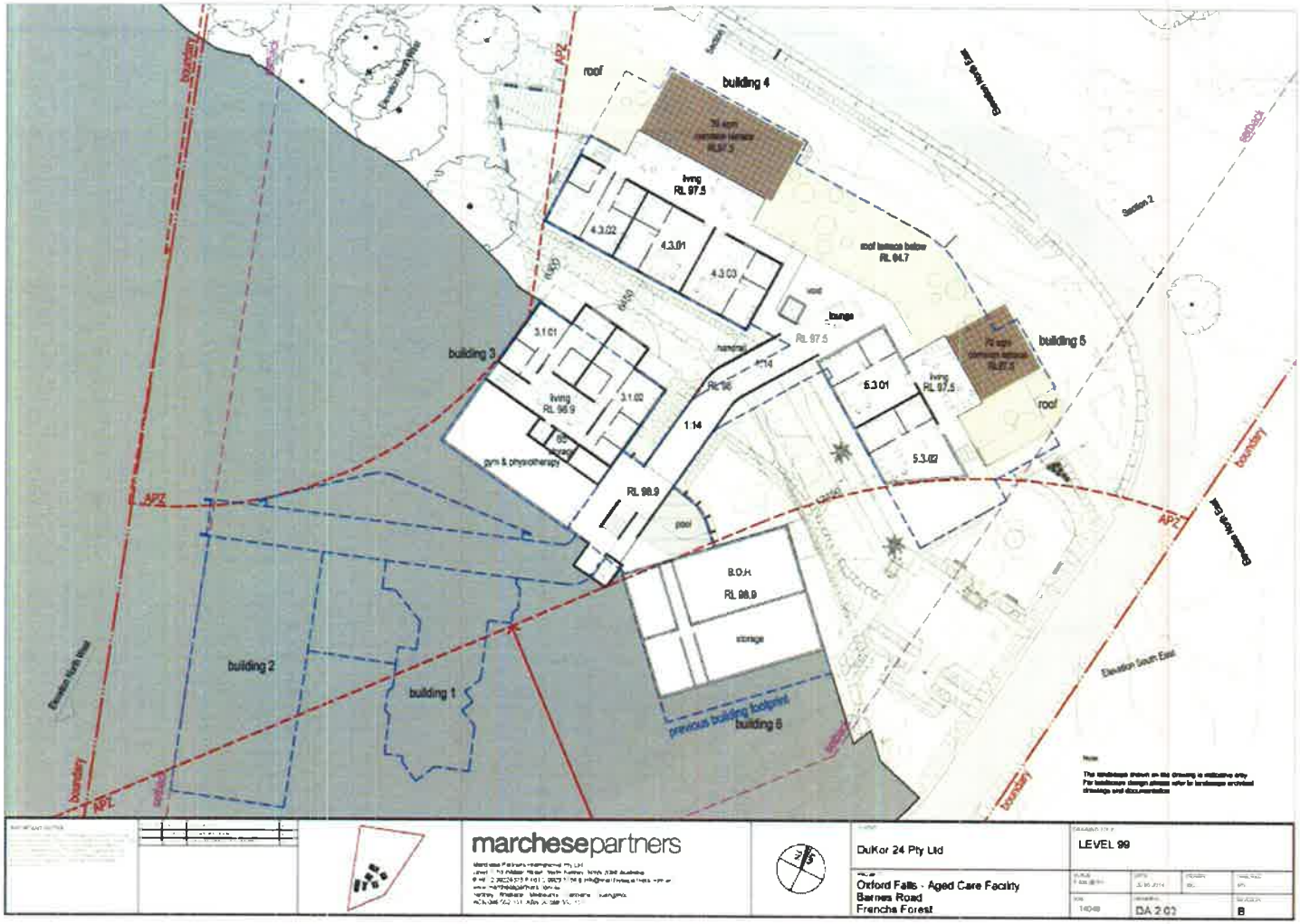


Figure 1.3 – Site plan / building use

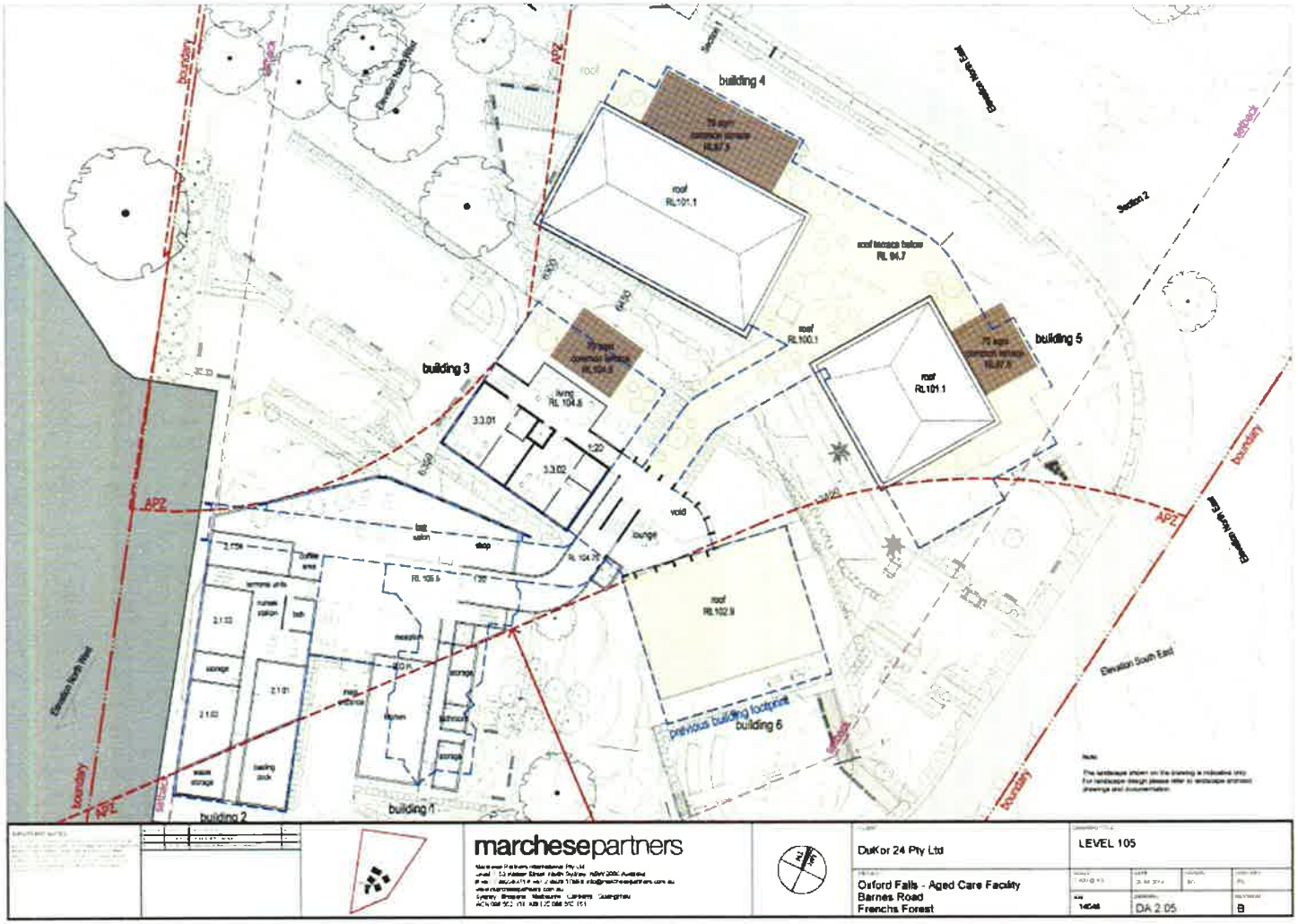


Figure 1.4 – Building use

1.3 Information collation

To achieve the aims of this report, a review of the information relevant to the property was undertaken prior to the initiation of field surveys.

Information sources reviewed include the following:

- Drawings prepared by *Marchese Partners*, Revision B dated 14/4/2015
- Landscape plans prepared by *John Chetham & Associates*
- *Google* aerial photography
- Topographical maps DLPI of NSW 1:25,000
- Australian Standard 3959 *Construction of buildings in bushfire-prone areas*
- *Planning for bush fire protection 2006 (NSW RFS).*

An inspection of the proposed development site and surrounds was undertaken by John Travers and Nicole van Dorst on several occasions during February 2013 and March 2015 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

1.4 Site description

The property is situated to the south west of the intersection of Oxford Falls Road and Barnes Road, Frenchs Forest – see location plan Figure 1.5.

Figure 1.5 – Location plan

The majority of the property is currently developed for rural residential use. An existing dwelling is located in the south west with established gardens and out-buildings.

The property is bounded to the south west and east by residential and rural residential land and elsewhere by fragmented natural bushland vegetation.

Table 1.1 – Site features

Location	Lots 1113 DP 752038 Oxford Falls Road and Barnes Road, Frenchs Forest
Local government area	Warringah
Grid reference	337700E and 6264700N
Elevation	Approximately 78-114m AHD
Topography	Situated on flat to undulating land. Gradients are generally 0-15%, with steeper grades in the west.
Geology and soils	Soils; Oxford Falls – Moderate to deep soils in valleys with underlying Sandstone. Lambert – Generally shallow soils over Hawkesbury Sandstone. Hawkesbury – Steep inclines, shallow soils. Geology; Hawkesbury Sandstone.
Catchment and drainage	Surface flows within the subject site flow into an unnamed watercourse that cuts within the north eastern portion of the subject site. Middle Creek.
Vegetation	Open Forest, scrub / heath and cleared areas. Refer to Sections 3 and 4
Existing land use	Residential (rural) and grazing by horses
Clearing	The majority of the subject site is cleared vegetation.

1.5 Legislation and Planning Instruments

1.5.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales. It provides for the establishment of environmental planning instruments, and development controls. The identification of bushfire prone land is required under Section 146 of the *EP&A Act*.

