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9 April 2013

Ian Hayson
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Tower 2, Level 23, Darling Park
201 Sussex Street
Sydney NSW 2000

Attention: Ian Cady, Associate Director of Urbis

RE: Flora related responses to Avon Road, Pymble (MP 08_0207 and MP 010_0219)

Dear Sir,

This letter has been prepared in response to the letter from the Department of Planning and Infrastructure dated 21 March 2013, notably Additional Information Required in Schedule 1, and Attachment A to the letter from the Department of Primary Industries (NSW Office of Water) dated 27 March 2013.

In terms of the NSW Office of Water
The rehabilitation design (Clements *et al*. 2012) is directed to restoring the fully structured ecosystems of the *Blue Gum High Forest* in the gully. The proposed stormwater management with ephemeral ponds, as described by Mark Tooker of National Project Consultants Pty Ltd, forms an integral part of re-establishing / enhancing natural ecosystems in the Conservation Area.

In terms of the Office of Environment and Heritage
Further analysis of the potential indirect impacts of the development on native vegetation within the proposed conservation area was requested.

To protect the Conservation Area (Figure 10 of Clements *et al*. 2012) from direct impact of the development, there is a managed buffer to the Conservation Area.

The Vegetation Management Plan is designed to enhance / restore the natural ecosystem processes in the Conservation Area including fauna habitat and nutrient cycling and soil stability. Mitigating the indirect impacts from the development includes:

- the removal of the exotic species;
- concrete surfaces and associated alkaline stormwater runoff;
- shading from buildings;
- increased risk of weed introduction associated with car tyres and pedestrians; and

- risk of introduction of plant pathogens.

1. Indirect impacts on fauna habitat from the removal of exotic species
The native understorey of the gully and adjoining slope of the Conservation Area has been replaced by exotic weed species including *Ligustrum lucidum* and *L. sinense* (Broad-leaved and Small-leaved Privet), *Erythrina* x *sykesii* (Coral Tree), *Lantana camara* (Lantana) and *Ipomoea indica* (Blue Morning glory). The projected foliage covers recorded in 10 m x 10 m quadrats onsite were up to 50% for *Lantana camara,* up to 83% for *Ligustrum* spp. and up to 80% for *Ipomoea indica.*

With localised decline of bushland, such as the existing degraded *Blue Gum High Forest* onsite, *Lantana camara* has become a fauna resource, providing habitat particularly for native small birds. Brush Turkey was also observed using the dense stand of *Ligustrum lucidum* as habitat onsite.

To minimise the indirect impact on the native fauna from the removal of exotic species;
- the cleared weeds, as required, are to be "rafted" into linear strips along the contours (page 54 of Clements *et al*. 2012). The rafting provides erosion control, fauna habitat and carbon sources for mycorrhiza fungi; and
- midstorey and shrub plantings and/or direct seeding in the prepared soil are to be undertaken under existing remnant trees at a density of 1 per 2 m^2 and 1 per 1 m^2 where there are no existing canopy trees. The midstorey and shrub plantings are to be installed in clumps with separation between clumps as directed by the Environmental Manager (page 60). These clumps of native shrubs will provide habitat for native fauna.

2. Indirect impacts on nutrient ecosystem cycling
From research on bushland surrounded by suburban development in northern Sydney (Clements 1983), *Lantana camara,* and *Ligustrum lucidum* are urban related species in bushland patches. Foliage nutrient concentrations are highest in the urban related species in urban bushland than in wet sclerophyll forest and dry sclerophyll forest (Lambert and Turner 1987). The nutrients held in these weed species are a major component of the ecosystem nutrient cycling. For example *Lantana camara*, interferes with the nutrient cycling in native forest. Abundant *Lantana camara* and its litter layer co-occurs with the decline in health and seed production of native canopy trees. Dense stands of *Lantana camara* decreases the conservation value of the vegetation and its long-term survival (Richard Lamb unpublished research discussed in Buchanan 1989).

To minimise the indirect impact of the removal of nutrient held in the exotic species:
- the cleared weed is to be "rafted" into linear strips along the contour;
- within the canopy, planting of native species, especially *Acacia floribunda*, *Acacia longissima*, *Allocasuarina torulosa*, *Glycine clandestina*, *Hardenbergia violacea* and *Kennedia rubicunda* is to be carried out to re-establish natural nutrient balance and native microrrhizal associations associated with native ecosystems; and
- a dense groundlayer of native spreading species, especially *Adiantum aethiopicum* (Common Maidenhair) and *Blechnum cartilagineum* with deep rhizomes, are to be established to act as soil stabilisers and for re-establishing the natural nutrient cycle. These native species are chosen for rapid spread and their ability to uptake the nutrients released during breakdown of weed and weed litter. The nutrient release and role of ferns are similar to that occurring post fires.

