Building Code & Bushfire Hazard Solutions

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Certified Business
Bushfire Planning & Design
BPD-BA-02354

Mirvac
C/- GLN Planning
GPO Box 5013
SYDNEY NSW 2001

3rd March 2016
Our Ref. 140990

Re: PLANNING PROPOSAL
LOT 61 DP 737386 / 55 COONARA AVENUE, WEST PENNANT HILLS NSW 2125
BUSHFIRE SITE COMPATIBILITIES ASSESSMENT

We thank you for allowing us to provide a bushfire site compatibility assessment for the above site.

The purpose of this report is to outline the required bushfire mitigation measures that would be applicable for a future residential development at 55 Coonara Avenue, West Pennant Hills.

The Planning Proposal seeks to establish a new residential use for the subject site. The land is proposed to be rezoned to R4 High Density Residential and RE1 Public Recreation.

This report will also address the broader strategic level bushfire safety considerations assessed for planning proposals. It is understood that the proposal ultimately is to construct multi storey residential apartment buildings and associated infrastructure within the subject site.

The subject property currently contains an operating commercial development.

Image 01: Extract from street-directory.com.au

NB: Update needed prior to public exhbition

Properties considered to be affected by possible bushfire impact are determined from the local Bushfire Prone Land Map as prepared by Council and / or the Rural Fire Service. All property development within affected areas is subject to the conditions detailed in the document '*Planning for Bush Fire Protection 2006*' (PBP).

Set back distances for the purpose of creating Asset Protection Zones (APZ) and building provisions under Australian Standard 3959 'Construction of buildings in bushfire-prone areas' 2009 must be applied to development within bushfire prone areas.

Bushfire prone areas are defined as those areas;

- Containing or being within 100 metres of designated Category 1 Vegetation; or
- Containing or being within 30 metres of designated Category 2 Vegetation.

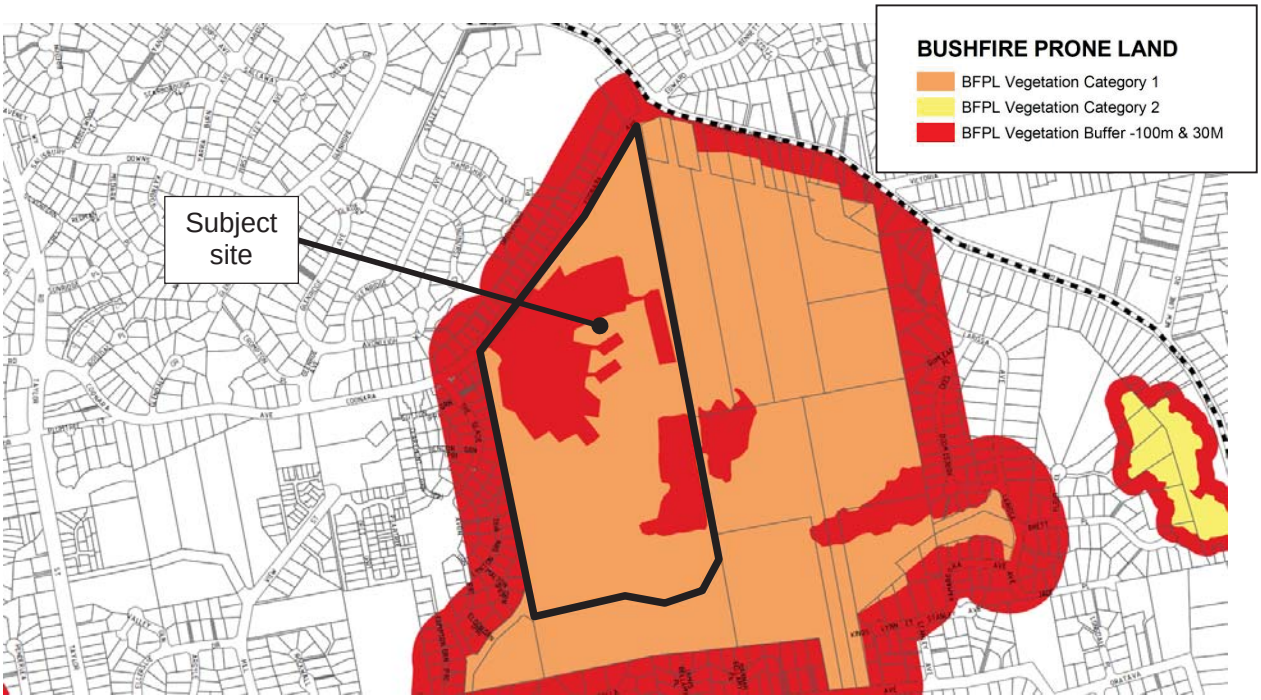

Image 02: Excerpt from The Hills Council's Bushfire Prone Land Map

In this instance the subject site is depicted on The Hills Council's Bushfire Prone Land Map as containing designated Category 1 Vegetation and its associated 100 metre buffer zone. The application of *Planning for Bush Fire Protection* 2006 and Australian Standard 3959 – 2009 is therefore triggered. As the subject site is considered 'bushfire prone' referral to the NSW Rural Fire Service is triggered for both the planning proposal and any future development application.

In relation to the planning proposal the Minister for Planning under section 117(2) of the *Environmental Planning and Assessment Act 1979* issues directions that the relevant planning authorities must follow when preparing proposals for new Local Environmental Plans. Direction 4.4 Planning for Bush Fire Protection identifies matters for consideration for a planning proposal that will affect or are in proximity to land mapped as bushfire prone.

In this regard consideration must be given to limiting or excluding incompatible development in bushfire affected areas commensurate with the level of risk. A key principle to ensure this is that future development is designed and sited capable of complying with Planning for Bush Fire Protection.

The NSW Rural Fire Service also encourages the application of zones that limit or exclude incompatible development in bush fire affected areas where:

- development is likely to be difficult to evacuate during a bush fire,
- development is likely to create control difficulties during a bush fire,
- development will adversely affect other bush fire protection strategies or place existing development at increased risk,
- development is likely to result in a substantially increased requirement for government spending on bush fire mitigation measures, infrastructure or services,
- environmental constraints to the site cannot be overcome,
- required bush fire protection measures would incur significant environmental costs.

We provide the following assessment in consideration of the above and Planning for Bush Fire Protection 2006 to highlight the suitability of the site for high rise apartment buildings, and the relevant bushfire protection measures.

Vegetation:

The vegetation posing a hazard to the proposed future development is located within the adjacent Cumberland State Forest and the subject property itself.

An investigation has been undertaken by Keystone Ecological in relation to identifying core riparian zones and retained / protected vegetation within the subject property. This initial investigation concluded that there is a first order stream in the centre of the site which will attract a 20 metre wide core riparian zone plus the channel width. The riparian zone is required to be fully structured forest habitat.

It was also identified that the subject property contains Sydney Turpentine Ironbark Forest (listed Endangered Ecological Community under the NSW TSC Act and Critically Endangered Ecological Community under the Commonwealth EPBC Act) and / or Blue Gum High Forest (listed as a Critically Endangered Ecological Community under both acts). The result of this ecological analysis is that the vegetation within the majority of the southern half and a small pocket to the north of the subject property must be retained and protected.

The Cumberland State Forest (CSF) is located to the east and south of the subject site and contains 40 hectares of native forest. A review of the Forestry Corporation website and a subsequent discussion with a representative from the Forestry Corporation found the following:

- Normal gate opening times are 8.30am - 5.00pm, except during daylight saving times where they are open 8.30am - 6.00pm;
- The CSF contains an independently-run nursery and café, with a high ropes course due to open soon;
- The CSF is dissected by various sealed roads, unsealed fire trails and walking tracks;
- There are 80 staff onsite;
- There are 6 firefighters onsite, with an additional 24 available at an as need basis. We were advised that additional staff would be requested to ‘stand up’ on high fire danger days;
- There is a Category 1 and a Category 9 fire appliance onsite;
- The site is subject to a comprehensive Bushfire Management Plan and Prescribed Burns Plan;
- There are no recorded significant wildfires within the CSF;
- The firefighters within CSF will respond to adjacent properties as necessary;
- The Forestry Corporation of NSW is one of four firefighting authorities in New South Wales.

