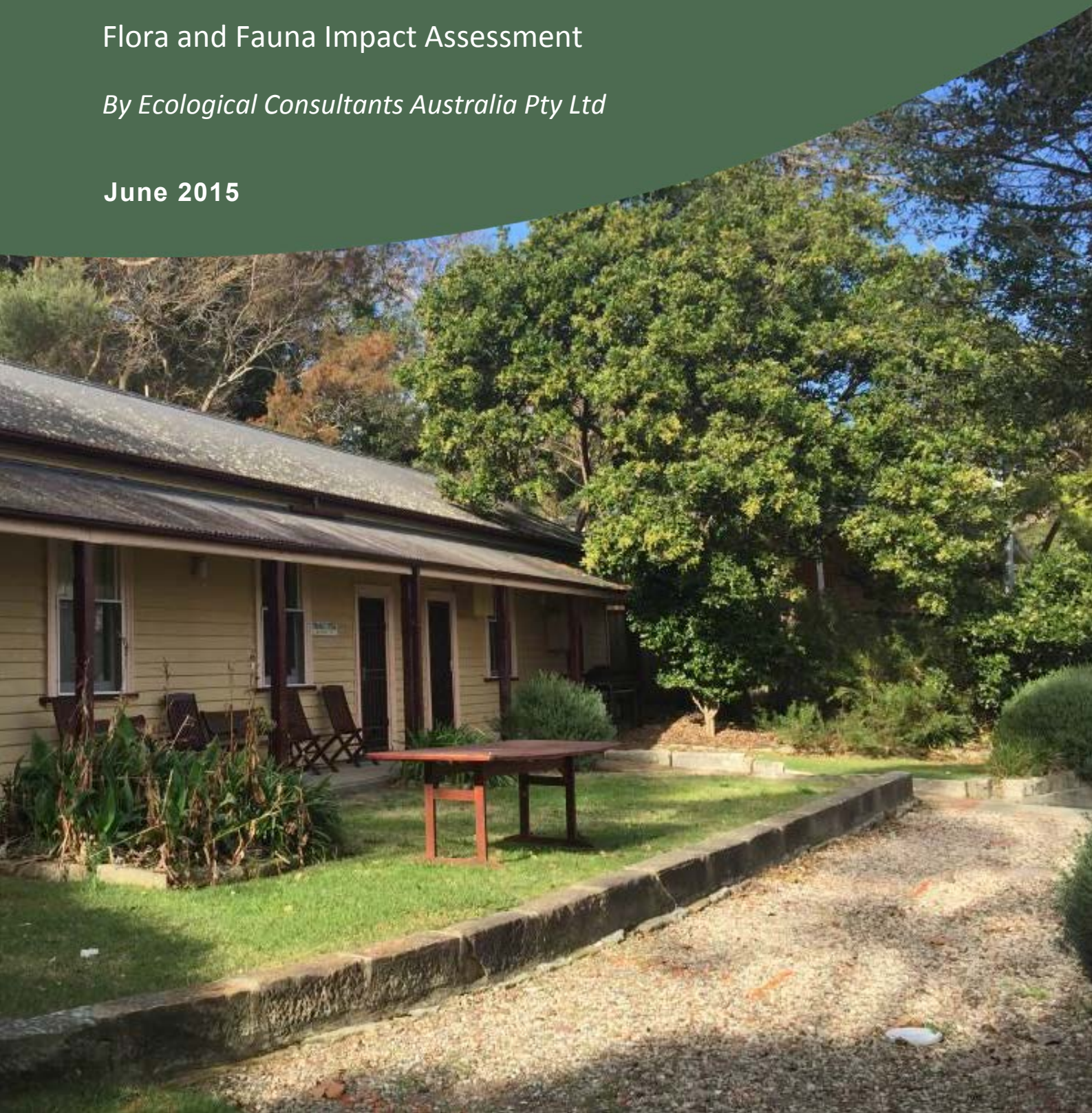
Exhibition Draft

Gap Bluff

Flora and Fauna Impact Assessment

By Ecological Consultants Australia Pty Ltd

June 2015



About this document

Copyright Statement©

Statement of Authorship

This study and report was undertaken by Ecological Consultants Australia for the Client. The authors of the report are Geraldene Dalby-Ball whose qualifications are BSc. majoring in Ecology and Botany with over 20 years' experience in this field and Emerald Cuthbertson BEnEng.

Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any particular proposal or pre-determined position.

Limitations of the study

Data from mapping lot boundaries have been relied upon as accurate.

Document Control Sheet	
Title:	Gap Bluff – Flora and Fauna Impact Assessment, Jun 2015
Version:	Final
Author:	Mia Dalby-Ball & Emerald Cuthbertson
Date:	June 10th 2015 update June 30th 2015
File location:	E:\ ECA 4 Prod\2 ECA Projects\Gap Bluff
Distribution:	Philip Beauchamp, Development Director Gap Bluff Hospitality Pty Ltd Phone +61 425 356729 Email pb@beaucon.net.au

Signed: Mia Dalby-Ball – Director of Ecological Consultants Australia

Executive Summary

Background

- The purpose of this report is to provide ecological information relating to the proposed redevelopment of the six Gab Bluff buildings. Specifically, the information addresses gaps raised by the OEH in the initial REF
- The sites are located in Watsons Bay, NSW
- Soil type is predominately Colluvial
- While the OEH mapping has the Vegetation Type listed as mostly heath the on-ground investigation found heath and open woodland along with forested creek lines and sand stone outcrops.

Flora

- Desk-top and in-field surveys were conducted in June 2015. Vegetation condition ranges from good to very poor with an improvement in condition with increasing distance from dwellings and clearings including access ways.
- No EECs occur on the site.
- Over 95 native species were recorded on-site during the survey.
- *Acacia terminalis* is growing on the site however no individuals of the Threatened *Acacia terminalis* subsp *terminalis* were found. The *Acacia terminalis* is outside the proposed development zones in close proximity to an existing access way. Actions from the *National Recovery Plan for Acacia terminalis* subsp *terminalis* (2010) could be implemented on this site to assist flora in general.
- Weed management as part of the development and regular maintenance will assist in reducing the bulk of weeds in the bushland adjoining the dwellings.
- Proposed tree removals are predominantly of introduced species. A small Coastal Banksia is proposed for removal and replanting, as is a Tuckeroo.

Fauna

- Densely vegetated areas of the site are generally good habitat for small birds, while the areas with a mix of lawn and trees were dominated by Noisy Minors. Frogs and lizards are expected to be on-site despite none being seen or heard during the survey. Micro-bats are expected to utilise the remnant vegetation on site.
- Long-nosed Bandicoots are an Endangered Population in the area. Bandicoots could live on the site as there is sufficient size and habitat diversity. No evidence of Bandicoots were observed. Predation by Foxes and Cats could significantly contribute to low / no Bandicoots.
- The proposed development will not directly impact any threatened species, nor will it remove significant habitat for other native species. The increased cart movements, especially at night, could result in increased road-kill. Slow speed limits for after dark driving is highly recommended.

Recommendations

- Recommendations have been made for enhancing the ecology of the general area through weed management, domestic and feral animal management and enhancement of habitat areas via micro-bat boxes and lizard and frog habitats. Of these recommendations weed removal is the only recommendation directly pertinent to the proposed development. Habitat enhancement is encouraged.

Table of Contents

1 Introduction

Trish Dobson (Trish Dobson landscape architecture), has contracted ECA to investigate the six Gap Bluff sites, for the purpose of providing a Flora and Fauna Impact Assessment, relating to their plans to redevelop them. The development will involve alterations and additions to the existing Gap Bluff buildings including The Armoury, Constables Cottage, Officers Mess, 33 Cliff Street, Gap Bluff Cottage and Green Point Cottage (see figure 1). This report details the findings and makes recommendations.

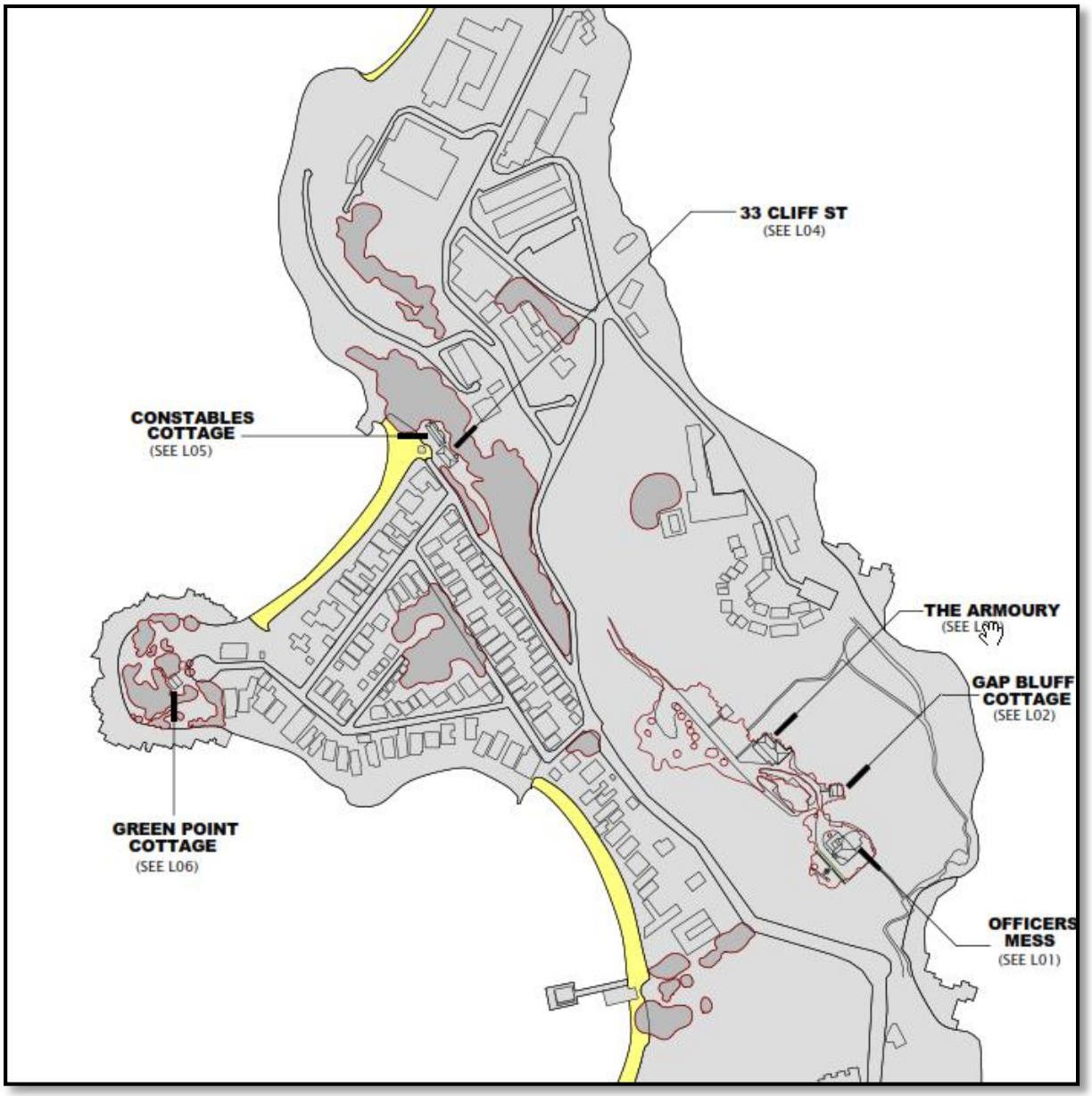


Figure 1. Location Plan (Source: Drawing L00, Detail Landscape Concept Plans, Gap Bluff, March 2015)

1.1 Site Location

The sites are located at Watsons Bay in the Woolhara, Local Government Area, NSW. Sites are in close proximity to residential dwellings and Sydney Harbour National Park (see Figure 2).

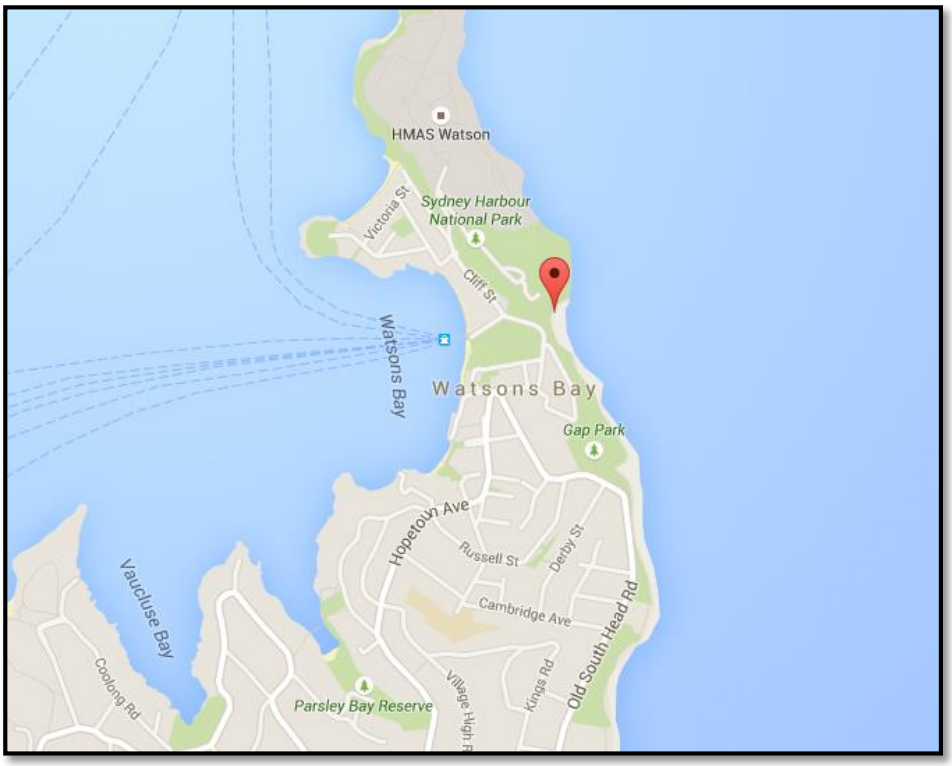


Figure 2. General location of the Gap Bluff sites (Source: Google Maps)

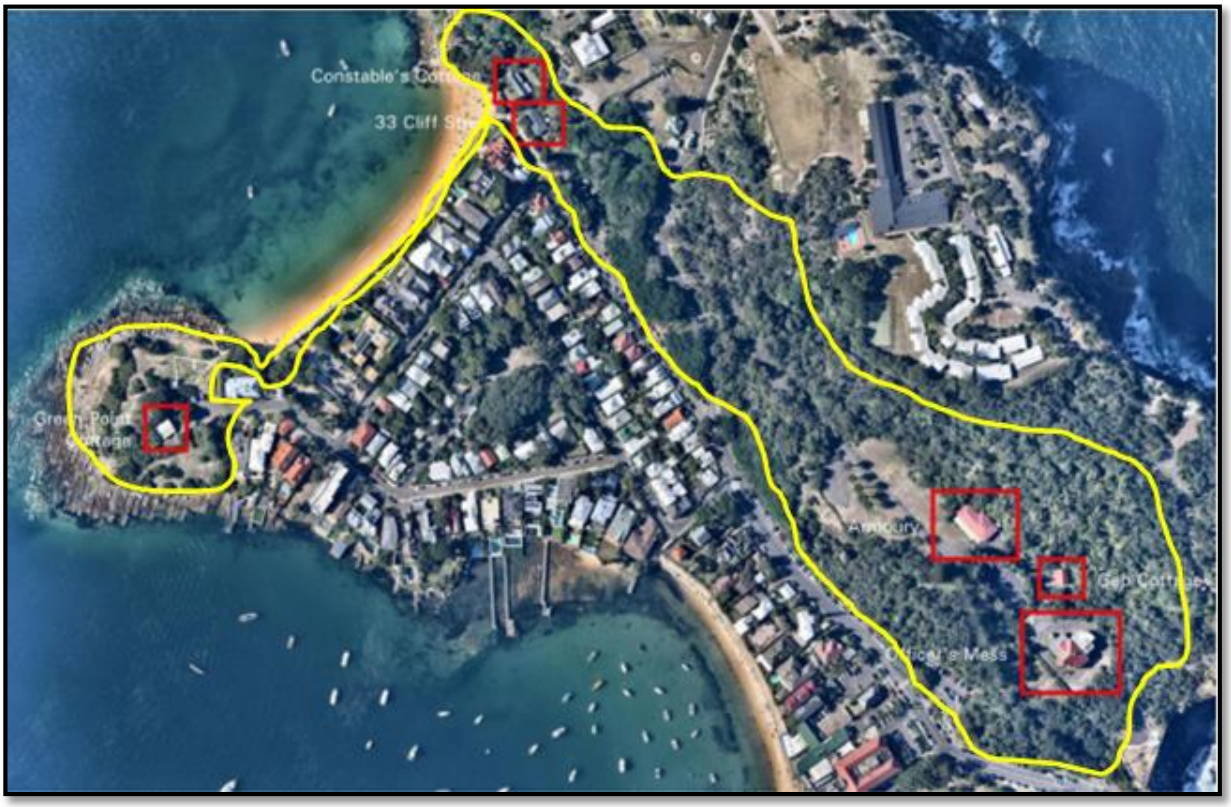


Figure 3. Location of the Gap Bluff sites survey area is shown in yellow (Source of underlying image and red squares: REF)

1.2 Limitations of the Study

This report is not a comprehensive flora or fauna investigation. Spot notes and species were taken on flora across the site. The purpose of the flora and fauna work is to have a preliminary investigation to determine the sites ecological value, particularly listed species, communities and population. Data was used to contribute to the creation of the developable land map. It is not an impact assessment; hence, no Tests of Significance (7-part tests) have been conducted.