1.5.2 Bushfire prone land

Bushfire prone land maps provide a trigger for the development assessment provisions of Section 100b of the Rural Fires Act and Section 79BA of the *EP&A Act*.

The proposed development is located on land that is partly mapped by *Warringah Council* as being bushfire prone - refer Figure 1.6.

The proposed development is an 'integrated development' under Section 91 of the *EP&A Act*. Consequently, to proceed, the proposed development will require a bushfire safety authority (BSA) from the RFS. The Commissioner must be satisfied that the proposal complies with *PBP* before granting a BSA.

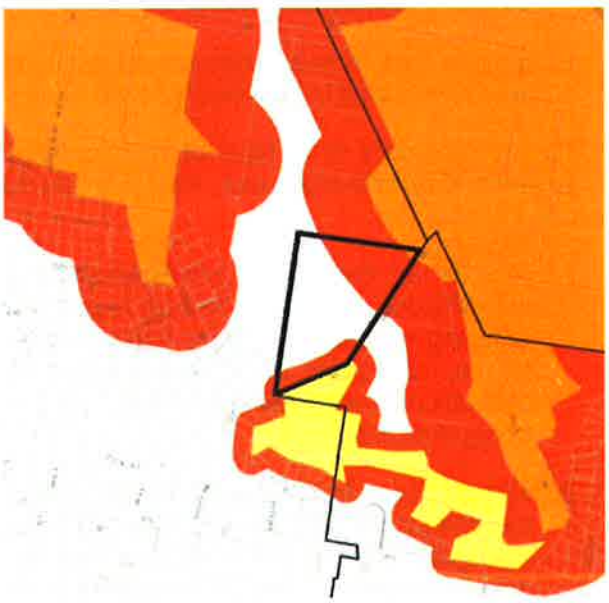


Figure 1.6 – Bushfire Prone Land Map

1.5.3 Rural Fires Act 1997 (RF Act)

This legislation is concerned with the prevention and control of bushfire, hazard reduction and administration.

Section 100B of the *RF Act* states that the Commissioner may issue a *bush fire safety* authority for a *special fire protection purpose* development on bushfire prone land.

1.5.4 Planning for Bushfire Protection 2006 (PBP)

Bushfire protection planning requires the consideration of the RFS planning document entitled *PBP* published in 2006. *PBP* provides planning controls for building in bushfire prone areas as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment. More specifically, the aims and objectives for all development located on bushfire prone land should:

1. Afford occupants of any building adequate protection from exposure to a bushfire.

2. Provide for a defendable space to be located around buildings.

3. Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevents direct flame contact and material ignition.

4. Ensure that safe operational access and egress for emergency service personnel and residents is available.

5. Provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the APZ.

6. Ensure that utility services are adequate to meet the needs of fire fighters (and others who may assist in bushfire fighting).

As the development is a type of development regarded by the RFS as a *special fire protection purpose* development, *PBP* requires additional objectives to be considered. These include the need to:

1. Provide for the special characteristics and needs of occupants. Unlike residential subdivisions, which can be built to a construction standard to withstand the fire event, enabling occupants and fire fighters to provide property protection after the passage of fire, occupants of SFPP developments may not be able to assist in property protection. They are more likely to be adversely affected by smoke or heat while being evacuated.