In accordance with Planning for Bush Fire Protection 2006 (PBP) the vegetation posing a hazard was determined to be Forest. Where the width of the riparian corridor within the subject site does not exceed 40 metres it has been assessed as a 'riparian area' in accordance with PBP and a Rainforest structure used to determine the minimum required Asset Protection Zones.

It should be noted that the extent of the Asset Protection Zones within the subject property have been limited to existing disturbed areas within the subject site. This means maintenance of Asset Protection Zones does not need to occur within the retained bushland or riparian corridor.

There are two 'managed areas' within the subject site, the first being located along the western boundary and the second being located around the existing dam between the two existing carparks adjacent the eastern boundary (see attached APZ overlay).

These 'managed areas' are to be managed to satisfy the dual objectives of bushfire hazard management and conservation and will be subject to a comprehensive Vegetation Management Plan.

Slope:

The slope that would most significantly affect bushfire behaviour must be assessed for at least 100 metres from the available building footprints.

In accordance with the assessment methodology detailed within Planning for Bush Fire Protection 2006, the most significant bushfire impact from within the hazard to the west is expected to be a bushfire burning directly up slope toward the subject site.

The slope that would **most significantly** influence bushfire impact was determined to be:

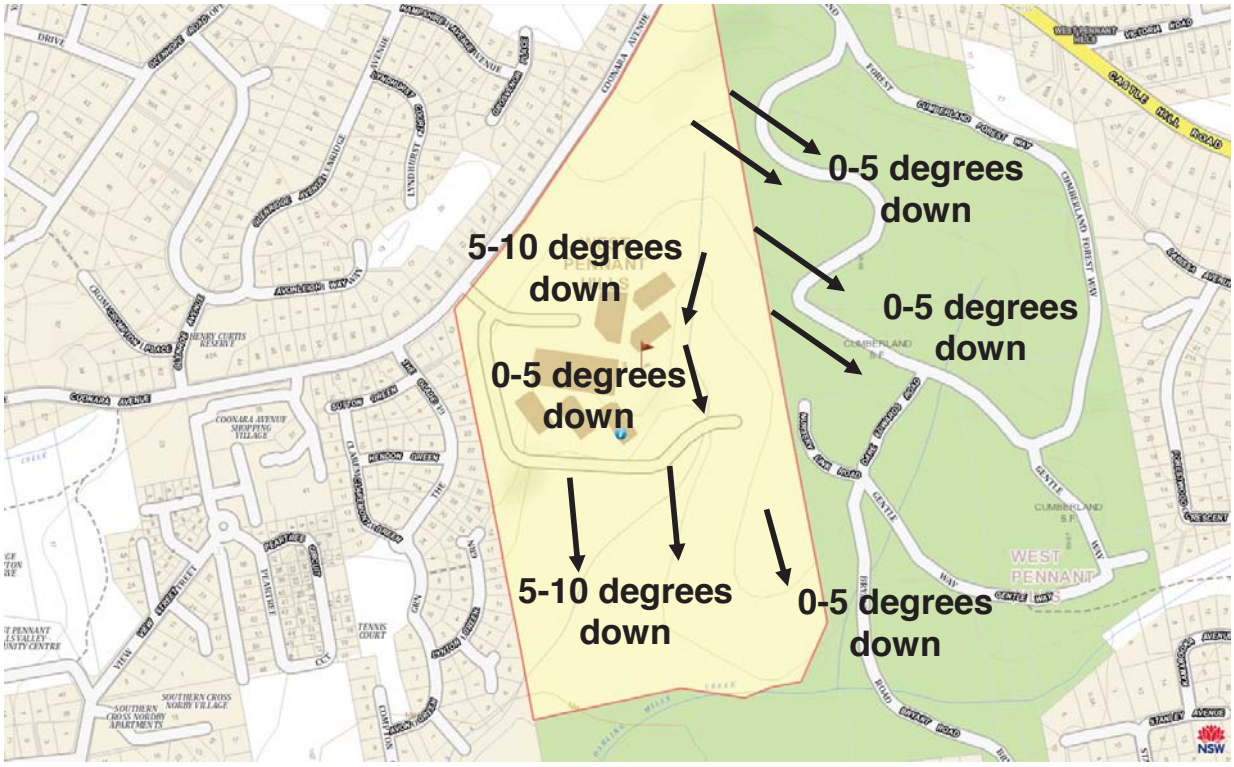

Image 03: Topographic image of the subject area from the Dept. of Lands SixMaps database

Asset Protection Zone:

Asset Protection Zones for new residential development are determined from Table A2.4 of PBP or bushfire design modelling achieving a radiant heat impact of no more than 29kW/m^2 at the closest point of the available building footprint.

Planning for Bush Fire Protection 2006 is currently under review and it is understood that as part of this review the Asset Protection Zones detailed in Appendix 2 may be revised to correspond with Australian Standard 3959 'Construction of buildings in bushfire-prone areas' 2009.

The minimum required Asset Protection Zones (APZs) were therefore determined from Table 2.4.2 of AS3959 - 2009 and have been depicted on the attached Overlay. These Asset Protection Zones are for residential development only, not childcare or any other Special Fire Protection Purpose development.

Where possible it is recommended that a perimeter road be located within the Asset Protection Zone adjacent the hazard interface. Non-habitable structures are permitted within the APZs, these include car parking, swimming pools, tennis courts and the like.

As noted earlier the extent of the Asset Protection Zones within the subject property has been limited to existing disturbed areas within the subject site.

Grounds Management Plan:

A fuel management plan for the Asset Protection Zones would be recommended as part of any future Development Application. This plan will be required to address

- Contact person / department and details
- Schedule and description of works for establishing and continued maintenance of the Asset Protection Zones
- Management strategies and description of works for landscaped areas within the site

As noted earlier the extent of the Asset Protection Zones within the subject property has been limited to existing disturbed areas within the subject site.

Water Supply:

Any future residential development must comply with the water supply requirements detailed in section 4.1.3 of Planning for Bush Fire Protection 2006. These requirements can be achieved in two ways, being:

- Fire hydrants with the sizing, spacing and pressures complying with AS2419.1-2005

  or

- The provision of a 20,000 litre static water supply (e.g. tank) per apartment building.

Access:

The subject property has street frontage to Coonara Avenue to the northwest. Vehicle access to the bushfire hazards is currently available via Coonara Avenue and the existing internal road network within the subject property or via Castle Hill Road and the existing internal road network within Cumberland State Forest for hazard reduction and fire suppression activities.

Planning for Bush Fire Protection addresses design considerations for internal roads for properties determined to be bushfire prone. Any future internal road must satisfy the requirements for 'Public Roads' as detailed in section 4.1.3(1) of PBP, in particular:

- Public roads are two-wheel drive, all weather roads.
- Urban perimeter roads are two-way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb), allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 4.1 – Road widths for Category 1 Tanker (medium Rigid Vehicle).
- The perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas.
- Traffic management devices are constructed to facilitate access by emergency services vehicles.
- Public roads have a cross fall not exceeding 3 degrees.
- All roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end and direct traffic away from the hazard.
- Curves of roads (other than perimeter roads) are a minimum inner radius of six metres and minimal in number, to allow for rapid access and egress.
- The minimum distance between inner and outer curves is six metres.
- Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient.
- There is a minimum vertical clearance to a height of four metres above the road at all times.
- The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 15 tonnes for areas with reticulated water, 28 tonnes or 9 tonnes per axle for all other areas). Bridges clearly indicate load rating.
- Public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression.
- Public roads between 6.5 metres and 8 metres wide are No Parking on one side with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression.
- Public roads up to 6.5 metres wide provide parking within parking bays and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression.
- One way only public access roads are no less than 3.5 metres wide and provide parking within parking bays and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression.
- Parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within the parking bays.
- Public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of the road.

Image 05: 'Table 4.1 – Road widths for Category 1 Tanker' from PBP 2006

Curve radius (inside edge) (metres)	Swept Path (metres width)	Single lane (metres width)	Two way (metres width)
<40	3.5	4.5	8.0
40-69	3.0	3.9	7.5
70-100	2.7	3.6	6.9
>100	2.5	3.5	6.5

The main points of consideration above are that perimeter roads (8m carriageway) are the preferred design option with internal roads having a minimum carriageway of 6.5m for two-way and 3.5m for one-way roads. We have reviewed the attached masterplan and are satisfied that compliance with these requirements is achievable.