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, grazing pressure, biological life-cycle patterns as in the case of small plants such as species of orchids etc.

While searches were conducted for snails no other invertebrate surveys were conducted.

Surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame, and assess the suitability of habitat for particular species.

Considering the site and habitat availability, ECA are confident that this survey is representative of the likely species and vegetation community and that future studies at other times would not change the conclusions on flora. Additional studies are likely to reveal and or confirm information on fauna such as for Owls, Micro-bats, birds and ground and tree mammals e.g. Gliders. For example, Anabat recordings during Spring and Summer would better indicate the species of Micro-bats on site and provide more detailed information on the use of the site by birds, including migratory species, tree mammals (such as Gliders) and ground mammals.

2 Background

Following is a summary of each of the gap bluff sites showing location, basic vegetation characteristics, proposed works and vegetation disturbance. The Flora Findings section includes images of each site in general and the vegetation present.

2.1.1 Officers Mess

Officers Mess is proposed to be used as a function/reception centre and is part of the Gap Bluff Centre located on Military Road, Watsons Bay (see figure 10 and 11). Works to be conducted include refurbishment, internal alterations and replacement of the roof.

Officers Mess is set within a large area of handstand (bitumen) within turf and bushland. While the species proposed for planting include introduced species they are not environmental weeds. Native species for landscaping include the Coastal Banksia and Coastal Tea-tree.

Proposed vegetation disturbance and removal is:

- Only landscaped areas, already planted, will be affected
- Removal and replacement of small ornamental shrubs

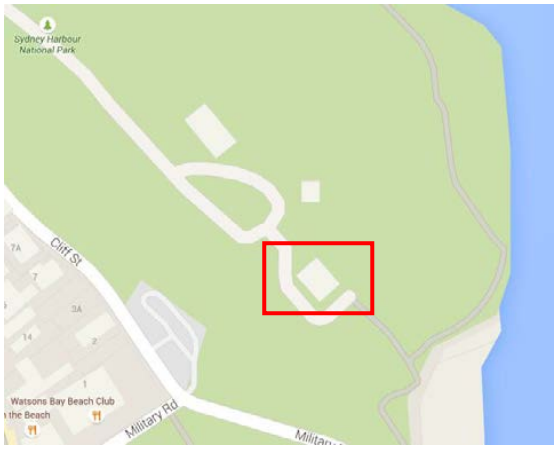


Figure 4. Location of Officers Mess (Source: Google Maps)

Figure 5. Location of Officers Mess showing flora density (Source: Google Maps)

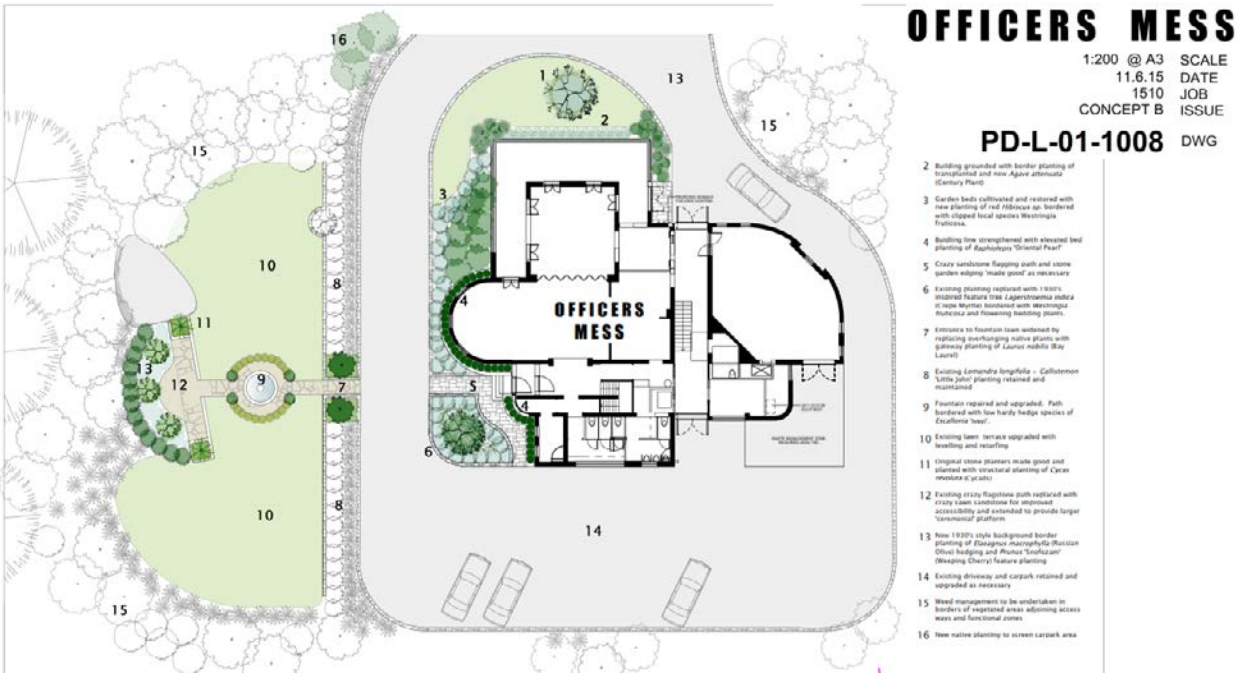


Figure 6. Landscape plan of Officers Mess (Source: Trish Dobson Landscape Architecture. Please see landscape drawings submitted for detail)

2.1.2 Gap Bluff Cottage

The Gap Bluff Cottage is proposed to be used as temporary accommodation and is located on Military Rd, Watsons Bay (see figure 6 and 7). The works to be conducted there include refurbishment and minor alterations.

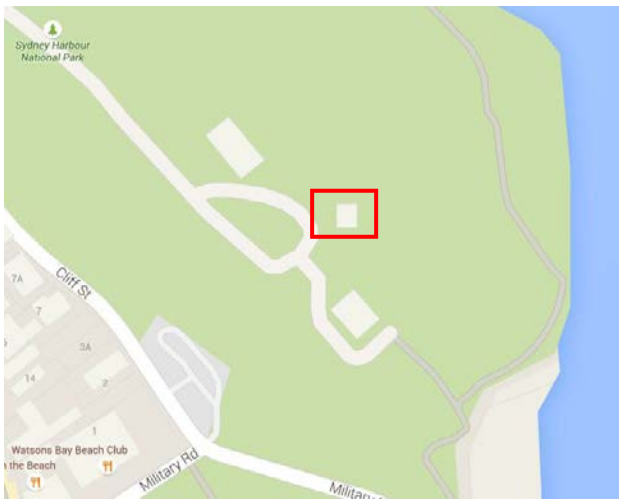


Figure 7. Location of Gap Bluff Cottage (Source: Google Maps)

Figure 8. Location of Gap Bluff Cottage showing flora density (Source: Google Maps)

The Gap Bluff Cottage has turf and landscape plants surrounding the dwelling which merges into bushland on 3 sides. The western side is boarded by the road. The Landscape Plan proposes species for planting in the leased area that include introduced however they can be maintained so as not to become environmental weeds. Native species included in the landscaping include Coastal Banksia and Coastal Tea-tree.

Proposed vegetation disturbance and removal is:

- Minor amendments to cultural landscape areas.
- Standing dead trees should be assessed for stability, and if structurally stable left for habitat. While it was noted that the dead trees did not have any hollows, they may be used for roosting by birds. Removal of existing dead native trees, stumps and limited environmental weeds immediately adjoining the previously cleared areas i.e. *Yucca* spp and *Strelitzia nicolai* (see figure 9, location shown in red).

The landscape plan includes the areas for weed removal works (see figure 9 below). Weed removal in areas of Bushland will be conducted by people with a minimum of Cert III in Natural Area Specialists / Bush regeneration.

Figure 9. Landscape plan of Gap Bluff Cottage showing location of *Strelitzia Nicolai* for removal (Source: Trish Dobson Landscape Architecture. Please see submitted landscape Drawings for more detail.)

The proposed landscape species which can become weedy in bushland such as the Mexican Sage and German Mint will be contained within the landscaping area (see figure 10). Bird dispersed weed species will not be used in final landscaping.

Figure 10. Landscape species which are proposed for planting

2.1.3 The Armoury

The Armoury is used as a function/reception centre and is part of the Gap Bluff Centre located on Military road in Watsons Bay (see figures 11 and 12). The works to be conducted there include refurbishment, internal alterations and addition of a second story and side wing.

Figure 11. Location of The Armoury (Source: Google Maps)

Figure 12. Location of The Armoury showing flora density (Source: Google Maps)

Currently the Armoury's vegetation is exotic turf on 2 and ½ sides and bushland o the remaining sides.

Proposed vegetation disturbance and removal is:

- Removal of noxious and environmental weeds in the car park perimeter and replacement of introduced species with exotic (non-weedy) and native species.
- Removal of *Cupaniopsis anacardioides* (Tuckeroo) for works and replacement in future landscape works (see Figure 11a, location shown in red)
- Removal of at least one *Banksia integrifolia* and replacement in future works.
- Excavation of 8.5m^2 of rock at the rear of the building (see Figure 13b and c.)

The species proposed for planting include:

- In Area 6 of the detailed landscape plan, an existing group of *Eucalyptus* sp. and *Banksia integrifolia* are to be enhanced with the addition of native vegetation including:
    - *Banksia integrifolia* (Coast Banksia)
    - *Banksia spinulosa* (Hairpin Banksia)
- The following plants are proposed for landscaping in this zone and could be removed from the planting list if required:
    - *Cupaniopsis anacardioides* (Tuckeroo)
    - *Doryanthes excelsa* (Gymea Lily)

- *Lomandra longifolia* 'Tanika' (Fine Leaf Mat Rush)

- In Area 7 of the detailed landscape plan, there is proposed planting of locally native grasses under the Norfolk Island Pine post removal of weeds including a Noxious Asparagus fern.
- Species proposed for planting are local native, Australian native or hybrids. Where native species are proposed, the aim is that they come from locally native stock as far as practical and that pure bread plants are used where ever practical rather than hybrids. This is particularly important for *Grevillea* sp. and *Ficinia nodosa* (Knobby Club Rush), which may also be added to this planting list.

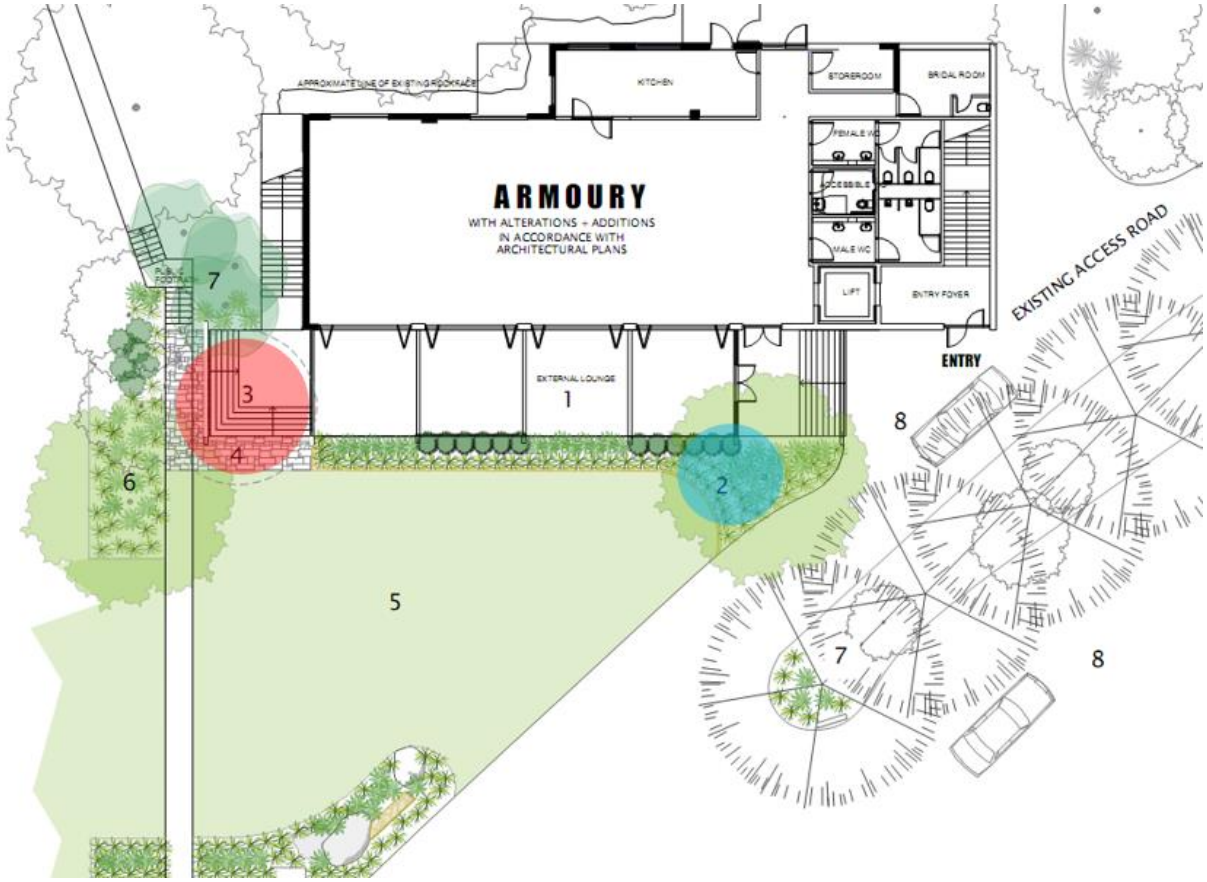


Figure 13a. Landscape plan of the Armoury showing location of Tuckeroo plant to be removed (shown in red) and location where Tuckeroo plant will be replaced (shown in blue) (Source: Trish Dobsion Landscape Architecture. Please see Landscape Drawings submitted for detail.)