2. Provide for safe emergency evacuation procedures. SFPP developments are highly dependent on suitable emergency evacuation arrangements, which require greater separation from bushfire threats. During emergencies, the risk to fire fighters and other emergency services personnel can be high through prolonged exposure, where door-to-door warnings are being given and exposure to the bushfire is imminent.

The nature of *special fire protection purpose* means that occupants may be more vulnerable to bushfire attack for one or more of the following reasons:

- They may be less educated in relation to bushfire impacts.
- They may have reduced capacity to evaluate risk and to respond adequately to the bushfire threat.
- They may present organisational difficulties for evacuation and or management.
- They may be more vulnerable through stress, anxiety and smoke impacts arising from bushfire threat.
- There may be significant communication barriers.
- Supervision during a bushfire may be difficult
- Logistical arrangements for the numbers of residents may be complicated in terms of alternate accommodation, transport, healthcare and food supplies.

In addition, *PBP* outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas. The proposal has been assessed in compliance with the following measures:

- Asset protection zones
- Building construction and design
- Access arrangements
- Water supply and utilities
- Landscaping, and
- Emergency management arrangements.

1.5.5 Building Code of Australia and the Australian Standards AS3959 - 2009

The BCA is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls. The BCA outlines objectives, functional statements, performance requirements and deemed-to-satisfy provisions.

In NSW, construction in bushfire prone areas applies to Class 2, 3, 4 & 9 buildings or a Class 10a associated with Class 2, 3, 4 & 9 buildings.

The construction manual for the deemed-to-satisfy requirements is the Australian Standard AS3959 (2009).

1.6 Environmental and Cultural Constraints

A flora and fauna assessment has been undertaken by *Travers bushfire & ecology (2014 / 2013 / 2010 / 2015))*.

The assessment concluded that in accordance with Section 5A of the *EP&A Act* the proposed development will not have a significant impact on any threatened species, populations or EECs.

The report also deals with riparian issues and advises no impacts will occur upon creeks or waterways.

Bushfire Threat Assessment 2

To assess the bushfire threat and to determine the required width of an APZ for a development, a review of the elements that comprise the overall threat needs to be completed.

PBP provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack.

These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

2.1 Hazardous fuels

PBP guidelines require the identification of the predominant vegetation formation in accordance with David Keith (2004) to determine APZ distances for subdivision developments. However, when determining construction standards in accordance with *AS3959,* AUSLIG Pictorial Analysis is used to determine the vegetation and hence building construction standards (refer Section 3.2 of this report). The hazardous vegetation is calculated for a distance of at least 140m from a proposed building envelope.

The vegetation within 140m of the proposed seniors living facility has been identified as:

- Short heath / Tall heath with emergent eucalypts along the short ridgeline in the north-west

Photo 1 – Short heath to the north-west or the staff management cottage

Photo 2 – Tall heath to the north-west

- Forest vegetation associated with the creek line in the north-east and within the adjoining residential land to the south.

Photo 3 – Forest to the north-east

Photo 4 – Forest to the north-east

The proposed wildlife corridor within and adjoining the northern property boundary, as well as the riparian zone adjoining the north eastern boundary will be revegetated as recommended within the Flora and Fauna Assessment undertaken by *Travers bushfire & ecology*, 2014 and the Vegetation Management Plan also undertaken by *Travers bushfire & ecology*, 2015.

APZs have been provided from the proposed edge of the revegetated lands and will therefore not pose an increased bushfire threat to the development and / or egress / access opportunities.

The remaining land, within 140m of the dwellings, is not considered a bushfire threat as it consists of a managed landscape with mown grass and scattered trees as depicted within the following photographs.

Photo 5 – Managed land to the east

Photo 6 – Managed land to the west

2.2 Effective Slope

The effective slope is assessed for a distance 100m external to a building facade.

Effective slope refers to that slope which provides the most effect upon likely fire behaviour. A mean average slope may not in all cases provide sufficient information such that an appropriate assessment can be determined. The effective slope within the hazardous areas is detailed within Table 2.1 and summarise below:

- 9 degrees down slope within the tall heath vegetation to the north-west of building 1 & 2.
- Level to upslope within the tall heath vegetation to the west of building 4
- Level to upslope within the forest vegetation to the north-east of Buildings 4 & 5
- Level within the proposed wildlife corridor (to be restored & revegetated)
- 0-5 degrees downslope within the forest vegetation to the south of the development
- Level within the short heath vegetation to the north-west of the staff management cottage and 9 degrees upslope within the tall heath to the south-west of the cottage.

2.3 Bushfire Attack Assessment

A fire danger index (FDI) of 100 has been used to calculate bushfire behaviour on the site using forest and remnant vegetation located within the Greater Sydney region. Table 2.1, 2.2 & 2.3 below provides a summary of the bushfire attack assessment and the minimum required APZs in compliance with Appendix 2 *(PBP)* for the aged care facility buildings (SFPP) as well as the staff management cottage and 'other' buildings (i.e. office, storage, kitchen etc.).

Table 2.1 – Bushfire Attack Assessment – SFPP buildings

Aspect	Vegetation within 140m of development	Effective slope of land	APZ Required (metres)	APZ Provided (metres) (refer Note 1)	APZ on neighbouring lands
North	Proposed wildlife corridor (to be revegetated)	Level	30	75 (IPA)	Nil
North-west (building 1 & 2)	Tall Heath	5-10^{0D}	50	50 (IPA)	Nil
West (building 4)	Tall Heath	Level to upslope	45	45 (IPA)	Nil
North-east (building 5)	Forest	Level to upslope	60	110 (IPA)	Nil
South (portions of building 1,2 & 6 used for aged care)	Forest	0-5^{0D}	70	70 (50m IPA & 20m OPA)	20m within Barnes Road (refer Note 2)
South-east, east & west	Grassland / managed rural residential	0-5^{0d}	N/A	>100	Not required due to existing lawn management on adjacent urban lands

*Notes: * Slope is either 'U' meaning upslope or 'C' meaning cross slope or 'D' meaning downslope*

Note 1 – The allowable OPA portion within an APZ is determined by Table A2.7 of *PBP* p58.
Note 2 – The APZ extends within the adjoining lots to the south and south east. The ongoing management of this APZ (within Barnes Road Reserve) is to be assured through the provision of an 88b easement agreement as detailed within Section 3.3 of this report and as outlined in Councils condition of consent.