The NSW Rural Fire Service encourages the application of zones that limit or exclude incompatible development in bush fire affected areas where development is likely to be difficult to evacuate during a bush fire. We have undertaken a desktop analysis of the existing public road infrastructure in this locality in consideration of the bushfire threat to the subject property.

We have reviewed the attached masterplan and are of the opinion that the proposal, in combination with the bushfire protection measures discussed, is suitable.

Construction:

The provision of the minimum required Asset Protection Zone (no closer) would result in a Bushfire Attack Level of BAL 29 under Australian Standard 3959 'Construction of buildings in bushfire-prone areas' 2009.

Further downgrades in the required construction level can be applied where the setbacks to the bushfire hazards are increased.

Services:

Planning for Bush Fire Protection also addresses the installation of services (i.e. electricity and gas) within bushfire prone areas. The following are the requirements for the relevant services.

Electricity:

- Where practicable, electrical transmission lines are underground.
- Where overhead electrical transmission lines are proposed:

  - lines are installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas; and

  - no part of a tree is closer to a power line than the distance set out in accordance with the specifications in 'Vegetation Safety Clearances' issued by Energy Australia (NS179, April 2002).

Gas:

- Reticulated or bottled gas is installed and maintained in accordance with AS 1596 and the requirements of relevant authorities. Metal piping is to be used.
- All fixed gas cylinders are kept clear of all flammable materials to a distance of 10 metres and shielded on the hazard side of the installation.
- If gas cylinders need to be kept close to the building, the release valves are directed away from the building and at least 2 metres away from any combustible material, so that they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal.
- Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not used.

It is noted that electricity transmission lines on the site would be underground as part of any redevelopment of the site.

Bushfire Evacuation Plan:

After development occurs an emergency/evacuation plan will be required to be prepared. This plan must be prepared consistent with the NSW Rural Fire Service document Guidelines for the Preparation of Emergency/Evacuation Plan which should include the following:

1) under what circumstances will the development be evacuated;
2) where will occupants be evacuated to;
3) roles and responsibilities of persons co-ordinating the evacuation;
4) roles and responsibilities of persons remaining with the development after evacuation; and
5) a procedure to contact the NSW Rural Fire Service District Office / Fire & Rescue NSW and inform them of the evacuation and where they will be evacuated to

RFS Practice Note 2/12 'Planning instruments and Policies':

Consideration has also been given to the NSW Rural Fire Service Practice Note 2/12 'Planning Instruments and Policies', specifically in relation to high-rise development within bushfire prone land detailed within Appendix 1.

This document details additional points of consideration when assessing high-rise development within bushfire prone areas. The following table lists the additional consideration points and our comment of the proposals ability to address them.

Consideration	Comment
Location – high-rise buildings should not be located along ridges or along slopes with significant fire runs;	The proposed buildings are not located on a ridge, being located further down within the site.
Existing infrastructure – when highrise developments are proposed their impact during potential bush fire emergencies needs to be considered, particularly in terms of evacuating occupants along the road network and the availability of water supplies available for high-rise fire fighting;	The subject property is located within a substantially developed area with the bushfire hazard being confined primarily to the adjacent State Forest and subject site. There is therefore a low likelihood that a mass evacuation of the area would be required. Localised evacuation could be instigated. All surrounding existing public roads were found to exceed the minimum carriageway specifications detailed in section 4.1.3(1) of PBP for Public Roads. Hydrants will also be installed throughout the development in accordance with AS2419.1-2005. Furthermore where required fire hose reels and other essential fire safety provisions will be installed in accordance with the National Construction Code. In consideration of the bushfire threat posed to the subject development and site specific circumstances, the subject site is considered acceptable for its proposed redevelopment development.

External facades – external facades may result in increased exposure to radiant heat and also convection columns. Specialised modelling may be needed and APZs may need to be increased over and above those specified to account for this.	Bushfire design modelling has been undertaken and the peak elevation of receiver was found to be 11.91 metres, which is exposed to a maximum potential radiant heat flux of 23.75kW/m^2 (PBP Appendix 2).
Potential for entrapment - the risk associated with occupant egress is higher in high-rise buildings than for lower-rise structures and therefore the potential for entrapment during a bush fire emergency should be addressed	In consideration of the bushfire threat posed to the subject development and site specific circumstances and egress routes the subject site is considered acceptable for its proposed redevelopment.

Conclusion:

Any future residential development at 55 Coonara Avenue, West Pennant Hills would require Asset Protection Zones (APZ) from the retained / protected vegetation within the subject site and from the Forest within the adjacent Cumberland State Forest.

Asset Protection Zones for new residential development are determined from Table A2.4 of PBP or bushfire design modelling achieving a radiant heat impact of no more than 29kW/m^2 at the closest point of the available building footprint.

Planning for Bush Fire Protection 2006 is currently under review and it is understood that as part of this review the Asset Protection Zones detailed in Appendix 2 may be revised to correspond with Australian Standard 3959 'Construction of buildings in bushfire-prone areas' 2009.

The minimum required Asset Protection Zones (APZs) were therefore determined from Table 2.4.2 of AS3959 - 2009 and have been depicted on the attached Constraints Overlay.

The provision of the minimum required Asset Protection Zones would result in a Bushfire Attack Level of BAL 29 under Australian Standard 3959 'Construction of buildings in bushfire-prone areas' 2009. This is deemed to satisfy provisions of the National Construction Code.

We have reviewed the attached masterplan and are of the opinion that the development is capable of achieving compliance with the relevant specifications and requirements of Planning for Bush Fire Protection 2006.

Comments provided are based on advice received from the NSW Rural Fire Service and the requirements of the *Environmental Planning and Assessment Act* 1979, the *Rural Fires Act* 1997, the *Rural Fires Regulations* 2013, the RFS document known as '*Planning for Bush Fire Protection* 2006' for the purposes of bushfire hazard determination and Australian Standard 3959 'Construction of buildings in bushfire-prone areas' 2009 as amended for building/structural provisions.

A company representative has made a single site visit to the subject property.

We are therefore in support of the planning proposal.

Should you have any further questions please do not hesitate in contacting myself.

Prepared by
Building Code & Bushfire Hazard Solutions

Stuart McMonnies
G. D. Design in Bushfire Prone Areas.
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Certification number – BPAD9400

Reviewed by
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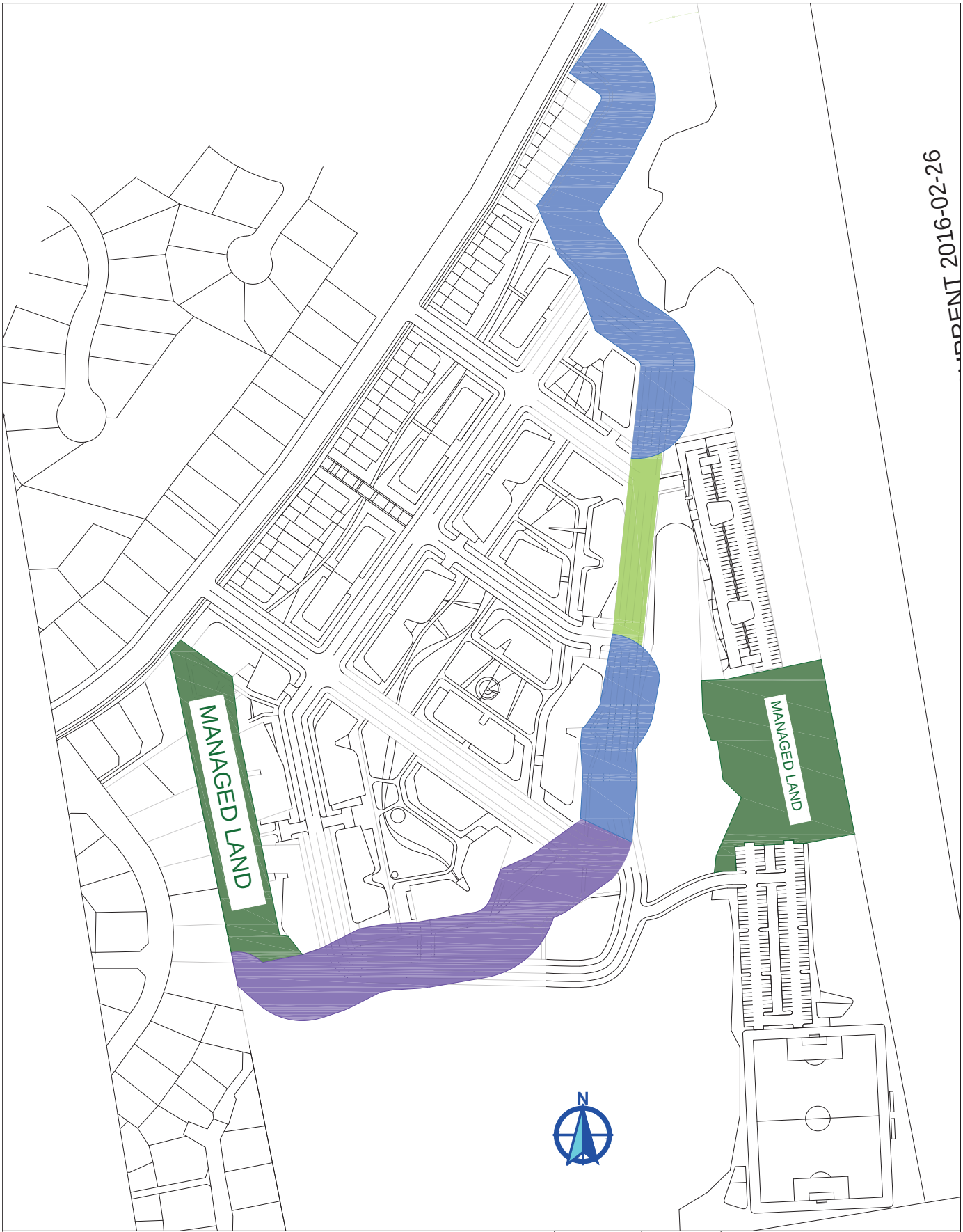
Disclaimer:

Quote from Planning for Bushfire Protection 2006, '*Any representation, statement opinion, or advice expressed or implied in this publication is made in good faith on the basis that the State of New South Wales, the NSW Rural Fire Service, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement or advice referred to above..'*

Similarly the interpretations and opinions provided by Building Code and Bushfire Hazard Solutions in regard to bushfire protection are also given in the same good faith.



NOTES:

REFERENCE NO.	140990	LOT 61 DP 737386		
ADDRESS	55 COONARA AVENUE, WEST PENNANT HILLS			
DATE.	01/03/2016	DRAWN BY	IT	SCALE: NTS
REVISION	REVISION	A	REVISION DATE	01/03/2016
CLIENT	MIRVAC			

LEGEND

- MANAGED LAND
- 18m MINIMUM SETBACK
- 32m MINIMUM SETBACK
- 39m MINIMUM SETBACK

CONSTRAINTS OVERLAY

Building Code & Bushfire Hazard Solutions
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FPA AUSTRALIA SILVER MEMBER Fire Protection Association Australia

Development Constraints and Opportunities

Lot 61 DP 737386
55 Coonara Avenue
West Pennant Hills
The Hills LGA

For: Mirvac

REF: HiSC 14-660
7th March 2016

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NB: Update needed prior to public exhbition

Development Constraints and Opportunities

Lot 61 DP737386
55 Coonara Avenue
West Pennant Hills
The Hills LGA

REF: HiSC 14-660
7th March 2016

Author:

Elizabeth Ashby

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Cover: Looking north into one of the large car parks that has been excavated in the early 1980s and planted with canopy trees between the car spaces.

Photo: E. Ashby, 20th June 2014.

TABLE OF CONTENTS

1 BACKGROUND AND SITE HISTORY

Keystone Ecological has been contracted by Mirvac to explore the ecological constraints to the redevelopment of Lot 61 DP 737386, 55 Coonara Avenue, West Pennant Hills in the Hills LGA.

The location of the site and an aerial photograph are shown at Figures 1 and 2 respectively.

The subject site is part of an urban forest that is partially connected to other patches of native vegetation in the local area such as Lane Cove River National Park to the north east and Bidjigal Reserve to the south west. It is a large lot (>25 hectares) in an area otherwise dominated by residential development. It is adjacent to another large holding (Cumberland State Forest) that together comprise over 60 hectares of ridge, slope and gully habitat. Aerial photography shows that these two sites are mostly vegetated and only lightly fragmented, with buildings and roads nestled in amongst the forest.

However, this was not always the case. Aerial photography dating from 1943 shows that the subject site supported an orchard and open grassland (see Figure 3), which was typical for the Hornsby Plateau in the mid 20th century. The site also supported a large expanse of natural bushland in its southern part and along a creek line extending up along the centre of the site. It is unknown whether this bushland was original remnant or regrowth after earlier clearing.

The Cumberland State Forest (established in the late 1930s) had a similar land use pattern at the time, with vegetation in its southern portion and a cleared agricultural landscape in its northern half. The cleared area was set aside for the planting of an arboretum and is now fully vegetated.

The subject site currently houses the Sydney headquarters for IBM, a facility that was purpose-built in the early 1980s. It is made up of a number of interconnected buildings and a number of large car parks.

Aerial photography at that time (see Figure 4) shows that the northern part of the subject site was excavated and the landform reconstructed, including two dams. As a result of these profound landform changes, most of the vegetation seen now around the current buildings and in the open car parks has been planted, with the oldest being approximately 30 years old. The current distribution of vegetation and development is shown in Figure 5.

Such a large vegetated area – some remnant, some regrowth and some planted –

across many topographic positions within suburban Sydney is of great ecological value. This report has been prepared in response to a request to investigate the options for redevelopment of part of this site in the light of the likely ecological constraints to development.

2 METHODS

The site was investigated by the compilation and analysis of published scientific papers and reports, interpretation of aerial photography, the interrogation of publicly available databases and supplemented by site visits in June 2014 and September 2015. The major objective of this work was to establish the broad ecological parameters of the site: the classification and distribution of vegetation communities and the habitats available for threatened species of flora and fauna likely to occur on site.

The history and vegetation of the site was mapped by combining the aerial photography from 1943, the early 1980s and 2014, along with the most recent vegetation mapping of the Sydney Metropolitan Catchment Management Area (DECCW 2009 / OEH 2013). Analysis of the topographic maps revealed the position and order of the gazetted streams on site and the extent of the protected Riparian Zones, pursuant to the Water Management Act (2000).

These data were then distilled in order to identify the ecological constraints of the site. These were then ranked, mapped and provided to a bushfire consultant (Mr Stuart McMonnies of Building Code and Bushfire Hazard Solutions) for the application of an appropriate Asset Protection Zone (APZ) that would be sufficient to protect potential development areas from the adjacent vegetated hazard.

An Indicative Masterplan was then developed as part of an iterative process that took into account the ecological constraints, bushfire hazard and urban design. The Indicative Masterplan (Mirvac Design, scheme 05) has been assessed in this report in regards to its compliance with those combined constraints.

3 RESULTS

3.1 Biodiversity

The biodiversity of the site and surrounds has been previously explored in many vegetation mapping programs conducted by State Government agencies (e.g. Royal Botanic Gardens, Department of Environment) and Local Government. The current distribution of vegetation and development is shown in Figure 5.

The naturally-occurring vegetation on site is made up of two main vegetation communities. The majority comprises Blue Gum High Forest (BGHF), a Critically Endangered Ecological Community listed under both NSW and Commonwealth legislation. The vegetation along the southern gully is probably best described as Sydney Turpentine Ironbark Forest (STIF), an Endangered Ecological Community under NSW legislation and a Critically Endangered Ecological Community under Commonwealth law.

The site has also been indirectly studied by ecological surveys and research conducted in the adjacent State Forest. One of the most important threatened species known to inhabit these forests is the threatened top predator *Ninox strenua* Powerful Owl. It is known to nest, forage and roost in the bushland of which the subject site is a part – results from investigations by State Forests' researchers are shown at Figure 6. Three nesting trees were identified (one on the subject site) and the densest gullies of Cumberland State Forest also provide roosting habitat.