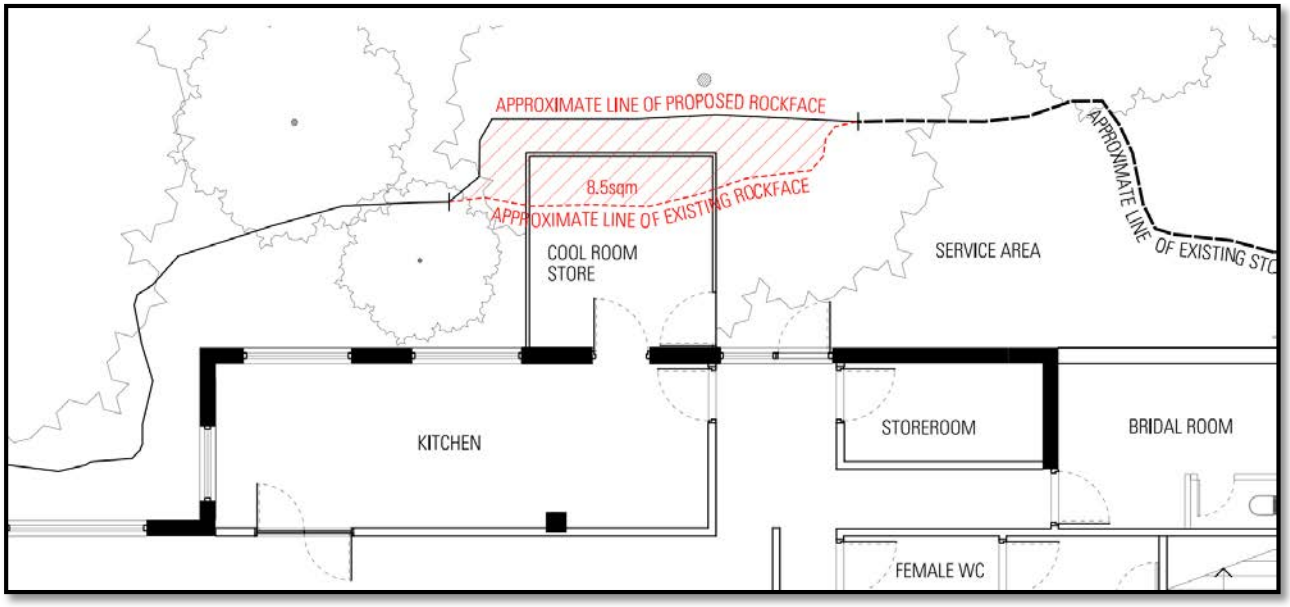
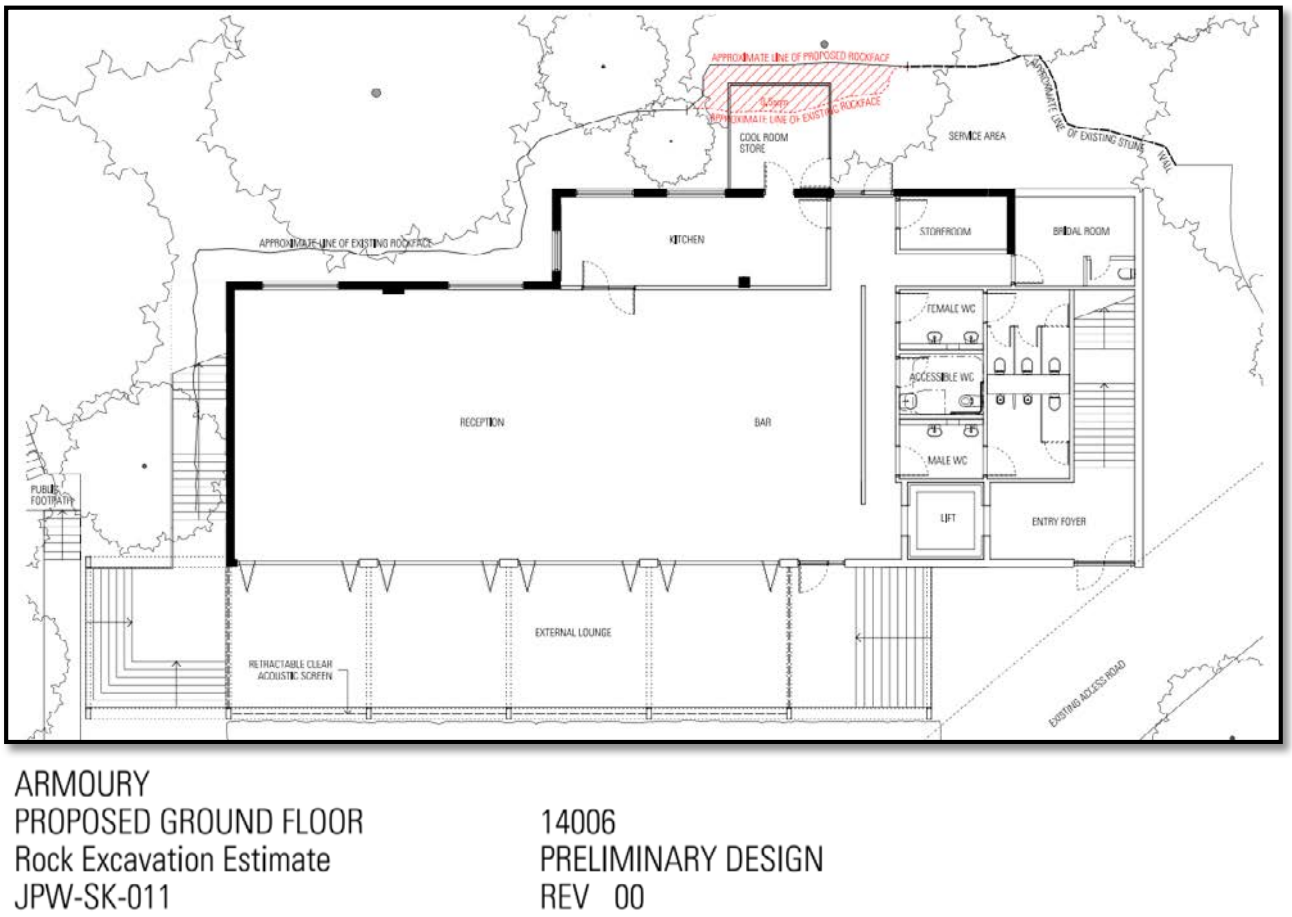


Figure 13b. Close up of proposed rock excavation area



ARMOURY
PROPOSED GROUND FLOOR
Rock Excavation Estimate
JPW-SK-011

14006
PRELIMINARY DESIGN
REV 00

Figure 13c. Site plan for the Armory showing proposed rock excavation area
(Source: JPW Johnson Pilton Walker 03 – 06 – 15)

2.1.4 Constables Cottage

Constables Cottage is used as a café/restaurant and is located by the harbor at 32 Cliff Street, Watsons Bay (see figure 14 and 15). Works to be conducted there include refurbishment and extension.

Figure 14. Location of Constables Cottage (Source: Google Maps)

Figure 15. Location of Constables Cottage showing flora density (Source: Google Maps)

The land to the north east of Constables Cottage slopes steeply up resulting in the rear of the property being shaded and vegetated by shade tolerant weed species and planted Lily Pillys.

Proposed vegetation disturbance and removal is:

- Possible removal of 1 x *Acmena smithii* and Possible removal of 1 x unidentified *Eucalyptus* sp.

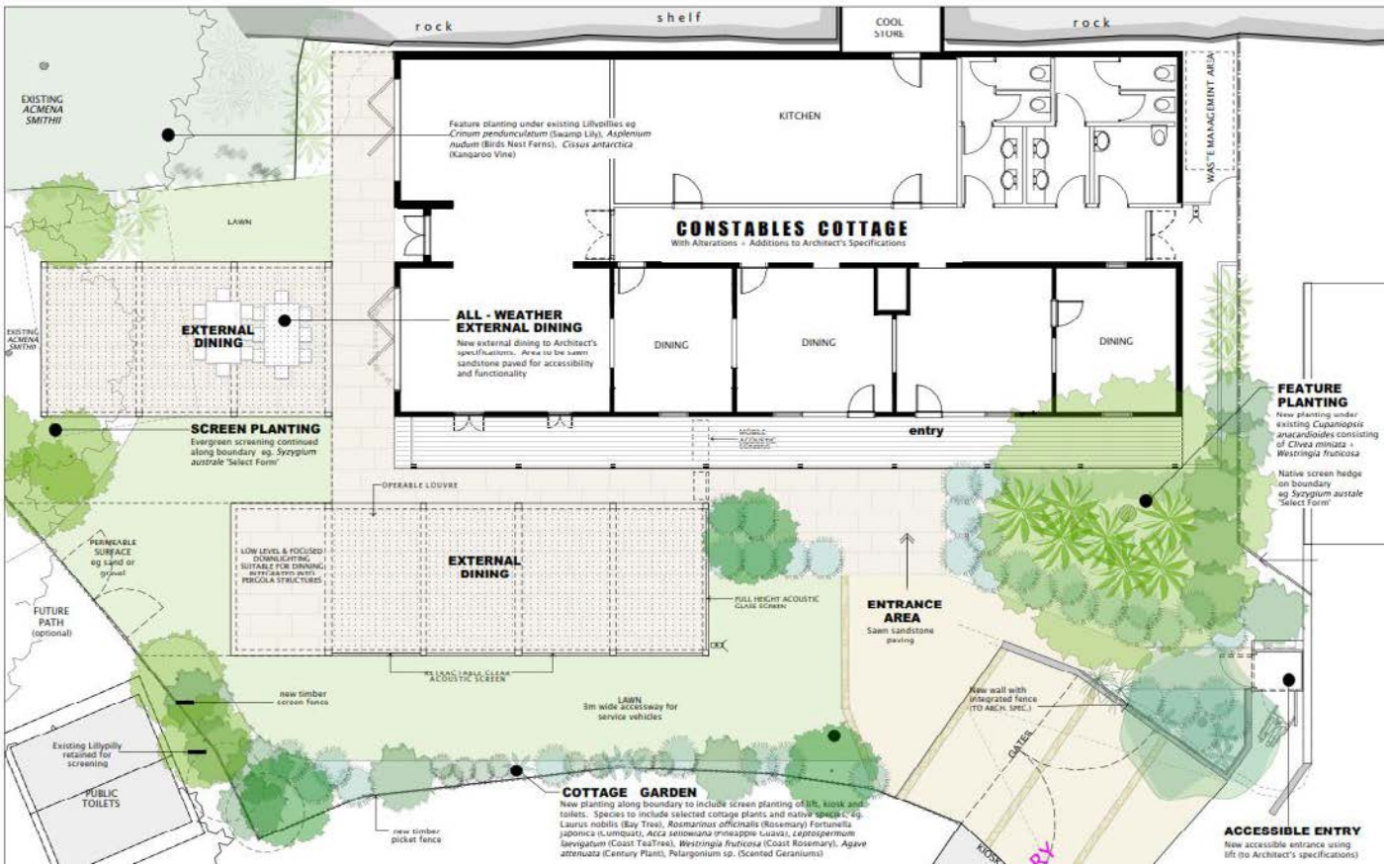


Figure 16. Constables Cottage proposed Landscape Plan

(Source: Trish Dobson Landscape Architecture.

Please see Landscape Drawings submitted for detail.)

2.1.5 33 Cliff Street

33 Cliff Street is used as temporary accommodation and is located at 33 Cliff Street, Watsons Bay (see figure 17 and 18). The works to be conducted there include refurbishment and alterations, including excavation for a new garage.

As 33 Cliff Street is located next to Constables Cottage it has a similar aspect and while the land to the rear is less steeply sloping, it is still shaded and vegetated by shade tolerant weed species. No vegetation is proposed to be removed, however the landscape plan states that selected shrubs (these are weed species) will be removed and replaced with coastal species suitable to the site soil and location (see figure 17).

Figure 17. Location of 33 Cliff Street (Source: Google Maps)

Figure 18. Location of 33 Cliff Street showing flora density (Source: Google Maps)

Figure 19. Landscape plans for 33 Cliff Street showing location of shrubs for removal in red (Source: Trish Dobson Landscape Architecture. Please see submitted Landscape Drawings for more detail)

2.1.6 Green Point Cottage

Green Point Cottage used as temporary accommodation, is located at 36 Pacific Street, Watsons Bay (see figure 20 and 21). The works to be conducted there include refurbishment and minor alterations.

Proposed vegetation disturbance and removal is (see figure 20):

- Removal of 1 X *Phoenix canariensis* adjoining front driveway on public land
- Removal of 2 x *Erythrinia sykesii* from adjoining reserve to west (see figure 20)
- Removal of 1 x *Lagunaria patersonii* under the canopy of large *Ficus rubiginosa* on site to north of the cottage (see figure 20).
- Removal of weed species from the property and bushland boundary.

Figure 20. Location of Green Point Cottage (Source: Google Maps)

Figure 21. Location of Green Point Cottage showing flora density (Source: Google Maps)

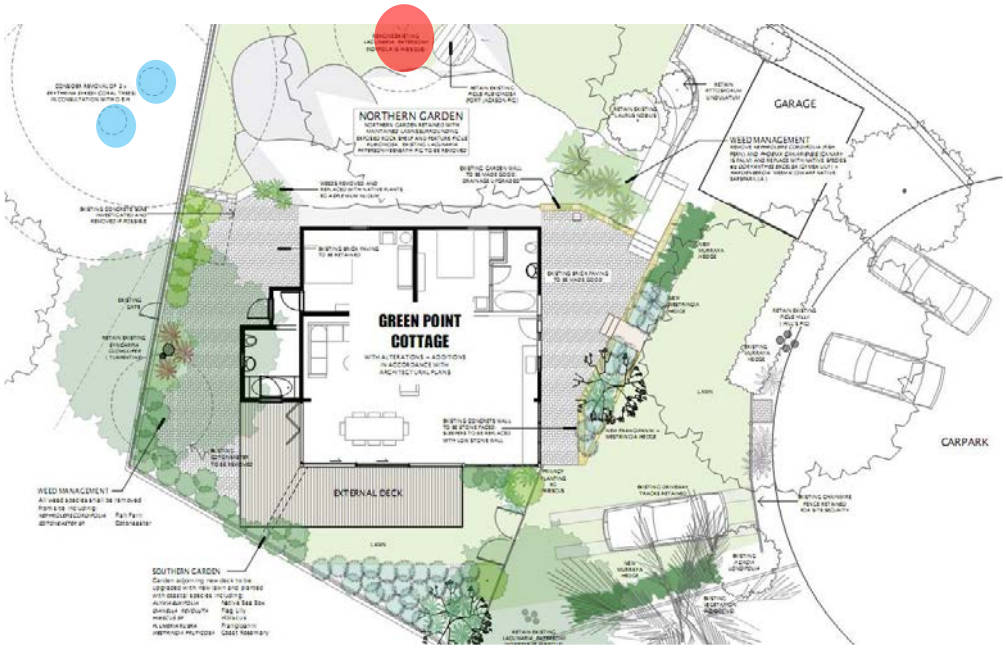
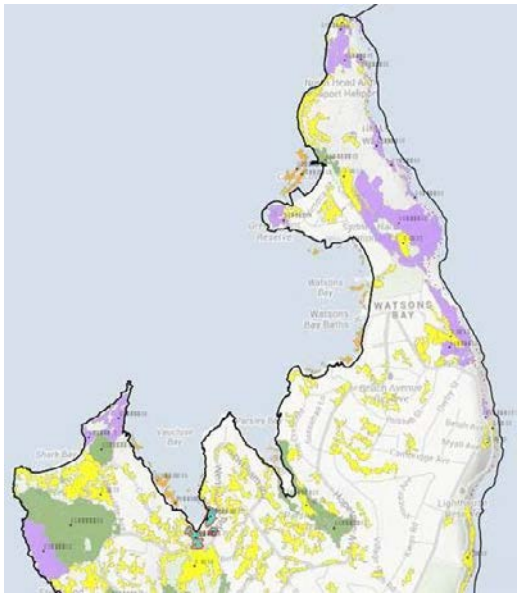


Figure 22. Green Point Cottage showing location of *Erythrinia* to be removed in blue and *Lagunaria* to be removed in red (Source: Trish Dobson Landscape Architecture. Please see submitted Landscape Drawings for more detail)

2.1.7 Vegetation types in the area

Both desk-top and field investigations were undertaken to determine the vegetation types in the area. The Desk-top investigation was carried out using the OEH vegetation mapping accessed via VIS in June, 2015 and the ECA licensed copy of these maps (see figure 23 and 24). While the OEH data has the vegetation type on site listed as mostly coastal heathland, the on-ground investigation also found open woodland, forested creek lines and sand stone outcrops. Previous studies were also reviewed – see Previous Studies section.