Table 2.2 – Bushfire Attack Assessment – staff management cottage

Aspect	Vegetation within 140m of development	Effective slope of land	APZ Required (based on BAL 29) (metres)	APZ Provided (metres) (refer Note 1)	Existing management on neighbouring lands
North & north-east	Proposed wildlife corridor (to be revegetated)	Level	11	>16 (IPA)	Nil
South & East	Managed Land	Level to upslope	N/A	>100 (IPA)	Nil
North-west	Short Heath	Level to upslope	9	16 (IPA)	10m within adjoining land consists of mown grass
South-west	Tall Heath	11^{0U}	10 (refer Note 1)	10 (IPA)	3-10m within adjoining land consists of mown grass

*Notes: * Slope is either 'U' meaning upslope or 'C' meaning cross slope or 'D' meaning downslope*

Note 1: Performance based assessment

A performance based assessment using Appendix B of *AS3959* was undertaken to determine the required APZ (equivalent to BAL 29 construction) based on tall heath vegetation on an upslope of 11° (determined to be the worst case scenario). The results of the assessment, provided within Appendix 2, were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting.*

Table 2.3 – Bushfire Attack Assessment – 'other' development'

Aspect	Vegetation within 140m of development	Effective slope of land	APZ Required (metres)	APZ Provided (metres) (refer Note 1)	APZ on neighbouring lands
North, North-west. west	Grassland / managed rural residential	0-5^{0d}	N/A	>100	Not required due to existing lawn management on adjacent urban lands
South (portions of building 1,2 & 6 used for 'other' uses)	Forest	0-5^{0D}	32	49 - 58 (50m IPA & 20m OPA)	20m within Barnes Road (refer Note 2)

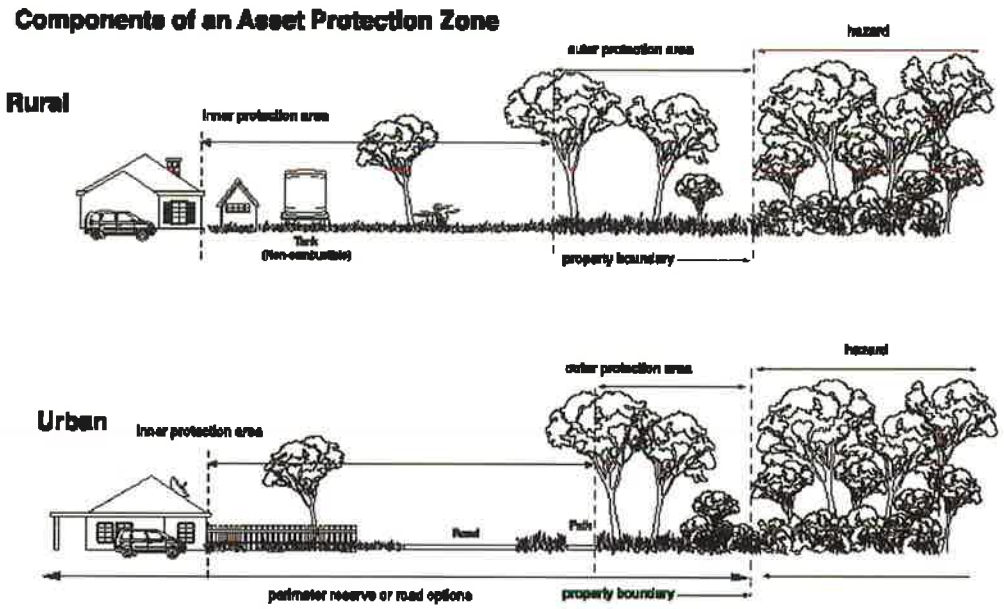
Note 1: Portions of buildings 1, 2 & 3 are located within the minimum 70m APZ required for 'aged care' use. The development design has been amended to ensure these portions of the building are not used for aged care or associated 'congregation' of people whom may be vulnerable to bushfire. The southern portion of Buildings 1, 2 & 6 will be used as a loading dock, storage / kitchen or administration. Buildings 1 & 6 are provided with a separation of between 50 & 57m and will therefore be constructed in accordance with BAL 19 standards.

Specific Protection Issues

3

3.1 Asset protection zones

APZs are areas of defendable space separating hazardous vegetation from buildings. The APZ generally consists of two subordinate areas, an *inner protection area* (IPA) and an *outer protection area* (OPA). The OPA is closest to the bush and the IPA is closest to the dwellings. The IPA cannot be used for habitable dwellings but can be used for all external non habitable structures such as pools, sheds, non-attached garages, cabanas, etc. A typical APZ and therefore defendable space is graphically represented below:



Source: RFS, 2006

Note: Vegetation management as shown is for illustrative purposes only. Specific advice is to be sought in regard to vegetation removal and retention from a qualified and experienced expert to ensure APZs comply with the RFS performance criteria.

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 10*kW/m*^{2} for SFPP developments and 29kW/m^2 for residential or 'other' development (i.e. staff management cottage, offices & retail).

These ratings assist in determining the size of the APZ in compliance with Appendix 2 of *PBP* to provide the necessary defendable space between hazardous vegetation and a building. Table 3.1 outlines the proposed aged care buildings compliance with the performance criteria for APZs, whilst Table 3.2 outlines the staff management cottage / other development compliance.

Table 3.1 – Performance Criteria for Asset Protection Zones (SFPP) (*PBP* guidelines pg. 19)

Performance Criteria as determined by RFS in PBP	Acceptable Solutions as required by RFS in PBP	Compliance or not
Radiant heat levels of greater than 10kW/m^2 will not be experience by occupants or emergency services workers entering or exiting a building.	An APZ is provided in accordance with the relevant tables and figures in Appendix 2 of *PBP*. Exits are located away from the hazard side of the building. The APZ is wholly within the boundaries of the development.	The APZs provided do comply and exceed the minimum requirements as outlined within Appendix 2 of *PBP* 2006. The APZs do extend over Barnes Road reserve in the south. The ongoing maintenance of the APZ within Barnes Road Reserve will be assured through an 88B easement agreement and a fuel management plan therefore complying with the performance criteria as outlined within Section 3.3 of this report.
Applicant demonstrates that issues relating to slope are addressed: maintenance is practical, soil stability is not compromised and the potential for crown fire is negated.	Mechanisms are in place to provide for the maintenance of the APZ over the life of the development. The APZ is not located on land with a slope exceeding 18 degrees.	Complies – The APZ consists of landscaped areas, roads and turf areas which require minimal maintenance. An 88B easement agreement and *fuel management plan* will ensure ongoing maintenance of APZ. As per Councils condition a positive covenant will also be applied over Barnes Road. The APZ does extend within a narrow area exhibiting a slope of 18–20^0. The majority of this area however consists of rocky escarpment interspersed with a low density of native woodland trees. The ongoing management of this area, in its current state, will therefore not pose a risk to soil stability and will comply with the standards of an APZ.
APZs are managed and maintained to prevent the spread of a fire towards the building.	In accordance with the requirements of *Standards for Asset Protection Zones* (RFS 2005).	Complies – Can be made a condition of consent.