Recent survey in Cumberland State Forest also established the presence of realised habitat for other threatened species (Footprint Green 2013):

- *Glossopsitta pusilla* Little Lorikeet
- *Pteropus poliocephalus* Grey-headed Flying-fox
- *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat

3.2 Ecological Value

In increasing order of ecological value and resilience, 10 habitat types were identified on site (and illustrated in Figure 5):

- Type 1 - built form on excavated land;
- Type 2 - hardstand with landscaped strips of 25-30 year old canopy trees on excavated land (2 polygons);
- Type 3 - dams with surrounding remnant and regrowth canopy trees and a variety of weeds (2 polygons);

- Type 4 - landscaped patches surrounding the buildings with 25 year old canopy trees on excavated land (7 polygons);
- Type 5 – open grassy area that was historically part of the orchard and on natural landform (1 polygon);
- Type 6 - open grassy areas on natural landform but not cultivated (1 polygon);
- Types 7 and 8 - natural woody regrowth (up to 71 years old) of an area cleared prior to 1943, and in an area with natural landform (1 and 11 polygons respectively);
- Type 9 - young regrowth evident in 1943 (therefore >71 years old) and maintained as bush since then, in an area with natural landform (1 polygon); and
- Type 10 – (probably) natural remnant bushland (8 polygons).

It is considered that the following areas are very significant and absolute constraints to development due to their ecological rarity, importance, extent, shape or are otherwise protected:

- remnant Endangered Ecological Communities (type 10);
- protected riparian zones; and
- areas containing Powerful Owl nest trees.

3.3 Developable Area

An appropriate APZ was applied from the edges of these no-go zones, with the resultant developable area shown in Figure 7.

The Indicative Masterplan has been produced according to these constraints and an APZ applied from the edges of the footprint. This is shown in Figure 8.

The map of the extent of the 10 habitat types was overlaid on the Masterplan and APZ and the results tabulated overleaf in Table 1.

3.4 Adequacy of Masterplan

The development areas of the Indicative Masterplan are wholly within the white areas (nominated as wholly developable) or red areas (managed as an APZ). The areas of each habitat type within these development zones is shown in Table 1.

TABLE 1: SUMMARY OF FATE OF VEGETATION ON SITE

Habitat Type	Content	Within development zone (ha)	APZ area (ha)	Retained area (ha)	Total Area (ha)
1	Built form on excavated land	2.93	0.31	0.00	**3.24**
2	Built form + planted trees on excavated land	4.53	0.85	0.17	**5.55**
3	Dams and immediate surrounds	0.00	0.10	0.15	**0.25**
4	Planted trees, some understorey + built form on excavated land	1.30	1.51	0.49	**3.30**
5	Cleared, cultivation history on natural landform	1.10	0.15	0.52	**1.77**
6	Cleared, no cultivation history on natural landform	0.00	0.00	0.14	**0.14**
7	STIF natural regrowth (up to 71 yrs old) on natural landform	0.00	0.00	0.13	**0.13**
8	BGHF natural regrowth (up to 71 yrs old) on natural landform	0.03	0.18 (0.10 M)	1.03	**1.24**
9	BGHF young regrowth as of 1943 (currently >71 yrs old native regrowth) on natural landform	0.00	0.00	0.15	**0.15**
10	BGHF and STIF natural remnant bushland	0.00	0.50 (0.34 M)	9.30	**9.80**
	TOTAL	9.89	3.60	12.08	**25.57**

M = Managed for dual objectives of hazard control and biodiversity protection through judicious weed control.

The Indicative Masterplan shows the Development Zone as being overwhelmingly made up habitat types 1 to 6 – the areas with least ecological value, as they have been cleared or are built form with landscaped areas on excavated land. These make up 99.7% of the Development Zone.

Of the 12.08 hectares of vegetation to be retained, the overwhelmingly majority (88%) is made up of the highest ecological value vegetation. These are habitat types 7, 8, 9 and 10 but, even more importantly, are made up of the large uninterrupted remnants of the central and southern part of the site. These have the smallest edge and, together with the adjacent Cumberland State Forest, comprise a much larger continuous remnant.

None of the area of STIF regrowth on natural landform (habitat type 7) will be impacted.

The area of post 1943 regrowth of BGHF on natural landform (habitat type 8) on site

occupies only 1.24 hectares in total, made up of small patches around the edges of the existing developed footprint. There is the potential for 300 square metres to be impacted by the proposed footprint, with the construction of internal roads. However, very small alterations to the Masterplan can achieve zero loss of this habitat type. Other small areas of habitat type 8 (totalling 0.18 hectares) are included in the APZ (0.08 hectares) and other managed areas (0.10 hectares), but these, too, may be further minimised or avoided with minor alterations to the footprint.

The area of regrowth of BGHF that was evident in 1943 (habitat type 9) occupies only 0.15 hectares and is confined to the northern end of the site at the corner of Coonara Avenue and Castle Hill Road. This will be retained in its entirety.

The area of remnant BGHF and STIF (habitat type 10) covers 9.80 hectares and occurs principally as a large uninterrupted patch across the majority of the southern end of the site. However, it also occurs as a small sliver of a few hundred square metres along the north western boundary, in very small patches around the existing dam and as a narrow buffer between the existing development and the adjacent residential development to the west.

The buffer along the north western boundary will be retained and enhanced. The large areas in the southern part of the site will be wholly retained. The small weedy patches around the dams fall within the APZ but weed management will suffice for bushfire hazard control in these patches, which will be of benefit to this habitat type.

The western buffer is to be managed to satisfy the dual objectives of bushfire hazard management and conservation. There are currently no management controls in place, with the residential interface showing evidence of dumping of garden refuse, uncontrolled mowing and clearing. Weeds are dominant in the understorey. In order to prevent this area being a fire hazard, some understorey management is required, but this can be minimised with the provision of a 20 metre break to the vegetation to the south and a much smaller break immediately along the rear fences of the adjacent residences. A maximum area of 0.34 hectares will be so managed.

A small area of this habitat type that is within the riparian zone also now falls within the APZ (0.16 hectares). This minor unintentional infringement can also be removed with a small alteration to the footprint so that the APZ is outside of the riparian zone.

Even without these suggested changes, the total impact to small patches of old regrowth and remnant vegetation, will be offset by the retention and conservation management of 12.08 hectares, most of which (88%) is old regrowth or remnant forest. While this offset ratio is clearly a positive outcome, this scenario was further assessed quantitatively for its conservation adequacy by the hypothetical application of the BioBanking

methodology. The BioBanking Assessment Methodology (version 2) was followed, as detailed in the relevant Operational Manuals (DECC 2009, OEH 2012), and is not reiterated here.

Notional calculations indicate that something in the order of 12 Ecosystem credits would need to be retired to account for the losses and disturbances generated by the Masterplan and produce a 'maintain or improve' result for the environment. The area to be retained would create something in the order of 82 ecosystem credits, far in excess of the 12 required. Therefore, the Indicative Masterplan has significant conservation merit.

4 CONCLUSIONS AND RECOMMENDATIONS

The current development on the subject site is a result of long-standing clearing and significant excavation works. The ecological values of these areas are diminished. By contrast, it also contains many very important ecological features that are recognised and protected by both NSW and Commonwealth legislation, namely the large intact remnant of BGHF and STIF. Removal of any part of the remnant forest in the southern part of the site is likely to result in a significant adverse impact and trigger a Species Impact Statement and / or referral to the Commonwealth Department of the Environment.

The Indicative Masterplan has been developed with regard to these significant ecological features that are both a constraint to development and a significant opportunity for conservation.

The development areas within the Indicative Masterplan are overwhelmingly made up of existing development or otherwise cleared areas. A notional quantitative analysis of this Masterplan has confirmed that the potential offset ratio would deliver a 'maintain or improve' result for the environment. Thus the development of approximately 9.89 hectares can be successfully offset by the conservation management of 12.08 hectares of bushland with 0.68 hectares of natural vegetation strategically managed for bushfire control.

The known locations of nesting trees and roosting habitat for the Powerful Owl are depicted in Figure 6. A single nesting tree is known from the gully within the area to be retained. This important feature will also be served by the Indicative Masterplan.

This means that the development proposal is unlikely to result in a significant adverse impact on the listed CEEC and species of concern, and so should be able to be approved via the standard assessment process under Section 5A of the Environmental Planning and Assessment Act (1979).

Such a proposal would need to be accompanied by a comprehensive ecological impact assessment and a management plan for the retained vegetation, including strategies to protect and manage Powerful Owl habitat.