Key:

Purple: Coastal Heathland

Yellow: Other

Green: Dry sclerophyll forest

White: Cleared areas

Figure 23. Vegetation types in the general area (Source: OEH Vegetation Mapping accessed via VIS)

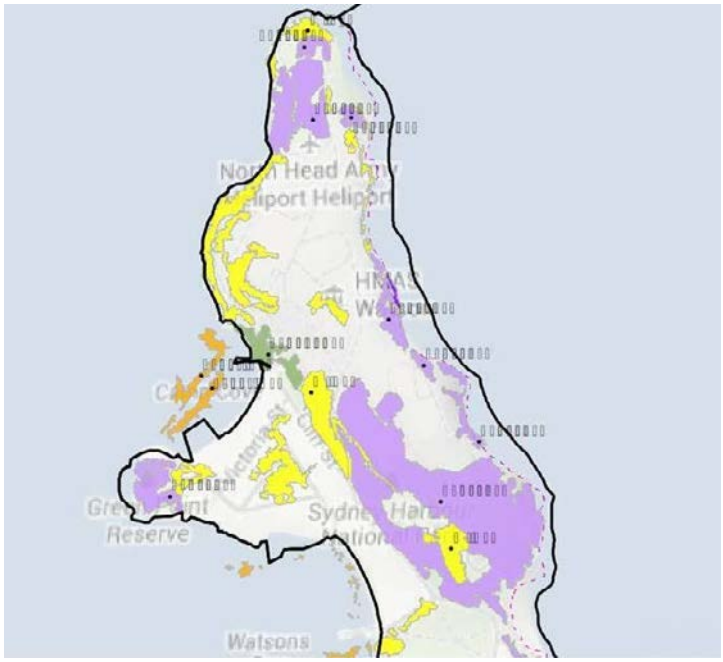


Figure 24. Vegetation types at the Gap Bluff sites (Source: OEH Vegetation Mapping accessed via VIS)

2.1.8 Soil types in the area

To determine the soil type in the area the Sydney Metropolitan Catchment Management Authority soil mapping data was accessed (see figure 25 – 27). The data reveals that the soil on the sites is predominately colluvial, however, Green Point Cottage, 33 Cliff Street and Constables Cottage also have erosional soils.

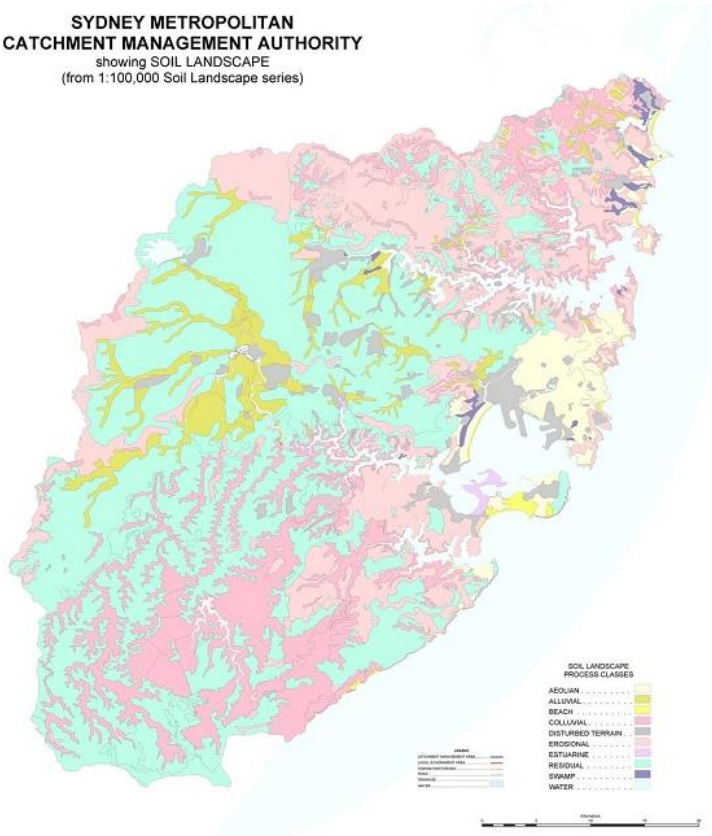


Figure 25. Soil types in the Sydney (Source: Sydney Metropolitan Catchment Management Authority)

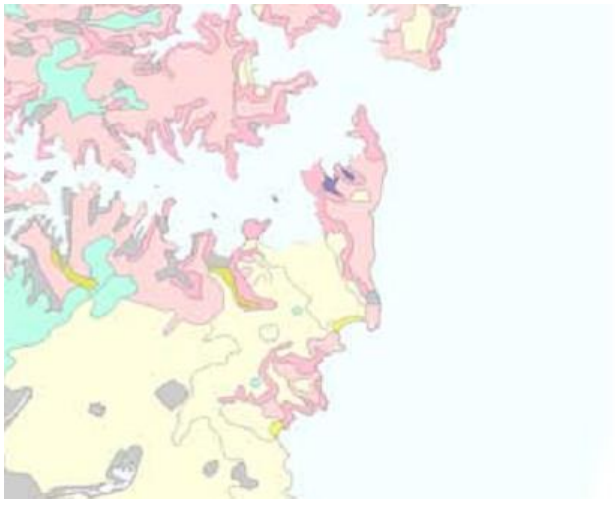


Figure 26. Soil types on site (Source: Sydney Metropolitan Catchment Management Authority)

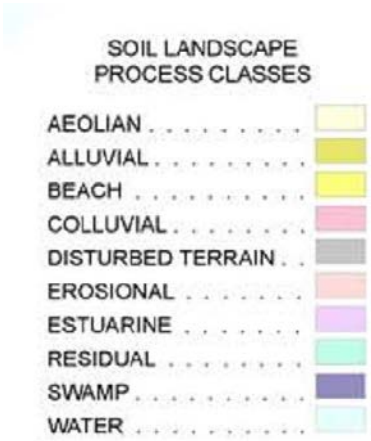


Figure 27. Key for soil type (Source: Sydney Metropolitan Catchment Management Authority)

3 Flora Findings

The purpose of the flora work is to conduct a preliminary investigation to determine the sites value to flora, particularly vulnerable and endangered species.

Forty two native species were identified in this survey. No threatened species or EECs were located on the site. *Acacia terminalis* is on site; however it is outside the areas proposed for development. The *Recovery Plan for Acacia terminalis* subsp*. terminalis* (2010) outlines management that would also benefit the *Acacia terminalis* growing on site.

A number of species occur on this sites which are listed as threatened at national (EP&BC Act) and state (NSW TSC Act) level including *Allocasuarina portuensis*, *Acacia terminalis* subsp*. terminalis* and *Eucalyptus camfieldii*; along with other possible species such as orchids. Management action is currently being undertaken to ensure their long term survival (Benson 2011).

A regionally important species *Melaleuca hypericifolia* is growing on-site, near a landscaped area and Officers Mess (see Plate 2). However, it is at least 20m from the proposed development and it is unclear if this is a naturally occurring plant or planted. Regionally important species are based on some particular features such as unusual distribution, general uncommonness in the region, disjunct occurrences or at or near limits of range. *Melaleuca hypericifolia* is a regionally important species because it is near its northern geographical limit and is disjunct from other populations.

General flora images from the site are shown in the images below.

Plate 1. *Epacris longiflora* growing naturally on the rock shelf behind the dwelling

Plate 2. *Melaleuca hypericifolia* growing in garden beds and could have been planted or self-seeded.

Plate 3. *Angophora hispita* growing in a garden bed and could have been planted or self-seeded.

Plate 4. General vegetation type between the Officers Mess and Gap Bluff Cottage – understorey is comprised of weed species and mid canopy are dominated by native plant species

Plate 5. Diverse native species are growing on sandstone behind the dwelling.

Plate 6. Coral Fern in sandstone overhangs behind the dwelling.

Plate 7. Vegetation near Gap Bluff Cottage – showing the typical mix of native and exotic. Native vegetation proposed to be retained.

3.1 Methods

Mia Dalby-Ball and Emerald Cuthbertson assessed the site on the 4th of June, 2015. During this site visit, notes and photos were taken of the vegetation types and species present. Prior to field work, BioNet was also used to determine what endangered ecological communities and threatened plant species have been recorded within 10km of the site since 1980. Soil maps were also reviewed to determine possible changes in soil type. The area surveyed is shown in Figure 3.

Specific searches were made for these species in areas of suitable habitat. We note that a one-off survey is unlikely to find all species particularly cryptic and seasonal species such as Orchids. Effort was focused on the proposed development areas and immediate surrounds (within 200m and within 20m) of the disturbance foot print. General searches were also made across the study area with a focus on the habitat areas of listed species.

Species collation was conducted via walking through habitat areas and noting all plants seen. Care was taken to observe small plants despite not using small quadrats. 20 x 20 m quadrats were not used in this instance, as the question being answered relates more to the proposed development rather than the vegetation composition in general. Hence, the effort was focused within 200m of buildings for proposed re-development. The full species list is included in Table 1.

3.2 Previous Studies

Studies covering vegetation were reviewed as part of the project. This included Woollahra Council documents, however the key paper reviewed was *Native plants of Sydney Harbour National Park: historical records and species lists, and their value for conservation monitoring* (Benson 2011), as South Head was one of the 7 terrestrial sub regions studied in the paper. The research in this paper shows that in 2011, South Head has the second smallest vegetated area and the lowest corresponding species diversity out of the six other harbour headland areas. There were 51 native species recorded at South Head, see an extract from the report in figure 28 below.

Table 2 Mainland precinct/subregions of Sydney Harbour National Park ordered by area (ha), showing aspect, number of native plant species (including historical records), and number of single record species.

Precinct /region	Area (ha)	Aspect	No of species	Percent of flora	Single record species
North Head (Fed Trust 72 ha not incl.)	183	Ocean-influenced	351	86%	90
Dobroyd Head	65	Ocean-influenced	222	55%	15
Middle Head incl Clifton Gardens (13 ha)	52	Sheltered harbour	99	24%	6
Bradleys Head	31	Sheltered harbour	157	39%	5
Nielsen Park	24	Sheltered harbour	112	28%	11
South Head	16	Ocean-influenced	51	13%	1
Chowder Head	9	Sheltered harbour	120	29%	2
Total	**380**		**406**		**131**

Figure 28. Extract from Native plants of Sydney Harbour National Park: historical records and species lists, and their value for conservation monitoring (Benson 2011)

The paper also gives possible reasons for the loss of species, in addition to clearing, including fire frequency and separation from other populations. Woollahra Council has been undertaking native plantings in Council

managed reserves near South Head. Vegetation restoration programs aim to increase resilience of native vegetation communities.

3.3 Current Study

This study is a general flora survey with specific searches for listed flora and EECs. Flora species presence and absence has been recorded here. Notes were taken of the relative abundance of species. Section 3.4 describes the flora findings from each location. Table 1, summarises all native species identified on-site and Table 2 summarises all exotic species identified on-site.

This study has drawn upon the information in the development documents particularly the Detail Landscape Concept Plans, Gap Bluff, March 2015, including the proposed development plans. The study also included a review of feedback on the SEE from OEH (May 2015).

3.4 Flora findings from site investigation

3.4.1 The Armoury

Currently the vegetation is exotic turf on 2 1/2 sides and bushland on the remaining edges.

Plate 8. View from the front showing existing turf.

The images here, Plate 8 - 14 show the typical vegetation. The Tuckeroo in Plate 9 is proposed for removal (and replanting). Tuckeroo may not be a locally native species, as it is generally a more northerly species, despite being recorded in Sydney. A small Coastal banksia is also proposed for removal and replanting.

Plate 9. Tuckeroo tree to be removed

Plate 10. Banksia integrifolia

Plate 11. *Banksia integrifolia* close ot the existing building.

Plate 12. Ipomea – Morning Glory around Lomandra. Common understory mix.

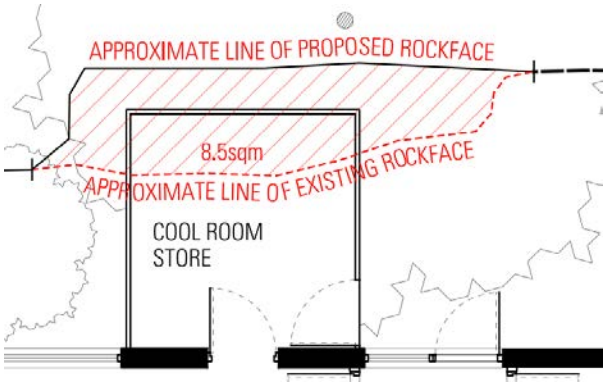
Plate 13. Pathway on the northern side of the Armoury leading to heathland areas of the site.

Plate 14. Large *Banksia integrifolia* with a weedy understory to the North of the pathway.

Bushland to the North and east of the Armory has mature canopy trees such as *Banksia integrifolia* and Bangally (Eucalypts) and shrubs including *Pittosporum revolutum*, while the ground around the building is planted with native species including Lomandra and Banksia. Ground cover is dominated by weed species including Noxious Asparagus Fern and Fishbone Fern (exotic) is also common.

Removal of Rock

It is proposed to remove 8.5m^2 of rock from behind the Armoury to make room for the extension to the cool room store. This area of rock is currently vegetated by weed species and Lomandra. The rock has previously been cut to enable the building to be in its current location. No threatened plant species were growing on the rock. Removal of bush-rock is a listed threatening process. Rock removed for the excavation could be re-located on-site in rehabilitated bush land areas as lizard habitat areas. (Right: extract from JPW 03-06-15).



3.4.2 Gap Bluff Cottage

The Gap Bluff Cottage has an exotic garden surrounded by bushland. The rear of the dwelling slopes up and has thick vegetation growing on it and sandstone rock outcrops with under hangs and ferns.

The front is lawn and exotic plants such as Clavier Lilies, Rosemary and Hibiscus are in the landscaping. A strip of lawn occurs each side of the dwelling about 1 – 3m wide. There is a vegetable patch in a raised garden bed.

The native canopy is Eucalypt with a mid-story of *Monotoca* sp., *Leptospermum leavigatum* and *Banksia integrifolia.* The understory is dominated by weeds particularly *Ehrharta erecta*, Asparagus Fern and Fish-bone Fern.

Garden weeds are in the immediate surrounds including Spider Plant, Iris, Strelitzia, Fish-bone Fern and others as can be seen in the images below.

Proposed disturbance around this building is within either turf or edge areas dominated by weed. Weed management during construction and post works could assist with longer term care for native remnants.

The following images, Figure 40 to 52, show the vegetation at this site and surrounds.

Plate 15. Gap Bluff Cottage showing open turf front (western-side)

Plate 16. Bushland to the South. Banksias dominate the canopy and mid-story

Plate 17. Monotoca – native mid-story growing with Banksias under a canopy of Eucalyptus botriodies.

Plate 18. Garden escapes including Agave growing with Noxious Weed – Asparagus Fern.

Plate 19. Fish Bone Fern growing densely in the understory

Plate 20. Pheonix Palms have self-seeded in the bushland areas.

Plate 21. Hibiscus and other ornamental plants are gorwining in the landscape area of the dwelling.

Plate 22. Fig trees are common around these buildings.

Plate 23. Striletzia – Giant Bird of Paradise. These were examimed for signs of ring-tail Possums. No drays or similar were observed.

Plate 24. Exotic Iris in areas immediatley adjoining the cleared turf area.