Table 3.2 – Performance criteria for asset protection zones (Residential and 'other') (*PBP* guidelines pg. 19)

Performance criteria	Acceptable solutions	Complies
Radiant heat levels at any point on a proposed building will not exceed 29kW/m^2	APZs are provided in accordance with Appendix 2 APZs are wholly within the boundary of the development site	Yes – A performance based assessment has been undertaken for the Managers Residence (refer Table 2.2 & Appendix 2) and APZs provided allow for a BAL rating of 29. The 10 – 16 metre separation is provided via the existing grassland vegetation on the adjoining land (refer photo 7).
APZs are managed and maintained to prevent the spread of fire towards the building	In accordance with the requirements of *Standards for Asset Protection Zones* (RFS 2005)	Yes – can be made a condition of consent
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is negated	The APZ is located on lands with a slope of less than 18°	Yes. APZs are located on slopes less than 18°

Photo 7 – Existing grassland vegetation providing separation between the dwelling and the tall heath / short heath vegetation.

3.2 Building protection

The construction of buildings in bushfire-prone areas is subject to stringent rules pertinent to the building envelope being located on the non-hazardous side of the APZ. The role of the APZ is to provide a safe space to separate the hazard from the building.

The NSW RFS have released an interim amendment to *PBP* in the form of Appendix 3. This amendment follows the adoption on 1 May 2010 of AS3959 – *Construction of buildings in bushfire-prone areas* (2009) through the *Building Code of Australia (BCA)* 2010. This appendix, in conjunction with Table 2.4.2 of AS3959 (2009), is used to determine construction considerations when building on bushfire prone land.

The construction classification system is based on six (6) bushfire attack levels (BAL). These are BAL – Flame Zone (FZ), BAL 40, BAL 29, BAL 19, BAL 12.5 and BAL LOW. The lowest level, BAL 12.5, has the longest APZ distance while BAL – FZ has the shortest APZ distance. These allow for varying levels of building design and use of appropriate materials.

The proposed aged care buildings (Buildings 2, 3, 4, 5) should comply with BAL 12.5 building construction standards.

Buildings 1 & 6 will be constructed to comply with BAL 19 building construction standards.

Note: There is no BAL 10 in AS3959.

3.2.1 Existing building – staff management cottage

The manager's residence is to be upgraded to improve ember protection as follows:

- Where a circular probe of 3mm diameter is capable of being passed through external vents, weepholes or gaps, the vents, weepholes and gaps shall be screened with a mesh with a maximum aperture of 2mm, made of corrosion resistant steel, bronze or aluminium.

- Gaps between doors and the door jams, heads or sills shall be protected by draught excluders.

- All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt jointed to prevent gaps greater than 3mm.

- All doors and the openable portions of all windows are to be screened internally or externally with screens that that have a mesh or perforated sheet with a maximum aperture of 2mm, made of corrosion resistant steel, bronze or aluminium. Gaps between the perimeter of the screen assembly and the building element to which it is fitted shall not exceed 3mm.

- Roof ventilation openings, such as gable and roof vents (where applicable), shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2mm, made of corrosion resistant steel, bronze or aluminium.

- Gutter and valley leaf guards are to be installed are shall be non-combustible.

3.3 Hazard management

The owner or occupier of the property will be required to manage the APZ in accordance with RFS guidelines *Standards for Asset Protection Zones* (RFS, 2005) with landscaping design to comply with Appendix 5 of *PBP*. In terms of implementing and / or maintaining APZs there is no physical reason that could constrain hazard management from being successfully carried out by normal means (e.g. mowing / slashing / grazing). A summary of the guidelines for managing APZs are attached as Appendix 1 to this report.

The APZs occur within the property as well as

- Barnes Road Reserve – as per council conditions

An 88b easement agreement is not required for Lot 80 DP 846099 to the immediate west, due to the well managed grassed lawn on those lands.

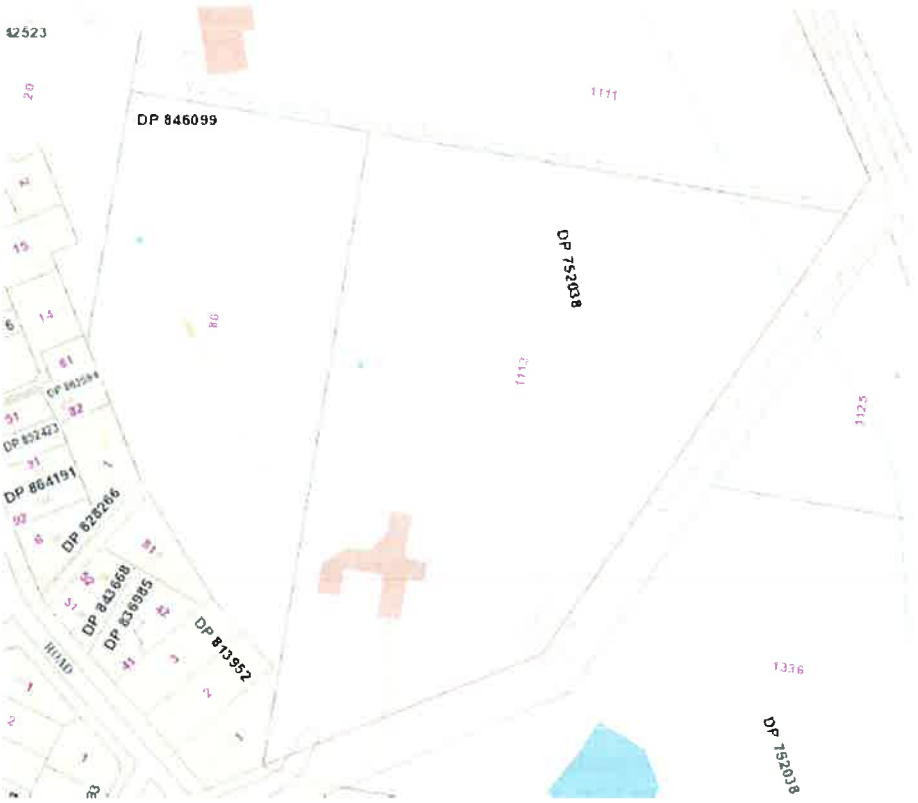


Figure 3.1 – Cadastral plan of adjoining allotments

A landscaping plan has been prepared for the site by *John Chetham & Associates*. A review of this plan has been undertaken and *TBE* can confirm that it complies with Appendix 5 of *Planning for Bushfire Protection 2006* and the guideline *Standards for Asset Protection Zones*.