REFERENCES

Department of Environment and Climate Change (NSW) (2009) *BioBanking Assessment Methodology and Credit Calculator Operational Manual*. DECC, Sydney

Department of Environment, Climate Change and Water (2009) The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area. Department of Environment and Climate Change NSW, Hurstville

Footprint Green (2013) SIS for proposed Treetop Adventure Trail, Cumberland State Forest, West Pennant Hills. Unpublished report for the Forestry Corporation of NSW

Office of Environment and Heritage Change (2012) *BioBanking Assessment Methodology and Credit Calculator Operational Manual Version 2*. OEH, Sydney

FIGURES

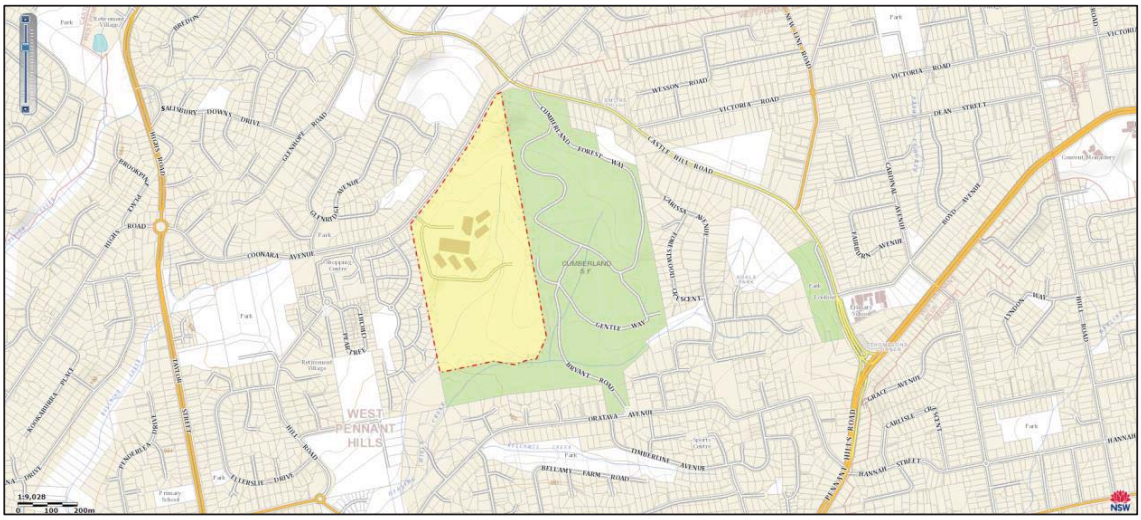

Figure 1: Location of the subject site. Source: Department of Lands Spatial Information Exchange.

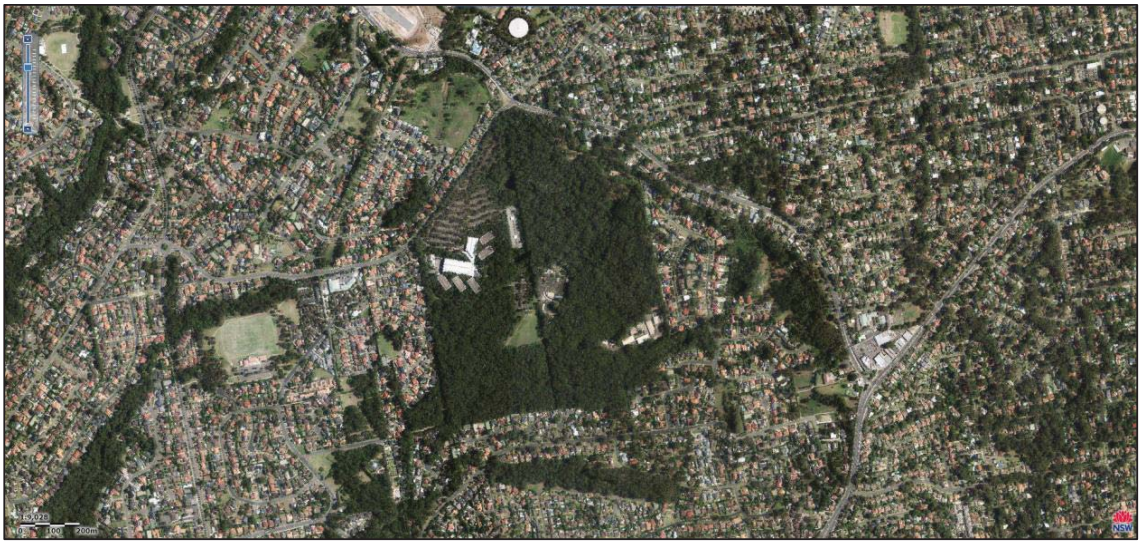

Figure 2: Aerial photograph. Source: Department of Lands Spatial Information Exchange.

Figure 3: 1943 aerial photography showing that more than half of the site contained an orchard and large open paddocks.

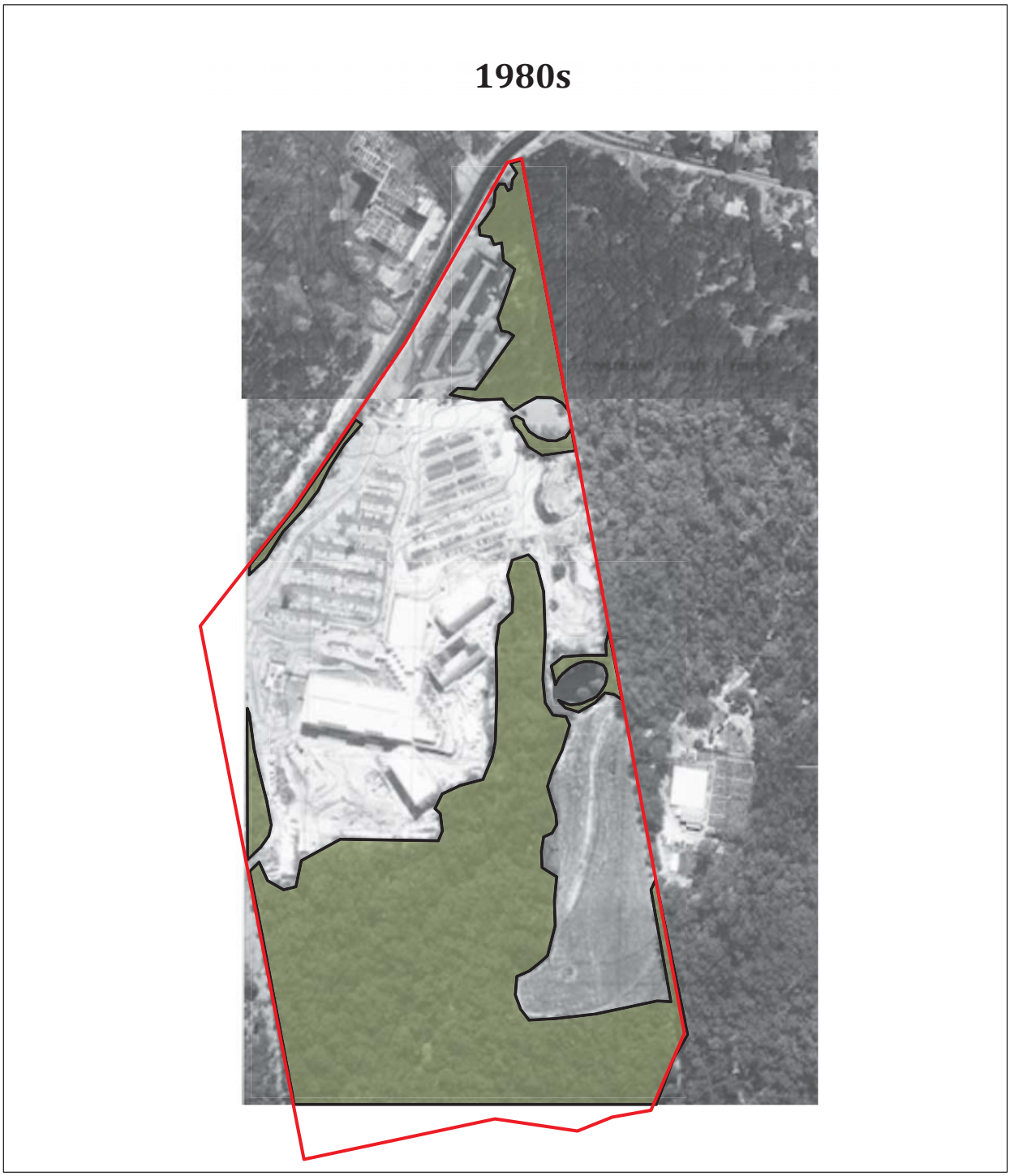

Figure 4: 1980s. Construction of the IBM facility began in 1983, opening in 1988. This aerial photograph shows the large area excavated for the buildings and surroundings car parks and roads. This is more or less coincident with the area occupied by the orchards and open grassy areas in 1943. The cleared grassy area in the south eastern corner that was an orchard in 1943 was occasionally used by the adjacent nursery in Cumberland State Forest to store excess stock.