Plate 25. Landscape plant – now growing on the edge of the boundary of turf and bushland.

Plate 26. Spider Plant, Bromeliads and Asparagus Fern

Plate 27. Side of the dwelling showing thin turf strip between dwelling and bushland. Bushland here has the introduced species listed above, as well as native species such as Swamp Lilies that may have been planted as part of the Landscaping.

3.4.3 Officers Mess

Officers Mess is largely within a hard-stand area (car-park and turning circle). The south eastern side has plantings, mostly Lomandra, while the north eastern side appears to be remnant or regrowth bushland with a diversity of species including Coastal Banksia, Coastal Tea-tree, Monotoca, Nobby Club Rush, Lomandra, Climbing Guinea Flower and the wetter Cheese Tree, Blue-berry Ash, Pittosporum and Lily Pillies.

Weeds dominate the understory and their management will assist the remaining native species.

An *Acacia terminalis* is growing around 50m from the building. This has been discussed elsewhere in the report.

Plate 28. Banksia integrifolia

Plate 29. Lomandra longifolia

Plate 30. Asparagus Fern – Noxious Weeds

Plate 31. Knobby Club Rush

Plate 32. Exotic platnings in bush-edge around the car-park.

Plate 33. Wet-schlerophyl understorey specesi including Cheese tree, Blue-berry Ash and Lily Pillies.

Plate 34. Banksia and exposed rock with weed cover for undertsotry.

Plate 35. *Hibbertia scandens* – Climbing Guinea Flower – common on-site.

Plate 36. Coastal tea-tree

Plate 37. Front of the building – largely sealed for car-parking.

3.4.4 Constables Cottage

Constables Cottage is on the Harbour side, close to the beach. The land to the north east slopes steeply up, resulting in the rear of the property being shaded and vegetated by shade tolerant weed species and Lily Pillys (*Acmeana smithii).* A Coastal Tea-tree is at the front of the property.

Plate 38. Front of Constables Cottage

Plate 39. Native plants in landscaping – here Coastal Rosemary *Westringia fruticosa*.

Plate 40. Lily Pilys on-site - possibly planted.

Plate 41. Lily Pilly – typical size of trunk.

Plate 42. Rear of the dwelling with sandstone ~2m high.

Plate 43. Weeds and native ferns dominate the damp, shaded vertical wall.

Plate 44. Landscaping plants which are common around the dweling – these are also environmental weeds.

Plate 45. Rear of property showing degraded bushland. Sparse canopy and mid-storey and dense weed growth understorey.

Plate 46. Weeds dominating understorey.

Plate 47. Side and front of property is turf. Coastal tea-tree.

Plate 48. Ground coverof *Eharata erecta* weed grass and Morning Glory.

Plate 49. Stritlitza growing as a weed under native canopy

3.4.5 33 Cliff Street

33 Cliff street is adjoining Constables Cottage and while it has a more modern building (brick), it has the same existing vegetation quality as Constables Cottage, including the sandstone wall at the rear, which can be seen in the plates below. Weed grasses, Ehrharta form the understory. The southern side is open grass area with exposed sandstone and canopy trees.

Proposed landscaping includes planting native and exotic species and formalizing the lawn area to the East. Currently, the property is surrounded by weed species in the understorey, midstorey and native canopy. Proposed landscaping will not impact on native species and weed management of surrounds will enhance native species.

Plate 50. Rear of the site (west) – grass and Coastal Tea-trees

Plate 51. South of the site – grass and Coastal Tea-trees grading to an area dominated by weeds with no mid-storey.

3.4.6 Green Point Cottage

Green Point Cottage is on land that outcrops into the harbour. The immediate surrounding land is ~90% landscaped with native canopy trees including She-Oaks along the water, planted Fig trees and *Melaleuca quinquenervia* along one boundary. The grounds within the fenced zone are turf, exposed sandstone boulders and sparse canopy trees (See Figure 85 and Landscape plan for species details). NB these trees are being retained.

Plate 52. Cottage with turf surrounding.

Plate 53. Honey Suckle is common around the cottage.

Plate 54. Phoenix Palms grow close to the dwelling – these are weed species and being small have low habitat value for micro-bats.

Plate 55. Weedy mass on the outer perimeter of the dwelling. This area has a few native plants, including *Melaleuca ericifolia* within it, so clearing in this area is to be done with care.

Plate 56. *Pittosporum undulatum*

Plate 57. Weed – Climbing Asparagus.

Plate 58. Noxious Weed African Olive

Plate 59. *Hakea gibbosa* growing on the headland but not within the property boundary.

Plate 60. Rear garden showing turf, exposed rocks and Fig Trees.

Plate 61. *Melaleuca quinquenervia* outside the property fencing.

Plate 62. Sandstone outcrops are common on this site and habitat for reptiles.

Plate 63. Turf and sandstone.

3.4.7 General Area

Vegetation types include open grass, exotic landscaping, native landscaping, Woodland, Dry Sclerophyll Forest, riparian zones along ephemeral water-courses and heathland. Following are images showing some of these vegetation types.

Plate 64. Open grass areas

Plate 65. Phoenix Palms in turf. Rear = bushland

Plate 66. Dry Sclerophyll Forest grading to woodland on the shallower soils

Plate 67. Scribble Gum

Plate 68. Bat Fern

Plate 69. Callistemon (possibly planted)

Plate 70. Lower section of the study located near 33 Cliff Street. Dense weed understory and Phoenix Palms

Plate 71. Coral Trees and weeds. Cliff Street.

3.4.8 Flora Species List

Table 1 provides a list of flora recorded on-site. Ninety five species were recorded. The searches included a detailed list from within 100m of any of the six proposed re-development areas and those species recorded opportunistically on the site as part of a general flora survey. The general survey included specific searches in habitats suitable for threatened species and locally and regionally significant species. The survey site is shown in the Methods.

Native species were recorded and while most appear to be naturally occurring, some may be planted and some are almost certainly planted (like Bangalow Palm). Some plants were only identified to Genus level due to lack of flowering / fruit parts or other diagnostic features.

Weeds are abundant and include both planted and naturally occurring weeds. Noxious and environmental weeds are in the study area. Over 150 species of weeds were identified. Table 2 provides a list of weed species from the site.

Table 1. Native Plant species list

Family	Scientific Name	Common Name	NSW status	Comm. status
Adiantaceae	*Pellaea falcata*	Sickle Fern		
Aizoaceae	*Carpobrotus glaucescens*	Pigface		
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach		
Amaryllidaceae	*Crinum pedunculatum*	Swamp Lily		
Apiaceae	*Centella asiatica*	Indian Pennywort		
Apiaceae	*Hydrocotyle* spp.			
Apiaceae	*Xanthosia* spp.	Xanthosia		
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm	P	
Aspleniaceae	*Asplenium australasicum*	Bird's Nest Fern	P	
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern		
Blechnaceae	*Blechnum nudum*	Fishbone Water Fern		
Blechnaceae	*Doodia caudata*	Small Rasp Fern		
Casuarinaceae	*Allocasuarina distyla*	Heath She-Oak		
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak		
Casuarinaceae	*Casuarina glauca*	Swamp Oak		
Commelinaceae	*Commelina cyanea*	Native Trad		
Convolvulaceae	*Dichondra repens*	Kidney Weed		
Convolvulaceae	*Dichondra* spp.	Dichondra		
Cyatheaceae	*Cyathea* spp.	Tree Fern	P	
Cyperaceae	*Baumea juncea*	Baumea		
Cyperaceae	*Carex* spp.	Carex		
Cyperaceae	*Cyperus* spp.	Cyperus		
Cyperaceae	*Ficinia nodosa*	Knobby Club-rush		
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge		
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern		

Family	Scientific Name	Common Name	NSW status	Comm. status
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower		
Dilleniaceae	*Hibbertia* spp.	Hibbertia		
Doryanthaceae	*Doryanthes excelsa*	Gymea Lily	P	
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash		
Ericaceae	*Epacris longiflora*	Fuchsia Heath		
Ericaceae	*Leucopogon ericoides*	Pink Beard-heath		
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath		
Ericaceae	*Monotoca elliptica*	Monotoca Tree Broom-heath		
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine		
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine		
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		
Fabaceae (Faboideae)	*Kennedia rubicunda*	Dusky Coral Pea		
Fabaceae (Mimosoideae)	*Acacia longifolia*	Sydney Golden Wattle		
Fabaceae (Mimosoideae)	*Acacia longifolia subsp. sophorae*	Coastal Wattle		
Fabaceae (Mimosoideae)	*Acacia suaveolens*	Sweet Wattle		
Fabaceae (Mimosoideae)	*Acacia terminalis*	Sunshine Wattle		
Gleicheniaceae	*Gleichenia* spp.			
Gleicheniaceae	*Sticherus flabellatus var. flabellatus*	Umbrella Fern	P	
Juncaceae	*Juncus usitatus*	Juncus		
Lamiaceae	*Westringia fruticosa*	Coastal Rosemary		
Lindsaeaceae	*Lindsaea linearis*	Screw Fern		
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		

Family	Scientific Name	Common Name	NSW status	Comm. status
Moraceae	*Ficus coronata*	Creek Sandpaper Fig		
Moraceae	*Ficus macrophylla*	Moreton Bay Fig		
Moraceae	*Ficus rubiginosa*	Port Jackson Fig		
Myrtaceae	*Acmena smithii*	Lilly Pilly		
Myrtaceae	*Angophora costata*	Sydney Red Gum		
Myrtaceae	*Angophora hispida*	Dwarf Apple		
Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush		
Myrtaceae	*Callistemon* spp.			
Myrtaceae	*Corymbia gummifera*	Red Bloodwood		
Myrtaceae	*Corymbia maculata*	Spotted Gum		
Myrtaceae	*Eucalyptus botryoides*	Bangalay		
Myrtaceae	*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum		
Myrtaceae	*Eucalyptus* sp.			
Myrtaceae	*Kunzea ambigua*	Tick Bush	P	
Myrtaceae	*Leptospermum arachnoides*	Spidery Tea-tree		
Myrtaceae	*Leptospermum laevigatum*	Coast Teatree		
Myrtaceae	*Leptospermum* spp.	Tea-tree		
Myrtaceae	*Lophostemon confertus*	Brush Box		
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark		
Myrtaceae	*Melaleuca hypericifolia*	Hillock bush		
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark		
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark		
Myrtaceae	*Melaleuca* spp.			
Myrtaceae	*Tristaniopsis laurina*	Kanooka		
Oxalidaceae	*Oxalis* spp.			
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree		

Family	Scientific Name	Common Name	NSW status	Comm. status
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum		
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum		
Poaceae	*Cynodon dactylon*	Common Couch		
Poaceae	*Entolasia marginata*	Bordered Panic		
Poaceae	*Entolasia stricta*	Wiry Panic		
Poaceae	*Imperata cylindrica*	Blady Grass		
Polygonaceae	*Persicaria decipiens*	Slender Knotweed		
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn Fern	P	
Proteaceae	*Banksia ericifolia*	Heath-leaved Banksia		
Proteaceae	*Banksia integrifolia*	Coast Banksia		
Proteaceae	*Banksia oblongifolia*	Fern-leaved Banksia		
Proteaceae	*Banksia serrata*	Old-man Banksia		
Proteaceae	*Banksia spinulosa*	Hairpin Banksia	P	
Proteaceae	*Grevillea sericea*	Pink Spider Flower		
Proteaceae	*Hakea gibbosa*	Hakea		
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo		
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush		
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla		
Violaceae	*Viola hederacea*	Ivy-leaved Violet		

Table 2. Weed plant species list

Family	Species Name	Common Name
Oleaceae	*Olea europaea* subsp. *cuspidata*	African Olive
Alliaceae	*Agapanthus* spp.	Agapanthus
Agavaceae	*Agave* spp.	Agave
Asphodelaceae	*Aloe vera*	Aloe
Araceae	*Zantedeschia aethiopica*	Arum Lily
Asparagaceae	*Asparagus officinalis*	Asparagus
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern

Family	Species Name	Common Name
Sapindaceae	*Cardiospermum grandiflorum*	Balloon Vine
Asteraceae	*Chrysanthemoides monilifera*	Bitou Bush
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass
Fabaceae (Faboideae)	*Medicago polymorpha*	Burr Medic
Asteliaceae	*Cordyline australis*	Cabbage Tree
Lauraceae	*Cinnamomum camphora*	Camphor Laurel
Asteraceae	*Conyza canadensis var. canadensis*	Canadian Fleabane
Arecaceae	*Phoenix canariensis*	Canary Island Date Palm
Asteraceae	*Dimorphotheca ecklonis*	Cape Daisy
Solanaceae	*Physalis peruviana*	Cape Gooseberry
Bignoniaceae	*Tecoma capensis*	Cape Honeysuckle
Asteraceae	*Delairea odorata*	Cape Ivy
Asteraceae	*Arctotheca calendula*	Capeweed
Euphorbiaceae	*Ricinus communis*	Castor Oil Plant
Bignoniaceae	*Macfadyena unguis-cati*	Cat's Claw Creeper
Asteraceae	*Hypochaeris radicata*	Catsear
Agavaceae	*Agave americana*	Century Plant
Euphorbiaceae	*Triadica sebifera*	Chinese Tallowood
Asparagaceae	*Asparagus plumosus*	Climbing Asparagus Fern
Fabaceae (Faboideae)	*Trifolium* spp.	Clover
Asteraceae	*Bidens pilosa*	Cobbler's Pegs
Arecaceae	*Syagrus romanzoffiana*	Cocos Palm
Brassicaceae	*Cardamine hirsuta*	Common Bittercress
Caryophyllaceae	*Stellaria media*	Common Chickweed
Convolvulaceae	*Ipomoea purpurea*	Common Morning Glory
Fabaceae (Faboideae)	*Erythrina x sykesii*	Coral Tree
Asteliaceae	*Cordyline* spp.	Cordyine
Asteraceae	*Coreopsis lanceolata*	Coreopsis
Malaceae	*Cotoneaster* spp.	Cotoneaster
Oxalidaceae	*Oxalis corniculata*	Creeping Oxalis
Asteraceae	*Ageratina adenophora*	Crofton Weed

Family	Species Name	Common Name
Iridaceae	*Dietes grandiflora*	Dietes
Araliaceae	*Hedera helix*	English Ivy
Chenopodiaceae	*Chenopodium album*	Fat Hen
Moraceae	*Ficus* spp.	Fig
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane
Asteraceae	*Conyza* spp.	Fleabane
Liliaceae	*Lilium formosanum*	Formosan Lily
Caryophyllaceae	*Polycarpon tetraphyllum*	Four-leaved Allseed
Araceae	*Monstera deliciosa*	Fruit Salad Plant
Fumariaceae	*Fumaria* spp.	Fumitory
Asteraceae	*Gazania rigens*	Gazania
Fabaceae (Faboideae)	*Trifolium arvense*	Haresfoot Clover
Apiaceae	*Hydrocotyle bonariensis*	Hydrocotyle
Araceae	*Arum italicum*	Italian Arum
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle
Nandinaceae	*Nandina domestica*	Japanese Sacred Bamboo
Poaceae	*Pennisetum clandestinum*	Kikuyu Grass
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues
Verbenaceae	*Lantana camara*	Lantana
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet
Basellaceae	*Anredera cordifolia*	Madeira Vine
Rutaceae	*Murraya paniculata*	Marraya
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant
Convolvulaceae	*Ipomoea indica*	Morning Glory
Apocynaceae	*Araujia sericifera*	Moth Vine
Crassulaceae	*Bryophyllum delagoense*	Mother of millions
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed
Tropaeolaceae	*Tropaeolum majus*	Nasturtium
Myrtaceae	*Metrosideros excelsa*	New Zealand Christmas Bush
Phormiaceae	*Phormium tenax*	New Zealand Flax
Araucariaceae	*Araucaria heterophylla*	Norfolk Island Pine
Alliaceae	*Nothoscordum borbonicum*	Onion Weed

Family	Species Name	Common Name
Oxalidaceae	*Oxalis* spp.	Oxalis
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne
Poaceae	*Setaria palmifolia*	Palm Grass
Poaceae	*Ehrharta erecta*	Panic Veldtgrass
Arecaceae	*Phoenix* spp.	Phoenix Palm
Polygonaceae	*Acetosa sagittata*	Rambling Dock
Fabaceae (Caesalpinioideae)	*Senna pendula var. glabrata*	Senna
Brassicaceae	*Capsella bursa-pastoris*	Shepherd's Purse
Oleaceae	*Ligustrum sinense*	Small-leaved Privet
Agavaceae	*Yucca aloifolia*	Spanish Bayonet
Anthericaceae	*Chlorophytum comosum*	Spider Plant
Strelitziaceae	*Strelitzia reginae*	Strelitzia
Cannaceae	*Canna indica*	Tous-les-mois Arrowroot
Cyperaceae	*Cyperus eragrostis*	Umbrella Sedge
Poaceae	*Bambusa* spp.	Unidentified bamboo
Commelinaceae	*Tradescantia fluminensis*	Trad
Iridaceae	*Watsonia meriana*	Watsonia
Fabaceae (Faboideae)	*Trifolium repens*	White Clover

3.5 Endangered Ecological Communities

There were no Endangered Ecological Communities (EEC) listed on BioNet in the wider area. During the site visit, it was found that there were species common to the EEC Eastern Suburbs Banksia Scrub (ESBS), however the soil type was not indicative of ESBS. Following are species typical of ESBS and those species in bold are growing on the site.