3.4 Access for fire fighting operations

The primary access route to the development will utilise the existing driveway access to the south of buildings 1 & 2 via an extension from the public Barnes Road in the south west – refer Schedule 1 attached.

The proposed public portion of the road is 6 metres in width until the road turns west (adjacent Building 5) where the width reduces to 5.5 metres. The northern portion of the road will be used as a service road only to provide access to the staff management cottage. The proposed turning circle at the northern road extent is 4 metres in width and provides a minimum 12m outer radius turning circle.

The *intent of measures* required by the RFS for internal roads is "*to provide safe operational access for emergency services personnel in suppressing a bush fire, while residents are accessing or egressing an area*".

Table 3.2 below outlines the proposals compliance with the performance criteria for public roads.

Table 3.3 – Performance Criteria for Internal Roads (*PBP* guidelines pg. 35)

Performance Criteria as determined by PBP	Acceptable Solutions required by RFS PBP	Compliance or not
Internal road widths and design enable safe access for emergency services and allow crews to work with equipment about the vehicle.	Internal roads are two-wheel drive, sealed, all weather roads.	Complies.
	Internal perimeter roads are provided with at least two traffic lane widths (carriageway 8m minimum kerb to kerb) and shoulders on each side, allowing traffic to pass in opposite directions.	There are no perimeter roads proposed for the development as previously approved by the NSW RFS. However the existing unformed road 'Barnes Road' provides unsealed secondary access from Oxford Falls Road in the north-east and runs parallel to the sites eastern boundary. Public access (including the existing driveway) will be upgraded to provide a 6 m wide road to enable safe access for emergency services in compliance with the performance criteria.
	Roads are through roads. Dead end roads are not more than 100m in length from a through road, incorporate a minimum 12m outer radius turning circle, and are clearly sign posted as a dead end.	Complies
	Traffic management devices are constructed to facilitate access by emergency services vehicles.	Complies.
	A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	Complies.

Performance Criteria as determined by PBP	Acceptable Solutions required by RFS PBP	Compliance or not
	Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress.	Complies.
	The minimum distance between inner and outer curves is 6m.	Complies.
	Maximum grades do not exceed 15 degrees and average grades are not more than 10 degrees.	Complies.
	Cross fall of the pavement is not more than 10 degrees.	Complies.
	Roads do not traverse through a wetland or other land potentially subject to periodic inundation (other than storm surge).	Complies.
	Roads are clearly sign posted and bridges clearly indicate load ratings.	Complies.
	The internal road surfaces and bridges have a capacity to carry fully-loaded firefighting vehicles (15 tonnes).	Complies.

3.5 Water supplies

Town reticulated water supply is available to the proposed development in the form of an underground reticulated water system.

Table 3.4 outlines the proposals compliance with the performance criteria for reticulated water supply.

Table 3.4 – Performance Criteria for Reticulated Water Supplies (*PBP* guidelines pg. 37)

Performance criteria	Acceptable Solutions	Complies
Water supplies are easily accessible and located at regular intervals	Access points for reticulated water supply to SFPP developments incorporate a ring main system for all internal roads. Fire hydrant spacing, sizing and pressures comply with AS2419.1 - 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority, once development has been completed. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. The provisions of public roads in Section 4.1.3 of PBP in relation to parking are met.	Complies - can be made a condition of consent.

3.6 Gas

Table 3.5 outlines the required performance criteria for the proposals gas supply.

Table 3.5 – Performance Criteria for Gas Supplies (*PBP* guidelines pg. 37)

Performance criteria	Acceptable Solutions	Complies
Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings	Reticulated or bottled gas bottles are to be installed and maintained in accordance with AS 1596 – 2002 and the requirements of relevant authorities. Metal piping is to be used. All fixed gas cylinders are to be kept clear of flammable materials and located on the non-hazard side of the development. If gas cylinders are to be kept close to the building the release valves must be directed away from the building and away from any combustible material, so that they do not act as a catalyst to combustion. . Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used	Complies - can be made a condition of consent.

3.7 Emergency and evacuation planning

Table 3.6 outlines the required performance criteria for the proposals emergency procedures

Table 3.6 – Performance Criteria for Emergency and Evacuation Planning (*PBP* guidelines pg.39)

Performance criteria	Acceptable Solutions	Complies
An Emergency and Evacuation Management Plan is approved by the relevant fire authority for the area.	An emergency / evacuation plan is prepared consistent with the RFS Guidelines for the Preparation of Emergency / Evacuation Plan. *Note: The applicant should provide a copy of the above document to the local Bush Fire Management Committee for their information prior to the occupation of any accommodation of a SFPP.*	Complies - can be made a condition of consent.
Suitable management arrangements are established for consultation and implementation of the emergency and evacuation plan.	An Emergency Planning Committee is established to consult with staff in developing and implementing and Emergency Procedures Manual. Detailed plans of all Emergency Assembly Areas including on site and off site arrangements as stated within AS3745 are clearly displayed, and an annual trial emergency evacuation is conducted.	Complies - can be made a condition of consent.

Conclusion & Recommendations 4

4.1 Conclusion

This addendum bushfire protection assessment has been undertaken for the proposed expansion of the recently approved (2013) low care seniors living facility at Barnes Road, Frenchs Forest.

This addendum report has been prepared based on a revised development layout, due to the removal of a portion (variable width) APZ which was previously approved in the adjoining Lot 1336 DP 752038 in the south. The revised proposal maintains the 70m APZ (within the development site and adjoining Barnes Road Reserve) to all buildings used for aged care (accommodation / gym / pool area). Buildings for non-aged care use (i.e. storage, administration, loading dock etc.) have been provided with a smaller APZ, in compliance with PBP.

The assessment found that bushfire can potentially affect the proposed development from the existing tall heath / short heath vegetation located to the north west and the forest vegetation associated with the creek line in the north-east and within the adjoining residential land to the south resulting in possible ember and radiant heat attack.

The bushfire risk posed to the development can however be effectively mitigated if appropriate bushfire protection measures are put in place and managed in perpetuity.