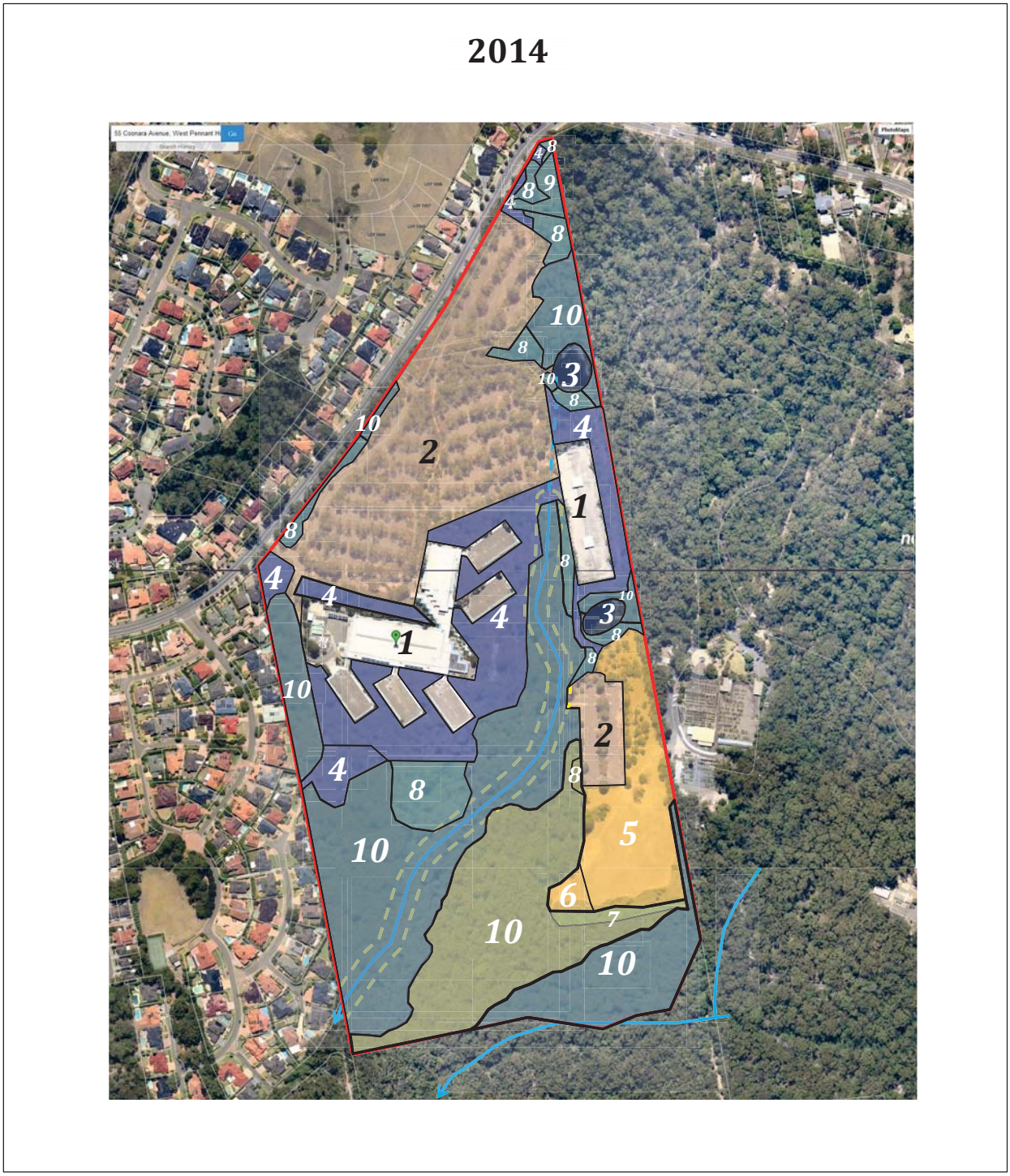

Figure 5: 2014. The site is now a complex mix of modified and natural landscapes. In increasing order of ecological value and resilience, it contains built form on excavated land (1); hardstand with landscaped strips of 25-30 year old canopy trees on excavated land (2); dams with surrounding remnant and regrowth canopy trees and a variety of weeds (3); landscaped patches surrounding the buildings with 25 year old canopy trees on excavated land (4); open grassy areas on natural landform (5 and 6); natural woody regrowth up to 70 years in age on natural landform (7, 8 and 9); and remnant natural bushland (10).

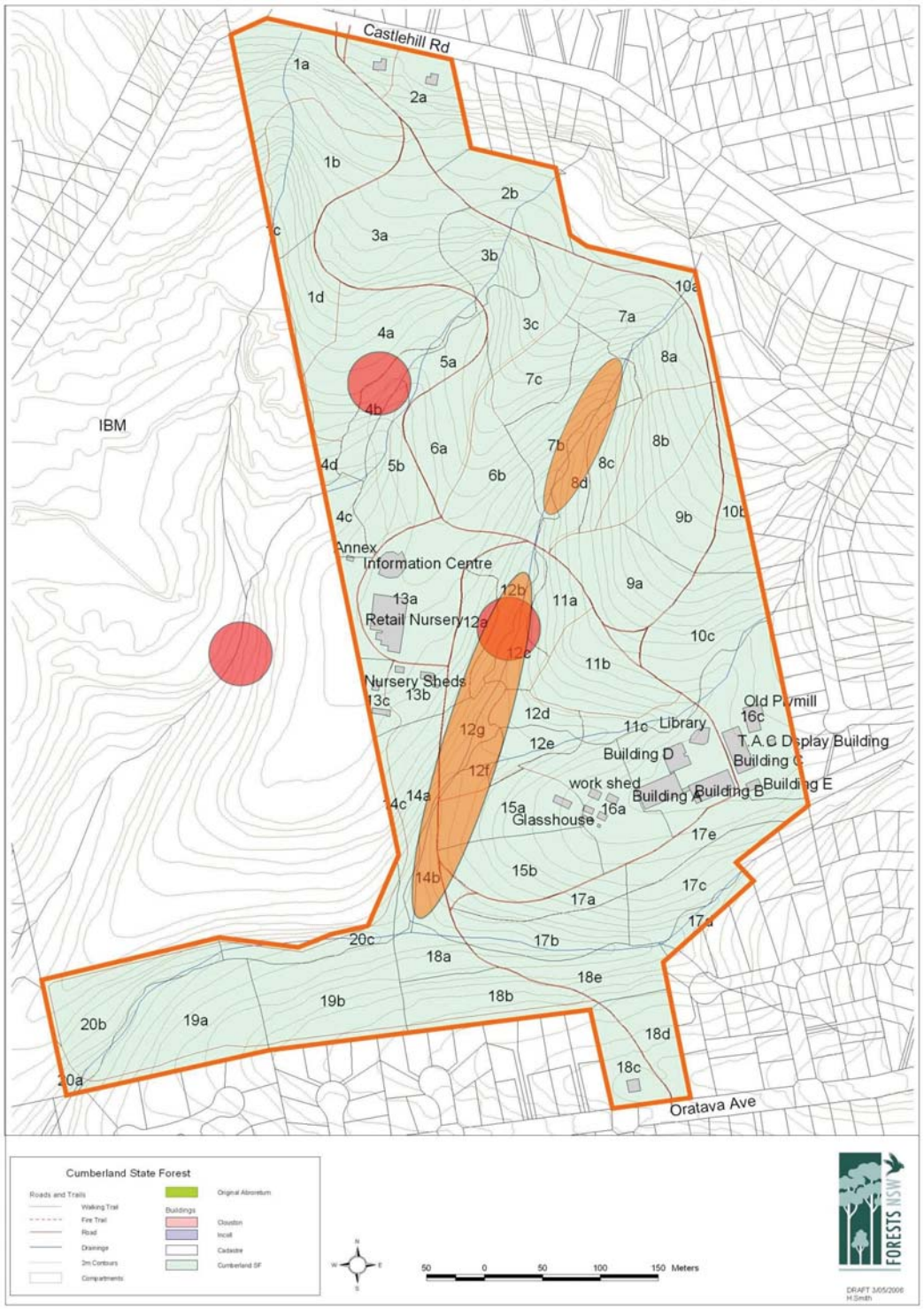

Figure 6: Powerful Owl habitat. Nesting tree locations are shown as red circles and roosting habitat indicated as orange ovals.