Common species of ESBS: Banksia aemula, ***B. ericifolia, B. serrata,*** *Eriostemon australasius, Lepidosperma laterale,* ***Leptospermum laevigatum, Monotoca elliptica,*** *Xanthorrhoea resinfera*

3.6 Threatened Plant Species

The vulnerable and endangered species to focus on-site searches for can be seen below in Table 3. Following this Table is a brief discussion on each listed species that could be on the site.

Table 3. Threatened Plant Species (Source: Bionet)

Scientific Name	Common Name	NSW Status	Commonwealth Status	No. of records
Chamaesyce psammogeton	Sand Spurge	Endangered		1
Acacia terminalis subsp. terminalis	Sunshine Wattle	Endangered	Endangered	196
Syzygium paniculatum	Magenta Lilly Pilly	Endangered	Vulnerable	15
^^Allocasuarina portuensis	Nielsen Park She-oak	Endangered	Endangered	70
^^Persoonia hirsuta	Hairy Geebung	Endangered	Endangered	1
Epacris purpurascens var. purpurascens		Vulnerable		1
Eucalyptus camfieldii	Camfield's Stringybark	Vulnerable	Vulnerable	12
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Vulnerable	Vulnerable	2
Pimelea curviflora var. curviflora		Vulnerable	Vulnerable	1
^^Callistemon linearifolius	Netted Bottle Brush	Vulnerable		2

3.6.1 Sand Spurge *Chamaesyce psammogeton*

Habitat for Sand Spurge does not occur in the proposed development areas or immediate surrounds.

3.6.2 Sunshine Wattle *Acacia terminalis subsp. terminalis*

TSC-E, EPBC-E

Acacia terminalis is growing on-site, however the threatened subspecies, *Acacia terminalis subsp. terminalis*, was not identified to be growing on the site. No seven part test was required. There is no proposed disturbance near *Acacia terminalis.*

The recovery plan for this species (2010) has the site marked as a 'current site'; see Figure 30, an extract from the *Acacia terminalis subsp. terminalis* Recovery Plan (Bremner and Goeth, April 2010).

Between Gap Bluff Cottage and Officers Mess there is a sealed road way and garden bed edging. A garden bed within 1m of the road way has an *Acacia terminalis* growing in it (see figure 29).

Plate 72. *Acacia terminalis* growing on site

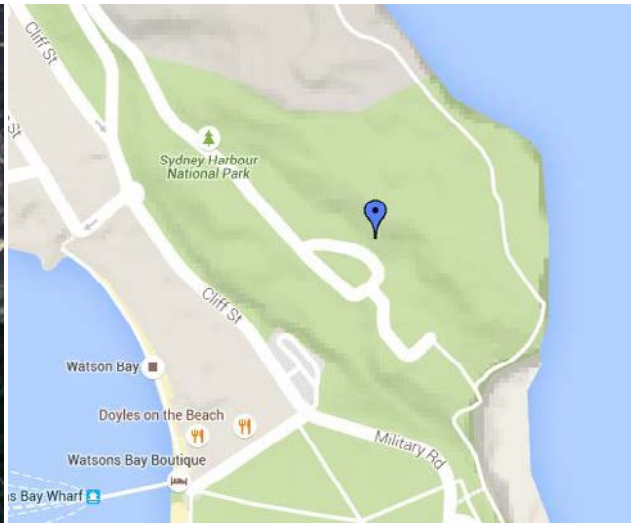


Figure 29. Location of *Acacia terminalis* growing on site (Latitude: 33°50'30", Longitude: 151°17'00) (Source: MotionX-GPS Waypoint)

Acacia terminalis subsp. terminalis is an erect or spreading shrub, 1-5 metres tall, with pale yellow flowers and seed pods 3-11 cm long. Very limited distribution between Botany Bay to the northern foreshore of Port Jackson. Recent collections have only been made from the Quarantine Station, Clifton Gardens, Dover Heights, Parsely Bay, Nielson Park, Cooper Park, Chifley and Watsons Bays.

Coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Most areas of habitat or potential habitat are small and isolated. Most sites are highly modified or disturbed due to surrounding urban development. Flowers in autumn. Small birds and bees are natural pollinators. Seeds mature in November and are dispersed by ants. Seed viability is high and recruitment occurs mainly after fire. A fire temperature of 60 degrees is required for optimum germination. Although plants are killed by fire, they have been recorded sprouting from the base.

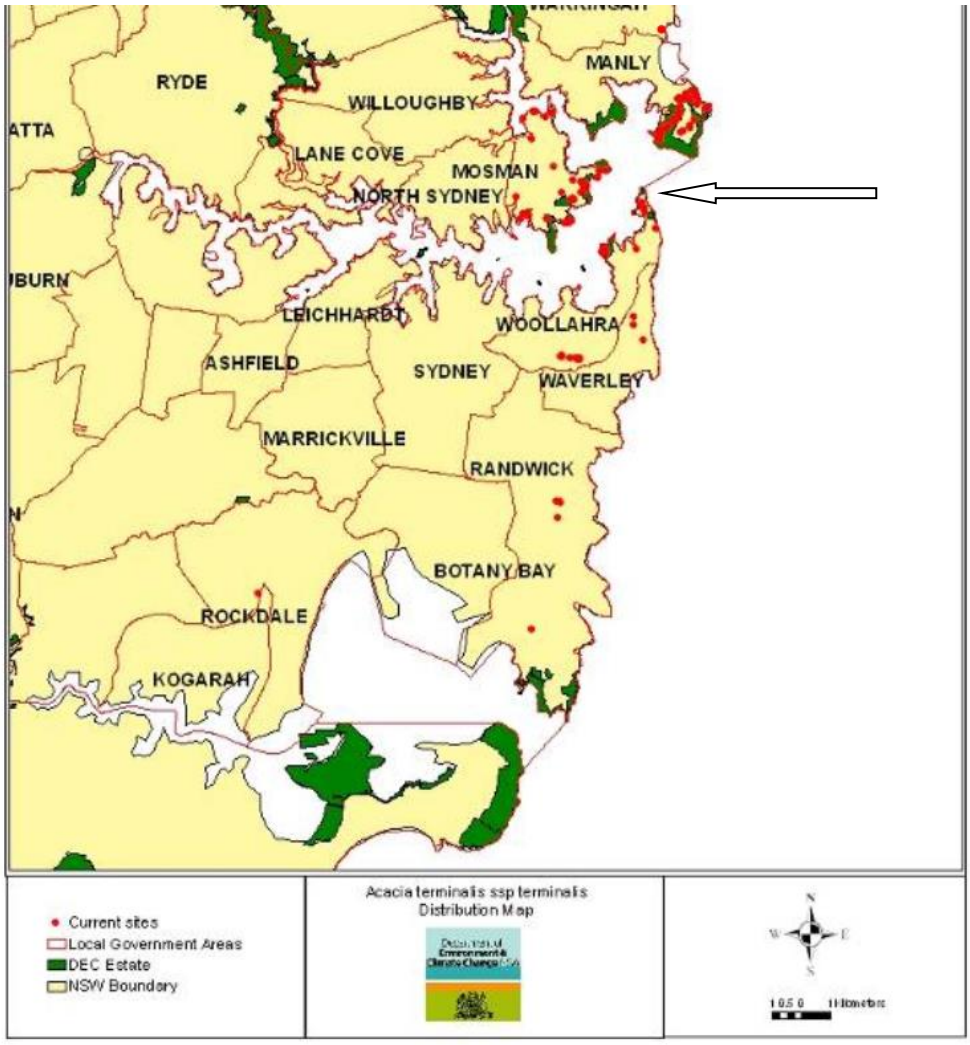


Figure 30. Extract from *Acacia terminalis subsp. terminalis* Recovery Plan (April 2010)

3.6.3 Magenta Lilly Pilly *Syzygium paniculatum*

TSC-E, EPBC-V

Habitat on the site is suitable for Magenta Lilly Pilly *Syzygium paniculatum.* While planted Lily Pillys are common, a naturally occurring Magenta Lilly Pilly was not identified in the proposed re-development zone or identified as naturally occurring plants elsewhere on site. A test of significance has not been conducted.

A tree to 15 m tall, but is generally 3–8 m high and shrubby in form. Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest. Has been recorded in widely scattered small populations along the NSW coast from Booti Booti (near Forster) in the north to Conjola State Forest (near Jervis Bay) in the south. Found in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas. Rainforests are often remnant stands of littoral or gallery rainforest. Associated species include Alphitonia excelsa, Acmena smithii, Cryptocarya glaucescens, Toona ciliata, Eucalyptus saligna, Ficus fraseri, Syzygium oleosum, Acmena smithii, Cassine australe, F. obliqua, Glochidion ferdinandi, Endiandra sieberi, Synoum glandulosum, Podocarpus elatus, Notelaea longifolia, Guioa semiglauca and Pittosporum undulatum. Is thought to tolerate wet and dry conditions on sands. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in

riverside gallery rainforests and remnant littoral rainforest communities. Flowers December to March, with fruit ripe from March to May, occasionally to September.

3.6.4 Hairy Geebung *Persoonia hirsuta*

TSC-E, EPBC-E

Searches were made for Hairy Geebung but none were found. The site is suitable habitat and ecological burns could benefit this species. A test of significance has not been conducted.

Hairy Geebung has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. Persoonia hirsuta has a large area of occurrence, but occurs in small populations, increasing the species fragmentation in the landscape. The Hairy Geebung has been recorded in the Sydney coastal area (subsp. hirsuta - Gosford to Berowra to Manly to Royal National Park), the Blue Mountains area (subsp. evoluta - Springwood, Lithgow, Putty) and the Southern Highlands (subsp. evoluta - Balmoral, Buxton, Yanderra and Hill Top areas). The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone from near sea level to 600m altitude. It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed. Flowering is generally in summer.

3.6.5 Nielsen Park She-oak *Allocasuarina portuensis*

Known habitat is not present on the site. Searches for Nielsen Park She-oak were made in suitable locations, however none were observed.

3.6.6 *Epacris purpurascens var. purpurascens*

The site is not optimal habitat for this species as the vegetation communities it is typically found within are different from that on-site. There are no records of Epacris purpurascens var. purpurascens from within the study site. A test of significance has not been conducted.

An erect shrub, 50 - 180 cm high. Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. E. purpurascens var. purpurascens has been recorded from Ku-Ring-Gai Chase National Park, Berowra Valley Regional Park, Muogamarra Nature Reserve, and Brisbane Waters National Park, with unconfirmed records from Gulger Nature Reserve and Bents Basin State Recreation Area.

Large populations exist in protected water supply catchment lands in the vicinity of Picton Road. Found in a range of habitat types, most of which have a strong shale soil influence. These include ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities eg. Stringybark and Ironbark woodlands, various shale/sandstone transition forest associations including Turpentine Ironbark Margin Forest, Stringybark/Scribbly Gum Woodland and Scribbly Gum/ Grey Gum/ Red Bloodwood Woodland.

The species also occurs in riparian zones draining into Sydney Sandstone Gully Forest, shale lenses within sandstone habitats and colluvial areas overlying or adjoining sandstone or tertiary alluvium. Lifespan is recorded to be 5-20 years, requiring 2-4 years before seed is produced in the wild. Killed by fire and re-establishes from soil-stored seed.

3.6.7 Camfield's Stringybark *Eucalyptus camfieldii*

The site has suitable habitat for *Eucalyptus camfieldii* and targeted searches were conducted in the exposed ridge top heath. While no plants were observed in this survey they could still grow in the area. *Eucalyptus camfieldii* are not growing in the proposed works / disturbance zones. Following is a summary of attributes of *Eucalyptus camfieldii.* A test of significance has not been conducted.

Mostly mallee to 4 m tall though can grow to a straggly tree to 9 m high. Bark is rough, fibrous and stringy, red or dark grey-brown. Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.

Occurs in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Grows in coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.

Associated species frequently include stunted species of E. oblonga Narrow-leaved Stringybark, E. capitellata Brown Stringybark and E. haemastoma Scribbly Gum. Population sizes are difficult to estimate because its extensive lignotubers may be 20 m across. A number of stems arise from these lignotubers giving the impression of individual plants. Flowering period is irregular, flowers recorded throughout the year. Poor response to too frequent fires.

3.6.8 Netted Bottle Brush *Callistemon linearifolius*

While the general habitat type of dry sclerophyll forest on the coast and adjacent ranges occurs on site, *Callistemon linearifolius* has not been recorded from this location. General searches during the survey time did not result in any *Callistemon linearifolius* being located. A test of significance has not been conducted.

A shrub up to 3-4m tall. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coal Cliffs in the Southern Rivers CMA. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Was more widespread across its distribution in the past. There are currently only 5-6 populations in the Sydney area, of the 22 populations recorded in the past. Three of these are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring to summer.

3.7 Flora Conclusion

- Diversity of native flora in the area due to variations in soil, aspect and disturbance. Condition is from good to very poor. Generally around the existing buildings the condition is very poor.
- Over 95 native species were recorded on-site.
- No threatened species or EECs were recorded on-site. An *Acacia terminalis* was identified on-site.
- The proposed development will have no direct impact on threatened species or EECs.
- Recommended actions are for weed management.
- Monitoring vegetation communities, by NPWS, is recommended to gauge vegetation management outcomes across the whole site. NPWS will provide the lessee with information on vegetation management as it applies to the protection of bushland and biodiversity on the site.

3.7.1 On-going Management - Vegetation

- The lessee will be responsible for general vegetation and weed management within the leased area. Management of areas dominated by native vegetation will include at least a team leader with Certificate III or above in Natural Area Conservation (Bush Regeneration).
- For 'garden areas' this will include the management of non-native plant species such that they do not spread into bushland areas. This includes stopping propagules or pieces being spread by birds, wind / water.
- The lessee and NPWS will work collaboratively in relation any boundary management issues.
- No planting is to include Environmental or Noxious Weeds at any time. Landscaping should continue to discourage 'bully-birds' such as Noisy Minors'.

4 Fauna Findings

4.1 Methods

Mia Dalby-Ball assessed the site on the 3rd of June, 2015. Searches were made for scats, tracks, hollows and other habitats. Searches were done for listed species / populations particularly for Long-nosed Bandicoots. A Camera trap was set on site and no fauna was recorded. Anabat was conducted for 2 hours at and after dusk and at night spotlighting was done along with Call play-back for large forest owls, Gliders and Ring-tails with the Owl calls played last.