The assessment has concluded that the proposed development will provide compliance with *PBP* through;

- The application of APZs in accordance with *PBP*, with the provision of an 88b easement agreement within Barnes Road reserve (Lot 1113 in DP 752038) as per Council condition.
- On site safety through the implementation of an emergency incident and evacuation plan in accordance with the NSW Rural Fire Service evacuation planning guidelines.
- Compliance with the access provisions of *PBP*.

The following recommendations are provided to ensure that the development is in accord or greater than the requirements of *PBP*.

4.2 Recommendations

Recommendation 1 - The development is as generally indicated on the attached Schedule 1 – Plan of Bushfire Protection Measures.

Recommendation 2 - APZs are to be provided to the proposed development. APZs are to be measured from the exposed wall of the aged care facility toward the hazardous

vegetation. The APZs shall be as nominated in Table 2.1, 2.2 & 2.3 and also as generally depicted in Schedule 1.

Recommendation 3 - The landscape plan is to ensure compliance with Appendix 5 of *PBP*. A summary of the guidelines for managing APZs are attached as Appendix 1 to this report and are summarised below:

- *Mowing of grass*: Grass needs to be kept short (approximately 5cm in height) and green where adequate water supplies are available.

- *Raking or manual removal of fine fuels*: Ground fuels such as fallen leaves, twigs (less than 6mm in diameter) and bark should be removed on a regular basis. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

- *Removal or pruning of trees, shrubs and understorey*: The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by 2-5m. A canopy is not to overhang a dwelling unless specifically approved by the RFS. Native trees and shrubs should be retained as clumps in landscape beds and should not exceed a covering of more than 20% of the IPA.

- Trees or tall shrubs may require pruning upon building completion in line with *PBP*. Notwithstanding this, the presence of shrubs and trees close to a building in a bushfire prone landscape requires specific attention to day-to-day management and owners and / or occupiers should be made aware that whilst landscaping can contribute to a way of life and environmental amenity, the accumulated fuels must be regularly removed.

- Trees may remain within close proximity of a building where it can be demonstrated that the tree is not able to produce a build-up of fuel on the roof of a dwelling due to:

    1. A roof pitch which self sheds leaf litter
    2. Ongoing roof maintenance by staff or contractors
    3. Adequate ember protection has been installed

- Trees that are likely to be structurally unstable such that they could cause a limb to fall would require removal for the RFS to agree to a dwelling in proximity to the trees.

In addition, the following general APZ planning advice is to be followed:

- Ensure that vegetation does not provide a continuous ignition path to the building.

- Plant or clear vegetation into clumps rather than continuous rows.

- Prune low branches 2m from the ground to prevent a ground fire from spreading into trees.

- Locate vegetation far enough away from the proposed building so that plants will not ignite the dwelling by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non-flammable ground cover such as pebbles and crushed tiles.

- The following RFS diagram depicts one version of an ideal situation. Divergence from this ideal should not be undertaken without expert advice.

Recommendation 4 - The proposed buildings and refurbishments to the managers residence are to comply with BAL 12.5 (Buildings 2, 3, 4 & 5) and BAL 19 (Buildings 1 & 6) Australian Standard AS3959 *Construction of buildings in bushfire prone areas (2009;)* with additional construction requirements as listed within Section A3.7 of Addendum Appendix 3 *(Planning for Bush Fire Protection, 2006).*

To improve the bushfire protection measures offered to the managers residence the following measures are to be implemented into the building design to protect the building from ember attack.

- Where a circular probe of 3mm diameter is capable of being passed through external vents, weepholes or gaps, the vents, weepholes and gaps shall be screened with a mesh with a maximum aperture of 2mm, made of corrosion resistant steel, bronze or aluminium.

- To determine the maximum aperture size of screening material, it shall not be possible to pass a circular probe of 2mm diameter through the aperture.

- Gaps between doors and the door jambs, heads or sills shall be protected by draught excluders.

- All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt jointed to prevent gaps greater than 3mm.

- All doors and the openable portions of all windows are to be screened internally or externally with screens that that have a mesh or perforated sheet with a maximum aperture of 2mm, made of corrosion-resistant steel, bronze or aluminium. Gaps between the perimeter of the screen assembly and the building element to which it is fitted shall not exceed 3mm.

- Roof ventilation openings, such as gable and roof vents (where applicable), shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2mm, made of corrosion-resistant steel, bronze or aluminium.

- Gutter and valley leaf guards are to be installed and shall be non-combustible.

Recommendation 5 – Access, water, electricity and gas supply is to comply with Section 4.2.7 of *PBP*. The internal road access is to be upgraded to 6 m in width.

Recommendation 6 – The emergency / evacuation plan is to be prepared for the new proposal and is to be consistent with the RFS *Guidelines for the Preparation of Emergency / Evacuation Plan.*

Recommendation 7 - The landowner / manager is to be made aware of their liability to manage the development lands for the ongoing protection of themselves and their neighbours (refer Section 63(2) *RF Act*)

Recommendation 8 - Landowners living in bushfire prone areas should familiarise themselves with publications published by the RFS. These are located on the RFS web site www.rfs.nsw.gov.au under 'Publications'.

REFERENCES

Australian Building Codes Board (2010) – *Building Code of Australia*, Class 1 and Class 10 Buildings Housing Provisions Volume 2.

Chan, K.W. (2001) – *The suitability of the use of various treated timbers for building constructions in bushfire prone areas*. Warrington Fire Research.

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Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.

Rural Fire Service (2006) - *Planning for bushfire protection – a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service.

Rural Fire Service (2006) - Bushfire Attack Software on RFS Web site.

Tan, B., Midgley, S., Douglas, G. and Short (2004) - *A methodology for assessing bushfire attack.* RFS Development Control Service.

Plan of Bushfire Protection Measures

S1

Legend

- Subject site
- Lot boundary (Lot 2873 DP 824283)
- Proposed building envelope (SFPP)
- Proposed building envelope (other uses)
- Access road and carpark
- Stormwater basin
- Metal barn
- Stair management cottage
- 30m wildlife corridor (for restoration)
- Core Riparian Zone (10m)
- Managed Vegetated Buffer (10m)
- Proposed canopy planting (Zone 4 & Zone 8)

Asset Protection Zone (APZ)

- Inner Protection Area
- Outer Protection Area

Travers bushfire & ecology

Barnes Road, Frenchs Forest A14054_BF004	16/04/2015 Issue 1	1:1,000 @ A3 GDA 1994 MGA Zone 56

0 20 40 m

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

Schedule 1 - Bushfire Protection Measures

Management of Asset Protection Zones

A1

The NSW Rural Fire Service (RFS) advises that when living in a bushfire prone environment APZs are required to be provided between hazardous fuels and a dwelling.