Potential development scenario

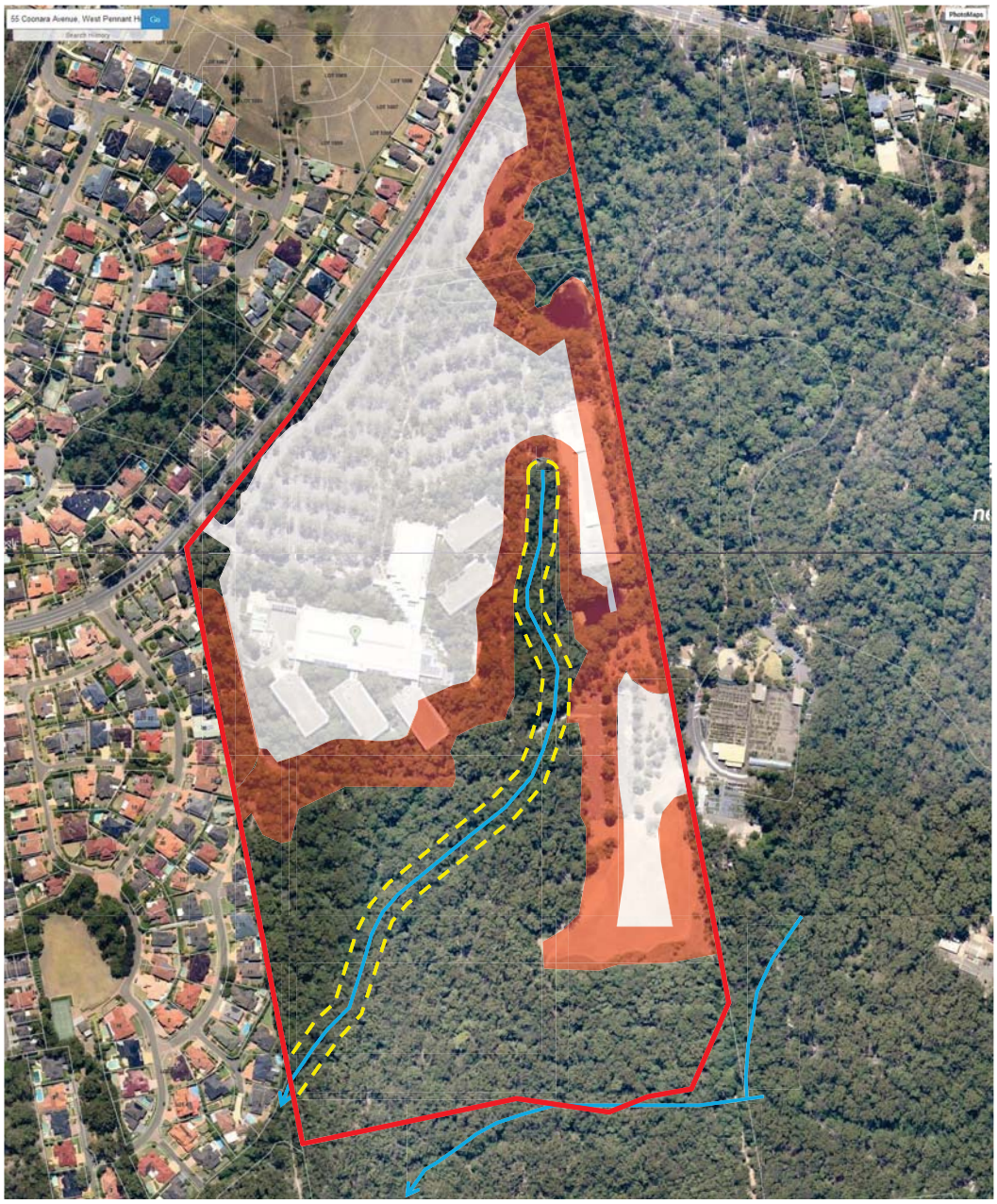

Figure 7: Potential development area (white) and associated APZ (red).

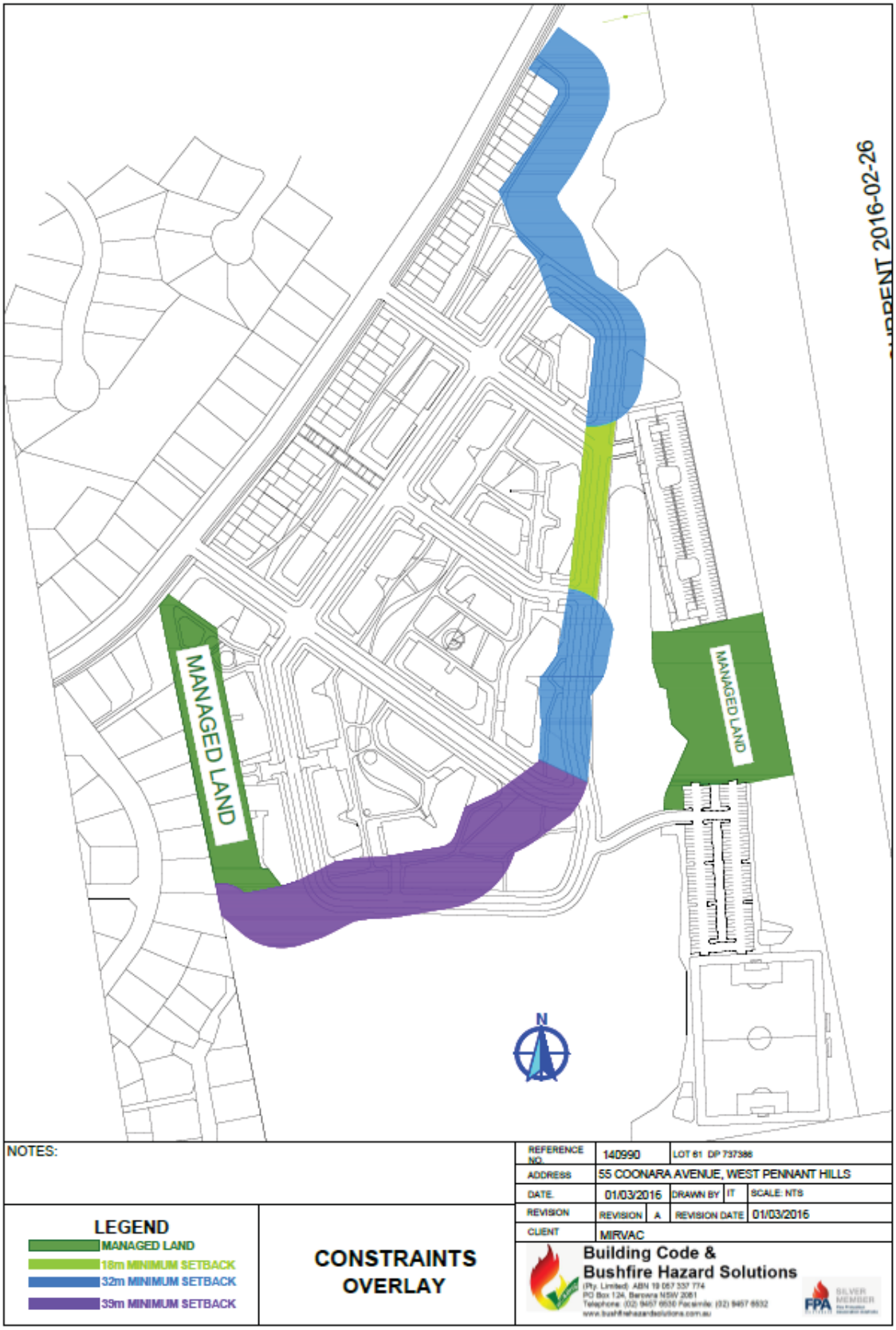

Figure 8: Masterplan and associated APZ. The "Managed Land" areas are to serve a dual purpose of biodiversity conservation and hazard reduction and so are to be treated separately and in detail.