During these site visits, notes and photos were taken of the important fauna and fauna habitat present. BioNet was also used to determine the threatened fauna and endangered populations, which have been recorded within 10km of the site since 1980.

4.2 Fauna Findings from Site Investigation

In summary, there is a diversity of fauna habitats including highly modified landscapes (turf) to bushland with all strata present.

Habitat features include:

- Sandstone, outcrops overhangs and waterfalls (ephemeral)
- Trees with small hollows and flaking barks
- Dense leaf litter
- Thick vegetation
- Buildings and
- A variety of vegetation types

Table 4 lists the species recorded. A total of 15 native bird species were identified. One reptile (Common Skink) and some butterflies were also seen on site.

While no mammals were observed Brush-tail and Ringtail Possums could live on the site as could micro-bats. For this study, it has been assumed that micro-bats are on site and possible impacts of the proposed works have been assessed assuming micro-bats are on-site. Introduced Black Rats are expected to be present on-site, though none were seen.

Table 4. Fauna species list

Class	Scientific name	Common name
Birds	*Malurus cyaneus*	Superb Blue Wren
Birds	*Rhipidura leucophrys*	Willie Wagtail
Birds	*Sericornis frontalis*	White-browed Scrubwren
Birds	*Trichoglossus moluccanus*	Rainbow Lorikeet
Birds	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet
Birds	*Daclelo novaeguineae*	Laughing Kookaburra
Birds	*Cracticus tibicen*	Magpie
Birds	*Strepera graculina*	Pied Currawong
Birds	*Manorina melanocephala*	Noisy Miner
Birds	*Anthochaera carunculata*	Red Wattlebird
Birds	*Rhipidura rufifrons*	Rufus Fantail
Birds	*Chroicocephalus novaehollandiae*	Silver Gull
Birds	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
Reptile	*Lamphropholis guichenoti*	Garden skink
Insect	Three species of Butterflies not identified to genus or species level	

4.3 Threatened Fauna

Table 5 lists the Threatened fauna listed on BioNet from within 10km of the site. No threatened fauna were recorded on or near the site. Micro-bats could use the site and have been discussed in the section following threatened species.

Habitat is suitable for Long-nosed Bandicoots.

Red-crowned Toadlets may be able to live along the ephemeral watercourses and waterfalls. None were seen or heard and generally the site appears to be drier than areas RCT are usually found.

Species in bold have habitat on-site and have been recorded in the area in the past 5 years. Marine species including birds that would not use this habitat have been removed from the list.

No threatened species will be impacted by the proposed development.

Table 5. Threatened Fauna (Source: Bionet)

Class	Scientific Name	Common Name	NSW Status	Comm. Status	No. of records
Aves	^^*Lathamus discolor*	Swift Parrot	E1,P,3	E	2
Mammalia	***Perameles nasuta***	**Long-nosed Bandicoot, North Head**	**E2,P**		**277**
Amphibia	***Pseudophryne australis***	**Red-crowned Toadlet**	**V,P**		**61**
Aves	***Ptilinopus superbus***	**Superb Fruit-Dove**	**V,P**		**1**
Aves	***Hieraaetus morphnoides***	**Little Eagle**	**V,P**		**3**
Aves	*Glossopsitta pusilla*	Little Lorikeet	V,P		1
Aves	*Petroica boodang*	Scarlet Robin	V,P		1
Aves	***Stagonopleura guttata***	**Diamond Firetail**	**V,P**		**1**
Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	1
Mammalia	***Pteropus poliocephalus***	**Grey-headed Flying-fox**	**V,P**	**V**	**34**
Mammalia	***Miniopterus schreibersii oceanensis***	**Eastern Bentwing-bat**	**V,P**		**10**
Mammalia	*Myotis macropus*	Southern Myotis	V,P		464
Aves	^^*Pandion cristatus*	Eastern Osprey	V,P,3		3
Aves	^^*Ninox connivens*	Barking Owl	V,P,3		1
Aves	^^*Ninox strenua*	Powerful Owl	V,P,3		26

*Large Forest Owls – habitat is foraging only.

4.3.1 Microbats

Although no microbats were seen on site, two species have been recorded within the locality. Microbats, could be likely to utilize foraging resources within the study area as part of a wider network of fragmented habitat patches across the landscape. From *pers. comm.* with people recently in the buildings, it appears there are no micro-bats in the buildings.

Areas of native woodland in the study area are likely to contain trees which contain hollows for microbat roosting. In addition, the Pheonix Palms on the turf at the front of Gap Bluff Cottage also had hollows in the upper overlapping leaf stems which could also be used by microbats for roosting. Sandstone outcrops and overhangs occur across the site and some of these may be used by cave roosting bats, although all those inspected appeared to be too small.

4.3.1.1 Tree-roosting microbats

Although the study area contains few habitat trees (hollows, flaking bark etc) micro-bats could occur here. Vegetation is fragmented and does not meet the preferred habitat requirements. Following is a summary of micro-bats basic resource requirements.

Eastern Freetail-bat *Mormopterus norfolkensis*

The Eastern Freetail Bat inhabits dry sclerophyll forest and woodland east of the Great Dividing Range. It forages in natural and artificial openings in vegetation, typically within a few kilometers of its roost. Roosts are primarily in tree hollows, mostly in hollow spouts of large mature trees but have also been recorded from man-made structures or under bark (Churchill 2008).

Eastern False Pipistrelle *Falsistrellus tasmaniensis*

The Eastern False Pipistrelle inhabits moist forest generally with trees larger than 20 metres and roosts in eucalypt hollows, underneath bark or in buildings. No favorable habitat on-site.

Greater Broad-nosed Bat *Scoteanax rueppellii*

The Greater Broad-nosed Bat inhabits tall wet forests with a dense understory. The species prefers continuous forest, and is generally absent from small patches of remnant forest. No favorable habitat on-site.

4.3.1.2 Cave-roosting microbats

The site does rock overhangs and possibly caves. Cave-roosting species would utilise the study area as foraging habitat.

Large-eared Pied Bat *Chalinolobus dwyeri*

The Large-eared Pied Bat roosts in rock overhangs, caves, mine tunnels and the abandoned nests of Fairy Martins. It is most commonly recorded from dry sclerophyll forests and woodlands, but has also been recorded from a range of other forest and woodland types (Hoye and Schulz 2008). It is an insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney it appears to be largely restricted to the interface between sandstone escarpments and fertile valleys (OEH 2013a). It has been recorded breeding in mine tunnels and caves (Pennay 2008, Hoye and Schulz 2008, DERM 2011).

Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*

The Eastern Bentwing Bat is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures outside the breeding season. Breeding takes place from October to April in a number of maternity caves that host up 100,000 females. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands. In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within 6 meters of the ground. Moths form the major component of their diet (Churchill 2008).

The Eastern Bentwing Bat has no breeding habitat in the locality: only four maternity caves are known in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Breeding takes place in October and females may travel several hundred kilometers to the nearest maternal colony (Churchill 2008).

Little Bentwing-bat *Miniopterus australis*

The Little Bentwing-bat inhabits rainforests, wet and dry Sclerophyll forests, paperbark swamps and vine thickets. There is only one maternity cave known in NSW, at Willi Willi, near Kempsey, which is shared with Eastern Bentwing-bats. Outside the breeding season it roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. It forages for insects beneath the canopy of well-timbered habitats (Churchill 2008, Hoye and Hall 2008).

Southern Myotis *Myotis macropus*

The Southern Myotis is mainly coastal but may occur inland along large river systems. It is usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. It forages over streams and watercourses feeding on fish and insects from the water surface. The Southern Myotis roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011).

It is possible that this species occurs within the study area on an occasional or transient basis, utilising foraging resources or overflying the site, but would be unlikely to be dependent on resources present within the site. Fishing Bats have recently (2014- 2015) been recorded in Sydney Harbour and roosting in hollows in Mangroves.

4.4 Endangered Populations

There were only two endangered populations found within 10km of the site (see Table 6). Neither are listed for South Head.

Table 6. Endangered populations

Family	Common name	Scientific name	NSW status	Comth status	No. of records
Aves	Little Penguin in the Manly Point Area	*Eudyptula minor*	Endangered		4
Mammalia	Long-nosed bandicoot, North Head	*Perameles nasuta*	Endangered		277

The following images, Figure 100 to 105, show some of the variety of Fauna habitat. Habitat improvement is possible and practical and could result in safeguarding existing populations of small birds and reptiles.

Plate 73. Sandstone rocks - habitat for lizards

Plate 74. Phoenix Palms - habitat for birds and microbats

Plate 75. Weeds - habitat for small birds and mammals

Plate 76. Weeds and bushland

Plate 77. Rock and little cave for lizards

Plate 78. Good ground cover for invertebrates

4.5 Feral Animals/Pests

Pest animals that occur on site and have the potential to increase in abundance with increase site use. Species include Black Rats and Common Myna Birds. Native species that can reach pest levels include Ibis and Seagulls. Foxes live in the area and are known to feed on discarded food and other scraps – minimising food foxes is important as part of the overall management of this pest species.

To minimize the populations of pest species the following is required:

- Outdoor waste facilities to be vermin proof
- Outdoor areas free of food scraps and organic wastes
- Patrons to be discouraged from feeding animals particularly birds

4.6 Fauna Conclusion and Recommendations

- Native birds, including wrens and other small birds, live in bushland on the site. Common urban birds are also present including an abundance of Noisy Minors. These territorial birds can reduce the diversity of small birds by mobbing them and driving them out of areas.
- No threatened fauna were recorded on or near the site. Micro-bats could use the site and have been assumed to be present.
- Habitat is suitable for Long-nosed Bandicoots, though none are on-site.
- Red-crowned Toadlets may be able to live along the ephemeral watercourses and waterfalls. None were seen or heard and generally the site appears to be drier than areas RCT are usually found.
- No tests of significance (7-part tests) were required.
- Habitat enhancement and fauna monitoring could be feasibly conducted on-site, however that is outside the scope of this project.

References

- Office of Environment and Heritage (OEH) 2015, *BioNet*. [5 June 2015]Available from: http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx
- VIS plant search, Accessed 10 June 2015, Available from:

  < http://www.environment.nsw.gov.au/research/Vegetationinformationsystem.htm>
- Department of Environment, Climate Change and Water Recovery, 2010, *National Recovery Plan Acacia terminalis subsp. Terminalis (Sushine Wattle),* Australian Government. Available from:

  < http://www.environment.gov.au/system/files/resources/da1a376c-0b3e-4612-8c37-2bea5ad12a6e/files/acacia-terminalis-terminalis.pdf> [9 June 2015]
- Trish Dobson Landscape Architecture. (2015) Detail Landscape Concept Plans, Gap Bluff, March 2015
- *Sydney Metropolitan Catchment Management Authority showing Soil Landscape.* Available from:

  < http://archive.lls.nsw.gov.au/__data/assets/pdf_file/0011/496757/archive-soil-landscape.pdf> [10 June 2012]
- OEH Vegetation Mapping, Accessed 10 June 2015, Available from:

  < http://www.environment.nsw.gov.au/research/Vegetationinformationsystem.htm>
- JPW Rock excavation Estimate Drawing JPW-SK-011 dated 03-06-15

5 Experience of authors

CV of Mia Dalby-Ball, ECA Director

Qualifications

Bachelor of Science (Hons I), Sydney University, 1995.

Majoring in Zoology, Ecology and Botany.

Background

As a child Mia loved the times in Nature – frequently outside in bush areas she was a keen observer of native animals and in primary school she was already showing others the animals and where they lived and their calls.

As she grew so did her interest and she continued her passion in the area of biology and ecology. Mia excelled in these subjects at school and university – getting 1st Class Honors. She then went on to teach Ecology and Biology at Sydney University and TAFE. Following this she travelled extensively over a number of years – keenly interested in the natural places and people's interaction and management of these areas. Mia often seeks the advice from Indigenous Knowledge Holders recognising that their knowledge of Australian Flora and Fauna goes way back.

As a mum she now delights in sharing this natural world with her Children and many others as she passionately leads eco walks and talks and co-facilitates eco-events.

Mia is skilled in experimental design and analysis; research; saltwater and freshwater wetland design and management; teaching, environmental legal work, negotiating and strategic planning regarding environmental outcomes.

Mia has over 8 years Local Government Experience as *Manager of Environment and Education* for Pittwater Council. Plus over 15 years wetland experience and has presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Mia was a Technical Advisor, on the Saltmarsh Technical Committee for Hawkesbury Nepean Catchment Management Authority (HNCMA) for its duration 2006-2009.

Mia has up to date knowledge of environmental policies and guidelines and frequently provides input to such works. Mia was a key contributor to the recent set of Guidelines commissioned by South East Queensland Healthy Waterways *Water Sensitive Urban Design Guidelines*. Mia's role included significant contributions and review of the *Guideline for Maintaining WSUD Assets* and the *Guideline for Rectifying WSUD Assets*. This information is being used by the Sydney Metropolitan CMA for implementation in NSW.

Mia is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Mia is a joint author on the popular book *Burnum Burnum's Wildthings* published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter *Estuary Plants of East Coast Australia* published by Sainty and Associates (2013). Mia's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Mia is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.
Mia is also presenter on a weekly business program – Business Success Now on Blog-talk radio an popular internationally broadcast radio program.

Specialist Skills

- Urban Ecology – and habitat rehabilitation and re-creation.
- Urban waterway management – assessing, designing and supervising rehabilitation works
- Saltmarsh and Wetland re-creation and restoration – assessment, design and monitoring
- Engaging others in the area of environmental care and connection
- Technical Advisor – environmental design, guidelines and policies
- Sound knowledge and practical application of experimental design and statistics
- Project management and supervision
- Grant writing and grant assessment
- Budget estimates and tender selection
- Expert witness in the Land and Environment Court

Professional Experience

2014-current	Director and Ecologist - Ecological Consultants Australia.
1998–2014	**Dragonfly Environmental,** Principal Urban Waterways and Wetlands and Eco-tours**.** Specializing in design, assessment, monitoring and rehabilitation of urban waterways, wetlands and Saltmarsh. Mia is responsible for projects with multi-stakeholder communications and community engagement.
2001–2010	**Pittwater Council, Natural Environment and Education Manager**. Responsible for leading the Natural Environment and Education Unit, including the Coastal Environment Centre, in facilitating community and council actions resulting in the long-term sustainability of natural areas. Responsibilities included but were not limited to:

strategic planning relating to environment, sustainability and community engagement
risk management issues in natural areas including bushfire and coastal hazards
innovative, award winning and effective community engagement projects
writing and implementing policies
managing and peer-reviewing the Pittwater Estuary Management Plan and reviewing and providing input to the Narrabeen Lagoon Estuary Management
major works program relating to Environmental, Sustainability and Environmental Community Education (eg: walking tracks, major grants (applications and on-ground works) restoration and re-creation of environments (particularly saltmarsh projects); community based eco-adventures
tender selection, budget management, plans of management
part of the Section 94 Managers Team – devising and delivering a 12 million dollar program.
Mia inspired, gained funding for and ran many very successful community engagement projects including: *Ecoferry trips, Bilarong Festival, Seasons and Cycles*. More information on these can be provided if interested.

1998–2004 **Sainty and Associates**, Environmental Scientist. Involved in; wetland and waterway restoration, designing and planting constructed wetlands, writing and implementing management plans, project management, expert witness in Land and Environment Court and all aspects of field work and report writing.

1998–2000 Contracted to a number of Environmental and Engineering based companies including Martens and Associates, Pty. Ltd and GIS Consulting, Pty. Ltd., as an Environmental Scientist. Responsible for conducting on-site wastewater assessments, soil identification, EIS, Biodiversity studies and impact assessments (EIS) relating to fauna and design and calculations for wastewater disposal systems.

1994—1996 Associate Lecturer and Assistant Co-coordinator of first year biology, Univ. of Sydney. Responsible for Teaching biology to first year students in the Degree areas of medicine, dentistry and science.
1996 TAFE Ultimo, Ecology Lecturer. Responsible for writing Ecology Course – writing all lecture material, practicals and exams.