The RFS provide basic advice in respect of managing APZs in several documents namely, *Planning for bush fire protection 2006 (PBP)* and *Standards for Asset Protection Zones* (undated but circa 2006).

APZs provide a level of defendable space between the hazard and a habitable dwelling or similar structure. These zones are usually shown on plans adjacent to either cultural or natural assets (e.g. dwelling). They act to significantly lessen the impact of intense fire. 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.

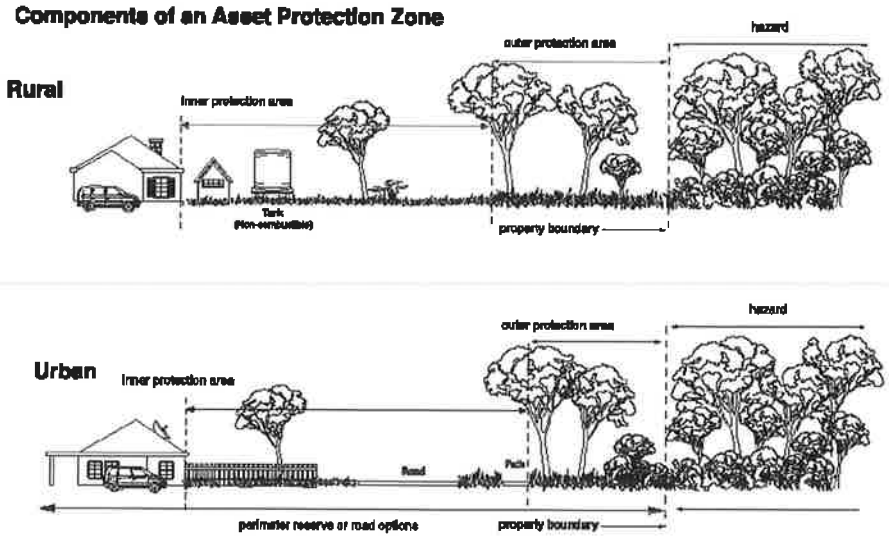
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

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	0-200mm	Litter layer (leaves & twigs)
Aerial fuels	200 – 3,000mm	Shrubs and grasses
Canopy fuels	>3,000mm	Tree canopy

The APZ can be further classified into two sub-zones with each having a specific role. These sub-zone areas are called the inner protection area (IPA) and the outer protection area (OPA) – see figure below.

The IPA is managed as a fuel free zone while the OPA is managed as a fuel reduced zone. This means that the fuel free zone has little fuel available to be consumed in the event of a fire whilst the fuel reduced zones has less than normal fuel levels that could be consumed in the event of a fire.



Inner Protection Area (IPA)

This area is *almost free* of all fuels and usually takes the form of grassy areas, car parks, roads, concrete areas, tracks or trails. It does not imply or require the wholesale removal of every tree and or shrub.

This zone is intended to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fuel. This area also allows airborne embers to fall safely without igniting further outbreaks.

This zone also provides a safe fire fighting position and is operationally important for implementation of clear fire control lines.

Grasses may occur within an IPA if they are generally no higher than 50-75mm. Above this height, fuel weights tend to increase exponentially and consequentially cause greater flame heights and therefore fire intensity

Shrubs may occur within an IPA in the form of clumping amidst open grassy areas. The design of the clumping will be dependent on species selection and spatial density. For example, the larger the shrubs the less clumping may occur in a given area.

As a general rule, trees are allowed within an IPA but only where those trees are at least 5m away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0 – 4 t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example an area of 100m^2 (10mx10m) can have up to 20% of this area composed of shrubs.

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 IPA if the canopy does not form a link with shrubs. The reason is to reduce 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 20m in height the canopy is separated from the land surface by some distance. In an 'open woodland' the low canopy height (usually <5m) 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 APZs. It is for this reason that vegetation such as Forest Oaks are usually excluded from an IPA.

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 IPA 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 an IPA 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 5m	No trees	No trees
Between 5-10m	One tree per 100m^2	2 trees per 100m^2
Between 10-20m	<10 tree per 400m^2.	<10 trees per 400m^2

Outer Protection Area (OPA)

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

The OPA assumes all trees will remain but with either a modified shrub / grass layer or regular removal of the litter layer. In some sparse vegetation communities the shrub layer may not require modification.

The fire fighting advantage will manifest in 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.

In most cases the removal of 85% of the litter layer will achieve a satisfactory OPA. A recommended performance standard for the fuel load of an OPA is between 4-6 t/ha.

Managing the APZ

Fuel management within the APZs should be maintained by regular maintenance such as:

- Mowing grasses regularly - Grass needs to be kept short and, where possible, green.

- Raking or manual removal of fine fuels - Ground fuels such as fallen leaves, twigs (less than 6mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

- Removal or pruning of trees, shrubs and understorey - The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by 2-5m. A canopy should not overhang within 2-5m of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.

- Tree or tall shrubs may require pruning upon dwelling completion in line with *PBP*. Notwithstanding this, the presence of shrubs and trees close to a dwelling in a bushfire prone landscape requires specific attention to day to day management and owners and or occupier should be made aware that whilst landscaping can contribute to a way of life and environmental amenity the accumulated.

In addition, the following general APZ planning advice should be followed.

- Ensure that vegetation does not provide a continuous path to the house.

- Plant or clear vegetation into clumps rather than continuous rows.

- Prune low branches 2m from the ground to prevent a ground fire from spreading into trees.

- Locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non flammable ground cover such as pebbles and crush tile; and

- The following RFS illustrative diagram depicts one version of an ideal situation. Specific advice is to be sought from qualified experts to ensure that the implemented APZs meet the *performance criteria* of APZs.

Performance based assessment

A2

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 11/07/2014 **Assessment Date:** 8/07/2014

Site Street Address: Barnes Road, Frenchs Forest

Assessor: Nicole Van Dorst; Travers Bushfire and Ecology

Local Government Area: Warringah **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: West - managers residence

Vegetation Information

Vegetation Type:	Scrub/Tall Heath	**Vegetation Group:**	Shrub & Heath
Vegetation Slope:	11 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	25	**Overall Fuel Load(t/ha):**	25

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Upslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	10

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100

Program Outputs

Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	9.75
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	25193
Radiant Heat(kW/m2):	27.08	**Flame Angle (degrees):**	66
Flame Length(m):	8.2	**Maximum View Factor:**	0.409
Rate Of Spread (km/h):	1.95	**Inner Protection Area(m):**	10
Transmissivity:	0.87	**Outer Protection Area(m):**	0