3. Indirect impacts of pH increases from runoff from concrete surfaces
Concrete surfaces are alkaline. Stormwater running over freshly laid concrete surfaces is likely to be more alkaline than that running over naturally occurring soils. Also pollutants deposited onto exposed areas can be dislodged and entrained by the rainfall-runoff process. Usually the stormwater that initially runs off an area will be more polluted than the stormwater that runs off later, after the rainfall has 'cleansed' the catchment. The stormwater containing this high initial pollutant load is called the 'first flush'.

To minimise the impact on the Conservation Area:

- Once earthworks within the Conservation Area are complete, buffer plantings (details on page 56 of Clements *et al*. 2012) are to be undertaken on the edge of the Conservation Area and the adjoining properties to assist in protection of the Conservation area from weed invasion and nutrient, sediment and water runoff from the adjoining properties;
- The outer edge of the Conservation Area (approximately 5 m wide) is to be planted with local native provenance tubestock to demarcate the boundary of the area to be conserved and to prevent any accidental or deliberate incursion into these areas. The buffer plantings are to be undertaken to allow as much time as practicable for the buffers to develop prior to completion of construction works.
- The choice of the species for the buffer includes species that respond to high light, are known to filter pollutants and grow in a wide range of soils. These include *Dianella caerulea* and *Lomandra longifolia*.

4. Indirect impacts of shading by buildings
The Conservation Area is in a moist, steep-sided gully. The native component of the proposed Conservation Area is currently limited to canopy trees characteristic of Blue Gum High Forest with the dense exotic vines *Ipomoea indica* covering trees and dense exotic understorey cover.

On the soil surface, there is expected to be an increase in light conditions after the removal of the dense exotic cover. The buildings are unlikely to decrease light in the gully.

5. Indirect impacts of weeds transported by cars and pedestrians
Wace (1977) pointed out that car tyres are a vector for introducing weeds. To mitigate the indirect impact of cars on the Conservation Area, edges of roads are densely planted with native species to reduce potential niches for weed growth. Buffer plantings are to be undertaken on the edge of the Conservation Area and the adjoining properties to assist in protection of the Conservation area from weed invasion and nutrient, sediment and water runoff from the adjoining properties (page 54 of Clements *et al*. 2012).

Pedestrian paths are generally proposed on the edge of the Conservation Area and used as a buffer with the exception of the walking trail in the southern part of the Site. Formalised walking paths and boardwalks are widely utilised in Conservation Areas including through endangered ecological communities such as Eastern Suburbs Banksia Scrub at Jennifer Street, La Perouse - Botany Bay National Park, and Sydney Coastal Estuary Swamp Forest Complex at the Warriewood wetlands.

These formalised paths are designed to maximise the appreciation of and minimise risk of fragmentation and disturbance to the Conservation Area. Buffer plantings are to be undertaken on the edge of the paths.

6. Introduction of pathogens

To minimise risk of introduction of pathogens (pages 53, 61 of Clements *et al*. 2012):

- All site workers are to be inducted and made fully aware of the significance of the Conservation Area. This area is to be clearly identified on a plan and marked on the Site as “no-go” areas to construction workers;
- Sediment fencing is to be erected as required by the Environmental Manager supervising the earthworks;
- All machinery is to be cleaned prior to entry into the Conservation Area. The machinery and loading equipment is to be inspected and photographed as required by the Environmental Manager; and
- Before any material is distributed in the Conservation Area, it must be checked by the Environmental Manager or qualified bush regenerators to ensure it does not introduce any weed material or pathogens to the Conservation Area.

The works outlined in Clements *et al.* (2012) are planned to minimise direct and potential indirect impacts associated with the development on the Conservation Area, as well as reduce existing threats to the *Blue Gum High Forest* ecosystem onsite.

Yours faithfully,

Dr AnneMarie Clements

References

Buchanan R.A. (1989). *Bush Regeneration: recovering Australian landscapes*. TAFE Student Learning Publications, Sydney.

Clements A (1983). Suburban development and resultant changes in the vegetation of the bushland of the northern Sydney region. *Aust.J.Ecol*.**8:** 307-319.

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Response to the flora related issues raised in the Department of Planning and Infrastructure's letter dated 19 April 2011: 1, 1A and 5 Avon Road, and 4 and 8 Beechworth Road, Pymble. Prepared for Marchese + Partners International Pty Ltd. Dated 17 December 2012.

Lambert M.J. and Turner J. (1987). Suburban development and change in vegetation nutritional status. *Australian Journal of Ecology* 12(2): 193–196.

Wace N. 1977. Assessment of dispersal of plant species - The car born flora in Canberra. In: *Proc. Ecol. Soc. of Australia, 1977*. 167-186.