Selected Projects, Design, Reporting and Monitoring

- **Plans of Management for 3 Sydney Water Wetlands (2012)** Writing Plans of Management for 3 of Sydney Waters Wetlands including recommendations for management of 3 coastal Endangered Ecological Communities.
- **Biodiversity Strategy and Fauna Survey for Canterbury City Council (2012)** Conducting Fauna Survey and Writing Biodiversity Strategy with community Engagement.
- **Seasons and Cycles – Eco-tours with Indigenous Elders (2012)** series of eco-tours for community facilitated by Mia as a joint project with Tina Demetriou (Tide Event Mgt) for Hawkesbury Nepean Catchment Management Authority.
- **Mapping Saltmarsh and other EEC and protected vegetation for Sydney Waters Tidal Assets (2011-2012)** mapping Saltmarsh in Sydney Waters Tidal Assets.
- **Review of Environmental Factors for Proposed Mountain Bike Trail Old Mans Valley and Hornsby Conservation Park (2011)**. For Hornsby Council. Works involved researching, field work and writing the REF covering all areas – environmental, heritage, noise, social, parking etc.
- Technical Advice and on-site Supervision of **Saltmarsh Restoration Works (2011-current)** Ecological restoration and rehabilitation works for the **Victorian Desalination Plant** crossing of Woolshed Creek for **Thiess Degrémont Nacap - Victorian Desalination Project** 2011-2012. Saltmarsh Ecologist for the works. Works involve the weed management, translocation of Saltmarsh and supply and installation of 30,000 Saltmarsh and wetland species.
- **Saltmarsh Monitoring and Reporting (2008 contracted to 2011). Baulderstone JDN, Port Botany Expansion Project,** Mia is monitoring designated Saltmarsh sites within the Penrhyn Estuary. Mia is responsible for the design and implementation of the monitoring program. Twenty sites are monitored weekly and monthly. Monitoring involves quantitative surveys assessing Saltmarsh before and post construction including photo-monitoring points.
- **Moore Park Wetland Health Assessment and Recommendations for Management (2011), Kograh Council.** Mia was responsible for the identification of causes of wetland problems and recommend recommendations for the wetlands rehabilitation including provision of brief for quoting on proposed works.
- **Ecological Monitoring and Reporting (2008 to 2013+). TSA Management, Dardanelles RSL Retirement Village**. Mia is contracted through DFE as the Site Ecologist to monitor environmental aspects at the Dardanelles retirement village. Including six monthly monitoring and reporting with quadrat sampling and photo. monitoring points. As site ecologists DFE is responsible for determining if construction is in compliance with the Conditions of Consent and the 3a Permit (Water Management Act 2000).
- **Monitoring and Reporting on Mangrove Rehabilitation Mortlake (2010 to 2012) Jemena Asset Management**. Responsible for monthly monitoring and reporting of the Mangrove Rehabilitation Area. Reporting to agencies licensing Jemena Asset Management pipeline works.
- **Scarborough Park Wetland Rehabilitation Project Plan (2010) Rockdale City Council and monthly monitoring and reporting (to 2012+)**Management Plan design and Works for the wetland and surrounding Endangered Ecological Communities. This included a specific works plan, budget and prioritised on-going works.
- **Acid Sulphate Soil Testing, One Tree Reach Wetland (2010) Hornsby Shire Council.** Site Assessment of the One Tree Reach Estuarine Wetland including Water and Soil Sampling and recommendations for remediation of the wetland.
- **Shellharbour Pond Wetland Assessment and Management Plan (2010). Shellharbour City Council,** Dragonfly Environmental was commissioned to do a wetland assessment including sediment and water quality sampling, to determine cause of odours and to make recommendations for improving this constructed wetland.
- **Mapping of Saltmarsh Vegetation in Penhryn Estuary**, **Port Botany for Sydney Ports Corporation, (2008).** On-ground mapping of saltmarsh and production of GIS map.
- **Section 95 (2) Certificate to collect Seed from Saltmarsh Endangered Ecological Community (2009) and Monitoring**

Report – *Samolus repens* Horning Street Saltmarsh, Kurnell (2010) Reports to Department of Environment Climate Change and Water. Reports, field monitoring and vegetation mapping of the Horning Street Saltmarsh and surrounding area before seed collection and 12 months after.

- **Cooks River Foreshore Restoration and Saltmarsh Creation, Gough Whitlam Park (2002-2005).** Mia provided the detailed concept design for the re-created Saltmarsh, the riverbank erosion management works and the riparian plantings. Her involvement included liaison with Agencies and Council, writing the environmental impact statement, the detailed design report, aquatic and terrestrial plant technical specifications, statement of environmental effects, planting schedules and all environmental documents for the development application including getting data from doing soil surveys **Canterbury City Council.**
- **Riverwood Wetland and Salt Pan Creek, Canterbury City Council (2004-2007).** Works involved Environmental Impact Statement, detailed design report, aquatic plant technical specifications, & operation and maintenance manual for the site. Dragonfly Environmental project managed construction of the wetland and Creek-line. Plant supply, planting and 13 weeks maintenance of the wetland and creek-line.
- **Saltmarsh Creation Kooroowall Reserve, Bayview, NSW** (2002-2007) Mia obtained a grant from the HN CMA to create a Saltmarsh in an area that way estuary fill. Mia's role included costing the project and managing the funds, designing the saltmarsh, project management of on-ground works, community and stakeholder engagement, grant reporting to HN CMA and monitoring the outcomes of the success Creation of Saltmarsh at Kooroowall Reserve in Pittwater Estuary.
- **Seawall Rehabilitation and Saltmarsh Creation – Rowland Reserve, Pittwater NSW** (2006). Mia's role was provision of technical advice on the Saltmarsh Creation and determining the Saltmarsh planting technical specifications and supervising planting.
- **Community Engagement 'Saltmarsh and Seagrass – Fish for the Future'** (2003-2008) joint project of Pittwater Council (Mia Dalby-Ball), Ocean Watch and Hawkesbury Nepean CMA. Mia initiated the project and continued as part of the core team of 3 developing the engagement program. Mia was the project manager for rolling out the engagement which included six Eco-ferry trips around Pittwater with stops, on-ground workshops, seagrass and saltmarsh education. Over 120 people attended each trip with more on the wait list. The feed-back showed a high level of community engagement and peoples increase in knowledge and interest.
- **Careel Bay Saltmarsh Restoration** (2003-2007) for Pittwater Council. Mia obtained a grant from the HN CMA to rehabilitate this existing Saltmarsh, designed works, compiled reports required, conducted detailed community engagement – particularly for adjoining residents – and project managed on-ground works.
- **Snowy River Environmental Flows Study** (1999–2005) Vegetation Monitoring and Reporting. Project Manager for Sainty and Associates. Long term study for DECCW (then DLWC).
- **DCP for Wetlands in the Sydney Region Sydney for the Sydney Coastal Council Group** (2000). Mia was the Project Manager for Sainty and Associates she was a key field person and was responsible for writing background and technical reports.
- Dalby-Ball, M, et al (2003) **Quantitative Analysis of Flora at Wingecarribee Swamp** (2001-2002) Sydney Catchment Authority
- 2000 Project Manager for the planting design for a number of constructed wetlands including constructed wetlands in Mingara, and sub-surface systems in Blue Haven Wyong—for Sainty and Associates.
- 2000 Wetland health assessment in natural and artificial wetlands, Management Manual for bushland and natural wetlands on Main Camp Tea-tree Property, Northern NSW
- 2000 Project Manager for writing background to the regional DCP for wetlands in the Sydney Region—for Sainty and Associates, report to Sydney Coastal Council Group, NSW
- 2000 Project Manager of wetland works and assessing potential impacts of residential development at the Katoomba Golf Course, NSW—for Sainty and Associates.
- 1998–1999. Wetlands and vegetated diversion areas to treat storm water—Project Manager, for Sainty and Associates and Wyong Shire Council.

Selected Published Books and Peer Reviewed Papers

Dalby-Ball and Olson (2012) *Saltmarshes Restoring and Creating Them*, in *Estuary Plants of South East Australia Book*, published by Sainty and Associates (2011 in press).
Dalby-Ball, M, et al (2003) Quantitative Analysis of Flora at Wingecarribee Swamp (2001-2002) Sydney Catchment Authority.
Minchinton T. E. and M. **Dalby-Ball** (1997). Herbivory by insects on seeds of the grey mangrove Avicennia marina: effects on dispersal, establishment, early survivorship, and growth. Benthic Ecology Meetings. Portland, Maine, USA. Oral presentation and paper.
Minchinton T. E. and M. **Dalby-Ball** (2000). Effects of pre-dispersal predation by insects on recruitment of the grey mangrove Avicennia marina. Ecology Society of America Meetings. Snowbird, Utah, USA.
Minchinton, T. E. and M, **Dalby-Ball** (2001). Effects of pre-dispersal predation by insects on the early life history of the mangrove Avicennia marina. Oecologia 129:243–252.
Dalby-Ball, and Meats, (2000) Influence of the odour of fruit, yeast and cue-lure on the flight activity of the Queensland fruit fly, Bactrocera tryoni (Froggatt) (Diptera: Tephritidae). Australian Journal of Entomology 39 (3), 195-200.
Dalby-Ball, Meats, (2000) Effects of fruit abundance within a tree canopy on the behaviour of wild and cultured Queensland fruit flies, Bactrocera tryoni (Froggatt) (Diptera: Tephritidae) Australian Journal of Entomology 39 (3), 201-207.
Joint author of the second edition of *Burnum Burnum's Wild Things*. Published by Sainty and Associates, Sydney 2000.
Joint author of *Managing Wetlands on the Lower South Coast*. Published by Sainty and Associates, Sydney 1999.

Selected Conference Proceedings and Presentations

Dalby-Ball (2012) paper accepted for 2012 NSW Coastal Conference: *How to Engage the People*
Dalby-Ball (2011) Presentation to the Sydney Coastal Councils Group, Rockdale. *How to make Saltmarsh and Urban waterway and wetland projects successful now and in the long-term*.
Dalby-Ball (2011) Climate Changes and Community Stewardship, workshop for the Learning Centre for Human Development, Mosman, January Sydney 2011
Dalby-Ball (2010) *Port Botany The Biggest Saltmarsh Re-creation Project in the World.* Presentation and Paper at the 20th NSW Coastal Conference 2010 Batemans Bay, NSW.

Dalby-Ball (2010). *Saltmarsh What is it, Where is it, How do we Care for it*? Presentation to the Hunters Hill and Land Cove Preservations Groups at the Field of Mars Education Centre Land Cove.
Dalby-Ball (2009) Assisted DECCW with presenting at the field-day on *Environmentally Friendly Sea Walls*. Presented the Saltmarsh and foreshore works at Gough-Whitlam Park along the Cooks River and Winnererremy Bay at Bayview in Pittwater.
Dalby-Ball M (2009) Sydney Regional Organisation of Councils "Sustainability Conference" Presenting 40,000+ How is Indigenous Wisdom relevant to Sustainability Today.
Dalby-Ball (2009-current) leads Eco Kayaking on Pittwater increasing community appreciation of the water ways.
Dalby-Ball (2007). *We can grow the plants but are we really re-creating Saltmarsh? Implications of Climate Change on Saltmarshes.* Presenter at the 16th NSW Coastal Conference The Tide is High–Coastal pressures, climate change, sustainability – the way forward, November 2007, Yamba, NSW.
Dalby-Ball and Professor G. Chapman (2007) Saltmarsh – Restoration and Rehabilitation. Landcare Conference, Gosford, Central Coast NSW.
Dalby-Ball (2006) What Makes Corridors Effective in Urban Areas? Ecological Consultants Association Annual Conference, Australian Museum, Sydney.
Dalby-Ball (2006) One of three key speakers – role to summaries the Forum and provide conclusions / recommendations. Effective Community Engagement. Workshop facilitated by the Sydney Catchment Management Authority. University of Technology, Sydney.
Dalby-Ball (~2005) *Wetlands and Legislation.* Workshop presenter for Sydney Olympic Park (SOCOG) WET Workshops series.
Dalby-Ball (2004) *Bushfire and Biodiversity a Local Government Perspective* for Nature Conservation Council Biodiversity Bi-annual Forum 2004. Oral presentation and paper.
Dalby-Ball and Sainty (2000). *Healthy Plants for Healthy Wetlands*. Stormwater Industry Association Annual Conference, Burwood, Sydney, Australia. Oral presentation and paper.

CV of Emerald Cuthbertson, ECA Environmental Engineer

Qualifications

Mar 2011 - Jun 2014 Bachelor of Environmental Engineering (Honours) at Monash University

- Achievements: Second Class Honours A
- Major: Land and Water Management

2008 Higher School Certificate at Wenona School North Sydney

- UAI: 96.45
- Subjects: Advanced Mathematics, English, Biology, Earth & Environmental Science, Chemistry & Visual Arts

Relevant Work Experience

Mar 2015 - Ongoing consultancy to Ecological Consultants Australia

- Responsibilities:
  - Including flora, fauna and environmental impact assessments for residential development applications
  - Website design and branding development
  - Quotes and tenders
  - Educational videos
  - Attended Water Sensitive Urban Design Workshop

Dec 2013 - Feb 2014 Assistant Environmental Consultant (Intern) at Ecological Consultants Australia

- Responsibilities:
  - Environmental consulting and project management
  - Project background and data research
  - Report writing and editing
  - Assisted in Wetland design
  - Conducted frequent site visits
  - Attended meetings with clients and colleagues
  - Developing business' social media presence through educational films and photo management
- Achievements:
  - Environmental Management Plan and the Plan of Management for the Botany Wetlands commissioned by Sydney Water
  - Developed engineering methods to fix major erosion and flooding issues due to the recent construction of the War Veterans Retirement Village Narrabeen
  - Collaborated with civil and structural engineers to develop appropriate pond design for a major development by Australand

Volunteer and Community Experience

2015 Volunteer for Surfaid Charity Dinner

- *Responsibilities:* Escort, Selling raffle tickets, Collecting donations, Collecting money from auction winners, Organising and managing function – team raised $44 000 for isolated communities

2009 - 2014 Volunteer for Red Cross Fundraising

- *Responsibilities:* Door to door fundraising

2009 Fundraising team member at the Wharf 4 Ward Charity Lunch

- *Responsibilities:* Through personal efforts collected donations from celebrities at the event - team raised $300 000 for cancer

Other Work Experience

2015 Declaration Vote Issuing Officer for the NSW State Election

- Responsibilities: supervising election, issuing declaration forms for out of district, sorting and tallying votes

2011 - 2014 Sweeney Research

- Responsibilities: Conducted market research via surveys
- Achievements:
  - Customer feedback for Telstra
  - Interviewing small and medium sized businesses throughout Australia to collect data for the Sensis Small Business Index Study
  - Transport Accident Commission (TAC) research

2009 - 2011 Firehouse Hotel

- Responsibilities: Team work, presentation and customer service

2007 Work experience for News Limited Magazines

- Responsibilities: Filing, archiving and styling for photography
- Achievements: Experience with Photoshop, styling & design

Key Skills

Computer: Matlab, HYSYS, Adobe Photoshop, Microsoft Office (Word, Excel, PowerPoint, Outlook)

Personal: Problem solving, Analytical skills, Accuracy, Team player, Planning, Organising, Ability to learn quickly, Enthusiasm, Motivation, Time Management, Flexibility, Adaptability

Communication:

- High standard of written skills especially in report writing which was further developed during internship
- Oral presentation skills e.g. received high distinction on presentation of final year Engineering project "Green Chemical Futures Facility"
- Communication skills developed at Sweeney Research through work requiring constant engagement and consultation with the public

Interests

- Arts: Drawing and Music – I love using my creative side and have always been interested in design
- Sport: Surfing, Northern Suburbs Basketball & Netball Association
- Leisure: Travel – spent 6 months travelling around Europe and Asia from Jul 2014 - Jan 2015 which helped to develop my communication skills and interpersonal skills by interacting with people from different cultures, backgrounds and ages